City of Warrenton City Commission
Agenda
City Hall, 225 S. Main Warrenton, OR 97146
Tuesday, April 08, 2025

*****The meeting will be broadcast via Zoom at the following link*****
https://us02web.zoom.us/j/5332386326?pwd=VHNVVXU5blkxbDZ2YmxISWpha0dhUT09#success
Meeting ID: 533 238 6326 | **Passcode:** 12345 | **Dial-in Number**: 253-215-8782

Public Comment: To provide public comment, participants should register prior to the meeting. All remarks will be addressed to the whole City Commission and limited to 3 minutes per person. The Commission reserves the right to delay any action, if required, until such time as they are fully informed on a matter. Once your public comment is submitted it becomes part of permanent public record.

You may provide public comment using the following methods:

1. In-person: Complete a public comment card and submit to the City Recorder prior to the start of the meeting.
2. Via Zoom: Register with the City Recorder, at cityrecorder@warrentonoregon.us no later than 3pm the day of the meeting. Please ensure that your zoom name matches the name registered to comment.
3. Written comments: Submit via e-mail to the City Recorder, at cityrecorder@warrentonoregon.us, no later than 3:00 p.m. the day of the meeting.

City Commission Regular Meeting 6:00 PM

1. Call to order

2. Pledge of Allegiance

3. Consent Calendar

A. City Commission Meeting Minutes 2025.03.25
B. Harbormaster Report – March 2025
C. Marina Advisory Committee Minutes 2025.02.24
D. Encroachment Agreement – 1006 SW 9th

4. Commissioner Reports

5. Public Comment

6. Public Hearings

A. Comprehensive Plan & Municipal Code Amendment; Exception for Flowlane Dredge Material

7. Business Items

A. Consideration of Hammond Transmission Waterline – Phase 1; Advertise for Bids
B. Consideration of Raw Waterline RP-1 Easements
C. Consideration of Fort Stevens Guardhouse Street Closure
D. Request for Support – Frolic and Lark

8. Discussion Items

A. Fluoride Supplementation

Warrenton City Hall is accessible to the disabled. An interpreter for the hearing impaired may be requested under the terms of ORS 192.630 by contacting Dawne Shaw, City Recorder, at 503-861-0823 at least 48 hours in advance of the meeting so appropriate assistance can be provided.

9. **Good of the Order**
10. **Executive Session**
11. **Adjournment**

Warrenton City Hall is accessible to the disabled. An interpreter for the hearing impaired may be requested under the terms of ORS 192.630 by contacting Dawne Shaw, City Recorder, at 503-861-0823 at least 48 hours in advance of the meeting so appropriate assistance can be provided.

City of Warrenton City Commission
Minutes
City Hall, 225 S. Main Warrenton, OR 97146
Tuesday, March 25, 2025

1. **City Commission meeting called to order at 6:00 pm.**

2. **Pledge of Allegiance**

Commission Members	Present	Excused
Gerald Poe	X	
Jessica Sollaccio	X	
Tom Dyer	X	
Paul Mitchell, Mayor Pro tem	X	
Henry Balensifer, Mayor		X

Staff Members Present	
City Manager Esther Moberg	Public Works Kevin Gorman
City Recorder Dawne Shaw	Code Compliance Officier Christian Salinas
Police Chief Mathew Workman	Library Director Joshua Saranpaa

3. **Consent Calendar**

*Items on the Consent Calendar have previously been discussed and/or are considered routine. Approval of the Consent Calendar requires a motion, a second, and no discussion, unless requested by a member of the City Commission.

A. City Commission Meeting Minutes 2025.03.11
B. Joint Work Session Minutes 2025.03.11
C. Community Library Board Meeting Minutes 2024.12.12
D. NW Natural Franchise Agreement
E. Police Department Monthly Report – February 2025

Motion:	Move to approve the consent calendar as presented.				
Moved:	Dyer				
Seconded:	Sollaccio	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell			X	
Passed:	3/0				

4. **Commissioner Reports**

Commissioner Sollaccio noted a ways and means meeting this Friday and discussed the meeting.

Mayor Pro tem Mitchell encouraged everyone to attend the ways and means meeting.

5. **Public Comment**

John Wilson spoke regarding the development process in Warrenton and voiced his frustration.

Jim Gannaway handed out a document to the Commission and spoke about being a public servant, doing business in Warrenton and the permitting/development process.

Mayor Pro tem Mitchell noted the commission sees this as a priority and a task force will be put together.

Kenneth Culp spoke regarding the building process in Warrenton.

Chuck Bergerson deferred until after Robin Bergerson speaks.

Liane Bogh Spoke regarding the health of the community.

Troy Schaffer spoke regarding the nuisance consideration on SW 4th.

6. Public Hearings – None

7. Business Items

Mayor Pro tem Mitchell added two items to the agenda 7H Bergerson hardship request and 7I Request for letter of Support. There were no objections.

A. Consideration of Nuisance Citation – 247 Tyee Street:

Code Compliance Officer Christian Salinas discussed the ongoing nuisance issues at 247 Tyee Street. Commissioner Dyer noted he spoke with the property owner and reviewed the progress. Discussion continued on the amount of fine, the process that would follow and the potential donation of dumpsters.

Motion:	Move that the Warrenton City Commission declare that a citation, not to exceed $1,000.00 is warranted in accordance with Municipal Code 8.16.220.				
Moved:	Poe				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

B. Consideration of Nuisance Declaration – 45 SW 4th Street:

Salinas discussed the nuisance at 45 SW 4th Street. Property owner Karen Cochran spoke in regard to the nuisance property. She noted the issues she has had, and that cleanup is happening, but not very quickly. Discussion continued. Commissioner Poe suggested declaring it a nuisance with a 30 day stay without a fine.

Motion:	Move that the Warrenton City Commission declare that a public nuisance exists at 45 SW 4th Street, Warrenton, OR 97146, and direct staff to move forward with the appropriate abatement procedures or citations as outlined in the municipal code and wait 30 days to bring citations or fines.
Moved:	Poe

Seconded:	Dyer	Aye	Nay	Abstain	Recused
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

C. Consideration of Ordinance No. 1286; Rezone and Site Design Review:

City Manager Esther Moberg presented Ordinance No. 1286 for its second reading and adoption.

Motion:	Move to conduct a second reading by title only of Ordinance 1286.				
Moved:	Sollaccio				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

Mayor Pro tem Mitchell conducted the second reading by title only, of Ordinance No. 1286; an Ordinance Approving with Conditions, the Site Design Review Application SDR-24-2 and the Rezone Application RZ-24-2 and Amending the City of Warrenton Zoning Map to Reclassify a Portion of Real Property Identified as Tax Lot 81028AD03400 from R-10 Intermediate Density Residential to R-H High Density Residential.

Motion:	Move to adopt Ordinance No. 1286.				
Moved:	Poe				
Seconded:	Sollaccio	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

D. Consideration of Water Ordinance No. 1292:

Moberg presented Ordinance No. 1292 for its second reading and adoption.

Motion:	Move to conduct the second reading, by title only, of Ordinance No. 1292.				
Moved:	Poe				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

Mayor Pro tem Mitchell conducted the second reading, by title only, of Ordinance No. 1292; Providing for Rules and Regulations for City of Warrenton Water Department and All Areas Served by the Municipal Water Department Outside Warrenton's City Limits; Requiring Installation of Water Meters; Repealing any other Water Ordinances or Resolutions or Parts Thereof in Conflict Herewith; Providing a Penalty for Violation of any Terms and Conditions Herein.

Motion:	Move to adopt Ordinance No. 1292.				
Moved:	Poe				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

E. Consideration of Waterline Replacement Project RP-2:

Public Works Director Kevin Gorman discussed a request to advertise for bids for Phase 2 of the Raw Waterline Replacement project.

Motion:	Move to approve the request to advertise for bids for Phase 2 of the Raw Waterline Replacement project.				
Moved:	Poe				
Seconded:	Sollaccio	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

F. Consideration of Vactor Truck Purchase:

Gorman presented a contract for the purchase of a Vactor truck; he noted the necessity of this piece of equipment. Brief discussion followed.

Motion:	Move to approve the purchase of a Vactor Truck as outlined.				
Moved:	Dyer				
Seconded:	Poe	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

G. Consideration of Seafarers Bank Stabilization Project:

Gorman discussed a contract for the bank stabilization at Seafarers Park.

Motion:	Move to award the Engineering Professional Services contract to North Coast Civil Design, LLC for $95,800.				
Moved:	Poe				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

H. Consideration of Robin Bergerson Hardship Request:

Moberg noted Robin Bergerson has requested a hardship consideration for his sidewalk in lieu of payment in the amount of $9,720. Bergerson discussed the issues he has had with the building/development process and the sidewalk in lieu of fees. Brief discussion followed between the commission and Bergerson. Commissioner Sollaccio disclosed she had conversations with Bergerson and visited the property. Discussion continued on the cost calculation. Moberg explained the issues with setting a precedent. She also noted the challenges with tracking an IOU.

Motion:	Move to reduce the fee by half.				
Moved:	Dyer				
Seconded:	Poe	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

I. Consideration of Letter of Support for Salvage Chief:

Mayor Pro tem Mitchell noted the request for a letter of support for the Salvage Chief. Brief discussion followed.

Motion:	Move to support the letter for the City of Astoria.				
Moved:	Poe				
Seconded:	Dyer	**Aye**	**Nay**	**Abstain**	**Recused**
	Sollaccio	X			
	Dyer	X			
	Poe	X			
	Mitchell	X			
Passed:	4/0				

Moberg asked for clarification if the Commission is sending a letter to show support or if they are supporting the City of Astoria's letter. The commission confirmed they are showing support for the City of Astoria's letter.

8. Discussion items – None

9. **Good of the Order** – None

10. **Executive Session** - None

11. **Adjournment**

There being no further business, Mayor Pro tem Mitchell adjourned the meeting at 7:51 pm.

Approved:

Attest:

Henry A. Balensifer III, Mayor

Dawne Shaw, CMC, City Recorder

DRAFT

WARRENTON & HAMMOND MARINAS

HARBORMASTER REPORT

MARCH, 2025 // PREPARED BY JESSICA MCDONALD

WARRENTON & HAMMOND MARINAS

Harbormaster Report: March 2025

MONTH IN BRIEF

Introduction:

Staff have been making excellent progress preparing docks and getting ready to launch many rebuilt sections. So far, they have completed 14 sections of 20-foot docks, totaling 280 feet, for the Hammond D Dock main walkway.

In addition, staff have been working on cleanup efforts in the dry storage areas, dismantling and removing old, rotten dock sections that are no longer usable.

Recent windstorms caused some minor damage, but staff quickly made necessary repairs to Commercial E Dock and the Hammond launch ramp. With the weather starting to improve, we are hopeful to begin launching rebuilt docks soon.

Key Activities:

1. Completed Projects
   - Warrenton Pier Ladders
   - Updating Resolution

1. Projects in Progress
   - OSMB Grant & Possibly DOT Grant
   - Hammond Dredge Permit
   - Pile Replacement Permitting in Warrenton and Hammond Marinas
   - Warrenton and Hammond Marina Redesign
   - Dock Repairs and Rebuilds

PROJECTS IN PROGRESS

Grant Opportunities
Staff are finalizing grant application submissions for the current grant season and will provide updates on any awarded funding in the coming months.

Hammond Dredge Permitting
Surveys were conducted in the Hammond Marina on February 14, 2025. Staff are currently refining the dredge prism and preparing permits for the planned dredging project in 2026-2027.

Pile Permitting
Permits have been submitted and are awaiting final approvals.

Warrenton and Hammond Marina Redesign:
After receiving feedback from the City Commission and Advisory Board at the joint work session on March 11, 2025, North Coast Civil will begin finalizing redesigns and preparing additional reports to incorporate into our Master Plans. Staff will continue planning for future marina improvements.

Dock Repairs and Rebuilds
We have prepped over 280 feet of dock and will continue working on additional sections in the coming months. In March and April, many of these sections will be installed, and we look forward to sharing progress photos highlighting the crew's hard work!

MESSAGE FROM THE HARBORMASTER

As we head into a busy season, I want to remind you that the Marinas Advisory Board will be taking a break from meetings between April and September. Monthly meetings will resume in the fall.

During this time, staff will be busy preparing for another successful Buoy 10 season in August. While my formal reports will be less frequent, I will continue to send important marina updates as needed to keep the board and commission informed.

Thank you all for your support, and I look forward to reconvening in the fall!

Jessica McDonald
Harbormaster

City of Warrenton Marina Advisory Committee Minutes

City Hall, 225 S. Main Warrenton, OR 97146
Monday February 24, 2025

1. Marina Advisory Committee meeting called to order at 2 p.m.

Members	Present	Excused
Jen Fowler, Chair	X	
Bill Kerr	X	
Larry Ausman	X	
Mike Balensifer	X	
Lylla Gaebel	X	

Staff Members Present	
Jessica McDonald	Harbormaster
Shara Ford	Marina Office Secretary

2. Consent Calendar

A. Meeting Minutes January 27, 2024

Motion:	Move to approve the consent calendar as presented.				
Moved:	Kerr				
Seconded:	Balensifer	**Aye**	**Nay**	**Abstain**	**Recused**
Vote:	Kerr	X			
	Fowler	X			
	Ausman	X			
	Balensifer	X			
	Gaebel	X			
Passed:	5/0				

3. Public Comment

A. None

4. Reports

A. Harbormaster Jessica McDonalds read over her Harbormaster Report key activities:

i. Ms. McDonald shared the Hammond parking lot lights are now complete.
ii. Ms. McDonald shared an update on the Hammond dredge permits. Ms. McDonald mentioned the last dredge was 8 feet and this time it will need to be at 10 feet to help with the less silt settling in the marina. The slope on the banks will also be corrected to help maintain the basin.
iii. Ms. McDonald shared with the advisory committee that the city commission was very supportive in updating the marinas resolution to raise the moorage price $3.00 more per foot for the next two years.
iv. Ms. McDonald shared the commercial gates estimate came in higher than expected and the project is being paused for this budget year.

v. Ms. McDonald noted that one of three pier ladders has been installed. The next two will be installed next week.

B. Ms. McDonald reviewed the quarterly finance report with the committee.

5. Business Items

A. Ms. McDonald read over the proposed capital improvement projects for 2025-2031.

i. Ms. McDonald noted that while the Warrenton Marina generates enough user fees to cover operational costs, there are limited funds available for the Warrenton Capital Reserve Fund. With many capital projects needed, securing funding remains a priority. For the upcoming budget year, pile replacement is likely the only project we will have funding for.

ii. Ms. McDonald is proposing the Hammond Marina spend $200,000 on the replacement of 40 piles if the permits come through.

iii. Ms. McDonald noted the future dredging of the Hammond Marian will hopefully happen at the same time as the center launch ramp and replacement of piles. This project is slated for budget year in 2026-27 and would save funds if all projects were completed together to save on mobilization costs.

Motion:	Move made to make a recommendation to bring forward capital improvement projects to the City Commission.				
Moved:	Balensifer				
Seconded:	Kerr	**Aye**	**Nay**	**Abstain**	**Recused**
Vote	Kerr	X			
	Fowler	X			
	Ausman	X			
	Balensifer	X			
	Gaebel	X			
Passed:	5/0				

6. Good of the Order

A. Balensifer would like to discuss updating the marina's insurance policy for customers.

B. Ms. Fowler asked if the marina could declare a derelict boat a "nuisance." Ms. McDonald noted she will investigate it.

7. Adjournment

There being no further business, Chair Fowler adjourned the meeting at 3:09 pm.

Approved:

Attest:

Shara Ford, Marina Advisory Committee Secretary

Jen Fowler, Chair

City Commission Agenda Memo

Meeting Date: April 8, 2025
From: Esther Moberg, City Manager
Subject: Encroachment Agreement Jernigan 1006 SW 9th

Summary:

The property at 1006 SW 9th was recently purchased by Mr. and Mrs. Jernigan. They are requesting an encroachment agreement with the City of Warrenton for the adjacent lot, similar to the encroachment agreement that Mr. and Mrs. Bergerson had previously. This agreement allows for a 5 year agreement with the understanding they cannot develop or improve the City of Warrenton lot beyond what is existing.

Recommendation/Suggested Motion:

Consent Calendar approval

Alternative:

Other action as deemed appropriate by the City Commission

OR

None recommended

Fiscal Impact:

N/A

Attachments:

(All supporting documentation, i.e., maps, exhibits, etc., must be attached to this memorandum.)

- Encroachment Agreement

Approved by City Manager: _____

ENCROACHMENT AGREEMENT

This Agreement is entered into this _____ day of _____, 20___, between the City of Warrenton ('City') and Russell and Barbara Jernigan ('Owners'). The City owns property which is legally described at Tract C Janessa Park as recorded in the Clatsop County Records as Tax lot 81020DD02600 (the Property). The Owners own adjacent property with an address of 1006 SW 9th Street, which is legally described as Lot 11 Janessa Park as recorded in the Clatsop County Records as Tax lot 81020DD02400 (Owner's Property). The Owners have located a shed and a fire pit which are encroaching on the Property. The City has the exclusive right to hold and manage the Property for the benefit of the public. Subject to Owners' compliance with the terms and conditions of this Agreement as set forth below, the City will allow Owners to maintain the encroachment.

The City grants Owners the authority to maintain the shed and fire pit (Improvements) located on the Property. Unless otherwise terminated as set forth herein, the Owner will be allowed to maintain the Improvements on the Property for a time period of five years through April 1, 2030. A picture accurately depicting the location and condition of the Improvements as of the date of this Agreement is attached as Exhibit A. A description showing the portion of the Property burdened by the encroachment ('Encroachment Area') is attached as Exhibit B.

In consideration of which the Owners and their assigns hereby promise and agree as follows:

1. To release, discharge and covenant not to sue City for any claim, demand, loss, cost, expense or cause of action, of any nature, arising out of or related to Owner's use, occupation or enjoyment of the Encroachment Area, including any claim arising out of or related to work performed on the Property. Examples of such work include but are not limited to access to the nearby wetlands, water access, or any utility work.

2. To reimburse the City for the total repair expense if repair work on the Property is necessitated by damage caused as a result of the encroachment.

3. To cooperate with the City and any franchise utility company in the event that such entity needs access to the Encroachment Area to service, maintain, or repair utilities, including removal of the Improvements in the Encroachment Area if required to provide access for such service, maintenance, or repair. Owners shall be responsible for all costs associated with repair or replacement of such Improvements when removal is required.

4. To completely and permanently remove the Improvements and all other structures or improvements added by Owner in the Encroachment Area at such time as they are no longer needed, when the

City deems it necessary, or when this Agreement expires. Removal of the Improvements shall be done at the sole expense of the Owners. In the event the Owner does not timely remove any structures on the Property, the City will remove such structures and the cost of removal shall be paid by the Owner. Any costs that are not paid by the Owner, will become a lien on the Owner's Property.

5. Owner may not expand beyond the Encroachment Area to use other parts of the Property nor shall the Owner add any additional structures or improvements to the Encroachment Area beyond what is on the Property on the date this Agreement is signed. Further the Owner may only use the Encroachment Area for the purposes it is currently used for during the term of this Agreement.

6. To comply with all federal, state, and local laws that apply, now or in the future, to Owner's use, occupation and enjoyment of the Encroachment Area.

7. This agreement is non-transferrable.

Owner will indemnify and hold harmless City, its officers, elected officials, directors, employees, agents and contractors from and against any and all claims demands, losses, costs, expenses or cause of action, of any nature, arising out of or related to Owner's exercise of the authority City grants in this Agreement, provided that Owner shall not be responsible for any claims arising from the negligence or intentional conduct of City, its employees, its agents, or independent contractors.

During the term of this Agreement, Owner will procure and maintain homeowner's liability and property damage insurance to cover the Encroachment Area with a responsible company with limits of not less than $100,000 for injury to one person, $200,000 for injury to two or more persons in one occurrence, and $ 100,000 for damage to property. City shall be named as an additional insured on such policy.

Unless and until it is terminated, this Agreement runs with and binds the Property. Owner may not otherwise assign or transfer the authority the City grants in this Agreement.

The City has the right to terminate the agreement without cause after giving due notice of 30 days.

This Agreement shall terminate if Owner fails to maintain the Improvements or the Encroachment Area or Owner uses or occupies any part of the Property outside of the Encroachment Area. The authority the City grants in this Agreement shall terminate upon removal or relocation of the Improvements.

This Agreement does not convey to Owner any right, title or interest in or to the Property other than a license to occupy and use the Encroachment Area consistent with its terms. The Owner's obligation to indemnify the City and to remove the Improvements and all other structures or improvements put on the Property by the Owner in the Encroachment Area survives termination of this Agreement.

This Agreement is governed by and construed in accordance with the laws of the State of Oregon, without respect to conflict of laws principles. Failure of the City at any time to require performance of any provision of this Agreement shall not limit the City's right to enforce the provision, nor shall any waiver of a breach of a provision of the Agreement be a waiver of any subsequent breach of the provision or a waiver of the provision itself or any other provision. No amendment or modification of this agreement shall be valid unless in writing and signed by the City and re-recorded against the property.

SIGNATURES

_____ _____

Russell Jernigan, Owner Barbara Jernigan, Owner

_____ _____

Date Date

_____

Esther Moberg, Warrenton City Manager

_____

Date

STATE OF OREGON)

) ss.

County of _____)

On this day of _____, 202_, personally appeared before me, the above named persons, _____ _____, _____, known to me to be the persons(s) whose signature is above subscribed, and acknowledged to me that this is a free act and deed, for the uses and purposes therein expressed. In witness whereof, I have hereunto set my hand and affixed my official seal on the day and year last above written.

_____

NOTARY PUBLIC FOR OREGON

My Commission Expires: _____

STATE OF OREGON)

) ss.

County of _____)

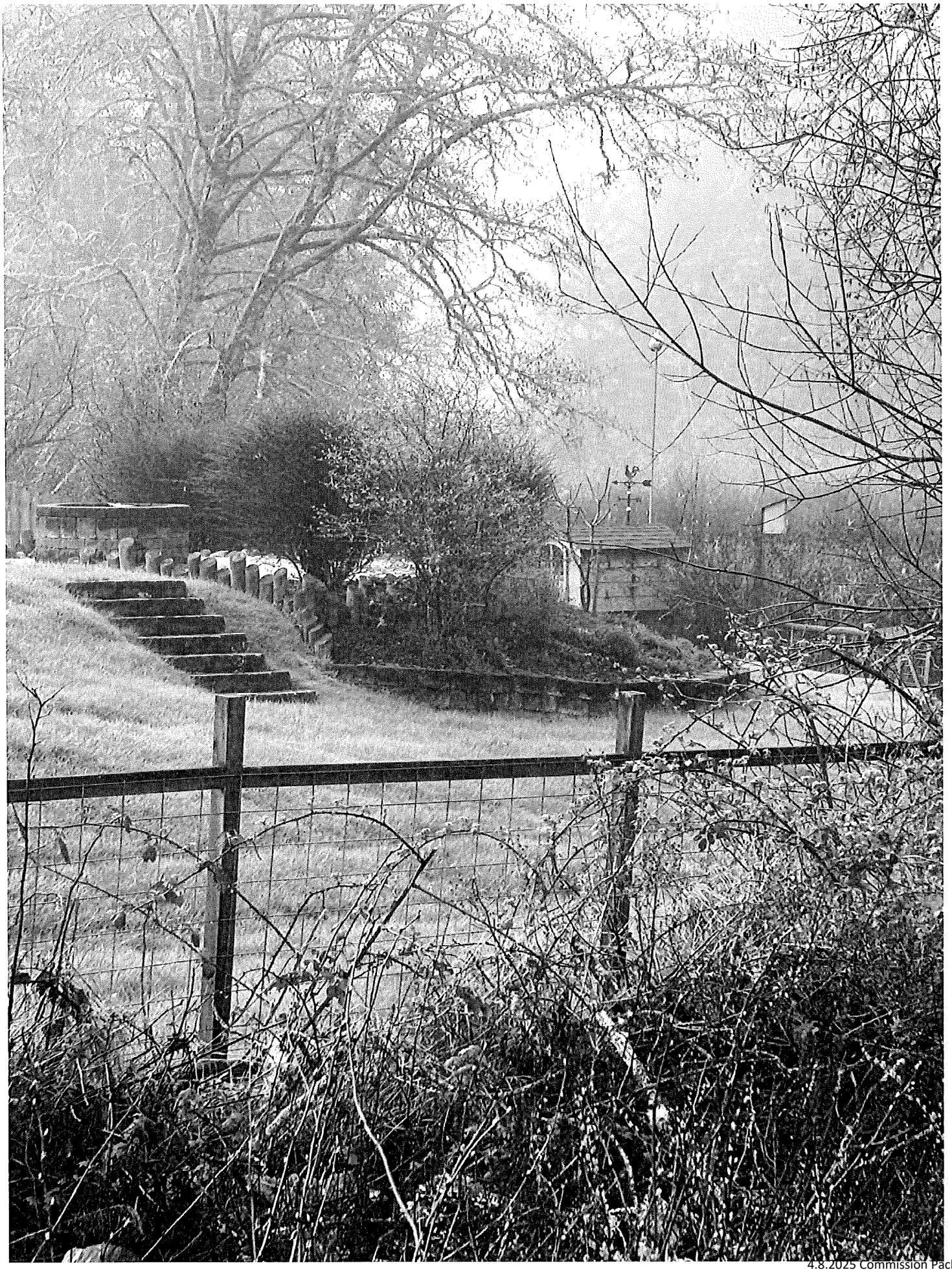
On this day of _____, 202_, personally appeared before me, the above named persons, _____ _____, _____, known to me to be the persons(s) whose signature is above subscribed, and acknowledged to me that this is a free act and deed, for the uses and purposes therein expressed. In witness whereof, I have hereunto set my hand and affixed my official seal on the day and year last above written.

_____

NOTARY PUBLIC FOR OREGON

My Commission Expires: _____

Exhibit B



CYRUS JAVADI, DDS
STATE REPRESENTATIVE
DISTRICT 32

HOUSE OF REPRESENTATIVES

April 6, 2025

Statement from Representative Cyrus Javadi, DDS
Re: Fluoridation Discussion – Warrenton City Commission

Thank you for the opportunity to share my perspective.

As a practicing dentist and State Representative, I've supported community water fluoridation for a long time. It's a proven tool for reducing cavities, especially in areas where access to dental care is limited. But I also believe in updating our thinking when new science gives us reason to ask fresh questions.

Earlier this year, a federal judge in California ruled that the U.S. Environmental Protection Agency (EPA) must re-evaluate its position on fluoride in drinking water. This ruling came after reviewing a set of newer studies suggesting that elevated fluoride exposure during pregnancy may be linked to reduced IQ in children.

The most cited study—a large, government-funded longitudinal study conducted in Mexico—tracked pregnant women and their children. It found that children whose mothers had higher fluoride exposure during pregnancy (around 1.5 mg/L and above) scored 2–3 points lower on IQ tests. These levels are higher than what's added to public water in the U.S. (which is currently 0.7 mg/L), but they're not extreme, and they fall well below the EPA's maximum allowable level of 4.0 mg/L.

This isn't a call to abandon fluoridation. It's a call to reexamine whether our current standards provide an adequate margin of safety—especially for the most vulnerable populations. Fluoride clearly reduces cavities. But like any medical intervention, we should be open to weighing the benefits against emerging risks as the science evolves.

I commend the Warrenton Commission for approaching this topic thoughtfully. I trust your deliberation will reflect both the long-standing benefits of fluoridation and the need to consider the latest data with care and humility.

Sincerely,

Cyrus Javadi

Representative Cyrus Javadi
State of Oregon House of Representatives

Capitol Address: 900 Court St. NE, H-373, Salem, OR 97301 – Phone: (503) 986-1432 – Rep.CyrusJavadi@oregonlegislature.gov
District Office: 1010 Main Ave, Tillamook, OR 97141 – District Phone (503) 842-7788

From: Jana Dean
Sent: Monday, April 7, 2025 11:21 AM
To: Dawne Shaw; Henry Balensifer
Subject: Fluoride in our water

To Whom It May Concern,

My life experience has lit a fire inside of me to help others see how sick and toxic our daily lives have become. It is up to us to help each other, to be the change we want to see in the world. To take preventative measures to end the pain and suffering we see all around us today.

I watched my grandmother slowly suffer from Alzheimers. It was heartbreaking for our family to watch her slowly fade away. After 10 years of agony, Alzheimers finally took her life in 2020.

Last year my mom was diagnosed with stage 4 breast cancer. I have spent countless hours researching and trying to find answers. During this process, I have uncovered so many alarming facts.

We have to ask ourselves, Why is our country so sick? Why are our shopping centers and malls being taken over by the healthcare industry? Why is every other commercial on TV pushing pharmaceuticals? Why do we all know someone who's been affected by Cancer or Alzheimers?

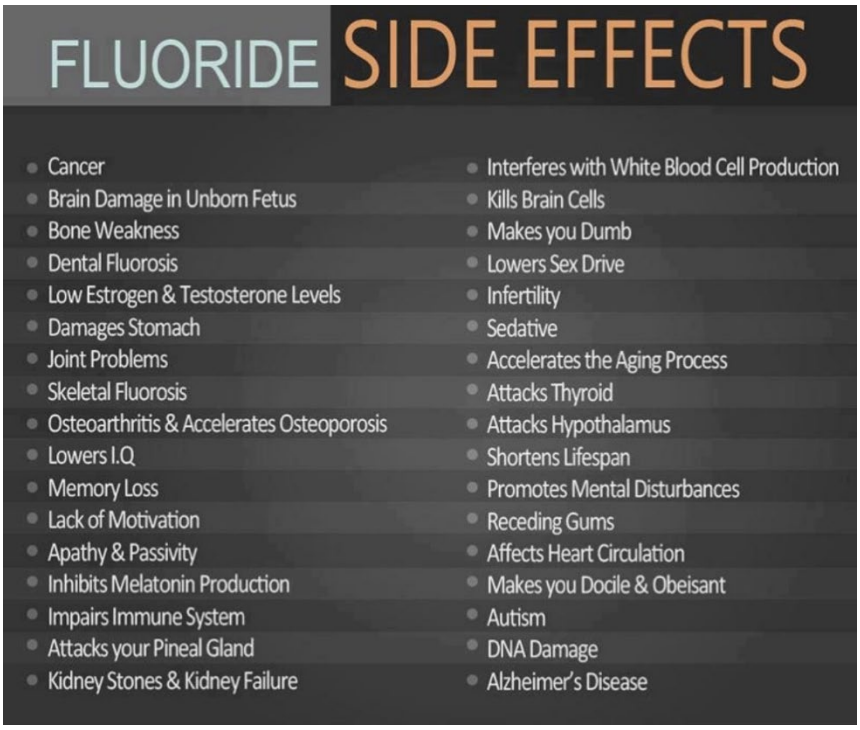
The answer is very simple. It's our toxic environment. We are slowly being poisoned. Our daily lives and routines have been taken over by toxic food, beauty products, radiation, toxins being sprayed in the air we breathe and the water we drink. So let's focus on the fluoride in our water.

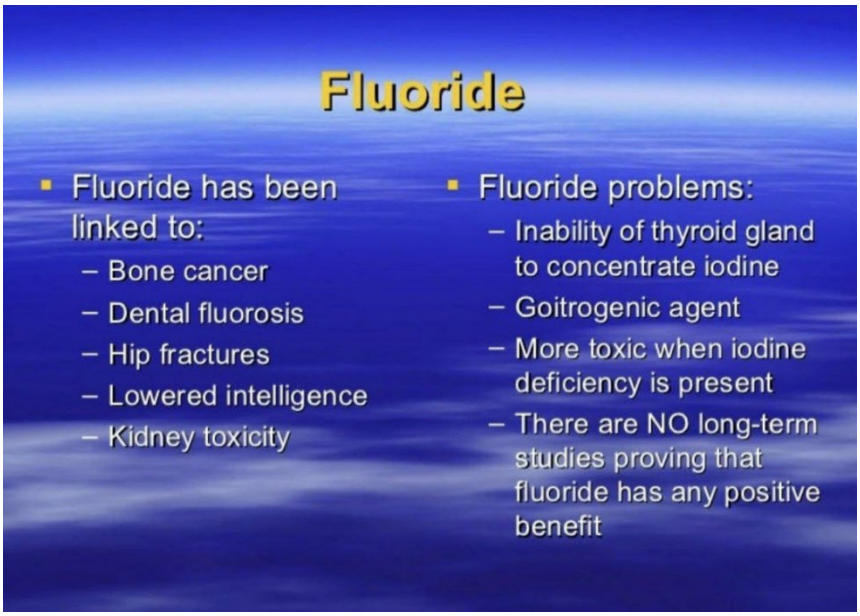
I am 100% in support of taking the fluoride out of our water. At this point, I feel it's criminal to continue poisoning our community.

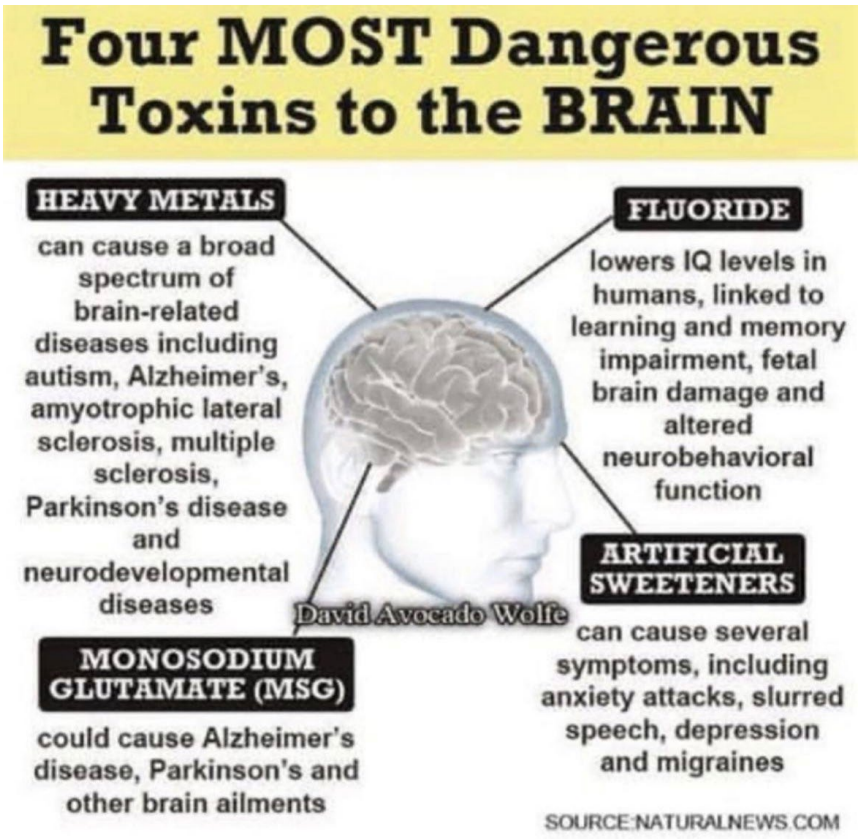
Here is a list of resources. Thank you for taking the time to look at the research.

Sincerely,

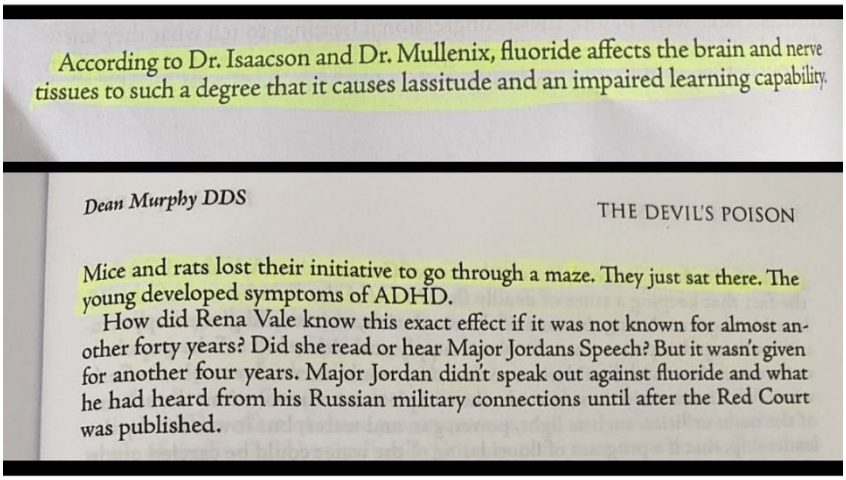
Jana Dean
90537 Par Road
Warrenton, OR


FLUORIDE SIDE EFFECTS
Cancer
Brain Damage in Unborn Fetus
Bone Weakness
Dental Fluorosis
Low Estrogen & Testosterone Levels
Damages Stomach
Joint Problems
Skeletal Fluorosis
Osteoarthritis & Accelerates Osteoporosis
Lowers I.Q
Memory Loss
Lack of Motivation
Apathy & Passivity
Inhibits Melatonin Production
Impairs Immune System
Attacks your Pineal Gland
Kidney Stones & Kidney Failure
Interferes with White Blood Cell Production
Kills Brain Cells
Makes you Dumb
Lowers Sex Drive
Infertility
Sedative
Accelerates the Aging Process
Attacks Thyroid
Attacks Hypothalamus
Shortens Lifespan
Promotes Mental Disturbances
Receding Gums
Affects Heart Circulation
Makes you Docile & Obeisant
Autism
DNA Damage
Alzheimer's Disease


Fluoride
Fluoride has been linked to:
– Bone cancer
– Dental fluorosis
– Hip fractures
– Lowered intelligence
– Kidney toxicity
Fluoride problems:
– Inability of thyroid gland to concentrate iodine
– Goitrogenic agent
– More toxic when iodine deficiency is present
– There are NO long-term studies proving that fluoride has any positive benefit


Four MOST Dangerous Toxins to the BRAIN
HEAVY METALS
can cause a broad spectrum of brain-related diseases including autism, Alzheimer's, amyotrophic lateral sclerosis, multiple sclerosis, Parkinson's disease and neurodevelopmental diseases
FLUORIDE
lowers IQ levels in humans, linked to learning and memory impairment, fetal brain damage and altered neurobehavioral function
ARTIFICIAL SWEETENERS
can cause several symptoms, including anxiety attacks, slurred speech, depression and migraines
MONOSODIUM GLUTAMATE (MSG)
could cause Alzheimer's disease, Parkinson's and other brain ailments
David Avocado Wolfe
SOURCE:NATURALNEWS.COM

FLUORIDE WAS FOUND TO BE A NEUROTOXIN, CAUSING IQ DEFECTS



According to Dr. Isaacson and Dr. Mullenix, fluoride affects the brain and nerve tissues to such a degree that it causes lassitude and an impaired learning capability.

Dean Murphy DDS THE DEVIL'S POISON

Mice and rats lost their initiative to go through a maze. They just sat there. The young developed symptoms of ADHD.

How did Rena Vale know this exact effect if it was not known for almost another forty years? Did she read or hear Major Jordans Speech? But it wasn't given for another four years. Major Jordan didn't speak out against fluoride and what he had heard from his Russian military connections until after the Red Court was published.

@nutritionwithtomandlauren

MICE GIVEN FLUORIDE DEVELOPED LEARNING DISABILITIES AND WERE UNABLE TO COMPLETE BASIC TASKS

Dr. Isaacson
Toxic Torts

Toxic Torts.MP4

http://www.newmediaexplorer.org/chris/Isaacson_My_Fluoride_position2.pdf

https://www.plattsburgh.edu/news/news-archive/neuroscientist-to-speak-on-the-effects-of-fluoridation.html

https://fluoridealert.org/content/bulletin_10-12-22/

Dr. Mullenix

https://gloucester-ma.gov/DocumentCenter/View/3028/Dr-Phyllis-Mullenix

https://youtu.be/9daqPRUWpMc?si=uW9BeFIFpgqKVhMM

Dr Charles Clymer

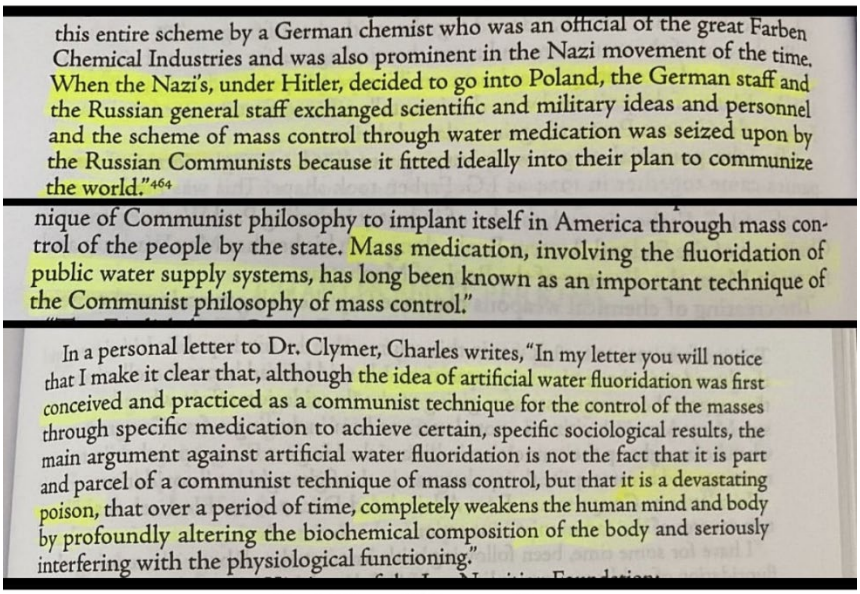
https://www.kindness2.com/age-of-treason.html

https://12160.info/profiles/blogs/the-age-of-treason-1958-book-exposes-chemical-attack-on-humanity

https://www.seacoastonline.com/story/news/local/york-star/2016/10/26/how-fluoridated-water-impacted-my/24671802007/

https://fluoridealert.org/news/higher-levels-of-fluoride-found-to-be-linked-with-adhd-in-children/

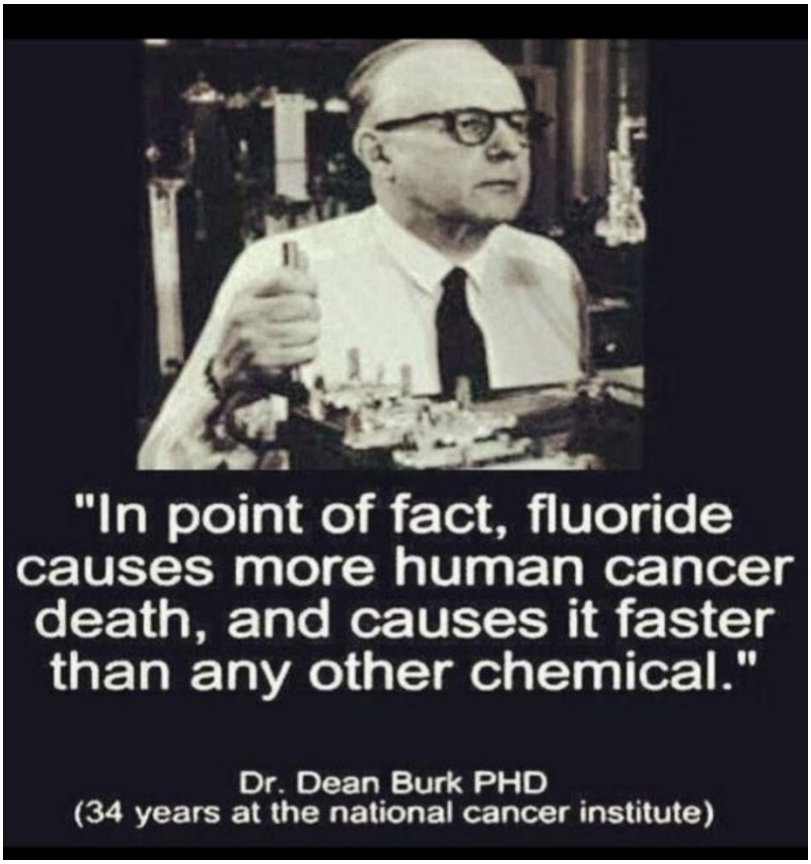
THE SOVIETS WERE THE FIRST TO USE FLUORIDE AS AN IDEOLOGICAL TOOL TO INSTILL COMMUNISM - IT WAS AN "IMPORTANT TECHNIQUE OF THE COMMUNIST PHILOSOPHY OF MASS CONTROL"



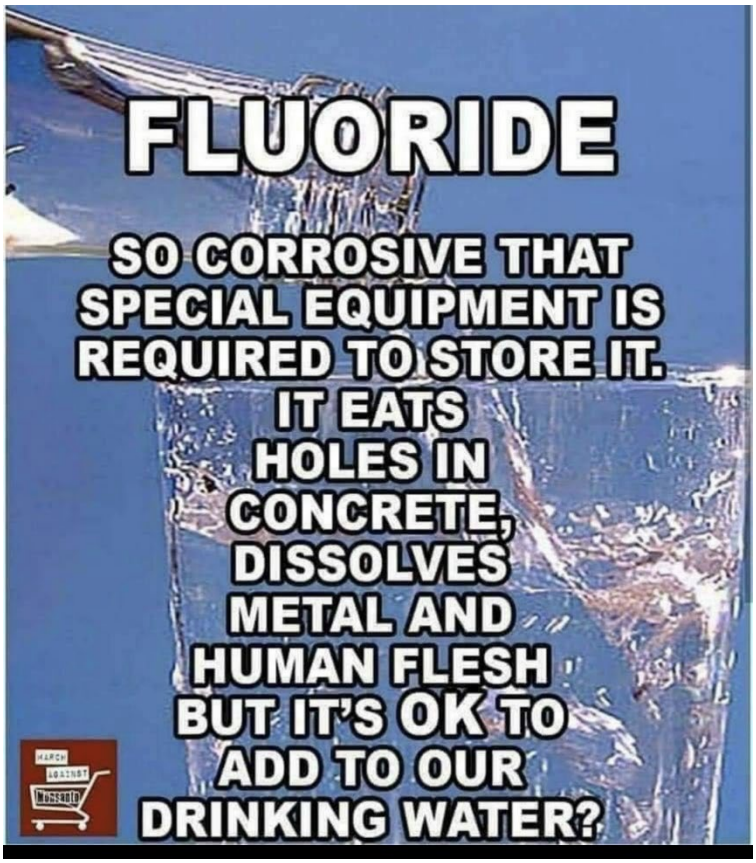
this entire scheme by a German chemist who was an official of the great Farben Chemical Industries and was also prominent in the Nazi movement of the time. When the Nazi's, under Hitler, decided to go into Poland, the German staff and the Russian general staff exchanged scientific and military ideas and personnel and the scheme of mass control through water medication was seized upon by the Russian Communists because it fitted ideally into their plan to communize the world."[464]

nique of Communist philosophy to implant itself in America through mass control of the people by the state. Mass medication, involving the fluoridation of public water supply systems, has long been known as an important technique of the Communist philosophy of mass control."

In a personal letter to Dr. Clymer, Charles writes, "In my letter you will notice that I make it clear that, although the idea of artificial water fluoridation was first conceived and practiced as a communist technique for the control of the masses through specific medication to achieve certain, specific sociological results, the main argument against artificial water fluoridation is not the fact that it is part and parcel of a communist technique of mass control, but that it is a devastating poison, that over a period of time, completely weakens the human mind and body by profoundly altering the biochemical composition of the body and seriously interfering with the physiological functioning."



https://youtu.be/ClqK7XvfLg0?si=86AvO4_PdfzZDPew


FLUORIDE
SO CORROSIVE THAT SPECIAL EQUIPMENT IS REQUIRED TO STORE IT. IT EATS HOLES IN CONCRETE, DISSOLVES METAL AND HUMAN FLESH BUT IT'S OK TO ADD TO OUR DRINKING WATER?
MARCH AGAINST MONSANTO

KNOW YOUR ENDOCRINE DISRUPTORS

@nutritionwithtomandlauren

Tap water is a source of multiple endocrine disruptors such as fluoride and microplastics

Synthetic clothing such as polyester are endocrine disruptors. Opt for natural materials such as wool

BPA or BPS from receipts, plastic bottles and metal cans can contribute to hormonal imbalances

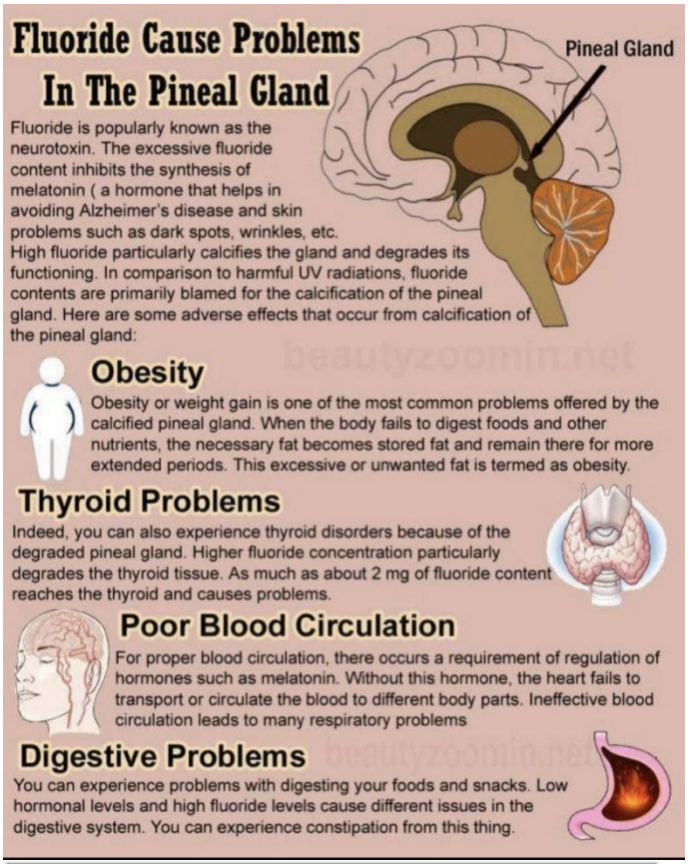
Pesticides also interfere with hormonal production. Buy organic where possible

Microplastics from plastic packaging or bottles are endocrine disruptors. Take food out of plastic when you can

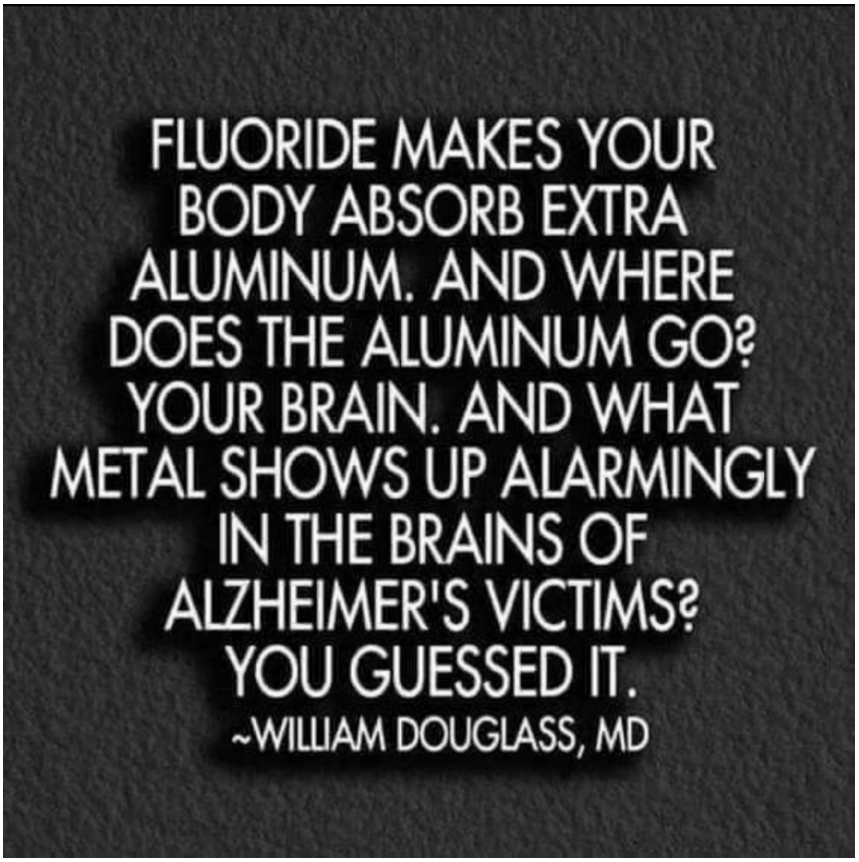
Birth control is a major endocrine disruptor linked to depression

Non stick pans contain PFAS, a known endocrine disruptor also linked to infertility

Conventional makeup contains hormone disruptors such as phthalates. Opt for organic makeup


Fluoride Cause Problems
In The Pineal Gland
Pineal Gland
Fluoride is popularly known as the neurotoxin. The excessive fluoride content inhibits the synthesis of melatonin (a hormone that helps in avoiding Alzheimer's disease and skin problems such as dark spots, wrinkles, etc.
High fluoride particularly calcifies the gland and degrades its functioning. In comparison to harmful UV radiations, fluoride contents are primarily blamed for the calcification of the pineal gland. Here are some adverse effects that occur from calcification of the pineal gland:
Obesity
Obesity or weight gain is one of the most common problems offered by the calcified pineal gland. When the body fails to digest foods and other nutrients, the necessary fat becomes stored fat and remain there for more extended periods. This excessive or unwanted fat is termed as obesity.
Thyroid Problems
Indeed, you can also experience thyroid disorders because of the degraded pineal gland. Higher fluoride concentration particularly degrades the thyroid tissue. As much as about 2 mg of fluoride content reaches the thyroid and causes problems.
Poor Blood Circulation
For proper blood circulation, there occurs a requirement of regulation of hormones such as melatonin. Without this hormone, the heart fails to transport or circulate the blood to different body parts. Ineffective blood circulation leads to many respiratory problems
Digestive Problems
You can experience problems with digesting your foods and snacks. Low hormonal levels and high fluoride levels cause different issues in the digestive system. You can experience constipation from this thing.

PUBLIC NOTICE
PLEASE BE ADVISED
SODIUM FLUORIDE
(found in most bottled/tap water and foods)
☑ KILLS RODENTS
☑ CAUSES CANCER
☑ LOWERS YOUR IQ
☑ CAUSES APATHY
☑ USED BY NAZIS
☑ IN YOUR WATER



https://www.agreenroadjournal.com/2012/05/christopher-bryson-investigative.html?view=flipcard

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Jana Dean
High Life Adventure Park
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Seaside, Oregon 97146
(503) 717-5444 Office
(503) 440-1438 Cell

Warrenton City Commission
Public Comment Form

Name: Suzi Palensfer

Address: 947 St Anchor

Email: MLSPalensfer@gmail.com

Does your comment have to do with an agenda item? (Y or N) _____

Briefly describe your topic: Removal of floride from the City Water.

Please give this card to the city recorder prior to the meeting

Once this card is submitted to the City Recorder, it becomes a part of the permanent public record.

The Weston A. Price Foundation

Fluoride: Worse than We Thought

APRIL 14, 2004 BY ANDREAS SCHULD (HTTPS://WWW.WESTONAPRICE.ORG/AUTHOR/ASCHULDD/)

Print post

Translations: Spanish (https://www.westonaprice.org/fluoruro-mas-peligroso-de-lo-que-pensamos/#gsc.tab=0)

In 1999 the US Center for Disease Control (CDC) released a glowing report on the fluoridation of public water supplies, citing the procedure as one of the century's great public health successes.[1]

Ironically, the same report hints that the alleged benefit from fluorides may not be due to ingestion: "Fluoride's caries-preventive properties initially were attributed to changes in enamel during tooth development because of the association between fluoride and cosmetic changes in enamel and a belief that fluoride incorporated into enamel during tooth development would result in a more acid-resistant mineral."

The CDC report then acknowledges new studies which indicate that the effects are "topical" rather than "systemic." "However, laboratory and epidemiologic research suggests that fluoride prevents dental caries predominately after eruption of the tooth into the mouth, and its actions primarily are topical for both adults and children."

The obvious question is this: How can the CDC consider the addition of fluoride to public water supplies to be a public health success while admitting at the same time that fluoride's benefits are not "systemic," in other words, are not obtained from drinking it?

The truth, now becoming increasingly evident, is that fluoridation and the proclaimed benefit of fluoride as a way of preventing dental decay is perhaps the greatest "scientific" fraud ever perpetrated upon an unsuspecting public.

Even worse, the relentless promotion of fluoride as a "dental benefit" is responsible for the huge neglect in proper assessment of its toxicity, an issue that has become a major concern for many nations. As there is no substance as biochemically active in the human organism as fluoride, excessive total intake of fluoride compounds might well be contributing to many diseases currently afflicting mankind, particularly those involving thyroid dysfunction. In the United States, most citizens are kept entirely ignorant of any adverse effect that might occur from exposure to fluorides. Dental fluorosis, the first visible sign that fluoride poisoning has occurred, is declared a mere "cosmetic effect" by the dental profession, although the "biochemical events which result in dental fluorosis are still unknown."[2,3,4] The quantity of fluoride needed to prevent caries but avoid dental fluorosis is also unknown.[5]

What is Fluoride?

Fluoride is any combination of elements containing the fluoride ion. In its elemental form, fluorine is a pale yellow, highly toxic and corrosive gas. In nature, fluorine is found combined with minerals as fluorides. It is the most chemically active nonmetallic element of all the elements and also has the most reactive electro-negative ion. Because of this extreme reactivity, fluorine is never found in nature as an uncombined element.

Fluorine is a member of group VIIa of the periodic table. It readily displaces other halogens–such as chlorine, bromine and iodine–from their mineral salts. With hydrogen it forms hydrogen fluoride gas which, in a water solution, becomes hydrofluoric acid.

There was no US commercial production of fluorine before World War II. A requirement for fluorine in the processing of uranium ores, needed for the atomic bomb, prompted its manufacture.[6]

Fluorine compounds or fluorides are listed by the US Agency for Toxic Substances and Disease Registry (ATSDR) as among the top 20 of 275 substances that pose the most significant threat to human health.[7] In Australia, the National Pollutant Inventory (NPI)

recently considered 400 substances for inclusion on the NPI reporting list. A risk ranking was given based on health and environmental hazard identification and human and environmental exposure to the substance. Some substances were grouped together at the same rank to give a total of 208 ranks. Fluoride compounds were ranked 27th out of the 208

ranks.[8]

Fluorides, hydrogen fluoride and fluorine have been found in at least 130, 19, and 28 sites, respectively, of 1,334 National Priorities List sites identified by the Environmental Protection Agency (EPA).[9] Consequently, under the provisions of the Superfund Act (CRECLA, 1986), a compilation of information about fluorides, hydrogen fluoride and fluorine and their effects on health was required. This publication appeared in 1993.[9]

Fluorides are cumulative toxins. The fact that fluorides accumulate in the body is the reason that US law requires the Surgeon General to set a Maximum Contaminant Level (MCL) for fluoride content in public water supplies as determined by the EPA. This requirement is specifically aimed at avoiding a condition known as Crippling Skeletal Fluorosis (CSF), a disease thought to progress through three stages. The MCL, designed to prevent only the third and crippling stage of this disease, is set at 4ppm or 4mg per liter. It is assumed that people will retain half of this amount (2mg), and therefore 4mg per liter is deemed "safe." Yet a daily dose of 2-8mg is known to cause the third crippling stage of CSF.[10,11]

In 1998 EPA scientists, whose job and legal duty it is to set the Maximum Contaminant Level, declared that this 4ppm level was set fraudulently by outside forces in a decision that omitted 90 percent of the data showing the mutagenic properties of fluoride.[12]

The *Clinical Toxicology of Commercial Products, 5th Edition* (1984) gives lead a toxicity rating of 3 to 4 (3 = moderately toxic, 4 = very toxic) and the EPA has set 0.015 ppm as the MCL for lead in drinking water–with a goal of 0.0ppm. The toxicity rating for fluoride is 4, yet the MCL for fluoride is currently set at 4.0ppm, over 250 times the permissable level for lead.

Water Fluoridation

In 1939 a dentist named H. Trendley Dean, working for the U.S. Public Health Service, examined water from 345 communities inTexas. Dean determined that high concentrations

of fluoride in the water in these areas corresponded to a high incidence of mottled teeth. This explained why dentists in the area found mottled teeth in so many of their patients. Dean also claimed that there was a lower incidence of dental cavities in communities having about 1 ppm fluoride in the water supply. Among the native residents of these areas about 10 percent developed the very mildest forms of mottled enamel ("dental fluorosis"), which Dean and others described as "beautiful white teeth."

Dean's report led to the initiation of artificial fluoridation of drinking water at 1part-per-million (ppm) in order to supply the "optimal dose" of 1mg fluoride per day–assuming that drinking four glasses of water every day would duplicate Dean's "optimal" intake for most people. Now, according to the American Dental Association, all people, rich or poor, could have "beautiful white teeth" and be free of caries at the same time. After all, the benefits of water fluoridation had been documented "beyond any doubt."[13]

When other scientists investigated Dean's data, they did not reach the same conclusions. In fact, Dean had engaged in "selective use of data," using findings from 21 cities that supported his case while completely disregarding data from 272 other locations that did not show a correlation.[14] In court cases Dean was forced to admit under oath that his data were invalid.[15] In 1957 he had to admit at AMA hearings that even waters containing a mere 0.1ppm (0.1 mg/l) could cause dental fluorosis, the first visible sign of fluoride overdose.[16] Moreover, there is not one single double-blind study to indicate that fluoridation is effective in reducing cavities.[17]

So What's the Truth About Tooth Decay?

The truth is that more and more evidence shows that fluorides and dental fluorosis are actually associated with *increased* tooth decay. The most comprehensive US review was carried out by the National Institute of Dental Research on 39,000 school children aged 5-17 years.[18] It showed no significant differences in terms of DMF (decayed, missing and filled teeth). What it did show was that high decay cities (66.5-87.5 percent) have 9.34 percent more

decay in the children who drink fluoridated water. Furthermore, a 5.4 percent increase in students with decay was observed when 1 ppm fluoride was added to the water supply. Nine fluoridated cities with high decay had 10 percent more decay than nine equivalent non-fluoridated cities.

The world's largest study on dental caries, which looked at 400,000 students, revealed that decay increased 27 percent with a 1ppm fluoride increase in drinking water.[19] In Japan, fluoridation caused decay increases of 7 percent in 22,000 students,[20] while in the US a decay increase of 43 percent occured in 29,000 students when 1ppm fluoride was added to drinking water.[21]

Dental Fluorosis: A "Cosmetic" Defect?

Dental fluorosis is a condition caused by an excessive intake of fluorides, characterized mainly by mottling of the enamel (which starts as "white spots"), although the bones and virtually every organ might also be affected due to fluoride's known anti-thyroid characteristics. Dental fluorosis can only occur during the stage of enamel formation and is therefore a sign that an overdose of fluoride has occurred in a child during that period.

Dental fluorosis has been described as a subsurface enamel hypomineralization, with porosity of the tooth positively correlated with the degree of fluorosis.22 It is characterized by diffuse opacities and under-mineralized enamel. Although identical enamel defects occur in cases of thyroid dysfunction, the dental profession describes the defect as merely "cosmetic" when it is caused by exposure to fluoride.

What is now becoming apparent is that this "cosmetic" defect actually predisposes to tooth decay. In 1988 Duncan[23] stated that hypoplastic defects have a strong potential to become carious. In 1989, Silberman,[24] evaluating the same data on Head Start children, wrote that "preliminary data indicate that the presence of primary canine hypoplasia [enamel defects] may result in an increased potential for the tooth becoming carious." In 1996 Li [25] wrote that children with enamel hypoplasia demonstrated a significantly higher caries experience than those who did not have such defects and, further, that the "presence of enamel hypoplasia may be a predisposing factor for initiation and progression of dental caries, and a predictor of high caries susceptibility in a community." In 1996 Ellwood & O'Mullane[26] stated that "developmental enamel defects may be useful markers of caries susceptibility, which should be considered in the risk-benefit assessment for use of fluoride."

Currently up to 80 percent of US children suffer from some degree of dental fluorosis, while in Canada the figure is up to 71 percent. A prevalence of 80.9 percent was reported in children 12-14 years old in Augusta, Georgia, the highest prevalence yet reported in an "optimally" fluoridated community in the United States. Moderate-to-severe fluorosis was found in 14 percent of the children.[27]

Before the push for fluoridation began, the dental profession recognized that fluorides were not beneficial but *detrimental* to dental health. In 1944, the *Journal of the American Dental Association* reported: "With 1.6 to 4 ppm fluoride in the water, 50 percent or more past age 24 have false teeth because of fluoride damage to their own."[28]

The Wonder Nutrient?

On countless internet sites, fluoride is proclaimed as the "wonder nutrient," the "deficiency" symptom being increased dental caries.[29] It boggles the mind that a cumulative toxin and toxic waste product can be described a "nutrient." Nevertheless, such claims are repeatedly made by pro-fluoridationists.[30]

On March 16, 1979, the FDA deleted paragraphs 105.3(c) and 105.85(d)(4) of Federal Register documents which had classified fluorine, among other substances, as "essential" or "probably essential." Since that time, nowhere in the Federal Regulations is fluoride classified as "essential" or "probably essential." These deletions were the immediate result of 1978 Court deliberations.[31] No essential function for fluoride has ever been proven in humans.[32,33,34,35,36]

"Nature Thought of It First"

A popular slogan employed by the ADA and other pro-fluoridation organizations is, "Nature thought of it first!" The slogan creates the impression that the fluoridation compounds used in water fluoridation are the same as those discovered many years ago in the water in some areas of the US.[37] The fluoride compound in "naturally" fluoridated waters is calcium fluoride. Sodium fluoride, a common fluoridation agent, dissolves easily in water, but calcium fluoride does not.[9]

Animal studies performed by Kick and others in 1935 revealed that sodium fluoride was much more toxic than calcium fluoride.[38] Even worse, toxicity was recorded for hydrofluorosilicic acid, the compound now used in over 90 percent of fluoridation programs, Hydrofluorosilicic acid is a *direct* byproduct of pollution scrubbers used in the phosphate fertilizer and aluminum industries. Our government adds it to water supplies even though it is also involved in getting rid of its own stockpile of fluoride compounds left over from years and years of stockpiling fluorides for use in the process of refining uranium for nuclear power and weapons.[39]

In the Kick study, less than 2 percent of calcium fluoride was absorbed and this was excreted quantitatively in the urine. But even calcium fluoride is not benign. As the animals given calcium fluoride also developed mottled teeth, it was clear that such compounds could produce changes on the teeth merely by passing through the body, and not by being "stored in a tooth" or anywhere else. No calcium fluoride was retained.

In 1946 Samuel Chase, one of the authors of the Kick study, became president of the International Association for Dental Research (IADR). This organization promoted the idea that only the fluoride ion in the various fluoridation compounds was of importance. Yet he well knew that sodium fluoride did not behave like calcium fluoride. Unlike calcium fluoride, sodium fluoride was retained in great amounts in the body and was very toxic. Rock phosphate and hydro-fluorosilicic acid experiments yielded the same information.

New areas with "natural" fluoride are appearing all over the world, as now all areas not "artificially" fluoridated are considered "natural." The problem is that this "natural" fluoride is the result of direct water and soil contamination from petrochemical land treatment, uncontrolled fertilizer use, pesticide applications, ground water contamination from industrial waste sites, rocket fuel "burial grounds," and so forth. Suddenly we have "natural" fluorides showing up in areas previously deemed "fluoride deficient"!

Total Intake

It is well established that it is TOTAL fluoride intake from ALL sources which must be considered for any adverse health effect evaluation.[40,41,42] This includes intake by ingestion,

inhalation and absorption through the skin. In 1971, the World Health Organization (WHO) stated: "In the assessment of the safety of a water supply with respect to the fluoride concentration, the total daily fluoride intake by the individual must be considered."[41] Exposure to airborne fluorides from many diverse manufacturing processes–pesticide applications, phosphate fertilizer production, aluminum smelting, uranium enrichment facilities, coal-burning and nuclear power plants, incinerators, glass etching, petroleum refining and vehicle emissions–can be considerable.

In addition, many people consume fluorine-based medications such as Prozac, which greatly adds to fluoride's anti-thyroid effects. ALL fluoride compounds–organic and inorganic–have been shown to exert anti-thyroid effects, often potentiating fluoride effects many fold.[43]

Household exposures to fluorides can occur with the use of Teflon pans, fluorine-based products, insecticides sprays and even residual airborne fluorides from fluoridated drinking water. Decision-makers at 3M Corporation recently announced a phase-out of Scotchgard products after discovering that the product's primary ingredient–a fluorinated compound called perfluorooctanyl sulfonate (PFOS)–was found in all tested blood bank examinations.[44] 3M's research showed that the substance had strong tendencies to persist and bioaccumulate in animal and human tissue.

In 1991 the US Public Health Service issued a report stating that the range in total daily fluoride intake from water, dental products, beverages and food items exceeded 6.5 milligrams daily.[42] Thus, the total intake from those sources alone already greatly exceeds the levels known to cause the third stage of skeletal fluorosis.

Besides fluoridated water and toothpaste, many foods contain high levels of flouride compounds due to pesticide applications. One of the worse offenders is grapes.[45] Grape juice was found to contain more than 6.8 ppm fluoride. The EPA estimates total fluoride intake from pesticide residues on food and fluoridated drinking water alone to be 0.095 mg/kg/day,

meaning a person weighing 70 kg takes in more than 6.65 mg per day.[45b] Soy infant formula is high in both fluoride and aluminum, far surpassing the "optimal" dose[46,47] and has been shown to be a risk factor in dental fluorosis.[48]

Tea

In their drive to fluoridate the public water supplies, dental health officials continue to pretend that no other sources of fluoride exist. This notion becomes absurd when one looks at the fluoride content in tea. Tea is very high in fluoride because tea leaves accumulate more fluoride (from pollution of soil and air) than any other edible plant.[49,50,51] It is well established that fluoride in tea gets absorbed by the body in a manner similar to the fluoride in drinking water.[49,52]

Fluoride content in tea has risen dramatically over the last 20 years due to industry contamination. Recent analyses have revealed a fluoride content of 17.25 mg per teabag or cup in black tea, and a whopping 22 mg of soluble fluoride ions per teabag or cup in green tea. Aluminum content was also high–over 8 mg. Normal steeping time is five minutes. The longer a tea bag steeped, the more fluoride and aluminum were released. After ten minutes, the measurable amounts of fluoride and aluminum almost doubled.[53]

A website by a pro-fluoridation infant medical group states that a cup of black tea contains 7.8 mgs of fluoride[54] which is the equivalent amount of fluoride from 7.8 litres of water in an area fluoridated at 1ppm. Some British and African studies from the 1990s showed a daily fluoride intake of between 5.8 mgs and 9 mgs a day from tea alone.[55, 56, 57] Tea has been found to be a primary cause of dental fluorosis in many international studies.[58-70]

In Britain, over three-quarters of the population over the age of ten years consumes three cups of tea per day.[71]Yet the UK government and the British Dental Association are currently contemplating fluoridation of public water supplies! In Ireland, average tea consumption is four cups per day and the drinking water is heavily fluoridated.

Next to water, tea is the most widely consumed beverage in the world. Tea can be found in almost 80 percent of all US households and on any given day, nearly 127 million people–half of all Americans–drink tea.[71]

The high content of both aluminum and fluoride in tea is cause for great concern as aluminum greatly potentiates fluoride's effects on G protein activation,[72] the on/off switches involved in cell communication and of absolute necessity in thyroid hormone function and regulation.

Fluoride and the Thyroid

The recent re-discovery of hundreds of papers dealing with the use of fluorides in effective anti-thyroid medication poses many questions demanding answers.[73,74] The enamel defects observed in hypothyroidism are identical to "dental fluorosis." Endemic fluorosis areas have been shown to be the same as those affected with iodine deficiency, considered to be the world's single most important and preventable cause of mental retardation,[75] affecting 740 million people a year. Iodine deficiency causes brain disorders, cretinism, miscarriages and goiter, among many other diseases. Synthroid, the drug most commonly prescribed for hypothyroidism, became the top selling drug in the US in 1999, according to Scott-Levin's Source Prescription Audit, clearly indicating that hypothyroidism is a major health problem. Many more millions are thought to have undiagnosed thyroid problems.

Environment

Every year hundreds and thousands of tons of fluorides are emitted by industry. Industrial emissions of fluoride compounds produce elevated concentrations in the atmosphere. Hydrogen fluoride can exist as a particle, dissolving in clouds, fog, rain, dew, or snow. In clouds and moist air it will travel along the air currents until it is deposited as wet acid deposition (acid rain, acid fog, etc.) In waterways it readily mixes with water.

Sulfur hexafluoride (SF6), emitted by the electric power industry, is now among six greenhouse gases specifically targeted by the international community, through the Kyoto protocol, for emission reductions to control global warming. The others are carbon dioxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), methane and nitrous oxide (N2O).

SF6 is about 23,900 times more destructive, pound for pound, than carbon dioxide over the course of 100 years. EPA estimates that some seven-million metric tons of carbon equivalent (MMTCE) escaped from electric power systems in 1996 alone. The concentration of SF6 in the

atmosphere has reportedly increased by two orders of magnitude since 1970. Atmospheric models have indicated that the lifetime of an SF6 molecule in the atmosphere may be over 3000 years.[76]

The ever-increasing fluoride levels in food, water and air pose a great threat to human health and to the environment as evidenced by the endemic of fluorosis worldwide. It is of utmost urgency that public health officials cease promoting fluoride as beneficial to our health and address instead the issue of its toxicity.

Sidebars

Symptoms of Fluoride Poisoning

- Black tarry stools
- Bloody vomit
- Faintness
- Nausea and vomiting
- Shallow breathing
- Stomach cramps or pain
- Tremors
- Unusual excitement
- Unusual increase in saliva
- Watery eyes
- Weakness
- Constipation
- Loss of appetite
- Pain and aching of bones
- Skin rash
- Sores in the mouth and on the lips
- Stiffness
- Weight loss
- White, brown or black discoloration of teeth

Long Term Effects of Fluoride

- Accelerated aging
- Immune system dysfunction

- Compromised collagen synthesis
- Cartilage problems
- Bony outgrowths in the spine
- Joint "lock-up"

G Proteins

Signals or communications from one cell to another, and from the outside of the cell to the inside, are made possible by the action of special proteins called "G" proteins, which are found in all animal life, including yeasts. G proteins are so called because they bind to guanine nucleotides, a major component of DNA and RNA. G proteins mediate the actions of neurotransmitters, peptide hormones, odorants and light. In other words, G proteins make it possible for our nervous systems to function properly and, in particular, allow for night vision and the sense of smell. All thyroid function is mediated by G-protein activity. Both aluminum and fluoride interfere with the activation of G proteins. Thyrotropin, the thyroid-stimulating hormone (TSH), is considered the natural G-protein activator. Its action is mimicked by fluoride and vastly potentiated by the presence of aluminum. Pharmacologists estimate that up to 60 percent of all medicines used today exert their effects through G-protein signaling pathways. Vitamin A from cod liver oil has been used successfully to bypass blocked G-protein pathways due to vaccination damage. (See Autism and Vaccinations (index.php?option=com_content&view=article&id=334:autism-and-vaccinations&catid=35:childrens-health&Itemid=127).) Myristic acid, a saturated fatty acid having 14 carbons, plays an important roll in G-protein function as these signaling proteins require myristic acid added to one end of the protein. (See Saturated Fats and the Kidneys (index.php?option=com_content&view=article&id=539:saturated-fats-and-the-kidneys&catid=32:know-your-fats&Itemid=134).) Thus, diets deficient in vitamin A and saturated fats can be expected to contribute to nervous disorders and vision problems.

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Print post

About Andreas Schuld

Andreas Schuld is head of the global organization Parents of Fluoride Poisoned Children (PFPC). He is considered by many to be the world's

foremost authority on the effects of inorganic and organic fluorides on the thyroid gland and on thyroid hormone metabolism.

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Water Fluoridation

APRIL 25, 2019 BY PAUL CONNETT (HTTPS://WWW.WESTONAPRICE.ORG/AUTHOR/PCONNETT/)

Print post

The Latest Science Indicates That the Practice Must Stop

Water fluoridation is the deliberate addition of a substance containing, or yielding, fluoride (that is, in the form of the free fluoride ion) to the public water supply with the ostensible aim of reducing tooth decay. The concentrations of fluoride used for this purpose in the U.S. range from 0.7 to 1.2 milligrams of fluoride per liter of water (0.7-1.2 parts per million or ppm). When the practice began in the U.S. and Canada in 1945 there were no published studies available which demonstrated that consuming fluoride at these levels was safe.

Without any formal study, it was assumed that because some people in some places had consumed natural fluoride levels higher than 1 ppm for many years, with no "apparent" harm recorded, adding fluoride to water would be safe.

The authors both work for the Fluoride Action Network (FAN),[1] a nonprofit dedicated to education and sharing information on the toxicity of fluoride. FAN maintains the largest database dedicated to fluoride's toxicity on blood,[2] bone,[3] brain,[4] heart,[5] kidney,[6] liver,[7] lung,[8] the reproductive system,[9] and the thyroid gland;[10] as well as the largest collection of news articles on fluoride[11] that are accessible by country, by state for the U.S. and by province for Canada. The website also contains links to many videotaped interviews,[12] government reports by country,[13] fluoride industrial emissions by state[14] and more.

NEITHER ETHICAL NOR SCIENTIFIC

public health experiments in U.S. history.

PROTECTING A BELIEF SYSTEM

The dilemma for those who believe that this practice is causing harm is how to end it when most people don't even know their water is being fluoridated and don't know the potential risks it may be posing to their children. Sadly, most doctors and dentists simply follow the policies of their professional bodies without reading the literature for themselves. The media are not telling the public about the latest health studies and are simply parroting statements from organizations like the American Dental Association (ADA) and agencies like the Oral Health Division of the Centers for Disease Control and Prevention (CDC), which hold a long standing "belief" in the "safety and effectiveness" of this practice. Meanwhile, government health departments at all levels appear to be more interested in protecting this outdated policy than protecting the health of our children.

The task that FAN has set itself since 2000 is to share the science about the dangers posed by this practice with those who are willing to read and listen, mainly through our web page at FluorideALERT.org and through public presentations (for example, in Seattle[15]). The latest science makes it very clear that the practice of fluoridation must stop!

FLUORIDE AND INTELLIGENCE

In 2006, the National Research Council (NRC) of the National Academies concluded that "fluorides have the ability to interfere with functions of the brain"[16] and for the first time called fluoride an endocrine disruptor.[17]

In 2006, there were only five IQ studies available to the NRC panel. Subsequently, many more have been published (including studies that were previously only available in Chinese). As of 2019, we now have sixty studies, fifty-three of which have shown a lowered IQ in children in communities with high fluoride exposure compared to communities with lower fluoride

from Harvard, which was published in one of the world's leading environmental health journals, *Environmental Health Perspectives*.[19] While this team had concerns about the lack of information on several possible confounding factors in many of these studies, they were struck by the consistency of the results. Even though the research was carried out over a period of twenty-one years, by many different research teams, in two countries (China and Iran) and in many different locations, twenty-six out of the twenty-seven studies found the same result: a lowering of IQ. The average lowering was seven IQ points.

It should be noted that a shift downward of five IQ points in a large population would halve the number of very bright children (IQ greater than one hundred thirty) and increase by over 50 percent the number of mentally handicapped (IQ lower than seventy). Such a downward shift would have both huge economic and social consequences for a country like the USA.

Promoters of fluoridation have done their best to diminish the significance of these findings for fluoridated communities, but recent findings have largely undermined their self-serving arguments. A rigorous U.S. government-funded study carried out by a highly qualified research team headed by Dr. Morteza Bashash confirmed that fluoride is neurotoxic at levels currently experienced in fluoridated communities and, for this effect, the most vulnerable stage of human life is during fetal development.[20] This study was conducted in Mexico City with two hundred ninety-nine mother-offspring pairs. The authors found strong associations between fluoride exposure to the pregnant women (as measured in their urine) and lowered IQ in their offspring at age four and again at six to twelve years of age. Subsequently, in 2018, a study reported that the lowering of IQ in the same cohort also occurred in an earlier age range (one to three years).[21]

In 2018, using the same Mexico City cohort, Dr. Bashash found that there was a strong association between some of the symptoms of ADHD in the children and urine fluoride levels in the pregnant women.[22] A 2015 study found a relationship between the prevalence of ADHD in the U.S. and fluoridation status by state; the higher the percentage of the state fluoridated, the greater the prevalence of ADHD.[23]

Life Exposures in Mexico to Environmental Toxicants) directed by professor Howard Hu from the University of Toronto. The Bashash study took over twelve years and involved researchers from many distinguished universities and institutions in Canada, the U.S. and Mexico. These included the universities of Toronto, McGill, Indiana, Illinois, Michigan, Harvard, as well as Mount Sinai and the National Institute of Perinatology in Mexico. These researchers have published over fifty studies conducted along similar lines for other neurotoxicants. Of particular importance was the fact that, unlike most of the other IQ studies on fluoride, this study involved measurements at the individual (not community) level for both mother and child. Based upon their extensive experience, the authors controlled for a large number of potential confounding variables, and even after controlling for these they still found a very strong relationship between fluoride exposure during pregnancy in the mother and lowered IQ in their offspring.

Fluoridation promoters, including the American Dental Association, have claimed that this study was not relevant to fluoridated communities in the U.S. because Mexico City does not have artificial fluoridation and pregnant women there are likely to have higher doses of fluoride from fluoridated salt and some naturally fluoridated water areas. Such arguments are not convincing because the biometric of exposure used was fluoride levels in the urine, which is a measure of total dose of fluoride and is independent of the source. Moreover, the range of exposure in Mexico City was within the range of fluoride levels in the urine of adults in the U.S. This point was further confirmed by a subsequent national study of the urine fluoride levels in pregnant women in Canada. This study found that levels of fluoride in the urine of Canadian women living in fluoridated communities were almost identical to the levels in Mexico City, namely 0.87 ppm in Canada versus 0.91 ppm in Mexico City.[24]

As far as the politics of fluoridation are concerned, it is significant that some of the world's leading neurotoxicologists, like Phillipe Grandjean (mercury specialist) and David Bellinger (lead specialist), are now participating in this research as well as reviewing the literature.[25,26] They now see fluoride's neurotoxicity in the same vein as that of lead, arsenic, mercury and other well-established neurotoxicants.

cellular brain studies;[29] and thirty review studies.[30]

FLUORIDE AND HYPOTHYROIDISM

In the 1930s, '40s and '50s, doctors in Argentina, France and Germany used sodium fluoride to lower the activity of the thyroid gland for those suffering from hyperthyroidism (overactive thyroid gland).[31 -37] Despite this knowledge, government agencies in the U.S. and other fluoridating countries have never seen fit to investigate a possible relationship between fluoride exposure and the rising level of hypothyroidism in their countries. Only recently have scientists reviewed the matter.[38-41]

A 2018 study, reported that while they could find no relationship between fluoride exposure and TSH levels (thyroid stimulating hormone and an indicator of hypothyroidism) and fluoridation status among the general population, they did find that for those who had low or even borderline iodine intake, fluoride exposure was associated with an increase in their TSH levels.[42]

The importance of this finding is that it gives a very plausible mechanism for why fluoride might lower IQ in children born to mothers with high fluoride exposure. When the fetus comes into existence it has no thyroid gland. It is entirely dependent on the mother's thyroid levels for its early mental development. So any depression in the mother's thyroid hormone levels will increase the risk of lowered IQ in their offspring (see Vyvyan Howard's explanation of this situation in a PowerPoint presentation he gave in New Zealand in 2018).[43]

WARNING PREGNANT WOMEN

One of the sad consequences of the medical community's acceptance of the safety-and-effectiveness argument for water fluoridation, based upon dogma rather than upon the latest science, is that many doctors are oblivious of these findings. The result is that women are not being warned to avoid fluoride exposure during pregnancy. They are not being warned by

to try to end the well-entrenched practice of water fluoridation.

LAWSUIT PROVIDES NEW HOPE

In November 2016, the Fluoride Action Network, along with Food & Water Watch, the American Academy of Environmental Medicine, the International Academy of Oral Medicine and Toxicology, Moms Against Fluoridation, the Organic Consumers Association and individuals, petitioned the EPA[46] to ban the deliberate addition of fluoride to public drinking water under provisions in the Toxic Substances and Control Act.

We argued that "[t]he risk to the brain posed by fluoridation additives is an unreasonable risk because, *inter alia*, it is now understood that fluoride's predominant effect on tooth decay comes from topical contact with teeth, not ingestion. Since there is little benefit in swallowing fluoride, there is little justification in exposing the public to any risk of fluoride neurotoxicity, particularly via a source as essential to human sustenance as the public drinking water and the many processed foods and beverages made therefrom. The addition of fluoridation chemicals to water thus represents the very type of unreasonable risk that EPA is duly authorized to prohibit pursuant to its powers and responsibilities under Section 6 of TSCA, and Petitioners urge the Agency to exercise its authority to do so."

In September 2017[47] the EPA rejected our petition on its scientific merits. In response to an appeal from FAN, a federal court denied EPA's motion to dismiss in December 2017.[48]

Also in December 2017[49] the EPA argued that no other studies should be added to the case after our petition was first delivered to them in November 2016. The court disagreed with EPA[50] and ruled to allow new studies, such as those by Bashash and others discussed above. A trial date has been set to take place in federal district court in San Francisco in August 2019.

We are confident that we can win this case. In order to do so, it will require us to demonstrate three things: 1) that fluoride poses a hazard to the developing brain; 2) that there is a risk at

ways of delivering fluoride to the surface of teeth than putting fluoride into the drinking water. Indeed, the majority of countries worldwide that do not fluoridate their water have actually demonstrated this over many years.

SUMMARY AND CONCLUSIONS

There are many ethical and scientific arguments against the seventy-year practice of water fluoridation. The evidence that swallowing fluoride reduces tooth decay remains weak. Not a single randomized controlled trial has been attempted to demonstrate this, and promoters have relied on studies with far weaker methodologies.[65] Meanwhile, the number of studies that indicate harm can be caused, even at the doses experienced in fluoridated communities, has been growing, particularly studies on the brain.[20,22,24,42,46]

With such risks on the table, it is unconscionable, in our view, that governments continue to promote the deliberate addition of a known neurotoxic and endocrine-disrupting substance to the drinking water of millions of people, most of whom have not been informed of the risks involved, or been given the opportunity to give—or refuse—their consent on the matter.

SIDEBARS

ELEVEN ARGUMENTS WHY FLUORIDATION SHOULD BE ENDED

1. Fluoridation is unethical. Using the public water supply to deliver dental therapy goes against all recognized principles of modern pharmacology and ethical healthcare practice. It imposes medication on all water consumers indiscriminately and without the individual's informed consent. These include the unborn, bottle-fed infants, persons with chronic diseases known to be aggravated by fluoride (such as poor kidney function), the poorly nourished (such as those with low iodine intake) and the elderly. It does so with uncontrolled dosage, no monitoring of adverse effects and no possibility of avoiding treatment for most, if not all, people. This is especially true for those on a low-income budget who simply cannot

population. Ninety-five percent of the world's people drink water without artificial fluoridation. Over half of those who do, live in the U.S. In Europe, where forty-three out of forty-eight nations have no water fluoridation, 98 percent of the population is not forced to drink fluoridated water. A few European countries (namely France, Germany, Switzerland and Austria) have fluoridated salt available, but people are not forced to buy this salt, as non-fluoridated salt is also available. Despite this, World Health Organization (WHO) data61 indicate that since the 1960s, tooth decay in twelve-year-olds has been coming down as fast in non-fluoridated countries as in fluoridated ones.

3. Children in fluoridated communities are being grossly over-exposed to fluoride. In the U.S. and other fluoridated countries, there has been a dramatic increase in young children and teens in the prevalence of dental fluorosis (discoloration of tooth enamel caused by low-level systemic fluoride toxicity during tooth formation). This condition indicates that children have been grossly over-exposed to fluoride before their permanent teeth have erupted. The latest national survey indicates that over 60 percent of U.S. teens have dental fluorosis.[52,53] Of those, 24 percent have moderate and nearly 2 percent have severe levels of the disease. These levels can produce yellow and brown staining and structural damage to the enamel. To put this into context, the early promoters of fluoridation anticipated only 10 percent of the children in fluoridated communities would be affected by this condition, and these would be only in the "very mild" category. They believed that this was an acceptable trade-off for reducing tooth decay. Even avid promoters of fluoridation no longer accept that the current prevalence rates as acceptable but they tend to blame other sources of fluoride—rather than water fluoridation—for the dramatic increase. In reality, every source of fluoride ingested contributes to this prevalence. The contribution from water fluoridation can be eliminated with a simple policy change.

4. Fluoride has the potential to damage many other tissues. Because of the prevalence of dental fluorosis, there is no question that fluoride can damage the developing teeth. Nor is there any question from the evidence provided in countries with large areas of endemic fluorosis (such as India and China) where millions of people have both dental and skeletal fluorosis, that high doses of fluoride can damage other tissues including bones, connective tissue, the brain, the endocrine system, the gut and kidneys. The Indian Ministry of Health &

that this harm can occur at doses experienced in artificially fluoridated communities.

5. Fluoridation is unnecessary. Fluoride is not an essential nutrient. No one has ever demonstrated that a single biological process in the human body needs fluoride to function properly. There is no such thing as a "fluoridedeficiency" disease. Children can have perfectly good teeth without ingesting fluoride. Even promoters of water fluoridation admit that the predominant benefit of fluoride is topical, not systemic.[55-58] Thus, it is morally indefensible to force people to ingest fluoride via the public water supply, when for those who want fluoride, fluoridated toothpaste is universally available. Moreover, the fluoride used in toothpaste is pharmaceutical grade whereas the fluoride used to fluoridate water is an industrial grade hazardous waste product from the phosphate fertilizer industry.[25]

6. Today's fluoride is worse. The fluoridating chemical used in over 90 percent of the fluoridating communities in the U.S. is a substance called hexafluorosilicic acid (H2SiF6). This substance is removed from the scrubbing systems of the phosphate fertilizer industry as a 23-25 percent solution. It is contaminated with trace amounts of other toxic substances including aluminum, arsenic, lead and radioactive isotopes (the same ore that is mined for fluoride in Florida is also mined for uranium). Ironically, this waste product cannot be dumped into the sea by international law, but health authorities blandly allow it to be put untreated into the public water supply!

7. Fluoride is very toxic and nature has developed protection mechanisms for many living things. For lower creatures like bacteria and fungi, there are genes—switched on by high levels of fluoride—which code for proteins called fluoride exporting proteins (FEX proteins). These proteins are located in the cellular membranes and pump fluoride out of the cell.[26] In mammals, the kidney excretes about 50 percent of fluoride ingested each day from healthy individuals, and most of the rest is rapidly sequestered in hard tissues like the bones. Importantly, the human breast appears to act as a fluoride filter for the new born baby. The level in mothers' milk is remarkably low (0.004 ppm).[27] Thus, a bottle-fed baby, when the formula is made up with fluoridated tap water (0.7 to 1.2 ppm), will get approximately two hundred times more fluoride than a breastfed infant (that is, two hundred times more than nature intended).

8. Fluoridation is unscientific. Fluoridation is promoted with PR techniques like endorsements,

value unless they are accompanied by an up-to-date review of the literature—and very few are. Incredibly, in over seventy years there has been no randomized control trial (RCT) to demonstrate that swallowing fluoride lowers tooth decay. As far as the U.S. Food and Drug Administration (FDA) is concerned, an RCT is the gold standard for approving new drugs. According to the FDA, fluoride is an unapproved drug[28] and the FDA has never approved fluoride tablets for ingestion. Many decision makers and journalists around the world are impressed when they read the notorious statement from the CDC in 1999 that "Fluoridation is one of the top public health achievements of the 20th century."[63] However, what they may not realize is that this statement did not come from the CDC itself (which has about thirty thousand employees, many of whom are highly qualified in many medical fields as well as toxicology) but from the CDC's small Oral Health Division with only thirty employees, most of whom only have dental qualifications. Moreover, their job is defined as promoting fluoridation. They even admit to not following—or being responsible for—the science pertaining to fluoride's harmful effects. Journalists and others have been impressed by a public relations exercise by a promotional body, not by a body that maintains a careful overview of any harm the practice may be causing.

9. Health risks are ignored in fluoridated countries. Sadly, because the imposed dental practice of water fluoridation is so entrenched in the psyche of the medical, dental and public health establishments in fluoridated countries, neither governments nor the mainstream media are warning the public about the large and growing
body of scientific research30 that shows that fluoride exposure poses many health risks.

10. Fluoridation violates the precautionary principle. The scientific evidence that swallowing fluoride lowers tooth decay is weak,[31] but the weight of evidence that it causes harm to the developing brain is so one-sided, that to wait for further studies before halting the deliberate addition of fluoride to water is a rash and irresponsible public health position.

11. Fluoridation violates the principles of environmental justice. The addition of fluoride to public water is an environmental injustice to people living in poverty in fluoridated areas who do not have access to alternative water
sources and are captive to tap water for all their water needs. Moreover, it is well established that those with poor

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Print post

About Paul Connett

Dr. Paul Connett is a graduate of Cambridge University and holds a PhD in chemistry from Dartmouth College. From 1983-2006 Paul taught chemistry at St. Lawrence University in Canton, New York, where he specialized in environmental chemistry and toxicology. Over the past thirty-two years his research on waste management has taken him throughout the U.S. and Canada and sixty-four other countries, where he has given over 2500 pro bono public presentations. Ellen Connett has a long history of environmental and social activism having been involved with the American Committee to Keep Biafra Alive, Operation Omega, Work on Waste St. Lawrence County, NY and Waste Not. She is managing director of the Fluoride

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City Commission Agenda Memo

Meeting Date: April 8, 2025
From: Scott Fregonese, Interim Planning Director
Subject: Ordinance 1283, Goal Exception for Flowlane Dredge Material

Summary:

The United States Army Corps of Engineers (USACE) operates and maintains the Columbia River Federal Navigation Channels (CR FNCs), which includes dredging and dredged material placement to maintain congressionally-authorized channel dimensions. The 600-foot wide, 43-foot deep navigation channel generally follows the Oregon-Washington border and extends 142 miles from the Mouth of the Columbia River (RM3) to the Bonneville Dam (RM 145). Per information from the USACE, the Columbia-Snake River Navigation System moves over 50 million tons of cargo annually. The estimated value of that cargo is approximately $23 billion. The Lower Columbia River is used to annually transport and/or export commodities including wheat, soy, corn, grain, and forest and mineral bulk exports.

In 2023, the USACE applied to the Oregon Department of Environmental Quality (DEQ) to renew its existing Section 401 Water Quality Certification for the continued Operation and Maintenance (O&M) of the Columbia River FNC. This includes associated disposal of dredged materials in identified locations. As part of ongoing Columbia River management discussion with the USACE, the State had been aware of the Corps' ongoing maintenance included disposing of materials in the "flowlane".

Around 2010, the USACE altered its flowlane disposal practices, such that they were no longer consistent with flowlane definition contained in Clatsop County's or the City of Warrenton's policies. The intent of the changes, as stated by the USACE, was to adaptively manage sediments based on current river conditions and to keep sediments within the riverine sediment budget whenever feasible. To accomplish this goal, the USACE switched from disposing of dredged materials only on the flowlane, to a "thalweg"-based approach that utilizes both the flowlane and contours immediately adjacent to the flowlane that are 20-foot deep or deeper. It is estimated that the annual volume of dredged sediment that is typically placed within the expand flowlane/thalweg is approximately one million cubic yards per year. That estimate does not include future placement by non-USACE users such as the Port of Astoria and the U.S. Coast Guard.

Because the thalweg-based approach is based upon river hydrology and hydraulics, it does not remain in a fixed location. Conversely, the flowlane designated by Clatsop County is a static area. Therefore, USACE's change in practice resulted in a discrepancy between the City's comprehensive plan and the actual work being performed by the Corps.

In 2023, Clatsop County was notified by DEQ that USACE had submitted an application for a 401 Water Quality Certification for continued operations and maintenance in the Lower Columbia River. As part of that review, the state and County became aware that USACE's flowlane disposal practices had evolved and were no longer in compliance with flowlane regulations adopted by Clatsop County in 2005. As a result, County staff were unable to complete the required land use compatibility statement demonstrating consistency with the comprehensive plan and the County's land use regulations. Subsequently, DEQ was unable to approve the 401 Water Quality Certification. The denial led to a series of ongoing meetings between county, state and USACE staff, resulting in these applications. City of Warrenton staff were brought in to the conversation once a path of compliance was identified.

The purpose of this application is threefold:

1. to obtain a reasons-based exception from Goal 16 to allow this practice to continue and to be in compliance with the City of Warrenton's comprehensive plan and implementing ordinances,
2. allow dredged material to be placed in areas 20ft or deeper contiguous with the federal navigation channel and in waters deeper than 65' downstream of the Megler Bridge,
3. allow the expanded thalweg dredged material disposal area to be available for use by USACE as well as all other dredging users.

The Warrenton Development Code directs applicants requesting an Amendment to the Comprehensive Plan Text and Map, Rezone, and Development Code (16.232) to follow the Type IV Procedures outlined in Section 16.208.060. The application is being reviewed in accordance with those procedures. The application went before the Planning Commission on December 12, 2024, who moved to forward the applications to the City Commission for a decision.

The Interim Planning Director recommends approval of this application.

The action requested tonight is to either adopt or reject Ordinance 1283 for the approval of the changes to the Comprehensive Plan.

Recommendation/Suggested Motion:

"I move to conduct the first reading, by title only, of Ordinance number 1283, AN ORDINANCE APPROVING THE CHANGES TO THE WARRENTON COMPREHENSIVE PLAN AS DESCRIBED IN ORDINANCE NUMBER 1283 SUBJECT TO THE RECOMMENDED CONDITIONS OF APPROVAL."

Fiscal Impact:

N/A

Attachments:
(All supporting documentation, i.e., maps, exhibits, etc., must be attached to this memorandum.)

- Staff Report
- Ordinance No. 1283
- Exhibit 1

Approved by City Manager: Esther Moberg

Esther Moberg

From: Jessica McDonald
Sent: Monday, February 24, 2025 9:13 AM
To: Esther Moberg
Subject: Bathymetric Survey Review & Dredging Planning
Attachments: 25-003_Adv Remediation_Hammond Boat Basin 2025 Bathymetry_02-17-25.pdf; 2021 Post Dredge Survey.pdf; 2019 Pre Dredge Survey.pdf

Hi Esther,

I have received the Bathymetric Surveys and put together some thoughts on the reports, along with recommendations for the Hammond Marina Dredging Plan. I thought this might be information the Mayor and City Commission would be interested in reviewing. I'm not sure if they'd want all of my insights on the sediment buildup and dredging considerations, but I wanted to share just in case it's helpful!

I have reviewed the bathymetric surveys completed in February 2025 and compared them with the pre- and post-dredge surveys from 2019, 2020, and 2021. It appears that most areas of the marina have accumulated 1–2 feet of sediment over the past four years since the last dredging. In my opinion the dredge prism from 2019–2021 did not fully cover the mooring slips or get close enough to the banks on the west, south, and east sides of the basin. With the additional sediment buildup, planning for dredging in 2026–2027 will definitely be necessary.

In the upcoming permits, I am proposing to expand the dredge prism in certain areas and further evaluate the slope on the south side, where the two runoff piles appear to be contributing to increased sediment buildup. Mike Balensifer has advocated for a deeper dredging area or a strategically placed hole near the runoff piles to slow down sediment accumulation. Our engineers are reviewing this, considering bank slope recommendations that were not factored into previous dredging efforts because the marina had to separate the Bank Stabilization project & Dredging at that time. Since bank stabilization occurred after the last dredging, proper slope adjustments may help mitigate sedimentation issues on the south side of the basin.

For the current dredging permits, I will be requesting authorization to dredge to -10 feet. As seen in the post-dredge surveys from 2021 compared to the 2025 surveys, the areas where Bergerson accidentally over-dredged to -10 feet have not experienced significant siltation. This aligns with the idea that deeper water supports stronger currents, which help flush sediment and reduce accumulation rates.

Additionally, the Army Corps of Engineers recently contacted our contractor, Eric Campbell, and indicated that any in-water disposal will likely depend on how/when the City approves USACE's dredging and in-water disposal around the navigation channel. There is a possibility that we may be required to barge materials elsewhere or conduct upland disposal, which could significantly increase—possibly even double—the cost of dredging for the Hammond Marina. The Army Corps has also thrown some extra hoops at us pertaining to our pile permit that was almost competed. It feels like they are flexing what they can to make our life more difficult and could potentially stop our pile permit or add additional permitting costs to that project as well. Hopefully, I am wrong. They are claiming that our pile permit could affect the federal levee system and requires an additional 408 review process, which has never been brought up or been an issue with prior pile replacement.

Please let me know if you have any questions or if there are any additional considerations we should factor into the dredging plan.

Jessica McDonald (she/her)
Harbormaster
Office : 503-861-3822
P.O. Box 250 | 501 NE Harbor Place
Warrenton OR, 97146
warrentonoregon.us/marinas | facebook.com

"Making a difference through excellence of service"

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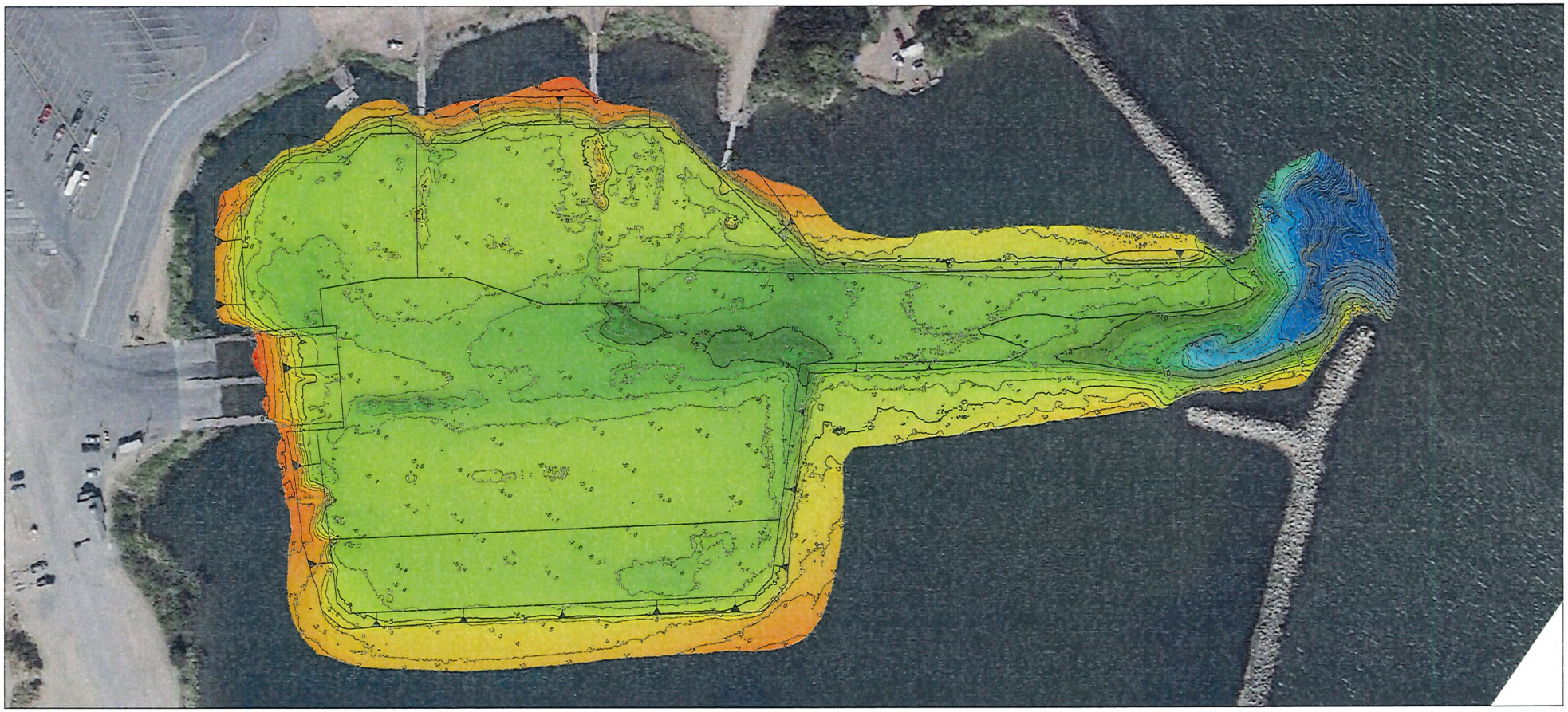
City of Warrenton

Hammond Boat Basin 2025 Bathymetry Survey

Data Collected: February 17, 2025

Drawing Date: February 20, 2025



NOTES:

1. HORIZONTAL DATUM NAD 83(2011) EPOCH 2010.00 NAD83 STATE PLANE COORDINATES, OREGON NORTH ZONE.
2. UNITS: U.S. SURVEY FEET
3. VERTICAL DATUM: MEAN LOWER LOW WATER (MLLW)
4. CONTOUR INTERVAL: 1 FOOT.
5. ALL HORIZONTAL POSITIONING AND VESSEL ATTITUDE WAS PROVIDED IN REAL TIME USING RTK APPLANIX POSPAC MMS. GPS ANTI-NOTIONAL ATMOSPHERIC REFRACTING SITE CORRECTIONS FROM THE NEARBY NETWORK.
6. SOUNDINGS WERE COLLECTED USING NORTH 3 DYNAMIC SURVEY MULTI-BEAM SONAR SYSTEM. DATA PROCESSING WAS COMPLETED USING CARIS HIPS&S. SEE SHEET NOTE PAGE
7. THIS BATHYMETRIC SURVEY IS REPRESENTATIVE OF THE GENERAL CONDITION OF THE SEAFLOOR AT THE TIME OF THE SURVEY. THE CONFIGURATION AND POSITION MAY CHANGE AT ANY TIME AFTER THE SURVEY IS MADE.
8. ALL BATHYMETRIC DATA WAS REDUCED ELECTRONICALLY AND MANUALLY WITHIN THE U.S. ARMY CORPS OF ENGINEERS HYDROGRAPHIC SURVEY MANUAL EM1110-2-1003 (ON FILE IN THE NORTHWEST DIVISION, U.S. ARMY CORPS OF ENGINEERS, PORTLAND, OREGON). NAVIGATION AND DREDGING SUPPORT SURVEYS, SECTION 12, SAMPLE STATEMENT OF SURVEY.
9. ATTEMPT WAS MADE TO LOCATE AND DEPICT ALL SIGNIFICANT NAVIGATIONAL HAZARDS, BOTH NATURAL AND MAN-MADE, AND ALL FEATURES DISPLAYED ON THIS PLAN SHOULD BE CONSIDERED APPROXIMATE ONLY.

THIS HYDROGRAPHIC SURVEY WAS COMPLETED BY AN AMERICAN CONGRESS ON SURVEYING AND MAPPING CERTIFIED HYDROGRAPHER.

JAMES W. GLASCOCK — DATE
AMERICAN CONGRESS ON SURVEYING AND MAPPING
CERTIFIED HYDROGRAPHER #1122

2025 Hammond Boat Basin Dredge Quantity - February 17, 2025

Bid Item	Minimum Dredge Elev (-8 MLLW)	+1 Allowable Over-dredge	Total Dredge Qty
Boat Basin	15,223 cy	9,786 cy	25,009 cy

NORTHWEST HYDRO INC.
31 COUGAR CREEK RD.
SKAMANIA, WA 98648
PH (509) 427-5081
EMAIL: NWHYDRO@SAW.NET

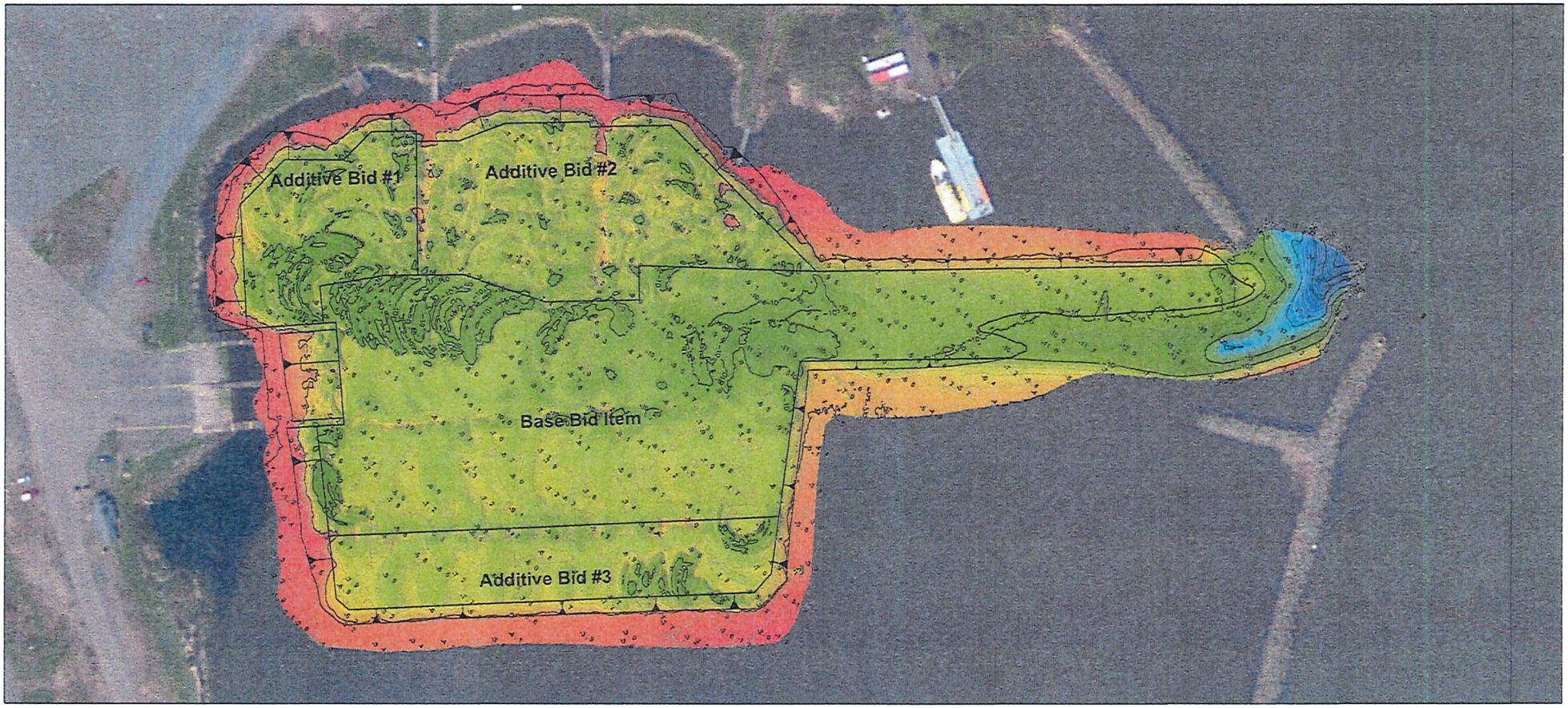
City of Warrenton

Hammond Boat Basin Maintenance Dredging

2021 Post-Dredge Bathymetric Survey

Data Collected: January 18, 2022

Drawing Date: January 20, 2021



2021 Base Bid Item Final Pay Dredge Quantities - January 18, 2022

	Minimum Dredge Elev	+1 Allowable Over-dredge	Total Dredge Qty Avail.
Pre-Dredge Available	1,591 cy	2,792 cy	4,383 cy
Post- Dredge Available	420 cy	1,973 cy	2,393 cy
Pay Quantity Removed	**1,171 cy**	**819 cy**	**1,990 cy**

2021 Additive Bid #1 Final Pay Dredge Quantities - January 18, 2022

	Minimum Dredge Elev	+1 Allowable Over-dredge	Total Dredge Qty Avail.
Pre-Dredge Available	6,313 cy	1,141 cy	7,454 cy
Post- Dredge Available	580 cy	385 cy	965 cy
Pay Quantity Removed	**5,733 cy**	**756 cy**	**6,489 cy**

2021 Additive Bid #2 Final Pay Dredge Quantities - January 18, 2022

	Minimum Dredge Elev	+1 Allowable Over-dredge	Total Dredge Qty Avail.
Pre-Dredge Available	11,669 cy	2,276 cy	13,945 cy
Post- Dredge Available	1,046 cy	1,134 cy	2,180 cy
Pay Quantity Removed	**10,623 cy**	**1,142 cy**	**11,765 cy**

2021 Additive Bid #3 Final Pay Dredge Quantities - January 18, 2022

	Minimum Dredge Elev	+1 Allowable Over-dredge	Total Dredge Qty Avail.
Pre-Dredge Available	793 cy	1,169 cy	1,962 cy
Post- Dredge Available	443 cy	984 cy	1,427 cy
Pay Quantity Removed	**350 cy**	**185 cy**	**535 cy**

NORTHWEST HYDRO INC.
31 COUGAR CREEK RD.
SKAMANIA, WA 98648
PH (509) 427-5081
EMAIL: NWHYDRO@SAW.NET

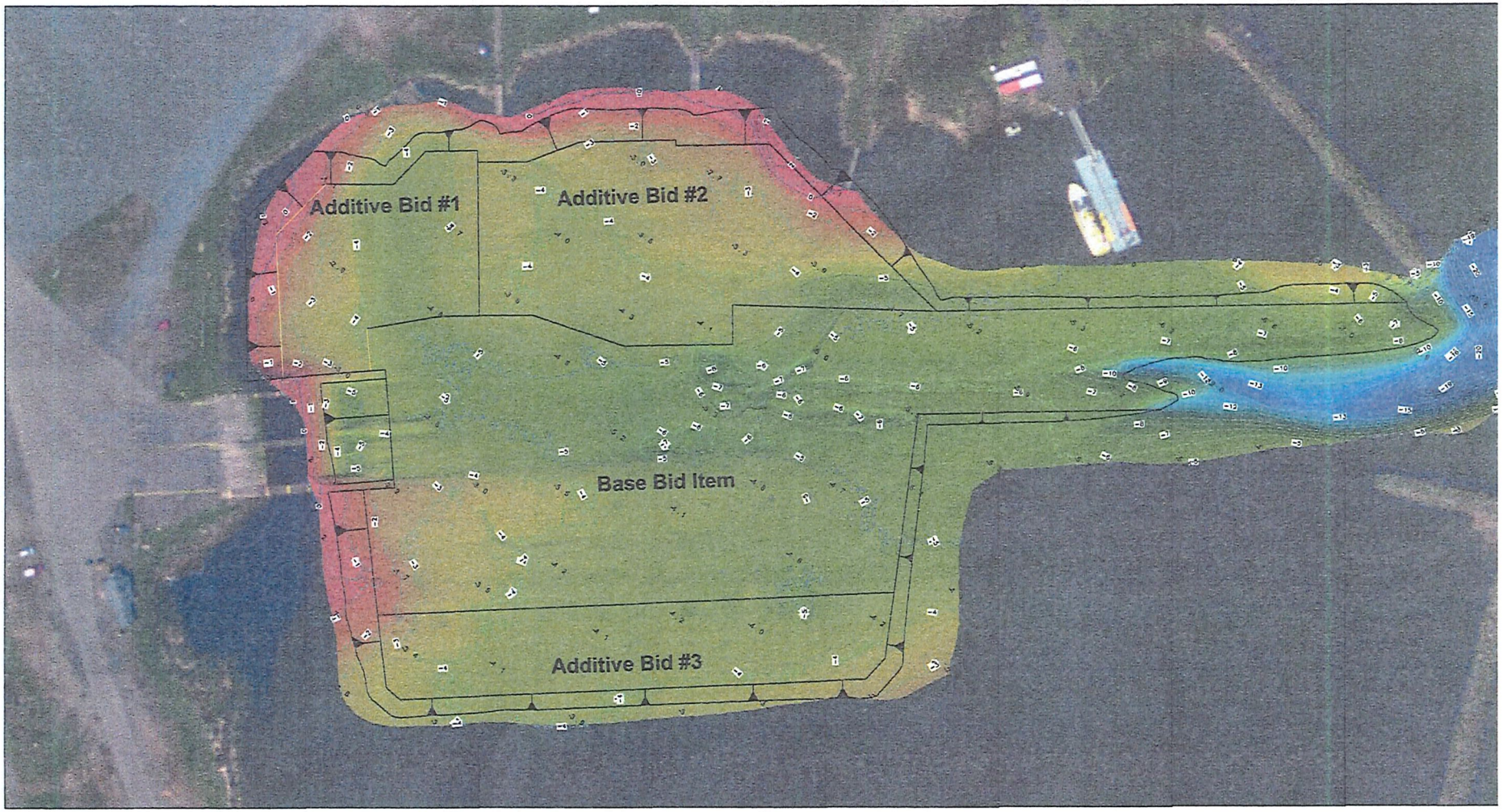
City of Warrenton

Hammond Boat Basin Maintenance Dredging

Pre-Dredge Bathymetric Survey

Data Collected: November 17, 2019

Drawing Date: November 21, 2019



2019 Hammond Boat Basin Pre-Dredge Quantity - November 17, 2019

Bid Item	Minimum Dredge Elev	+1 Allowable Over-dredge	Total Dredge Qty
Base Bid	21,261 cy	6,391 cy	27,652 cy
Additive Bid 1	6,444 cy	1,142 cy	7,586 cy
Additive Bid 2	11,856 cy	2,295 cy	14,151 cy
Additive Bid 3	6,964 cy	1,474 cy	8,438 cy
Project Total	46,525 cy	11,302 cy	57,827 cy

Oregon
Tina Kotek, Governor

Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
(503) 986-5200
FAX (503) 378-4844
www.oregon.gov/dsl

State Land Board

Tina Kotek
Governor

Tobias Read
Secretary of State

Elizabeth Steiner
State Treasurer

March 20, 2025

TO: Warrenton City Commission

FROM: Oregon Department of State Lands

RE: Comprehensive Plan Goal Exception for Flowlane Dredge Material - City Commission - Additional Information Request – 2/11/2025

The following are the Department of State Lands' responses to questions received from the City Commission following the City Commission's meeting on February 11, 2025. DSL is responding to questions 2, 5 and 8. The U.S. Army Corps of Engineers is responding to the other questions under separate cover.

1. How have the depths in the Urban Growth Boundary changed over the past 30 years?
    - See response from the U.S. Army Corps of Engineers.
2. Request for historic air photos showing the shifting of the land in the delta.
    - DLCD has provided photos which can be accessed at the following link: Warrenton Areial Historical Photos
3. What are the economic impacts to Hamond Marina? This is the dredging costs in 1980s by the USACE, Additionally, how many cubic yards were pulled out and to what depth was dredged. *Our City staff can provide the additional info since we started leasing after 1980s.*
    - See response from the U.S. Army Corps of Engineers.
4. Compare the overall timeline of erosion and silting since when the thalweg dredging began.
    - See response from the U.S. Army Corps of Engineers.
5. If data shows what anecdotes have indicated—that thalweg disposal has expedited silting of the marinas and the change of flow of the river causing erosion; is DSL willing to provide compensation or some sort of partnership to alleviate the effects of actions they are allowing on their submerged property. The allowance of such activities, regardless of in their control or not, is occurring on state property and is impacting the city's land mass and violating Oregon land use goals to not harm areas of public trust/use.
    - The Department of State Lands oversees Oregon-owned waterways and has a statutory obligation to ensure their availability for the use and enjoyment of all, i.e. ensure the ability of the public to exercise the public trust values of navigation, recreation, commerce, fishing, and other legal activities. The dredging activities implemented by the Corps and others facilitate navigation and other public trust uses. The Department has no authority to regulate the Corps' dredging activities as the United States government has "navigational servitude", a dominant servitude on land within the boundaries of navigable waters that entitles the United States to use the land for purposes related to

navigation and commerce, regardless of ownership and without compensation. The state has some authority regarding the placement of dredged material on state owned lands but not if the disposal is in-flow or in the ocean. The Corps through federal regulations, such as the Endangered Species Act, Clean Water Act, National Environmental Policy Act, etc., performs navigational maintenance in ways to avoid and minimize adverse effects of dredging and disposal of dredged material. Their current practice of disposal of dredged material thinly in the river thalweg is designed to minimize shoaling and effects on benthic habitats. The Department can only operate within its legislatively delegated authority, and the legislature has not provided DSL with authority or funding to compensate the City for perceived effects of the Corps' activities. Local governments can reach out to the State legislature to request funding to address issues affecting their communities.

6. Do the hydrologic models assume the pile dikes (Warrenton side) as being fully functional or under their current state of disrepair? Are there any plans for repair? What is expected to occur when they are repaired?
    - See response from the U.S. Army Corps of Engineers.
7. Any specific studies related to the channel movement and any depth studies between Megler Bridge and Parking Lot D. Specifically, historical depth data from their surveys.
    - See response from the U.S. Army Corps of Engineers.
8. What constructive partnership can the state (DSL) use to ensure the public resource as a condition of approval? The public resource must remain intact.
    - See response to question #5.
9. In hydraulic models generated for both Washington pile dike improvements, channel realignment as noted in the application for goal exception, and thalweg disposal—does the corps models show the Oregon side pile dikes as providing full function or as providing degraded function or none at all? Please explain what and how that conclusion was arrived at.
    - See response from the U.S. Army Corps of Engineers.

Sincerely,

Bill Ryan

Bill Ryan
Deputy Director, Aquatic Resource Management
Oregon Department of State Lands

Statement on USACE Navigation Channel Maintenance Flowlane Dredged Material Placement

For the Warrenton City Commission Hearing on Exception to Goal 16: Estuarine Resources, to allow the flowlane placement of dredged material in areas designated Conservation Aquatic

7 March 2025

Mayor Balensifer and City Commission Members, I am Jessica Stokke, Navigation Project Manager responsible for maintenance of the Federal Navigation Channels in the Columbia and Lower Willamette Rivers of the Portland District, U.S. Army Corps of Engineers (USACE).

I am responding to your request for additional information about USACE flowlane dredged material placement within the City of Warrenton. We first became aware of the City's designation of Conservation Aquatic areas, in the context of USACE thalweg placement, in September 2024 following the State of Oregon submitting a goal exception request to the City.

I worked with a team of USACE technical experts on this prepared statement and supporting enclosure. If you have additional questions about USACE flowlane dredged material placement, I will take those back to the team and may follow up with a written response.

Your first request for additional information was (1): How have the depths in the City's Urban Growth Boundary changed over the past 30 years? USACE surveys generally cover areas deeper than 40 feet within City of Warrenton on the Oregon side of the Columbia River Federal Navigation Channel between approximately River Miles (RM) 8.5 and 12. From RM 12 downstream below Tansy Point RM 10, surveys between 1982 and 2024 show greater than 10 feet of erosion. Areas that were previously 40 to 50 feet deep relative to Mean Lower Low Water datum are now 50 to 60 feet deep and areas previously 50 to 60 feet deep are now greater than 60 feet deep. The Skipanon Channel entrance is at RM 11. From downstream of Tansy Point to the Hammond Boat Basin, surveys between 1996 and 2023 show minimal changes near the Columbia River Federal Navigation Channel at depths between 40 and 50 feet, but there is some accretion farther landward where areas previously deeper than 50 feet are now 40 to 50 feet deep. Individual USACE surveys are shown in Enclosure pages 2 to 14, and a visual summary of the changes is in Enclosure page 16.

The next request for information from USACE was to inform (3): What are the Hammond dredging costs in 1980s by the USACE, how many cubic yards were pulled out, and to what depth was dredged? The Hammond Small Boat Basin was approved by the Chief of Engineers on 9 December 1975 under the authority of Section 107 of the River and Harbor Act of 1960, as amended. The access channel is authorized to a depth of 10 feet and width of 100 feet. Initial channel dredging was completed in 1977 and USACE records list two subsequent maintenance dredging events. From November 22 to December 10, 1982, 26,246 cubic yards of material were removed from the full channel length to achieve a depth of -11 feet (including one foot of allowable overdepth dredging) at a cost of $77,209. The second maintenance event occurred from October 12 to November 6, 1989, when 15,269 cubic yards of material were removed from the outer reach of the channel to achieve a depth of -12 feet at a cost of $64,840 (including two feet of overdepth dredging). Hammond Boat Basin Maintenance Dredging Records, including plan drawings and pre- and post-dredge surveys are in Enclosure pages 17 to 26.

The next request for information from USACE was to provide additional detail about thalweg placement to inform (4): Compare the overall timeline of erosion and silting since thalweg placement began. USACE records show five thalweg placement events within the City of Warrenton. In 2014, 2016, 2018, 2019, and 2022, a portion of material dredged from Skipanon Channel was placed on the Oregon side of the Columbia River Federal Navigation Channel at River Mile 9. USACE determines thalweg placement locations for each dredging event based on an applied understanding of hydrodynamic and sediment transport processes, informed by bathymetric depth surveys and river current velocity data from USACE's Lower Columbia River Adaptive Hydraulics model. Thalweg placement areas are consistent with City of Warrenton Comprehensive Plan Section 5.305 Dredging and Dredged Material Disposal 10, which states placement must occur where (a) sediments can reasonably be expected to be transported downstream without excessive shoaling. The thalweg placement that occurred at River Mile 9 is adjacent to the Columbia River Federal Navigation Channel, more than 500 feet channelward of the Hammond Boat Basin and Oregon side pile dikes, and where water depths are greater than 45 feet. This thalweg placement area was used during ebb flows only, when river current velocity vectors were of greatest magnitude and directional downstream parallel with the Columbia River Federal Navigation Channel, and not directed toward the Hammond Boat Basin. This has been confirmed by the USACE Adaptive Hydraulics model. During ebb flow, the model shows river current vectors are directional outgoing from the Hammond Boat Basin, not entering. During flood flow, the river current velocity vectors which are directional toward and entering the Hammond Boat Basin approach from downstream nearshore and are comparatively lesser magnitude. There is no overlap with USACE thalweg placement. USACE dredging and placement records are in Enclosure pages 27 to 73. USACE Adaptive Hydraulics model results are in Enclosure pages 74 to 86.

The next request for information from USACE was (6): Do the hydrologic models assume the pile dikes (Warrenton side) are fully functional or under their current state of disrepair? Are there any plans for repair? What is expected to occur when they are repaired? The three timber pile dikes on the Warrenton side between RM 9 and 10 were constructed by USACE and completed in 1964 for bank protection works under the authority of the Flood Control Act of 17 May 1950. In accordance with the authorizing Act, a local sponsor is required to maintain and operate the works after construction. USACE design memos from 1963 and 1985 state that the Port of Astoria agreed to sponsor and maintain the pile dikes. USACE is not responsible for their maintenance or repair. These structures are not included in USACE's Adaptive Hydraulics model, in either a fully functional condition or state of disrepair. These structures do not affect USACE's dredged material placement decisions because they are located landward of the surveyed deep-water area considered in the model. USACE Design memorandums documenting the bank protection pile dikes are in Enclosure pages 87 to 235.

Your next request for information was (7): Any specific studies related to the channel movement and any depth studies between Astoria-Megler Bridge and Parking Lot D; specifically, historical depth data from their surveys. USACE completed a report titled Evaluation of Pre- and Post-Construction Bathymetry Change in the Lower Columbia River Estuary for the Columbia River Channel Improvement Project, which includes a portion of the river zoned by the City of Warrenton. The bathymetry changes that occurred within the estuary between 2004 and 2012 far exceed any depth changes that could be associated with USACE dredging and placement. The largest and

more spatially coherent changes in depth, areas with greater than 10 to 20 feet of accumulation or erosion, occurred primarily around the natural North channel, which is not part of or located near the Columbia River Federal Navigation Channel. This area of the estuary is 2-6 miles wide versus the Federal Navigation Channel which is 600 feet wide. The volumetric change in this area beyond the Federal Navigation Channel was 65 million cubic yards of deposition and 62 million cubic yards of erosion; the net change was 3 million cubic yards of deposition. Approximately 1.5 million cubic yards of sand was dredged from the Federal Navigation Channel and placed in-water. The volume of USACE dredging and placement is less than 2.5 percent of the observed bathymetric change that occurred between 2004 and 2012 in the estuary from River Mile 3 to 17 where both surveys have overlapping, comprehensive data coverage. Within the survey extents, less than 7 feet of deposition occurred in the Columbia River near the Hammond Boat Basin between 2004 to 2012, and depths were consistently greater than 45 feet. The full evaluation is in Enclosure pages 236 to 244.

The next request for information from USACE was (9): In hydraulic models generated for both Washington pile dike improvements, channel realignment as noted in the application for goal exception, and thalweg placement, does the USACE model show the Oregon side pile dikes as providing full function or as providing degraded function, or none at all, and to explain how that conclusion was arrived at. The Oregon side pile dikes are not modeled in USACE's Adaptive Hydraulics model which focuses on the surveyed deep-water area where thalweg placement occurs. The Washington pile dikes, which are located more than 5 miles away, are being repaired to restore their function to stabilize the thalweg and prevent migration of the Columbia River Federal Navigation Channel to the north and modeling results did not show velocity changes near the Oregon side pile dikes. The channel realignment only consisted of changing the channel lines on maps to follow existing deep water and did not involve dredging or placement, so there were no physical changes to the river bottom or model. The channel realignment was coordinated with the City of Warrenton Interim Planning Director in 2011 and no further USACE action was requested.

At the City Commission Meeting on February 11, 2025, I also heard concerns about the technical feasibility of thin-layer placement and questions about placement on the eroding shoreline, so we prepared additional information for both topics.

Thin-layer placement is an existing USACE practice. Thin-layer placement is employed during maintenance of the Mouth of the Columbia River Federal Navigation Project as part of a comprehensive beneficial use sediment placement strategy that includes dispersive techniques to limit sediment mounding that could harm fauna and negatively impact wave amplification and navigation. This is the main placement method that USACE uses when dispersing dredged material at the four nearshore beneficial use placement sites. Each hopper load of dredged sediment is distributed along a placement track of 1,000 to 5,000 feet at depths between 35 to 85 feet. This thin-layer placement method essentially creates a crop-dusting effect on the ocean bed, limiting impacts to the benthic environment. This method is the result of years of research with the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) to monitor the impacts of dredge material placement. It is also in support of the Site Management/Monitoring Plan (SMMP) prepared jointly by the US Environmental Protection Agency (EPA) and USACE for the Mouth of the Columbia River. Links to the thin-layer placement video and research results, along with a summary poster, are in Enclosure pages 245 to 247.

Dredged material placement along the eroding shoreline within the City of Warrenton is not the Federal standard placement location for USACE Federal Navigation Channels. USACE is required to manage dredged sediments within the Federal standard defined as the least costly disposal alternative, consistent with sound engineering practices, and meeting the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process or ocean dumping criteria, 33 CFR 335.7. USACE would need to use a hopper dredge with pump ashore capability to perform placement along the shoreline, with significant additional costs compared with the Federal standard of in-water placement. If it is technically feasible for USACE to place material at this shoreline site, a Non-Federal Sponsor would be required to fund the incremental costs above the Federal standard and obtain all necessary real estate interests and permits.

I hope that this additional information helps to address your questions and concerns.

USACE Flowlane Placement
Additional Information Enclosure

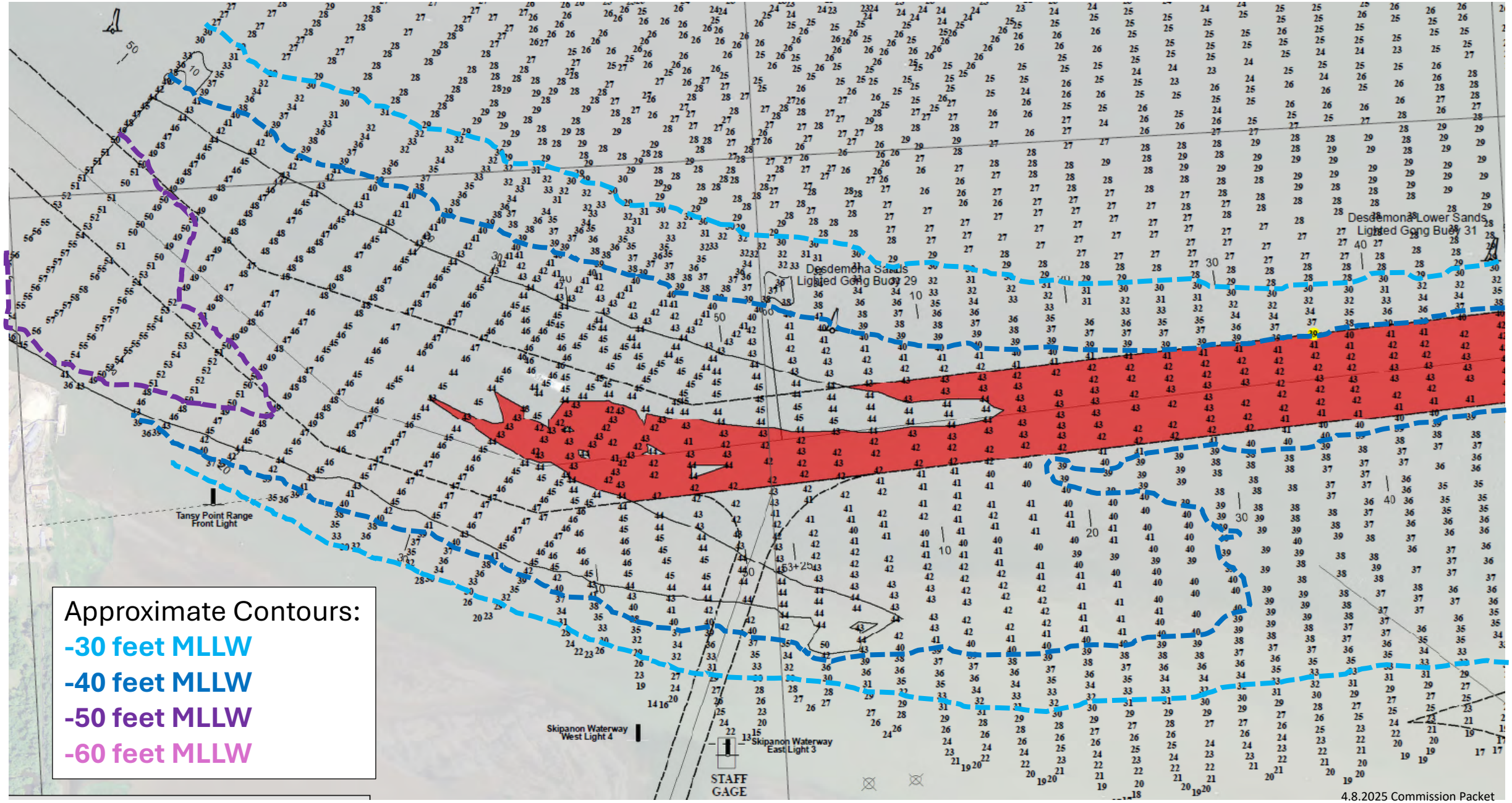
- USACE Surveys
- USACE Hammond dredge records
- USACE Thalweg placement records
- USACE Adaptive Hydraulics Model results
- USACE Bank Protection Pile Dikes records
- USACE Evaluation of Pre- and Post- Construction Bathymetry Change in Lower Columbia River Estuary, Columbia River Channel Improvement Project
- USACE Thin-layer placement

USACE Surveys

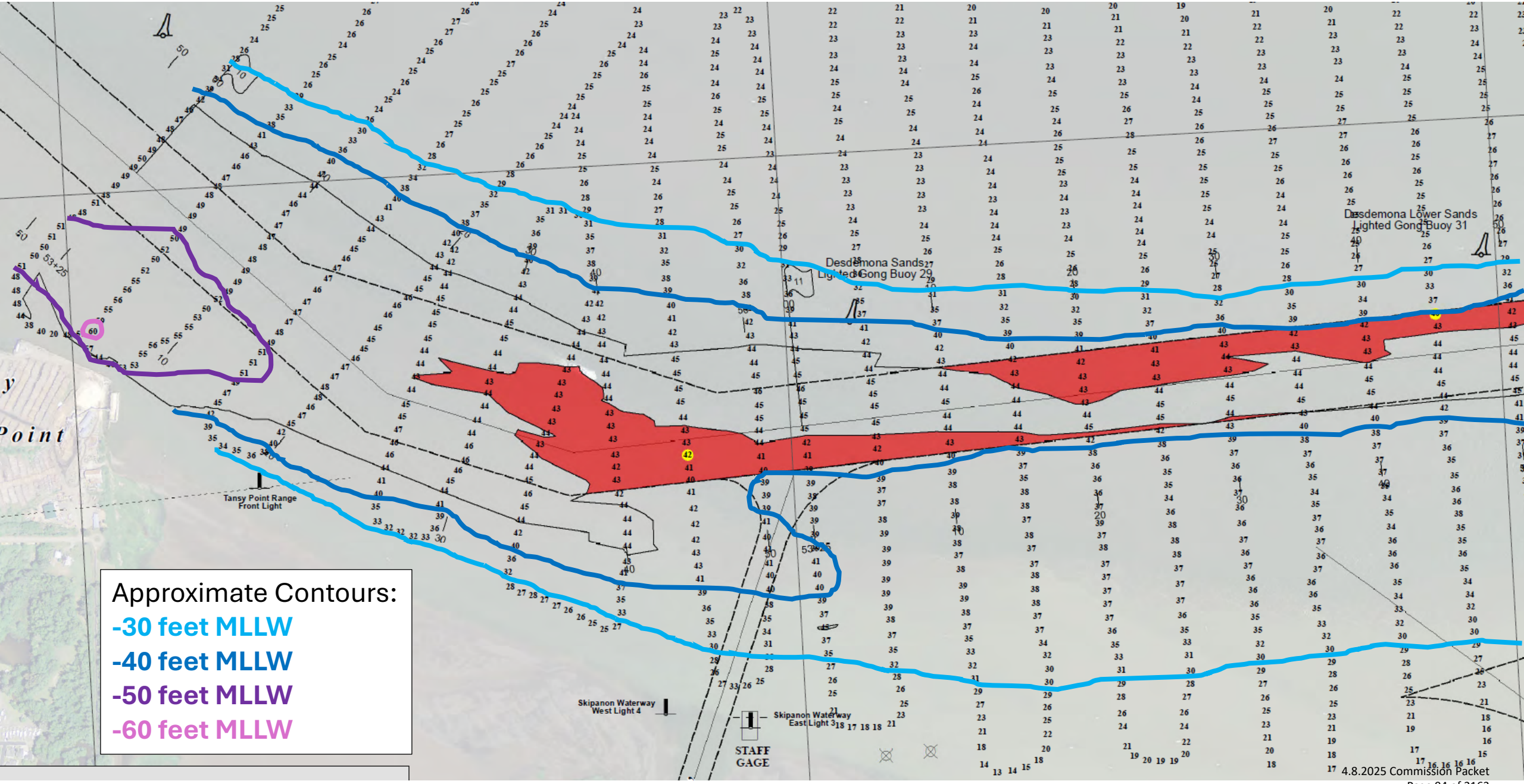
River Miles 8.5 to 12

USACE Surveys
River Miles 10 to 12
1982
1995
2005
2015
2024

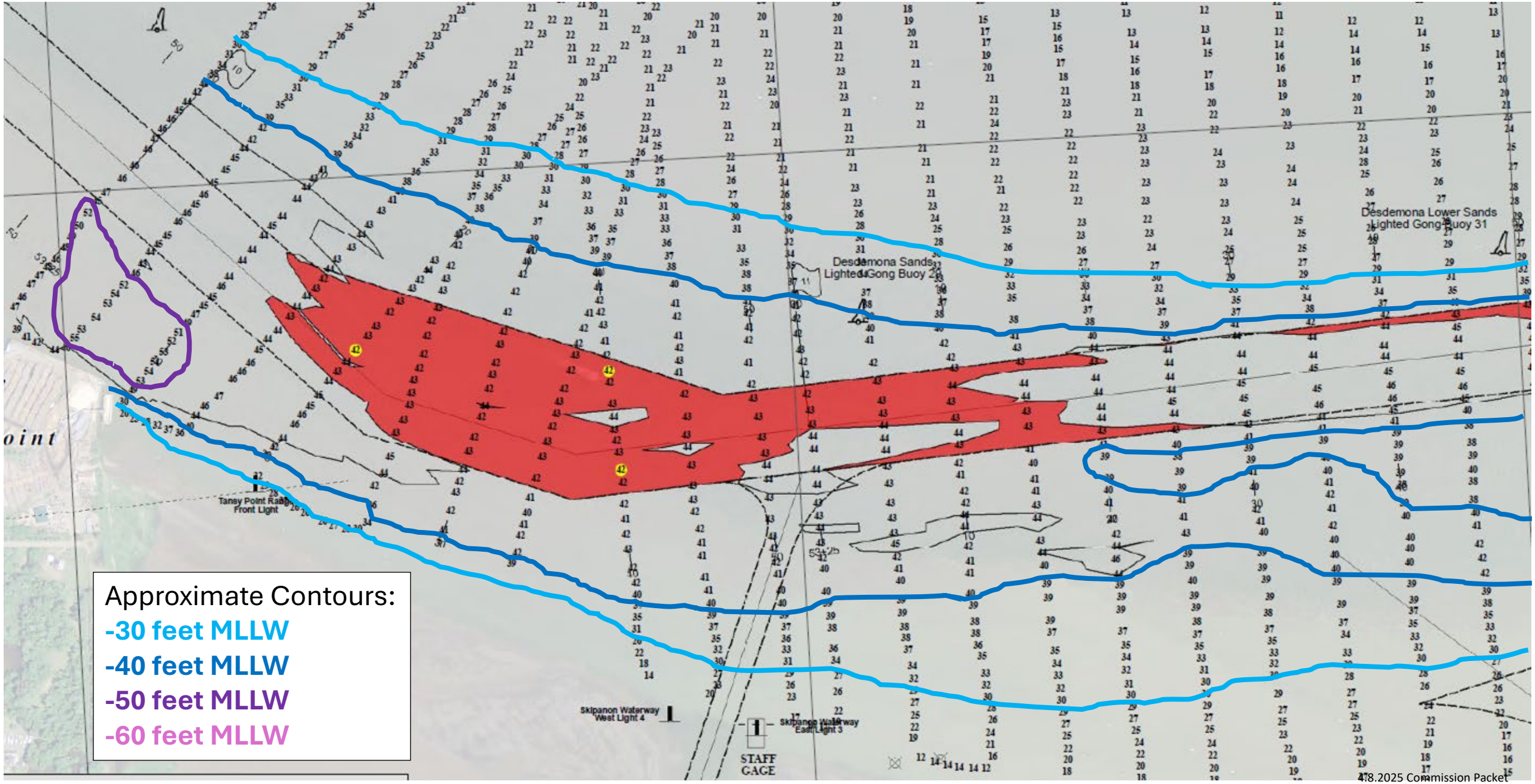
CL_03_FLVX_19820322. Survey dated 22 Mar 1982.



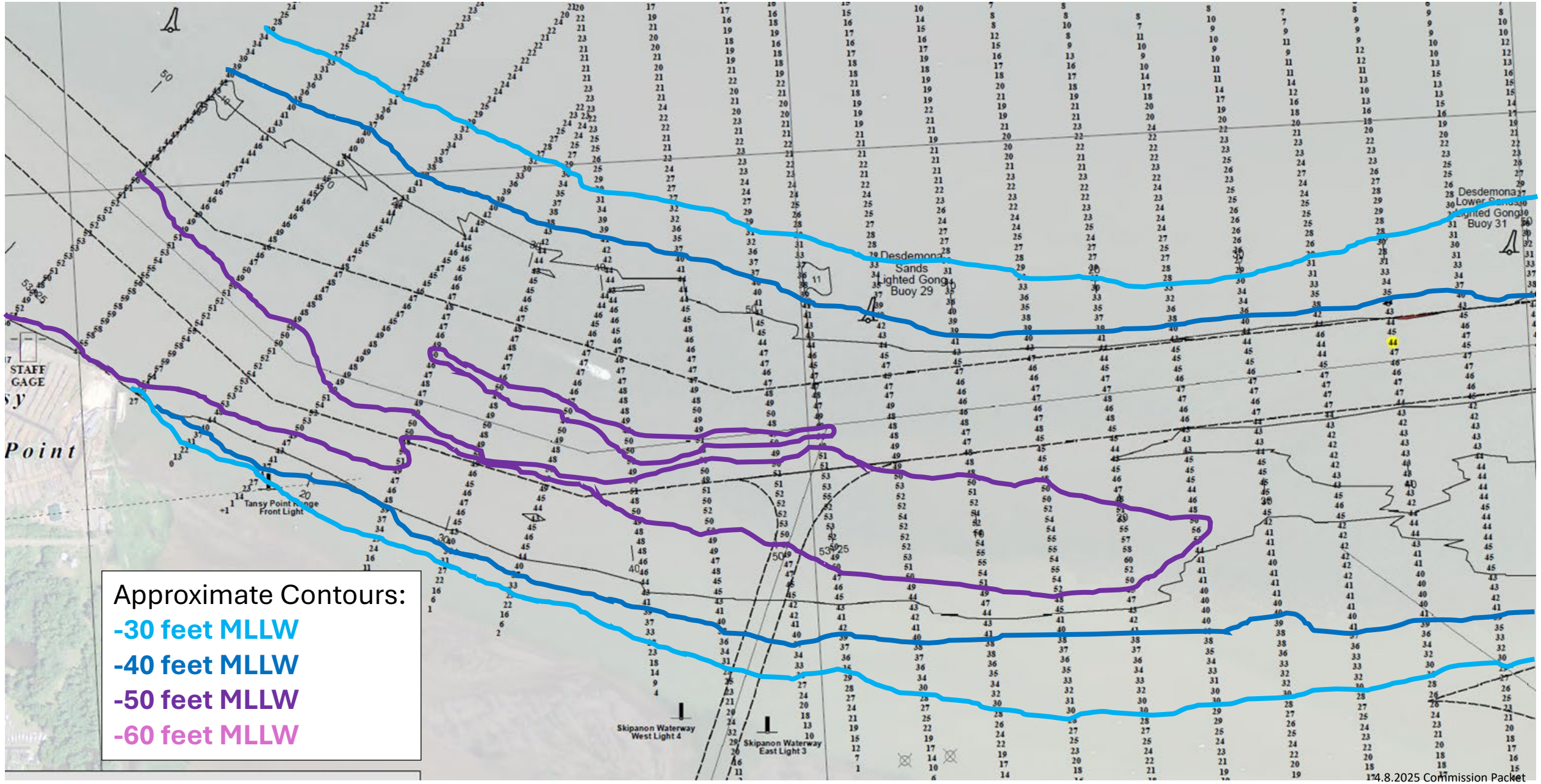
CL_03_FLVX_19950126. Survey dated 26 Jan 1995.



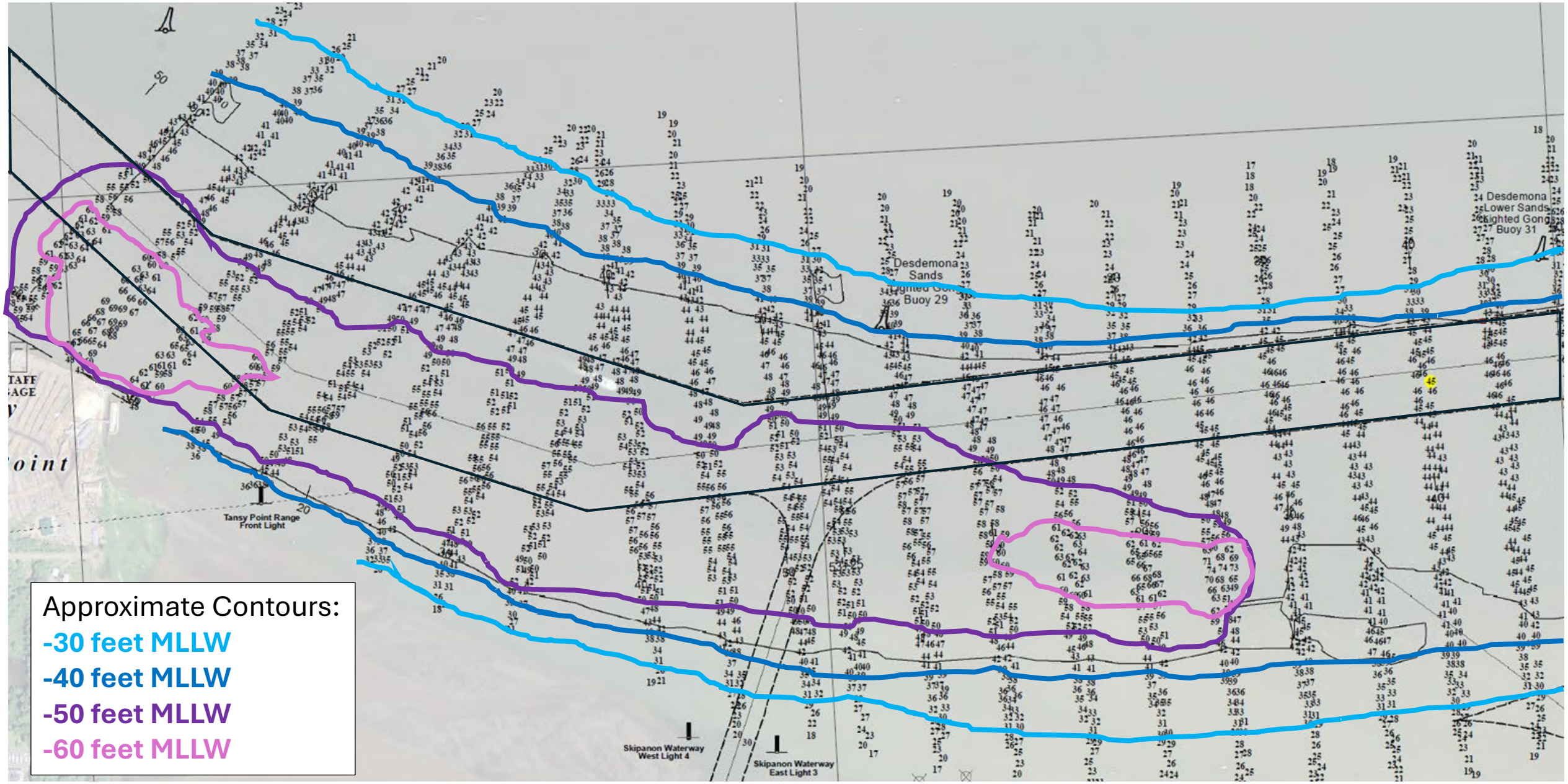
CL_03_FLVX_20050315. Survey dated 15 Mar 2005.



CL_03_FLVX_20150225. Survey dated 25 Feb 2015.

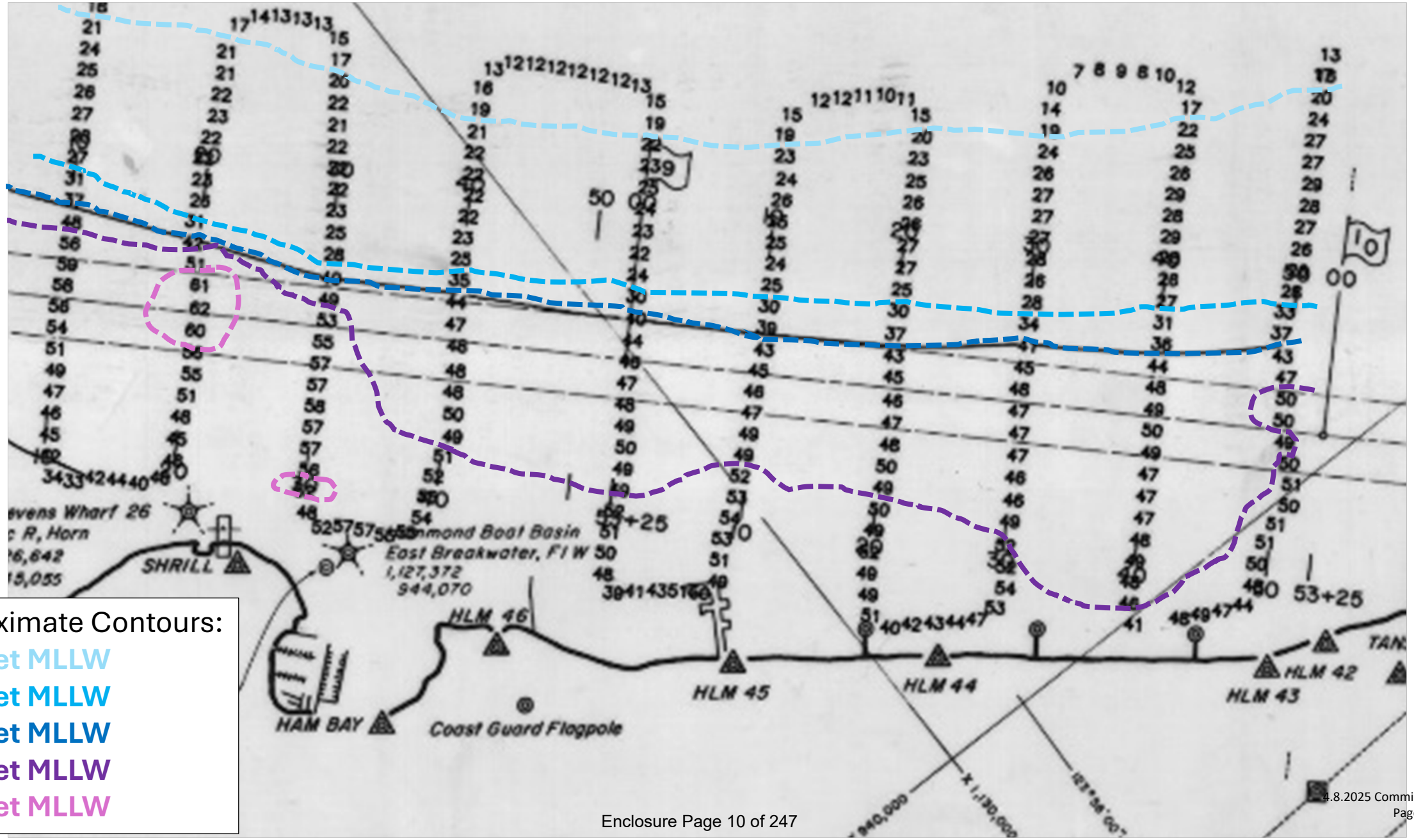


CL_03_FLVX_20240419_CS. Survey dated 19 Apr 2024.



USACE Surveys
River Miles 8.5 to 10
1996
2003
2006
2014
2023

CL-5-350-96. Survey dated 19 Feb 1996.



Approximate Contours:

-20 feet MLLW

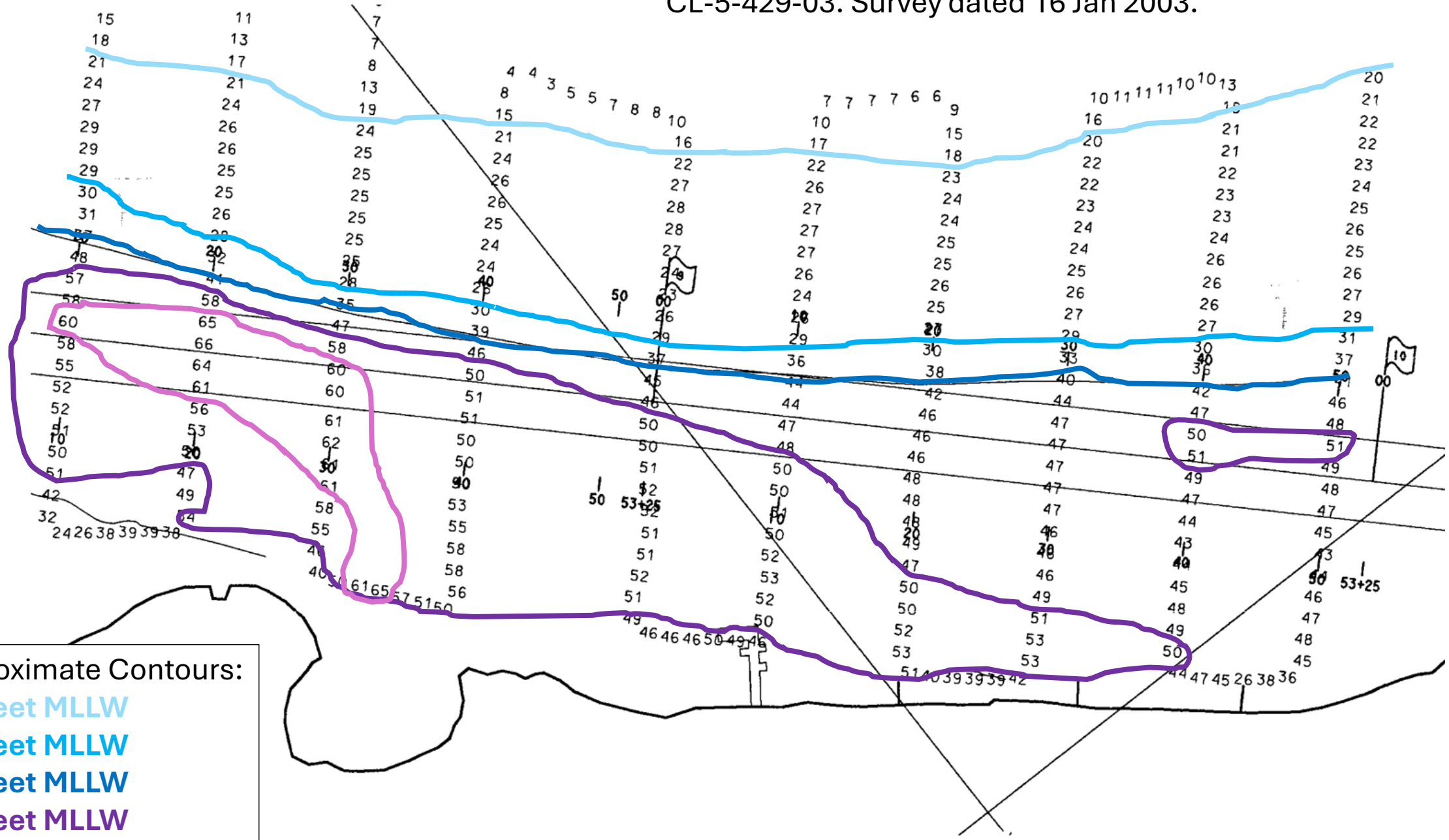
-30 feet MLLW

-40 feet MLLW

-50 feet MLLW

-60 feet MLLW

CL-5-429-03. Survey dated 16 Jan 2003.



Approximate Contours:

-20 feet MLLW

-30 feet MLLW

-40 feet MLLW

-50 feet MLLW

-60 feet MLLW

CL_02_UDSX_20060112. Survey dated 12 Jan 2006.

Approximate Contours:

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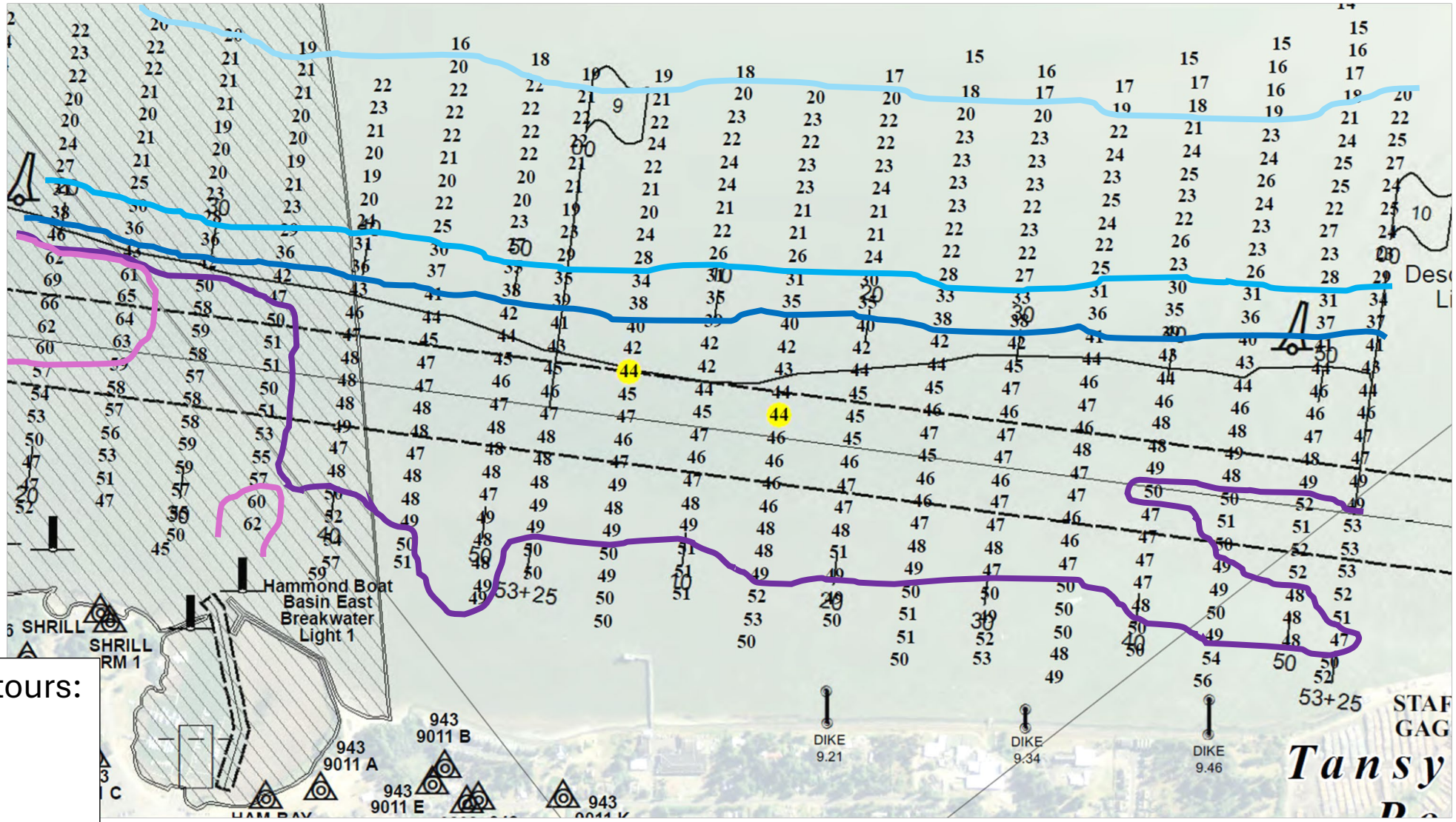
-30 feet MLLW

-40 feet MLLW

-50 feet MLLW

-60 feet MLLW

CL_01_DESX_20140408. Survey dated 8 Apr 2014.



Approximate Contours:

-20 feet MLLW

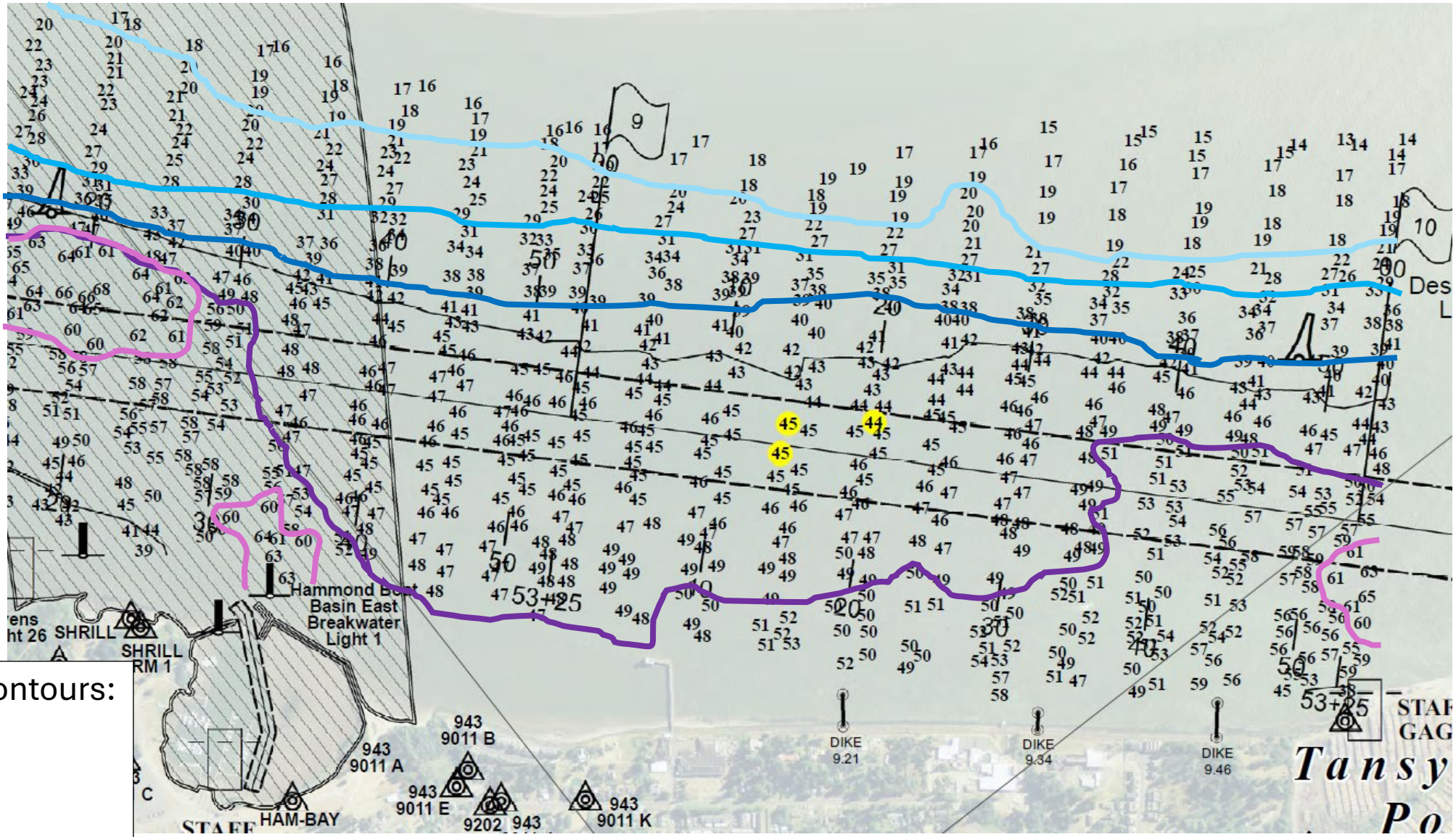
-30 feet MLLW

-40 feet MLLW

-50 feet MLLW

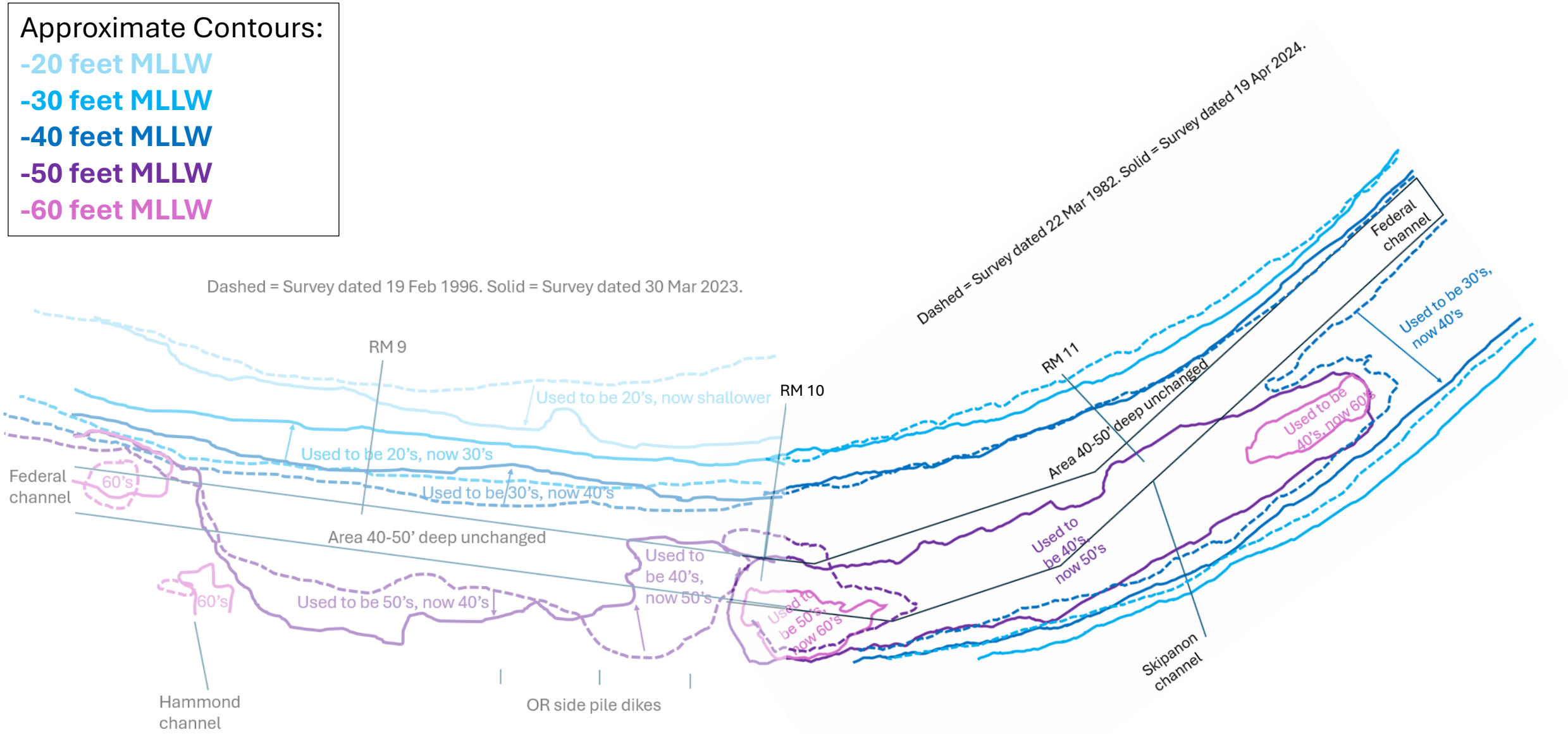
-60 feet MLLW

CL_01_DESX_20230330_CS. Survey dated 30 Mar 2023.



USACE Survey Contour Changes

River Miles 8.5 to 10: 1996 to 2023
River Miles 10 to 12: 1982 to 2024


Approximate Contours:
-20 feet MLLW
-30 feet MLLW
-40 feet MLLW
-50 feet MLLW
-60 feet MLLW
Dashed = Survey dated 19 Feb 1996. Solid = Survey dated 30 Mar 2023.
Dashed = Survey dated 22 Mar 1982. Solid = Survey dated 19 Apr 2024.
RM 9
RM 10
RM 11
Used to be 20's, now shallower
Used to be 20's, now 30's
Used to be 30's, now 40's
Federal channel
60's
Area 40-50' deep unchanged
Used to be 40's, now 50's
Used to be 50's, now 40's
Used to be 50's, now 60's
Used to be 40's, now 60's
Hammond channel
OR side pile dikes
Skipanon channel

USACE
Hammond Boat
Basin Maintenance
Dredging Records

Hammond Boat Basin

Fiscal Year	Dredge	Cu.Yds.	Plant Cost	Cost Per Cu.Yd.	Days	Cu.Yds. Pmp Min	Eff. Time	Disposal Site	Work Dates
1990	Renegade Cntr# 89-C-0115	15,269	$64,840 Dredging Depth -12 feet	$4.25	18.00	2	25%	HA 8	Oct 12 to Nov 6, 1989
1983	Karen	26,246	$77,209 Dredging Depth -11 feet	$2.94					Nov 22 to Dec 10, 1982

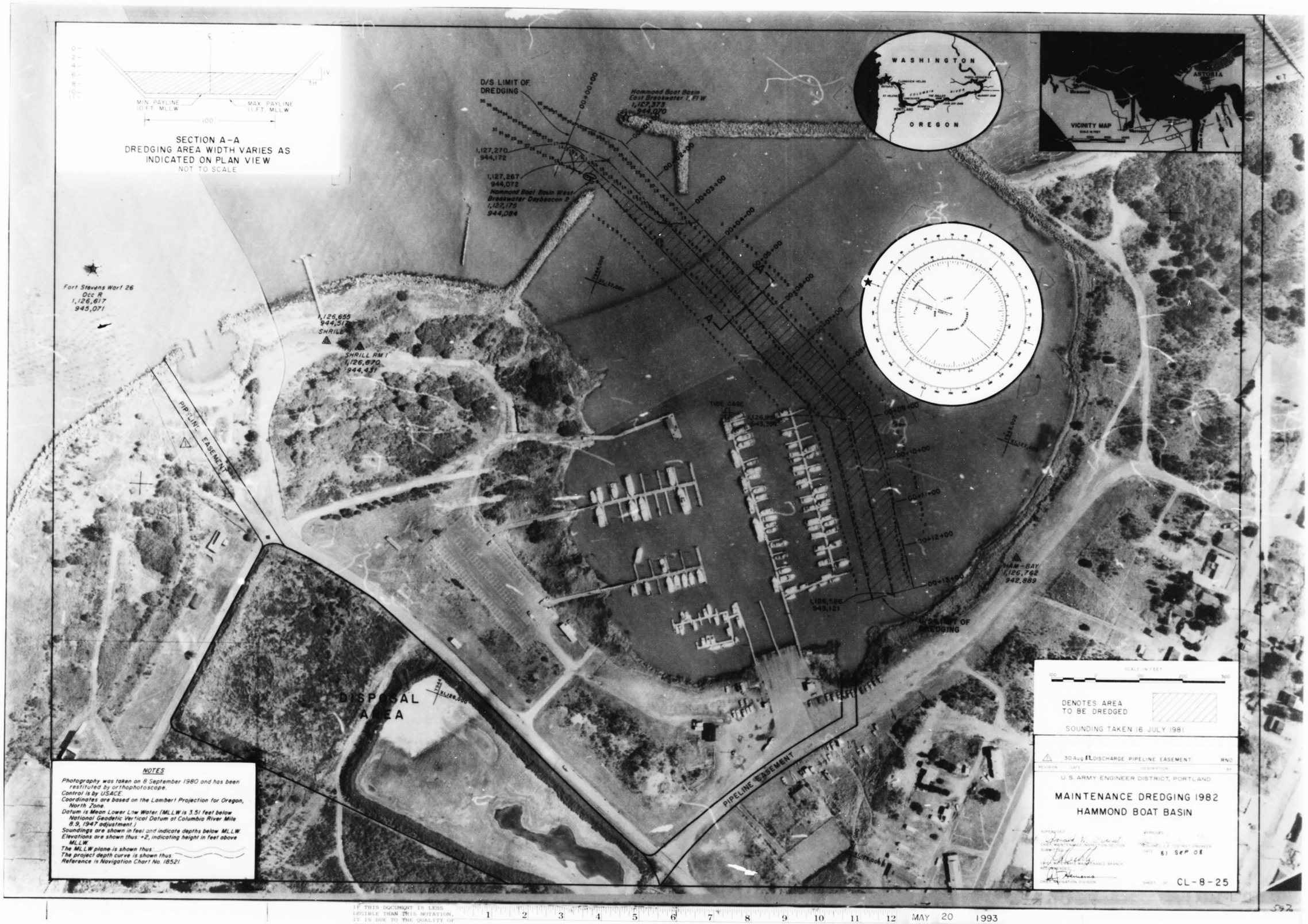
****
History: Hammond Boat Basin

FISCAL YEAR	1990	
DREDGE	Renegade	
COMPANY	Prt.Hyd.Drd	
TYPE & CAPACITY	Pipe:12	
DAILY RATE		
Cntr # DACW57-	89-C-0115	
DATES	Oct 12 to	
DATES	Nov 6,89	
CUYDS REPORTES	18,336	
CUYDS P/V	15,269	
PLANT COST	$64,840	
UNIT COST	$4.25	ERR
AVG WIDTH CUT	59	
TOTAL ADVANCE	1,520	
FLOATING PIPE	1,167	
SHORE PIPE	516	
SUB PIPE	0	
TOTAL LENGTH PIPE	1,683	0
AVG PMP SPEED	580	
AVG PER PMP HR	141	
SCOWS LOADED	0	
AVG LOAD PER SCOW	0	
PMP OR DREGING	108:10	
TLT NON-EFFECTIVE	323:50	
TLT EFF+NON-EFF	432:00	
TOTAL LOST	0:00	
TOTAL TIME	432:00	
DEPTH	-12	
DISP.SITE	HAM:HA 8	
CUYDS	15,269	
Plant Cost	$64,840	
SURVEYS	$4,200	
INSPECT & SUPRV	$4,000	
OVERHEAD	$700	
OTHER INDIRECT	$300	
SUBTOTAL	$9,200	
PROJECT COST	$74,040	
UNIT COST	$4.85	

ile:\LOTUS\HISTORY\HAMMOND
cs/4-19-90
****

Hammond Boat Basin

FY-Dredge		C.Y.		Cost	Unit Cost	Depth
82	KAREN	26,246	22 Nov - 10 Dec 82	$77,209.50	2.9418	11.0



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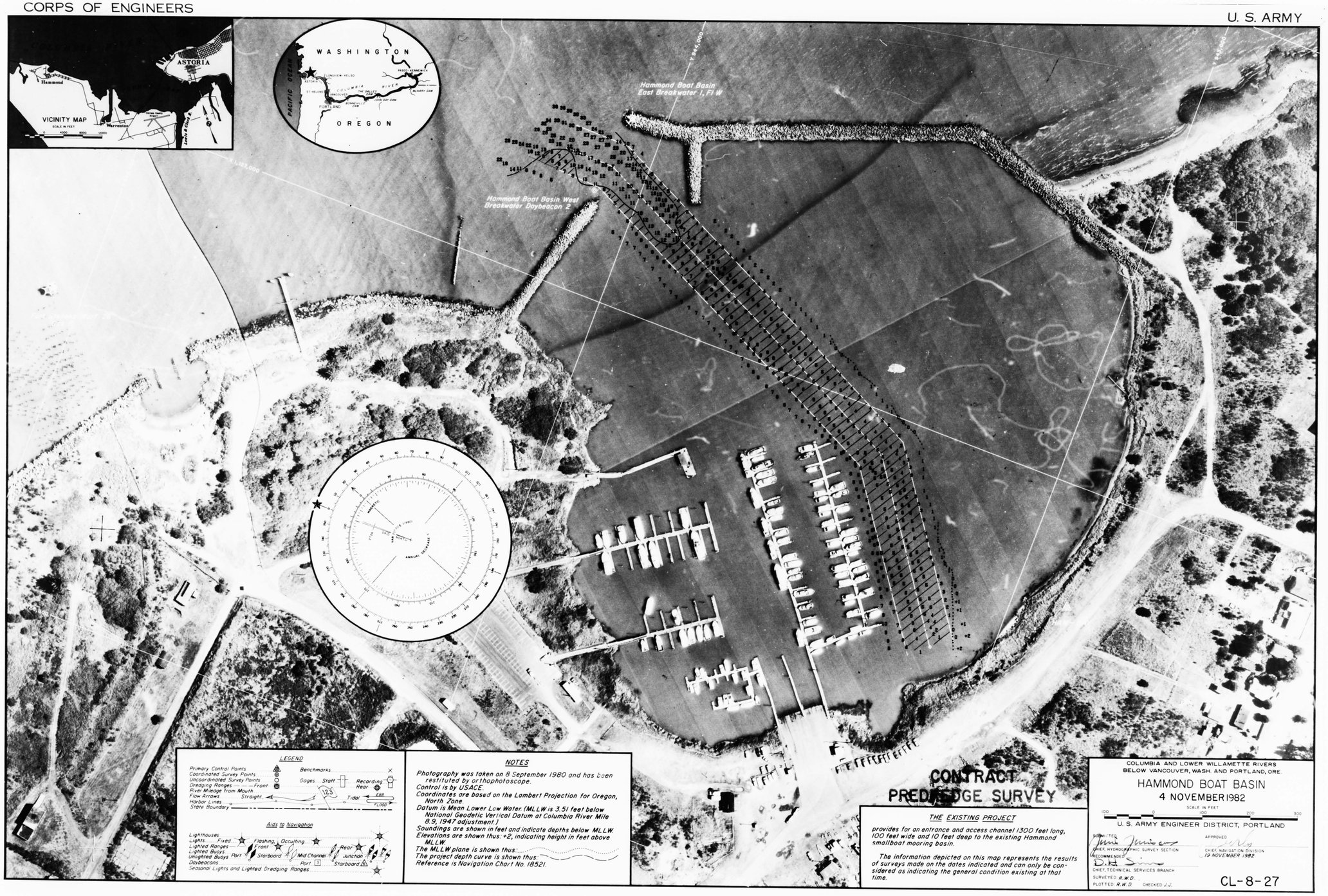
24X

CORPS OF ENGINEERS

U. S. ARMY



LEGEND

Primary Control Points
Coordinated Survey Points
Uncoordinated Survey Points
Dredging Ranges — Front
River Mileage from Mouth
Flow Arrows — Straight
Harbor Lines
State Boundary
Benchmarks
Gages — Staff, Recording, Rear
Tidal
EBB
FLOOD

Aids to Navigation

Lighthouses
Lights — Fixed, Flashing, Occulting
Lighted Ranges — Front, Rear
Lighted Buoys — Starboard, Mid Channel, Junction
Unlighted Buoys — Port, Starboard
Daybeacons
Seasonal Lights and Lighted Dredging Ranges

NOTES

Photography was taken on 8 September 1980 and has been restituted by orthophotoscope.
Control is by USACE.
Coordinates are based on the Lambert Projection for Oregon, North Zone.
Datum is Mean Lower Low Water. (MLLW is 3.51 feet below National Geodetic Vertical Datum at Columbia River Mile 8.9, 1947 adjustment.)
Soundings are shown in feet and indicate depths below MLLW.
Elevations are shown thus: +2, indicating height in feet above MLLW.
The MLLW plane is shown thus:
The project depth curve is shown thus:
Reference is Navigation Chart No. 18521.

CONTRACT
PREDREDGE SURVEY

THE EXISTING PROJECT

provides for an entrance and access channel 1300 feet long, 100 feet wide and 10 feet deep to the existing Hammond smallboat mooring basin.

The information depicted on this map represents the results of surveys made on the dates indicated and can only be considered as indicating the general condition existing at that time.

COLUMBIA AND LOWER WILLAMETTE RIVERS
BELOW VANCOUVER, WASH. AND PORTLAND, ORE.

HAMMOND BOAT BASIN
4 NOVEMBER 1982

SCALE IN FEET
100 0 100 200 300

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SURVEYED
CHIEF, HYDROGRAPHIC SURVEY SECTION
RECOMMENDED
CHIEF, TECHNICAL SERVICES BRANCH
APPROVED
CHIEF, NAVIGATION DIVISION
19 NOVEMBER 1982

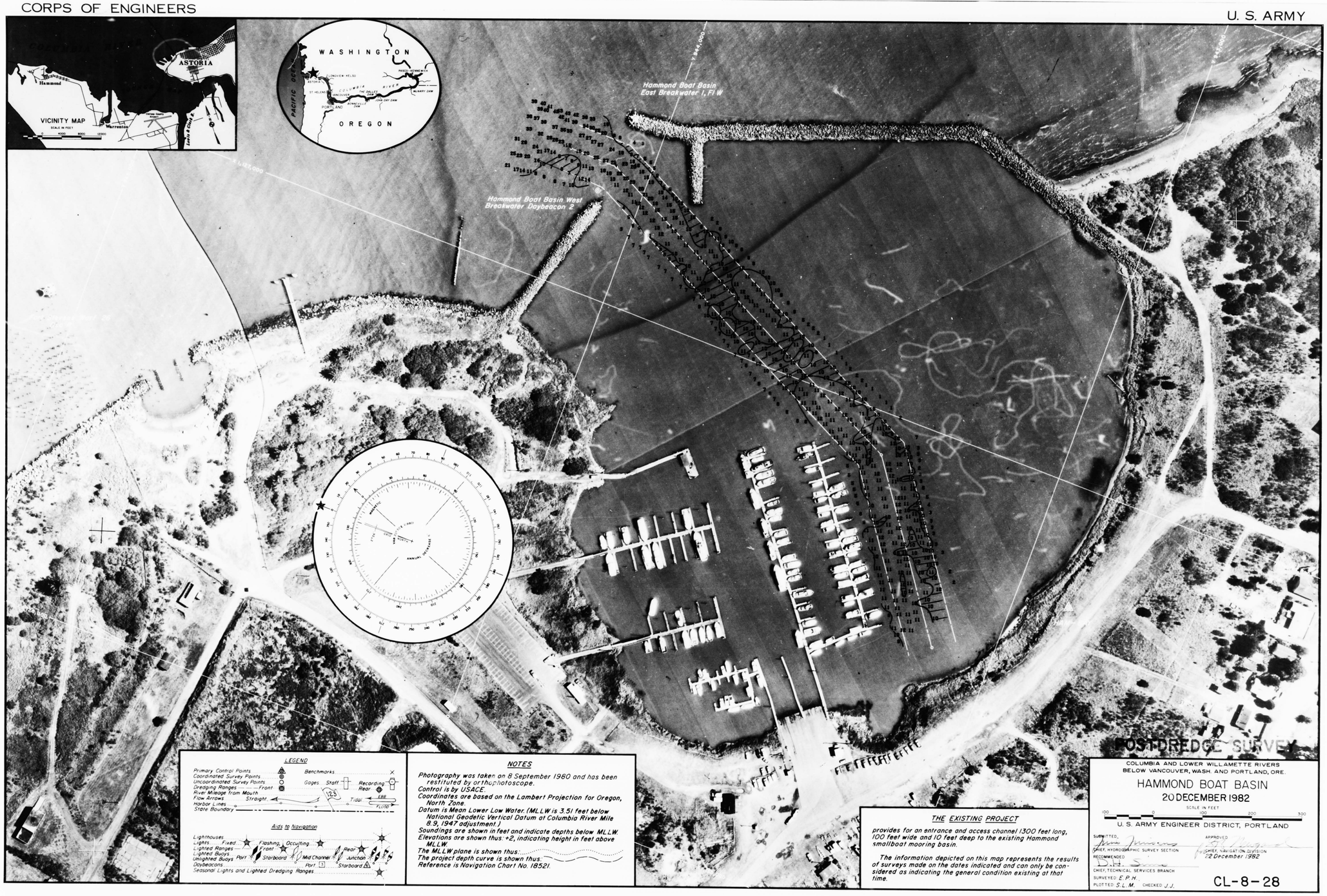
SURVEYED: R.W.D.
PLOTTED: R.W.D. CHECKED: J.J.

CL-8-27

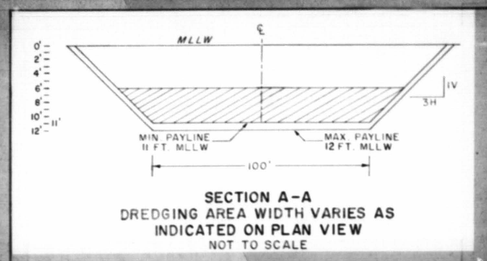
APR 0 5 1989
NOTICE: IF THE FILM IMAGE IS LESS CLEAR THAN THIS NOTICE, IT IS DUE TO THE QUALITY OF THE DOCUMENT BEING FILMED.
WESTERN IMAGE SYSTEMS 503 777 1961
24X

CORPS OF ENGINEERS

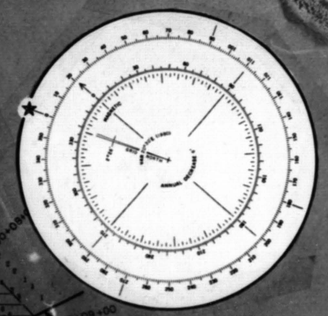
U. S. ARMY



NOTICE. IF THE FILM IMAGE IS LESS CLEAR THAN THIS NOTICE, IT IS DUE TO THE QUALITY OF THE DOCUMENT BEING FILMED. KESTERN IMAGE SYSTEMS



SECTION A-A
DREDGING AREA WIDTH VARIES AS INDICATED ON PLAN VIEW
NOT TO SCALE



Hammond Boat Basin
East Breakwater 1, Fl W
1,127,373
944,070

1,127,267
944,072
Hammond Boat Basin West
Breakwater Daybeacon 2
1,127,175
944,084

DOWNSTREAM LIMIT OF PAY AREA

UPSTREAM LIMIT OF PAY AREA

00+01+00
00+02+00
00+03+00
00+04+00
00+05+00
00+06+00
00+07+00
00+08+00
00+09+00
00+10+00
00+11+00
00+12+00
00+13+00

Fort Stevens Wart 26
Obc R
1,126,617
945,071

1,126,655
944,513
SHRILL

SHRILL RM 1
1,126,870
944,431

1,126,910
943,350

HAM BAY
1,126,782
942,889

PIPELINE EASEMENT AREA "B"

MLLW STAFF
TIDE GAGE

SECONDARY BASINS

DISPOSAL AREA H-I

PRIMARY SETTLING BASIN

PIPELINE EASEMENT AREA "A"

DISPOSAL LEGEND
Exterior Dikes
Interior Dikes
21ft. dia. Pipe
4ft wide Rip Rap
Easement Boundries
Average dike elevation is 15ft. above the basin floor.

NOTES
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The project depth curve is shown thus:
Reference is Navigation Chart No. 18521.

SCALE IN FEET
100 0 100 200 300

DENOTES AREA TO BE DREDGED

SOUNDINGS TAKEN 7 DECEMBER 1988

MICROFILMED

REVISION	DATE	DESCRIPTION	BY

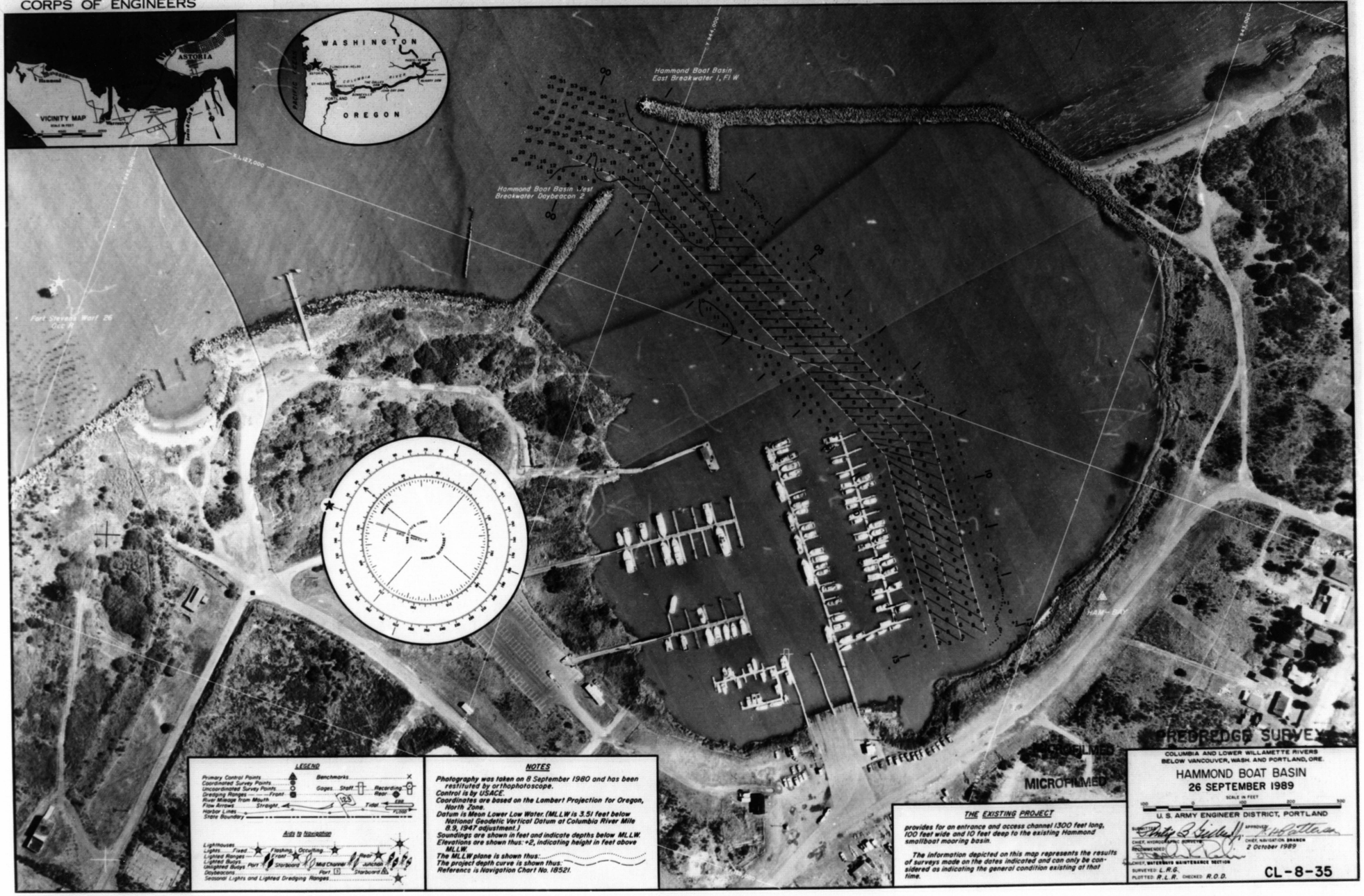
U.S. ARMY ENGINEER DISTRICT, PORTLAND
COLUMBIA RIVER
MAINTENANCE DREDGING 1989
HAMMOND BOAT BASIN

SUPERVISED: Kenneth W Espeseth, CHIEF ENGINEERING CONTRACTS SECTION
Ralf Goodell, P.E., COLONEL, U.S. DISTRICT ENGINEER
SUBMITTED: R.W. Patterson, CHIEF, NAVIGATION BRANCH
DATE: 5 July 1989
RECOMMENDED: R.W. Patterson, CHIEF, OPERATIONS DIVISION
SHEET # OF #
CL-8-33

K MERRITT
OFILMING, INC. 24x

CORPS OF ENGINEERS

U. S. ARMY

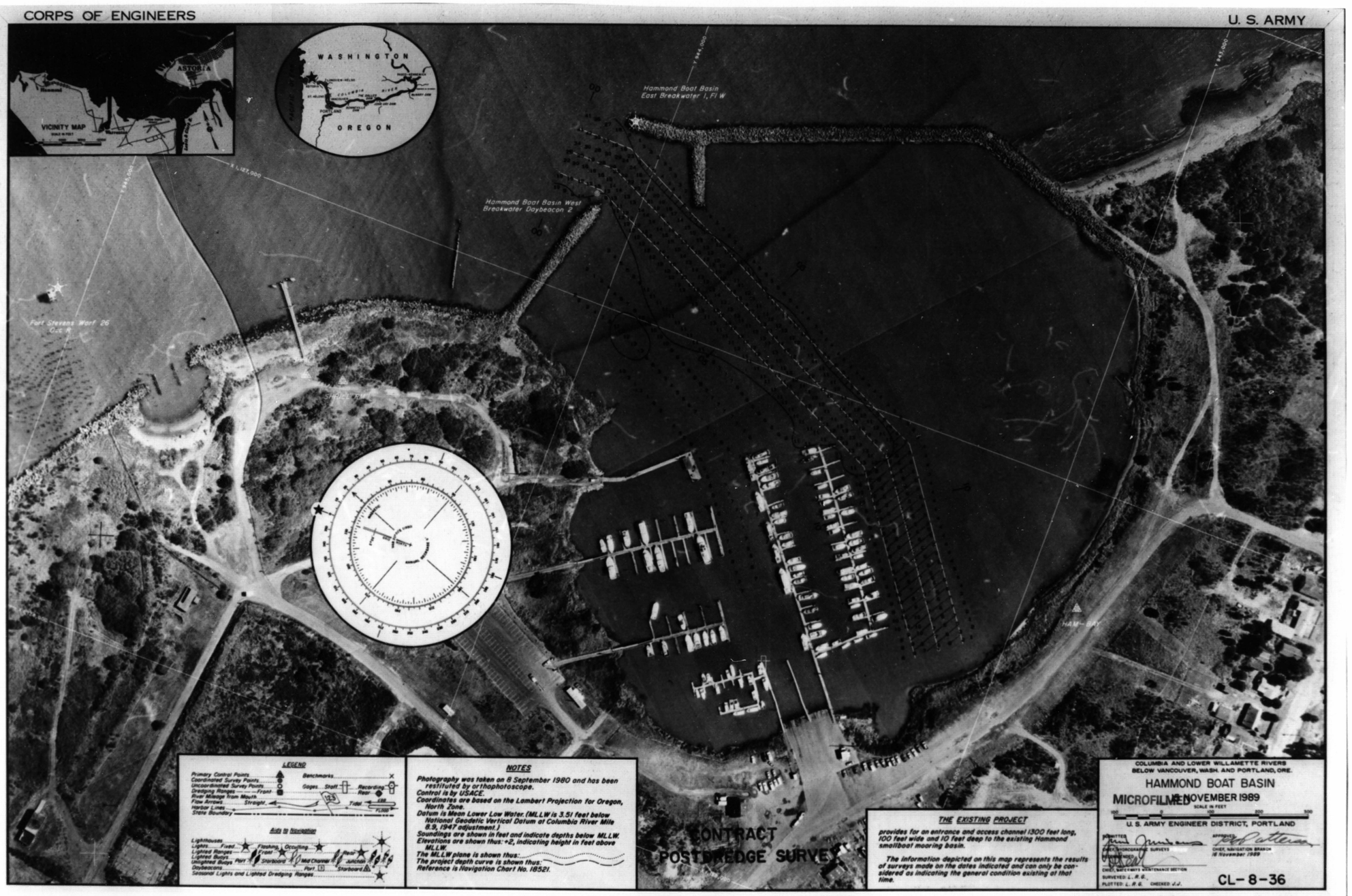


K MERRITT
OFILMING, INC. 24x

4.8.2025 Commission Packet
Page 114 of 247

CORPS OF ENGINEERS

U. S. ARMY



LEGEND

Primary Control Points — Benchmarks
Coordinated Survey Points
Uncoordinated Survey Points — Gages, Staff, Recording
Dredging Ranges — Front, Rear
River Mileage from Mouth
Flow Arrows — Straight, Tidal
Harbor Lines
State Boundary

Aids to Navigation

Lighthouses
Lights — Fixed, Flashing, Occulting
Lighted Ranges — Front, Rear
Lighted Buoys
Unlighted Buoys — Port, Starboard, Mid Channel, Junction
Daybeacons — Port, Starboard
Seasonal Lights and Lighted Dredging Ranges

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COLUMBIA AND LOWER WILLAMETTE RIVERS
BELOW VANCOUVER, WASH. AND PORTLAND, ORE.

HAMMOND BOAT BASIN

MICROFILMED NOVEMBER 1989

SCALE IN FEET 100 0 100 200 300

U. S. ARMY ENGINEER DISTRICT, PORTLAND

SURVEYED L. R. E.
PLOTTED L. R. E. CHECKED J. J.

CL-8-36

MERRITT
FILMING, INC. 24x

USACE Dredging and Placement 2013 - 2023

*Thalweg Placement Events in City of Warrenton circled in red (Skipanon Channel Maintenance 2014, 2016, 2018, 2019, 2022)

Water Quality Monitoring report for the Washington Department of Ecology and Oregon Department of Environmental Quality

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane/Nearshore Disposal (CY)	Ocean (DWS) Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Turbidity Monitoring Method	Exceedance Yes or No	DO Monitoring Method	DO Below Accept Yes or No
MOUTH OF THE COLUMBIA RIVER														
July / September - 2013	-48'/-55'	-53'/-60'	STUYVESANT	HOPPER	Quads 1, 2, 3, 4	SWS, NJS, DWS	1,998,916	578,842			Visual	No	N/A	
July / August - 2013	-48'/-55'	-53'/-60'	ESSYONS	HOPPER	Quads 2 7 4	DWS		276,310			Visual	No	N/A	
September - 2013	-48'/-55'	-53'/-60'	ESSYONS	HOPPER	Quad 3	SJS	62,902				Visual	No	N/A	
October / November - 2013	-48'/-55'	-53'/-60'	ESSYONS	HOPPER	Quad 3	DWS		347,802			Visual	No	N/A	
						MCR Totals RM -02-00 to 02+00	**2,061,818**	**1,202,954**	**0**	**0**				
						Total Dredged MCR	**3,264,772**							
COLUMBIA RIVER AND LOWER WILLAMETTE														
						Lower Desdemona Bar Totals RM 04+20 to 06+22	**0**	**0**	**0**	**0**				
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**				
October - 2013	-43	-48	YAQUINA	HOPPER	Flavel Bar	W-10.5-IW	47,984				Instrument	No	N/A	
November - 2013	-43	-48	YAQUINA	HOPPER	Flavel Bar	W-10.5-IW	18,711				Instrument	No	Instrument	No
						Flavel Bar Totals RM 10+00 to 13+30	**66,695**	**0**	**0**	**0**				
						Upper Sands Totals RM 13+30 to 17+28	**0**	**0**	**0**	**0**				
August - 2013	-43	-48	STUYVESANT	HOPPER	Tongue Point	O-18.1-IW	131,302				Instrument	No	N/A	
September - 2013	-43	-48	ESSAYONS	HOPPER	Tongue Point	O-18.1-IW	119,102				Instrument	No	N/A	
October - 2013	-43	-48	ESSAYONS	HOPPER	Tongue Point	O-18.1-IW	10,935				Instrument	No	N/A	
November - 2013	-43	-48	ESSAYONS	HOPPER	Tongue Point	O-18.1-IW	102,529				Instrument	No	N/A	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**363,868**	**0**	**0**	**0**				
April - 2013	-43	-48	YAQUINA	HOPPER	Miller Sands	W-24.0-IW	19,642				Instrument	No	N/A	
May - 2013	-43	-48	YAQUINA	HOPPER	Miller Sands	W-24.0-IW	71,165				Instrument	No	N/A	
August / September - 2013	-43	-48	OREGON	PIPELINE	Miller Sands	O-23.5-BN & W-21.0-UD			274,801	187,390	Instrument	Yes on W side No on O side	Instrument	No
August / September - 2013	-43	-48	STUYVESANT	HOPPER	Miller Sands	O-27.7-IW & W-21.5-IW	145,522				Instrument	No	N/A	
September - 2013	-43	-48	YAQUINA	HOPPER	Miller Sands	W-21.6-IW	8,491				Instrument	No	N/A	
November - 2013	-43	-48	YAQUINA	HOPPER	Miller Sands	W-21.6-IW	56,706				Instrument	No	Instrument	No
November - 2013	-43	-48	ESSAYONS	HOPPER	Miller Sands	O-27.6-IW	45,372				Instrument	No	Instrument	No
						Miller Sands Totals RM 21+20 to 25+10	**346,898**	**0**	**274,801**	**187,390**				
April - 2013	-43	-48	YAQUINA	HOPPER	Pillar Rock	W-36.4-IW	16,669				Instrument	No	N/A	
May - 2013	-43	-48	YAQUINA	HOPPER	Pillar Rock	W-24.0-IW	11,138				Instrument	No	N/A	
July - 2013	-43	-48	OREGON	PIPELINE	Pillar Rock	W-27.0-IW, W-26.6-IW & O-27.7-IW	241,749				Instrument	No	Instrument	No

Water Quality Monitoring report for the Washington Department of Ecology and Oregon Department of Environmental Quality

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane/Nearshore Disposal (CY)	Ocean (DWS) Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Turbidity Monitoring Method	Exceedance Yes or No	DO Monitoring Method	DO Below Accept Yes or No
November - 2013	-43	-48	ESSAYONS	HOPPER	Pillar Rock	O-27.6-IW	56,226				Instrument	No	Instrument	No
November - 2013	-43	-48	ESSAYONS	HOPPER	Pillar Rock	W-21.0-IW & W-26.9-IW	137,988				Instrument	No	Instrument	No
						Pillar Rock Totals RM 25+10 to 28+40	**463,770**	**0**	**0**	**0**				
July - 2013	-43	-48	OREGON	PIPELINE	Brookfield Welch	W-30.1-IW & W-29.5-IW	580,472				Instrument	No	Instrument	No
						Brookfield Welch Totals RM 28+40 to 32+30	**580,472**	**0**	**0**	**0**				
July - 2013	-43	-48	STUYVESANT	HOPPER	Skamokawa	W-31.1-FL & W-35.5-IW	157,693				Instrument	No	N/A	
						Skamokawa Totals RM 32+30 to 36+31	**157,693**	**0**	**0**	**0**				
June - 2013	-43	-48	OREGON	PIPELINE	Puget Island	O-38.3-UD			272,234		Instrument	No	Instrument	No
November - 2013	-43	-48	YAQUINA	HOPPER	Puget Island	W-37.3-FL	17,216				Instrument	No	N/A	
						Puget Island Totals RM 36+31 to 40+40	**17,216**	**0**	**272,234**	**0**				
March / April - 2013	-43	-48	ESSAYONS	HOPPER	Wauna/Driscoll	W-36.4-FL	18,063				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Wauna/Driscoll	O-34.0-IW	144,832				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Wauna/Driscoll	O-40.2-FL	58,654				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Wauna/Driscoll	O-40.2-FL & W-31.1-FL	168,436				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Wauna/Driscoll	W-35.5-IW	71,226				Instrument	No	N/A	
						Wauna/Driscoll Totals RM 40+40 to 44+27	**461,211**	**0**	**0**	**0**				
March - 2013	-43	-48	ESSAYONS	HOPPER	Westport Bar	W-36.4-FL	15,478				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Westport Bar	W-36.4-FL	291,631				Instrument	No	N/A	
July - 2013	-43	-48	STUYVESANT	HOPPER	Westport Bar	O-34.0-IW & O-40.2-FL	53,409				Instrument	No	N/A	
November - 2013	-43	-48	ESSAYONS	HOPPER	Westport Bar	O-34.0-IW, W-31.1-FL & W-36.4-FL	157,130				Instrument	No	Instrument	No
November - 2013	-43	-48	ESSAYONS	HOPPER	Westport Bar	O-34.0-IW, W-31.1-FL & W-36.4-FL	91,195				Instrument	No	Instrument	No
						Westport Bar Totals RM 44+27 to 48+10	**608,843**	**0**	**0**	**0**				
June - 2013	-43	-48	ESSAYONS	HOPPER	Eureka Bar	O-51.3-IW	21,243				Instrument	No	N/A	
October - 2013	-43	-48	YAQUINA	HOPPER	Eureka Bar	O-51.3-IW	21,525				Instrument	No	N/A	
						Eureka Bar Totals RM 48+10 to 51+45	**42,768**	**0**	**0**	**0**				
June - 2013	-43	-48	ESSAYONS	HOPPER	Gull Island	W-54.9-IW	23,191				Instrument	No	N/A	
October - 2013	-43	-48	YAQUINA	HOPPER	Gull Island	O-54.3-IW	23,115				Instrument	No	N/A	
						Gull Is. Totals RM 51+45 to 55+30	**46,306**	**0**	**0**	**0**				
June / July - 2013	-43	-48	ESSAYONS	HOPPER	Stella-Fisher	O/W-55.8-FL	81,502				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Stella-Fisher	O/W-55.8-FL	20,226				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Stella-Fisher	O/W-55.8-FL	5,612				Instrument	No	N/A	
September - 2013	-43	-48	YAQUINA	HOPPER	Stella-Fisher	O-57.5-IW	62,156				Instrument	No	N/A	
September / October - 2013	-43	-48	ESSAYONS	HOPPER	Stella-Fisher	W-54.9-IW & O/W-55.5-FL	60,941				Instrument	No	N/A	

Water Quality Monitoring report for the Washington Department of Ecology and Oregon Department of Environmental Quality

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane/Nearshore Disposal (CY)	Ocean (DWS) Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Turbidity Monitoring Method	Exceedance Yes or No	DO Monitoring Method	DO Below Accept Yes or No
October - 2013	-43	-48	YAQUINA	HOPPER	Stella-Fisher	O-55.9-IW	49,837				Instrument	No	N/A	
November / December - 2013	-43	-48	ESSAYONS	HOPPER	Stella-Fisher	O-52.3-IW, O-55.7-IW & W-54.9-IW	224,752				Instrument	No	Instrument	No
						Stella-Fisher Bar Totals RM 55+30 to 59+22	**505,026**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Walker Is. Reach	W-54.9-IW	29,013				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Walker Is. Reach	W-54.9-IW	15,204				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Walker Is. Reach	W-54.9-IW	11,130				Instrument	No	N/A	
November - 2013	-43	-48	YAQUINA	HOPPER	Walker Is. Reach	O-59.9-IW	26,838				Instrument	No	N/A	
						Walker Is. Reach Totals RM 59+22 to 63+10	**82,185**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	O-62.8-IW	24,460				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	O-62.8-IW	3,382				Instrument	No	N/A	
September - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	W-62.0-IW 7 O-62.3-IW	26,548				Instrument	No	N/A	
September - 2014	-43	-48	YAQUINA	HOPPER	Slaughters Bar	O-62.6-IW	11,681				Instrument	No	N/A	
October - 2013	-43	-48	YAQUINA	HOPPER	Slaughters Bar	O-62.6-IW	39,709				Instrument	No	N/A	
November - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	O-61.6-IW & W-61.0-IW	24,365				Instrument	No	Instrument	No
November - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	O-61.6-IW & W-61.0-IW	110,268				Instrument	No	Instrument	No
December - 2013	-43	-48	ESSAYONS	HOPPER	Slaughters Bar	O-61.6-IW & W-61.0-IW	33,777				Instrument	No	Instrument	No
						Slaughters Bar Totals RM 63+10 to 67+06	**274,190**	**0**	**0**	**0**				
November - 2013	-43	-48	YAQUINA	HOPPER	Lower Dobelbower	O-66.4-IW	27,054				Instrument	No	N/A	
July - 2013	-43	-48	ESSYONS	HOPPER	Lower Dobelbower	O-62.8-IW	97,670				Instrument	No	N/A	
						Lower Dobelbower Bar Totals RM 67+06 to 69+50	**124,724**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Upper Dobelbower	O-71.9-IW	87,098				Instrument	No	N/A	
November - 2013	-43	-48	YAQUINA	HOPPER	Upper Dobelbower	W-71.7-IW	32,950				Instrument	No	N/A	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**120,048**	**0**	**0**	**0**				
November - 2013	-43	-48	YAQUINA	HOPPER	Kalama Bar	O-76.5-IW & O-73.2-FL	116,955				Instrument	No	Instrument	No
						Kalama Bar Totals RM 72+40 to 76+25	**116,955**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Lower Martin Bar	O-80.5-IW	64,763				Instrument	No	N/A	
July - 2013	-43	-48	ESSAYONS	HOPPER	Lower Martin Bar	O-78.6-IW	45,026				Instrument	No	N/A	
						Lower Martin Is. Bar Totals RM 76+25 to 80+16	**109,789**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Upper Martin Bar	O-82.4-IW	63,469				Instrument	No	N/A	
						Upper Martin Is. Bar Totals RM 80+16 to 83+44	**63,469**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	St. Helens Bar	O-86.1-IW	102,691				Instrument	No	N/A	
September / Octorber - 2013	-43	-48	OREGON	PIPELINE	St. Helens Bar	O-86.2-BN & W-86.5-UD			233,122	91,640	Instrument	Yes on W side No on O side	Instrument	No

Water Quality Monitoring report for the Washington Department of Ecology and Oregon Department of Environmental Quality

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane/Nearshore Disposal (CY)	Ocean (DWS) Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Turbidity Monitoring Method	Exceedance Yes or No	DO Monitoring Method	DO Below Accept Yes or No
						St. Helens Bar Totals RM 83+44 to 87+15	**102,691**	**0**	**233,122**	**91,640**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Warrior Rock	O-90.3-IW	16,762				Instrument	No	N/A	
September - 2013	-43	-48	YAQUINA	HOPPER	Warrior Rock	W-89.4-IW	19,558				Instrument	No	N/A	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**36,320**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Henrici Bar	W-93.4-IW	39,797				Instrument	No	N/A	
September - 2013	-43	-48	YAQUINA	HOPPER	Henrici Bar	W-92.5-FL	5,479				Instrument	No	N/A	
						Henrici Bar Totals RM 90+20 to 93+50	**45,276**	**0**	**0**	**0**				
July - 2013	-43	-48	ESSAYONS	HOPPER	Willow Bar	W-95.6-IW & W-96.0-IW	21,463				Instrument	No	N/A	
September - 2013	-43	-48	YAQUINA	HOPPER	Willow Bar	O-94.6-IW & O-95.7-IW	26,888				Instrument	No	N/A	
						Willow Bar Totals RM 93+50 to 97+40	**48,351**	**0**	**0**	**0**				
											Instrument	No	N/A	
						Morgan Bar Totals RM 97+40 to 101+18	**0**	**0**	**0**	**0**				
March - 2013	-43	-48	ESSAYONS	HOPPER	Lower Vancouver	O-102.4-FL	4,800				Instrument	No	N/A	
April - 2013	-43	-48	YAQUINA	HOPPER	Lower Vancouver	O-102.4-FL	3,747				Instrument	No	Instrument	No
August / September - 2013	-43	-48	YAQUINA	HOPPER	Lower Vancouver	O-102.4-FL	33,876				Instrument	No	N/A	
September - 2013	-43	-48	ESSAYONS	HOPPER	Lower Vancouver	O-102.0-FL	7,708				Instrument	No	N/A	
October - 2013	-43	-48	ESSAYONS	HOPPER	Lower Vancouver	O-102.0-FL	1,278				Instrument	No	N/A	
						Lower Vancouver Bar Totals RM 101+18 to 104+31	**51,409**	**0**	**0**	**0**				
											Instrument	No	N/A	
						Vancouver Turning Basin Totals RM 104+31 to 106+23	**0**	**0**	**0**	**0**				
						C&LW TOTALS	**4,836,173**	**0**	**780,157**	**279,030**				
						Total Dredged C&LW	**5,895,360**							

Vancouver to the Dalles

						Upper Vancouver Bar Totals RM 106+24 to 110+10	**0**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Airport Bar	W-112.4-IW	3,011				Instrument	No	N/A	
						Airport Bar Totals RM 110+10 to 114+00	**3,011**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Government Island	W-112.4-IW	31,190				Instrument	No	N/A	
August - 2013	-17	-19	YAQUINA	HOPPER	Government Island	W-112.4-IW	5,175				Instrument	No	N/A	

Water Quality Monitoring report for the Washington Department of Ecology and Oregon Department of Environmental Quality

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane/Nearshore Disposal (CY)	Ocean (DWS) Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Turbidity Monitoring Method	Exceedance Yes or No	DO Monitoring Method	DO Below Accept Yes or No
						Government Island Totals RM 114+00 to 117+40	**36,365**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Lady Island	O-117.7-IW	26,034				Instrument	No	N/A	
						Lady Island Ranges RM 117+39 to 122+28	**26,034**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Washougal Ranges	O-123.9-IW	75,091				Instrument	No	N/A	
						Washougal Ranges Totals RM 122+28 to 125+15	**75,091**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Fashion Reef	W-133.2-IW	11,979				Instrument	No	N/A	
						Fashion Reef Totals RM 132+30 to 136+30	**11,979**	**0**	**0**	**0**				
August - 2013	-17	-19	YAQUINA	HOPPER	Multnomah Falls	O-107-9-IW	997				Instrument	No	N/A	
						Multnomah Falls Totals RM 136+30 to 140+20	**997**	**0**	**0**	**0**				
						VTD Totals	**153,477**	**0**	**0**	**0**				
						Total CY Dredged VTD	**153,477**							
Side Channels														
October - 2013	-16	-18	YAQUINA	HOPPER	Skipanon Entrance	W-10.5-IW	22,064				Instrument	No	Instrument	No
						Total CY Skipanon Entrance	**22,064**	**0**	**0**	**0**				

PM-E 2014 DREDGING SEASON

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish. (CY)	Water Quality Monitoring Method	Exceedance Summary Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER													
August / September - 2014	**-48**	**-53**	ESSAYONS	HOPPER	**Quads 2&4**	SJS & DWS		1,052,034			Visual	N	
October - 2014	**-48'/-53'**	**-55/-60'**	ESSAYONS	HOPPER	**Quads 1,2,3,4**	SJS & DWS		366,558			Visual	N	
August / October - 2014	**-48'/-53'**	**-55/-60'**	BAYPORT	HOPPER	**Quads 1,2,3,4**	SWS, NJS, DWS		2,140,015			Visual	N	
						MCR Totals RM -02-00 to 02+00	**0**	**3,558,607**	**0**	**0**			
						Total Dredged MCR	**3,558,607**						
COLUMBIA RIVER AND LOWER WILLAMETTE													
	-43												
						Lower Desdemona Bar Totals RM 04+20 to 06+22	**0**	**0**	**0**	**0**			
	-43												
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**			
September - 2014		**-46**	BAYPORT	HOPPER	**Flavel Bar**	W-7.8-IW	168,609				Visual	N	
October - 2014		**-46**	BAYPORT	HOPPER	**Flavel Bar**	W-7.8-IW	128,510				Visual	N	
November - 2014		**-46**	BAYPORT	HOPPER	**Flavel Bar**	W-7.8-IW	92,573				Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**389,692**	**0**	**0**	**0**			
October - 2014		**-44**	ESSAYONS	HOPPER	**Upper Sands**	**O-18.3-IW**	149,555						
						Upper Sands Totals RM 13+30 to 17+28	**149,555**	**0**	**0**	**0**			
August - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW	46,169				Visual	N	
September - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW	102,947				Visual	N	
October - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW	33,595				Visual	N	
October - 2014		**-46**	OREGON	PIPELINE	**Tongue Point**	W-21.0-UD Lwr End			166,515		Instrument	Y	Turbidity Confirmed Exceedance: (1) Ebb tide 31 October dewatering upland placement site; dredge shutdown for 43 min; weir boards added, tide changed from slack to flood, returned to acceptable level
						Tongue Point Crossing Totals RM 17+28 to 21+15	**182,711**	**0**	**166,515**	**0**			
April / May - 2014	**-43**	**-44**	YAQUINA	HOPPER	**Miller Sands - Downstream**	W-21.2-SW	47,571				Visual	N	
August - 2014	**-43**	**-45**	BAYPORT	HOPPER	**Miller Sands - Downstream**	W-21.1-IW & W-21.3-IW	86,598				Visual	N	
September/October - 2014		**-48**	OREGON	PIPELINE	**Miller Sands - Downstream**	W-21.0-UD			223,315		Instrument	N	
October - 2014	**-43**	**-46**	ESSAYONS	HOPPER	**Miller Sands - Downstream**	O-18.3-IW	95,702				Visual	N	
						Miller Sands - Downstream Totals RM 21+15 to 23+20	**229,871**	**0**	**223,315**	**0**			
September - 2014		**-48**	OREGON	PIPELINE	**Miller Sands - Mid**	O-23.5-BN				210,545	Instrument	N	
						Miller Sands - Mid Totals RM 23+20 to 24+15	**0**	**0**	**0**	**210,545**			
August - 2014	**-46**	**-47**	BAYPORT	HOPPER	**Miller / Pillar**	W-21.3-HPS	97,465				Visual	N	
October/November - 2014	**-46**	**-47**	BAYPORT	HOPPER	**Miller / Pillar**	W-30.0-IW, W-30.0-IW-REV, W-29.5-IW & W-29.7-IW	293,943				Visual	N	
						Miller / Pillar Totals RM 24+15 to 27+00	**391,408**	**0**	**0**	**0**			
April - 2014	**-44**	**-45**	YAQUINA	HOPPER	**Pillar Rock**	O-27.7-SW	40,378				Visual	N	
June/July - 2014		**-47**	OREGON	PIPELINE	**Pillar Rock**	O-27.2-BN				460,812	Instrument	Y	Turbidity Confirmed Exceedances: (1) Flood tide 30 June shoreline placement; dredge shut down for repairs anyway; retest by measurement confirmed return to acceptable level; (1) Ebb tide 9 July shoreline placement; dredge shut down for 26 min; retest by measurement confirmed return to acceptable level; (1) Ebb tide 10 July shoreline placement; dredge shut down for 50 min; retest by measurement confirmed return to acceptable level; (1) Ebb tide 14 July shoreline placement; dredge shut down for 28 min; retest by measurement confirmed return to acceptable level.
						Pillar Rock / Brookfield Totals RM 27+00 to 29+10	**40,378**	**0**	**0**	**460,812**			
						Brookfield Welch Totals RM 29+10 to 30+35	**0**	**0**	**0**	**0**			
						Brookfield / Skamokawa Totals RM 30+35 to 32+40	**0**	**0**	**0**	**0**			
March - 2014	**-43**	**-44**	YAQUINA	HOPPER	**Skamokawa - Downstream**	O-34.4-SW	16,381				Visual	N	
August - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Skamokawa - Downstream**	O-36.6-IW & W-31.1-FL	36,332				Visual	N	
October - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Skamokawa - Downstream**	W-31.2-FL	68,257				Visual	N	
						Skamokawa - Downstream Totals RM 32+40 to 34+30	**120,970**	**0**	**0**	**0**			
March - 2014	**-43**	**-44**	YAQUINA	HOPPER	**Skamokawa - Upstream**	O-34.4-SW	21,524				Visual	N	
June - 2014	**-44**	**-45**	ESSAYONS	HOPPER	**Skamokawa - Upstream**	W-35.3-IW & W-35.7-IW	121,358				Visual	N	
August - 2014	**-43**	**-45**	ESSAYONS	HOPPER	**Skamokawa - Upstream**	O-36.6-IW	11,124				Visual	N	
October/November - 2014	**-45**	**-46**	BAYPORT	HOPPER	**Skamokawa - Upstream**	W-30.0-IW, O33.8-IW & W-29.5-IW	168,394				Visual	N	
						Skamokawa - Upstream Totals RM 34+30 to 37+00	**322,400**	**0**	**0**	**0**			

PM-E 2014 DREDGING SEASON

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Summary Yes (Y) or No (N)	Notes
August - 2014	-43	-44	ESSAYONS	HOPPER	**Puget Island**	O-36.6-IW	11,057				Visual	N	
August - 2014		-46	OREGON	PIPELINE	**Puget Island**	O-38.3-UD			268,146		Instrument	N	
October - 2014	-44	-46	ESSAYONS	HOPPER	**Puget Island**	W-31.2-FL	50,031				Visual	N	
						Puget Island Totals RM 37+00 to 40+00	**61,088**	**0**	**268,146**	**0**			
June - 2014	-43	-45	ESSAYONS	HOPPER	**Wauna - Downstream**	W-35.3-IW, W-35.7-IW & W-31.1-IW	97,980				Visual	N	
August - 2014	-43	-44	ESSAYONS	HOPPER	**Wauna - Downstream**	W-40.2-IW	7,339				Visual	N	
October/November - 2014	-45	-46	BAYPORT	HOPPER	**Wauna - Downstream**	O-36.6-IW & O-33.8-IW	145,291				Visual	N	
						Wauna - Downstream Totals RM 40+00 to 44+27	**250,610**	**0**	**0**	**0**			
August - 2014	-43	-44	ESSAYONS	HOPPER	**Wauna - Mid**	W-40.2-IW	10,564				Visual	N	
November - 2014	-43	-46	ESSAYONS	HOPPER	**Wauna - Mid**	O-40.1-IW, W-36.6-IW & W-35.2-IW	74,505				Visual	N	
						Wauna - Mid Totals RM 41+40 to 43+20	**85,069**	**0**	**0**	**0**			
March - 2014	-43	-44	YAQUINA	HOPPER	**Wauna/Westport**	W-43.8-SW	5,722				Visual	N	
July/August - 2014	-44	-45	BAYPORT	HOPPER	**Wauna/Westport**	O-52.2-IW & W-39.3-IW	79,107				Visual	N	
October - 2014	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-36.6-IW	102,605				Visual	N	
						Wauna / Westport Totals RM 43+20 to 46+25	**187,434**	**0**	**0**	**0**			
April - 2014	-44	-45	ESSAYONS	HOPPER	**Westport/Eureka**	W-31.2-FL & O/W-62.4-FL	43,434				Visual	N	
July/August - 2014	-44	-45	BAYPORT	HOPPER	**Westport/Eureka**	O-52.2-IW & W-39.3-IW	222,465				Visual	N	
November - 2014	-46	-47	ESSAYONS	HOPPER	**Westport/Eureka**	W-35.2-IW, O-34.4-IW, O40.1-IW & O-52.8-IW	118,842				Visual	N	
January/February - 2015	-46	-47	OREGON	PIPELINE	**Westport/Eureka**	W-46.3-UD			455,943		Instrument	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**384,741**	**0**	**455,943**	**0**			
March - 2014	-43	-44	YAQUINA	HOPPER	**Eureka/Gull Is**	O/W-51.0-FL	5,667				Visual	N	
August - 2014	-44	-45	ESSAYONS	HOPPER	**Eureka/Gull Is**	O-53.9-IW & W-53.4-IW	42,484				Visual	N	
October/November - 2014	-43	-47	ESSAYONS	HOPPER	**Eureka/Gull Is**	O-52.8-IW & W-53.4-IW	70,072				Visual	N	
						Eureka / Gull Is. Totals RM 49+00 to 53+00	**118,223**	**0**	**0**	**0**			
August - 2014	-43	-44	ESSAYONS	HOPPER	**Gull Island**	O-53.9-IW & W-53.4-IW	45,715				Visual	N	
October - 2014	-43		ESSAYONS	HOPPER	**Gull Island**	W-53.4-IW & W-58.5-IW	73,769				Visual	N	
						Gull Is. Totals RM 53+00 to 55+30	**119,484**	**0**	**0**	**0**			
August - 2014	-43	-44	ESSAYONS	HOPPER	**Stella-Fisher**	W-54.9-IW	60,718				Visual	N	
October - 2014	-43	-45	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.4-IW & W-58.5-IW	60,951				Visual	N	
						Stella-Fisher Bar Totals RM 55+30 to 57+40	**121,669**	**0**	**0**	**0**			
July/August - 2014	-43	-44	ESSAYONS	HOPPER	**Stella / Walker**	W-54.9-IW & W-58.6-IW	134,155				Visual	N	
August/September - 2014		-48	OREGON	PIPELINE	**Stella / Walker**	W-59.7-UD			375,415		Instrument	N	
November - 2014	-46	-47	BAYPORT	HOPPER	**Stella / Walker**	O-58.3-IW, O-52.3-IW, O-55.8-IW & O-58.3-IW	174,612				Visual	N	
						Stella / Walker Totals RM 57+40 to 59+30	**308,767**	**0**	**375,415**	**0**			
July - 2014	-43	-44	ESSAYONS	HOPPER	**Walker Is. Reach**	W-54.9-IW	57,060				Visual	N	
November - 2014	-43	-48	ESSAYONS	HOPPER	**Walker Is. Reach**	O-61.4-IW	5,630				Visual	N	
November - 2014	-45	-46	BAYPORT	HOPPER	**Walker Is. Reach**	O-58.3-IW	61,940				Visual	N	
						Walker Is. Reach Totals RM 59+30 to 62+00	**124,630**	**0**	**0**	**0**			
April - 2014	-43		ESSAYONS	HOPPER	**Slaughters Bar**	O/W-62.4-FL	9,741				Visual	N	
November - 2014	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	W-61.4-IW & O-61.4-IW	65,079				Visual	N	
						Slaughters Bar Totals RM 62+00 to 65+20	**74,820**	**0**	**0**	**0**			
April	-44	-45	ESSAYONS	HOPPER	**Slaughters/Lwr Dobelbower**	O/W-62.4-FL	53,654				Visual	N	
July - 2014	-44	-45	ESSAYONS	HOPPER	**Slaughters/Lwr Dobelbower**	W-61.3-IW, O-62.3-IW & O-61.6-IW	247,428				Visual	N	
July - 2014	-41		YAQUINA	HOPPER	**Slaughters/Lwr Dobelbower**	O-68.4-IW & O-66.4-IW	27,881				Visual	N	
November - 2014	-46	-47	ESSAYONS	HOPPER	**Slaughters/Lwr Dobelbower**	O-71.9-IW, W-69.2-FL & O-70.6-IW	159,076				Visual	N	
November - 2014	-46	-47	BAYPORT	HOPPER	**Slaughters/Lwr Dobelbower**	O-58.3-IW, O-72.8-FL & O-77.9-IW	67,605				Visual	N	
						Slaughters / Lwr Dobelbower Totals RM 65+20 to 68+10	**555,644**	**0**	**0**	**0**			
November - 2014		-44	YAQUINA	HOPPER	**Lower Dobelbower**	W-69.4-IW	9,045				Visual	N	
						Lower Dobelbower Bar Totals RM 68+10 to 69+50	**9,045**	**0**	**0**	**0**			

PM-E 2014 DREDGING SEASON

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Summary Yes (Y) or No (N)	Notes
July - 2014	-43	-45	YAQUINA	HOPPER	Upper Dobelbower	W-71.7-IW	27,063				Visual	N	
August - 2014	-43	-44	ESSAYONS	HOPPER	Upper Dobelbower	O-71.9-IW	25,975				Visual	N	
November - 2014	-45	-46	YAQUINA	HOPPER	Upper Dobelbower	W-71.7-IW	17,518				Visual	N	
November - 2014	-45	-46	YAQUINA	HOPPER	Upper Dobelbower	O-70.6-IW	10,188				Visual	N	
December 2014 to January 2015		-48	OREGON	PIPELINE	Upper Dobelbower	W-70.1-UD			344,335		Instrument	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+10	**80,744**	**0**	**344,335**	**0**			
November - 2014	-43	-44	YAQUINA	HOPPER	Kalama Bar (Turning Basin)	O-73.2-IW	36,439				Visual	N	
						Kalama Bar (Turning Basin) Totals RM 72+10 to 74+00	**36,439**	**0**	**0**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	Kalama Bar	O-73.2-IW	13,635				Visual	N	
November - 2014	-43	-46	YAQUINA	HOPPER	Kalama Bar	O-75.1-SW	50,313				Visual	N	
						Kalama Bar Totals RM 74+00 to 75+30	**63,948**	**0**	**0**	**0**			
August - 2014	-44	-45	BAYPORT	HOPPER	Kalama / Lower Martin	O-78.5-IW	86,272				Visual	N	
November - 2014	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin	O-79.0-SW	61,401				Visual	N	
						Kalama / Lower Martin Totals RM 75+30 to 78+20	**147,673**	**0**	**0**	**0**			
August - 2014	-44	-45	BAYPORT	HOPPER	Lower / Upper Martin Bar	O-80.5-IW & O-78.5-IW	90,761				Visual	N	
November - 2014	-43	-45	YAQUINA	HOPPER	Lower / Upper Martin Bar	O-79.7-SW	77,821				Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 78+20 to 81+13	**168,582**	**0**	**0**	**0**			
August - 2014	-43	-44	BAYPORT	HOPPER	Upper Martin Bar	O-80.5-IW	55,444				Visual	N	
November - 2014	-45	-46	BAYPORT	HOPPER	Upper Martin Bar	O-82.9-IW & O-80.7-IW	120,782				Visual	N	
November - 2014	-46	-47	OREGON	PIPELINE	Upper Martin Bar	W-82.0-UD			191,469				
						Upper Martin Is. Bar Totals RM 81+13 to 83+45	**176,226**	**0**	**191,469**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-86.3-SW	16,236				Visual	N	
November - 2014	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-86.3-SW & O-84.7-SW	70,524				Visual	N	
						St. Helens Bar Totals RM 83+45 to 87+15	**86,760**	**0**	**0**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	Warrior Rock / Henrici	W-88.6-SW	11,135				Visual	N	
October - 2014		-45	YAQUINA	HOPPER	Warrior Rock / Henrici	W-88.6-SW & W-89.6-SW	62,168				Visual	N	
October / November - 2014	-43	-45	YAQUINA	HOPPER	Warrior Rock / Henrici	W-88.6-SW & W-89.6-SW	96,727				Visual	N	
						Warrior Rock / Henrici Totals RM 87+50 to 92+00	**170,030**	**0**	**0**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	Henrici Bar	W-89.6-SW & O-94.5-SW	48,637				Visual	N	
October - 2014	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-94.5-SW	52,116				Visual	N	
						Henrici Bar Totals RM 92+00 to 93+50	**100,753**	**0**	**0**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	Willow Bar	O-94.5-SW	33,578				Visual	N	
October - 2014	-43	-45	YAQUINA	HOPPER	Willow Bar	O-94.5-SW	58,638				Visual	N	
						Willow Bar Totals RM 93+50 to 96+00	**92,216**	**0**	**0**	**0**			
July - 2014	-43	-44	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	52,070				Visual	N	
October - 2014	-43	-45	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	75,511				Visual	N	
						Willow / Morgan Totals RM 96+00 to 98+00	**127,581**	**0**	**0**	**0**			
					Morgan Bar								
						Morgan Bar Totals RM 98+00 to 101+18	**0**	**0**	**0**	**0**			
May - 2014	-43	-44	ESSAYONS	HOPPER	Lower Vancouver	O/W-102.6-FL	5,310				Visual	N	
July - 2014	-43	-44	YAQUINA	HOPPER	Lower Vancouver	O-102.4-FL	12,924				Visual	N	
August - 2014	-43	-44	YAQUINA	HOPPER	Lower Vancouver	O-102.1-IW	1,994				Visual	N	2 Loads for shakedown post-repair
September - 2014	-43	-44	YAQUINA	HOPPER	Lower Vancouver	O-102.1-IW	5,089				Visual	N	
September /-2014	-43	-44	YAQUINA	HOPPER	Lower Vancouver	O-102.1-IW	53,683				Visual	N	
November - 2014	-43	-45	YAQUINA	HOPPER	Lower Vancouver	W-102.8-FL	14,311				Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+10	**93,311**	**0**	**0**	**0**			
March - 2014	-43	-44	YAQUINA	HOPPER	Vancouver Turning Basin	O-105.5-IW	3,096				Visual	N	Sea Trials
April - 2014	-43	-44	ESSAYONS	HOPPER	Vancouver Turning Basin	O/W-102.6-FL	15,163				Visual	N	Sea Trials
July - 2014	-43		YAQUINA	HOPPER	Vancouver Turning Basin	O-105.5-IW	3,067				Visual	N	
November - 2014	-43	-44	YAQUINA	HOPPER	Vancouver Turning Basin	W-102.8-FL & W-105.5-IW	22,106				Visual	N	
						Vancouver Turning Basin Totals RM 104+10 to 105+25	**43,432**	**0**	**0**	**0**			
						C&LW TOTALS	**5,615,904**	**0**	**2,025,138**	**671,357**			
						Total Dredged C&LW	**8,312,399**						

PM-E 2014 DREDGING SEASON

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Summary Yes (Y) or No (N)	Notes
Vancouver to the Dalles													
September - 2014	-16	-17	MCAMIS	CLAMSHELL	I-5 Alt Barge Channel	Contractor Owned	0	0	69	0	Visual	N	Contractor owned disposal
October - 2014	-16	-17	MCAMIS	CLAMSHELL	I-5 Alt Barge Channel	Contractor Owned	0	0	10	0	Visual	N	Contractor owned disposal
						I-5 Alt Barge Channel RM 106+25 to 108+00	**0**	**0**	**79**	**0**			
September - 2014	-17	-18	YAQUINA	HOPPER	Upper Vancouver Bar	O-109.9-IW	910				Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**910**	**0**	**0**	**0**			
					Airport Bar								
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**			
September - 2014	-17	-18	YAQUINA	HOPPER	Airport / Government	W-112.3-IW	36,654				Visual	N	
						Airport / Government Totals RM 113+00 to 114+30	**36,654**	**0**	**0**	**0**			
					Government Island								
						Government Island Totals RM 114+30 to 117+25	**0**	**0**	**0**	**0**			
September - 2014	-17	-18	YAQUINA	HOPPER	Government / Lady	O-117.3-IW	20,913				Visual	N	
						Government / Lady RM 117+25 to 119+00	**20,913**	**0**	**0**	**0**			
					Lady Island								
						Lady Island Ranges RM 119+00 to 122+28	**0**	**0**	**0**	**0**			
September - 2014	-17	-18	YAQUINA	HOPPER	Washougal Ranges	W-124.4-IW	80,399				Visual	N	
September - 2014	-17	-18	YAQUINA	HOPPER	Washougal Ranges	W-112.3-IW	574						
						Washougal Ranges Totals RM 122+28 to 125+15	**80,973**	**0**	**0**	**0**			
September - 2014	-17	-18	YAQUINA	HOPPER	Fashion Reef	O-133.3-IW & O/W-133.2-FL	15,079				Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**15,079**	**0**	**0**	**0**			
					Multnomah Falls								
						Multnomah Falls Totals RM 136+30 to 140+20	**0**	**0**	**0**	**0**			
						VTD Totals	**154,529**	**0**	**79**	**0**			
						Total CY Dredged VTD	**154,608**						
Side Channels													
October - 2013	-9	-10	MCAMIS	CLAMSHELL	Chinook	Area D & W-4.8-IW	87,019				Visual	N	
						Total CY Chinook Entrance	**87,019**	**0**	**0**	**0**			
October/November - 2014	-14	-16	HME	CLAMSHELL	Baker Bay	O-3.2-IW & W-4.8-IW	94,281				Visual	N	
						Total CY Baker Bay	**94,281**	**0**	**0**	**0**			
October/November - 2014	-14	-16	MCAMIS	CLAMSHELL	Skipanon Entrance	W-10.5-IW & O-9.5-IW	105,908				Instrument	N	
						Total CY Skipanon Entrance	**105,908**	**0**	**0**	**0**			
November - 2014	-9	-11	MCAMIS	CLAMSHELL	Westport Slough	W-40.9-IW & O-45.5-IW & O-45.9-IW	32,464				Instrument	N	
						Total CY Westport Slough	**32,464**	**0**	**0**	**0**			
December - 2014	-9	-11	HME	CLAMSHELL	Wahkiakum Ferry Crossing	W-40.9-IW	19,798				Visual	N	
						Total CY Wahkiakum Ferry Crossing	**19,798**	**0**	**0**	**0**			
						Columbia River Side Channels Totals	**339,470**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**339,470**						

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- 2015 DREDGING SEASON MAY TO NOVEMBER 2015

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER													
September/October - 2015	-48'/-53'	-55/-60'	ESSAYONS	HOPPER	Quads 1,2,3,4	SJS & DWS		1,190,398			Visual	N	
July - October - 2015	-48'/-53'	-55/-60'	BAYPORT	HOPPER	Quads 1,2,3,4	SWS, NJS, DWS		2,239,565			Visual	N	
						MCR Totals RM -02-00 to 02+00	**0**	**3,429,963**	**0**	**0**			
						Total Dredged MCR	**3,429,963**						
COLUMBIA RIVER AND LOWER WILLAMETTE													
					Lower Desdemona Bar								
						Lower Desdemona Bar Totals RM 04+20 to 06+22	**0**	**0**	**0**	**0**			
					Upper Desdemona Bar								
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**			
September - 2015	-43	-45	ESSAYONS	HOPPER	Flavel Bar	W-7.5-IW	167,128				Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**167,128**	**0**	**0**	**0**			
October - 2015	-43	-44	ESSAYONS	HOPPER	Upper Sands	**W-7.5-IW**	16,776				Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**16,776**	**0**	**0**	**0**			
August - October - 2015	-43	-45	BAYPORT	HOPPER	Tongue Point	O-18.3-IW	108,168				Visual	N	
November - 2015	-43	-45	BAYPORT	HOPPER	Tongue Point	O-18.3-IW	56,045				Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+15	**164,213**	**0**	**0**	**0**			
August - 2015	-43	-45	ESSAYONS	HOPPER	Miller Sands downstream	W-21.1-IW	17,810				Visual	N	
September - 2015	-43	-48	OREGON	PIPELINE	Miller Sands downstream OR	W-21.0-BN				151,901	Instrument	N	
November - 2015	-43	-46	BAYPORT	HOPPER	Miller Sands both shoals	O-18.3-IW	127,051				Visual	N	
						Miller Sands Totals RM 21+15 to 24+15	**144,861**	**0**	**0**	**151,901**			
July/August - 2015	-43	-45	YAQUINA	HOPPER	Miller / Pillar	O-25.5-SW & O-26.1-SW	52,564				Visual	N	
November - 2015	-43	-47	BAYPORT	HOPPER	Miller / Pillar	W-20.8-IW	187,352				Visual	N	
						Miller / Pillar Totals RM 24+15 to 27+00	**239,916**	**0**	**0**	**0**			
July/August - 2015	-43	-48	OREGON	PIPELINE	Pillar Rock	O-27.2-BN				264,554	Instrument	Y	Two turbidity exceedances: (1) 24-Jul and (1) 11-Aug; corrective actions taken.
						Pillar Rock / Brookfield Totals RM 27+00 to 29+10	**0**	**0**	**0**	**264,554**			
August/September - 2015	-43	-48	OREGON	PIPELINE	Brookfield Welch	W-29.0-IW & W-29.9-IW	404,479				Instrument	N	
						Brookfield Welch Totals RM 29+10 to 30+35	**404,479**	**0**	**0**	**0**			
						Brookfield / Skamokawa Totals RM 30+35 to 32+30	**0**	**0**	**0**	**0**			
May - 2015	-43	-44	YAQUINA	HOPPER	Skamokawa Bar both shoals	O-32.9-SW & O-34.4-SW	12,944				Visual	N	
June/July - 2015	-43	-48	OREGON	PIPELINE	Skamokawa Bar upstream	O-34.0-UD			273,618		Instrument	Y	Eleven turbidity exceedances: (1) 24-Jun, (1) 25-Jun, (2) 26-Jun, (2) 2-Jul, (1) 7-Jul, (1) 8-Jul, (2) 10-Jul, (1) 15-Jul; corrective actions taken.
August - 2015	-43	-45	ESSAYONS	HOPPER	Skamokawa Bar downstream	W-32.1-IW	12,795				Visual	N	
October - 2015	-43	-46	ESSAYONS	HOPPER	Skamokawa Bar mostly downstream	W-31.2-FL	151,115				Visual	N	
						Skamokawa Bar Totals RM 32+30 to 37+00	**176,854**	**0**	**273,618**	**0**			
July - 2015	-43	-46	BAYPORT	HOPPER	Puget Island	O-36.6-IW & W-36.3-IW	80,000				Visual	N	
November - 2015	-43	-46	BAYPORT	HOPPER	Puget Island	O-36.2-IW, O-34.2-IW & W-31.2-IW	139,599				Visual	N	
						Puget Island Totals RM 37+00 to 40+00	**219,599**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- 2015 DREDGING SEASON MAY TO NOVEMBER 2015

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
August - 2015	-43	-45	ESSAYONS	HOPPER	**Wauna downstream**	O-34.2-IW	57,872				Visual	N	
September - 2015	-43	-46	BAYPORT	HOPPER	**Wauna downstream**	W-35.3-IW, W-35.7-IW, O-36.8-IW, W-40.8-IW, O-27.9-IW, O-28.5-IW	160,887						
October - 2015	-43	-46	ESSAYONS	HOPPER	**Wauna mid**	W-36.0-IW	28,940				Visual	N	
						Wauna/Driscoll Totals RM 40+00 to 43+20	**247,699**	**0**	**0**	**0**			
October - 2015	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-36.0-IW	83,782				Visual	N	
						Wauna / Westport Totals RM 43+20 to 46+25	**83,782**	**0**	**0**	**0**			
May - 2015	-43	-45	YAQUINA	HOPPER	**Westport/Eureka**	W-46.4-SW	21,304				Visual	N	
June - 2015	-43	-45	OREGON	PIPELINE	**Westport/Eureka**	W-48.7-IW	26,233				Instrument	N	
August - 2015	-43	-46	ESSAYONS	HOPPER	**Westport/Eureka**	O-34.2-IW, O-40.1-IW & W-53.5-IW	128,033				Visual	N	
October - 2015	-43	-48	BAYPORT	HOPPER	**Westport/Eureka**	O-34.2-IW, O-52.3-IW & W-53.0-IW	380,758				Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**556,328**	**0**	**0**	**0**			
August - 2015	-43	-45	ESSAYONS	HOPPER	**Eureka/Gull Is**	W-53.5-IW	10,623				Visual	N	
November - 2015	-43	-46	YAQUINA	HOPPER	**Eureka/Gull Is**	O-52.0-SW	16,540				Visual	N	
						Eureka / Gull Is. Totals RM 49+00 to 53+00	**27,163**	**0**	**0**	**0**			
August - 2015	-43	-45	ESSAYONS	HOPPER	**Gull Island**	W-53.5-IW	20,676				Visual	N	
November - 2015	-43	-46	YAQUINA	HOPPER	**Gull Island**	W-53.6-IW	21,500				Visual	N	
						Gull Is. Totals RM 53+00 to 55+30	**42,176**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	**Stella-Fisher**	O-57.4-SW	39,688				Visual	N	
October - 2015	-43	-46	YAQUINA	HOPPER	**Stella-Fisher**	O-57.4-SW	41,091				Visual	N	
						Stella-Fisher Bar Totals RM 55+30 to 57+40	**80,779**	**0**	**0**	**0**			
July/August - 2015	-43	-45	YAQUINA	HOPPER	**Stella / Walker**	O-58.6-SW	18,471				Visual	N	
October - 2015	-43	-48	BAYPORT	hOPPER	**Stella / Walker**	W-53.0-IW, W-53.4-IW, W-53.8-IW & O-58.2-IW	214,779						
						Stella / Walker Totals RM 57+40 to 59+30	**233,250**	**0**	**0**	**0**			
August - 2015	-43	-45	ESSAYONS	HOPPER	**Walker Is. Reach**	W-60.7-IW	20,698				Visual	N	
October - 2015	-43	-46	YAQUINA	HOPPER	**Walker Is. Reach**	W-60.8-SW	15,334				Visual	N	
						Walker Is. Reach Totals RM 59+30 to 62+00	**36,032**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	**Slaughters Bar**	O-62.7-SW	10,264				Visual	N	
October - 2015	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-61.8-IW	47,929				Visual	N	
November - 2015	-43	-43	YAQUINA	HOPPER	**Slaughters Bar (Turning Basin)**	O-68.5-SW	1,370				Visual	N	
						Slaughters Bar Totals RM 62+00 to 65+20	**59,563**	**0**	**0**	**0**			
May - 2015	-43	-45	YAQUINA	HOPPER	**Slaughters/Lwr Dobelbower**	O-68.5-SW	34,579				Visual	N	
August - 2015	-43	-46	ESSAYONS	HOPPER	**Slaughters/Lwr Dobelbower**	O-61.9-IW, W-60.7-IW, W-61.3-IW	126,417				Visual	N	
November - 2015	-43	-48	BAYPORT	HOPPER	**Slaughters/Lwr Dobelbower**	W-60.9-IW, O-59.7-IW, O-58.2-IW, O-59.2-IW	195,246				Visual	N	
						Slaughters / Lwr Dobelbower Totals RM 65+20 to 68+10	**356,242**	**0**	**0**	**0**			
					Lower Dobelbower								
						Lower Dobelbower Bar Totals RM 68+10 to 69+50	**0**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	**Upper Dobelbower**	W-71.2-FL	10,155				Visual	N	
November - 2015	-43	-45	YAQUINA	HOPPER	**Upper Dobelbower**	O-71.8-IW & O-68.5-SW	28,591				Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+10	**38,746**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- 2015 DREDGING SEASON MAY TO NOVEMBER 2015

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
August - 2015	-43	-43	YAQUINA	HOPPER	Kalama Ranges	O-73.1-FL	6,178				Visual	N	
November - 2015	-43	-46	YAQUINA	HOPPER	Kalama Ranges	O-75.1-SW & O-73.2-FL	36,735				Visual	N	
November - 2015	-43	-44	YAQUINA	HOPPER	Kalama Ranges (Turning Basin)	O-73.2-IW	35,502				Visual	N	
						Kalama Ranges Totals RM 72+10 to 75+30	**78,415**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin	O-79.0-SW	45,948				Visual	N	
October/November - 2015	-43	-46	BAYPORT	HOPPER	Kalama / Lower Martin	O-76.4-FL & O-80.6-IW	107,108				Visual	N	
November - 2015	-43	-48	OREGON	PIPELINE	Kalama / Lower Martin	O-77.0-UD			169,007		Instrument	N	
						Kalama / Lower Martin Totals RM 75+30 to 78+20	**153,056**	**0**	**169,007**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	Lower / Upper Martin Bar	O-79.7-SW & O-79.0-SW	20,163				Visual	N	
November - 2015	-43	-46	YAQUINA	HOPPER	Lower / Upper Martin Bar	O-79.6-SW, O-78.8-SW & O-80.1-SW	54,344				Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 78+20 to 81+13	**74,507**	**0**	**0**	**0**			
August - 2015	-43	-43	YAQUINA	HOPPER	Upper Martin Bar	O-81.8-IW	3,895				Visual	N	
October/November - 2015	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	W-83.6-SW & O81.8-SW	33,006				Visual	N	
						Upper Martin Is. Bar Totals RM 81+13 to 83+45	**36,901**	**0**	**0**	**0**			
July - 2015	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.9-SW	4,293				Visual	N	
August - 2015	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.9-SW	35,860				Visual	N	
October - 2015	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-85.3-IW	16,795				Visual	N	
October/November - 2015	-43	-48	OREGON	PIPELINE	St. Helens Bar	O-86.2-BN				376,503	Instrument	Y	Six turbidity exceedances: (1) 9-Oct, (1) 27-Oct, (1) 28-Oct, (1) 2-Nov, (1) 5-Nov, (1) 6-Nov; corrective actions taken. On 27-Oct the dredge shut down for one hour (1215-1315) after one exceedance to fuel and add pipe.
						St. Helens Bar Totals RM 83+45 to 87+15	**56,948**	**0**	**0**	**376,503**			
October - 2015	-43	-45	YAQUINA	HOPPER	Warrior Rock	W-89.6-SW	20,497				Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**20,497**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	Warrior Rock / Henrici	W-89.6-SW	13,969				Visual	N	
						Warrior Rock / Henrici Totals RM 87+50 to 90+50	**13,969**	**0**	**0**	**0**			
October - 2015	-43	-45	YAQUINA	HOPPER	Henrici Bar	W-89.6-SW & O-94.5-SW	40,555				Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**40,555**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	Willow Bar	O-94.5-SW	10,277				Visual	N	
October - 2015	-43	-46	YAQUINA	HOPPER	Willow Bar	O-94.5-SW	18,098				Visual	N	
						Willow Bar Totals RM 93+50 to 96+00	**28,375**	**0**	**0**	**0**			
August - 2015	-43	-45	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	10,304				Visual	N	
October - 2015	-43	-46	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	30,721				Visual	N	
						Willow / Morgan Totals RM 96+00 to 98+00	**41,025**	**0**	**0**	**0**			
					Morgan Bar								
						Morgan Bar Totals RM 98+00 to 101+18	**0**	**0**	**0**	**0**			
October - 2015	-43	-45	ESSAYONS	HOPPER	Lower Vancouver	O-102.1-IW	53,499				Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+31	**53,499**	**0**	**0**	**0**			
May - 2015	-43	-45	YAQUINA	HOPPER	Lower Vancouver / Turning Basin	O-102.1-IW	7,786				Visual	N	Sea Trials
August - 2015	-43	-45	ESSAYONS	HOPPER	Lower Vancouver / Turning Basin	O-102.1-IW	25,060				Visual	N	Sea Trials
						Lower Vancouver / Turning Basin RM 104+10 to 105+00	**32,846**	**0**	**0**	**0**			
October - 2015	-43	-45	ESSAYONS	HOPPER	Vancouver Turning Basin	O-102.1-IW	22,695				Visual	N	
						Vancouver Turning Basin Totals RM 104+31 to 106+23	**22,695**	**0**	**0**	**0**			
						C&LW TOTALS	**3,948,874**	**0**	**442,625**	**792,958**			
						Total Dredged C&LW	**5,184,457**						

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- 2015 DREDGING SEASON MAY TO NOVEMBER 2015

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
Vancouver to the Dalles													
August - 2015	-17	-18	YAQUINA	HOPPER	Upper Vancouver Bar	O-107.9-IW	5,870				Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**5,870**	**0**	**0**	**0**			
August - 2015	-17	-18	YAQUINA	HOPPER	Airport Bar	W-112.3-IW	24,208				Visual	N	
						Airport Bar Totals RM 110+10 to 114+00	**24,208**	**0**	**0**	**0**			
					Airport / Government								
						Airport / Government Totals RM 113+00 to 114+30	**0**	**0**	**0**	**0**			
August - 2015	-17	-18	YAQUINA	HOPPER	Government Island	W-117.3-IW	12,312				Visual	N	
						Government Island Totals RM 114+00 to 117+40	**12,312**	**0**	**0**	**0**			
					Government / Lady								
						Government / Lady RM 117+25 to 119+00	**0**	**0**	**0**	**0**			
					Lady Island								
						Lady Island Ranges RM 117+39 to 122+28	**0**	**0**	**0**	**0**			
August - 2015	-17	-18	YAQUINA	HOPPER	Washougal Ranges	O/W-123.6-FL	46,165				Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**46,165**	**0**	**0**	**0**			
August - 2015	-17	-18	YAQUINA	HOPPER	Fashion Reef	O-133.6-IW & W-133.2-FL	4,956				Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**4,956**	**0**	**0**	**0**			
					Multnomah Falls								
						Multnomah Falls Totals RM 136+30 to 140+20	**0**	**0**	**0**	**0**			
						VTD Totals	**93,511**	**0**	**0**	**0**			
						Total CY Dredged VTD	**93,511**						
Side Channels													
August - October - 2015	-9	-10	Seahorse	Clamshell	Chinook	W-4.8-IW & Area D	87,410				Instrument	N	
						Total CY Chinook Entrance	**87,410**	**0**	**0**	**0**			
August/September - 2015	-15	-17	Seahorse	Clamshell	Baker Bay	O-3.2-IW & W-4.8-IW	92,104				Instrument	N	
						Total CY Baker Bay	**92,104**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**179,514**						

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- CALENDAR YEAR 2016

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER													
July - October - 2016	**-48'/-55'**	**-53/-60'**	ESSAYONS	HOPPER	**Quads 1,2,3,4**	SJS & DWS		1,300,991			Visual	N	
July - September - 2016	**-48'/-55'**	**-53/-60'**	BAYPORT	HOPPER	**Quads 1,2,3,4**	SWS, NJS, DWS		2,249,965			Visual	N	
						MCR Totals RM -02-00 to 02+00	**0**	**3,550,956**	**0**	**0**			
						Total Dredged MCR	**3,550,956**						
COLUMBIA RIVER AND LOWER WILLAMETTE													
						Lower Desdemona Bar Totals RM 04+20 to 06+22	**0**	**0**	**0**	**0**			
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**			
October - 2016	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Flavel Bar**	W-7.3-IW	5,903				Visual	N	
October - 2016	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Flavel Bar**	W-7.3-IW	126,570				Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**132,473**	**0**	**0**	**0**			
October/November - 2016	**-43**	**-44**	ESSAYONS	HOPPER	**Upper Sands**	**O-18.3-IW**	52,608				Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**52,608**	**0**	**0**	**0**			
July - 2016	**-43**	**-45**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW	79,630				Visual	N	
August/September - 2016	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW & W-20.8-IW	61,513				Visual	N	
November - 2016	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Tongue Point**	O-18.3-IW & W-20.8-IW	205,053				Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+15	**346,196**	**0**	**0**	**0**			
July - 2016	**-43**	**-45**	ESSAYONS	HOPPER	**Miller Sands**	W-20.8-IW	52,487				Visual	N	
September/October - 2016	**-43**	**-46/-48**	OREGON	PIPELINE	**Miller Sands RM 23+20 to 24+10**	Miller Sands Is O-23.5-BN u/s end				288,050	Instrument	N	
October - 2016	**-43**	**-46/-48**	OREGON	PIPELINE	**Miller Sands RM 21+25 to 21+45**	Miller Sands Is O-23.5-BN d/s end				62,975	Instrument	N	
November - 2016	**-43**	**-46**	ESSAYONS	HOPPER	**Miller Sands**	W-20.8-IW & O-22.9-IW	68,714				Visual	N	
						Miller Sands Totals RM 21+15 to 24+15	**121,201**	**0**	**0**	**351,025**			
April - 2016	**-43**	**-45**	YAQUINA	HOPPER	**Miller / Pillar**	O-26.1-SW	16,561				Visual	N	
July - 2016	**-43**	**-45**	ESSAYONS	HOPPER	**Miller / Pillar**	O-28.9-IW, O-27.8-IW & W-26.7-IW	84,524				Visual	N	
October/November - 2016	**-43**	**-46**	ESSAYONS	HOPPER	**Miller / Pillar**	O-22.9-IW, O-27.8-IW, W-24.1-IW & W-26.7-IW	187,501				Visual	N	
						Miller / Pillar Totals RM 24+15 to 27+00	**288,586**	**0**	**0**	**0**			
August/September - 2016	**-43**	**-46/-48**	OREGON	PIPELINE	**Pillar Rock**	Pillar Rock Island O-27.2-BN				303,032	Instrument	Y	Six turbidity exceedances: (1) 2-Sep, (1) 6-Sep, (1) 10-Sep, (2) 16-Sep, (1) 17-Sep; corrective actions taken.
						Pillar Rock RM 27+00 to 29+10	**0**	**0**	**0**	**303,032**			
						Brookfield Welch Totals RM 29+10 to 30+35	**0**	**0**	**0**	**0**			
November - 2016	**-43**	**-44**	ESSAYONS	HOPPER	**Brookfield / Skamokawa**	W-31.1-FL	20,784				Visual	N	
						Brookfield / Skamokawa Totals RM 30+35 to 32+30	**20,784**	**0**	**0**	**0**			
July - 2016	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Skamokawa Bar**	W-29.9-IW & O-28.9-IW	150,764				Visual	N	
October - 2016	**-43**	**-46**	ESSAYONS	HOPPER	**Skamokawa Bar**	W-31.1-FL	52,268				Visual	N	
October - 2016	**-43**	**-46**	BAYPORT	HOPPER	**Skamokawa Bar**	W-29.7-IW	79,039				Visual	N	
						Skamokawa Bar Totals RM 32+30 to 37+00	**282,071**	**0**	**0**	**0**			
April - 2016	**-43**	**-44**	YAQUINA	HOPPER	**Puget Island**	O-37.4-SW	23,121				Visual	N	
July - 2016	**-43**	**-46**	ESSAYONS	HOPPER	**Puget Island**	W-20.8-IW	5,623				Visual	N	
July - 2017	**-43**	**-45/-46**	BAYPORT	HOPPER	**Puget Island**	O-34.2-IW & W-29.8-IW	86,544				Visual	N	
October - 2016	**-43**	**-46**	ESSAYONS	HOPPER	**Puget Island**	W-35.3-IW & W-35.9-IW	61,180				Visual	N	
October/November - 2016	**-43**	**-46/-48**	OREGON	PIPELINE	**Puget Island**	Tenasillahe Island O-38.3-UP			123,053		Instrument	N	
						Puget Island Totals RM 37+00 to 40+00	**176,468**	**0**	**123,053**	**0**			

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- CALENDAR YEAR 2016

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
July - 2016	-43	-45/-46	BAYPORT	HOPPER	Wauna/Driscoll	W-35.3-IW, O-39.9-IW, O-38.1-IW, W-35.3-IW, O-34.2-IW & W-29.8-IW	141,255				Visual	N	
November - 2016	-43	-45/-46	ESSAYONS	HOPPER	Wauna/Driscoll	W-31.1-FL & W-32.2-FL	60,104				Visual	N	
						Wauna/Driscoll Totals RM 40+00 to 43+20	**201,359**	**0**	**0**	**0**			
April - 2016	-43	-44	YAQUINA	HOPPER	Wauna/Westport	W-44.5-IW	25,654				Visual	N	
July - 2016	-43	-44/-45	ESSAYONS	HOPPER	Wauna/Westport	W-39.7-IW, O-39.9-FL, O-49.7-IW & W-49.9-IW	60,211				Visual	N	
November - 2016	-43	-45/-46	ESSAYONS	HOPPER	Wauna/Westport	O-39.9-IW, W-39.6-IW, W-35.3-IW & W-34.9-IW	132,433				Visual	N	
						Wauna / Westport Totals RM 43+20 to 46+25	**218,298**	**0**	**0**	**0**			
April - 2016	-43	-45	YAQUINA	HOPPER	Westport/Eureka	W-46.4-SW	27,361				Visual	N	
July - 2016	-43	-46/-47	BAYPORT	HOPPER	Westport/Eureka	O-36.5-IW, W-45.9-IW, W-36.1-IW, W-35.7-IW & O-39.9-IW	199,414				Visual	N	
October - 2016	-43	-47/-48	BAYPORT	HOPPER	Westport/Eureka	W-29.7-IW, O-33.8-IW & O-38.5-IW	382,178				Visual	N	
						Westport/Eureka Totals RM 46+25 to 49+00	**608,953**	**0**	**0**	**0**			
July - 2016	-43	-43	ESSAYONS	HOPPER	Eureka/Gull Is	O-51.3-IW, W-50.5-IW & W-50.8-IW	32,222				Visual	N	
October - 2016	-43	-47	ESSAYONS	HOPPER	Eureka/Gull Is	W-53.0-IW	28,077				Visual	N	
						Eureka/Gull Is. Totals RM 49+00 to 53+00	**60,299**	**0**	**0**	**0**			
April - 2016	-43	-44	YAQUINA	HOPPER	Gull Island	W-53.7-IW	25,020				Visual	N	
June - 2016	-43	-43	BAYPORT	HOPPER	Gull Island	O-52.1	7,735				Visual	N	
July - 2016	-43	-46/-47	ESSAYONS	HOPPER	Gull Island	W-53.1-IW	75,288				Visual	N	
October - 2016	-43	-46/-47	ESSAYONS	HOPPER	Gull Island	W-53.7-IW	34,262				Visual	N	
						Gull Is. Totals RM 53+00 to 55+30	**142,305**	**0**	**0**	**0**			
April - 2016	-43	-44	YAQUINA	HOPPER	Stella-Fisher	O-57.3-SW	20,995				Visual	N	
July - 2016	-43	-46	ESSAYONS	HOPPER	Stella-Fisher	W-53.7-IW, O-52.5-IW & W-53.1-IW	102,226				Visual	N	
November - 2016	-43	-46/-47	ESSAYONS	HOPPER	Stella-Fisher	O-56.9-FL	75,309				Visual	N	
November/December - 2016	-43	-46/-48	OREGON	PIPELINE	Stella-Fisher	Crims Island O-57.0-UP			239,010		Instrument	N	
						Stella-Fisher Bar Totals RM 55+30 to 57+40	**198,530**	**0**	**239,010**	**0**			
July - 2016	-43	-46	ESSAYONS	HOPPER	Stella / Walker	O-59.4-IW & W-53.7-IW	78,380				Visual	N	
September/October - 2016	-43	-46/-47	BAYPORT	HOPPER	Stella / Walker	O-58.4-IW, O-55.8-IW & O-52.0-IW	144,920				Visual	N	
						Stella / Walker Totals RM 57+40 to 59+30	**223,300**	**0**	**0**	**0**			
April - 2016	-43	-44	YAQUINA	HOPPER	Walker Is. Reach	O-59.8-IW	10,766				Visual	N	
June - 2016	-43	-45/-46	BAYPORT	HOPPER	Walker Is. Reach	O-57.9-IW, O-55.8-IW & O-52.1-IW	114,175				Visual	N	
October - 2016	-43	-46/-47	ESSAYONS	HOPPER	Walker Is. Reach	O-59.3-IW	34,846				Visual	N	
						Walker Is. Reach Totals RM 59+30 to 62+00	**159,787**	**0**	**0**	**0**			
June/July - 2016	-43	-45/-46	BAYPORT	HOPPER	Slaughters Bar	O-57.9-IW	83,422				Visual	N	
November - 2016	-43	-45/-46	ESSAYONS	HOPPER	Slaughters Bar	O-61.1-IW	16,924				Visual	N	
						Slaughters Bar Totals RM 62+00 to 65+20	**100,346**	**0**	**0**	**0**			
February - 2016	-40	-41/-43	HEIDI RENEE	CLAMSHELL	Longview Turning Basin	O-57.5-IW	5,091				Visual	N	
April - 2016	-43	-44	YAQUINA	HOPPER	Slaughters/Lwr Dobelbower	O-70.4-SW	41,963				Visual	N	
April - 2016	-43	-44	YAQUINA	HOPPER	Slaughters/Lwr Dobelbower	O-71.8-IW	19,297				Visual	N	
June - 2016	-43	-45/-46	BAYPORT	HOPPER	Slaughters/Lwr Dobelbower	O-62.7-IW, O-62.1-IW, O-61.6-WI & W-61.1-IW	136,894				Visual	N	
July/August - 2016	-43	-46/-48	OREGON	PIPELINE	Slaughters/Lwr Dobelbower	Howard Island - 1A W-68.7-UP			104,622		Instrument	N	
September - 2016	-43	-46/-47	BAYPORT	HOPPER	Slaughters/Lwr Dobelbower	O-62.2-IW & W-60.8-IW	148,092				Visual	N	
						Slaughters / Lwr Dobelbower Totals RM 65+20 to 68+10	**351,337**	**0**	**104,622**	**0**			
November - 2016	-43	-45	YAQUINA	HOPPER	Lower Dobelbower	W-69.4-IW	8,938				Visual	N	
						Lower Dobelbower Bar Totals RM 68+10 to 69+50	**8,938**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- CALENDAR YEAR 2016

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
July - 2016	-43	-44/-45	YAQUINA	HOPPER	Upper Dobelbower	O-71.8-IW	42,123				Visual	N	
November - 2016	-43	-45/-46	YAQUINA	HOPPER	Upper Dobelbower	O-71.8-SW	29,508				Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+10	**71,631**	**0**	**0**	**0**			
July - 2016	-43	-44/-45	YAQUINA	HOPPER	Kalama Ranges	O-75.2-SW	20,097				Visual	N	
October - 2016	-43	-45/-46	YAQUINA	HOPPER	Kalama Ranges	O-75.3-SW	32,195				Visual	N	
October - 2016	-43	-44	YAQUINA	HOPPER	Kalama Ranges (Turning Basin)	O-73.2-FL	28,652				Visual	N	
						Kalama Ranges Totals RM 72+10 to 75+30	**80,944**	**0**	**0**	**0**			
July/August - 2016	-43	-45/-46	YAQUINA	HOPPER	Kalama / Lower Martin	O-78.5-SW & O-79.2-SW	32,777				Visual	N	
October/November - 2016	-43	-45/-46	YAQUINA	HOPPER	Kalama / Lower Martin	O-78.5-SW & O-79.2-SW	48,966				Visual	N	
						Kalama/Lower Martin Totals RM 75+30 to 78+20	**81,743**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Lower / Upper Martin Is. Bar	O-80.1-SW	52,645				Visual	N	
October - 2016	-43	-45/-46	YAQUINA	HOPPER	Lower / Upper Martin Is. Bar	O-80.1-SW	32,185				Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 78+20 to 81+13	**84,830**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Upper Martin Bar	O-81.0-SW & W-83.6-SW	60,411				Visual	N	
October - 2016	-43	-45/-46	YAQUINA	HOPPER	Upper Martin Bar	O-80.6-SW & W-83.6-SW	27,940				Visual	N	
						Upper Martin Is. Bar Totals RM 81+13 to 83+45	**88,351**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	St. Helens Bar	O-84.9-SW	15,537				Visual	N	
October - 2016	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.6-SW	13,518				Visual	N	
November - 2016	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.6-SW	4,057				Visual	N	
						St. Helens Bar Totals RM 83+45 to 87+15	**33,112**	**0**	**0**	**0**			
August - 2016	-43	-44	YAQUINA	HOPPER	Warrior Rock	W-90.0-SW	11,812				Visual	N	
October - 2016	-43	-45	YAQUINA	HOPPER	Warrior Rock	W-89.9-SW & W-89.0-SW	35,166				Visual	N	
November - 2016	-43	-45	YAQUINA	HOPPER	Warrior Rock	W-89.9-SW	4,207				Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**51,185**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Henrici Bar	O-91.3-SW & O-94.4-SW	39,936				Visual	N	
October - 2016	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-94.5-SW & O-91.3-SW	12,757				Visual	N	
November - 2016	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-91.3-SW	8,284				Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**60,977**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Willow Bar	O-95.0-SW	28,967				Visual	N	
October - 2016	-43	-45/-46	YAQUINA	HOPPER	Willow Bar	O-95.1-SW	17,102				Visual	N	
						Willow Bar Totals RM 93+50 to 96+00	**46,069**	**0**	**0**	**0**			
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	46,909				Visual	N	
October - 2016	-43	-45/-46	YAQUINA	HOPPER	Willow / Morgan	W-97.5-SW	33,888				Visual	N	
						Willow / Morgan Totals RM 96+00 to 98+00	**80,797**	**0**	**0**	**0**			
						Morgan Bar Totals RM 98+00 to 101+18	**0**	**0**	**0**	**0**			
April - 2016	-43	-47	YAQUINA	HOPPER	Lower Vancouver/Van TB	O/W-101.6-FL	10,686				Visual	N	
May - 2016	-43	-46	ESSAYONS	HOPPER	Lower Vancouver/Van TB	W-101.6-FL	15,180				Visual	N	
August - 2016	-43	-44/-45	YAQUINA	HOPPER	Lower Vancouver/Van TB	W-101.4-SW	16,640				Visual	N	
November - 2016	-43	-45/-46	YAQUINA	HOPPER	Lower Vancouver/Van TB	W-101.4-SW	28,220				Visual	N	
						Lower Vancouver Bar/Turning Basin Totals RM 101+18 to 105+00	**70,726**	**0**	**0**	**0**			
						Vancouver Turning Basin Totals RM 105+00 to 106+23	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**4,444,204**	**0**	**466,685**	**654,057**			
						Total Dredged C&LW	**5,564,946**						

COLUMBIA RIVER FNC O&M --- WQC REPORTING --- CALENDAR YEAR 2016

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
Vancouver to the Dalles													
August - 2016	-17	-18	YAQUINA	HOPPER	**Upper Vancouver Bar**	O-109.8-SW	2,062				Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**2,062**	**0**	**0**	**0**			
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**			
August - 2016	-17	-18	YAQUINA	HOPPER	**Airport Bar**	W-112.3-IW & W-115.3-IW	30,028				Visual	N	
						Airport / Government Totals RM 113+00 to 114+30	**30,028**	**0**	**0**	**0**			
						Government Island Totals RM 114+30 to 117+40	**0**	**0**	**0**	**0**			
August - 2016	-17	-18	YAQUINA	HOPPER	**Lady Island**	O-117.3-IW	17,737				Visual	N	
						Lady Island Ranges RM 117+40 to 122+28	**17,737**	**0**	**0**	**0**			
August - 2016	-17	-18	YAQUINA	HOPPER	**Washougal Ranges**	O/W-123.6-FL	40,109				Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**40,109**	**0**	**0**	**0**			
August - 2016	-17	-18	YAQUINA	HOPPER	**Fashion Reef**	W-133.0-FL & W-133.6-SW	5,453				Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**5,453**	**0**	**0**	**0**			
						Multnomah Falls Totals RM 136+30 to 140+20	**0**	**0**	**0**	**0**			
						VTD Totals	**95,389**	**0**	**0**	**0**			
						Total CY Dredged VTD	**95,389**						
Side Channels													
August/September - 2016	-14	-17	HEIDI RENEE	Clamshell	**Baker Bay**	O-3.2-IW & W-4.8-IW	83,809				Visual/Instrument	N	
						Total CY Baker Bay	**83,809**	**0**	**0**	**0**			
September - November - 2016	-16	-17	HEIDI RENEE	Clamshell	**Skipanon Entrance**	O-9.5-IW & W-10.5-IW	308,332				Visual/Instrument	N	
						Total CY Skipanon Entrance	**308,332**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**392,141**						

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2017

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER													
August/September - 2017	**-48**	**-53**	ESSAYONS	HOPPER	**Quads 2 & 4**	SJS, DWS & O-19.0-IW	1,259	782,630			Visual	N	Partial load of material placed in-river because dredge needed repairs and could not sail safely to ocean sites.
July/August - 2017	**-48/-55**	**-53/-60**	TERRAPIN IS.	HOPPER	**Quads 1,2,3,4**	SWS, NJS, DWS		1,112,941			Visual	N	
September - 2017	**-55**	**-60**	TERRAPIN IS.	HOPPER	**Quads 1 & 3**	SWS, NJS, DWS		715,409			Visual	N	
						MCR Totals RM -02-00 to 02+00	**1,259**	**2,610,980**	**0**	**0**			
						Total Dredged MCR	**2,612,239**						
COLUMBIA RIVER AND LOWER WILLAMETTE													
						Lower Desdemona Bar Totals RM 04+20 to 06+22	**0**	**0**	**0**	**0**			
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**			
July - 2017	**-43**	**-43**	ESSAYONS	HOPPER	**Flavel Bar**	W-10.4-IW	37,948				Visual	N	
July - October - 2017	**-43**	**-43**	TERRAPIN IS.	HOPPER	**Flavel Bar**	W-7.2-IW	200,000				Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**237,948**	**0**	**0**	**0**			
April - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Sands**	O-18.3-IW	25,882				Visual	N	
August - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Sands**	O-18.5-IW & O-19.0-IW	51,137				Visual	N	
November - 2107	**-43**	**-44**	ESSAYONS	HOPPER	**Upper Sands**	O-18.5-IW & O-19.0-IW	55,296				Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**132,315**	**0**	**0**	**0**			
August/September - 2017	**-43**	**-43**	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW & O-19.0-IW	45,448				Visual	N	
October - 2017	**-43**	**-44**	ESSAYONS	HOPPER	**Tongue Point**	O-19.0-IW	852				Visual	N	
October - 2017	**-43**	**-44**	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW, O-19.0-IW & W-21.7-IW	148,543				Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+15	**194,843**	**0**	**0**	**0**			
August - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Miller Sands**	O-23.1-IW & W-26.5-IW	31,092				Visual	N	
July/August - 2017	**-43**	**-46/-48**	DREDGE OR	PIPELINE	**Miller Sands**	Miller Sands O-23.5 beach nourish				607,674	Visual	N	
						Miller Sands Totals RM 21+15 to 24+15	**31,092**	**0**	**0**	**607,674**			
August - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Miller / Pillar**	W-24.2-IW & W-26.5-IW	32,749				Visual	N	
September - 2017	**-43**	**-44/-46**	ESSAYONS	HOPPER	**Miller / Pillar**	W-21.7-IW	5,350				Visual	N	
October - 2017	**-43**	**-44/-46**	ESSAYONS	HOPPER	**Miller / Pillar**	O-18.5-IW, O-19.0-IW, W-21.7-IW & W-24.1-IW	188,560				Visual	N	
April - 2017	**-43**	**-45**	YAQUINA	HOPPER	**Miller / Pillar**	O-25.9-SW	46,083				Visual	N	
June - 2017	**-43**	**-44/-45**	TERRAPIN IS.	HOPPER	**Miller / Pillar**	W-21.4-IW & W-26.5-IW	56,929				Visual	N	
July - 2017	**-43**	**-44/-45**	TERRAPIN IS.	HOPPER	**Miller / Pillar**	W-21.4-IW & W-26.5-IW	10,527				Visual	N	
						Miller / Pillar Totals RM 24+15 to 27+00	**340,198**	**0**	**0**	**0**			
June/July - 2017	**-43**	**-46/-48**	DREDGE OR	Pipeline	**Pillar Rock**	Pillar Rock Is. O-27.2 beach nourish				414,497	Visual	N	
						Pillar Rock RM 27+00 to 29+10	**0**	**0**	**0**	**414,497**			
November/December - 2017	**-43**	**-46/-48**	DREDGE OR	PIPELINE	**Brookfield Welch**	W-29.2-IW	416,199				Visual	N	
						Brookfield Welch Totals RM 29+10 to 30+35	**416,199**	**0**	**0**	**0**			
						Brookfield / Skamokawa Totals RM 30+35 to 32+30	**0**	**0**	**0**	**0**			
August - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Skamokawa Bar**	W-29.9-IW & W-31.4-IW	129,919				Visual	N	
September/October - 2017	**-43**	**-46/-48**	DREDGE OR	PIPELINE	**Skamokawa Bar**	Skamokawa-Vista Park W-33.4 upland/beach nourish			404,397		Visual	N	
October - 2017	**-43**	**-46/-48**	DREDGE OR	PIPELINE	**Skamokawa Bar**	Welch Island O-34.0 upland			204,548		Visual	N	
						Skamokawa Bar Totals RM 32+30 to 37+00	**129,919**	**0**	**608,945**	**0**			
August - 2017	**-43**	**-45**	ESSAYONS	HOPPER	**Puget Island**	W-32.0-IW	40,238				Visual	N	
November - 2017	**-43**	**-46**	ESSAYONS	HOPPER	**Puget Island**	O-35.3-IW, W-35.8-IW & O-40.4-IW	89,831				Visual	N	
April - 2017	**-43**	**-45**	YAQUINA	HOPPER	**Puget Island**	O-37.4-SW	17,983				Visual	N	
June - 2017	**-43**	**-44/-45**	TERRAPIN IS.	HOPPER	**Puget Island**	O-34.1-IW	138,288				Visual	N	
June - 2017	**-43**	**-44/-45**	TERRAPIN IS.	HOPPER	**Puget Island**	O-34.1-IW	11,482				Visual	N	
						Puget Island Totals RM 37+00 to 40+00	**297,822**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2017

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
July - 2017	-43	-44/-45	ESSAYONS	HOPPER	Wauna/Driscoll	Puget Is. Sump	17,510				Visual	N	
July/August - 2017	-43	-45	ESSAYONS	HOPPER	Wauna/Driscoll	O-34.1-IW, W-34.7-IW, W-35.8-IW & O-36.4-IW	84,243				Visual	N	
						Wauna/Driscoll Totals RM 40+00 to 43+20	**101,753**	**0**	**0**	**0**			
August/September - 2017	-41	-43	DREDGE OR	PIPELINE	Puget Is. Sump	James River O-42.9 upland			286,812		Visual	N	
						Puget Is. Sump (in-water rehandle site) Totals	**0**	**0**	**286,812**	**0**			
October - 2017	-43	-47	ESSAYONS	HOPPER	Westport Bar	W-29.9-IW, O-34.8-RH, W-35.3-IW, W-35.8-IW & Puget Is. Sump	436,876				Visual	N	
April - 2017	-43	-44	YAQUINA	HOPPER	Westport Bar	W-46.3-SW	39,452				Visual	N	
						Westport Bar Totals RM 43+20 to 46+25	**476,328**	**0**	**0**	**0**			
April - 2017	-43	-44	ESSAYONS	HOPPER	Westport/Eureka	O-52.2-IW	69,939				Visual	N	
July - 2017	-43	-45	ESSAYONS	HOPPER	Westport/Eureka	W-31.4-IW, O-34.1-IW, O-36.4-IW, & Puget Is. Sump	155,773				Visual	N	
June - 2017	-43	-44	TERRAPIN IS.	HOPPER	Westport/Eureka	O-34.1-IW, W-35.3-IW, W-35.8-IW & O-40.3-IW	199,187				Visual	N	
July - 2017	-43	-44	TERRAPIN IS.	HOPPER	Westport/Eureka	W-35.3-IW & O-40.3-IW	7,485				Visual	N	
						Westport/Eureka Totals RM 46+25 to 49+00	**432,384**	**0**	**0**	**0**			
July - 2017	-43	-46	ESSAYONS	HOPPER	Eureka Bar	O-49.5-IW & O-51.2-IW	44,278				Visual	N	
August - 2017	-43	-44/-45	YAQUINA	HOPPER	Eureka Bar	O-52.2-SW	16,068				Visual	N	
November - 2017	-43	-45	YAQUINA	HOPPER	Eureka Bar	O-52.2-SW	19,860				Visual	N	
						Eureka Bar Totals RM 49+00 to 53+00	**80,206**	**0**	**0**	**0**			
July - 2017	-43	-45	ESSAYONS	HOPPER	Gull Island	W-53.6-IW	39,202				Visual	N	
						Gull Is. Totals RM 53+00 to 55+30	**39,202**	**0**	**0**	**0**			
July - 2017	-43	-45	ESSAYONS	HOPPER	Stella-Fisher	W-53.6-IW, W-56.6-IW & W-58.2-IW	50,076				Visual	N	
October - 2017	-43	-46/-47	YAQUINA	HOPPER	Stella-Fisher	O-58.6-IW & O-58.8-IW	111,520				Visual	N	
October - 2017	-43	-46/-47	YAQUINA	HOPPER	Stella-Fisher	O-58.4-IW, O-61.4-IW & O-61.9-SW	52,207				Visual	N	
November - 2017	-43	-46/-47	YAQUINA	HOPPER	Stella-Fisher	O-61.4-IW & O-61.9-SW	43,731				Visual	N	
						Stella-Fisher Bar Totals RM 55+30 to 57+40	**257,534**	**0**	**0**	**0**			
June/July - 2017	-43	-44/-45	TERRAPIN IS.	HOPPER	Stella / Walker	O-52.6-IW & W-53.0-IW	90,235				Visual	N	
						Stella / Walker Totals RM 57+40 to 59+30	**90,235**	**0**	**0**	**0**			
April - 2017	-43	-45	ESSAYONS	HOPPER	Walker Is. Reach	O-58.9-IW & O-59.5-IW	53,991				Visual	N	
May - 2017	-43	-43	ESSAYONS	HOPPER	Walker Is. Reach	O-58.4-IW	3,740				Visual	N	
September - 2017	-43	-45	ESSAYONS	HOPPER	Walker Is. Reach	W-24.1-IW & O-59.2-IW	26,823				Visual	N	
September - 2017	-43	-44/-45	YAQUINA	HOPPER	Walker Is. Reach	O-62.8-SW	24,625				Visual	N	
November- 2017	-43	-45/-46	YAQUINA	HOPPER	Walker Is. Reach	O-61.7-SW, O-62.1-SW, O-62.3-SW & O-62.5-SW	73,961				Visual	N	
July - 2017	-43	-44/-45	TERRAPIN IS.	HOPPER	Walker Is. Reach	O-58.3-IW	73,481				Visual	N	
						Walker Is. Reach Totals RM 59+30 to 62+00	**256,621**	**0**	**0**	**0**			
August - 2017	-43	-44/-45	ESSAYONS	HOPPER	Slaughters Bar	W-53.0-IW, O-62.4-IW & O-63.1-IW	48,505				Visual	N	
November - 2017	-43	-45/-46	ESSAYONS	HOPPER	Slaughters Bar	W-53.0-IW, W-53.4-IW, W-58.1-IW, O-59.1-IW, O-59.7-IW & O-63.1-IW	115,090				Visual	N	
July - 2017	-43	-44	YAQUINA	HOPPER	Slaughters Bar	O-62.8-SW	34,036				Visual	N	
October - 2017	-43	-44/-45	YAQUINA	HOPPER	Slaughters Bar	O-62.8-SW	29,350				Visual	N	
October/November - 2017	-43	-44/-45	YAQUINA	HOPPER	Slaughters Bar	O-62.8-SW	19,563				Visual	N	
July - 2017	-43	-44	TERRAPIN IS.	HOPPER	Slaughters Bar	O-59.3-IW & O-62.2-IW	84,628				Visual	N	
						Slaughters Bar Totals RM 62+00 to 65+20	**331,172**	**0**	**0**	**0**			
March/April - 2017	-43	-45	YAQUINA	HOPPER	Slaughters/Lwr Dobelbower	O-70.4-SW	33,703				Visual	N	
September - 2017	-43	-44/-45	YAQUINA	HOPPER	Slaughters/Lwr Dobelbower	O-62.8-SW	4,995				Visual	N	
December - 2017	-40	-44/-45	HEIDI RENEE	Clamshell	Longview Turning Basin	O-55.9-IW	7,838				Visual	N	
						Slaughters / Lwr Dobelbower Totals RM 65+20 to 68+10	**46,536**	**0**	**0**	**0**			
April - 2017	-43	-45	ESSAYONS	HOPPER	Lower Dobelbower	O-61.4-IW & W-61.3-IW	60,444				Visual	N	
May - 2017	-43	-45	ESSAYONS	HOPPER	Lower Dobelbower	O-58.4-IW, O-58.9-IW, O-59.5-IW & O-61.4-IW	76,258				Visual	N	
November - 2017	-43	-45/-47	ESSAYONS	HOPPER	Lower Dobelbower	O-59.7-IW & O-63.1-IW	46,894				Visual	N	
July - 2017	-43	-44/-45	TERRAPIN IS.	HOPPER	Lower Dobelbower	O-62.8-IW	50,394				Visual	N	
						Lower Dobelbower Bar Totals RM 68+10 to 69+50	**233,990**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2017

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
April - 2017	-43	-44/-45	ESSAYONS	HOPPER	Upper Dobelbower	O-73.2-IW	10,678				Visual	N	
July - 2017	-43	-44	ESSAYONS	HOPPER	Upper Dobelbower	O-71.9-IW	64,364				Visual	N	
July/August - 2017	-43	-45	YAQUINA	HOPPER	Upper Dobelbower	O-71.9-IW & O-73.3-IW	38,201				Visual	N	
September - 2017	-43	-44/-45	YAQUINA	HOPPER	Upper Dobelbower	O-71.9-IW	31,477				Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+10	**144,720**	**0**	**0**	**0**			
July - 2017	-43	-43	YAQUINA	HOPPER	Kalama Ranges (Turning Basin)	O-73.3-IW	53,793				Visual	N	
August - 2017	-43	-44	YAQUINA	HOPPER	Kalama Ranges	O-75.3-SW & O-76.5-SW	10,336				Visual	N	
						Kalama Ranges Totals RM 72+10 to 75+30	**64,129**	**0**	**0**	**0**			
July - 2017	-43	-44	TERRAPIN IS.	HOPPER	Kalama / Lower Martin	O-77.9-IW, O-78.8-IW & O-80.4-IW	82,144				Visual	N	
July - 2017	-43	-44	ESSAYONS	HOPPER	Kalama / Lower Martin	O-78.4-IW	11,495				Visual	N	
August - 2017	-43	-44	YAQUINA	HOPPER	Kalama / Lower Martin	O-76.5-SW & O-78.6-SW	18,309				Visual	N	
September - 2017	-43	-44/-45	YAQUINA	HOPPER	Kalama / Lower Martin	O-76.5-SW, O-78.4-SW & O-78.7-SW	31,450				Visual	N	
						Kalama/Lower Martin Totals RM 75+30 to 78+20	**143,398**	**0**	**0**	**0**			
July - 2017	-43	-44	TERRAPIN IS.	HOPPER	Lower Martin/Upper Martin Is. Bar	O-80.4-IW	82,164				Visual	N	
						Lower Martin/Upper Martin Is. Bar Totals RM 78+20 to 81+13	**82,164**	**0**	**0**	**0**			
July - 2017	-43	-44	ESSAYONS	HOPPER	Upper Martin Bar	W-82.0-IW, O-82.2-IW, W-82.6-IW & W-83.1-IW	50,461				Visual	N	
August - 2017	-43	-44	YAQUINA	HOPPER	Upper Martin Bar	O-80.9-SW, O-81.7-SW, W-82.2-IW & O-82.9-IW	50,037				Visual	N	
September - 2017	-43	-44/-45	YAQUINA	HOPPER	Upper Martin Bar	O-80.4-SW & O-82.9-IW	27,131				Visual	N	
						Upper Martin Is. Bar Totals RM 81+13 to 83+45	**127,629**	**0**	**0**	**0**			
August - 2017	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-84.6-SW	37,794				Visual	N	
September - 2017	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-8436-SW	17,582				Visual	N	
						St. Helens Bar Totals RM 83+45 to 87+15	**55,376**	**0**	**0**	**0**			
August - 2017	-43	-44	YAQUINA	HOPPER	Warrior Rock	W-90.0-SW	15,171				Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**15,171**	**0**	**0**	**0**			
July - 2017	-43	-44	ESSAYONS	HOPPER	Henrici Bar	O-93.8-IW	16,399				Visual	N	
July - 2017	-43	-44	YAQUINA	HOPPER	Henrici Bar	O-94.6-SW	18,733				Visual	N	
September - 2017	-43	-44	YAQUINA	HOPPER	Henrici Bar	O-91.3-SW & O-94.6-SW	13,460				Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**48,592**	**0**	**0**	**0**			
July - 2017	-43	-44	ESSAYONS	HOPPER	Willow Bar	O-93.8-IW & W-96.0-IW	51,679				Visual	N	
July - 2017	-43	-44	YAQUINA	HOPPER	Willow Bar	O94.6-SW & O-95.7-SW	39,846				Visual	N	
September - 2017	-43	-44	YAQUINA	HOPPER	Willow Bar	O-94.6-SW	4,899				Visual	N	
						Willow Bar Totals RM 93+50 to 98+00	**96,424**	**0**	**0**	**0**			
August - 2017	-43	-44	YAQUINA	HOPPER	Morgan Bar	W-97.2-IW & W-97.7-IW	16,545				Visual	N	
						Morgan Bar Totals RM 98+00 to 101+18	**16,545**	**0**	**0**	**0**			
September - 2017	-43	-44	ESSAYONS	HOPPER	Lower Vancouver Bar	O/W-101.6-FL	40,040				Visual	N	
October - 2017	-43	-44	ESSAYONS	HOPPER	Lower Vancouver Bar	O/W-101.6-FL	5,170				Visual	N	
March - 2017	-43	-48	YAQUINA	HOPPER	Lower Vancouver Bar	O/W-101.6-FL	11,304				Visual	N	
August - 2017	-43	-43	YAQUINA	HOPPER	Lower Vancouver Bar	W-101.4-SW	41,260				Visual	N	
September - 2017	-43	-43	YAQUINA	HOPPER	Lower Vancouver Bar	W-101.4-SW	3,513				Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 105+00	**101,287**	**0**	**0**	**0**			
September - 2017	-43	-43	YAQUINA	HOPPER	Vancouver Turning Basin	W-101.4-SW	6,030						
						Vancouver Turning Basin Totals RM 105+00 to 106+23	**6,030**	**0**	**0**	**0**			
						C&LW TOTALS	**5,027,762**	**0**	**895,757**	**1,022,171**			
						Total Dredged C&LW	**6,945,690**						

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2017

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Vancouver to the Dalles													
August - 2017	-17	-17	YAQUINA	HOPPER	**Upper Vancouver Bar**	O-109.8-SW	6,246				Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**6,246**	**0**	**0**	**0**			
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**			
August - 2017	-17	-18	YAQUINA	HOPPER	**Airport Bar/Government Island**	W-112.3-IW	22,734				Visual	N	
						Airport / Government Totals RM 113+00 to 114+30	**22,734**	**0**	**0**	**0**			
						Government Island Totals RM 114+30 to 117+40	**0**	**0**	**0**	**0**			
August - 2017	-17	-17	YAQUINA	HOPPER	**Lady Island**	O-117.3-IW	13,262				Visual	N	
						Lady Island Ranges RM 117+40 to 122+28	**13,262**	**0**	**0**	**0**			
August - 2017	-17	-17	YAQUINA	HOPPER	**Washougal Ranges**	O/W-123.6-FL	56,215				Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**56,215**	**0**	**0**	**0**			
August - 2017	-17	-17	YAQUINA	HOPPER	**Fashion Reef**	W-133.0-FL	7,950				Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**7,950**	**0**	**0**	**0**			
						Multnomah Falls Totals RM 136+30 to 140+20	**0**	**0**	**0**	**0**			
						VTD Totals	**106,407**	**0**	**0**	**0**			
						Total CY Dredged VTD	**106,407**						
Side Channels													
April - 2017	-14	-18	HEIDI RENEE	Clamshell	**Baker Bay**	O-3.2-IW & W-4.8-IW	16,509				Visual/Instrument	N	
August - October - 2017	-16	-18	HEIDI RENEE	Clamshell	**Baker Bay**	O-3.2-IW & W-4.8-IW	187,694				Visual/Instrument	N	
						Total CY Baker Bay	**204,203**	**0**	**0**	**0**			
October/November - 2017	-9	-11	HEIDI RENEE	Clamshell	**Chinook Channel**	W-4.8-IW & Area D	133,234				Visual/Instrument	N	
						Total CY Chinook	**133,234**	**0**	**0**	**0**			
November - 2017	-9	-10/-11	HEIDI RENEE	Clamshell	**Westport Slough Ferry Crossing**	O-51.7-IW	12,095				Visual/Instrument	N	
						Total CY Westport Slough Ferry Crossing	**12,095**	**0**	**0**	**0**			
December - 2017	-9	-10/-11	HEIDI RENEE	Clamshell	**Wahkiakum Ferry Crossing**	O-51.7-IW	22,081				Visual/Instrument	N	
						Total CY Wahkiakum Ferry Crossing	**22,081**	**0**	**0**	**0**			
						Side Channels Totals	**371,613**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**371,613**						

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2018

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER														
August/September - 2018	-48	-53	ESSAYONS	HOPPER	**Quads 2 & 4**	SJS, NHS & DWS		821,879			452,424	Visual	N	
August to October - 2018	-55	-60	STUYVESANT	HOPPER	**Quads 1 & 3**	SWS, NJS, East Sand Island (Upland) & DWS		198,674	81,709		1,323,503	Visual	N	
						MCR Totals RM -02-00 to 02+00	**0**	**1,020,553**	**81,709**	**0**	**1,775,927**			
						Total Dredged MCR	**2,878,189**							
COLUMBIA RIVER AND LOWER WILLAMETTE														
					Lower Desdemona									
						Lower Desdemona Bar Totals RM 03+00 to 06+22	**0**	**0**	**0**	**0**	**0**			
					Upper Desdemona									
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**	**0**			
September - 2018	-45	-46	STUYVESANT	HOPPER	**Flavel Bar**	W-7.3-IW	200,352					Visual	N	
October - 2018	-43	-44	HEIDI RENEE	CLAMSHELL	**Astoria Turning Basin**	W-10.4-IW	21,220					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**221,572**	**0**	**0**	**0**	**0**			
					Upper Sands									
						Upper Sands Totals RM 13+30 to 17+28	**0**	**0**	**0**	**0**	**0**			
July - 2018	-43	-43	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW & W-20.7-IW	42,711					Visual	N	
August - 2018	-43	-44	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW, W-20.7-IW & W-21.5-IW	16,177					Visual	N	
September - 2018	-43	-44	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW, W-20.7-IW & W-21.5-IW	66,543					Visual	N	
November - 2018	-44	-44	ESSAYONS	HOPPER	**Tongue Point**	O-18.5-IW, W-20.8-IW & W-26.6-IW	118,623					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**244,054**	**0**	**0**	**0**	**0**			
June - 2018	-44	-44	ESSAYONS	HOPPER	**Miller Sands**	O-23.8-RH	16,086					Visual	N	
July to August - 2018	-46	-48	DREDGE OR	PIPELINE	**Miller Sands**	Miller Sands Is. O-23.5-BN, Rice Is. W-21.0-BN & W-21.0-UP			695,466	401,038		Visual	Y	One Visible plume observed, wing dikes added inside the site and weir boards added to increase ponding/settling time.
September - 2018	-44	-44	ESSAYONS	HOPPER	**Miller Sands**	O-18.5-IW & W-21.5-IW	11,400					Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**27,486**	**0**	**695,466**	**401,038**	**0**			
April - 2018	-45	-45	YAQUINA	HOPPER	**Miller / Pillar**	O-25.8-SW	37,527					Visual	N	
June - 2018	-43	-43	ESSAYONS	HOPPER	**Miller / Pillar**	O-23.8-RH	27,692					Visual	N	
July - 2018	-44	-45	ESSAYONS	HOPPER	**Miller / Pillar**	O-18.5-IW, W-21.5-IW & W-20.7-IW	60,154					Visual	N	
October - 2018	-45	-46	STUYVESANT	HOPPER	**Miller / Pillar**	W-24.0-IW, O-27.6-IW, O-18.9-IW, W-29.8A-IW & W-29.8B-IW	251,379					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**376,752**	**0**	**0**	**0**	**0**			
July - 2018	-44	-44	ESSAYONS	HOPPER	**Pillar Rock**	O-27.5-IW	5,681					Visual	N	
August to September - 2018	-46	-48	DREDGE OR	PIPELINE	**Pillar Rock**	Pillar Rock Is. O-27.2-BN				145,591		Visual	N	
September - 2018	-44	-45	ESSAYONS	HOPPER	**Pillar Rock**	W-26.9-IW	10,938					Visual	N	
October - 2018	-44	-44	YAQUINA	HOPPER	**Pillar Rock**	O-26.1-SW	6,140					Visual	N	
October/November - 2018	-46	-46	YAQUINA	HOPPER	**Pillar Rock**	O-28.5-SW	46,502					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+40	**69,261**	**0**	**0**	**145,591**	**0**			
September - 2018	-44	-45	ESSAYONS	HOPPER	**Brookfield Welch**	W-26.9-IW	5,800					Visual	N	
						Brookfield Welch Totals RM 28+40 to 32+30	**5,800**	**0**	**0**	**0**	**0**			
July - 2018	-44	-44	ESSAYONS	HOPPER	**Skamokawa Bar**	W-32.0-IW	5,555					Visual	N	
July - 2018	-44	-45	STUYVESANT	HOPPER	**Skamokawa Bar**	W-30.1-IW	72,151					Visual	N	
October - 2018	-46	-48	DREDGE OR	PIPELINE	**Skamokawa Bar**	Welch Is. O-34.0-UP			240,540			Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**77,706**	**0**	**240,540**	**0**	**0**			
June - 2018	-46	-48	DREDGE OR	PIPELINE	**Puget Island**	Tenasillahe Is. O-38.3-UP			235,909			Visual	N	
July - 2018	-43	-44	ESSAYONS	HOPPER	**Puget Island**	O-40.1-IW	16,653					Visual	N	
August - 2018	-43	-44	YAQUINA	HOPPER	**Puget Island**	O-36.7-SW	13,133					Visual	N	
September/October 2018	-45	-46	STUYVESANT	HOPPER	**Puget Island**	W-29.8A-IW & W-29.8B-IW	189,684					Visual	N	
						Puget Island Totals RM 36+31 to 40+30	**219,470**	**0**	**235,909**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2018

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
April - 2018	-43	-43	YAQUINA	HOPPER	**Wauna / Driscoll**	W-39.9-IW	11,430					Visual	N	
July - 2018	-44	-45	STUYVESANT	HOPPER	**Wauna / Driscoll**	O-36.2-IW & W-35.4-IW	74,561					Visual	N	
September - 2018	-44	-45	ESSAYONS	HOPPER	**Wauna / Driscoll**	W-44.3-RH (Puget Is. Sump)	21,480					Visual	N	
November - 2018	-43	-44	YAQUINA	HOPPER	**Wauna / Driscoll**	O-40.5-IW	72,907					Visual	N	
						Wauna Driscoll Totals RM 40+30 to 44+25	**180,378**	**0**	**0**	**0**	**0**			
September/October - 2018	-41	-43	DREDGE OR	PIPELINE	**Puget Is. Sump**	James River O-42.9-UP			122,804			Visual	N	
						Puget Is. Sump (in-water rehandle site) Totals	**0**	**0**	**122,804**	**0**	**0**			
November - 2018	-43	-43	YAQUINA	HOPPER	**Wauna / Westport**	W-44.3-RH (Puget Is. Sump)	20,168					Visual	N	
						Wauna / Westport Totals RM 44+25 to 46+25	**20,168**	**0**	**0**	**0**	**0**			
April - 2018	-45	-45	ESSAYONS	HOPPER	**Westport / Eureka**	O-39.9-IW	20,037					Visual	N	
May - 2018	-44	-44	ESSAYONS	HOPPER	**Westport / Eureka**	O-39.9-IW	11,936					Visual	N	
June - 2018	-43	-43	ESSAYONS	HOPPER	**Westport / Eureka**	O-33.8-IW, O-34.3-IW	61,492					Visual	N	
July - 2018	-44/-45	-45/-46	STUYVESANT	HOPPER	**Westport / Eureka**	O-52.7-IW, O-39.0-IW, W-37.6-IW, W-37.5-IW, W-37.0-IW, W-36.6-IW, W-40.9-IW	312,066					Visual	N	
October/November - 2018	-47	-47	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.3-RH (Puget Is. Sump), O-34.1-IW, W-35.4-IW, W-32.0-IW	332,237					Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**737,768**	**0**	**0**	**0**	**0**			
April - 2018	-45	-45	YAQUINA	HOPPER	**Eureka Bar**	O-51.9-SW, O-52.4-SW	26,488					Visual	N	
July - 2018	-43	-43	ESSAYONS	HOPPER	**Eureka Bar**	O-48.0-IW, W-54.7-IW	20,984					Visual	N	
September - 2018	-45	-46	ESSAYONS	HOPPER	**Eureka Bar**	W-53.8-IW	30,366					Visual	N	
October - 2018	-46	-47	YAQUINA	HOPPER	**Eureka Bar**	O-52.0-SW	62,115					Visual	N	
						Eureka Bar Totals RM 49+00 to 53+00	**139,953**	**0**	**0**	**0**	**0**			
July - 2018	-43	-43	ESSAYONS	HOPPER	**Gull Island**	W-54.7-IW	5,605					Visual	N	
						Gull Is. Totals RM 53+00 to 55+30	**5,605**	**0**	**0**	**0**	**0**			
May - 2018	-43	-43	ESSAYONS	HOPPER	**Stella-Fisher**	W-52.9-IW, W-53.3-IW	36,400					Visual	N	
June - 2018	-43	-43	ESSAYONS	HOPPER	**Stella-Fisher**	W-54.7-IW	16,889					Visual	N	
June - 2018	-43	-43	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.0-IW	33,000					Visual	N	
August - 2018	-43	-44	STUYVESANT	HOPPER	**Stella-Fisher**	O-58.5-IW, O-53.8-IW, O-58.2-IW, O-52.7-IW	80,753					Visual	N	
August - 2018	-44	-44	YAQUINA	HOPPER	**Stella-Fisher**	O-57.9-IW	1,980					Visual	N	
September - 2018	-44	-44	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.8-IW	817					Visual	N	
November - 2018	-47	-47	DREDGE OR	PIPELINE	**Stella-Fisher**	Crims Is. O-57.0-UP			382,681			Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**169,839**	**0**	**382,681**	**0**	**0**			
July - 2018	-45	-46	STUYVESANT	HOPPER	**Stella / Walker**	O-58.8-IW, W-53.4-IW, W-53.4-IW, W-53.8-IW, W-57.9-IW, O-58.5-IW	153,860					Visual	N	
October - 2018	-46	-47	ESSAYONS	HOPPER	**Stella / Walker**	O-56.9-IW, W-54.7-IW, W-53.7-IW, W-52.9-IW, O-56.8-IW, W-56.5-IW	170,314					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**324,174**	**0**	**0**	**0**	**0**			
April - 2018	-43	-45	ESSAYONS	HOPPER	**Walker Is. Reach**	W-53.3-IW, W-52.9-IW	17,080					Visual	N	
June - 2018	-43	-43	ESSAYONS	HOPPER	**Walker Is. Reach**	W-54.7-IW	26,094					Visual	N	
July - 2018	-45	-45	ESSAYONS	HOPPER	**Walker Is. Reach**	O-59.7-IW, W-60.1-IW, W-61.5-IW, O-61.2-IW	23,135					Visual	N	
September/October - 2018	-46	-47	STUYVESANT	HOPPER	**Walker Is. Reach**	O-62.9-IW, O-62.1-IW, O-60.4-IW, O-58.8-IW, O-58.5-IW	161,346					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**227,655**	**0**	**0**	**0**	**0**			
June/July - 2018	-43	-43	ESSAYONS	HOPPER	**Slaughters Bar**	O-59.1-IW, W-61.5-IW	44,790					Visual	N	
August - 2018	-44	-45	STUYVESANT	HOPPER	**Slaughters Bar**	O-58.4-IW, O-58.8-IW, O-58.9-IW	73,131					Visual	N	
September - 2018	-44	-45	ESSAYONS	HOPPER	**Slaughters Bar**	O-62.7-IW	16,530					Visual	N	
November - 2018	-45	-45	ESSAYONS	HOPPER	**Slaughters Bar**	O-62.1, O-59.3-IW, O-59.0-IW	77,797					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**212,248**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2018

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
April - 2018	-46	-46	ESSAYONS	HOPPER	Slaughters / Lower Dobelbower	O-59.0-IW, O-59.7-IW, O-61.5-IW	90,609					Visual	N	
May - 2018	-43	-43	ESSAYONS	HOPPER	Slaughters / Lower Dobelbower	O-62.1-IW, O-62.5-IW	31,049					Visual	N	
June/July - 2018	-43	-43	ESSAYONS	HOPPER	Slaughters / Lower Dobelbower	O-62.3-IW, O-62.7-IW, O-59.1-IW, O-61.2-IW	60,957					Visual	N	
July/August - 2018	-45	-46	STUYVESANT	HOPPER	Slaughters / Lower Dobelbower	O-62.0-IW, O-61.2-IW, O-61.8-IW, O-61.5-IW, O-58.5-IW, O-58.8-IW, O-58.4-IW	133,606					Visual	N	
September - 2018	-44	-45	HEIDI RENEE	CLAMSHELL	Longview Turning Basin	O-55.9-IW	2,163					Visual	N	
September/October - 2018	-47	-48	STUYVESANT	HOPPER	Slaughters / Lower Dobelbower	O-61.7-IW, O-52.7-IW, O-61.4-IW, O-62.1-IW, W-60.4-IW, O-58.8-IW, O-53.8-IW, W-29.8B-IW	283,168					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**601,552**	**0**	**0**	**0**	**0**			
					Lower Dobelbower							Visual	N	
						Lower Dobelbower Bar Totals RM 67+40 to 69+50	**0**	**0**	**0**	**0**	**0**			
April - 2018	-45	-45	YAQUINA	HOPPER	Upper Dobelbower	O-71.8-IW	10,473					Visual	N	
July - 2018	-43	-43	ESSAYONS	HOPPER	Upper Dobelbower	O-73.1-FL	10,195					Visual	N	
August - 2018	-43	-44	YAQUINA	HOPPER	Upper Dobelbower	O-73.3-IW, O-71.9-IW	34,389					Visual	N	
November - 2018	-45	-46	YAQUINA	HOPPER	Upper Dobelbower	O-71.9-IW	13,600					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**68,657**	**0**	**0**	**0**	**0**			
October - 2018	-43	-43	YAQUINA	HOPPER	Kalama Turning Basin	O-73.1-IW	46,731					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**46,731**	**0**	**0**	**0**	**0**			
July - 2018	-43	-43	ESSAYONS	HOPPER	Kalama / Lower Martin	O-78.0-IW	30,615					Visual	N	
August - 2018	-43	-44	YAQUINA	HOPPER	Kalama / Lower Martin	O-76.5-SW, O-75.3-SW	41,379					Visual	N	
October - 2018	-45	-45	YAQUINA	HOPPER	Kalama / Lower Martin	O-78.6-SW	17,811					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 76+40	**89,805**	**0**	**0**	**0**	**0**			
July/August - 2018	-43	-44	YAQUINA	HOPPER	Lower Martin	O-79.1-SW, O-78.6-SW	77,387					Visual	N	
October - 2018	-45	-45	YAQUINA	HOPPER	Lower Martin	O-78.6-SW	2,160					Visual	N	
						Lower Martin Is. Bar Totals RM 76+40 to 80+16	**79,547**	**0**	**0**	**0**	**0**			
July - 2018	-43	-43	ESSAYONS	HOPPER	Upper Martin Bar	O-78.0-IW	27,122					Visual	N	
July - 2018	-43	-44	YAQUINA	HOPPER	Upper Martin Bar	O-82.9-SW, O-80.8-SW	72,575					Visual	N	
September - 2018	-44	-44	ESSAYONS	HOPPER	Upper Martin Bar	W-81.1-IW	5,750					Visual	N	
						Upper Martin Is. Bar Totals RM 80+16 to 83+44	**105,447**	**0**	**0**	**0**	**0**			
July - 2018	-43	-43	ESSAYONS	HOPPER	St. Helens Bar	O-78.0-IW	5,900					Visual	N	
July - 2018	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-86.6-SW, O-84.6-SW	47,000					Visual	N	
November - 2018	-46	-46	YAQUINA	HOPPER	St. Helens Bar	O-86.3-IW, O-86.8-IW	42,655					Visual	N	
January/February - 2019	-46	-48	DREDGE OR	PIPELINE	St. Helens Bar	Austin Point W-86.5-UP			**164,897**			Visual	N	
						St. Helens Bar Totals RM 83+44 to 87+15	**95,555**	**0**	**164,897**	**0**	**0**			
July - 2018	-43	-44	YAQUINA	HOPPER	Warrior Rock	W-89.1-SW, O-90.7-IW	19,464					Visual	N	
November - 2018	-44	-44	YAQUINA	HOPPER	Warrior Rock	O-86.8-IW, O-90.7-IW	23,752					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**43,216**	**0**	**0**	**0**	**0**			
July - 2018	-43	-44	YAQUINA	HOPPER	Henrici Bar	O-90.7-IW, O-91.2-SW, O-94.7-SW	24,124					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**24,124**	**0**	**0**	**0**	**0**			
July - 2018	-43	-44	YAQUINA	HOPPER	Willow Bar	W-97.1-IW, W-97.6-IW, O-94.9-SW, O-95.4-SW	67,107					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**67,107**	**0**	**0**	**0**	**0**			
					Morgan Bar									
						Morgan Bar Totals RM 97+40 to 101+18	**0**	**0**	**0**	**0**	**0**			
					Lower Vancouver Bar									
						Lower Vancouver Bar Totals RM 101+18 to 103+10	**0**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2018

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
April - 2018	-46	-46	YAQUINA	HOPPER	Lower Vancouver / Vancouver TB	W-101.7-IW	1,024					Visual	N	
April - 2018	-46	-46	ESSAYONS	HOPPER	Lower Vancouver / Vancouver TB	O/W-101.6-FL	32,339					Visual	N	
August - 2018	-43	-43	YAQUINA	HOPPER	Lower Vancouver / Vancouver TB	W-101.4-SW	47,895					Visual	N	
September - 2018	-43	-45	ESSAYONS	HOPPER	Lower Vancouver / Vancouver TB	O/W-101.6-FL	70,610					Visual	N	
November - 2018	-45	-45	YAQUINA	HOPPER	Lower Vancouver / Vancouver TB	O-104.7-FL	20,426					Visual	N	
December - 2018 / January - 2019	-43	-45	DREDGE OR	PIPELINE	Lower Vancouver / Vancouver TB	West Hayden Is. O-105.0-UP			324,258			Visual	N	
						Lower Vancouver / Vancouver Turning Basin Totals RM 103+10 to 105+20	**172,294**	**0**	**324,258**	**0**	**0**			
					Vancouver Turning Basin									
						Vancouver Turning Basin Totals RM 105+20 to 106+24	**0**	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**4,653,924**	**0**	**2,166,555**	**546,629**	**0**			
						Total Dredged C&LW	**7,367,108**							
						VANCOUVER TO THE DALLES								
August - 2018	-17	-17	YAQUINA	HOPPER	Upper Vancouver Bar	O-110.0-SW	9,197					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**9,197**	**0**	**0**	**0**	**0**			
						Airport Bar Totals RM 110+10 to 114+00	**0**	**0**	**0**	**0**	**0**			
August - 2018	-17	-18	YAQUINA	HOPPER	Airport Bar / Government Island	W-111.7-SW, W-112.5-SW	36,913					Visual	N	
						Airport / Government Totals RM 113+00 to 114+10	**36,913**	**0**	**0**	**0**	**0**			
						Government Island Reach Totals RM 114+00 to 117+39	**0**	**0**	**0**	**0**	**0**			
August - 2018	-17	-17	YAQUINA	HOPPER	Lady Island	O-117.3-SW	5,384					Visual	N	
						Lady Island Ranges RM 117+39 to 122+28	**5,384**	**0**	**0**	**0**	**0**			
August - 2018	-17	-18	YAQUINA	HOPPER	Washougal Ranges	O/W-123.6-FL	90,359					Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**90,359**	**0**	**0**	**0**	**0**			
August - 2018	-17	-17	YAQUINA	HOPPER	Fashion Reef	W-133.0-FL	11,292					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**11,292**	**0**	**0**	**0**	**0**			
August - 2018	-17	-17	YAQUINA	HOPPER	Multnomah Falls	O-136.1-FL	997					Visual	N	
						Multnomah Falls Totals RM 136+30 to 140+10	**997**	**0**	**0**	**0**	**0**			
						VTD Totals	**154,142**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**154,142**							
						PORTLAND / VANCOUVER ANCHORAGES								
November - 2018	-43	-45	YAQUINA	HOPPER	Anchorage A	O-104.7-FL	7,049					Visual	N	
November - 2018	-25	-27	YAQUINA	HOPPER	Anchorage B	O-104.7-FL	6,105					Visual	N	
						Portland/Vancouver Anchorages Totals	**13,154**	**0**	**0**	**0**	**0**			
						Total CY Dredged Portland/Vancouver Anchorages	**13,154**							
						SIDE CHANNELS								
September - 2018	-16	-18	HEIDI RENEE	CLAMSHELL	Baker Bay	O-3.2-IW & W-4.8-IW	53,348					Visual/Instrument	N	
						Baker Bay Totals	**53,348**	**0**	**0**	**0**	**0**			
August - 2018	-16	-17	YAQUINA	HOPPER	Skipanon Entrance	O-9.5-IW, W-11.6-IW	3,304					Instrument	N	
						Skipanon Entrance Totals	**3,304**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**90,828**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**90,828**							

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2019

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER															
August to October - 2019	-55	-60	BAYPORT	HOPPER	Quads 1,2,3,4	SWS, NJS, DWS	2,051,758		71,706			1,980,052	Visual	N	
September - 2019	-48	-53	ESSAYONS	HOPPER	Quads 2 & 4	SJS, NHS & DWS	741,193		355,913			385,280	Visual	N	
						MCR Totals RM -02-00 to 02+00	**2,792,951**	**0**	**427,619**	**0**	**0**	**2,365,332**			
						Total Dredged MCR	**2,792,951**								
COLUMBIA RIVER AND LOWER WILLAMETTE															
					Lower Desdemona										
						Lower Desdemona Bar Totals RM 03+00 to 06+22	**0**	**0**	**0**	**0**	**0**	**0**			
					Upper Desdemona										
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**	**0**	**0**			
August - 2019	-43	-45	HEIDI RENEE	CLAMSHELL	Astoria Turning Basin	W-10.4-IW	25,483	25,483					Visual	N	
September - 2019	-43	-45	ESSAYONS	HOPPER	Flavel Bar	O-5.3-IW, O-5.0-IW	130,994	130,994					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**156,477**	**156,477**	**0**	**0**	**0**	**0**			
September/October - 2019	-43	-45	BAYPORT	HOPPER	Upper Sands	W-7.0-IW	200,635	200,635					Visual	N	
October - 2019	-43	-43	ESSAYONS	HOPPER	Upper Sands	W-13.9-IW	16,735	16,735					Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**217,370**	**217,370**	**0**	**0**	**0**	**0**			
July/August - 2019	-45	-46	DREDGE OR	PIPELINE	Tongue Point	Rice Island W-21.0-UD, W-21.0R-UD	463,363			463,363			Visual	N	
Sept/Oct - 2019	-43	-45	ESSAYONS	HOPPER	Tongue Point	W-20.9-IW, O-18.3-IW	213,137	213,137					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**676,500**	**213,137**	**0**	**463,363**	**0**	**0**			
July - 2019	-43	-43	YAQUINA	HOPPER	Miller Sands	O-22.3-SW	7,171	7,171					Visual	N	
August/September - 2019	-46	-48	DREDGE OR	PIPELINE	Miller Sands	Rice Island W-21.0R-UD, Miller Sands O-23.5-BN	421,655			197,919	223,736		Visual	N	
October - 2019	-45	-47	ESSAYONS	HOPPER	Miller Sands	W-24.0-IW	56,506	56,506					Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**485,332**	**63,677**	**0**	**197,919**	**223,736**	**0**			
May - 2019	-43	-45	YAQUINA	HOPPER	Miller / Pillar	W-24.0-IW	28,901	28,901					Visual	N	
July - 2019	-43	-45	ESSAYONS	HOPPER	Miller / Pillar	W-24.0-IW	21,723	21,723					Visual	N	
August - 2019	-45	-47	BAYPORT	HOPPER	Miller / Pillar	O-18.3-IW, O-27.5-IW, W-26.6-IW	225,821	225,821					Visual	N	
October - 2019	-43	-47	ESSAYONS	HOPPER	Miller / Pillar	W-26.6-IW, W-24.0-IW	122,521	122,521					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**398,966**	**398,966**	**0**	**0**	**0**	**0**			
May - 2019	-43	-45	YAQUINA	HOPPER	Pillar Rock	O-28.4-SW	10,383	10,383					Visual	N	
June/July - 2019	-46	-48	DREDGE OR	PIPELINE	Pillar Rock	Pillar Rock O-27.2-BN	428,338				428,338		Visual	N	
October - 2019	-43	-46	ESSAYONS	HOPPER	Pillar Rock	O-27.7-IW	2,075	2,075					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+40	**440,796**	**12,458**	**0**	**0**	**428,338**	**0**			
July - 2019	-43	-43	YAQUINA	HOPPER	Brookfield Welch	O-33.8-SW	21,386	21,386					Visual	N	
October - 2019	-43	-44	ESSAYONS	HOPPER	Brookfield Welch	W-30.1-IW	14,520	14,520					Visual	N	
						Brookfield Welch Totals RM 28+40 to 32+30	**35,906**	**35,906**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2019

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
May - 2019	-43	-45	YAQUINA	HOPPER	**Skamokawa Bar**	O-33.9-SW	28,235	28,235					Visual	N	
June/July - 2019	-43	-43	ESSAYONS	HOPPER	**Skamokawa Bar**	W-32.1-IW	10,004	10,004					Visual	N	
July - 2019	-43	-44	YAQUINA	HOPPER	**Skamokawa Bar**	O-33.9-SW	11,213	11,213					Visual	N	
October - 2019	-45	-46	ESSAYONS	HOPPER	**Skamokawa Bar**	W-31.2-IW, W-31.4-IW, W-31.7-IW, W-30.4-IW, W-32.0-IW	80,788	80,788					Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**130,240**	**130,240**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	**Puget Island**	W-32.1-IW	9,544	9,544					Visual	N	
July - 2019	-45	-46	BAYPORT	HOPPER	**Puget Island**	O-34.1-IW, O-36.4-IW, W-29.6-IW, W-37.0-IW, W-37.4-IW	118,916	118,916					Visual	N	
November - 2019	-46	-47	BAYPORT	HOPPER	**Puget Island**	O-34.0-IW, O-34.2-IW, O-36.2-IW, O-36.8-IW, W-36.6-IW, W-37.0-IW, W-37.4-IW, W-37.5-IW	149,383	149,383					Visual	N	
						Puget Island Totals RM 36+31 to 40+40	**277,843**	**277,843**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	**Wauna Driscoll**	W-44.5-RH	14,932	14,932					Visual	N	
July - 2019	-45	-46	BAYPORT	HOPPER	**Wauna Driscoll**	O-34.1-IW, O-34.3-IW, W-29.6-IW, W-36.6-IW, W-37.0-IW	129,673	129,673					Visual	N	
Oct/Nov - 2019	-45	-46	ESSAYONS	HOPPER	**Wauna Driscoll**	O-40.1-IW, O-39.9-FL, W-35.4-IW, O-36.6-IW, W-40.4-IW	105,191	105,191					Visual	N	
						Wauna Driscoll Totals RM 40+40 to 44+27	**249,796**	**249,796**	**0**	**0**	**0**	**0**			
July - 2019	-43	-43	YAQUINA	HOPPER	**Westport**	W-45.1-SW	8,083	8,083					Visual	N	
November - 2019	-43	-47	ESSAYONS	HOPPER	**Westport**	O-39.9-FL	35,063	35,063					Visual	N	
						Westport Bar Totals RM 44+27 to 46+25	**43,146**	**43,146**	**0**	**0**	**0**	**0**			
August - 2019	-46	-47	BAYPORT	HOPPER	**Westport / Eureka**	O-34.2S-IW, O-36.8-IW, O-39.9-IW, W-35.8-IW, W-40.8-IW	127,774	127,774					Visual	N	
October - 2019	-46	-48	DREDGE OR	PIPELINE	**Westport / Eureka**	Brown Island W-46.3-UP	352,648			160,648			Visual	N	*192,000 CY of total dredged was placed at Cape Horn site W-47.5-BN (Wahkiakum Co. obtained permits and reports separately)
						Westport / Eureka Totals RM 46+25 to 49+00	**480,422**	**127,774**	**0**	**160,648**	**0**	**0**			
June - 2019	-43	-43	ESSAYONS	HOPPER	**Eureka Bar**	W-52.9-IW	4,731	4,731					Visual	N	
July - 2019	-44	-45	YAQUINA	HOPPER	**Eureka Bar**	O-51.8-SW	15,328	15,328					Visual	N	
September - 2019	-46	-47	ESSAYONS	HOPPER	**Eureka Bar**	W-53.0-IW	36,213	36,213					Visual	N	
November - 2019	-43	-47	ESSAYONS	HOPPER	**Eureka Bar**	W-32.0-IW	43,391	43,391					Visual	N	
						Eureka Bar Totals RM 49+00 to 51+45	**99,663**	**99,663**	**0**	**0**	**0**	**0**			
July - 2019	-43	-43	YAQUINA	HOPPER	**Gull Island**	W-53.9-IW	9,096	9,096					Visual	N	
November - 2019	-43	-45	ESSAYONS	HOPPER	**Gull Island**	O-49.7-IW	19,317	19,317					Visual	N	
						Gull Is. Totals RM 51+45 to 55+30	**28,413**	**28,413**	**0**	**0**	**0**	**0**			
June - 2019	-43	-45	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.9-IW	4,636	4,636					Visual	N	
July - 2019	-44	-45	YAQUINA	HOPPER	**Stella-Fisher**	O-58.1-IW, W-56.6-IW	12,507	12,507					Visual	N	
August - 2019	-45	-46	ESSAYONS	HOPPER	**Stella-Fisher**	W-54.6-IW, W-53.0-IW, W-53.8-IW	34,898	34,898					Visual	N	
November - 2019	-46	-48	BAYPORT	HOPPER	**Stella-Fisher**	O-52.8-IW, W-50.6-IW, W-53.0-IW, W-54.5-IW	170,921	170,921					Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**222,962**	**222,962**	**0**	**0**	**0**	**0**			
June - 2019	-46	-48	DREDGE OR	PIPELINE	**Stella / Walker**	Hump Island W-59.7-UD	366,000			366,000			Visual	N	
Oct/Nov - 2019	-47	-48	BAYPORT	HOPPER	**Stella / Walker**	O-52.8-IW, W-52.6-IW, W-53.0-IW, W-53.4-IW, W-53.9-IW, W-54.5-IW, W-54.9-IW	172,689	172,689					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**538,689**	**172,689**	**0**	**366,000**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	**Walker Is. Reach**	O-61.1-IW	9,148	9,148					Visual	N	
July/August - 2019	-43	-44	YAQUINA	HOPPER	**Walker Is. Reach**	O-62.5-SW	17,413	17,413					Visual	N	
November - 2019	-43	-47	ESSAYONS	HOPPER	**Walker Is. Reach**	O-49.7-IW, O-62.5-FL, W-62.5-FL, O-62.7-IW, W-62.0-IW	112,837	112,837					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**139,398**	**139,398**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2019

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
June - 2019	-43	-44	ESSAYONS	HOPPER	Slaughters Bar	O-61.5-IW, W-58.5-RH	27,019	27,019					Visual	N	
July/August - 2019	-45	-46	BAYPORT	HOPPER	Slaughters Bar	W-54.7-IW, W-53.3-IW, O-62.7-IW, W-60.4B-IW, O-59.8B-IW, W-56.1-IW	132,384	132,384					Visual	N	
Oct/Nov - 2019	-46	-47	BAYPORT	HOPPER	Slaughters Bar	O-59.0-IW, O-59.3-IW, O-59.4-IW, O-59.7-IW, O-60.9-IW, O-62.2-IW, O-63.3-IW, O-64.7B-IW, O-69.6-IW, W-53.4-IW, W-53.9-IW, W-54.5-IW, W-54.9-IW, W-60.0-IW, W-62.0-IW	406,833	406,833					Visual	N	
December - 2019	-47	-48	SEA HORSE	CLAMSHELL	Slaughters Bar	O-61.5-IW, O-61.2-IW, O-51.3-IW	18,972	18,972					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**585,208**	**585,208**	**0**	**0**	**0**	**0**			
June - 2019	-43	-45	ESSAYONS	HOPPER	Slaughters / Lower Dobelbower	O-61.5-IW, O-61.1-IW, W-58.5-RH	27,817	27,817					Visual	N	
July - 2019	-46	-47	BAYPORT	HOPPER	Slaughters / Lower Dobelbower	O-61.1-IW, W-60.0-IW, O-62.7-IW, W-60.4-IW, O-59.8-IW, W-57.9-IW, W-56.1-IW	116,476	116,476					Visual	N	
October - 2019	-47	-48	BAYPORT	HOPPER	Slaughters / Lower Dobelbower	O-59.3-IW, O-59.5-IW, O-59.8-IW, O-62.1-IW, O-63.1-IW, O-63.4-IW, O-64.7-IW, O-69.6-IW	197,150	197,150					Visual	N	
November - 2019	-44	-45	HEIDI RENEE	CLAMSHELL	Longview Turning Basin	O-55.4-IW	1,676	1,676					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**343,119**	**343,119**	**0**	**0**	**0**	**0**			
					Lower Dobelbower										
						Lower Dobelbower Bar Totals RM 67+40 to 69+50	**0**	**0**	**0**	**0**	**0**	**0**			
October/November - 2019	-40	-41	DREDGE OR	PIPELINE	Howard Is. In-Water Transfer Site	Howard Island W-68.7-UP	266,060			266,060			Visual	N	
						Howard Island In-Water Transfer Site Totals	**266,060**	**0**	**0**	**266,060**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Upper Dobelbower	O-73.1-FL	10,660	10,660					Visual	N	
July - 2019	-43	-43	YAQUINA	HOPPER	Upper Dobelbower	O-73.1-FL	23,547	23,547					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Upper Dobelbower	O-73.1-FL	8,323	8,323					Visual	N	
October - 2019	-43	-45	YAQUINA	HOPPER	Upper Dobelbower	W-72.9-FL	23,538	23,538					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**66,068**	**66,068**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Kalama Ranges	O-73.1-FL	2,973	2,973					Visual	N	
August - 2019	-43	-44	ESSAYONS	HOPPER	Kalama Ranges	O-73.1-FL	5,020	5,020					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Kalama Ranges	O-73.1-FL	2,049	2,049					Visual	N	
October - 2019	-44	-45	YAQUINA	HOPPER	Kalama Ranges	O-78.7-SW, O-72.9-FL	110,477	110,477					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**120,519**	**120,519**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Kalama / Lower Martin	O-78.6-IW	24,227	24,227					Visual	N	
August - 2019	-43	-44	ESSAYONS	HOPPER	Kalama / Lower Martin	O-78.2-IW	14,154	14,154					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 76+40	**38,381**	**38,381**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Lower Martin	O-80.5-IW	12,209	12,209					Visual	N	
August - 2019	-43	-44	ESSAYONS	HOPPER	Lower Martin	O-78.2-IW	1,549	1,549					Visual	N	
July - 2019	-43	-43	YAQUINA	HOPPER	Lower Martin	O-78.5-SW	9,176	9,176					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Lower Martin	O-80.8-SW	1,994	1,994					Visual	N	
October - 2019	-43	-45	YAQUINA	HOPPER	Lower Martin	O-78.7-SW, O-80.7-SW	79,376	79,376					Visual	N	
						Lower Martin Is. Bar Totals RM 76+40 to 80+16	**104,304**	**104,304**	**0**	**0**	**0**	**0**			
June - 2019	-44	-45	ESSAYONS	HOPPER	Upper Martin Bar	O-80.5-IW, O-82.2-IW	34,564	34,564					Visual	N	
July - 2019	-43	-43	YAQUINA	HOPPER	Upper Martin Bar	O-82.9-SW, O-80.3-SW	17,073	17,073					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Upper Martin Bar	O-80.8-SW, O-82.9-SW	13,046	13,046					Visual	N	
October - 2019	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-80.7-SW	55,932	55,932					Visual	N	
						Upper Martin Is. Bar Totals RM 80+16 to 83+44	**120,615**	**120,615**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	St. Helens Bar	O-83.9-IW	9,771	9,771					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-84.5-SW	7,135	7,135					Visual	N	
Oct/Nov - 2019	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.5-SW	41,880	41,880					Visual	N	
						St. Helens Bar Totals RM 83+44 to 87+15	**58,786**	**58,786**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2019

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
June - 2019	-43	-44	ESSAYONS	HOPPER	Warrior Rock	W-87.4-FL	11,714	11,714					Visual	N	
July - 2019	-43	-43	YAQUINA	HOPPER	Warrior Rock	O-91.2-SW	6,145	6,145					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Warrior Rock	O-91.2-SW, W-87.4-FL	11,750	11,750					Visual	N	
November - 2019	-43	-45	YAQUINA	HOPPER	Warrior Rock	O-89.4-IW, O-87.6-IW, O-88.6-IW, O-90.0-IW	39,865	39,865					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**69,474**	**69,474**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Henrici Bar	O-90.0-IW	5,690	5,690					Visual	N	
July - 2019	-43	-43	YAQUINA	HOPPER	Henrici Bar	O-91.2-SW	5,795	5,795					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Henrici Bar	O-91.2-SW	9,683	9,683					Visual	N	
November - 2019	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-91.0-SW, O-94.8-SW	34,711	34,711					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**55,879**	**55,879**	**0**	**0**	**0**	**0**			
June - 2019	-43	-44	ESSAYONS	HOPPER	Willow Bar	O-94.2-IW	18,647	18,647					Visual	N	
August - 2019	-43	-44	YAQUINA	HOPPER	Willow Bar	W-96.0-IW, O-95.4-SW	23,706	23,706					Visual	N	
November - 2019	-43	-45	YAQUINA	HOPPER	Willow Bar	O-95.4-SW, W-96.0-IW, O-94.8-SW	69,781	69,781					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**112,134**	**112,134**	**0**	**0**	**0**	**0**			
					Morgan Bar										
						Morgan Bar Totals RM 97+40 to 101+18	**0**	**0**	**0**	**0**	**0**	**0**			
November - 2019	-43	-44	YAQUINA	HOPPER	Lower Vancouver Bar	W-101.3-FL	890	890					Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 103+10	**890**	**890**	**0**	**0**	**0**	**0**			
June - 2019	-43	-46	ESSAYONS	HOPPER	Lower Vancouver / Vancouver TB	O-100.4-IW	11,486	11,486					Visual	N	
July - 2019	-46	-47	SEA HORSE	CLAMSHELL	Lower Vancouver / Vancouver TB	O-102.2-FL	4,971	4,971					Visual	N	
July/August - 2019	-43	-44	YAQUINA	HOPPER	Lower Vancouver / Vancouver TB	O-101.7-FL	13,360	13,360					Visual	N	
Oct/Nov - 2019	-43	-45	YAQUINA	HOPPER	Lower Vancouver / Vancouver TB	W-101.3-FL, O-101.7-FL	22,535	22,535					Visual	N	
						Lower Vancouver / Vancouver Turning Basin Totals RM 103+10 to 105+30	**52,352**	**52,352**	**0**	**0**	**0**	**0**			
August - 2019	-44	-45	SEA HORSE	CLAMSHELL	Oregon Slough Lower	O-102.5-FL, O-102.2-FL	26,876	26,876					Visual	N	
November - 2019	-43	-45	YAQUINA	HOPPER	Oregon Slough Lower	W-101.3-FL	1,680	1,680					Visual	N	
						Oregon Slough Lower Totals RM 00+00 to 01+00	**28,556**	**28,556**	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**6,644,264**	**4,346,200**	**0**	**1,453,990**	**652,074**	**0**			
						Total Dredged C&LW	**6,644,264**								

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2019

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
VANCOUVER TO THE DALLES															
August - 2019	-17	-18	YAQUINA	HOPPER	Upper Vancouver Bar	O-110.0-SW	8,833	8,833					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**8,833**	**8,833**	**0**	**0**	**0**	**0**			
					Airport Bar										
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**	**0**	**0**			
August - 2019	-17	-18	YAQUINA	HOPPER	Airport Bar / Government Island	W-112.5-SW	21,066	21,066					Visual	N	
						Airport / Government Totals RM 113+00 to 114+10	**21,066**	**21,066**	**0**	**0**	**0**	**0**			
					Government Island										
						Government Island Reach Totals RM 114+10 to 117+39	**0**	**0**	**0**	**0**	**0**	**0**			
August - 2019	-17	-18	YAQUINA	HOPPER	Lady Island	O-117.3-SW	34,851	34,851					Visual	N	
						Lady Island Ranges RM 117+39 to 122+28	**34,851**	**34,851**	**0**	**0**	**0**	**0**			
August - 2019	-17	-18	YAQUINA	HOPPER	Washougal Ranges	O/W-123.6-FL	37,656	37,656					Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**37,656**	**37,656**	**0**	**0**	**0**	**0**			
August - 2019	-17	-18	YAQUINA	HOPPER	Fashion Reef	W-133.0-FL	7,687	7,687					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**7,687**	**7,687**	**0**	**0**	**0**	**0**			
					Multnomah Falls										
						Multnomah Falls Totals RM 136+30 to 140+10	**0**	**0**	**0**	**0**	**0**	**0**			
						VTD Totals	**110,093**	**110,093**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**110,093**								
PORTLAND / VANCOUVER ANCHORAGES															
November - 2019	-43	-45	YAQUINA	HOPPER	Anchorage A	W-101.3-FL	4,467	4,467					Instrument	N	
						Portland/Vancouver Anchorages Totals	**4,467**	**4,467**	**0**	**0**	**0**	**0**			
						Total CY Dredged Portland/Vancouver Anchorages	**4,467**								
SIDE CHANNELS															
August/September - 2019	-16	-18	HEIDI RENEE	CLAMSHELL	Baker Bay	O-3.2-IW, W-4.8-IW	90,722	90,722					Visual/Instrument	N	
						Baker Bay Totals	**90,722**	**90,722**	**0**	**0**	**0**	**0**			
September - 2019	-15/-16	-16/-17	HEIDI RENEE	CLAMSHELL	Skipanon Entrance	W-10.5-IW, O-9.5-IW	41,404	41,404					Instrument	N	
						Skipanon Entrance Totals	**41,404**	**41,404**	**0**	**0**	**0**	**0**			
Oct/Nov - 2019	-7	-8	HEIDI RENEE	CLAMSHELL	Skamokawa Creek	O-32.2-IW	30,664	30,664					Visual/Instrument	N	
						Skamokawa Creek Totals	**30,664**	**30,664**	**0**	**0**	**0**	**0**			
November - 2019	-10	-11	SEA HORSE	CLAMSHELL	Wahkiakum Ferry Crossing	W-35.3-IW	9,571	9,571					Visual/Instrument	N	
						Wahkiakum Ferry Crossing Totals	**9,571**	**9,571**	**0**	**0**	**0**	**0**			
November/December - 2019	-21	-22	SEA HORSE	CLAMSHELL	Westport Slough	O-32.9-SW, O-32.2-SW, W-35.3-IW, W-30.1-IW	95,042	95,042					Instrument	N	
						Westport Slough Totals	**95,042**	**95,042**	**0**	**0**	**0**	**0**			
September/October - 2019	-9	-10	HEIDI RENEE	CLAMSHELL	Old Mouth Cowlitz	O-55.4-IW, W-56.1-IW, W-55.3-IW	63,411	63,411					Visual/Instrument	N	
						Old Mouth Cowlitz Totals	**63,411**	**63,411**	**0**	**0**	**0**	**0**			
August - 2019	-10	-11	SEA HORSE	CLAMSHELL	Oregon Slough Upper	W-110.7-IW	62,130	62,130					Instrument	N	
						Oregon Slough Totals	**62,130**	**62,130**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**392,944**	**392,944**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**392,944**								

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2020

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER															
AUGUST/SEPTEMBER - 2020	-55	-60	STUYVESANT	HOPPER	Quads 1 & 3	SWS, NJS, & DWS	1,498,920		103,332			1,395,588	Visual	N	
AUGUST/SEPTEMBER - 2020	-48/-55	-53/-60	ESSAYONS	HOPPER	Quads 2, 3, & 4	SJS, DWS, NHS, & SWS	1,186,839		216,384			970,455	Visual	N	
OCTOBER - 2020	-48/-55	-53/-60	ESSAYONS	HOPPER	Quads 1, 2, 3, & 4	SWS & DWS	288,957		38,368			250,589	Visual	N	
						MCR Totals RM -02-00 to 02+00	**2,974,716**	**0**	**358,084**	**0**	**0**	**2,616,632**			
						Total Dredged MCR	**2,974,716**								
COLUMBIA RIVER AND LOWER WILLAMETTE															
					Lower Desdemona										
						Lower Desdemona Bar Totals RM 03+00 to 06+22	**0**	**0**	**0**	**0**	**0**	**0**			
					Upper Desdemona										
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2020	-43	-46	STUYVESANT	HOPPER	Flavel Bar	W-7.1-IW	200,513	200,513					Visual	N	
OCTOBER - 2020	-43	-44	ESSAYONS	HOPPER	Flavel Bar	W-6.0-IW	51,699	51,699					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**252,212**	**252,212**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2020	-43	-44	ESSAYONS	HOPPER	Upper Sands	W-6.0-IW	28,196	28,196					Visual	N	
OCTOBER/NOVEMBER - 2020	-43	-44	ESSAYONS	HOPPER	Upper Sands	W-6.0-IW	126,532	126,532					Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**154,728**	**154,728**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-43	-45	ESSAYONS	HOPPER	Tongue Point	O-18.3-IW	14,765	14,765					Visual	N	
SEPTEMBER - 2020	-44	-45	STUYVESANT	HOPPER	Tongue Point	W-7.1-IW	101,519	101,519					Visual	N	
SEPTEMBER - 2020	-43	-45	ESSAYONS	HOPPER	Tongue Point	O-18.3-IW	84,420	84,420					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**200,704**	**200,704**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	ESSAYONS	HOPPER	Miller Sands	W-18.1-IW	17,238	17,238					Visual	N	
SEPTEMBER - 2020	-43	-45	ESSAYONS	HOPPER	Miller Sands	O-18.3-IW	16,835	16,835					Visual	N	
NOVEMBER - 2020	-43	-45	ESSAYONS	HOPPER	Miller Sands	W-24.0-IW	47,826	47,826					Visual	N	
JULY/AUGUST - 2020	-47	-48	DREDGE OR	PIPELINE	Miller Sands	Miller Sands Island (O-23.5-BN)	162,267				162,267		Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**244,166**	**81,899**	**0**	**0**	**162,267**	**0**			
APRIL - 2020	-43	-46	ESSAYONS	HOPPER	Miller / Pillar	W-24.0-IW	25,166	25,166					Visual	N	
JULY - 2020	-45	-47	STUYVESANT	HOPPER	Miller / Pillar	W-24.0-IW, W-26.7-IW, O-27.6-IW, & W-29.8-IW	230,936	230,936					Visual	N	
NOVEMBER - 2020	-43	-45	ESSAYONS	HOPPER	Miller / Pillar	W-24.0-IW	12,871	12,871					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**268,973**	**268,973**	**0**	**0**	**0**	**0**			
JULY - 2020	-43	-47	ESSAYONS	HOPPER	Pillar Rock	O-28.0-IW, O-28.0-IW-Shallow (O-28.0-SW)	20,506	20,506					Visual	N	
AUGUST - 2020	-43	-46	ESSAYONS	HOPPER	Pillar Rock	W-30.1-IW, O-28.0-IW-Shallow (O-28.0-SW)	18,732	18,732					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+45	**39,238**	**39,238**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	ESSAYONS	HOPPER	Brookfield Welch	W-32.0-IW	5,354	5,354					Visual	N	
AUGUST - 2020	-43	-45	ESSAYONS	HOPPER	Brookfield Welch	W-30.1-IW	26,142	26,142					Visual	N	
						Brookfield Welch Totals RM 28+45 to 32+30	**31,496**	**31,496**	**0**	**0**	**0**	**0**			
APRIL - 2020	-44	-45	ESSAYONS	HOPPER	Skamokawa Bar	W-32.0-IW, W-31.7-IW, & W-24.0-IW	87,098	87,098					Visual	N	
JULY - 2020	-43	-46	ESSAYONS	HOPPER	Skamokawa Bar	W-31.2-IW, W-31.4-IW, & O-28.0-IW-Shallow (O-28.0-SW)	62,841	62,841					Visual	N	
JULY/AUGUST - 2020	-43	-46	ESSAYONS	HOPPER	Skamokawa Bar	W-32.0-IW, O-28.0-IW, W-31.2-IW, W-31.4-IW, & W-31.7-IW	39,280	39,280					Visual	N	
JUNE/JULY	-47	-48	DREDGE OR	PIPELINE	Skamokawa Bar	Welch Island (O-34.0-UP)	240,092			240,092			Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**429,311**	**189,219**	**0**	**240,092**	**0**	**0**			
APRIL - 2020	-43	-45	ESSAYONS	HOPPER	Puget Island	W-36.8-IW	16,533	16,533					Visual	N	
JULY - 2020	-43	-44	ESSAYONS	HOPPER	Puget Island	W-31.7-IW	22,602	22,602					Visual	N	
JULY/AUGUST - 2020	-46	-47	STUYVESANT	HOPPER	Puget Island	W-40.8-IW, W-36.6-IW, W-37.5-IW, O-36.8-IW, O-36.4-IW, O-34.1-IW, W-35.3-IW, & W-7.1-IW	167,331	167,331					Visual	N	
						O-38.5-RH, W-44.5-RH (REHANDLE)	92,363	92,363					Visual	N	
AUGUST - 2020	-47	-48	DREDGE OR	PIPELINE	Puget Island	Tenasillahe Island (O-38.3-UP)	211,877			211,877			Visual	N	
						Puget Island Totals RM 36+31 to 40+40	**510,706**	**298,829**	**0**	**211,877**	**0**	**0**			

CCOLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2020

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
JULY - 2020	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-31.7-IW	10,984	10,984					Visual	N	
JULY - 2020	-45	-46	STUYVESANT	HOPPER	**Wauna Driscoll**	O-40.0-IW, O-40.4-IW, W-36.6-IW, O-36.4-IW	77,527	77,527					Visual	N	
NOVEMBER - 2020	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-44.5-RH (REHANDLE)	83,651	83,651					Visual	N	
						W-44.5-RH (REHANDLE)	30,569	30,569					Visual	N	
						Wauna Driscoll Totals RM 40+40 to 44+27	**202,731**	**202,731**	**0**	**0**	**0**	**0**			
AUGUST/SEPTEMBER - 2020	-42	-43	DREDGE OR	PIPELINE	**Puget Is. In-Water Transfer Site**	Pancake Point (W-43.9-BN)	310,876						Visual	N	*This report is for dredging action only. Dredged material was placed at Pancake Point site (separate Wahkiakum Co. permit compliance and reporting)
						Puget Is. In-Water Transfer Site Totals	**310,876**	**0**	**0**	**0**	**0**	**0**			
APRIL - 2020	-44	-45	YAQUINA	HOPPER	**Wauna/Westport**	O-40.5-IW	27,833	27,833					Visual	N	
JULY - 2020	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-32.0-IW, O-40.0-IW	56,710	56,710					Visual	N	
NOVEMBER - 2020	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-44.5-RH (REHANDLE)	77,389	77,389					Visual	N	
						Westport Bar Totals RM 44+27 to 46+25	**161,932**	**161,932**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	ESSAYONS	HOPPER	**Westport / Eureka**	O-40.1-IW	12,000	12,000					Visual	N	
JULY - 2020	-44	-47	STUYVESANT	HOPPER	**Westport / Eureka**	O-34.1-IW, W-35.8-IW, W-36.6-IW, W-35.3-IW, W-37.5-IW, O-36.4-IW, O-40.4-IW, O-52.4-IW, O-36.8-IW, W-40.8-IW, & O-40.0-IW	354,620	354,620					Visual	N	
NOVEMBER - 2020	-43	-47	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	38,948	38,948					Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**405,568**	**405,568**	**0**	**0**	**0**	**0**			
APRIL - 2020	-45	-46	ESSAYONS	HOPPER	**Eureka**	W-53.8-IW	16,726	16,726					Visual	N	
JULY - 2020	-43	-47	ESSAYONS	HOPPER	**Eureka / Gull**	W-54.9-IW, W-53.1-IW	73,544	73,544					Visual	N	
NOVEMBER - 2020	-43	-47	ESSAYONS	HOPPER	**Eureka / Gull**	W-44.5-RH (REHANDLE)	33,880	33,880					Visual	N	
						Eureka Bar Totals RM 49+00 to 51+45	**124,150**	**124,150**	**0**	**0**	**0**	**0**			
JULY - 2020	-43	-45	ESSAYONS	HOPPER	**Gull Island**	W-53.1-IW	32,062	32,062					Visual	N	
						Gull Is. Totals RM 51+45 to 55+30	**32,062**	**32,062**	**0**	**0**	**0**	**0**			
NOVEMBER - 2020	-43	-46	ESSAYONS	HOPPER	**Stella-Fisher**	W-55.9-FL	39,441	39,441					Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**39,441**	**39,441**	**0**	**0**	**0**	**0**			
JULY - 2020	-43	-46	ESSAYONS	HOPPER	**Stella / Walker**	W-55.9-FL, W-53.1-IW, & W-53.8-IW	99,956	99,956					Visual	N	
NOVEMBER - 2020	-46	-47	ESSAYONS	HOPPER	**Stella / Walker**	W-53.1-IW	49,700	49,700					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**149,656**	**149,656**	**0**	**0**	**0**	**0**			
APRIL - 2020	-46	-47	ESSAYONS	HOPPER	**Walker Is. Reach**	W-54.7-IW	21,618	21,618					Visual	N	
JULY - 2020	-43	-46	ESSAYONS	HOPPER	**Walker Is. Reach**	W-53.8-IW	86,521	86,521					Visual	N	
NOVEMBER - 2020	-43	-47	ESSAYONS	HOPPER	**Walker Is. Reach**	W-61.3-IW, W-60.0-IW, & W-53.8-IW	85,211	85,211					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**193,350**	**193,350**	**0**	**0**	**0**	**0**			
JULY - 2020	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	W-55.9-FL	75,951	75,951					Visual	N	
OCTOBER - 2020	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-62.6-IW, W-61.3-IW	51,371	51,371					Visual	N	
						O-69.6-RH (REHANDLE)	89,466	89,466					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**216,788**	**216,788**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-47	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-62.8-IW & W-62.0-IW	22,482	22,482					Visual	N	
JULY - 2020	-46	-47	STUYVESANT	HOPPER	**Slaughters / Lower Dobelbower**	O-58.7-IW, O-59.2-IW, O-59.7-IW, O-61.6-IW, W-60.9-IW, O-62.4-IW, & O-62.9-IW	170,197	170,197					Visual	N	
OCTOBER - 2020	-43	-47	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-69.6-RH (REHANDLE)	132,192	132,192					Visual	N	
NOVEMBER - 2020	-44	-45	HEIDI RENEE	CLAMSHELL	**Longview Turning Basin**	O-62.7-IW	1,673	1,673					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**326,544**	**326,544**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	**Lower Dobelbower**	W-69.7-IW	4,180	4,180					Visual	N	
JUNE - 2020	-47	-48	DREDGE OR	PIPELINE	**Lower Dobelbower**	Howard Island (W-68.7-UP)	163,614			163,614			Visual	N	
						Lower Dobelbower Bar Totals RM 67+40 to 69+50	**167,794**	**4,180**	**0**	**163,614**	**0**	**0**			
OCTOBER/NOVEMEBER - 2020	-41	-42	DREDGE OR	PIPELINE	**Howard Is. In-Water Transfer Site**	Howard Island (W-68.7-UP)	386,121			386,121			Visual	N	
						Howard Island In-Water Transfer Site Totals	**386,121**	**0**	**0**	**386,121**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2020

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
APRIL - 2020	-43	-45	YAQUINA	HOPPER	Upper Dobelbower	O-72.9-FL	16,344	16,344					Visual	N	
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	Upper Dobelbower	O-71.8-IW & O-73.0-FL	41,837	41,837					Visual	N	
OCTOBER - 2020	-43	-45	ESSAYONS	HOPPER	Upper Dobelbower	O-69.6-RH (REHANDLE)	78,303	78,303					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**136,484**	**136,484**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	Kalama Ranges	O-78.2-SW	19,601	19,601					Visual	N	
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	Kalama Turning Basin	O-73.0-FL	35,608	35,608					Visual	N	
OCTOBER/NOVEMEBER - 2020	-43	-44	YAQUINA	HOPPER	Kalama Ranges	O-73.0-FL	6,488	6,488					Visual	N	
OCTOBER/NOVEMEBER - 2020	-43	-45	YAQUINA	HOPPER	Kalama Turning Basin	O-73.0-FL	34,673	34,673					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**96,370**	**96,370**	**0**	**0**	**0**	**0**			
APRIL - 2020	-44	-45	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-78.8-SW	17,390	17,390					Visual	N	
JULY - 2020	-43	-45	ESSAYONS	HOPPER	Kalama / Lower Martin Bar	O-78.3-IW	86,696	86,696					Visual	N	
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	Lower Martin Bar	O-78.2-SW	6,185	6,185					Visual	N	
OCTOBER - 2020	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-78.8-SW	44,542	44,542					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 77+30	**154,813**	**154,813**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-80.7-SW	11,171	11,171					Visual	N	
JULY - 2020	-43	-45	ESSAYONS	HOPPER	Lower Martin / Upper Martin Bar	O-78.3-IW & O-80.6-IW	55,559	55,559					Visual	N	
OCTOBER - 2020	-43	-45	YAQUINA	HOPPER	Lower Martin / Upper Martin Bar	O-80.4-SW	57,952	57,952					Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 77+30 to 81+00	**124,682**	**124,682**	**0**	**0**	**0**	**0**			
JULY/AUGUST - 2020	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-82.3-IW & O-81.0-SW	66,348	66,348					Visual	N	
OCTOBER - 2020	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-82.3-SW & O-81.0-SW	43,703	43,703					Visual	N	
						Upper Martin Is. Bar Totals RM 81+00 to 83+44	**110,051**	**110,051**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43		YAQUINA	HOPPER	St. Helens Bar	O-84.4-SW	6,942	6,942					Visual	N	
JULY - 2020	-43	-44	YAQUINA	HOPPER	St. Helens Bar	O-85.3-IW	22,025	22,025					Visual	N	*This report is for dredging action only.
SEPTEMBER/OCTOBER - 2020	-47	-48	DREDGE OR	PIPELINE	St. Helens Bar	Woodland Islands (W-84.9-SW)	237,483						Visual	N	Dredged material was placed at Woodland Islands site (separate Section 204 project compliance and reporting)
						St. Helens Bar Totals RM 83+44 to 87+15	**266,450**	**28,967**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	YAQUINA	HOPPER	Warrior Rock	O-90.8-SW	5,850	5,850					Visual	N	
JULY - 2020	-43	-45	YAQUINA	HOPPER	Warrior Rock	O-90.9-IW & O-90.0-IW	39,655	39,655					Visual	N	
SEPTEMBER - 2020	-43	-45	ESSAYONS	HOPPER	Warrior Rock	O-85.2-RH (REHANDLE)	99,585	99,585					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**145,090**	**145,090**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-90.8-SW	7,825	7,825					Visual	N	
JULY - 2020	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-94.5-SW	20,294	20,294					Visual	N	
NOVEMBER - 2020	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-90.9-IW & O-94.4-SW	33,927	33,927					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**62,046**	**62,046**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43	-45	YAQUINA	HOPPER	Willow Bar	W-96.0-IW	1,974	1,974					Visual	N	
JULY - 2020	-43	-44	YAQUINA	HOPPER	Willow Bar	W-97.9-IW & 0-95.7-SW	39,000	39,000					Visual	N	
NOVEMBER - 2020	-43	-45	YAQUINA	HOPPER	Willow Bar	W-97.9-IW & 0-95.7-SW	98,057	98,057					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**139,031**	**139,031**	**0**	**0**	**0**	**0**			
					Morgan Bar										
						Morgan Bar Totals RM 97+40 to 101+18	**0**	**0**	**0**	**0**	**0**	**0**			
APRIL - 2020	-43		YAQUINA	HOPPER	Lower Vancouver Bar	O-100.3-IW	13,599	13,599					Visual	N	
JULY - 2020	-43		YAQUINA	HOPPER	Lower Vancouver Bar	W-101.3-FL	2,681	2,681					Visual	N	
AUGUST - 2020	-43	-44	YAQUINA	HOPPER	Lower Vancouver Bar	W-101.3-FL	5,997	5,997					Visual	N	
NOVEMBER - 2020	-43	-45	YAQUINA	HOPPER	Lower Vancouver Bar	W-101.3-FL & O-101.4-FL	38,766	38,766					Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+30	**61,043**	**61,043**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2020

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
JULY - 2020	-43		YAQUINA	HOPPER	**Vancouver Turning Basin**	W-101.3-FL	3,114	3,114					Visual	N	
AUGUST - 2020	-43		YAQUINA	HOPPER	**Vancouver Turning Basin**	W-101.3-FL	48,529	48,529					Visual	N	
OCTOBER - 2020	-43	-44	YAQUINA	HOPPER	**Vancouver Turning Basin**	W-101.3-FL	43,172	43,172					Visual	N	
NOVEMBER - 2020	-43	-44	YAQUINA	HOPPER	**Vancouver Turning Basin**	W-101.3-FL	25,503	25,503					Visual	N	
						Vancouver Turning Basin Totals RM 104+30 to 105+30	**120,318**	**120,318**	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**6,264,925**	**4,552,595**	**0**	**1,001,704**	**162,267**	**0**			
						Total Dredged C&LW	**6,264,925**								
						VANCOUVER TO THE DALLES									
AUGUST - 2020	-17	-18	YAQUINA	HOPPER	**Upper Vancouver Bar**	O-109.9-SW	16,993	16,993					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**16,993**	**16,993**	**0**	**0**	**0**	**0**			
					Airport Bar		0								
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-17	-18	YAQUINA	HOPPER	**Airport Bar / Government Island**	W-112.4-SW & W-111.8-SW	31,413	31,413					Visual	N	
						Airport / Government Totals RM 113+00 to 114+10	**31,413**	**31,413**	**0**	**0**	**0**	**0**			
					Government Island										
						Government Island Reach Totals RM 114+10 to 117+39	**0**	**0**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-17	-18	YAQUINA	HOPPER	**Lady Island**	O-117.3-IW	8,460	8,460					Visual	N	
						Lady Island Ranges RM 117+39 to 122+28	**8,460**	**8,460**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-17	-18	YAQUINA	HOPPER	**Washougal Ranges**	O/W-123.6-FL	62,720	62,720					Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**62,720**	**62,720**	**0**	**0**	**0**	**0**			
AUGUST - 2020	-17	-18	YAQUINA	HOPPER	**Fashion Reef**	W-132.7-FL	13,350	13,350					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**13,350**	**13,350**	**0**	**0**	**0**	**0**			
					Multnomah Falls										
						Multnomah Falls Totals RM 136+30 to 140+10	**0**	**0**	**0**	**0**	**0**	**0**			
						VTD Totals	**132,936**	**132,936**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**132,936**								
						PORTLAND / VANCOUVER ANCHORAGES									
NOVEMBER - 2020	-43	-45	YAQUINA	HOPPER	**Anchorage A**	W-101.3-FL & O-101.4-FL	4,730	4,730					Visual/Instrument	N	
						Portland/Vancouver Anchorages Totals	**4,730**	**4,730**	**0**	**0**	**0**	**0**			
						Total CY Dredged Portland/Vancouver Anchorages	**4,730**								
						SIDE CHANNELS									
SEPTEMBER - 2020	-16	-18	HEIDI RENEE	CLAMSHELL	**Baker Bay**	W-4.8-IW & O-3.2-IW	55,219	55,219					Visual/Instrument	N	
						Baker Bay Totals	**55,219**	**55,219**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMBER - 2020	-10	-12	HEIDI RENEE	CLAMSHELL	**Chinook**	W-4.8-IW & AREA D	139,506	139,506					Visual/Instrument	N	
						Chinook Totals	**139,506**	**139,506**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**194,725**	**194,725**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**194,725**								

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2021

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER															
AUGUST/SEPTEMBER - 2021	-48/-55	-53/-60	ESSAYONS	HOPPER	Quads 1, 2, 3, & 4	SJS, DWS, NHS, & SWS	1,104,076		33,277			1,070,799	Visual	N	
SEPTEMBER - 2021	-55	-60	STUYVESANT	HOPPER	Quads 1 & 3	SWS, NJS, & DWS	207,364		38,306			169,058	Visual	N	
OCTOBER - 2021	-48/-55	-53/-60	ESSAYONS	HOPPER	Quads 3 & 4	NHS & DWS	150,797		12,895			137,902	Visual	N	
OCTOBER/NOVEMBER - 2021	-48/-55	-53/-60	STUYVESANT	HOPPER	Quads 1, 3, & 4	SWS & DWS	929,555		122,598			806,957	Visual	N	
						MCR Totals RM -02-00 to 02+00	**2,391,792**	**0**	**207,076**	**0**	**0**	**2,184,716**			
						Total Dredged MCR	**2,391,792**								
COLUMBIA RIVER AND LOWER WILLAMETTE															
					Lower Desdemona										
						Lower Desdemona Bar Totals RM 03+00 to 06+22	**0**	**0**	**0**	**0**	**0**	**0**			
					Upper Desdemona										
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**0**	**0**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2021	-43	-45	STUYVESANT	HOPPER	Flavel Bar	W-7.4-IW	141,514	141,514					Visual	N	
OCTOBER - 2021	-43	-45	STUYVESANT	HOPPER	Flavel Bar	W-7.4-IW	58,558	58,558					Visual	N	
NOVEMBER - 2021	-43	-44	ESSAYONS	HOPPER	Flavel Bar	O-5.8-IW	10,302	10,302					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**210,374**	**210,374**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2021	-43	-44	ESSAYONS	HOPPER	Upper Sands	W-5.3-IW	16,337	16,337					Visual	N	
OCTOBER - 2021	-43	-44	ESSAYONS	HOPPER	Upper Sands	W-5.3-IW	10,329	10,329					Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**26,666**	**26,666**	**0**	**0**	**0**	**0**			
JULY/AUGUST - 2021	-45	-46	STUYVESANT	HOPPER	Tongue Point	W-7.2N-IW, W-7.2S-IW, W-20.9-IW	258,378	258,378					Visual	N	
AUGUST - 2021	-43	-44	ESSAYONS	HOPPER	Tongue Point	O-18.3-IW	1,596	1,596					Visual	N	
SEPTEMBER - 2021	-43	-45	ESSAYONS	HOPPER	Tongue Point	W-5.3-IW	66,806	66,806					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**326,780**	**326,780**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-44	ESSAYONS	HOPPER	Miller Sands	W-7.4-IW	24,738	24,738					Visual	N	
AUGUST - 2021	-43	-44	ESSAYONS	HOPPER	Miller Sands	O-18.3-IW	3,107	3,107					Visual	N	
AUGUST - 2021	-47	-48	DREDGE OR	PIPELINE	Miller Sands RM 21	Miller Sands Island (O-23.5-BN)	235,287				235,287		Visual	N	
AUGUST/SEPTEMBER - 2021	-47	-48	DREDGE OR	PIPELINE	Miller Sands RM 24	Miller Sands Island (O-23.5-BN), W-23.9-IW	493,960	398,250			95,710		Visual	N	
NOVEMBER - 2021	-43	-45	ESSAYONS	HOPPER	Miller Sands	W-26.7-IW	10,000	10,000					Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**767,092**	**436,095**	**0**	**0**	**330,997**	**0**			
MAY - 2021	-43	-45	ESSAYONS	HOPPER	Miller / Pillar	W-24.0-IW	34,298	34,298					Visual	N	
JULY - 2021	-46	-47	STUYVESANT	HOPPER	Miller / Pillar	O-36.4-IW, W-20.9-IW, W-24.0-IW, W-35.8-IW	175,365	175,365					Visual	N	
						W-44.5-RH (REHANDLE)	5,657	5,657					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**215,320**	**215,320**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-43	ESSAYONS	HOPPER	Pillar Rock	O-27.6-IW	9,791	9,791					Visual	N	
AUGUST - 2021	-43	-44	ESSAYONS	HOPPER	Pillar Rock	O-27.6-IW	4,393	4,393					Visual	N	
SEPTEMBER - 2021	-47	-48	DREDGE OR	PIPELINE	Pillar Rock	Pillar Rock Island (O-27.2-BN)	70,264				70,264		Visual	N	
OCTOBER - 2021	-47	-48	DREDGE OR	PIPELINE	Pillar Rock	Pillar Rock Island (O-27.2-BN)	37,942				37,942		Visual	N	
NOVEMBER - 2021	-43	-46	ESSAYONS	HOPPER	Pillar Rock	W-26.7-IW	20,197	20,197					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+45	**142,587**	**34,381**	**0**	**0**	**108,206**	**0**			
JUNE - 2021	-43	-46	ESSAYONS	HOPPER	Brookfield Welch	O-27.6-IW	15,179	15,179					Visual	N	
JULY/AUGUST - 2021	-43	-46	ESSAYONS	HOPPER	Pillar Rock / Brookfield Welch	O-27.6-IW	16,291	16,291					Visual	N	
OCTOBER/NOVEMBER - 2021	-43	-45	ESSAYONS	HOPPER	Brookfield Welch	W-31.3-IW & W-26.7-IW	52,582	52,582					Visual	N	
						Brookfield Welch Totals RM 28+45 to 32+30	**84,052**	**84,052**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-46	ESSAYONS	HOPPER	Skamokawa Bar	W-32.0-IW, W-31.3-IW, O-27.6-IW	111,779	111,779					Visual	N	
NOVEMBER - 2021	-43	-46	YAQUINA	HOPPER	Skamokawa Bar	O-34.1-SW	39,522	39,522					Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**151,301**	**151,301**	**0**	**0**	**0**	**0**			
JUNE/JULY - 2021	-43	-46	ESSAYONS	HOPPER	Puget Island	W-31.3-IW, W-32.0-IW, W-36.6-IW, W-37.5-IW	69,708	69,708					Visual	N	
NOVEMBER - 2021	-43	-46	ESSAYONS	HOPPER	Puget Island	W-44.5-RH (REHANDLE)	32,390	32,390					Visual	N	
						Puget Island Totals RM 36+31 to 40+40	**102,098**	**102,098**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2021

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MAY - 2021	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-37.5-IW	21,839	21,839					Visual	N	
JUNE/JULY - 2021	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-31.3-IW, W-35.8-IW, W-36.6-IW, W-40.8-IW, W-32.0-IW, W-36.6-IW	49,534	49,534					Visual	N	
JULY - 2021	-46	-47	STUYVESANT	HOPPER	**Wauna Driscoll**	O-34.1-IW, W-20.9-IW, W-30.0N-IW, W-30.0S-IW	211,838	211,838					Visual	N	
						W-44.5-RH (REHANDLE)	6,151	6,151					Visual	N	
NOVEMBER - 2021	-43	-46	ESSAYONS	HOPPER	**Wauna Driscoll**	W-44.5-RH (REHANDLE)	27,240	27,240					Visual	N	
						Wauna Driscoll Totals RM 40+40 to 44+27	**316,602**	**316,602**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMBER - 2021	-42	-43	DREDGE OR	PIPELINE	**Puget Is. In-Water Transfer Site**	James River (O-42.9-UP)	228,248			228,248			Visual	N	
						Puget Is. In-Water Transfer Site Totals	**228,248**	**0**	**0**	**228,248**	**0**	**0**			
APRIL - 2021	-43	-44	YAQUINA	HOPPER	**Wauna/Westport**	W-44.0-RH (REHANDLE)	4,810	4,810					Visual	N	
MAY - 2021	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-40.8-IW	21,772	21,772					Visual	N	
JULY - 2021	-43	-45	ESSAYONS	HOPPER	**Wauna/Westport**	W-37.5-IW & W-40.8-IW	49,754	49,754					Visual	N	
NOVEMBER - 2021	-43	-46	YAQUINA	HOPPER	**Wauna/Westport**	W-44.5-RH (REHANDLE)	87,841	87,841					Visual	N	
						Westport Bar Totals RM 44+27 to 46+25	**164,177**	**164,177**	**0**	**0**	**0**	**0**			
JULY - 2021	-46	-47	STUYVESANT	HOPPER	**Westport / Eureka**	O-34.1-IW, O-36.4-IW, W-35.3-IW, W-35.8-IW	226,222	226,222					Visual	N	
						W-44.5-RH (REHANDLE)	81,473	81,473					Visual	N	
NOVEMBER - 2021	-43	-47	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	75,098	75,098					Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**382,793**	**382,793**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Eureka Bar / Gull Island**	W-44-5-IW & W-36.6-IW	54,003	54,003					Visual	N	
NOVEMBER - 2021	-43	-47	ESSAYONS	HOPPER	**Eureka Bar / Gull Island**	W-44.5-RH (REHANDLE)	12,682	12,682					Visual	N	
						Eureka Bar Totals RM 49+00 to 51+45	**66,685**	**66,685**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-45	ESSAYONS	HOPPER	**Gull Island**	W-53.1-IW	22,035	22,035					Visual	N	
						Gull Is. Totals RM 51+45 to 55+30	**22,035**	**22,035**	**0**	**0**	**0**	**0**			
MAY - 2021	-43	-45	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.8-IW	19,665	19,665					Visual	N	
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.1-IW, W-54.9-IW, W-53.8-IW, W-54.5-IW, W-55.9-FL	114,660	114,660					Visual	N	
OCTOBER - 2021	-43	-47	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.1-IW	82,376	82,376					Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**216,701**	**216,701**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Stella / Walker**	W-55.9-FL & O-58.7-IW	20,740	20,740					Visual	N	
OCTOBER - 2021	-43	-47	ESSAYONS	HOPPER	**Stella / Walker**	W-53.8-IW, W-54.9-IW, W-54.5-IW	157,253	157,253					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**177,993**	**177,993**	**0**	**0**	**0**	**0**			
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Walker Is. Reach**	O-59.2-IW & O-59.7-IW	37,730	37,730					Visual	N	
OCTOBER/NOVEMBER - 2021	-43	-46	ESSAYONS	HOPPER	**Walker Is. Reach**	W-55.9-FL-D	32,245	32,245					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**69,975**	**69,975**	**0**	**0**	**0**	**0**			
APRIL - 2021			ESSAYONS	HOPPER	**Slaughters Bar**	W-60.0-IW & W-61.1-IW	14,129	14,129					Visual	N	
JUNE - 2021	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-59.2-IW & O-59.7-IW	21,408	21,408					Visual	N	
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-58.7-IW	25,353	25,353					Visual	N	
AUGUST - 2021	-46	-47	STUYVESANT	HOPPER	**Slaughters Bar**	O-61.6-IW, O-62.2-IW, O-62.8-IW	81,726	81,726					Visual	N	
OCTOBER - 2021	-43	-47	ESSAYONS	HOPPER	**Slaughters Bar**	O-69.6-RH (REHANDLE)	160,495	160,495					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**303,111**	**303,111**	**0**	**0**	**0**	**0**			
MAY - 2021	-43	-46	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	W-61.1-IW, O-61.5-IW, W-60.0-IW	47,672	47,672					Visual	N	
JUNE - 2021	-43	-46	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-59.7-IW & O-59.2-IW	43,489	43,489					Visual	N	
JULY - 2021	-43	-46	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	W-53.1-IW, W-53.8-IW, W-54.9-IW	59,673	59,673					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**150,834**	**150,834**	**0**	**0**	**0**	**0**			
JUNE/JULY - 2021	-47	-48	DREDGE OR	PIPELINE	**Lower Dobelbower**	Howard Island (W-68.7-UP)	213,148			213,148			Visual	N	
JULY - 2021	-45	-45	YAQUINA	HOPPER	**Lower / Upper Dobelbower**	O-71.8-IW & W-69.7-IW	43,799	43,799					Visual	N	
DECEMBER - 2021	-47	-48	DREDGE OR	PIPELINE	**Lower Dobelbower**	Howard Island (W-68.7-UP)	82,988			82,988			Visual	N	Volume dredged during preferred season, 1 Jun t
DECEMBER/JANUARY - 2021	-47	-48	DREDGE OR	PIPELINE	**Lower Dobelbower**	Howard Island (W-68.7-UP)	86,810			86,810			Visual	N	Volume dredged after 15 Dec
						Lower Dobelbower Bar Totals RM 67+40 to 69+50	**426,745**	**43,799**	**0**	**382,946**	**0**	**0**			
NOVEMBER/DECEMBER - 2021	-42	-43	DREDGE OR	PIPELINE	**Howard Is. In-Water Transfer Site**	Howard Island (W-68.7-UP)	325,898			325,898			Visual	N	

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2021

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
						Howard Island In-Water Transfer Site Totals	**325,898**	**0**	**0**	**325,898**	**0**	**0**			
OCTOBER - 2021	**-43**	**-46**	ESSAYONS	HOPPER	**Lower / Upper Dobelbower**	O-69.6-RH (REHANDLE)	63,221	63,221					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**63,221**	**63,221**	**0**	**0**	**0**	**0**			
JULY - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Kalama Ranges**	O-72.9-FL	18,196	18,196					Visual	N	
JULY - 2021	**-43**	**-45**	YAQUINA	HOPPER	**Kalama Turning Basin**	O-72.9-FL	20,568	20,568					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**38,764**	**38,764**	**0**	**0**	**0**	**0**			
APRIL - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Kalama / Lower Martin Bar**	O-78.0-SW	34,308	34,308					Visual	N	
JULY - 2021	**-43**	**-46**	ESSAYONS	HOPPER	**Kalama / Lower Martin Bar**	O-77.7-IW, O-78.6-IW, O-73.2-IW	81,618	81,618					Visual	N	
OCTOBER - 2021	**-43**	**-47**	ESSAYONS	HOPPER	**Kalama / Lower Martin Bar**	O-69.6-RH (REHANDLE)	90,000	90,000					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 77+30	**205,926**	**205,926**	**0**	**0**	**0**	**0**			
APRIL - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Lower Martin / Upper Martin Bar**	O-80.7-SW	22,834	22,834					Visual	N	
JULY - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Lower Martin / Upper Martin Bar**	O-80.6-SW	52,601	52,601					Visual	N	
OCTOBER - 2021	**-46**	**-46**	YAQUINA	HOPPER	**Lower Martin / Upper Martin Bar**	O-80.8-SW	45,711	45,711					Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 77+30 to 81+00	**121,146**	**121,146**	**0**	**0**	**0**	**0**			
APRIL - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Upper Martin Bar**	O-82.3-SW	31,930	31,930					Visual	N	
JULY/AUGUST - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Upper Martin Bar**	O-82.3-SW & O-82.9-SW	46,213	46,213					Visual	N	
OCTOBER - 2021	**-46**	**-46**	YAQUINA	HOPPER	**Upper Martin Bar**	O-82.3-SW & O-82.9-SW	59,970	59,970					Visual	N	
						Upper Martin Is. Bar Totals RM 81+00 to 83+44	**138,113**	**138,113**	**0**	**0**	**0**	**0**			
JULY - 2021	**-46**	**-46**	YAQUINA	HOPPER	**St. Helens Bar**	O-82.9-SW	5,311	5,311					Visual	N	
OCTOBER - 2021	**-45**	**-45**	YAQUINA	HOPPER	**St. Helens Bar**	O-84.4-SW	15,024	15,024					Visual	N	
						St. Helens Bar Totals RM 83+44 to 87+15	**20,335**	**20,335**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Warrior Rock**	O-89.4-IW, O-90.9-SW, O-88.6-IW, O-87.6-IW	27,213	27,213					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**27,213**	**27,213**	**0**	**0**	**0**	**0**			
JULY - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Henrici Bar**	O-90.9-SW & W-93.2-IW	38,480	38,480					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**38,480**	**38,480**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Willow Bar / Morgan Bar**	O-95.7-SW, W-96.0-IW, O-94.4-SW	42,335	42,335					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**42,335**	**42,335**	**0**	**0**	**0**	**0**			
APRIL - 2021	**-43**		YAQUINA	HOPPER	**Lower Vancouver Bar**	O-100.5-IW	1,017	1,017					Visual	N	
APRIL - 2021	**-43**		ESSAYONS	HOPPER	**Lower Vancouver Bar**	O-100.5-IW	20,000	20,000					Visual	N	
AUGUST - 2021	**-44**	**-45**	YAQUINA	HOPPER	**Lower Vancouver Bar**	W-101.3-FL	25,986	25,986					Visual	N	
NOVEMBER - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Lower Vancouver Bar**	O-100.5-IW	7,802	7,802					Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+30	**54,805**	**54,805**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-44**	**-45**	YAQUINA	HOPPER	**Vancouver Turning Basin**	W-101.3-FL	54,960	54,960					Visual	N	
OCTOBER - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Vancouver Turning Basin**	W-97.9-IW	7,109	7,109					Visual	N	
NOVEMBER - 2021	**-45**	**-45**	YAQUINA	HOPPER	**Vancouver Turning Basin**	W-97.9-IW & O-100.5-IW	69,487	69,487					Visual	N	
						Vancouver Turning Basin Totals RM 104+30 to 105+30	**131,556**	**131,556**	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**5,759,961**	**4,383,666**	**0**	**937,092**	**439,203**	**0**			
						Total Dredged C&LW	**5,759,961**								

VANCOUVER TO THE DALLES

AUGUST - 2021	**-17**	**-18**	YAQUINA	HOPPER	**Upper Vancouver Bar**	O-109.6-SW	13,783	13,783					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**13,783**	**13,783**	**0**	**0**	**0**	**0**			
					Airport Bar		0								
						Airport Bar Totals RM 110+10 to 113+00	**0**	**0**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-17**	**-18**	YAQUINA	HOPPER	**Airport Bar / Government Island**	W-112.4-SW & W-111.8-SW	31,648	31,648					Visual	N	

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2021

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
						Airport / Government Totals RM 113+00 to 114+10	**31,648**	**31,648**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-17**	**-18**	YAQUINA	HOPPER	**Lady Island**	O-117.3-SW	18,085	18,085					Visual	N	
						Lady Island Ranges RM 117+39 to 122+28	**18,085**	**18,085**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-17**	**-18**	YAQUINA	HOPPER	**Washougal Ranges**	O/W-123.6-FL	49,189	49,189					Visual	N	
						Washougal Ranges Totals RM 122+28 to 125+15	**49,189**	**49,189**	**0**	**0**	**0**	**0**			
AUGUST - 2021	**-17**	**-18**	YAQUINA	HOPPER	**Fashion Reef**	W-132.7-FL & O-135.9-IW	13,749	13,749					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**13,749**	**13,749**	**0**	**0**	**0**	**0**			
						VTD Totals	**126,454**	**126,454**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**126,454**								
						Total CY Dredged Portland/Vancouver Anchorages	**0**								
						SIDE CHANNELS									
SEPTEMBER - 2021	**-16**	**-18**	HEIDI RENEE	CLAMSHELL	**Baker Bay**	W-4.8-IW & O-3.2-IW	46,267	46,267					Visual/Instrument	N	
OCTOBER - 2021	**-16**	**-18**	HEIDI RENEE	CLAMSHELL	**Baker Bay**	W-4.8-IW & O-3.2-IW	31,208	31,208					Visual/Instrument	N	
						Baker Bay Totals	**77,475**	**77,475**	**0**	**0**	**0**	**0**			
OCTOBER - 2021	**-9**	**-10**	SEA HORSE	CLAMSHELL	**Old Mouth Cowlitz**	W-56.0-IW	1,674	1,674					Visual/Instrument	N	
						Old Mouth Cowlitz Totals	**1,674**	**1,674**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMEBER - 2021	**-6**	**-7**	SEA HORSE	CLAMSHELL	**Lake River**	O-87.6-IW	4,640	4,640					Visual/Instrument	N	
						Lake River Totals	**4,640**	**4,640**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**83,789**	**83,789**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**83,789**								

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2022

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER															
AUGUST/SEPTEMBER - 2022	**-48/-55**	**-53/-60**	ESSAYONS	HOPPER	**Quads 1, 2, 3, & 4**	SJS,NHS, SWS, W-5.2-IW	958,388	200				958,188	Visual	N	*Dredge dug 200 cy from MCR then had to move to LCR and could not take the material to ocean disposal sites.
SEPTEMBER - 2022	**-48/-55**	**-53/-60**	BAYPORT	HOPPER	**Quads 3 & 4**	SWS, NJS	694,184					694,184	Visual	N	
OCTOBER - 2022	**-48/-55**	**-53/-60**	ESSAYONS	HOPPER	**Quads 1 & 4**	NHS & DWS	232,495		74,313			158,182	Visual	N	
OCTOBER/NOVEMBER - 2022	**-55**	**-60**	BAYPORT	HOPPER	**Quad 3**	SWS & DWS	1,066,143		193,644			872,499	Visual	N	
						MCR Totals RM -02-00 to 02+00	**2,951,210**	**200**	**267,957**	**0**	**0**	**2,683,053**			
						Total Dredged MCR	**2,951,210**								
COLUMBIA RIVER AND LOWER WILLAMETTE															
JULY - 2022	**-43**	**-46**	ESSAYONS	HOPPER	**Upper Desdemona**	W-8.2-IW	20,615	20,615					Visual	N	
OCTOBER - 2022	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Desdemona**	O-5.1-IW, W-5.2-IW	114,962	114,962					Visual	N	
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**135,577**	**135,577**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2022	**-43**	**-45**	BAYPORT	HOPPER	**Flavel Bar**	W-7.4-IW-A	24,575	24,575					Visual	N	
OCTOBER/NOVEMBER - 2022	**-43**	**-45**	BAYPORT	HOPPER	**Flavel Bar**	W-5.8-IW, W-7.4-IW-A, W-7.4-IW-B	204,706	204,706					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**229,281**	**229,281**	**0**	**0**	**0**	**0**			
OCTOBER - 2022	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Sands**	O-5.1-IW, W-5.2-IW	149,246	149,246					Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**149,246**	**149,246**	**0**	**0**	**0**	**0**			
AUGUST/SEPTEMBER - 2022	**-43**	**-46**	BAYPORT	HOPPER	**Tongue Point**	O-5.9-IW, W-5.8-IW	306,015	306,015					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**306,015**	**306,015**	**0**	**0**	**0**	**0**			
JULY/AUGUST - 2022	**-43**	**-45/-46**	ESSAYONS	HOPPER	**Miller Sands**	O-18.3-IW	40,571	40,571					Visual	N	
AUGUST - 2022	**-47**	**-48**	DREDGE OR	PIPELINE	**Miller Sands**	Rice Island (W-21.0-UP)	144,380			**144,380**			Visual	N	
OCTOBER - 2022	**-43**	**-46/-48**	ESSAYONS	HOPPER	**Miller Sands**	W-24.1-IW, O-18.3-IW	135,886	135,886					Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**320,837**	**176,457**	**0**	**144,380**	**0**	**0**			
JULY - 2022	**-43**	**-45**	ESSAYONS	HOPPER	**Miller / Pillar**	W-24.0-IW	24,987	24,987					Visual	N	
AUGUST - 2022	**-43**	**-47**	BAYPORT	HOPPER	**Miller / Pillar**	W-6.5-IW, W-6.6-IW, W-6.9-IW	168,089	168,089					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**193,076**	**193,076**	**0**	**0**	**0**	**0**			
MAY - 2022	**-43**	**-44**	YAQUINA	HOPPER	**Pillar Rock**	W-24.2-SW	9,510	9,510					Visual	N	
JULY - 2022	**-47**	**-48**	DREDGE OR	PIPELINE	**Pillar Rock**	Pillar Rock Island (O-27.2-BN)	238,681				**238,681**		Visual	N	
AUGUST - 2022	**-43**	**-46/-47**	ESSAYONS	HOPPER	**Pillar Rock**	W-26.7-IW	47,385	47,385					Visual	N	
OCTOBER - 2022	**-46**	**-47**	ESSAYONS	HOPPER	**Pillar Rock**	O-27.5-IW	44,611	44,611					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+45	**340,187**	**101,506**	**0**	**0**	**238,681**	**0**			
OCTOBER - 2022	**-43**	**-46**	ESSAYONS	HOPPER	**Brookfield Welch**	O-27.5-IW	15,954	15,954					Visual	N	
						Brookfield Welch Totals RM 28+45 to 32+30	**15,954**	**15,954**	**0**	**0**	**0**	**0**			
JULY - 2022	**-43**	**-46**	ESSAYONS	HOPPER	**Skamokawa Bar**	W-31.3-IW, W-32.0-IW, W-35.3-IW	98,658	98,658					Visual	N	
AUGUST/SEPTEMBER - 2022	**-47**	**-48**	DREDGE OR	PIPELINE	**Skamokawa Bar**	Welch Island (O-34.0-UP)	159,892			**159,892**			Visual	N	
NOVEMBER - 2022	**-43**	**-45/-46**	YAQUINA	HOPPER	**Skamokawa Bar**	O-34.0-SW	32,127	32,127					Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**290,677**	**130,785**	**0**	**159,892**	**0**	**0**			
JULY - 2022	**-43**	**-46**	BAYPORT	HOPPER	**Puget Island**	O-34.1-IW	111,578	111,578					Visual	N	
OCTOBER/NOVEMBER - 2022	**-43**	**-46**	ESSAYONS	HOPPER	**Puget Island**	W-29.9-IW	66,417	66,417					Visual	N	
						Puget Island Totals RM 36+31 to 40+40	**177,995**	**177,995**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2022

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MAY - 2022	-43	-44	YAQUINA	HOPPER	**Wauna Driscoll**	W-44.0-RH (REHANDLE)	2,204	2,204					Visual	N	
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-31.3-IW	22,965	22,965					Visual	N	
JULY - 2022	-43	-46	BAYPORT	HOPPER	**Wauna Driscoll**	O-36.3-IW	72,663	72,663					Visual	N	
NOVEMBER - 2022	-43	-45/-46	YAQUINA	HOPPER	**Wauna Driscoll**	W-44.5-SW	28,169	28,169					Visual	N	
						Wauna Driscoll Totals RM 40+40 to 44+27	**126,001**	**126,001**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2022	-42	-43	DREDGE OR	PIPELINE	**Puget Is. In-Water Transfer Site**	James River (O-42.9-UP)	261,772			**261,772**			Visual	N	
						Puget Is. In-Water Transfer Site Totals	**261,772**	**0**	**0**	**261,772**	**0**	**0**			
JULY - 2022	-43	-45/-46	ESSAYONS	HOPPER	**Wauna/Westport**	W-36.6-IW, W-35.3-IW	50,927	50,927					Visual	N	
NOVEMBER - 2022	-43	-45/-46	YAQUINA	HOPPER	**Wauna/Westport**	W-44.5-SW	32,580	32,580					Visual	N	
						Westport Bar Totals RM 44+27 to 46+25	**83,507**	**83,507**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Westport / Eureka**	W-32.0-IW	38,474	38,474					Visual	N	
JULY - 2022	-43	-45	BAYPORT	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	151,912	151,912					Visual	N	
OCTOBER/NOVEMBER - 2022	-43	-47	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	204,024	204,024					Visual	N	
						W-29.9-IW, W-31.3-IW	110,396	110,396					Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**504,806**	**504,806**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-46	ESSAYONS	HOPPER	**Eureka Bar / Gull Island**	W-53.1-IW	29,897	29,897					Visual	N	
NOVEMBER - 2022	-43	-47	ESSAYONS	HOPPER	**Eureka Bar**	O-39.5-FL	32,919	32,919					Visual	N	
						Eureka Bar Totals RM 49+00 to 51+45	**62,816**	**62,816**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Gull Island**	W-53.1-IW, W-53.8-IW	21,580	21,580					Visual	N	
						Gull Is. Totals RM 51+45 to 55+30	**21,580**	**21,580**	**0**	**0**	**0**	**0**			
APRIL - 2022	-43	-45	YAQUINA	HOPPER	**Stella-Fisher**	O-59.8-SW	13,396	13,396					Visual	N	
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Stella-Fisher**	W-53.8-IW	94,960	94,960					Visual	N	
NOVEMBER - 2022	-43	-46/-47	ESSAYONS	HOPPER	**Stella-Fisher**	W-54.5-IW, W-53.8-IW, W-53.1-IW	130,677	130,677					Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**239,033**	**239,033**	**0**	**0**	**0**	**0**			
JULY/AUGUST - 2022	-43	-47	BAYPORT	HOPPER	**Stella / Walker**	O-51.9-IW, O-52.3-IW, O-58.2-IW	165,553	165,553					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**165,553**	**165,553**	**0**	**0**	**0**	**0**			
APRIL - 2022	-43	-45	YAQUINA	HOPPER	**Walker Is. Reach**	W-60.8-SW	5,324	5,324					Visual	N	
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Walker Is. Reach**	W-54.9-IW, W-53.8-IW	38,436	38,436					Visual	N	
AUGUST - 2022	-43	-45	ESSAYONS	HOPPER	**Walker Is. Reach**	W-53.8-IW	16,213	16,213					Visual	N	
NOVEMBER - 2022	-43	-47	ESSAYONS	HOPPER	**Walker Is. Reach**	W-55.9-FL, W-54.9-IW, W-54.5-IW	80,356	80,356					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**140,329**	**140,329**	**0**	**0**	**0**	**0**			
OCTOBER - 2022	-39	-40	DREDGE OR	PIPELINE	**Walker Is. In-Water Transfer Site**	Hump Island (W-59.7-UP)	155,843			**155,843**			Visual	N	
						Walker Island In-Water Transfer Site Totals	**155,843**	**0**	**0**	**155,843**	**0**	**0**			
JULY - 2022	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-59.7-IW	48,482	48,482					Visual	N	
NOVEMBER - 2022	-43	-46/-47	ESSAYONS	HOPPER	**Slaughters Bar**	O-62.4-IW	5,320	5,320					Visual	N	
NOVEMBER - 2022	-43	-46/-47	ESSAYONS	HOPPER	**Slaughters Bar**	W-60.9-RH (REHANDLE)	20,993	20,993					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**74,795**	**74,795**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	W-55.9-FL	42,269	42,269					Visual	N	
AUGUST - 2022	-43	-47	BAYPORT	HOPPER	**Slaughters / Lower Dobelbower**	O-62.5-IW, O-62.8-IW, W-60.8-IW, W-61.0-IW	183,890	183,890					Visual	N	
NOVEMBER - 2022	-43	-47	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-63.2-IW, O-62.8-IW, O-62.4-IW	57,399	57,399					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**283,558**	**283,558**	**0**	**0**	**0**	**0**			
JUNE - 2022	-47	-48	DREDGE OR	PIPELINE	**Lower Dobelbower**	Howard Island (W-68.7-UP)	110,758			**110,758**			Visual	N	
MAY - 2022	-43	-45	YAQUINA	HOPPER	**Lower Dobelbower**	O-62.7-SW	8,542	8,542					Visual	N	
						Lower Dobelbower Bar Totals RM 67+40 to 69+50	**119,300**	**8,542**	**0**	**110,758**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2022

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
AUGUST - 2022	-43	-45	YAQUINA	HOPPER	Upper Dobelbower	O-72.9-FL	41,824	41,824					Visual	N	
OCTOBER - 2022	-43	-45	YAQUINA	HOPPER	Lower / Upper Dobelbower	O-72.9-FL	25,980	25,980					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**67,804**	**67,804**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-43	-44/-45	YAQUINA	HOPPER	Kalama Ranges	O-72.9-FL	43,926	43,926					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**43,926**	**43,926**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-78.2-SW	38,650	38,650					Visual	N	
AUGUST - 2022	-43	-44	YAQUINA	HOPPER	Lower Martin Bar	O-78.2-SW	7,314	7,314					Visual	N	
OCTOBER - 2022	-43	-46	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-78.6-SW, O-72.9-FL	89,242	89,242					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 77+30	**135,206**	**135,206**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	YAQUINA	HOPPER	Lower Martin / Upper Martin Bar	O-80.8-SW	50,257	50,257					Visual	N	
OCTOBER - 2022	-43	-45	YAQUINA	HOPPER	Lower Martin / Upper Martin Bar	O-80.3-SW	34,569	34,569					Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 77+30 to 81+00	**84,826**	**84,826**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-82.3-SW	58,437	58,437					Visual	N	
OCTOBER/NOVEMBER - 2022	-43	-45/-46	YAQUINA	HOPPER	Upper Martin Bar	O-80.7-SW	66,390	66,390					Visual	N	
						Upper Martin Is. Bar Totals RM 81+00 to 83+44	**124,827**	**124,827**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.1-FL	5,299	5,299					Visual	N	
NOVEMBER - 2022	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-84.3-IW	5,162	5,162					Visual	N	
						St. Helens Bar Totals RM 83+44 to 87+15	**10,461**	**10,461**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-43	-45	YAQUINA	HOPPER	Warrior Rock	O-87.3-IW, O-88.7-IW	22,025	22,025					Visual	N	
NOVEMBER - 2022	-43	-45/-46	YAQUINA	HOPPER	Warrior Rock	O-87.5-IW	6,786	6,786					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**28,811**	**28,811**	**0**	**0**	**0**	**0**			
JULY/AUGUST - 2022	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-94.3-IW, O-90.0-IW, W-93.3-IW	32,744	32,744					Visual	N	
NOVEMBER - 2022	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-90.0-IW, W-93.3-IW	15,412	15,412					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**48,156**	**48,156**	**0**	**0**	**0**	**0**			
JULY - 2022	-43	-45	YAQUINA	HOPPER	Willow Bar	O-94.3-IW, W-97.9-IW	77,883	77,883					Visual	N	
NOVEMBER - 2022	-43	-45	YAQUINA	HOPPER	Willow Bar / Morgan Bar	O-94.3-SW	43,436	43,436					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**121,319**	**121,319**	**0**	**0**	**0**	**0**			
MAY - 2022	-43	-46	ESSAYONS	HOPPER	Lower Vancouver Bar	O-100.5-IW	20,159	20,159					Visual	N	
AUGUST - 2022	-43	-44	YAQUINA	HOPPER	Lower Vancouver Bar	O-101.5-FL, O-100.4-IW	19,807	19,807					Visual	N	
NOVEMBER - 2022	-43	-44.5	YAQUINA	HOPPER	Lower Vancouver / Turning Basin	O-102.5-FL	43,328	43,328					Visual	N	
NOVEMBER - 2022	-43	-45	YAQUINA	HOPPER	Kelley Pt Shoal	O-101.5-FL	2,211	2,211					Visual	N	
NOVEMBER - 2022	-43	-45	YAQUINA	HOPPER	Approaches to OSL	O-102.5-FL	1,939	1,939					Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+30	**87,444**	**87,444**	**0**	**0**	**0**	**0**			
APRIL - 2022	-43	-45	YAQUINA	HOPPER	Vancouver Turning Basin	O-100.5-IW	997	997					Visual	N	
AUGUST - 2022	-43	-44	YAQUINA	HOPPER	Vancouver Turning Basin	O-102.5-FL, O-101.5-FL, O-101.1-FL	57,158	57,158					Visual	N	
						Vancouver Turning Basin Totals RM 104+30 to 105+30	**58,155**	**58,155**	**0**	**0**	**0**	**0**			
						C&LW TOTALS (2012 BiOp)	**5,208,673**	**4,137,347**	**0**	**832,645**	**238,681**	**0**			
NOVEMEBER 2022-JANUARY 2023	-20	-48	DREDGE OR	PIPELINE	Columbia River FNC advanced maintenance dredging of the Cowlitz River Sediment Trap	Howard Island (W-68.7-UP)	1,139,757			**1,139,757**			Visual	N	
						Columbia AMD Cowlitz River Sediment Trap	**1,139,757**	**0**	**0**	**1,139,757**	**0**	**0**			
						Total Dredged C&LW	**6,348,430**								

COLUMBIA RIVER FNC O&M --- 401 CERT REPORTING --- DREDGE SEASON 2022

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
VANCOUVER TO THE DALLES															
AUGUST - 2022	-17	-18	YAQUINA	HOPPER	Upper Vancouver Bar	O-109.6-SW	29,350	29,350					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**29,350**	**29,350**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-17	-18	YAQUINA	HOPPER	Airport Bar / Government Island	W-111.9-SW, W-112.4-SW	34,466	34,466					Visual	N	
						Airport / Government Totals RM 113+00 to 114+10	**34,466**	**34,466**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-17	-18	YAQUINA	HOPPER	Lady Island	O-117.3-SW	16,162	16,162					Visual	N	
						Lady Island Ranges RM 117+39 to 122+28	**16,162**	**16,162**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-17	-18	YAQUINA	HOPPER	Fashion Reef	O-135.8-IW, W-132.5-FL	14,125	14,125					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**14,125**	**14,125**	**0**	**0**	**0**	**0**			
AUGUST - 2022	-17	-19	YAQUINA	HOPPER	Bonneville Dam	O/W-144.1-FL	2,209	2,209					Visual	N	
						Bonneville Dam Totals RM 143+50 to DAM	**2,209**	**2,209**	**0**	**0**	**0**	**0**			
						VTD Totals	**96,312**	**96,312**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**96,312**								
PORTLAND / VANCOUVER ANCHORAGES															
AUGUST - 2022	-43	-44	YAQUINA	HOPPER	Anchorage A	O-100.4-IW	1,907	1,907					Visual/Instrument	N	
						Portland/Vancouver Anchorages Totals	**1,907**	**1,907**	**0**	**0**	**0**	**0**			
						Total CY Dredged Portland/Vancouver Anchorages	**1,907**								
SIDE CHANNELS															
SEPTEMBER - 2022	-16	-18	HEIDI RENEE	CLAMSHELL	Baker Bay	W-4.8-IW & O-3.2-IW	35,018	35,018					Visual	N	
OCTOBER - 2022	-16	-18	HEIDI RENEE	CLAMSHELL	Baker Bay	W-4.8-IW & O-3.2-IW	43,404	43,404					Visual	N	
						Baker Bay Totals	**78,422**	**78,422**	**0**	**0**	**0**	**0**			
NOVEMBER/DECEMBER - 2022	-10	-12	PATRIOT	CLAMSHELL	Chinook	W-4.8-IW & AREA D	96,674	96,674					Visual/Instrument	N	
						Chinook Totals	**96,674**	**96,674**	**0**	**0**	**0**	**0**			
OCTOBER - 2022	-10	-11	HEIDI RENEE	CLAMSHELL	Wahkiakum Ferry Crossing	O-33.0-SW	18,073	18,073					Visual	N	
						Wahkiakum Ferry Crossing Totals	**18,073**	**18,073**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMEBER - 2022	-9	-10	HEIDI RENEE	CLAMSHELL	Old Mouth Cowlitz	W-56.0-IW	15,709	15,709					Visual	N	
						Old Mouth Cowlitz Totals	**15,709**	**15,709**	**0**	**0**	**0**	**0**			
OCTOBER - DECEMBER - 2022	-20	-21	SEA HORSE	CLAMSHELL	Oregon Slough	O-90.5-IW, W-90.9-IW, O-91.1-SW, W-91.3-IW, O-94.9-SW, O-95.4-SW, O-95.5-IW, O-95.9-IW, W-96.0-IW	291,593	291,593					Visual/Instrument	N	
						Oregon Slough Totals	**291,593**	**291,593**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMBER - 2022	-14/-15/-16	-15/-16/-17	PATRIOT	CLAMSHELL	Skipanon	O-9.2-IW, W-10.2-IW	73,137	73,137					Visual/Instrument	N	
						Skipanon Totals	**73,137**	**73,137**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**573,608**	**573,608**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**573,608**								

COLUMBIA RIVER FNC O&M --- 401 REPORTING --- CALENDAR YEAR 2023

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
MOUTH OF THE COLUMBIA RIVER															
AUGUST/SEPTEMBER - 2023	**-48/-55**	**-53/-60**	ESSAYONS	HOPPER	**Quads 2, 3, 4**	DWS, NHS, SJS, SWS	1,088,153		208,087			880,066	Visual	N	
SEPTEMBER - 2023	**-48/-55**	**-53/-60**	BAYPORT	HOPPER	**Quads 3, 4**	DWS, NJS, SWS	968,193		179,628			788,565	Visual	N	
OCTOBER - 2023	**-48/-55**	**-53/-60**	ESSAYONS	HOPPER	**Quads 2, 3, 4**	DWS, NHS, SWS	432,049		186,443			245,606	Visual	N	
OCTOBER - 2023	**-55**	**-60**	BAYPORT	HOPPER	**Quad 3**	SWS, DWS	251,015		90,974			160,041	Visual	N	
						MCR Totals RM -02-00 to 02+00	**2,739,410**	**0**	**665,132**	**0**	**0**	**2,074,278**			
						Total Dredged MCR	**2,739,410**								
COLUMBIA RIVER AND LOWER WILLAMETTE															
SEPTEMBER - 2023	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Desdemona**	W-4.5-IW	60,504	60,504					Visual	N	
OCTOBER - 2023	**-43**	**-45**	ESSAYONS	HOPPER	**Upper Desdemona**	W-6.9-IW	5,023	5,023					Visual	N	
						Upper Desdemona Bar Totals RM 06+22 to 10+00	**65,527**	**65,527**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2023	**-46**		BAYPORT	HOPPER	**Flavel Bar**	W-8.0-IW, W-8.6-IW, W-4.3-IW	146,718	146,718					Visual	N	
JULY/AUGUST - 2023	**-45**	**-46**	SEA HORSE	CLAMSHELL	**Astoria Turning Basin**	W-3.9-IW	40,352	40,352					Visual	N	
						Flavel Bar Totals RM 10+00 to 13+30	**187,070**	**187,070**	**0**	**0**	**0**	**0**			
OCTOBER - 2023	**-43**	**-44**	ESSAYONS	HOPPER	**Upper Sands**	W-4.3-IW	53,555	53,555					Visual	N	
OCTOBER - 2023	**-44**	**-45**	BAYPORT	HOPPER	**Upper Sands**	W-7.1-IW, W-4.9-IW	82,614	82,614					Visual	N	
						Upper Sands Totals RM 13+30 to 17+28	**136,169**	**136,169**	**0**	**0**	**0**	**0**			
AUGUST - 2023	**-47**	**-48**	DREDGE OR	PIPELINE	**Tongue Point**	Rice Island (W-21.0-BN)	138,554				138,554		Visual	N	
AUGUST/SEPTEMBER - 2023	**-44**	**-45**	BAYPORT	HOPPER	**Tongue Point**	W-4.9-IW, W-7.5-IW, W-20.5-IW	79,069	79,069					Visual	N	
						Tongue Point Crossing Totals RM 17+28 to 21+20	**217,623**	**79,069**	**0**	**0**	**138,554**	**0**			
AUGUST - 2023	**-46**	**-47**	BAYPORT	HOPPER	**Miller Sands**	W-20.5-IW, W-21.4-IW, W-21.5-IW	58,192	58,192					Visual	N	
SEPTEMBER - 2023	**-43**	**-46**	ESSAYONS	HOPPER	**Miller Sands**	W-6.9-IW, W-4.5-IW	15,198	15,198					Visual	N	
OCTOBER - 2023	**-43**	**-46**	ESSAYONS	HOPPER	**Miller Sands**	W-6.9-IW, W-4.5-IW	41,863	41,863					Visual	N	
JUNE/JULY - 2023	**-47**	**-48**	DREDGE OR	PIPELINE	**Miller Sands**	Miller Sands Island (O-23.5-BN)	155,737				155,737		Visual	N	
JULY/AUGUST - 2023	**-47**	**-48**	DREDGE OR	PIPELINE	**Miller Sands**	W-23.9-IW, Rice Island (W-21.0-BN)	351,457	219,895			131,562		Visual	N	
						Miller Sands Totals RM 21+20 to 24+35	**622,447**	**335,148**	**0**	**0**	**287,299**	**0**			
APRIL/MAY - 2023	**-43**	**-47**	ESSAYONS	HOPPER	**Miller / Pillar**	W-24.1-IW	65,691	65,691					Visual	N	
AUGUST - 2023	**-46**	**-47**	BAYPORT	HOPPER	**Miller / Pillar**	W-4.6-IW, W-4.4-IW, W-29.8-IW, W-7.5-IW, W-24.2-IW, W-23.9-IW, W-29.7-IW, W-20.5-IW, W-21.5-IW	200,542	200,542					Visual	N	
						Miller / Pillar Totals RM 24+35 to 26+20	**266,233**	**266,233**	**0**	**0**	**0**	**0**			
JULY - 2023	**-43**	**-46**	ESSAYONS	HOPPER	**Pillar Rock**	O-27.6-IW	3,144	3,144					Visual	N	
OCTOBER - 2023	**-43**	**-47**	ESSAYONS	HOPPER	**Pillar Rock**	O-28.4-RH (REHANDLE)	39,305	39,305					Visual	N	
						Pillar Rock Ranges Totals RM 26+20 to 28+45	**42,449**	**42,449**	**0**	**0**	**0**	**0**			
AUGUST/SEPTEMBER - 2023	**-42**	**-43**	DREDGE OR	PIPELINE	**Pillar Transfer Site O-28.4-IW-T**	Pillar Rock Island (O-27.2-BN)	356,525				356,525		Visual	N	
						O-28.4-IW-T Pillar Transfer Site Totals	**356,525**	**0**	**0**	**0**	**356,525**	**0**			
NOVEMBER - 2023	**-43**	**-45**	YAQUINA	HOPPER	**Brookfield/Skamokawa**	W-29.8-IW	15,113	15,113					Visual	N	
						Brookfield Welch Totals RM 28+45 to 32+30	**15,113**	**15,113**	**0**	**0**	**0**	**0**			
APRIL - 2023	**-45**	**-46**	YAQUINA	HOPPER	**Skamokawa Bar**	O-34.0-SW	23,004	23,004					Visual	N	
JULY - 2023	**-43**	**-45**	ESSAYONS	HOPPER	**Skamokawa Bar**	W-32.1-IW	2,040	2,040					Visual	N	
JULY/AUGUST - 2023	**-46**	**-47**	BAYPORT	HOPPER	**Skamokawa Bar**	O-34.1-IW, W-26.4-IW, O-34.0-IW, W-29.8-IW, W-26.6-IW, W-29.7-IW, O-27.6-IW, W-35.3-IW, W-40.7-IW	262,400	262,400					Visual	N	
						Skamokawa Bar Totals RM 32+30 to 36+31	**287,444**	**287,444**	**0**	**0**	**0**	**0**			
APRIL - 2023	**-43**	**-45**	YAQUINA	HOPPER	**Puget Island**	O-36.3-SW	23,102	23,102					Visual	N	
JULY - 2023	**-45**	**-46**	BAYPORT	HOPPER	**Puget Island**	W-35.3-IW, W-36.5-IW, W-36.1-IW, W-35.7-IW	107,949	107,949					Visual	N	
OCTOBER/NOVEMEBER - 202	**-43**	**-46**	ESSAYONS	HOPPER	**Puget Island**	O-28.4-RH (REHANDLE)	97,215	97,215					Visual	N	
						Puget Island Totals RM 36+31 to 40+40	**228,266**	**228,266**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 REPORTING --- CALENDAR YEAR 2023

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
APRIL - 2023	-43	-45	YAQUINA	HOPPER	**Wauna Driscoll**	O-39.5-FL, W-44.6-SW	29,900	29,900					Visual	N	
JULY - 2023	-45	-46	BAYPORT	HOPPER	**Wauna Driscoll**	W-30.1-IW, W-31.2-IW, W-31.6-IW, W-31.4-IW	76,602	76,602					Visual	N	
NOVEMBER - 2023	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-31.3-IW	19,966	19,966					Visual	N	
NOVEMBER - 2023	-43	-45	ESSAYONS	HOPPER	**Wauna Driscoll**	W-44.5-RH (REHANDLE)	1,359	1,359					Visual	N	
NOVEMBER - 2023	-43	-46	YAQUINA	HOPPER	**Wauna Driscoll**	W-44.5-RH (REHANDLE)	25,358	25,358					Visual	N	
						Wauna Driscoll Totals RM 40+40 to 44+27	**153,185**	**153,185**	**0**	**0**	**0**	**0**			
SEPTEMBER - 2023	-42	-43	DREDGE OR	PIPELINE	**Puget Is. Transfer Site W-44.5-IW-T**	James River (O-42.9-UP)	164,338			164,338			Visual	N	
OCTOBER - 2023	-42	-43	DREDGE OR	PIPELINE	**Puget Is. Transfer Site W-44.5-IW-T**	James River (O-42.9-UP)	164,996			164,996			Visual	N	
						W-44.5-IW-T Puget Is. Transfer Site Totals	**329,334**	**0**	**0**	**329,334**	**0**	**0**			
JULY - 2023	-45	-46	BAYPORT	HOPPER	**Wauna/Westport**	O-27.6-IW, W-40.7-IW, O-39.9-IW, O-34.1-IW	59,684	59,684					Visual	N	
						Westport Bar Totals RM 44+27 to 46+25	**59,684**	**59,684**	**0**	**0**	**0**	**0**			
APRIL - 2023	-43	-46	ESSAYONS	HOPPER	**Westport / Eureka**	W-31.3-IW	36,466	36,466					Visual	N	
JULY - 2023	-43	-44	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	9,438	9,438					Visual	N	
JULY - 2023	-45	-46	BAYPORT	HOPPER	**Westport / Eureka**	O-34.1-IW	7,647	7,647					Visual	N	
						W-44.5-RH (REHANDLE)	141,914	141,914					Visual	N	
OCTOBER/NOVEMEBER - 202	-43	-47	ESSAYONS	HOPPER	**Westport / Eureka**	W-44.5-RH (REHANDLE)	178,937	178,937					Visual	N	
						Westport / Eureka Totals RM 46+25 to 49+00	**374,402**	**374,402**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-45/-46	ESSAYONS	HOPPER	**Eureka / Gull**	W-44.5-RH (REHANDLE)	15,117	15,117					Visual	N	
NOVEMBER - 2023	-43	-46	ESSAYONS	HOPPER	**Eureka / Gull**	W-44.5-RH (REHANDLE)	24,894	24,894					Visual	N	
						Eureka Bar Totals RM 49+00 to 51+45	**40,011**	**40,011**	**0**	**0**	**0**	**0**			
JULY - 2023	-46	-47	BAYPORT	HOPPER	**Gull Island**	O-52.1-IW	50,562	50,562					Visual	N	
						Gull Is. Totals RM 51+45 to 55+30	**50,562**	**50,562**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-45/-46	ESSAYONS	HOPPER	**Stella-Fisher**	W-55.9-FL	20,806	20,806					Visual	N	
NOVEMBER - 2023	-43	-45	ESSAYONS	HOPPER	**Stella-Fisher**	O-69.6-RH (REHANDLE)	2,054	2,054					Visual	N	
						Stella Fisher Bar Totals RM 55+30 to 57+30	**22,860**	**22,860**	**0**	**0**	**0**	**0**			
APRIL - 2023	-43	-46	YAQUINA	HOPPER	**Stella / Walker**	O-58.7-SW	7,905	7,905					Visual	N	
JULY - 2023	-46	-47	BAYPORT	HOPPER	**Stella / Walker**	O-52.7-IW, O-59.8-IW, W-53.1-IW, W-53.8-IW, W-54.5-IW	120,347	120,347					Visual	N	
NOVEMBER - 2023	-43	-47	ESSAYONS	HOPPER	**Stella / Walker**	O-69.6-RH (REHANDLE)	87,399	87,399					Visual	N	
						Stella / Walker Totals RM 57+30 to 59+30	**215,651**	**215,651**	**0**	**0**	**0**	**0**			
JULY - 2023	-46	-47	BAYPORT	HOPPER	**Walker Is. Reach**	W-53.8-IW, W-54.5-IW	78,773	78,773					Visual	N	
NOVEMBER - 2023	-43	-46	ESSAYONS	HOPPER	**Walker Is. Reach**	O-69.6-RH (REHANDLE)	38,444	38,444					Visual	N	
						Walker Is. Bar Totals RM 59+30 to 63+10	**117,217**	**117,217**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMBER - 2023	-42	-43	SEA HORSE	CLAMSHELL	**Transfer Site W-60.9-IW-T**	O-56.7-IW, O-57.0-IW	115,767	115,767					Visual	N	
						W-60.9-IW-T Transfer Site Totals	**115,767**	**115,767**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-45/-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-61.3-IW, O-59.4-IW	26,097	26,097					Visual	N	
NOVEMBER - 2023	-43	-46	ESSAYONS	HOPPER	**Slaughters Bar**	O-69.6-RH (REHANDLE)	59,469	59,469					Visual	N	
						Slaughters Bar Totals RM 63+10 to 66+00	**85,566**	**85,566**	**0**	**0**	**0**	**0**			
MARCH/APRIL - 2023	-43	-46	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-59.7-IW, O-62.6-IW, W-60.0-IW, W-31.3-IW	57,599	57,599					Visual	N	
JUNE/JULY - 2023	-46	-47	BAYPORT	HOPPER	**Slaughters / Lower Dobelbower**	O-62.2-IW, O-62.9-IW, O-59.8-IW, O-52.7-IW	141,447	141,447					Visual	N	
NOVEMBER - 2023	-43	-47	ESSAYONS	HOPPER	**Slaughters / Lower Dobelbower**	O-69.6-RH (REHANDLE)	68,690	68,690					Visual	N	
NOVEMBER - 2023	-44	-45	SEA HORSE	CLAMSHELL	**Longview Turning Basin**	W-56.1-IW	3,094	3,094					Visual	N	
						Slaughters / Lower Dobelbower Totals RM 66+00 to 67+40	**270,830**	**270,830**	**0**	**0**	**0**	**0**			
OVEMEBER/DECEMBER - 202	-42	-43	DREDGE OR	PIPELINE	**Howard Is. Transfer Site O-69.6-IW-T**	Howard Island (W-68.7-UP)	251,019			251,019			Visual	N	
						O-69.6-IW-T Howard Island Transfer Site Totals	**251,019**	**0**	**0**	**251,019**	**0**	**0**			
JULY/AUGUST - 2023	-43	-45	YAQUINA	HOPPER	**Upper Dobelbower**	O-72.9-FL	23,315	23,315					Visual	N	
NOVEMBER - 2023	-43	-45	YAQUINA	HOPPER	**Upper Dobelbower**	O-72.9-FL	22,759	22,759					Visual	N	
						Upper Dobelbower Bar Totals RM 69+50 to 72+40	**46,074**	**46,074**	**0**	**0**	**0**	**0**			

COLUMBIA RIVER FNC O&M --- 401 REPORTING --- CALENDAR YEAR 2023

Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
JULY/AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Kalama Ranges	O-72.9-FL	36,295	36,295					Visual	N	
						Kalama Ranges Totals RM 72+40 to 75+10	**36,295**	**36,295**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-77.9-SW	25,336	25,336					Visual	N	
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Lower Martin Bar	O-77.9-SW	4,171	4,171					Visual	N	
NOVEMBER - 2023	-43	-45	YAQUINA	HOPPER	Kalama / Lower Martin Bar	O-81.0-RH (REHANDLE)	30,967	30,967					Visual	N	
						Kalama / Lower Martin Totals RM 75+10 to 77+30	**60,474**	**60,474**	**0**	**0**	**0**	**0**			
DECEMBER - 2023	-39	-40	DREDGE OR	PIPELINE	Lower Martin Transfer Site O-77.9-IW-T	Lower Deer Island (O-77.0-UP)	132,519			132,519			Visual	N	
						O-77.9-IW-T Martin Bar Transfer Site Totals	**132,519**	**0**	**0**	**132,519**	**0**	**0**			
JULY - 2023	-43	-44	ESSAYONS	HOPPER	Lower Martin / Upper Martin Bar	O-78.0-IW	18,998	18,998					Visual	N	
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Lower Martin / Upper Martin Bar	O-77.9-SW	26,337	26,337					Visual	N	
NOVEMBER - 2023	-43	-45	YAQUINA	HOPPER	Lower Martin / Upper Martin Bar	O-81.0-RH (REHANDLE)	22,846	22,846					Visual	N	
						O-80.6-SW	7,306	7,306					Visual	N	
						Lower / Upper Martin Is. Bar Totals RM 77+30 to 81+00	**75,487**	**75,487**	**0**	**0**	**0**	**0**			
OCTOBER/NOVEMBER - 2023	-34	-35	DREDGE OR	PIPELINE	Upper Martin Transfer Site O-81.1-IW-T	Martin Bar (W-82.0-UP)	164,527			164,527			Visual	N	
						O-81.1-IW-T Martin Bar Transfer Site Totals	**164,527**	**0**	**0**	**164,527**	**0**	**0**			
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-81.0-SW	27,290	27,290					Visual	N	
SEPTEMBER - 2023	-45	-46	YAQUINA	HOPPER	Upper Martin Bar	O-80.9-RH (REHANDLE)	52,153	52,153					Visual	N	
OCTOBER - 2023	-43	-45	YAQUINA	HOPPER	Upper Martin Bar	O-80.9-RH (REHANDLE)	5,141	5,141					Visual	N	
						Upper Martin Is. Bar Totals RM 81+00 to 83+44	**84,584**	**84,584**	**0**	**0**	**0**	**0**			
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-81.0-SW	9,847	9,847					Visual	N	
OCTOBER - 2023	-43	-46	YAQUINA	HOPPER	St. Helens Bar	O-82.3-SW	10,268	10,268					Visual	N	
NOVEMBER - 2023	-43	-45	YAQUINA	HOPPER	St. Helens Bar	O-82.3-SW	12,642	12,642					Visual	N	
						St. Helens Bar Totals RM 83+44 to 87+15	**32,757**	**32,757**	**0**	**0**	**0**	**0**			
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Warrior Rock	O-90.0-IW, O-88.7-IW	17,999	17,999					Visual	N	
						Warrior Rock Bar Totals RM 87+15 to 90+20	**17,999**	**17,999**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-44	ESSAYONS	HOPPER	Henrici Bar	O-90.0-IW	6,493	6,493					Visual	N	
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Henrici Bar	O-90.8-SW	26,432	26,432					Visual	N	
						Henrici Bar Totals RM 90+20 to 93+50	**32,925**	**32,925**	**0**	**0**	**0**	**0**			
JULY - 2023	-43	-44	ESSAYONS	HOPPER	Willow Bar	O-94.8-IW	12,917	12,917					Visual	N	
AUGUST - 2023	-43	-45	YAQUINA	HOPPER	Willow Bar	O-94.2-SW, O-95.8-SW	51,071	51,071					Visual	N	
NOVEMBER - 2023	-43	-45	YAQUINA	HOPPER	Willow Bar	O-95.8-SW	15,536	15,536					Visual	N	
						Willow Bar Totals RM 93+50 to 97+40	**79,524**	**79,524**	**0**	**0**	**0**	**0**			
MARCH - 2023	-43	-45	ESSAYONS	HOPPER	Lower Vancouver Bar	O-101.5-FL	24,608	24,608					Visual	N	
APRIL - 2023	-43	-45	YAQUINA	HOPPER	Lower Vancouver Bar	O-100.4-IW	548	548					Visual	N	
AUGUST - 2023	-43	-44	YAQUINA	HOPPER	Lower Vancouver Bar	O-101.5-FL	14,829	14,829					Visual	N	
AUGUST - 2023	-43	-44	YAQUINA	HOPPER	Kelley Pt Shoal	O-101.5-FL	2,992	2,992					Visual	N	
NOVEMBER - 2023	-44	-44.5	YAQUINA	HOPPER	Lower Vancouver Bar	O-102.5-FL	3,374	3,374					Visual	N	
						Lower Vancouver Bar Totals RM 101+18 to 104+30	**46,351**	**46,351**	**0**	**0**	**0**	**0**			

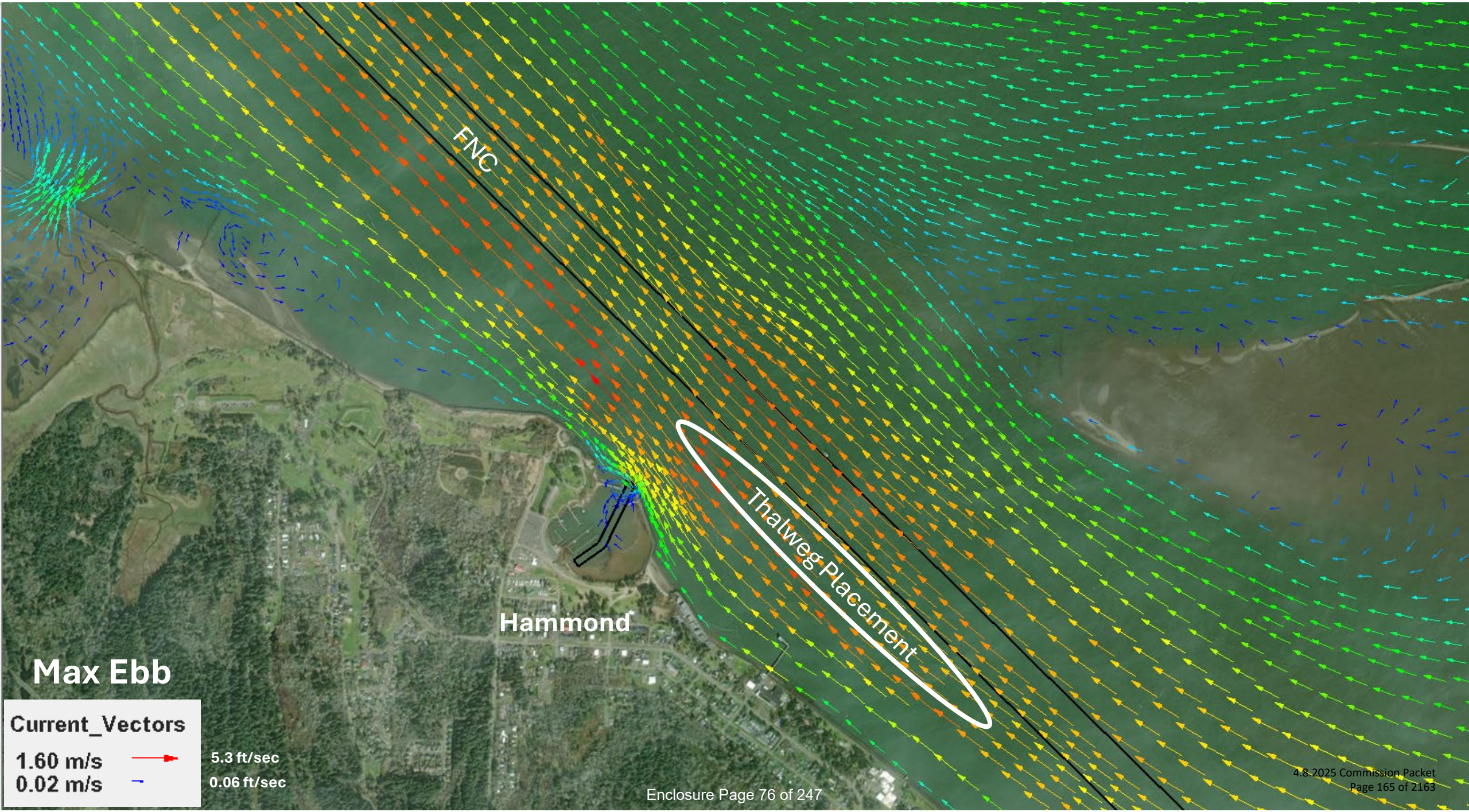
COLUMBIA RIVER FNC O&M --- 401 REPORTING --- CALENDAR YEAR 2023

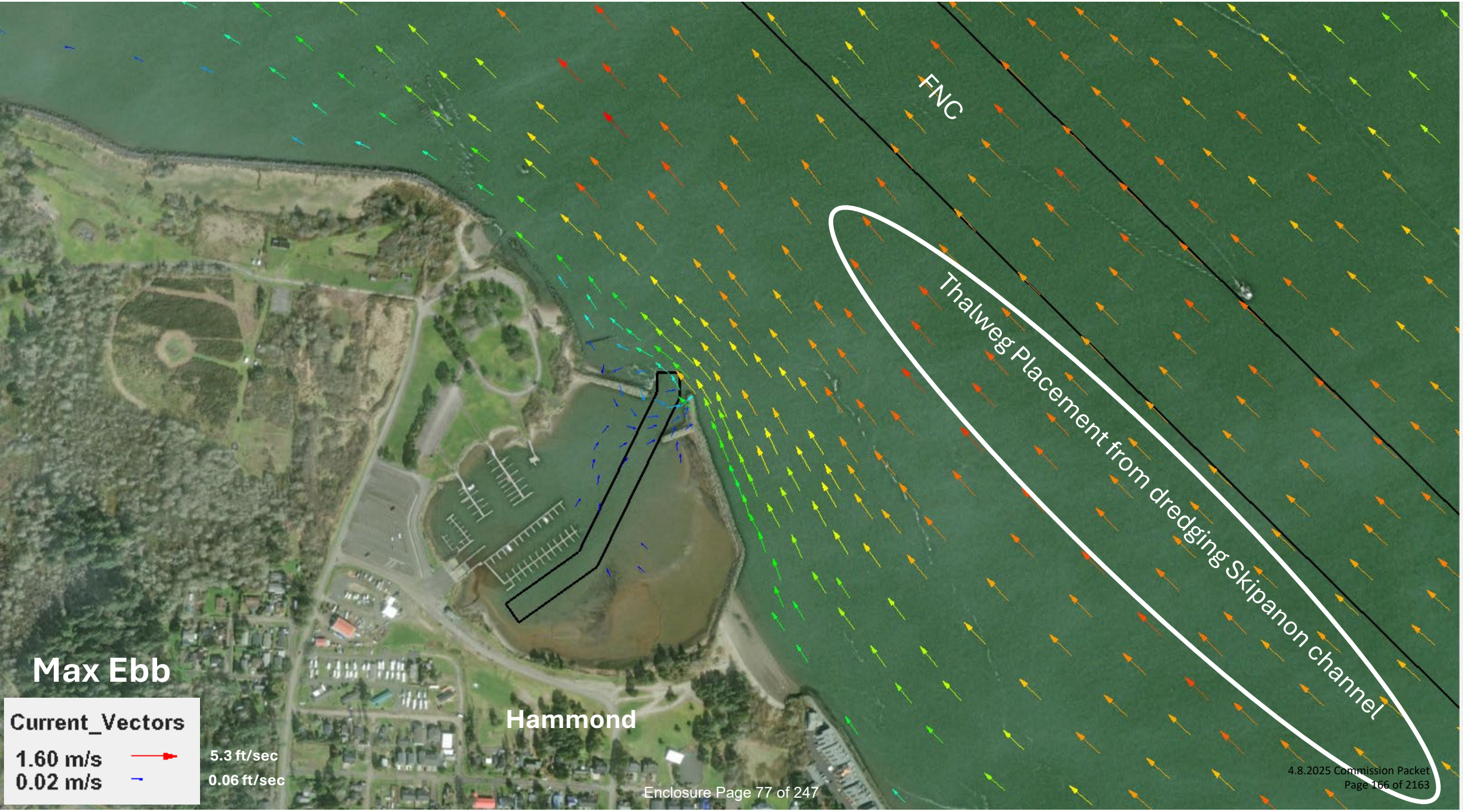
Month - Year	Project Depth (ft)	Adv. Maint. Depth (ft)	Dredge Name	Dredge Type	Dredging Location	Disposal Location	Dredged (CY)	In-Water/Flow Lane Disposal (CY)	Ocean Disposal (CY)	Upland Disposal (CY)	Beach Nourish (CY)	Littoral Zone (CY)	Water Quality Monitoring Method	Exceedance Yes (Y) or No (N)	Notes
JULY - 2023	-43	-45	ESSAYONS	HOPPER	Vancouver Turning Basin	O-101.5-FL	18,963	18,963					Visual	N	
AUGUST - 2023	-43	-44	YAQUINA	HOPPER	Vancouver Turning Basin	W-101.6-IW, O-102.5-FL	41,308	41,308					Visual	N	
OCTOBER/NOVEMEBER - 202	-44	-44.5	YAQUINA	HOPPER	Vancouver Turning Basin	W-101.2-FL, O-102.5-FL	45,149	45,149					Visual	N	
						Vancouver Turning Basin Totals RM 104+30 to 105+30	**105,420**	**105,420**	**0**	**0**	**0**	**0**			
						C&LW TOTALS	**5,425,890**	**3,766,113**	**0**	**877,399**	**782,378**	**0**			
						Total Dredged C&LW	**5,425,890**								
VANCOUVER TO THE DALLES															
AUGUST - 2023	-17	-18	YAQUINA	HOPPER	Upper Vancouver Bar	O-109.6-SW	22,446	22,446					Visual	N	
						Upper Vancouver Bar Totals RM 106+24 to 110+10	**22,446**	**22,446**	**0**	**0**	**0**	**0**			
AUGUST - 2023	-17	-18	YAQUINA	HOPPER	Airport Bar / Government Island	W-111.9-SW, W-112.4-SW	36,417	36,417					Visual	N	
						Airport / Government Totals RM 113+00 to 114+10	**36,417**	**36,417**	**0**	**0**	**0**	**0**			
AUGUST - 2023	-17	-18	YAQUINA	HOPPER	Fashion Reef	O-135.8-IW, W-132.5-FL, W-135.3-IW	20,722	20,722					Visual	N	
						Fashion Reef Totals RM 132+30 to 136+30	**20,722**	**20,722**	**0**	**0**	**0**	**0**			
						VTD Totals	**79,585**	**79,585**	**0**	**0**	**0**	**0**			
						Total CY Dredged VTD	**79,585**								
SIDE CHANNELS															
AUGUST - 2023	-16/-17	-18	SEA HORSE	CLAMSHELL	Baker Bay	W-4.8-IW, O-3.2-IW	75,535	75,535					Visual/Instrument	N	
						Baker Bay Totals	**75,535**	**75,535**	**0**	**0**	**0**	**0**			
AUGUST/SEPTEMBER - 2023	-34	-35	PATRIOT	CLAMSHELL	Tongue Point Access Channel	W-5.9-IW, W-5.2-IW, W-3.2-FL	419,668	419,668					Visual/Instrument	N	
OCTOBER - 2023	-34	-35	PATRIOT	CLAMSHELL	Tongue Point Access Channel	W-3.2-FL, O-6.0-IW	195,175	195,175					Visual/Instrument	N	
						Tongue Point Totals	**614,843**	**614,843**	**0**	**0**	**0**	**0**			
OCTOBER - 2023	-9	-10	SEA HORSE	CLAMSHELL	Old Mouth Cowlitz	W-56.1-IW	6,607	6,607					Visual/Instrument	N	
						Old Mouth Cowlitz Totals	**6,607**	**6,607**	**0**	**0**	**0**	**0**			
						Side Channels Totals	**696,985**	**696,985**	**0**	**0**	**0**	**0**			
						Total CY Dredged Side Channels	**696,985**								

USACE Adaptive Hydraulics model results

MAX Ebb Currents

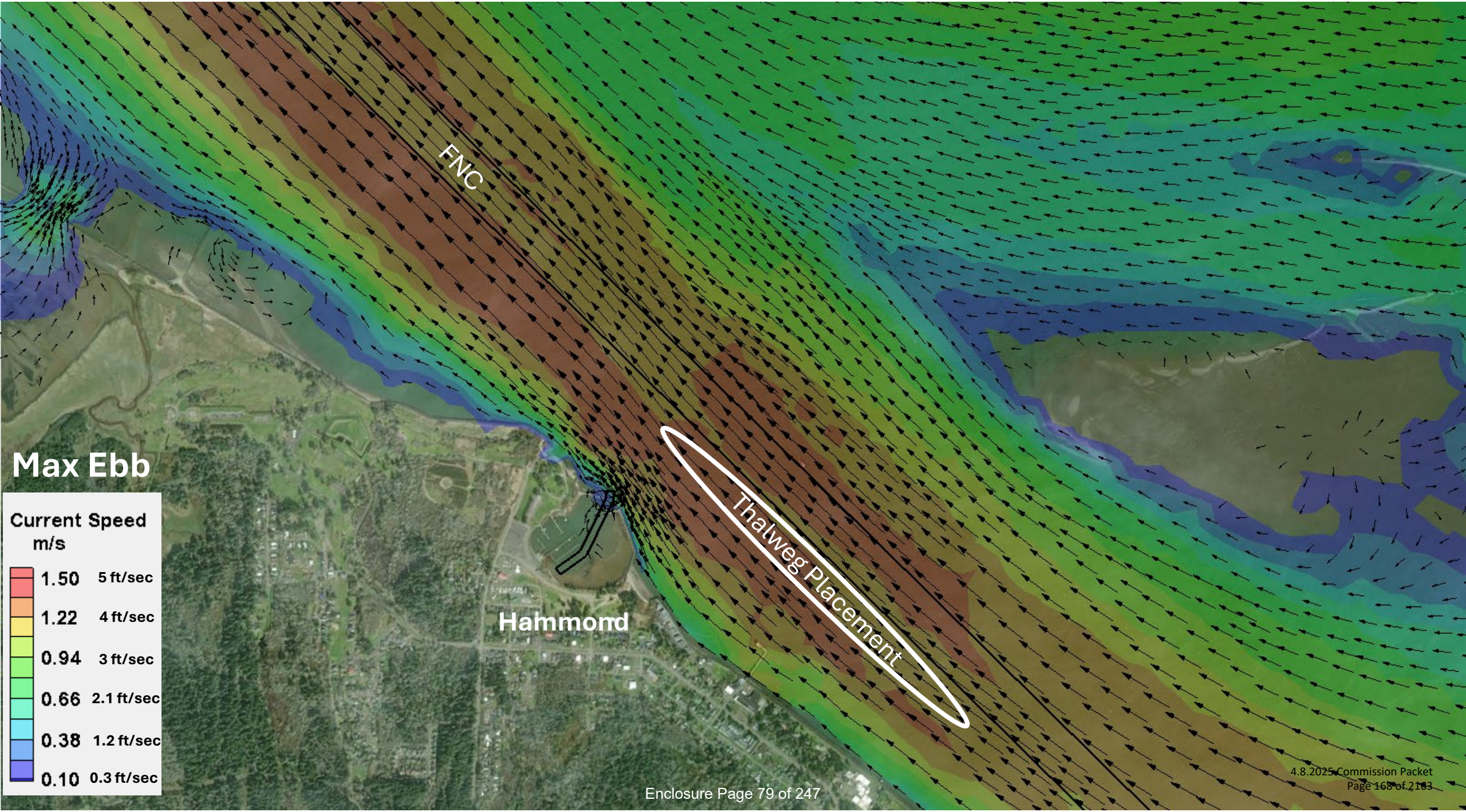
Visual Option 1 – Velocity Vectors Colored by Magnitude

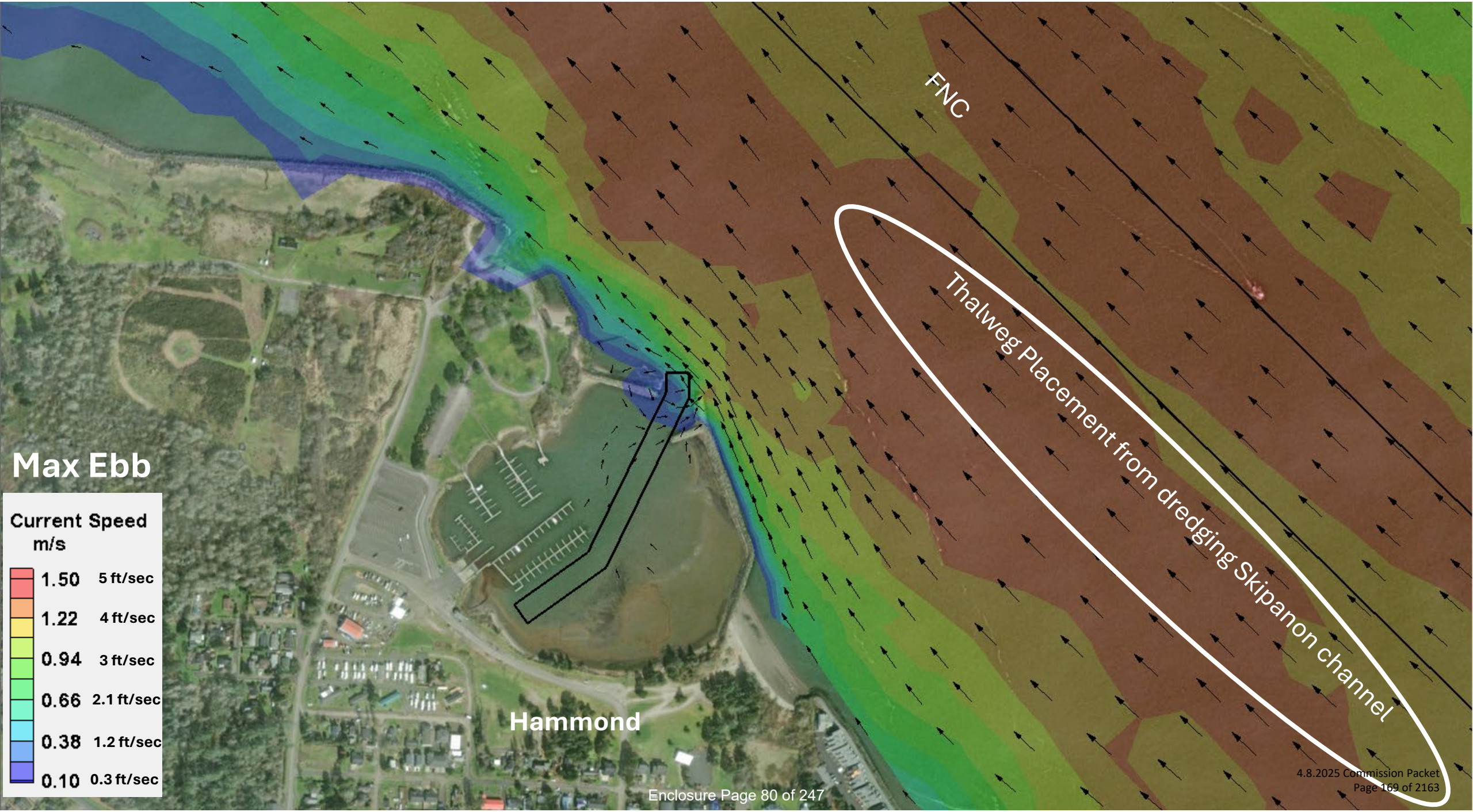

FNC
Thalweg Placement
Hammond
Max Ebb
Current_Vectors
1.60 m/s
0.02 m/s
5.3 ft/sec
0.06 ft/sec


FNC
Thalweg Placement from dredging Skipanon channel
Max Ebb
Current_Vectors
1.60 m/s
0.02 m/s
5.3 ft/sec
0.06 ft/sec
Hammond

MAX Ebb Currents

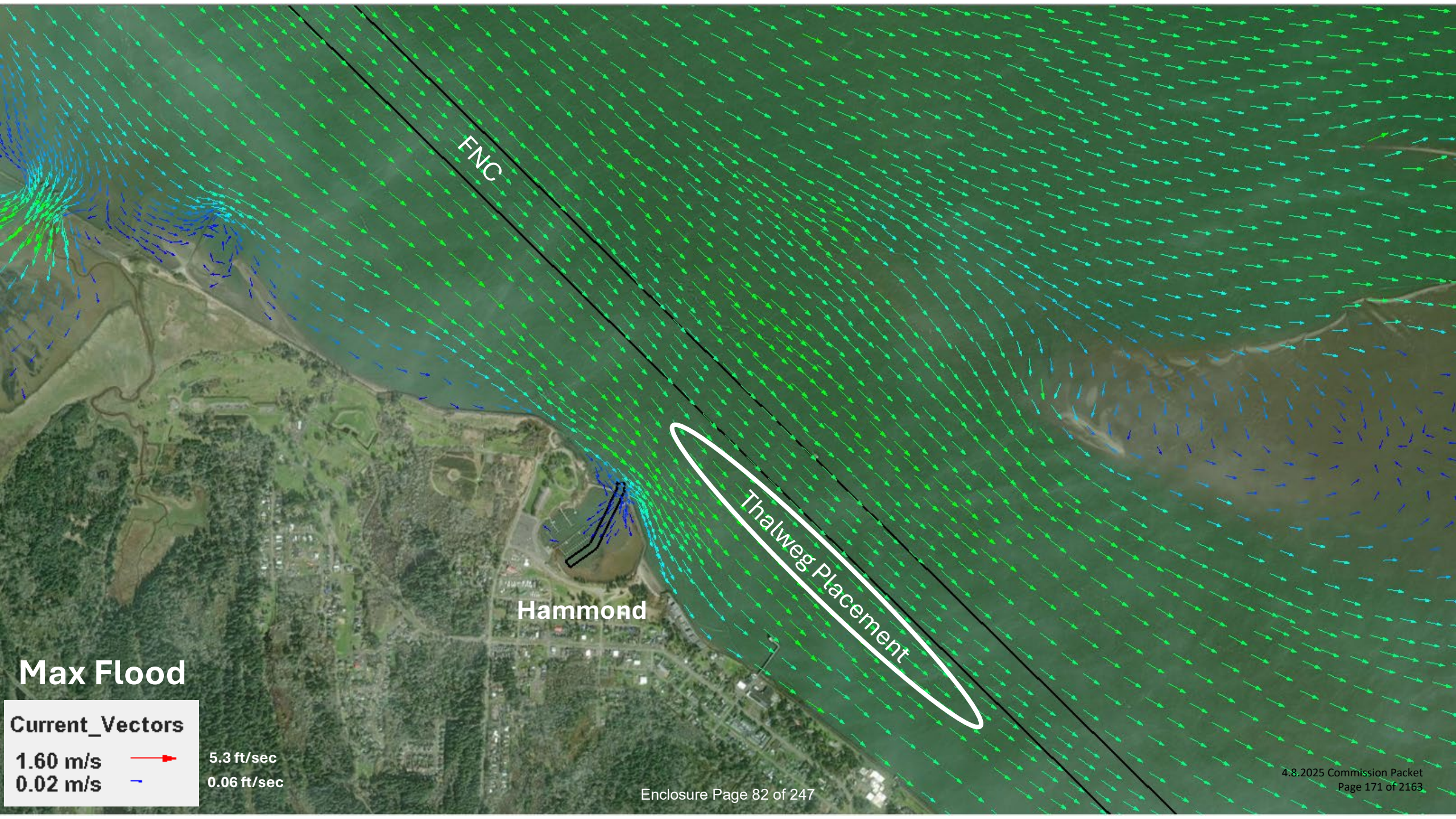
Visual Option 2 – Velocity Areas Colored by Magnitude

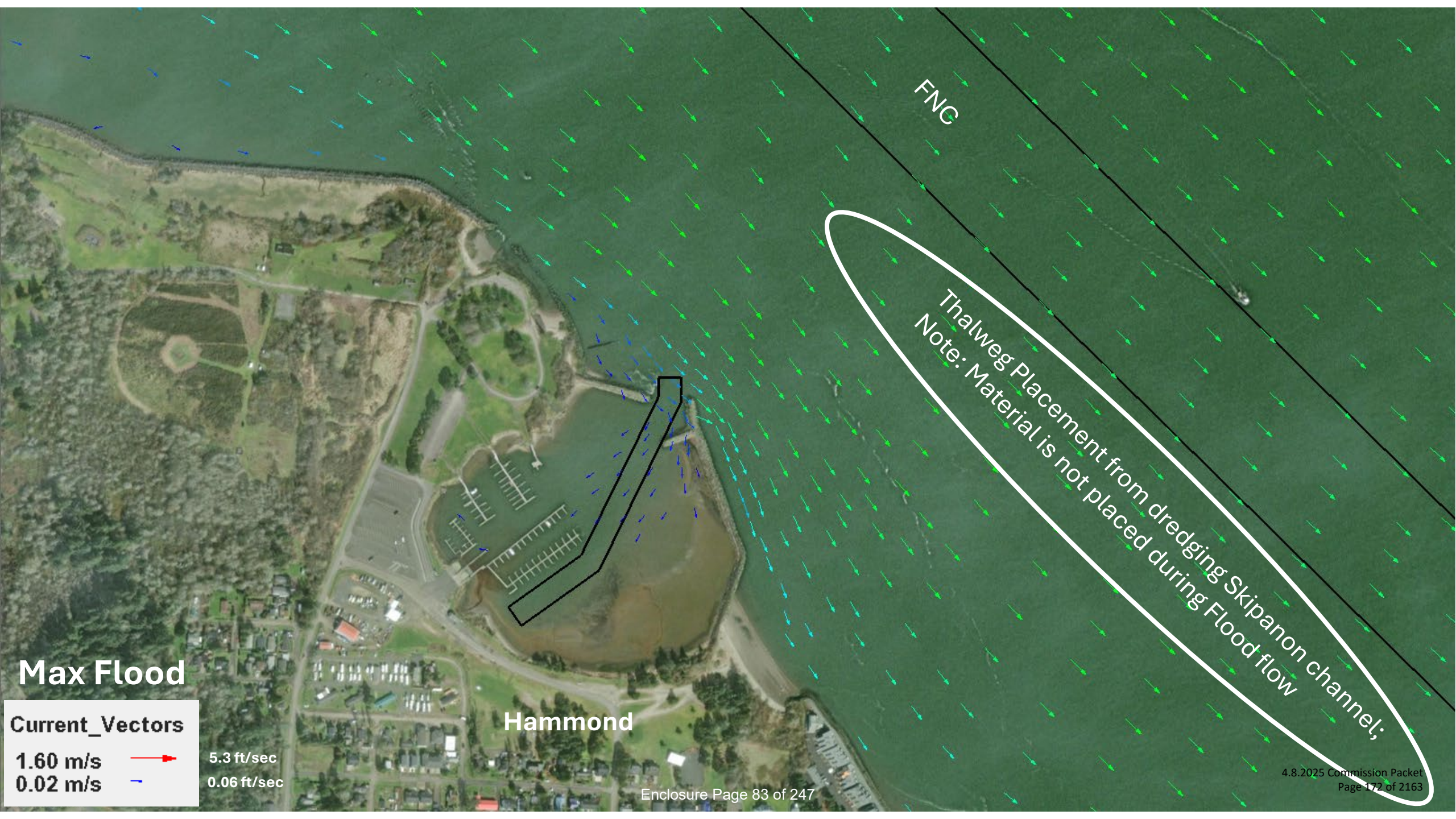

FNC
Thalweg Placement
Hammond
Max Ebb
Current Speed
m/s
1.50 5 ft/sec
1.22 4 ft/sec
0.94 3 ft/sec
0.66 2.1 ft/sec
0.38 1.2 ft/sec
0.10 0.3 ft/sec


FNC
Thalweg Placement from dredging Skipanon channel
Hammond
Max Ebb
Current Speed
m/s
1.50 5 ft/sec
1.22 4 ft/sec
0.94 3 ft/sec
0.66 2.1 ft/sec
0.38 1.2 ft/sec
0.10 0.3 ft/sec

MAX Flood Currents

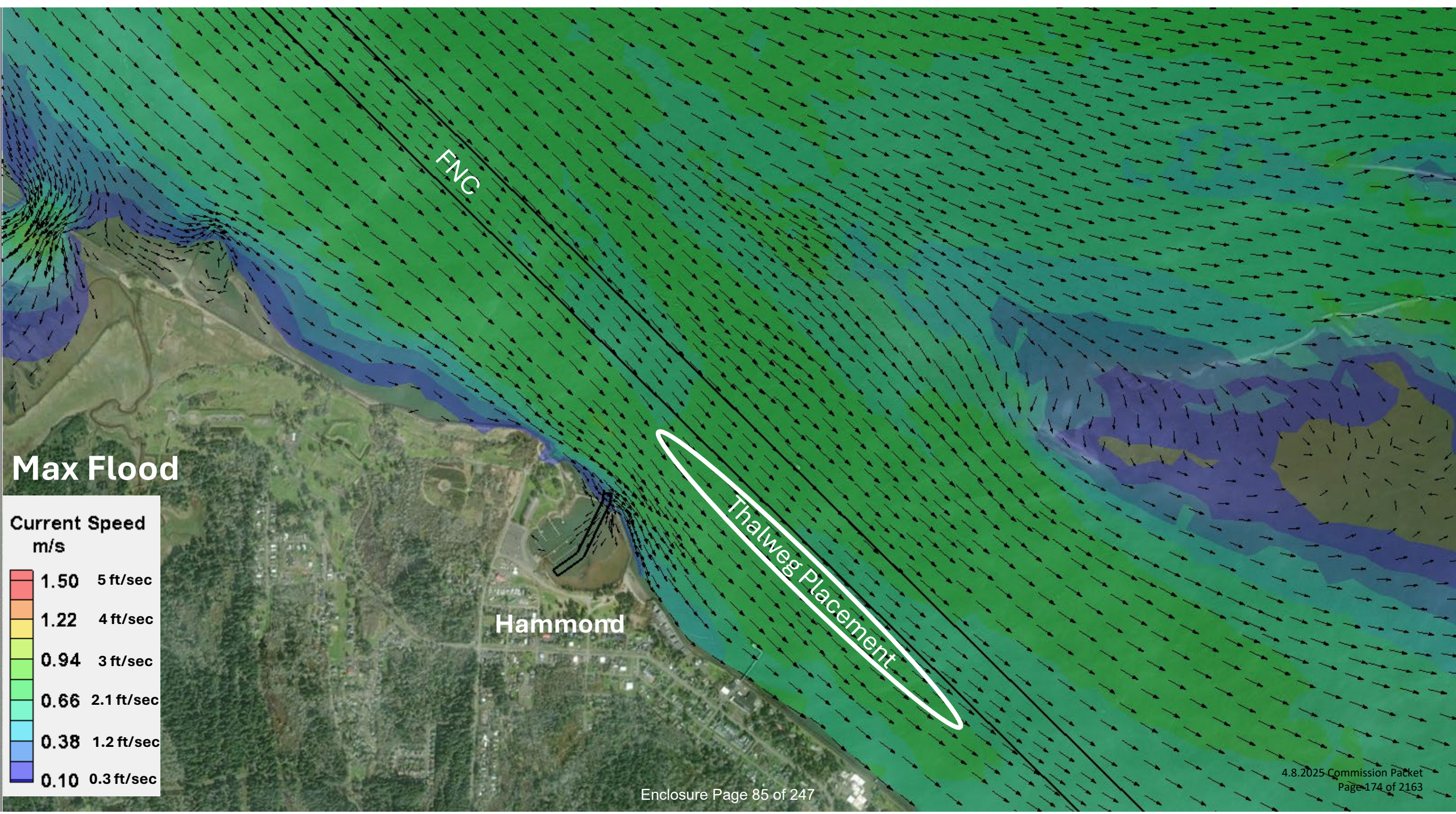
Visual Option 1 – Velocity Vectors Colored by Magnitude

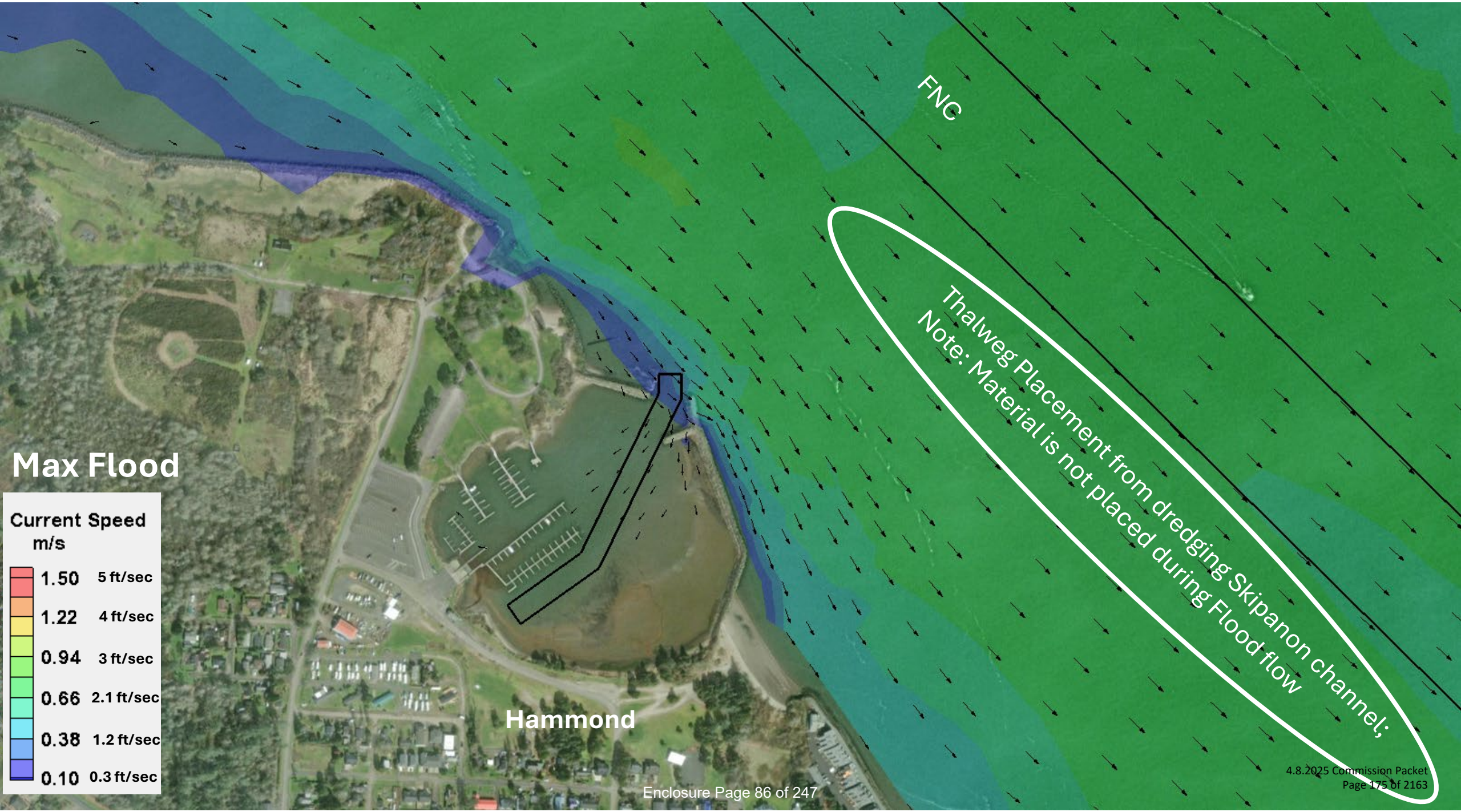

FNC
Thalweg Placement
Hammond
Max Flood
Current_Vectors
1.60 m/s
0.02 m/s
5.3 ft/sec
0.06 ft/sec


FNC
Thalweg Placement from dredging Skipanon channel;
Note: Material is not placed during Flood flow
Max Flood
Current_Vectors
1.60 m/s
0.02 m/s
5.3 ft/sec
0.06 ft/sec
Hammond

MAX Flood Currents

Visual Option 2 – Velocity Areas Colored by Magnitude


FNC
Thalweg Placement
Hammond
Max Flood
Current Speed
m/s
1.50 5 ft/sec
1.22 4 ft/sec
0.94 3 ft/sec
0.66 2.1 ft/sec
0.38 1.2 ft/sec
0.10 0.3 ft/sec


FNC
Thalweg Placement from dredging Skipanon channel;
Note: Material is not placed during Flood flow
Max Flood
Current Speed
m/s
1.50 5 ft/sec
1.22 4 ft/sec
0.94 3 ft/sec
0.66 2.1 ft/sec
0.38 1.2 ft/sec
0.10 0.3 ft/sec
Hammond

USACE
Bank Protection
Pile Dikes Oregon
River Mile 9

Design
Memorandums:
1963, 1985

DESIGN MEMORANDUM

LOWER COLUMBIA RIVER
BANK PROTECTION
OREGON AND WASHINGTON

PORT OF ASTORIA, OREGON

TANSY POINT LOCATION

SOILS ENGINEERING
RECORD COPY
18

SOILS SECTION

Prepared By
U. S. Army Engineer District, Portland
Corps of Engineers

MARCH 1963

Scanned
Date: July 2022
File: 000384

4-03. QUARRIED EMBANKMENT. - a. General. - No borrow area will be designated but the quarried embankment may be obtained from any approved source. Rights-of-way for borrow areas and access thereto shall be obtained by the Contractor at his expense, and copies of all rights-of-way agreements shall be furnished the Contracting Officer. The material shall consist of stone or broken concrete from excavation, granular material from quarry waste, or bank-run gravel with at least 50 percent of the material larger than 1/2 inch size, with no more than 10 percent of the material passing a No. 200 screen.

At end of para. 506a.

The quality of the dike stone shall be as specified for stone protect in paragraph 4-02b.

NPDEN-GS (29 Mar 63) 3rd Ind
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection and Pile Dike Construction in the Vicinity of Tansy Point, Oregon.

U. S. Army Engr Div, North Pacific, Portland, Oregon 20 May 1963

TO: District Engineer, U. S. Army Engr Dist, Portland

Design Memorandum modified in accordance with preceding Indorsement is satisfactory.

FOR THE ACTING DIVISION ENGINEER:

GORDON H. FERNALD, Jr.
Chief, Engineering Division

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
628 PITTOCK BLOCK
PORTLAND 5, OREGON

NPPEN-PR-8 29 March 1963

SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection and Pile Dike Construction in the Vicinity of Tansy Point, Oregon

TO: Division Engineer
U. S. Army Engineer Division, North Pacific

1. Inclosed are eight copies of the design memorandum outlining the proposed bank protection and pile dike construction project near Tansy Point, Oregon.

2. Provision of assured protection along the Warrenton-Hammond reach would require construction of 1,744 linear feet of bank protection and 1,098 linear feet of pile dikes. The estimated capital cost of this work is $466,500. Based on accepted practice for pile dike construction along lower Columbia River, an initial contract is proposed for award on or before 17 June 1963 for the construction of 1,744 linear feet of revetment and 663 linear feet of pile dikes along the left bank near Tansy Point. This work, it is believed, will reduce channel scour and prevent further damage to existing industries. The estimated capital cost of the initial contract is $283,500. If this system proves unsatisfactory, two additional pile dikes will be added as indicated by model studies.

3. Approval of the design memorandum is recommended. In view of the urgency of this project, approval is requested for advertising concurrently with your review of the plans and specifications.

1 Incl. (Octo)
Design Memorandum

STERLING K. EISIMINGER
Colonel, Corps of Engineers
District Engineer

NPDEN-CS (29 Mar 63) 1st Ind
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection and Pile Dike Construction in the Vicinity of Tansy Point, Oregon

U. S. Army Engr Div, North Pacific, Portland, Oregon, 2 May 1963

TO: District Engineer, U. S. Army Engr Dist, Portland

Design Memorandum for the subject work is approved subject to the following comments:

a. The pile dike structures proposed for construction are in an area of severe and repeated wave attack. The structure, using walers and tie rods, may require costly maintenance as a result of rocking due to wave action. In lieu of design presented, it is suggested a structure utilizing a 3 or 4 pile cluster, securely wrapped with wire rope and driven to essentially the same ground line pattern as now shown, be investigated. Cable wrapped pile clusters are used extensively on the Missouri and Arkansas Rivers.

b. If the predominant and higher velocities at ends of pile dikes occur on a flood tide, the dike stone end blanket shown on Plate 4 should be reversed.

FOR THE ACTING DIVISION ENGINEER:

Incl wd

RAYMOND E. HOLE
Ass't. Chief, Engineering Division

NPPEN-PR-8 (29 Mar 63) 2nd Ind.
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection and Pile Dike Construction in the Vicinity of Tansy Point, Oregon

U. S. Army Engineer District, Portland, Portland, Oregon, 16 May 1963

TO: Division Engineer, U. S. Army Engineer Division, North Pacific

Modifications recommended in 1st Indorsement are discussed or complied with as follows:

a. The use of 3 or 4 pile clusters wrapped with wire rope was considered. However, after a telephone conversation with personnel of the Kansas City District, the proposal was dropped. Kansas City District engineers report that they have abandoned the suggested design because of maintenance and operational deficiencies and are now using rock groins.

b. It is realized that at certain river stages ebb tides could become predominant. Therefore, the design of the dike stone cap and the dike end blanket was revised and made symmetrical with the centerline of the structure. This increased the quantity of dike stone a total of 1,000 cubic yards, which is considered justified because adequate protection will be provided against either direction of flow.

FRANCIS G. CHRADOVICH
LT COL C E
DEPUTY DISTRICT ENGINEER
FOR: STERLING K. EISIMINGER
Colonel, Corps of Engineers
District Engineer

LOWER COLUMBIA RIVER BANK PROTECTION

OREGON AND WASHINGTON

PREVIOUSLY ISSUED DESIGN MEMORANDUMS

Subject	Submission date	Approval date
General Design Memorandum	3 Jun 1960	11 Aug 1960
Beaver Drainage District and Sauvie Island Drainage District	14 Dec 1960	11 Apr 1961
Clatsop County Diking District No.6	22 Aug 1961	1 Sept 1961
Svensen Island District Improvement Company	14 Dec 1961	4 Jan 1962
Midland Drainage District	8 Feb 1962	27 Feb 1962
Kalama River South Area	28 Mar 1962	12 Apr 1962
Peninsula Drainage District No.1	29 Jun 1962	24 Jul 1962
Multnomah County Drainage District No. 1	9 Jan 1963	25 Jan 1963

TABLE OF CONTENTS

Paragraph		Page
1	Pertinent data	1
2	Project authorization	1
4	Investigations	2
6	Local cooperation	3
8	Location of project	3
9	Present conditions	4
15	Existing improvements in immediate vicinity	6
16	Other plans investigated	7
17	Proposed improvement	7
19	Design data	9
22	Winds	10
23	Waves	10
24	Runup	11
25	Stone size	11
26	Material	12
32	Real estate requirements	14
33	Cost estimate	14
34	Annual costs	15
35	Economic evaluation	15
40	Prospective future conditions	17
43	Economic justification	17
45	Construction schedule	18
46	Recommendation	18

TABLE OF CONTENTS

APPENDIX

Waterways Experiment Station Interim Report

FIGURES

1. Gradation curves for gravel bedding

TABLES

1. Estimated cost of bank protection and 5 pile dike construction

2. Estimated cost of bank protection and 3 pile dike construction

3. Estimated annual charges

4. Maximum recorded velocities

PLATES

1. Project map

2. Tansy Point Location, plan and profile

3. Tansy Point Location, revetment sections

4. Tansy Point Location, pile dike details

5. 1959 tidal hydraulic data, velocity-direction

DESIGN MEMORANDUM

LOWER COLUMBIA RIVER BANK PROTECTION
OREGON AND WASHINGTON
PORT OF ASTORIA, OREGON
TANSY POINT LOCATION

1. Pertinent data. - Pertinent data on the proposed bank protection works for the Tansy Point Location along the left bank of the Columbia River between river miles 9.4 and 10.2, are summarized below:

a.	Estimated capital cost		$466,500
	(1) Federal cost	$463,000	
	(2) Non-Federal cost	3,500	
b.	Proposed improvements		
	(1) Linear feet of riprap		1,744
	(2) Linear feet of pile dike		1,098
	(3) Top elevation of riprap, m.s.l.		Variable
	(4) Pile cutoff elevation, m.s.l.		4
c.	Benefit-to-cost ratio		2.0 to 1

2. Project authorization. - The Flood Control Act of 17 May 1950 (Public Law 516, 81st Congress, 2d session) authorized construction of bank protection works on lower Columbia River at 66 individual locations, totaling 123,800 linear feet, along existing diking and drainage district levees, and along unprotected highly developed industrial areas, as proposed in House Document 531, 81st Congress, 2d session. This construction consists of two general types: One in which riprap is placed along the riverbank to arrest and prevent further erosion; another in which timber pile dikes are constructed to divert the flow from the

bank in areas that cannot be controlled by riprap alone. Investigations presented in the General Design Memorandum for Lower Columbia River Bank Protection, dated June 1960, indicated the need for a total of 133,680 linear feet of riprap and 1,350 linear feet of timber pile dikes at 61 locations. Based on recent model studies about 1,718 linear feet of riprap and 5 timber pile dikes, totaling 1,098 linear feet, should be constructed at the Tansy Point Location to stabilize this problem area. Plate 1 shows the overall project as now authorized, locations completed, and the work proposed herein. All improvements required for stabilization and protection of this area are justified economically as an isolated location based on its own merits.

3. Although the linear feet of riprap and timber pile dike necessary at individual locations for the overall project may change considerably, the amount now proposed for Tansy Point is based on the latest information available.

4. Investigations. - Shoaling at the Point Adams Packing Company wharf was investigated by this office in the fall of 1951. Bank erosion and the landward movement of the river channel was reported by local interests in April 1958. Since that time several examinations have been made of the area. Representatives of municipalities, the Port of Astoria, and private individuals, have contacted the Congressional delegation and this office numerous times since 1958 regarding bank protection work and the condition of the channel between Tansy Point and Hammond, Oregon.

5. Topographic surveys of the bankline and adjacent channel were completed in June 1961. Six check sections taken in September 1962 at

and upstream from the Pacific Shrimp wharf showed scour along the toe of the slope.

6. Local cooperation. - All work proposed in accordance with the authorizing Act requires local interests to: (a) Provide without cost to the United States all lands, easements, and rights-of-way; (b) make all necessary highway, highway bridge, and utility alterations; (c) hold and save the United States free from all damages due to the construction works; and (d) maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army.

7. Portions of the area proposed for improvement are within the boundary of the City of Warrenton Diking District No. 1, the City of Warrenton, and the town of Hammond, Oregon. As the area is not completely contained in an organized district, letters were forwarded to officials of the City of Warrenton, Town of Hammond, the Port of Astoria, and Clatsop County, to determine whether an agency was available and willing and able to comply with the above requirements either singly or in conjunction with other agencies. In August 1962 the Port of Astoria, organized under the laws of the State of Oregon, provided the necessary assurance to act as the sponsoring agency. The total estimated first cost to local interests is $3,500.

8. Location of project. - Tansy Point Location lies along the left bank of Columbia River between river miles 9.4 and 10.2 in Section 9, Township 8 North, Range 10 West of the Willamette Meridian, in Clatsop County, Oregon. The upper end of this location is 2 miles downstream

from Warrenton, Oregon, and about 1.4 miles upstream from Hammond, Oregon. A branch line of the Spokane, Portland and Seattle Railway parallels the shoreline and for the downstream portion of the project the riverward shoulder of the railway embankment is the bankline. Industries in the area include Pacific Shrimp, Inc.; E. H. Carruthers Company; Bioproducts, Inc.; Point Adams Packing Company; and the Point Adams Coast Guard Lifeboat Station.

9. Present conditions. - Primarily, the problem at this location has arisen as a result of erosion and deepening on the outside of a bend in the stream, causing a gradual southward shifting of the main channel of Columbia River. This action has been taking place for a number of years and is a phenomenon natural to all streams. As the channel shifts southward, deposition is taking place on Desdemona Sands, a large bar in Columbia River estuary, northerly of the channel. Hydrographic survey records of many years indicate the southward shift of the channel although the navigation channel has remained fixed. The present condition is only the latest in a long series of channel changes in the estuary extending back beyond the period of record.

10. Prior to 1950 a hopper dredge periodically deposited dredge spoil from channel maintenance dredging just downstream from river mile 10.0. However, shoaling of the dock facilities at Point Adams Packing Company was reported in the fall of 1951, with a request to stop further disposal along this reach. This office complied with the request until the summer of 1955 when the area was again used for disposal and has continued as such through 1961. Meanwhile, Bioproducts,

Inc. and Pacific Shrimp, Inc. announced that they were concerned with a scouring action of the riverbed in the vicinity of and at the end of their respective wharves. Bank erosion is occurring immediately downstream from an old wharf at Tansy Point. The 7-foot high sandy soil bank is readily eroded by wave action, both from passing ships and the wind, during high tides.

11. There are three structures in the area subject to damage, not including the Spokane, Portland and Seattle Railway branch line which parallels the shoreline and services the area. Pacific Shrimp, Inc., consisting of a cannery and wharf, is located at Tansy Point. Officials state that the company would have to go out of business if it lost its dock facilities.

12. The whaling station and loading dock of Bioproducts, Inc., a fish rendering industry, is the next downstream installation. Several changes have occurred since Bioproducts' original wharf was built about 1948. In 1953 the end of the wharf was sideswiped and damaged by a passing vessel. The wharf was rebuilt 100 feet shorter than the original, leaving a structure 275 feet long. Soundings taken from the deck by local interests have shown additional depths between November 1953 and May 1960 of 14 feet at the end of the wharf, and 31 feet, 120 feet landward of the end. This indicates that scour has displaced the riverbed material. The topographic survey made in June 1961 indicated the wharf to be only 235 feet long. Between June and August 1961 more piling were lost and the present length of this wharf is about 60 feet.

13. The largest structure endangered in this reach is the wharf and appurtenant facilities of the Point Adams Packing Company. Numerous repairs have been made on the piling supporting this wharf. Continued shifting of the channel landward and deepening of the water at the outer end of the wharf could cause serious losses to this important industry. The reach downstream from this wharf to the Point Adams Coast Guard Lifeboat Station at Hammond, Oregon, appears to be well stabilized.

14. The E. H. Carruthers Company, cannery equipment manufacturing firm, is located landward of the railway right-of-way and would be endangered only if a breakthrough occurred in the railway embankment. Approximately 22 suburban residences are within this vulnerable area and they would be abandoned or relocated if the railway embankment failed.

15. Existing improvements in immediate vicinity. - At present there are no Federally constructed navigation or flood control improvements in the immediate vicinity of the proposed work. The Railway Company has dumped stone of varying gradation along the riverside of its branch line in the vulnerable reaches. It is believed this stone was originally placed without a toe. The company maintains its embankment and in January 1959 lost entire sections of the roadbed because of unusual currents and wave action in the area. Repairs were promptly made by railway maintenance crews, using a rail-mounted dragline and a clamshell bucket. In August 1961 it was noted that the railway crews had added a considerable quantity of stone along this reach and it is believed they will continue to maintain their branch line in the future.

16. Other plans investigated. - Since the railway embankment is the riverbank throughout most of the project area, relocation of the track was not feasible. The use of rock groins was considered, but it was concluded that pervious timber pile dikes would be more effective.

17. Proposed improvement. - Because of existing stone within the area to be protected, riprap will be required in only two locations to produce a contiguous stone blanket along the damaged bank. On the upstream section a 42-inch armor stone blanket will be placed for 423 linear feet on the existing stone or on a prepared 1 on 2 slope to elevation -12.0 m.s.l. (By "P" line stationing this distance extends from Station P4+00 to Station P6+50.) A quarry stone blanket with a minimum thickness of 3 feet will continue on a 1 on 2 slope to bottom elevations varying between -16.0 and -47.0 m.s.l. The other section extends along the bank approximately 1,321 linear feet. It is also proposed to revet the eroding bank at this location with armor stone, beginning at elevation 9.0 m.s.l. and extending the stone blanket on a 1 on 2 slope to elevation -6.0 m.s.l. The ends of the riprap will be joined smoothly to existing stone. Bedding layers, composed of two thicknesses of bedding material, an 18-inch upper layer and a 12-inch lower layer, will be placed as a foundation for the riprap above elevation -12.0 m.s.l. at each site. Surface velocities past this reach on ebb tide particularly, exceed the critical velocity for the sandy soil in the wetted perimeter of the channel. Table 4 shows the maximum recorded velocities for normal, high, and low river flows in the lower estuary.

18. Five timber pile dikes spaced approximately 600 feet apart with dike stone to elevation -10.0 m.s.l. were determined by model studies to provide positive protection along this reach with no failure anticipated. See appendix. However, in the interest of economy and in line with accepted practice along lower Columbia River, three timber pile dikes with dike stone to one-third depth below low water and approximately 1,200 feet apart will be constructed initially downstream from the revetted bank in an attempt to divert the current away from the shore. See plate 2 for design and table 2 for a detailed cost estimate. Each structure will consist of three rows of piling separated by a double row of timber spreaders between the rows. Each outside row of piling will be driven on 5-foot centers with a 12 on 1 slope as batter piles, the center row of piling will be driven vertical and staggered on 5-foot centers. See plate 4. A 7-pile dolphin will mark the end of each dike. The dolphin cutoff will be at elevation 16.0 m.s.l. with the king pile standing 6 feet higher. The cutoff of the dike piles will be elevation 4.0 m.s.l. Each pile will be cut off true to grade on a slope of 1 on 4, and the top will be given a coat of emulsified asphalt over a coat of creosote. All piles will be placed and fastened in the structure with acceptable galvanized hardware consisting of tie rods, malleable iron washers, nuts, and wire rope. A stone blanket, as shown in detail on plate 4, will be provided the full length of each structure to prevent undermining from scour. If the three pile dikes are inadequate to control erosion along this reach, the dike system will be augmented with two additional structures and added dike stone.

19. Design data. - Storm tides and not river flow have the greatest influence on water stages below river mile 30. This is attributed to the wide, deep estuary that extends for 30 miles above the mouth of the river and in places is over 5 miles wide. The highest tide observed during the December 1933 high water reached a maximum elevation of 9.0 feet m.s.l. at river mile 30 and 8.2 feet m.s.l. at Fort Stevens, river mile 8.3. On the basis of available water surface data for the lower river it has been estimated that the December 1933 high water has a probable recurrence frequency of approximately once in 50 years.

20. Prototype measurements of the Columbia River estuary taken during 1959 included observations of current velocity and direction and salinity and temperature at different levels. Three cycles of measurements were taken at 23 stations along 7 ranges at 30-minute intervals to obtain data for conditions of low, normal, and high river discharge. Each cycle included observations for a continuous full tidal period of about 25 hours.

21. Range 3 is about 6 miles upstream and range 2 is about 4 miles downstream from the proposed location. See plate 5. Station A and B on each range border the navigation channel. The estuary at range 3 measures twice the distance across that of range 2. This results in a deeper cross-sectional area with greater velocities downstream. Maximum recorded surface and bottom velocities past the above stations are shown in table 4. Ebb tides are significantly higher than the constricted reach at range 2. It is believed these velocities begin to accelerate in the vicinity of Tansy Point, causing scour of the riverbed.

22. Winds. - Design winds were selected from consolidated records of the Clatsop Airport Weather Bureau Station available at their Climatological Service Office, United States Customs House, Portland, Oregon. An examination of fetch areas indicated that winds from the northwest and east-northeast quadrants would produce the maximum wave heights at Tansy Point Location. Records for the years 1953, 1955, 1956, 1957, and 1958 indicate winds from these quadrants exceeded 25 knots on 9 occasions each. In 1961, winds from west-northwest reached a velocity of 37 knots. Accordingly, design winds of 55 miles per hour from the northwest quadrant and 45 miles per hour from the east-northeast quadrant were chosen. The design winds include a 30-percent increase factor for winds over water as compared to winds recorded at land stations in accordance with table 2, "Freeboard Allowance for Waves in Inland Reservoirs", Saville, McClendon, and Cochrane; Journal of Waterways and Harbors Division, Proceedings of A.S.C.E., volume 88, No. WW 2, May 1962, part 1.

23. Waves. - Effective fetch lengths were determined by the method outlined in the above-referenced article. The average depth of fetch was determined by prorating the average depth of each radial according to its effective length. As the portion of the fetches nearest Tansy Point Location are materially deeper than the majority of the remainder of the fetches, each fetch was divided into two portions. Wave heights were determined at the downwind end of the more remote, shallower portion. The increase in wave height through the close-in, deeper portions was then determined. Figure 7 of Beach Erosion Board Technical Report

No. 4, 1961, was used to determine wave heights. A check of figure 5b., Beach Erosion Board Technical Memorandum No. 72, March 1955, indicated very little, if any, reduction in wave height due to shallow water conditions. Any correction was neglected in the interest of conservatism. An estimate based on frequency of occurrence and spectral distribution indicated that approximately 1,000 waves from each of the studied directions would occur in a 50-year period for the wave height exceeded by 3-percent of the waves due to the design winds. Accordingly, deep water design heights of 8.0 and 5.5 feet with periods of 4.5 and 4.0 seconds were determined for winds from the northwest and east-northeast quadrants, respectively.

24. Runup. - Runup was determined by using 50 percent of the value indicated for smooth slopes in "Freeboard Allowances for Waves in Inland Reservoirs" referenced above. Two feet additional allowance for uncertainties gave a total freeboard allowance of 8.0 feet above a design still water level based on a tidal height of 8.0 feet of plus 4.0 feet, mean sea level.

25. Stone size. - The following Waterways Experiment Station stone weight formula was used to determine stone size:

$$W_r = \frac{\gamma_r H^3}{K_\Delta (S_r - 1)^3 \cot \alpha}, \text{ in which}$$

W_r = weight of average armor stone in pounds;

γ_r = unit weight of stone in pounds per cubic foot;

H = height of design waves in feet;

K_Δ = a dimensionless coefficient experimentally determined;

S_r = ratio of unit weight of stone to unit weight of sea water;

α = angle jetty face makes with horizontal.

A value of K = 3.5, with armor-layer thickness equal to two nominal stone diameters and a unit weight of stone equal to 165 pounds per cubic-foot, yielded an average stone weight of 1,000 pounds and a layer thickness of 3.5 feet. Specific weight of stone may vary between 160 to 170 pounds per cubic-foot and be within design limits. Maximum size of stone should not exceed 1,500 pounts and ideally, no more than 10 percent of the stones should be smaller than 600 pounds. Since the usual gravel bedding material is apt to wash through the voids in the cover layer, the loss could be overcome by providing two gradations of bedding material as backing for the cover layer, and reducing the minimum stone size to 200 pounds to the piece. The ratio of the longest dimension of a stone to its shortest dimension should not exceed 3. All stone having a long-to-short dimension ratio exceeding 2 should be placed with their long axis nearly normal to the revetment face. The revetment face above mean lower low water should be reworked so that pockets of small stone are eliminated. In other words, any given area of appreciable extent should be well graded from largest to smallest stones.

26. Material. - Materials obtained from bank and toe excavation are unsuitable for bedding material. However, borrow areas capable of producing acceptable material are available locally or by barge haul; or suitable filter material could be manufactured from quarried stone. The type and gradation of stone used in construction of bank protection works is available from quarries in the vicinity or by barge haul.

27. The specifications will require that the bedding layer will be composed of an 18-inch upper layer and a 12-inch lower layer of granular material reasonably well graded within the limits shown on figure 1. The materials must be composed of tough, durable particles, be reasonably free from thin, flat, and elongated pieces, and contain no organic matter, nor soft, friable particles in objectionable quantities.

28. The specifications for 42-inch armor stone will require that the stone be durable and of suitable quality to insure permanence in the structure and range in size from 200 to 1,500 pounds to the piece, provided that at least 75 percent of the stone shall be in sizes of 600 to 1,500 pounds, and provided further that at least 30 percent of the stone shall be in sizes larger than 1,000 pounds. The riprap stone shall be reasonably well graded from the smaller to the maximum size specified. Stone less than 200 pounds in weight, and spalls, will not be permitted in an amount exceeding 10 percent by weight of each load.

29. The specifications will require the quarry stone blanket material to be reasonably well graded within the limits shown on figure 1 for the 18-inch upper layer. The material must be durable, angular stone, and contain no organic matter, nor soft, friable particles in objectionable quantities. Neither the breadth nor the thickness of any piece of stone shall be less than one-third of its length.

30. Wood piles will be Douglas Fir, conforming to the applicable requirements of Federal Specification MM-P-371a, entitled "Piles; Wood". Horizontally placed spreader timbers will be rough Douglas Fir, graded

as "Construction" or better, in accordance with paragraph 125b of the West Coast Lumbermens' Association No. 15 rule. All bolts and tie rods will conform to Federal Specification FF-B-571a, entitled, "Bolts; Nuts; Studs; and Tap Rivets (and material for same)".

31. The specifications will require dike stone to range in sizes from 100 to 600 pounds to the piece. Smaller pieces and spalls will be allowed only to the amount which will fill the voids between the larger stones. Stone placed on the downstream side of any dike will be placed during flood tide. The stone blanket along each dike has a thickness of 3 feet over most of its length, 1 on 1-1/2 side slopes, and a top width of 30 feet. A dike end stone blanket 3 feet thick and 100 feet in diameter will protect the dolphin from scour. When the water depth below mean lower low water exceeds 15 feet, a dike stone cap with a 10-foot top width will be provided as shown on plate 4.

32. Real estate requirements. - Local interests will furnish all lands, easements, and rights-of-way. It will be necessary, however, to render advice to local interests, review assurances and the grants from local interests to the Federal Government to ascertain sufficiency, and to prepare a report upon completion in accordance with existing procedures.

33. Cost estimate. - The estimated total capital cost of the work proposed herein is $466,500, of which $302,000 is for timber pile dike construction. A detailed cost estimate, based on current price levels, is shown in table 1.

34. Annual costs. - Annual costs, including interest, amortization in 50 years, and annual maintenance of the stone and timber pile dike protection are estimated at $24,165. Details are shown in table 3.

35. Economic evaluation. - The Tansy Point Location consists of Tansy Point, a promontory at the upstream end of the project and in direct line with the main channel of Columbia River past the Port of Astoria, and the riverbank adjacent to it and extending downstream. Many years ago the Spokane, Portland and Seattle Railway had an important dock and warehouse facility at Tansy Point which now has been abandoned for that purpose, and the docking facilities have completely eroded and disintegrated with only a vestige of the wharf remaining. The area is now occupied by the warehouse which is now used by Bioproducts, Inc., a large vacant office building, a residence, Spokane, Portland and Seattle Railway trackage and a large building with docking facilities used by Pacific Shrimp, Inc.

36. Erosion is increasing at Tansy Point and offshore waters are deepening along the entire reach from Tansy Point downstream to the Point Adams Coast Guard Station. The gradual shifting of the channel has been in evidence for several years and during the last six years has interferred with fishing docks and Coast Guard structures in the vicinity. Tansy Point is now in danger of complete destruction. Downstream from Tansy Point a wide beach has gradually disappeared, leaving the Spokane, Portland and Seattle Railway tracks vulnerable to wave and tidal action.

37. The railroad grade at elevation 10 feet m.s.l. protects 85 acres from erosion and inundation by high tides and is the only protection this area has. During the past 5 years, the Spokane, Portland and Seattle Railroad has been reinforcing this grade annually with rock in an attempt to maintain their right-of-way. They have had to replace ballast several times. This has cost about $5,000 annually and has not been fully effective. It is believed that unless protection is provided, the railroad grade will fail within 10 years. In this event, the land lying between the railroad and the Warrenton-Hammond road, at elevations of 1 to 8 feet m.s.l., will be lost.

38. The Warrenton-Hammond road provides some degree of protection, and it is assumed to limit the area that would be eroded. Without this road embankment, the whole Clatsop plains section of Clatsop County is vulnerable to wave and tidal action, and a possible channel cutting, in case of failure of the railroad grade.

39. The 85-acre area that would be lost to erosion contains Bio-products, Inc., a million-dollar concern manufacturing fish products of many types, which does an annual business of over one-half million dollars, with a payroll of over $200,000; the E. H. Carruthers Co., a canning machine manufacturing concern which had a gross revenue of over $700,000 in 1962, with a payroll of $156,000; and the Point Adams Packing Company, which has a large packing plant and docking facilities for general fishing interests and employs 125 on a year-around basis. Besides these industries, 23 private residences valued at $290,000, and one building valued at $25,000 are within the threatened area.

40. Prospective future conditions. - Several plans are now under way for further expansion and development of this area. This investment and development has been based on the assumption that the area will be relieved of the threat of erosion.

41. Pacific Shrimp, Inc. plans to develop the fillet industry this year. Bioproducts, Inc. established a whaling station in 1960, which has a potential of doubling their present sales and payroll. It also plans to build a new dock for landing ocean fish and to build a 26,000 square foot plant to manufacture food for hatchery fish which will have a capacity of 3 million pounds and annual sales valued at $360,000. The E. H. Carruthers Co. has shown a regular increase in their gross revenue and payroll over the last several years. The Point Adams Packing Company, the largest employer in the area, has been revising its plans and has ordered piling and materials for the rebuilding and remodeling of a portion of its docking facilities. Business in the area generally shows an aggressive attitude and with protection will undoubtedly increase rapidly in value.

42. Unless protection is assured, much of this development will undoubtedly not take place.

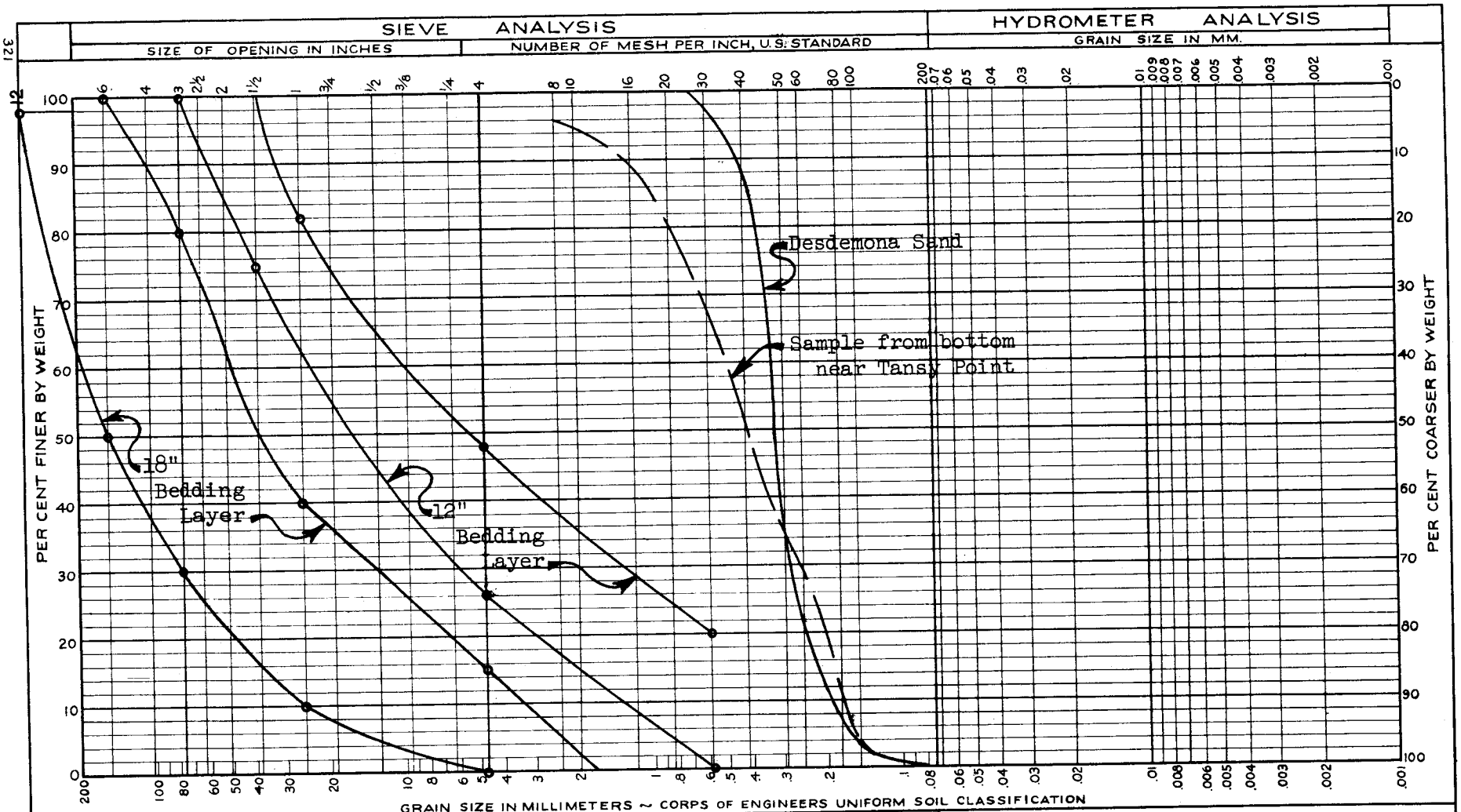
43. Economic justification. - Evaluation of the benefits for the protection of the Tansy Point area has been done on a very conservative basis, with no credit being taken for increased activity resulting from protection. The railroad might be able to preserve its grade with its present maintenance program for the next ten years, at a cost of $5,000 annually. The present worth of this series of expenditures would be

$44,000. At that time, destruction of the railroad grade may be expected to occur and the present industries and homes in the area would be required to move to new locations. Any salvage value of buildings and equipment would no more than compensate for the cost of moving. The present value of industrial improvements, including buildings and equipment, amounts to $1,600,000. There are also 23 residences in the area valued at $290,000. Since there would be forewarning of the prospective loss of protection, no further development would occur and present values of industrial and residential improvements could be expected to depreciate by 2 percent per year, or $380,000, resulting in a value of $1,510,000 ten years hence. Land is valued at $210,000 and is assumed not to depreciate. The depreciated value at the end of ten years would amount to $1,720,000, which corresponds to a present worth of $1,344,000. Including the $44,000 present worth of maintenance cost to the railroad, this would result in an annual equivalent benefit of $48,900 creditable to protection for a 50-year economic life.

44. Based on the estimated average annual cost of $24,165 and equivalent annual benefits of $48,900, the benefit-to-cost ratio would be 2.0 to 1.

45. Construction schedule. - It is proposed to award a contract in June 1963 for construction of the revetments and three timber pile dikes situated on the left bank of Columbia River, downstream from Tansy Point. This work should be completed in 150 days.

46. Recommendation. - It is recommended that the bank protection work and timber pile structures described herein be constructed in the areas outlined at a total Federal cost of $463,000. Construction will be contingent upon receipt of rights-of-way necessary for the work.



SAMPLE NO.	DEPTH - FT.	CLASSIFICATION	NAT. W.C.	LL	PI	

PROJECT LOWER COLUMBIA R. BANK PROTEC.

Sample data Gravel Bedding

Submitted by

Expl. or gp. sample No.

W/O No.

Jan. 1963 (Date of report)

Chief, Soil Mechanics Branch

NPD RF JULY 1952 321

GRADATION CURVES

CORPS OF ENGINEERS, NORTH PACIFIC DIVISION TESTING LABORATORY, PORTLAND, OREGON

Plotted:

Checked:

FIGURE 1

Army-Port. Dist., Oreg.

TABLE 1

LOWER COLUMBIA RIVER, OREGON

WARRENTON-HAMMOND AREA

Estimated cost of bank protection

and

pile dike construction

Bank protection					
Clearing	1	Job	L. S.	$ 2,400	
Excavation	10,460	Cu.Yd.	$1.00	10,460	
Quarried embankment	6,070	Cu.Yd.	2.50	15,175	
Bedding material "A"	2,220	Cu.Yd.	5.00	11,100	
Bedding material "B"	1,590	Cu.Yd.	4.00	6,360	
42-inch armor stone	7,720	Cu.Yd.	5.50	42,460	
Quarry stone blanket	5,920	Cu.Yd.	4.50	26,640	
Contingencies				17,105	
Total contract cost					$131,700
Engineering and design				$16,100	
Supervision and administration				13,200	
					$ 29,300
Estimated total Federal cost					$161,000
Estimated non-Federal cost					3,500
ESTIMATED TOTAL CAPITAL COST					$164,500

TABLE 1

(Continued)

LOWER COLUMBIA RIVER, OREGON

WARRENTON-HAMMOND AREA

Estimated cost of bank protection

and

pile dike construction

Five pile dikes

Piling, Douglas Fir	26,500	Lin.Ft.	$2.50	$66,250	
Timbers, Douglas Fir	1	Job	L.S.	15,150	
Hardware	1	Job	L.S.	7,280	
Dike stone	27,960	Cu. Yd.	4.50	125,820	
Contingencies				32,200	
Total contract cost					$246,700
Engineering and design				$30,600	
Supervision and administration				24,700	
					$55,300
Estimated total Federal cost					$302,000
Estimated non-Federal cost					---
ESTIMATED TOTAL CAPITAL COST					$302,000
GRAND TOTAL CAPITAL COST					$466,500

TABLE 2

LOWER COLUMBIA RIVER, OREGON

WARRENTON-HAMMOND AREA

Estimated cost of bank protection

and

pile dike construction

Bank protection					
Estimated total Federal cost (see table 1)					$161,000
Estimated non-Federal cost (see table 1)					3,500
Three pile dikes					
Piling, Douglas Fir	16,500	Lin.Ft.	$2.50	$41,250	
Timbers, Douglas Fir	1	Job	L.S.	9,075	
Hardware	1	Job	L.S.	4,360	
Dike stone	6,700	Cu. Yd.	4.50	30,150	
Contingencies				12,765	
Total contract cost					$97,600
Engineering and design				11,600	
Supervision and administration				9,800	
					$21,400
Estimated total Federal cost					119,000
Estimated non-Federal cost					---
ESTIMATED TOTAL CAPITAL COST					$283,500

TABLE 3

LOWER COLUMBIA RIVER, OREGON

WARRENTON-HAMMOND AREA

Estimated annual charges

	Bank Protection	Pile Dikes	Totals
CAPITAL COST	$164,500	$302,000	$466,500
ANNUAL CHARGES			
Federal	($161,000)	($302,000)	
Interest at 2-1/2 percent	4,025	7,550	11,575
Amortization (50 years)	1,650	3,100	4,750
Non-Federal	($3,500)		
Interest at 5 percent	175	---	175
Amortization (50 years)	15	---	15
Maintenance	1,610	6,040	7,650
TOTAL ANNUAL CHARGES	$7,475	$16,690	$24,165
TOTAL ANNUAL BENEFITS			$48,900
BENEFIT-TO-COST RATIO			2.0 to 1

TABLE 4

LOWER COLUMBIA RIVER, OREGON

WARRENTON-HAMMOND AREA

Maximum recorded velocities

Date 1959	Station	Discharge c.f.s.	Surface Velocity f.p.s. Ebb	Surface Velocity f.p.s. Flood	Bottom Velocity f.p.s. Ebb	Bottom Velocity f.p.s. Flood
7 May	3-A	404,000	4.4	2.3	3.3	1.2
7 May	2-A	404,000	9.9	3.1	3.0	2.0
5 May	3-B	371,000	4.0	1.3	2.5	0.9
7 May	2-B	404,000	10.3	3.4	4.2	1.9
19 June	3-A	570,000	5.4	2.0	3.8	1.2
19 June	2-A	570,000	10.9	3.2	5.4	2.2
17 June	3-B	547,000	4.5	1.4	2.7	1.1
19 June	2-B	570,000	11.8	3.7	5.6	2.3
17 September	3-A	163,000	5.9	3.3	2.4	2.6
17 September	2-A	163,000	8.9	4.8	3.7	3.0
	3-B		No Readings			
17 September	2-B	163,000	8.8	4.8	2.7	2.7

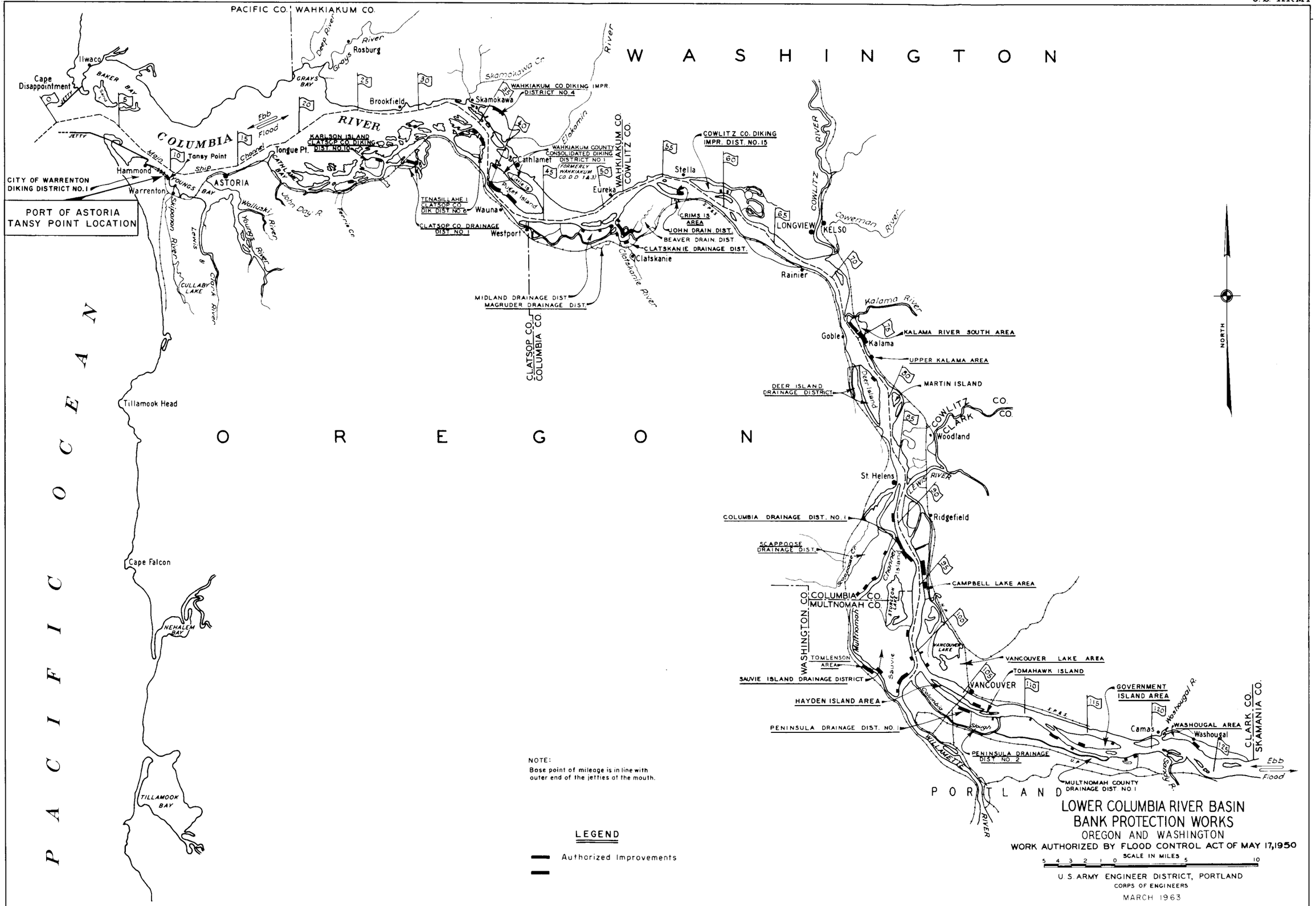
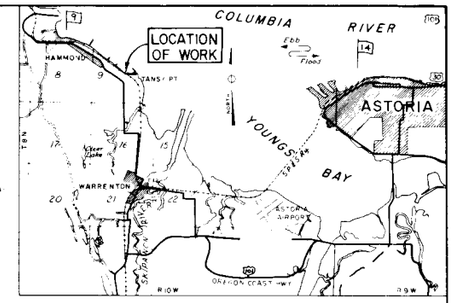

PACIFIC OCEAN
OREGON
WASHINGTON
PACIFIC CO.
WAHKIAKUM CO.
COWLITZ CO.
CLATSOP CO.
COLUMBIA CO.
CLARK CO.
SKAMANIA CO.
MULTNOMAH CO.
WASHINGTON CO.
Ilwaco
Cape Disappointment
BAKER BAY
JETTY
Tansy Point
COLUMBIA RIVER
Ebb
Flood
Channel
Main Ship
CITY OF WARRENTON DIKING DISTRICT NO. 1
PORT OF ASTORIA TANSY POINT LOCATION
Hammond
Warrenton
YOUNGS BAY
ASTORIA
Skipanon River
Lewis & Clark River
CULLABY LAKE
Wallooski River
Youngs River
John Day R.
Ferris Cr.
Tillamook Head
Cape Falcon
NEHALEM BAY
TILLAMOOK BAY
GRAYS BAY
Deep River
Grays River
Rosburg
Brookfield
KARLSON ISLAND CLATSOP CO. DIKING DIST. NO. 10
Tongue Pt.
TENASILLAHE I CLATSOP CO DIK DIST NO 6
CLATSOP CO. DRAINAGE DIST NO. 1
Wauna
Westport
MIDLAND DRAINAGE DIST
MAGRUDER DRAINAGE DIST.
Skamokawa Cr.
Skamokawa
WAHKIAKUM CO. DIKING IMPR. DISTRICT NO. 4
Elokomin River
WAHKIAKUM COUNTY CONSOLIDATED DIKING DISTRICT NO. 1
(FORMERLY WAHKIAKUM CO. D.D. 1 & 3)
Cathlamet
Puget Island
Eureka
Stella
COWLITZ CO. DIKING IMPR. DIST. NO. 15
CRIMS 15 AREA
JOHN DRAIN DIST.
BEAVER DRAIN DIST
CLATSKANIE DRAINAGE DIST.
Clatskanie
Clatskanie River
Rainier
LONGVIEW
KELSO
COWLITZ RIVER
Coweman River
Kalama River
Goble
Kalama
KALAMA RIVER SOUTH AREA
UPPER KALAMA AREA
MARTIN ISLAND
DEER ISLAND DRAINAGE DISTRICT
Deer Island
Woodland
St. Helens
LEWIS RIVER
Ridgefield
COLUMBIA DRAINAGE DIST. NO. 1
SCAPPOOSE DRAINAGE DIST.
Scappoose Cr.
Channel
Sturgeon Lake
CAMPBELL LAKE AREA
Multnomah
TOMLENSON AREA
SAUVIE ISLAND DRAINAGE DISTRICT
Sauvie
HAYDEN ISLAND AREA
PENINSULA DRAINAGE DIST. NO. 1
Columbia
Slough
Vancouver Lake
VANCOUVER LAKE AREA
TOMAHAWK ISLAND
VANCOUVER
GOVERNMENT ISLAND AREA
Camas
Washougal R.
WASHOUGAL AREA
Washougal
PENINSULA DRAINAGE DIST NO 2
MULTNOMAH COUNTY DRAINAGE DIST NO 1
Scappoose
Ebb
Flood
WILLAMETTE RIVER
PORTLAND
NORTH
NOTE:
Base point of mileage is in line with outer end of the jetties at the mouth.
LEGEND
Authorized Improvements
LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
WORK AUTHORIZED BY FLOOD CONTROL ACT OF MAY 17, 1950
SCALE IN MILES 5 4 3 2 1 0 5 10
U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
MARCH 1963

PLATE I



VICINITY MAP
SCALE IN MILES
0 1 2 3

GENERAL PLAN
SCALE IN FEET
200 0 200 400 600

COLUMBIA RIVER

Ebb
Flood

Grid North

N 942,000
E 1,130,000

Point Adams Packing Company

Pile dike P47+00

P40+50 Possible future pile dike construction

Pile dike P34+00

P28+00 Possible future pile dike construction

Pile dike P22+00

N 940,000
E 132,000

L13+10.73

L10+00

W.S. 1960 Aerial photograph

Top of bank

High water line

N53°00'04"W

P47+23.88

N50°16'11"W

Bioproducts Inc.

E.H. Carruthers Machine Shop

P27+00 Ref.

S.P. & S. Ry.

N50°16'11"W

P13+26.83

N83°20'32"W

P8+39.96

QCD N63°33'04"W

P4+63.11

Pacific Shrimp

Tansy Pt. (U.S.C. & G.S.)

P0+00

E 1,134,000

W.S. 1960 Aerial photograph

Top of bank

High water line

N 939,000

L1+54.93 P.I. is 65.97' Rt. of P9+10.58

P6+50 (Approx.) End Quarry Stone Blanket

Limits of existing piling

(6) Armor Stone

(7) Quarry Stone Blanket

P4+63.11

P4+00 Approx. Begin Armor Stone & Quarry Stone Blanket

N 939,500
E 133,500

L13+10.73 is 3.02' Rt. of P20+00.01 (Approx.) End of Armor Stone

L6+16.06 is 12.4.04' Rt. of P12+41.42

L4+87.36 is 103.61' Rt. of P11+20.34

L10+55.65 P.T.

Δ 20°56'
D 6°
T 176.41'
L 348.89

L7+26.76 P.I.

Pile

N74°29'W

N74°13'W

Top of Bank

Quarried Embankment

N83°20'32"W

P8+33.46

Δ 30°56'
D 40°
T 34.63'
L 77.32

L0+00 is 5.13' Rt. of P6+65

N 938,500

E 133,000

N 17°14'E

Quarried Embankment

Top of Bank

Concrete

Existing Rock

P0+00

N63°33'04"W
N43°33'W

N74°44'W

F

Quarried Embankment

N53°48'W

Telephone Line

L9+03.17 P.I. is 28.36' Rt. of P15+89.30

P12+77.42 POT
BM 31 is 56.65' Rt. of P12+77.74 (1929 adj.)

E 1,132,500

Note:
See Dwg CLW-10-3/2 for revetment details.

Note:
For details of pile dikes, see Dwg. CLW-10-3/3

(11) Dike stone in place

℄ of Pile dike P47+00 P.O.T.

℄ of Pile dike P34+00 P.O.T.

℄ Pile dike P22+00 P.O.T.

Existing Stone

Join smoothly to existing stone

(6) Armor Stone

Pile

Top of Bank

Telephone Line

S.P. & S. Ry.

N53°00'04"W

N50°16'11"W

P47+23.88

P6+17.11

Ebb
Flood

PLAN
SCALE IN FEET
100 0 100 200 300

L13+10.73 Approx. End Armor Stone

P4+00 Approx. Begin Armor Stone & Quarry Stone Blanket

Distance at center of Quarry Stone Blanket 87' 86'

P4+63.11 ⊥ Fwd. Tan.

P4+63.11 Split

P4+63.11 ⊥ Back Tan.

Dock

Grade (for staking purposes only) El. 15.0

Quarried Embankment

Top of Bank

Top of Armor Stone

Armor Stone (6)

M.L.L.W. El. -4.2

El. -12.0

Bedding Material "A"

Bedding Material "B"

Bottom of Armor Stone

P6+50 Approx. End Quarry Stone Blanket

Quarry Stone Blanket (7)

Bottom of Quarry Stone Blanket

ELEVATIONS IN FEET M.S.L. (1929 Adj.)

20
10
0
-10
-20
-30
-40

Estimated Quantities	Units	L13+10.73	L10+00	L5+00	P7+07=L0+43	P6+50	P4+00	Totals
(2) Excavation	Cu. Yd.	2,360	4,240	2,400	1,460			10,460
(3) Quarried Embankment	Cu. Yd.	110	1,100	3,970	890			6,070
(4) Bedding Material "A"	Cu. Yd.	600	850	570	200			2,220
(5) Bedding Material "B"	Cu. Yd.	430	610	440	110			1,590
(6) Armor Stone	Cu. Yd.	1,350	2,180	2,290	1,900			7,720
(7) Quarry Stone Blanket	Cu. Yd.	0	0	0	5,920			5,920

PROFILE

LEGEND

- Excavation
- Quarried Embankment
- Armor Stone (Plan & Profile)
- Quarry Stone Blanket
- Armor Stone (Sections)
- Dike Stone (Plan & Sections)
- Existing Stone
- (2) Bid Item Number

OFFSET TABLE

"P" Stations	Approximate Limits Of Armor Stone		Quarry Stone Blanket	
4+00	26' Rt.	115' Rt.	115' Rt.	
4+25	36' "	90' "	90' Rt.	134' Rt.
4+63.11 ⊥ B.T.	55' "	93' "	79' "	160' "
4+63.11 Split	117' Rt.		117' "	201' "
4+63.11 ⊥ F.T.	53' Rt.	124' Rt.	117' "	198' "
5+00	74' "	142' "	133' "	198' "
5+50	86' "	136' "	129' "	208' "
5+66	86' "	136' "	129' "	213' "
6+00	80' "	129' "	122' "	196' "
6+50	78' "	128' "	121' "	186' "

Note:
Alignment transition of Armor Stone from "P" 6+50 to "L" 0+43. No stone placed under docks.

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PORTLAND, OREGON

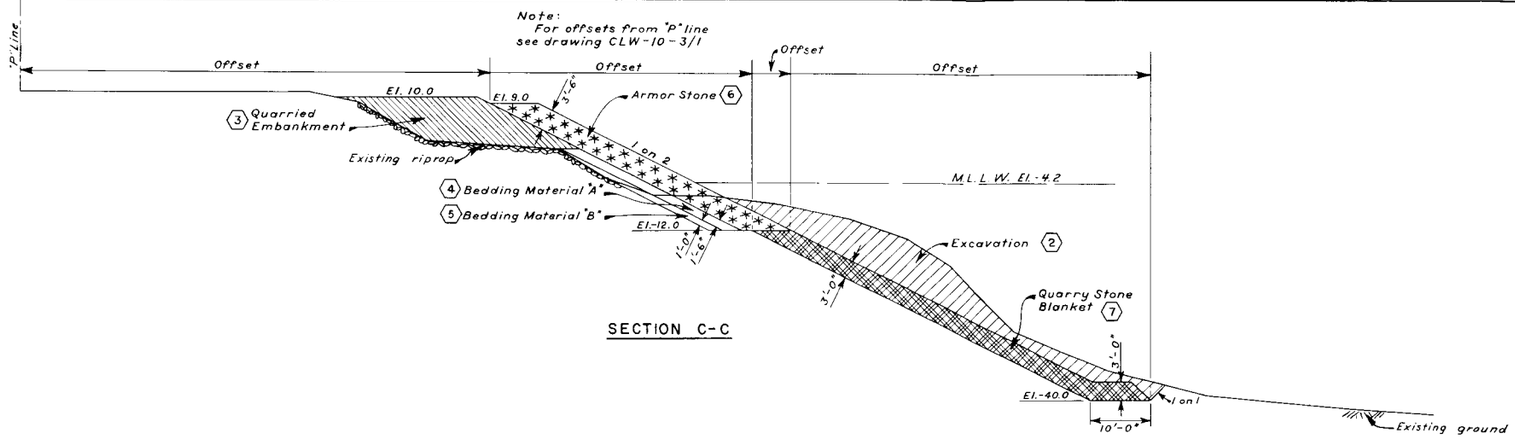
DESIGNED BY: D.K.P.
TRACED BY: E.C.K.-D.K.P.
CHECKED BY: G. McL.
PREPARED: H.F. Henderson
REVIEWED: [illegible]
CHIEF, ARDEVI BRANCH

LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
PORT OF ASTORIA, OREGON
TANSY POINT LOCATION
PLAN & PROFILE

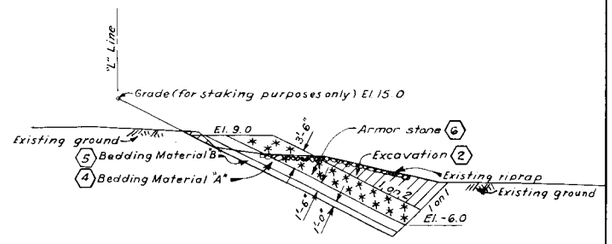
SUPERVISED:
CHIEF, FLOOD CONTROL SECTION
SUBMITTED:
CHIEF, PLANNING BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION

APPROVED: DATE
COLONEL, C. E. DISTRICT ENGINEER

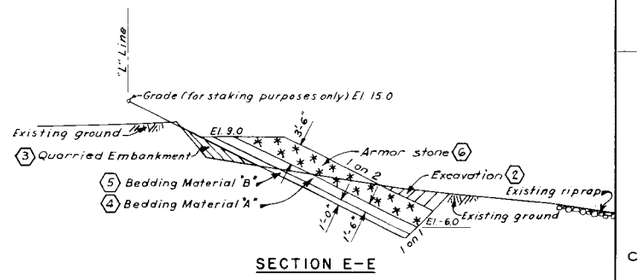
SCALE AS SHOWN SPEC. NO.
CLW-10-3/1
SHEET 1 OF 3 PLATE 5



SECTION C-C



SECTION F-F



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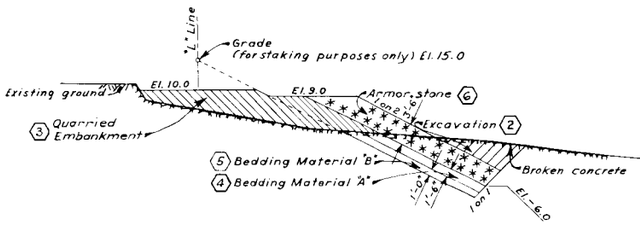

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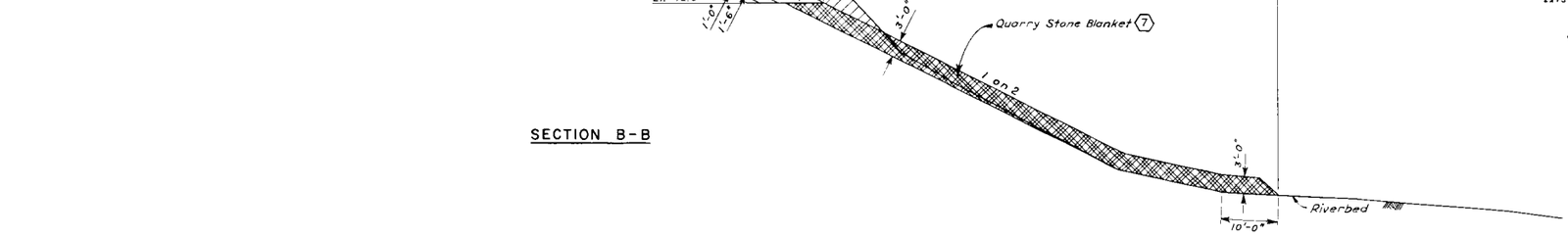


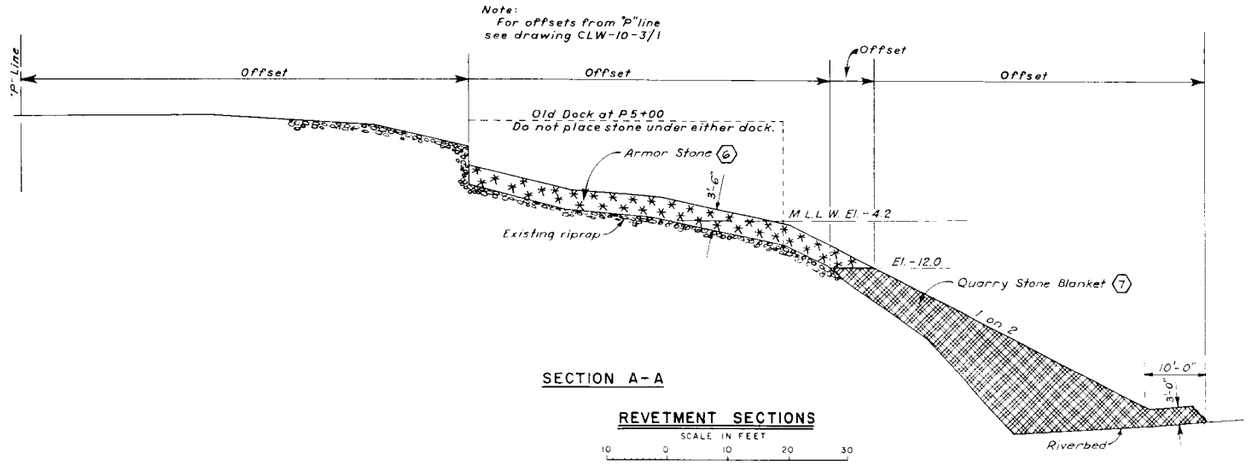
SECTION B-B

TYPICAL SECTIONS

SCALE IN FEET

10 0 10 20 30

Note:
See drawing CLW-10-3/1 for Legend.



SECTION A-A

REVETMENT SECTIONS

SCALE IN FEET

10 0 10 20 30

REVISION	DATE	DESCRIPTION	BY

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PORTLAND, OREGON

DESIGNED BY D.K.P.
TRACED BY E.C.K-D.K.P.
CHECKED BY G. McL.
PREPARED:
REVIEWED:
CHIEF, SAFETY BRANCH
SUPERVISED:
CHIEF, FLOOD CONTROL SECTION
SUBMITTED
CHIEF, PLANNING BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION

LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
PORT OF ASTORIA, OREGON
TANSY POINT LOCATION
REVETMENT SECTIONS

APPROVED: DATE
COLONEL, C.E. DISTRICT ENGINEER

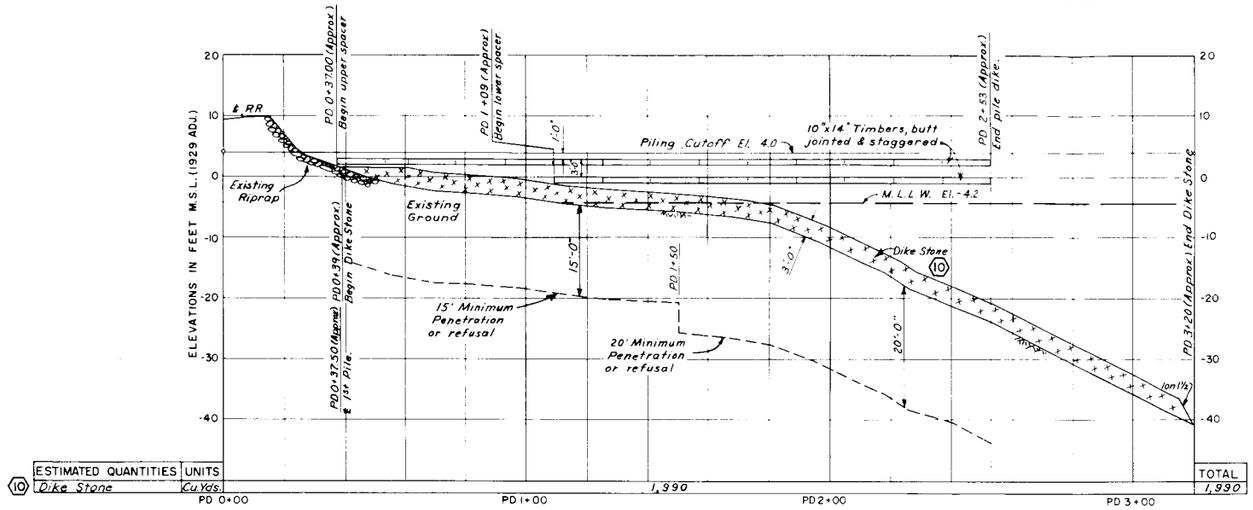
SCALE AS SHOWN | SPEC. NO.

CLW-10-3/2

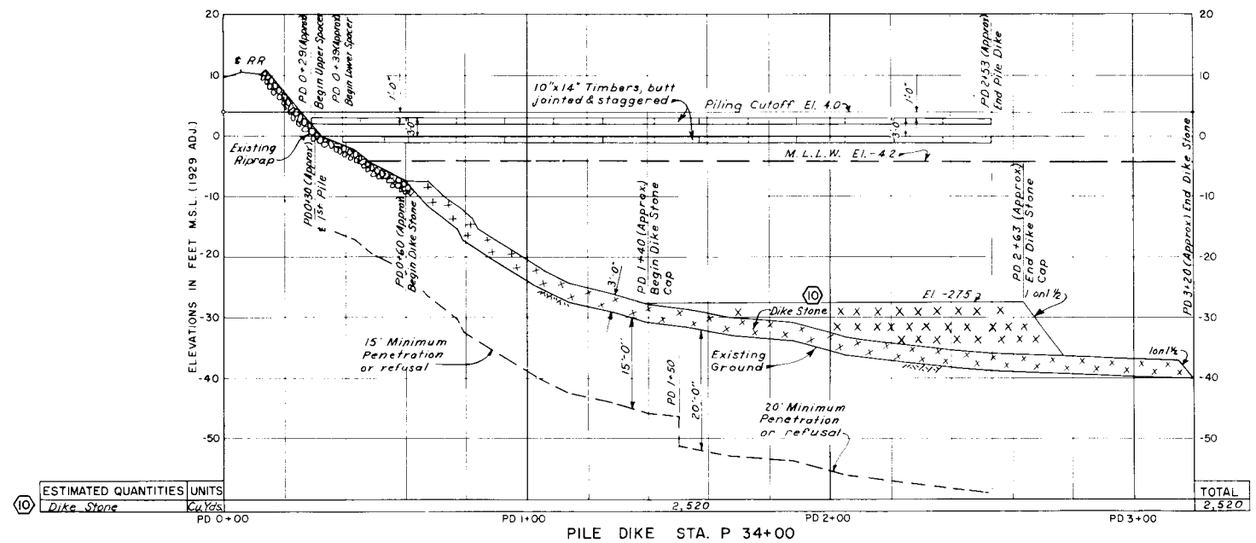
SHEET 2 OF 3

BLACK

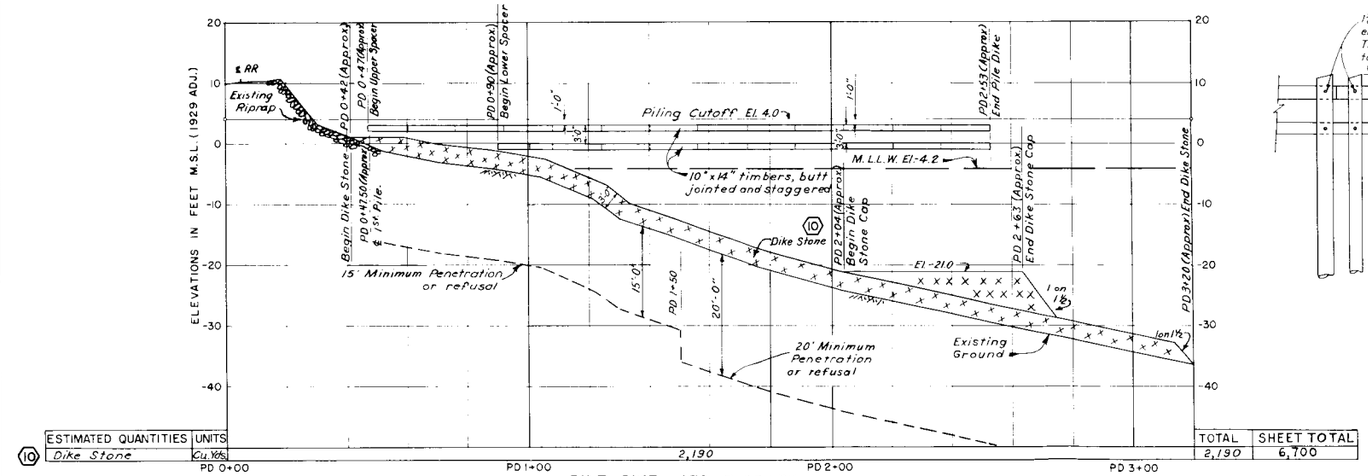
CORPS OF ENGINEERS U. S. ARMY



PILE DIKE STA. P 22+00

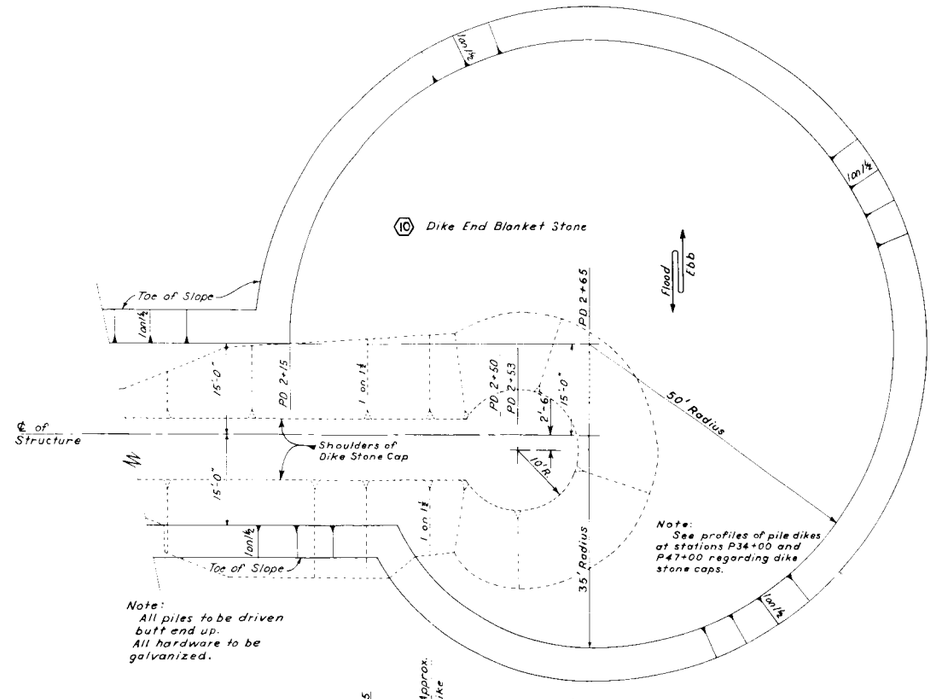


PILE DIKE STA. P 34+00

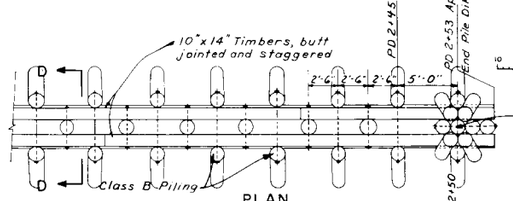


PILE DIKE STA. P 47+00

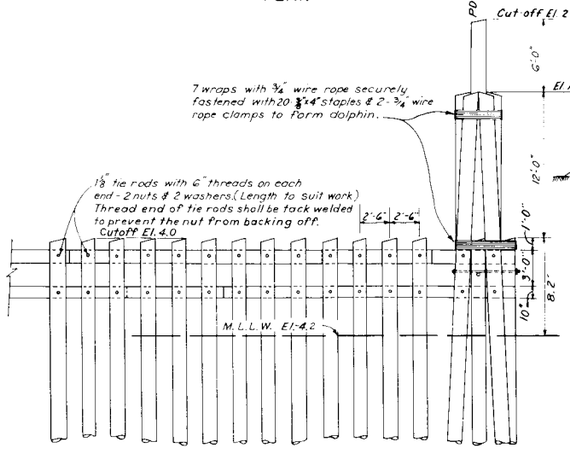
PROFILES



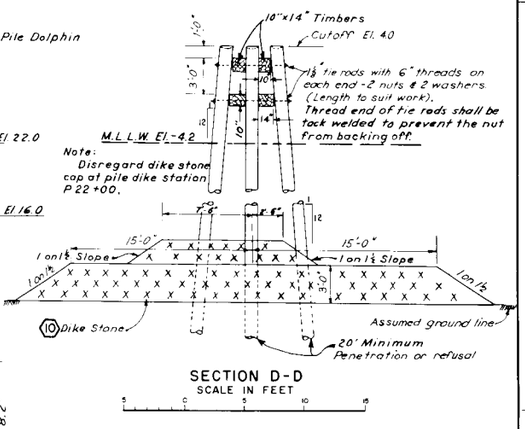
PLAN
DIKE END STONE BLANKET
SCALE IN FEET



PLAN



PROFILE
SCALE IN FEET



SECTION D-D
SCALE IN FEET

REVISION	DATE	DESCRIPTION	BY

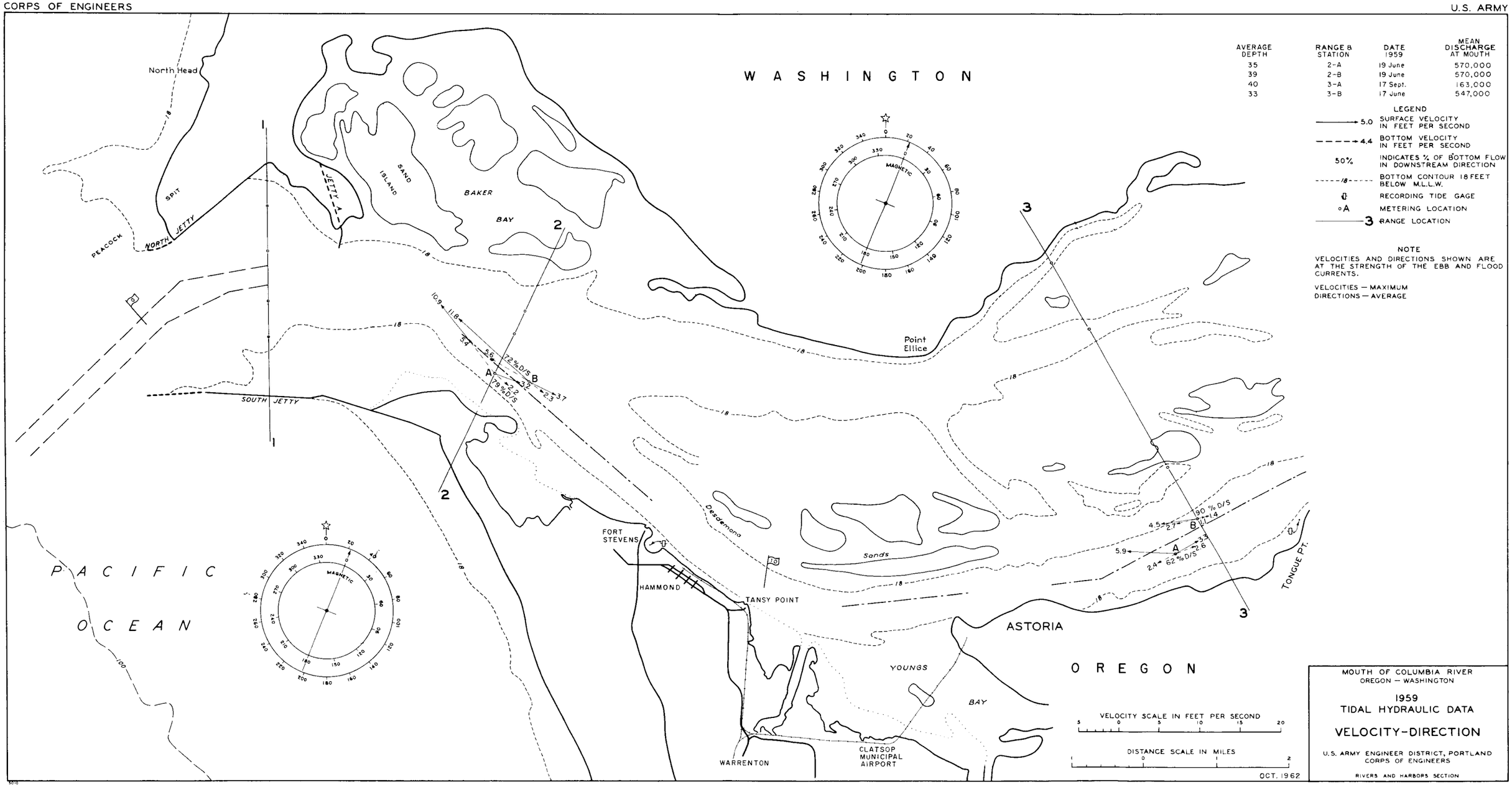
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
OFFICE OF THE DISTRICT ENGINEER, PORTLAND, OREGON

DESIGNED BY E.C.K.
TRACED BY E.C.K.
CHECKED BY G.McL.
PREPARED: L.K. Henderson
REVIEWED: W.H. Swick for
CHIEF, ENGR. BRANCH
SUPERVISED:
CHIEF, FLOOD CONTROL SECTION
SUBMITTED:
CHIEF, PLANNING BRANCH
RECOMMENDED:
CHIEF, ENGINEERING DIVISION

LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
PORT OF ASTORIA, OREGON
TANSY POINT LOCATION
PILE DIKE DETAILS

APPROVED: DATE
COLONEL, C.E. DISTRICT ENGINEER
SCALE AS SHOWN | SPEC. NO.
SHEET 3 OF 3 | CLW-10-3/3

PLATE 4



AVERAGE DEPTH
35
39
40
33

RANGE & STATION	DATE 1959	MEAN DISCHARGE AT MOUTH
2-A	19 June	570,000
2-B	19 June	570,000
3-A	17 Sept.	163,000
3-B	17 June	547,000

LEGEND

- 5.0 SURFACE VELOCITY IN FEET PER SECOND
- 4.4 BOTTOM VELOCITY IN FEET PER SECOND
- 50% INDICATES % OF BOTTOM FLOW IN DOWNSTREAM DIRECTION
- 18 BOTTOM CONTOUR 18 FEET BELOW M.L.L.W.
- RECORDING TIDE GAGE
- A METERING LOCATION
- 3 RANGE LOCATION

NOTE

VELOCITIES AND DIRECTIONS SHOWN ARE AT THE STRENGTH OF THE EBB AND FLOOD CURRENTS.

VELOCITIES — MAXIMUM
DIRECTIONS — AVERAGE

VELOCITY SCALE IN FEET PER SECOND 5 0 5 10 15 20

DISTANCE SCALE IN MILES 0 1 2

OCT. 1962

MOUTH OF COLUMBIA RIVER
OREGON — WASHINGTON

1959
TIDAL HYDRAULIC DATA

VELOCITY-DIRECTION

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
RIVERS AND HARBORS SECTION

PLATE 5

APPENDIX

COLUMBIA RIVER MODEL STUDY
INTERIM REPORT ON
LOWER COLUMBIA RIVER BANK PROTECTION
TANSY POINT LOCATION

1. In November 1962, the Portland District requested that model tests be undertaken immediately to determine the effectiveness of a proposed revetment and pile dike installation at Tansy Point, which is located on the south shore of the river about one and one-half miles from Fort Stevens, in reducing erosion of the bankline in that area. Although the current velocity and salinity verifications of the Columbia River model were not entirely complete, it was decided that the verifications were sufficiently advanced to warrant proceeding with the study without delay.

2. The problem. - The bankline immediately west (downstream) of Tansy Point has been eroding at a rapid rate in the last few years. Since the erosion problem is serious, and the Portland District has planned to take corrective measures in the immediate future, testing of these plans was given the highest priority in the model testing program.

3. The initially proposed construction called for three pile dikes, each approximately 200 feet in length, located at Stations P22+00, P34+00 and P47+00 as shown on plate 1. The plans also included enrockment to elevation -27.5 m.s.l. around the base of the dike at P34+00, and enrockment to elevation -21.0 m.s.l. around the base of the dike at P47+00. Plans for the proposed construction were shown on Portland

District drawings numbers CLW-10-3/1, CLW-10-3/2, and CLW-10-3/3.

4. Model testing procedure. - The model testing procedure agreed on during discussion with District representatives consisted of the following four phases:

a. Observation of the movement of simulated sediments throughout the problem area by the use of granular plastic material in the model;

b. Measurement of velocities near the river bottom at critical locations in the problem area;

c. The determination of bottom current patterns by making photographs of dye streaks on the river bottom; and

d. Determination of surface current patterns and velocities at critical phases of tide by taking time-exposure photographs of confetti scattered on the model water surface. Each of these phases was completed for both a base condition and for the proposed plan condition.

5. A granular plastic material with specific gravity of 1.05 was introduced into the model in the immediate area of the Tansy Point bankline. The object of this procedure was to obtain a qualitative indication of the patterns of movement and deposition of sediments in the problem area. The material was placed upstream and downstream from the problem area and along the bankline of the problem area.

6. Miniature Price current meters were used to measure velocities in the model. Velocity measurements were taken at hourly (prototype) intervals at elevations approximately 5 feet (prototype) above the river bottom. Metering stations were located off the ends of the proposed dikes, on ranges midway between the dikes, and on ranges upstream and

downstream from the end dikes. The station layout used for velocity measurements is shown on plate 1.

7. Crystals of potassium permanganate dye were introduced into the model, and the dye streaks produced were photographed for record purposes. Photographs were taken at the two strengths of ebb and at the two strengths of flood during the diurnal tidal cycle. The photographs thus give a good indication of the patterns of the strongest currents on the river bottom near the shoreline. Comparison of the base test photographs with the plan test photographs shows the changes in bottom currents caused by the proposed dikes.

8. Pieces of confetti were scattered on the water surface, and time-exposure photographs were taken at strengths of ebb and flood current. The time exposure employed was five seconds, which is equivalent to 250 seconds in the prototype. A 6-foot rule was placed on the model overbank to indicate the scale of the photographs. Since 1 foot on the model is equivalent to 500 feet in the prototype, surface velocities can be determined with fair accuracy by dividing the length of a confetti streak (prototype dimension) by 250 to obtain the current velocity in prototype feet per second.

9. The base test for the initially-proposed dikes was run with the Tansy Point bankline in the 1958 condition to which the model was initially molded. The river discharge for these tests was 170,000 c.f.s. and the diurnal tide range at the Fort Stevens tide gage was 8.2 feet. The tide used in the model was the prototype tide of 6 a.m., 20 September 1959 to 7 a.m., 21 September 1959. The tide curve is shown on

plate 3. The ocean salinity was maintained at 33,000 ppm. The set of conditions described above is referred to hereinafter as Base A, and Plan A-1 was tested under these same conditions.

10. Additional studies requested. - In a letter dated 29 November 1962, subject: "Model Study, Lower Columbia River Bank Protection, Tansy Point Location," supplemented by a telephone conversation on 11 December 1962 between representatives of the Portland District and the Waterways Experiment Station, it was decided to test two additional dike plans. Furnished with the request for additional tests was a set of cross sections, measured in 1961, at 100 foot stations, for the Tansy Point location. The model bankline was checked against the cross sections, and it was found that there were major differences between the two. Therefore, before proceeding with the additional tests, the area in question was broken out of the model and remolded to the 1961 conditions. This condition is referred to hereinafter as Base B, and Plans B-1 and B-2 were tested under these conditions.

11. The first of the additional tests called for increasing the height of the enrockment around the proposed dikes to elevation -10 feet m.s.l., which is designated Plan B-1. The other proposal was to add a fourth and fifth dike at Stations P28+00 and P40+50, with enrockment to elevation -10 feet m.s.l., and this has been designated Plan B-2. It was requested by the Portland District that current velocity observations be made at a point "A", located 255 feet from the "P" line on the split angle at Station P4+63.11. The elements of these two proposals, as well as the locations of observation stations, are shown on plate 2.

12. The testing of Plans B-1 and B-2 was carried out in the same manner as Plan A-1, which is described in paragraphs 4 to 8 above. All testing conditions for the two series of tests were the same, except for the change in bankline described in paragraph 10 above.

13. Results. - Plan A-1. - For both Base A and Plan A-1, the granular plastic material initially placed near the bankline was moved toward the channel; on reaching deep water, the material moved upstream to and deposited in the Flavel Bar. Material that was initially placed in deep water in or near the channel at no time moved towards the bankline.

14. Velocity observations for Base A and Plan A-1 are shown on plates 4 through 8. Plate 4 indicates that flood velocities off the ends of dikes 22+00 and 47+00 were increased, and ebb velocities off the ends of dikes 34+00 and 47+00 were decreased. Plate 6 shows that flood velocities were decreased at the two shoreward stations and increased at the deep-water station; there was an increase of ebb velocities at all three of these stations. Plate 7 shows that a significant reduction of ebb velocities occurred at the two shoreward stations. Plate 8 shows that flood velocities at the shoreward station were increased, and ebb velocities at the two shoreward stations were decreased.

15. Bottom current patterns (as indicated by dye streaks) for Base A and Plan A-1 are shown on photos 1 through 8. The large number near the bottom of each photo is the time of the photo in prototype hours, corresponding to the time in hours shown on the tide curve,

(plate 3). Photos 1 through 4 indicate that Plan A-1 had little effect on bottom current directions in the problem area. There are indications, from the lengths of the dye streaks, that bottom ebb velocities were increased, especially between dikes 34+00 and 47+00, and photos 5 through 8 indicate that bottom flood velocities were decreased slightly between the dikes.

16. Photographs 9 through 16 show surface current patterns for Base A and Plan A-1. Photos 9 through 12 show that Plan A-1 caused a significant decrease in surface ebb velocities between the dikes. Photos 13 through 16 indicate that the plan produced little change in surface flood velocities.

17. Base B. - Following remolding of the model bankline to reproduce 1961 prototype conditions, a difference was noted in the movement of the granular plastic material in the problem area. Material introduced just upstream from the wharf at Station 58+50, and shoreward of the channel, was moved out into the channel at a much slower rate than for the Base A condition; otherwise, the movement pattern was much the same as for the Base A condition.

18. Photographs 17 through 20 show bottom current patterns as indicated by dye streak for Base B, and photographs 21 through 24 show the surface current patterns by means of confetti for Base B.

19. Plan B-1. - Because of the steeper side slopes of the Base B bankline condition, as compared with Base A, it was infeasible to study the movement of granular plastic material between the dikes in water less than about 30 feet deep. However, it was noted that material placed

between the ends of the dikes was moved towards the channel at a somewhat slower rate than for Base B. There was no tendency for material placed in the channel to move toward or deposit near the bankline.

20. Velocity observations for Base B and Plan B-1 are presented on plates 9 through 16. Plate 9 shows that the only major velocity change off the ends of the dikes was a reduction in flood velocity at dike 34+00. Plates 10 through 16 show that, for the shoreward stations, the maximum flood velocities ranged generally from 0.5 to 1.0 fps for Base B, and ranged from 0.3 to 0.5 fps for Plan B-1. Maximum ebb velocities for the same stations were not significantly affected by Plan B-1. For stations located in the second position from the bankline, a significant flood velocity reduction caused by Plan B-1 may be noted on plate 14 (1.8 to 0.7 fps), a significant flood velocity increase may be noted on plate 15 (0.5 to 1.5 fps), and a significant ebb velocity decrease may be noted on plate 16 (0.8 to 0.4 fps). Generally speaking, current velocities at the deeper water stations showed no significant changes attributable to Plan B-1.

21. Photographs 25 through 28 show bottom flow patterns as indicated by dye streaks for Plan B-1. Photos 25 and 26, compared against the photos for Base B, indicate that bottom ebb velocities were decreased adjacent to the dikes, but little change was noted midway between the dikes. Photos 27 and 28 indicate that bottom flood velocities were decreased adjacent to dike 22+00, but little change was noted elsewhere in the problem area.

22. Photographs 29 through 32 show surface current patterns for Plan B-1. Photos 29 and 30 indicate that the plan caused little or no change in surface ebb velocities or directions. Photos 31 and 32 indicate that surface flood velocities were decreased slightly along the bankline between the dikes.

23. Plan B-2. - As for Plan B-1, it was considered infeasible to attempt any studies of sediment movement in shallow water between the dikes because of the steep side slopes. Material placed between the dikes in deep water was observed to move towards the channel at a much slower rate than for Base B or Plan B-1. There was no indication that material placed in the channel would move toward or deposit along or near the bankline.

24. Velocity observations for Plan B-2 are presented on plates 9 through 16, along with those for Base B and Plan B-1. Plates 9, 12, and 14 show the following significant velocity changes off the ends of the dikes:

a. Strength of flood current was reduced at dike 34+00 (3.3 to 2.1 fps);

b. Ebb velocities were reduced at dike 47+00 (1.2 to 0.7 fps); and

c. Flood velocities were increased at dike 28+00 (2.5 to 3.3 fps). Plan B-2 also reduced maximum ebb and flood velocities at all stations between the dikes to about 0.2 fps or less; maximum velocities at the same stations for Base B and Plan B-1 were about 1.0 fps. Plates 10, 11, and 13 show that flood velocities were reduced appreciably and

ebb velocities were reduced slightly at the deep water stations. Plate 15 indicates that both ebb and flood velocities were reduced appreciably for the deep water station.

25. Photographs 33 through 36 show bottom current patterns by means of dye streaks for Plan B-2. Photos 33 and 34, compared with the photos of Base B and Plan B-1, indicate that bottom ebb velocities were reduced between the dikes. Photos 35 and 36 indicate that bottom flood velocities were also reduced slightly between the dikes.

26. Photographs 37 through 40 show surface current patterns for Plan B-2. Photos 37 and 38 indicate that surface ebb velocities were reduced between the dikes, especially between the downstream dikes. Photos 39 and 40 indicate that surface flood velocities were reduced appreciably between all the dikes.

27. Point "A". - The location of Point "A" is shown on plate 2. Granular plastic placed in the vicinity of Point "A" was observed to move slowly and progressively upstream; some of this material deposited immediately south of the navigation channel where it changes direction near Tansy Point, and some deposited in the Flavel Bar. Material introduced at other localities did not tend to deposit near Point "A". These movement patterns were not affected by any of the plans tested.

28. Velocity observations for Point "A" are presented on plate 16. Velocities at this location were not materially affected by either Plan B-1 or Plan B-2.

29. Discussion. - Plan A-1. - Although velocities were significantly reduced immediately adjacent to the Tansy Point bankline by the

dikes for Plan A-1, it appears that the reductions were not sufficient to eliminate bankline erosion in the problem area, especially if the erosion is caused primarily by wave action, with the tidal currents acting as a transporting force to remove the eroded material from the problem area.

30. Plan B-1. - Plan B-1 caused a substantial reduction in velocities close to the bankline. However, velocities were not reduced appreciably by this plan between the dikes in water depths exceeding about 20 feet. It appears that if wave action plays a major part in eroding the bankline and/or suspending sediments in depths of 20 feet or less, velocities with this plan installed would still be sufficient to remove the material from the area.

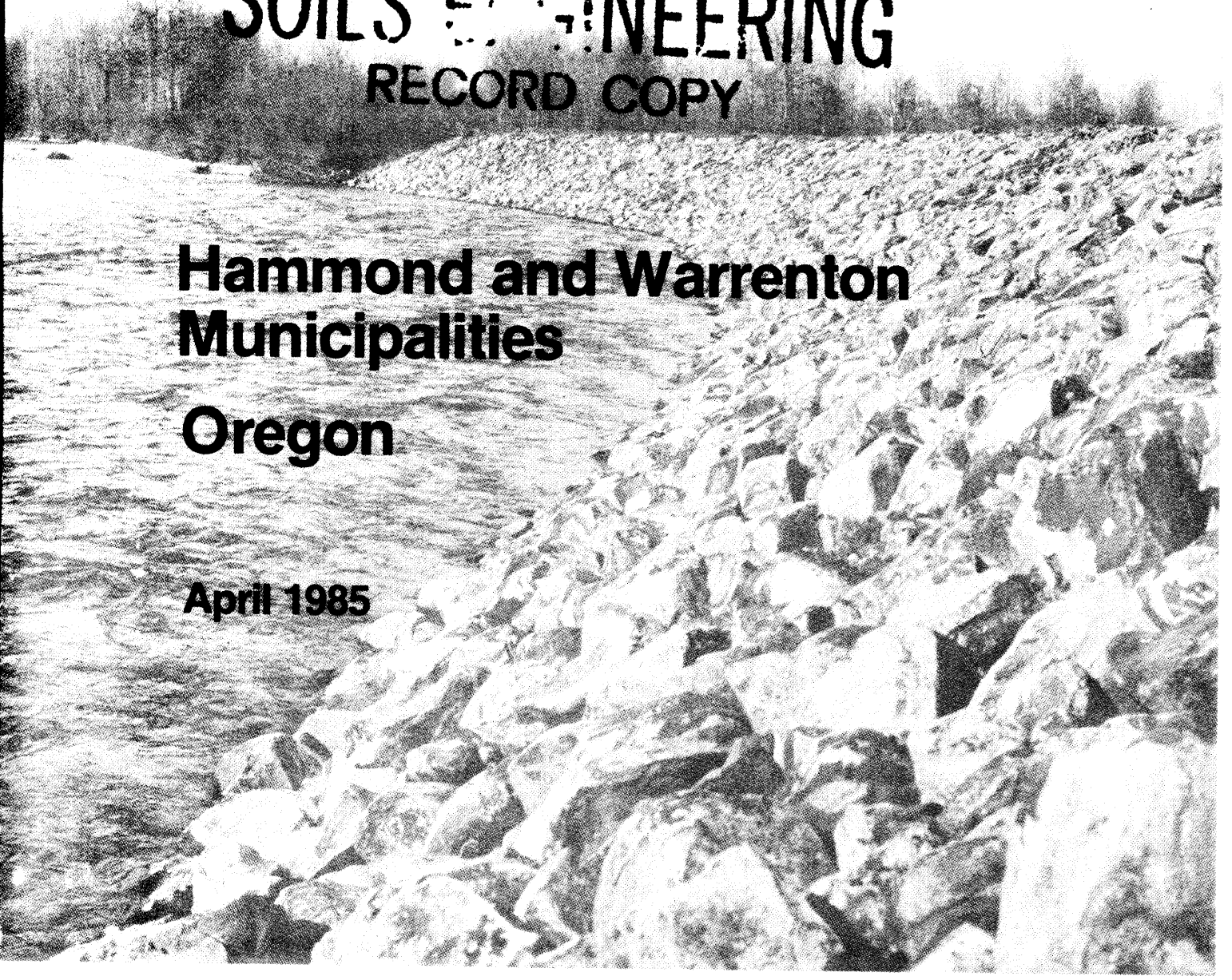
31. Plan B-2. - Addition of the intermediate dikes at Stations 28+00 and 40+50 appreciably reduced bottom velocities between the dikes and especially within about 150 feet of the bankline. It appears that this plan would greatly retard or eliminate erosion of the bankline and shallow water areas, regardless of whether the erosion is caused primarily by tidal current action or if wave action plays a primary role in the erosion process.

US Army Corps
of Engineers
Portland District

Design Memorandum

Lower Columbia River Bank Protection

SOILS ENGINEERING
RECORD COPY



Hammond and Warrenton Municipalities
Oregon

April 1985

NPDEN-TE (NPPEN-DB-CL) 3d End Mr. Oliver/kkd/FTS 423-3859
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection at Tansy Railroad Location

DA, North Pacific Division, Corps of Engineers, P. O. Box 2870, Portland, Oregon 97208-2870 9 August 1985

TO: Commander, Portland District, ATTN: NPPEN-DB-CL

The design memorandum is approved.

FOR THE COMMANDER:

Gary G Sturman

GARY G. STURMAN, Acting Chief
Engineering Division

3 Encls
3. nc exc 3 cys wd

DEPARTMENT OF THE ARMY
PORTLAND DISTRICT, CORPS OF ENGINEERS
P. O. BOX 2946
PORTLAND, OREGON 97208

NPPEN-DB-CL

9 April 1985

SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection at Tansy Railroad Location

Commander, North Pacific Division
ATTN: NPDEN-TE

1. Pursuant to Paragraph 19 of ER 1110-2-1150, eight copies of the subject design memorandum for construction of bank protection at Tansy Railroad Location on the Lower Columbia River are inclosed (Incl 1).

2. Contract award for construction of 3,840 linear feet of stone protection at Tansy Railroad Location, as outlined in this design memorandum, is proposed for August 1985. The estimated capital cost of the proposed work is $1,827,000.

3. Formal assurances have been obtained and are inclosed (Incl 2). Rights-of-way will be obtained prior to advertisement.

4. Environmental considerations: The supplemental environmental impact statement for Lower Columbia River Bank Protection, Oregon and Washington, was filed on 8 October 1976. Tansy Railroad Location was not specifically identified in that document, thus, an Environmental Assessment and Finding of No Significant Impact will be prepared for the proposed work. Formal documentation of compliances with the Endangered Species Act of 1973, Sections 401 and 404 of the Clean Water Act of 1977, and Cultural Resources Acts will be furnished by separate correspondence.

5. Approval of the design memorandum is recommended.

FOR THE COMMANDER:

ROBERT P. FLANAGAN, P.E.
Chief, Engineering Division

2 Incls
1. as (8 cys)
2. as

NPDEN-TE (NPPEN-DB-CL/9 Apr 85) 1st End Mr. Oliver/rm/FTS 423-3859
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection at Tansy Railroad Location

DA, North Pacific Division, Corps of Engineers, P. O. Box 2870, Portland, Oregon 97208-2870 10 MAY 1985

TO: Commander, Portland District

1. The design memorandum is returned unapproved for incorporation of a more complete economic and technical analysis, and your program for funding. Environmental coordination should continue during the period of analysis so a construction start is not impacted by that aspect of the project.

2. Specific comments on the report are:

a. The Tansy point location comprises only a portion of the length of bankline that can be subjected to erosion during the next 50 years. Due to this and an increasing tendency of the river to meander in this reach, additional revetment may be required. The economic analysis is to include your best estimate of future costs during the project life.

b. The economic analysis must be based on the least cost without project condition. It is not apparent that the analysis is based on this. The description of the without project condition, indicate the improvements are located above the 500 year flood level. It therefore appears only storage, parking areas, and access roads would be subject to inundation. Hence, raising of roadways and storage area may be more cost effective than the $5 million relocation described in the report. Since benefits are based on prevention of the $5 million relocation cost, reasons for not solving the storage and access problem at a lesser cost must be included in the discussion of the without project condition.

c. Caution is to be used in claiming benefits for an erosion location that is not expected to be a problem for another 25 years. We suggest those claims not be used due to the uncertainty associated with projecting erosion over a 25 year period but if they are claimed, strong support is required. The report does not supply that support and we are not able to verify claims of benefits associated with preventing flooding to Warrenton due to lack of description of the procedures used to calculate the benefits and lack of supporting information in the report.

d. The technical analysis for sizing revetment has used out of date technology. ETL 1110-2-305 or the 1984 shore protection manual are to be used to derive the design wave. The 1984 shore protection manual is to be used to analyze wave runup. The use of the Hudson damage coefficient of 4.37 as given in ETL 1110-2-222 is not recommended in open sea conditions, and as this site has many of the characteristics of an open sea environment, use of that value must be justified by experience or rationalization.

e. Riprap below about -12MLLW can be sized for tractive force in lieu of wave requirements. A reduction in stone size class should have a significant effect on costs and is to be reflected in the design analysis and section.

f. Appendix B-3 paragraph 7.3.1 makes statements as to why the design section is stable. You are to complete an arc or wedge type stability analysis and rewrite the paragraph so the correct reasons for stability are stated.

g. The current cost estimate for the project is $1,827,000 while the latest estimate submitted to Congress Feb 85 was $710,000. ER 1110-2-1150 requires that significant changes in the estimate be explained. We require compliance with the ER and an explanation as to how the project is to funded.

h. Real estate requirement whether local or federal are to be explained. Paragraph 6 of the main text is to be rewritten to reflect those requirements.

i. NEPA requires that no administrative action be taken until environmental documentation is completed. The report fails to provide that documentation and, therefore, could not be approved, even if technically sound. The following documentation must be completed and formal documentation furnished NPDO before we approve the project:

(1) Environmental assessments and FONSI.

(2) Fish and Wildlife Coordination Act Report.

(3) Clean Water Act Requirements.

(4) Sec. 309, Clean Air Act Coordination.

(5) Documented Coordination with State Historic Preservation Office.

(6) Current letters from the State supporting the proposed action.

FOR THE COMMANDER:

Gary G Sturman

GARY G. STURMAN, Acting Chief
Engineering Division

Encl
1. nc exc 3 cys wd
2. wd

NPPEN-DB-CL (NPPEN-DB-CL/9 Apr 85) 2nd End Todd/rb/6491
SUBJECT: Lower Columbia River Bank Protection, Oregon and Washington, Transmittal of Design Memorandum for Bank Protection at Tansy Railroad Location

DA, Portland District, Corps of Engineers, P.O. Box 2946, Portland, Oregon 97208-2946 30 July 1985

TO: Commander, North Pacific Division
ATTN: NPDEN-TE

1. Eight copies of the revised design memorandum for construction of bank protection work at Tansy Railroad Location are enclosed (Encl 3). The revised design memorandum has been coordinated with NPD's John Oliver, Ken Boire, and Don Campbell.

2. Specific replies to your comments in paragraph 2 of the 1st Endorsement are as follows:

a. Aerial photographs and data contained in the Lower Columbia River Shoaling Study, May 1985, prepared for the Portland District by Ogden Beeman and Associates, Inc., indicates that within the last 30 years, migration of the navigation channel towards the left bank has been insignificant in this reach of river. Within the next 50 years (life of the project), no major migration is expected that will affect the left bank at Tansy Railroad Location. Design was based on this analysis and is considered adequate for the life of the project. Therefore, no additional costs were included for future protection.

b. Economic benefits that are taken for improvements located above the 500-year flood level would be impacted by erosion with the without-project-condition. The economic analysis is based on erosion control and not flood control of these areas. The economic analysis, paragraph 15, has been revised for clarification, and to further detail the least cost-without-project condition.

c. Due to the uncertainty associated with projecting erosion over a 25-year period, benefits associated with preventing flooding at Warrenton have been deleted.

d. We have reanalyzed the revetment design utilizing the 1984 Shore Protection Manual (SPM), (see paragraph 11). The 1984 SPM was used to derive the design wave, analyze wave runup, size riprap, and determine riprap layer thickness.

e. Using criteria outlined in Chapter 7 of the SPM, riprap placed below elevation -15.5 NGVD (-12 MLLW) can be sized for tractive force in lieu of wave requirements. The analysis shows that Class III riprap can be used in place of Class V below elevation -15.5. We have made this change due to your request, but have the following concerns:

(1) Placement of Class III riprap (below) and Class V riprap (above) elevation -15.5 NGVD would occur underwater the majority of the time. Problems may develop in maintaining the stone class break at the proper elevation.

Although contingencies are built into the calculations to account for this, it is our feeling that Class III and Class V riprap could get mixed together causing inadequate gradation of stone sizes. In addition, problems may develop in assuring that proper quality control is maintained at the tie-in between Class III and V.

(2) In the event one quarry is utilized for Class III and Class V riprap, unit costs are expected to be the same for both classes. Historical data has shown that for this situation the Corps normally receives the same price per cubic yard for various classes of riprap.

(3) Class III riprap is only required in the middle of the revetment. Logistics necessary for the Contractor to place and haul Class III and Class V riprap simultaneously could cause delays, and the possibility that Class III riprap would be placed in areas where Class V is required. Due to this situation, we expect the Contractor to request to use Class V in lieu of Class III at the same unit price.

f. An Arc Stability Analysis has been included as Figure 6, and results are reflected in Appendix B, Geotechnical Features.

g. The preliminary cost estimate of $710,000 was based on a standard two-layer revetment ($200/ft). With a more detailed study during the preparation of the Design Memorandum, it was determined that: (1) filter criteria would require three distinct layers of stone; (2) the toe elevation would be deeper than originally expected; and (3) construction and design of the revetment was more complex than originally expected due to the extent of existing stone on the face of the levee. An explanation for the significant changes in the estimate has been incorporated into paragraph 1, Scope, of the Design Memorandum. The project will be partially funded with FY 85 funds in the amount of $50,000. The balance will be funded with FY 86 funds programmed for the Lower Columbia River Bank Protection Program.

h. Real Estate Requirements, paragraph 6, has been rewritten to explain both local and Federal real estate requirements in more detail.

i. The Finding of No Significant Impact (FONSI), Environmental Assessment, Section 404 Evaluation, State Water Quality Certification, documented coordination with the State Historic Preservation Office, and coordination letters showing compliance with the Fish and Wildlife Coordination Act, are included in the Design Memorandum as Appendix C. All environmental requirements are fulfilled.

FOR THE COMMANDER:

ROBERT P. FLANAGAN, P.E.
Chief, Engineering Division

3 Encls
1. 1-2 wd
3. Added 1 Encl - Design Memorandum (Revised) (8 cys)

DESIGN MEMORANDUM

LOWER COLUMBIA RIVER BANK PROTECTION

OREGON AND WASHINGTON

HAMMOND AND WARRENTON MUNICIPALITIES, OREGON

TANSY RAILROAD LOCATION

FISCAL YEAR 1985

Prepared by
U.S. Army Engineer District, Portland
Corps of Engineers
April 1985

Rev Jul 85

TABLE OF CONTENTS

Paragraph		Page
	TITLE SHEET	i
	TABLE OF CONTENTS	ii-iii
	PREVIOUSLY ISSUED DESIGN MEMORANDUMS	iv-v
1	Scope	1
2	Pertinent Data	1
3	Project Authorization	1
4	Investigations	2
5	Local Cooperation	3
6	Real Estate Requirements	4
7	Location of Project	5
8	Present Conditions	5
9	Existing Revetments in Immediate Vicinity	6
10	Proposed Improvements	7
11	Design Data	8
12	Environmental Impacts	10
13	Cost Estimate	11
14	Annual Costs	11
15	Economic Analysis	11
16	Project Justification	14
17	Construction Schedule	14
18	Conclusions and Recommendations	14

TABLES

1. Cost Estimate, Tansy Railroad Location

2. Annual Costs, Tansy Railroad Location

PLATES

1. Project Map

2. Tansy Railroad Location, Site Plan, Location Map, Vicinity Map and Index

3. Tansy Railroad Location, Plan, Profile, and Typical Sections

4. Tansy Railroad Location, Plan, Profile, and Typical Sections

FIGURES

1. Tansy Railroad Location - Plan
2. Stage Frequency Curve
3. Columbia River Dredge Sediment Study
4. Filter Design
5. Riprap Gradation Curves
6. Stability Analysis Summary

APPENDIX

A. Revetment Design

B. Geotechnical Features

C. Environmental Assessment

LOWER COLUMBIA RIVER BANK PROTECTION

OREGON AND WASHINGTON

PREVIOUSLY ISSUED DESIGN MEMORANDUMS

Subject	Submission	Approval
General Design Memorandum	3 Jun 60	19 Aug 60
Beaver Drainage District and Sauvie Island Drainage District	14 Dec 60	11 Apr 61
Clatsop County Diking District No. 6	22 Aug 61	1 Sep 61
Svensen Island District Improvement Company	14 Dec 61	4 Jan 62
Midland Drainage District	8 Feb 62	27 Feb 62
Kalama River South Area	28 Mar 62	12 Apr 62
Peninsula Drainage District No. 1	29 Jun 62	24 Jul 62
Multnomah County Drainage District No. 1	9 Jan 63	25 Jan 63
Port of Astoria, Tansy Point Location	29 Mar 63	20 May 63
Wahkiakum County Consolidated Diking District No.1	25 Apr 63	7 Jun 63
Scappoose Drainage District	26 Apr 65	18 May 65
Cowlitz County Diking Improvement District No. 15	3 Jan 66	8 Feb 66
Clatsop County Drainage District No. 1	7 Feb 67	17 Feb 67
Wahkiakum County Diking Improvement District No. 4	14 Nov 67	1 Dec 67
Peninsula Drainage District No.2	15 Apr 69	6 May 69
Washougal Area, Washington	25 Feb 70	16 Mar 70
Wahkiakum County Consolidated Diking District No. 1 Supplement No. 1	19 Mar 70	1 Apr 70
Sauvie Island Drainage District Supplement No.1	16 Apr 70	24 Apr 70
Cowlitz County Consolidated Diking Improvement District No. 2	7 Apr 71	19 Apr 71
Clatsop County Diking District No. 7	14 Apr 71	30 Apr 71
Scappoose Drainage District Supplement No. 1 Supplement No. 1	24 Sep 71	22 Oct 71

Multnomah County Drainage District No. 1 Supplement No. 1	29 Mar 73	13 Apr 73
Port of Kalama, Washington	26 Mar 74	18 Apr 74
Clatsop County Diking District No. 9 Supplement No. 1	28 Jun 74	11 Jul 74
Svensen Island District Improvement Company Supplement No. 1	31 Mar 76	18 May 76
Clatsop County Diking District No. 5	16 Apr 76	2 Jun 76
Washougal Area, Washington, Supplement No. 1	7 Mar 77	28 Apr 77
Marshland Drainage District	16 Feb 78	4 May 78
Scappoose Drainage District, Supplement No. 2	14 Apr 80	7 Jul 80
Midland Drainage District, Supplement No. 1	1 Apr 82	19 Jul 82
Multnomah County District, No. 1 Supplement No. 2	12 May 83	30 Nov 83
Webb District Improvement Company	24 May 83	8 Dec 83
Marshland Drainage District, Supplement No. 1	6 Jun 83	30 Nov 83
Sauvie Island Drainage District, Supplement No. 2	13 Jul 83	3 Jan 84
Marshland Drainage District, Letter Supplement No. 1	12 Apr 84	15 Aug 84
Scappoose Drainage District, Supplement No. 2, Letter Supplement No. 1	16 Jul 84	26 Jul 84
Woodson Drainage District	24 Jul 84	29 Oct 84

LOWER COLUMBIA RIVER BANK PROTECTION
OREGON AND WASHINGTON
HAMMOND AND WARRENTON MUNICIPALITIES, OREGON
TANSY RAILROAD LOCATION

1. Scope. The scope of work proposed in this Design Memorandum includes the construction of 3,840 linear feet of stone blanket revetment at Tansy Railroad Location on the lower Columbia River. A preliminary construction cost estimate prepared in February, 1984, of $710,000 was based on a standard 2-layer revetment at Tansy Railroad Location. With a more detailed study during the preparation of this Design Memorandum, it was determined that filter criteria would require 3 layers, and the toe elevation would be deeper than previously estimated. Therefore, significant changes in the estimate were warranted.

2. Pertinent Data. Significant data on the proposed bank protection work is summarized below:

Location	Length Feet	Federal Cost	Non-Federal Cost	Total Cost
Tansy Railroad	3,840	$1,707,000	$23,000	$1,730,000

Benefit-to-cost ratio 2.73 to 1 (January 85 Price Level)

3. Project Authorization. Construction of bank protection works at 66 individual locations on the lower Columbia River was authorized by the Flood Control Act of 17 May 1950 (Public Law 516, 81st Congress, 2nd Session). Those locations (as proposed in House Document 531, paragraph 441, page 2,622, 81st Congress, 2nd Session), totaling 123,800 linear feet, are located along existing diking and drainage district levees, and unprotected highly developed areas. Numerous field investigations have been conducted along the riverbank since 1948. Investigations presented in the General Design Memorandum for Lower Columbia River Bank Protection dated June 1960, indicated the need for protective works at 61 locations totaling 133,680 linear feet, and the possible future need for protective works at an additional 35 locations

totaling 90,465 linear feet. Plate 1 shows the overall project as now authorized, locations completed, and proposed work. All bank stabilization required for protection of the town of Hammond, Oregon, and the City of Warrenton, Oregon, will be considered as a single unit for cost estimating and economic justification purposes.

4. Investigations. Erosion along Tansy Railroad Location has been reported by local interests. Erosion areas have been observed during periodic inspections at Tansy Point Location immediately upstream. That erosion is now endangering the integrity of the levee system. Stone dumped by local interests in the most critical locations as needed no doubt has prevented levee failure thus far.

a. Site Inspection.

The levee was inspected several times over the past year at different tidal stages.

b. Wave and Velocity Analysis.

A wave analysis was conducted based upon both wind and large boat generated waves. Velocity analysis was based on studies prepared by the Waterways Experiment Station in 1959 and 1983. An explanation of these activities is in Appendix A.

c. Surveys.

Cross-sections taken at 100-foot intervals, extending 20 feet landward from the toe of the levee and 100 feet past the toe of the levee riverward, were obtained in September 1984.

d. Soils Investigations.

Soils investigations have been accomplished. An explanation of these activities is in Appendix B of this design memorandum. Summaries of soil investigations are shown on Figures 3 through 6.

5. Local Cooperation. The 1950 Flood Control Act, as amended, and more recent legislation require that a local entity provide assurances of local cooperation. The agreement between the United States of America, represented by the Contracting Officer executing the agreement, and the Town of Hammond and the City of Warrenton (hereinafter called "the Sponsors") states the following:

a. The Sponsors agree that, upon notification that the Government will commence construction of Tansy Railroad Location substantially in accordance with the Federal legislation authorizing such project, the Sponsors shall, in consideration of the Government commencing construction of such Project, fulfill the requirements of non-Federal cooperation specified in such legislation, to wit:

(1) Provide, without cost to the United States, all lands, easements, and rights-of-way.

(2) Make all necessary highway, highway bridge and utility alterations.

(3) Hold and save the United States free from damages due to the construction, operation, and maintenance of the project except where such damages are due to the fault or negligence of the United States or its contractors.

(4) Maintain and operate the works after completion in accordance with regulations prescribed by the Secretary of the Army.

b. The project sponsors are further required to:

(1) Prevent future encroachment which might interfere with proper functioning of the project.

(2) Comply with the Department of Defense Directive under Title VI of the Civil Rights Act of 1964 (PL 88-352) (78 Stat. 241) and all requirements imposed by or pursuant to the Directive (32 CFR Part 300, issued as Department of Defense Directive 5500.11, May 27, 1971) to the end that no person in the

United States shall, on the grounds of race, color, or national origin be excluded from participation in, be denied the benefit of, or be otherwise subjected to, discrimination under any program or activity for which the sponsor received Federal financial assistance from the Corps of Engineers, Department of the Army, in connection with this project.

(3) Comply with Sections 210 and 305 of Public Law 91-646, The Uniform Relocation Assistance and Land Acquisition Policies Act of 1970, approved 2 January 1971.

c. As signatory to this agreement, said Sponsors assure that they are legally constituted with full authority and capability to perform the terms of their agreements and to pay damages, if necessary, in the event of failure to perform. Section 221 of Public Law 91-611, commonly referred to as the Flood Control Act of 1970, approved 31 December 1970, is deemed controlling under this assurance.

d. The Sponsors hereby give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which they own or control, for access to the Project for inspection purposes. If such inspection shows the Sponsors for any reason are failing to complete, repair, and maintain the Project in accordance with the assurances hereunder, and said Sponsors have persisted in such failure after a reasonable notice in writing by the Government delivered to said Sponsors, the Government shall have the further right, as stated above, to enter upon the land for the purpose of completing, operating, repairing and maintaining the Project. Completion, operation, repair and maintenance by the Government in such event shall not operate to relieve the Sponsors of responsibility to meet their obligations as set forth in paragraph one of the Agreement, or to preclude the Government from pursuing any other remedy at law or equity.

6. Real Estate Requirements. The local Sponsors will be required to obtain permanent easements and adequate access to provide for project construction, operation, and maintenance. It appears that the Burlington Northern Railroad, the Town of Hammond, and the City of Warrenton are the principal landowners. The railroad has abandoned the line within project boundaries. The Sponsors

will be required to work with the railroad to assure timely acquisition of the necessary permanent right-of-way. Project plans call for three points of access. Two of these access points are public roads and the third is privately owned. The sponsor may elect to obtain a temporary access permit for the term of construction. Maintenance can be accomplished via the public routes.

It will be necessary to render advice to the local Sponsors, review all grants from the landowners to the Sponsor, and review all assurances and grants from the local interests to the Government to ascertain sufficiency.

7. Location of Project. Tansy Railroad Location is on the left bank of the Columbia River between river miles (RM) 9 and 10 in Section 9, Township 8 North, Range 10 West, Willamette Meredian, near the town of Hammond and City of Warrenton in Clatsop County, Oregon (See Figure 1).

8. Present Conditions. Erosion is occurring along approximately 3,800 linear feet (LF) of bankline at Tansy Railroad Location. The bankline consists of existing riprap which provides protection for the riverward side of the levee, an abandoned railway embankment constructed by Burlington Northern Railroad. Because the existing riprap section protecting the levee does not include a filter material, the underlying sand embankment is being eroded out by wave action and tidal drawdown. In addition, the existing riprap is poorly graded and includes varied stone sizes. Inadequate interlock between the stones for strength, the presence of large voids, and the lack of filter material has resulted in revetment slope failures and major levee damage at a number of levee locations. The Port of Astoria, town of Hammond, and City of Warrenton have made temporary repairs by end-dumping rock and other materials at the most severely damaged locations. The erosion is worsening and, if no further action is taken, breaching of the levee is estimated to occur within 2 years.

a. History.

Prior to being abandoned by Burlington Northern Railroad, the embankment was maintained by the railroad company. In January 1959, the railroad lost entire sections of roadbed due to unusual currents and wave action in the area. At

various times the railroad company dumped stone of varying gradation along the riverside of the embankment. Burlington Northern has discontinued rail service to the area and has dropped all maintenance along the railroad embankment. Three timber pile dikes were constructed by the Corps between RM's 9 and 10 in 1963 to prevent migration of the Columbia River Channel into the Tansy Point area. The pile dikes have successfully stabilized the lower bank slopes and adjacent river bottom. The pile dikes are spaced approximately 1,200 feet apart, and contain dike stone to one-third depth below low water. Each structure consists of three rows of pilings marked at the end by a 7-pile dolphin. The pile dikes divert river currents away from the bank as designed, but erosion is continuing due to the unusual current and wave action.

b. Existing Soil Conditions.

The proposed bank protection improvements are situated on alluvial and dune deposits along the south shoreline of the Columbia River. Generally the bankline section within the improvement limits consists of a steep upper bank, a gentle sloped middle bench area, and a relatively steep lower bank. Residual bankline materials are fine grained dune and river sands covered with varying thicknesses of previously placed revetment-type materials. Upper river bank slopes vary from 1V on 2H to 1V on 1H or steeper in areas where the worst erosion has occurred. Slopes on the lower bank vary from 1V on 1.5H to 1V on 2H. The middle bench area slopes are 1V on 5H or flatter. Soil conditions are described in Section 3 of Appendix B, included in this design memorandum.

9. Existing Revetments in Immediate Vicinity.

a. Port of Astoria, Tansy Point Location.

Tansy Point Location, constructed in 1963 and maintained by the Port of Astoria, is situated on the left bank of the Columbia River at RM 10. Three timber pile dikes, discussed in paragraph 8(a), and two sections of revetment, with a combined length of about 1,700 feet, compose the Tansy Point Location. On the upstream section, a 3.5-foot armour stone blanket about 400 linear feet (LF) long was placed on existing stone or on a prepared 1V to 2H riverward

slope beginning at elevation (El.) 9 NGVD and extending to El. -12 NGVD. A quarry stone blanket with a minimum 3-foot thickness continues on a 1V to 2H slope to bottom elevations varying between -16 and -47 NGVD. On the downstream section, a 42-inch armor stone blanket about 1,300 LF long was placed on a 1V to 2H slope to El. -6 NGVD. Bedding layers, composed of two thicknesses, an 18-inch upper layer and a 12-inch lower layer, were placed as a foundation for the riprap above El. -12 NGVD. No appreciable damage to the revetment has occurred since original construction.

10. Proposed Improvements. It is proposed to place 3,840 LF of stone blanket revetment at Tansy Railroad Location. A 3.5-foot thick layer of Class V riprap will be placed on a IV and 2H slope above water surface El. 3 NGVD and a 5.25-foot thick layer placed on a 1V and 2H slope below El. 3 NGVD. A 5.25-foot thick layer of Class III riprap will be placed on a IV and 2H slope below El -15.5 NGVD. The 5.25-foot thick layer below El. 3 will insure thickness for underwater riprap placement. Two bedding layers, each sloped 1V and 2H, will be placed as a foundation for the riprap. The first layer, crushed rock bedding a minimum of 18 inches thick below the shoulder of the levee and 12 inches thick on the top of the levee, will be placed on the existing riprap and excavated slopes to fill in the voids between the existing riprap and to obtain a smooth surface. The second layer, composed of rockfill 18 inches thick will be placed on the crushed rock to provide bedding for the riprap, and to protect the top of levee. Filter fabric was considered but rejected at this location because of the existing riprap and because underwater placement of the fabric would be required. A 5-foot thick, 5-foot wide apron will be placed at the revetment toe. The downstream end will tie into existing riprap at the Point Adams Packing Company pier and the upstream end will tie into existing revetment with the standard cutoff. The riprap will be placed on a 1V and 2H slope around the existing piles and Bio Products pier. No riprap will be placed under the Bio Products pier (See Plates 3 and 4).

11. Design Data.

a. Design Analysis.

The design is based upon an analysis of the erosion force anticipated at Tansy Railroad Location and experience gained from construction of similar structures. Channel velocities, waves generated by wind, and tidal fluctuations have all contributed to the bankline erosion. As a result of investigations, a typical section consisting of crushed rock bedding, rockfill, Class V riprap and Class III riprap, including an excavated toe, was developed as a means of providing assured protection while reducing costs. Figure 2 shows the stage-frequency curve used in the revetment design. Appendix A contains revetment design data. The selected configuration was considered the most economical alignment that also satisfied the technical and environmental criteria.

b. Riprap Design.

Erosion due to flow velocity, and waves generated by wind and large ships were considered to be the design forces of major significance. (See riprap calculations in Appendix A).

(1) Flow Velocity Analysis. Natural current velocities were based on data collection for the Columbia River Model Study (1959), and the Columbia River Estuary Hybrid Model Studies (1983), prepared by the Waterways Experiment Station. Using this data, a design velocity of 10.5 FPS was determined.

(2) Wind-generated Waves. Utilizing the methods outlined in ETL 1110-2-305, an effective fetch distance of 13.25 miles was determined. Utilizing Chapter 3, Volume I, of the Shore Protection Manual (SPM), 1984, a design wind-speed factor of 44.4 miles per hour was obtained for the site. Using this data in SPM, Table 3-2, a significant wave height of 4.9 feet can be expected for deepwater waves.

(3) Ship generated Waves. The navigation channel (average depth 38 ft) paralleling Tansy Railroad Location and approximately 1,500 feet north is

heavily trafficked by large ocean-going ships. Utilizing data given in "Water Waves Produced by Ships," from the Journal of the Waterways, Harbors and coastal Engineering Division, a design wave height of 3 feet was determined.

(4) Riprap Size. The riprap size and layer thickness was determined utilizing Chapter 7, Volume II, of the SPM based on the significant wave height. Riprap requirements were plotted versus Class IV and Class V riprap gradations. A modified (maximum weight 3,350 lbs) Class V riprap, with a minimum thickness of 3.5 feet, was selected.

Erosion due to river velocities was considered to be the major design force below elevation -15.5 NGVD; therefore, riprap was sized for tractive force in lieu of wave requirements below EL -15.5. EM 1110-2-1601, amended by ETL 1110-2-120 was used as guidance in determining riprap size. Utilizing the design velocity of 10.5 FPS, Class III riprap, with the same thickness as Class V, was selected.

c. Toe and Crest Design. The toe elevations along the project length will vary depending on the expected erosion at the various toe reaches. Analysis of 1963 and 1984 surveys indicated a stable toe and bankline in the vicinity of Point Adams pier and at the east end of the project. Analyzing past river channel trends, erosion rates, and survey cross-sections, the toe elevations vary between -8 feet NGVD and -30 feet NGVD. Aerials and data contained in the Corps Lower Columbia River Shoaling Study, May 1985, indicate the Navigation Channel is migrating very slowly towards the project area. The toe elevations along the project length were designed based on the channel migration and are considered adequate for the life of the project. Since excavation below EL -8 would be in the wet, Method B as shown in plate 37 of EM 1110-2-1601 was selected for riprap toe protection. Cost considerations also played an important role in the determination of the toe elevations. The top elevation of the revetment follows the shoulder of the levee and varies between 12 and 14 feet NGVD. Rockfill materials will be placed on the top of the levee to provide protection from wave overtopping during high tide and storm wave conditions.

d. Filter Design and Slope Stability.

The sequence of materials subjected to filter action was analyzed for permeability and piping stability using criteria presented in EN 1110-2-2300. Slope Stability Analysis computations were performed for embankments with a 1V on 2H slope. Details and results of these analyses and evaluations are included in Appendix B, Geotechnical Features. Filter design is shown on Figure 5, and the Stability Analysis Summary is shown on Figure 6.

e. Material.

Required construction materials include Class V riprap, Class III riprap, and filter bedding materials consisting of rockfill and crushed rock bedding. There are several operating quarries in Clatsop County within 15 miles of the project. A field evaluation of the Youngs River Falls Quarry, considered the best source for Class V riprap, will be required to determine available quantities prior to construction. A discussion of construction materials and sources is located in Appendix B.

12. Environmental Impacts.

a. Fish and Wildlife. This project has been coordinated with the resource agencies pursuant to requirements of the Fish and Wildlife Coordination Act. Because the project is the rehabilitation of an existing structure, impacts are short-term and essentially limited to the period of construction. The excavation of shoreline materials, and the excavation for toe trench and revetment stone are the major in-water activities. Anticipated impacts are: 1) the impact on bottom dwelling species; 2) placement of unusable material in-water beyond toe; and 3) presence of riprap out to 70 feet and beyond. Under the authority of the Endangered Species Act, a list was requested and received from the United States Fish and Wildlife Service listing the bald eagle in the Project vicinity. A biological assessment has been completed and it has been determined that there will be no effect to bald eagles.

b. Cultural Resources. Field inspection by a staff archeologist has been conducted, including consultation with the Oregon State Historic Preservation Officer, and it has been determined that no cultural resources would be affected by the proposed construction. Letter from the State Historic Preservation Officer is included in Appendix C.

c. Environmental Assessment. An Environmental Assessment, indicating compliance with Section 7(c) of the Endangered Species Act, Section 106 of the National Historic Preservation Act, and associated antiquities laws, and an evaluation report under Section 404 of the Clean Water Act of 1977 has been prepared and circulated for public comment. The Finding of No Significant Impact (FONSI), Section 404 evaluation, and State Water Quality Certification are included in Appendix C. All environmental requirements have been fulfilled.

13. Cost Estimate. The estimated total capital cost (January 1985 price level) for the proposed work is $1,730,000. A detailed cost estimate is shown in Table 1.

14. Annual Costs. The economic life of the proposed work is assumed to be 50 years. Items of annual cost include interest at 2 1/2 percent and amortization of the capital cost, plus the estimated average annual maintenance cost for the proposed work. Estimated annual costs (January 1985 price level) are $61,500. A detailed breakdown of the annual costs is shown in Table 2.

15. Economic Analysis.

a. Statement of Problem.

Erosion is occurring at the Tansy Railroad Location between Columbia River miles 9 and 10 near the city of Warrenton, Oregon. An abandoned railway embankment which serves as a levee has been badly damaged. With no further action breaching is estimated to occur within 2 years. Once the embankment is breached, erosion activity through the sandy soil of the study area will continue. Without protection of the levee, tidal waters would cause daily inundation of lowland areas.

b. Delineation of Assumptions.

Following is a list of assumptions used in this analysis.

(1) Estimated breaching of the railroad embankment will occur within 2 years and the consequential erosion threat to structure improvements will occur 2 years hence.

(2) Erosion activity will continue through time; however, resulting damages have not been quantified in this report past the initial 2-year period.

(3) The lower Columbia River bank protection interest rate of 2-1/2 percent and a 50-year project life have been used for this analysis.

(4) Hydrology is based on the Lower Columbia River combined frequency curves (1979).

c. Without-Project Conditions.

Without the proposed project, erosion activity will continue along the bankline at Tansy Railroad Location. Local interests will continue to dump various quantities and qualities of rock in the most severely damaged locations along the bankline. These measures will not stop deterioration of the bankline, however, and it is estimated breaching of the levee will occur in a number of places within 2 years. Soils in the project area consist of highly erodable fine-grained dune and river sands, and once the bankline protection is gone, erosion will rapidly reach the foundations of two manufacturing firms in the study area.

Continuing bank erosion would eventually undermine existing pile dikes, which were constructed to divert the Columbia River currents away from, and create sediment disposition along, the bank. With loss of the pile dikes, the river channel would continue to migrate toward the bank in greater force, accelerate the erosion rate, and threaten other improvements in the study area.

Eventually, erosion would breach high ground between the study area and Warrenton and Hammond areas.

First floor levels of improvements in the study area are located above high water (500-year) occurrences. Foundations would be subject to inundation as well as erosion, however, as would some storage and parking areas, and portions of access road. Flood damages would be relatively minor, and have not been quantified for the report.

The two manufacturing firms which will be impacted by the erosion scenario within 2 years have unique products: fish feeds, including moist frozen pellets used for Federal, State, and private salmon hatcheries and research facilities, are among the products of one firm; tuna processing equipment is produced by the other. These established firms have been in business since the 1940's and presently have no competitors that could service market demand for their products. Neither firm is season- or water-dependent and both would be relocated under without-project conditions at an estimated cost of $5,000,000. This cost includes acquiring appropriate structures, movement of heavy industrial equipment, and cost of shutdown during the relocation process. Temporary closure of these firms would cause hardship to their customers. Without the proposed project, these firms would be relocated 2 years hence.

Other improvements in the study area include a fish processing plant and a number of residences. With loss of the Tansy Railroad embankment, erosion will impact these improvements and eventually breach the high ground between the study area and Hammond and Warrenton areas. A highway providing access to the community of Hammond and points beyond would also be threatened. This scenario is estimated to occur over a 25-year time period. The costs for these damages have not been quantified for this report.

d. Definition of With-Project Conditions.

With the proposed project, average annual damages equal to $167,800, associated with relocation costs of two manufacturing firms, would be prevented.

e. Summary of Benefits.

Average annual benefits for the proposed project are $167,800 at the authorized project rate of 2-1/2 percent over a 50-year project life.

f. Sensitivity.

The benefits to the project are sensitive to the point-in-time of relocation of the two firms. If relocation of the firms would be 10 years hence, average annual benefits to the proposed project are $137,700, and 20 years hence would be $107,600, with respective benefit-to-cost ratios of 2.24:1 and 1.75:1.

g. Conclusion.

The proposed bank protection works has an above unity benefit-to-cost ratio of 2.73:1. When subjected to a delayed time scenario to test the sensitivity of the analysis, the ratio remains well above unity. Therefore, based on the preceding analysis, the proposed bank protection at Tansy Railroad Location is a feasible project.

16. Project Justification. The costs of the proposed bank protection works are considered justified based on the benefits derived from this work. With annual benefits of $167,800 (paragraph 15), and annual costs of $61,500 (paragraph 14), the benefit-to-cost ratio is 2.73 to 1 for the proposed work.

17. Construction Schedule. Construction of the proposed work at Tansy Railroad Location is scheduled to begin in August 1985. Construction time would be 150 calendar days.

18. Conclusions and Recommendations. Bank erosion has encroached upon the levee side slope at Tansy Point Location and failure is expected within the next 2 years. The proposed work outlined and considered herein has a Benefit-Cost-Ratio of 2.73 to 1 and is planned to conform to the overall scheme for bank protection works authorized and deemed necessary under the comprehensive program for the Lower Columbia River Basin. It is recommended that bank protection work at Tansy Railroad Location, as presented here, be approved as the basis of preparation of plans and specifications.

LOWER COLUMBIA RIVER BASIN BANK PROTECTION WORKS

OREGON AND WASHINGTON

WORK AUTHORIZED BY FLOOD CONTROL ACT OF MAY 17,1950

SCALE IN MILES 5 4 3 2 1 0 5 10

U.S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

5 MARCH 85

PLATE I

NOTE:
Base point of mileage is in line with outer end of the jetties at the mouth.

LEGEND
- Authorized Improvements
- Existing Improvements

TABLE 1

TANSY RAILROAD LOCATION

COST ESTIMATE
(Jan 85 Price Level)

	Estimated Quantity	Unit	Unit Price	Estimated Cost
Clearing	1	JOB	xxxx	$ 5,000
Excavation	40,570	CU. YD.	2.00	81,140
Crushed Rock Bedding	25,110	CU. YD.	14.00	351,540
Rockfill	15,650	CU. YD.	12.00	187,800
Riprap, Class V	36,090	CU. YD.	16.00	577,440
Riprap, Class III	10,960	CU. YD.	13.00	142,480
Subtotal				1,345,400
Contingencies (15%)				$ 201,600
Estimated Contract Price				$1,547,000
Engineering and Design				$ 100,000
Supervision and Administration				$ 60,000
Estimated Federal Cost				$1,707,000
Estimated Non-Federal Cost				23,000
Total Federal and Non-Federal Cost (Capital Cost)				$1,730,000

Rev Jul 85

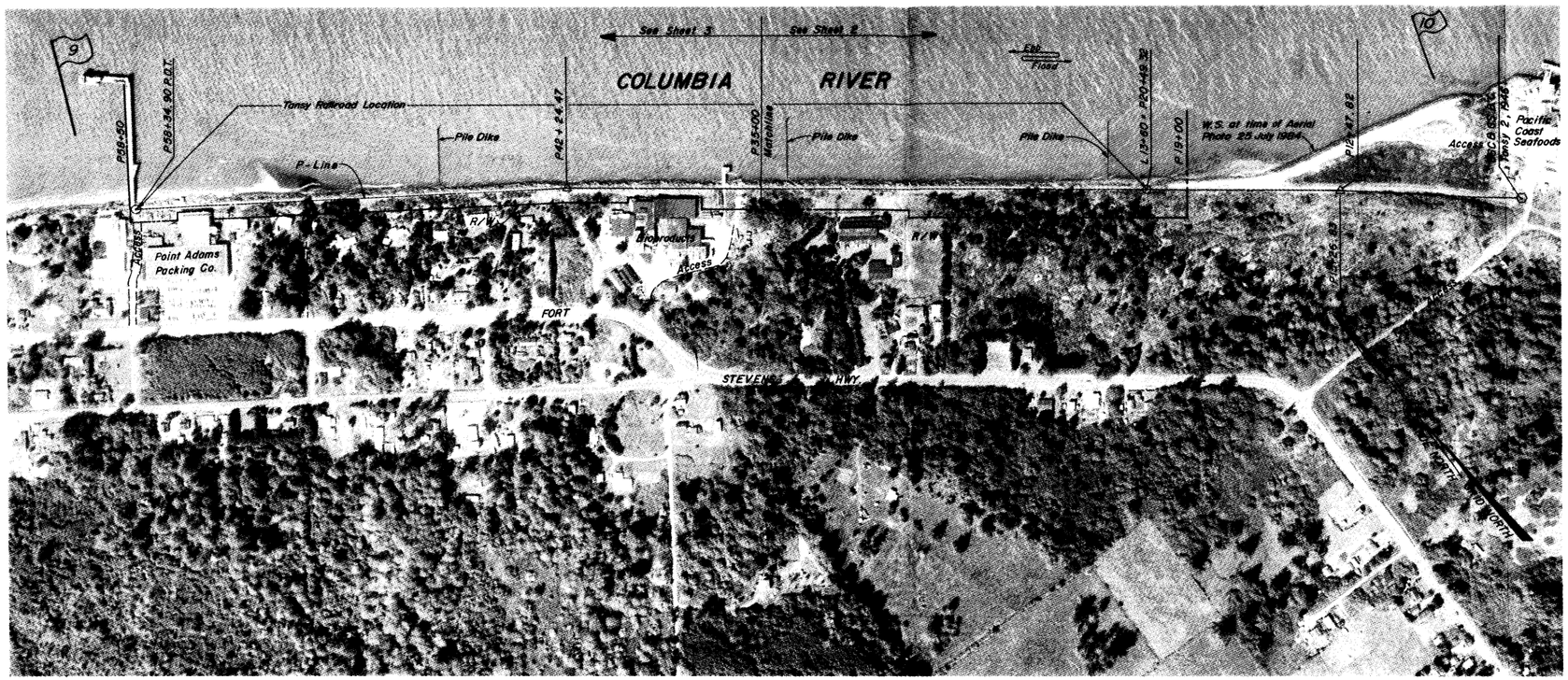
TABLE 2

TANSY RAILROAD LOCATION

ANNUAL COSTS
(Jan 85 price level)

Federal	
Interest (2 1/2%) Amortization (50 years)	$ 60,200
Non-Federal	
Interest (2 1/2%)	$ 810
Amortization (50 years)	
Maintenance	500
Subtotal	$ 1,310
Total Annual Cost	$ 61,510
Rounded To	$ 61,500
Total Annual Benefits	$167,800
Benefit-to-Cost Ratio	2.73:1

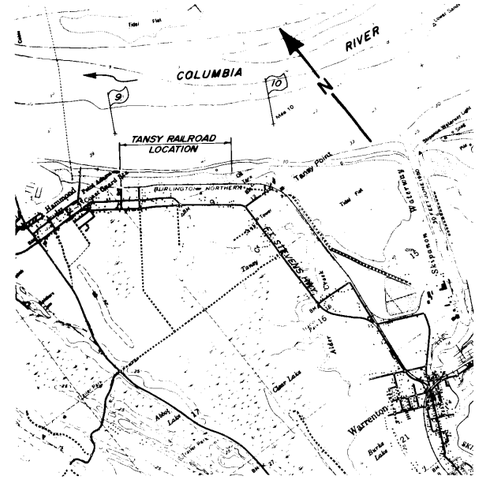
Rev Jul 85



SITE PLAN

200 0 200 400 600

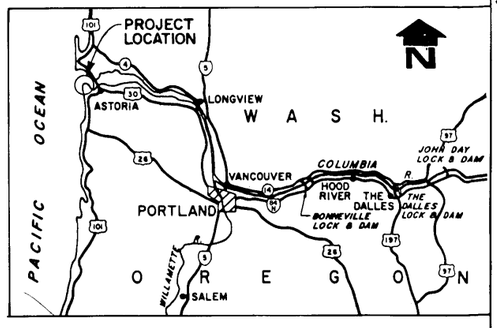
SCALE IN FEET



LOCATION MAP

10 0 10 20 30 40 50

SCALE IN MILES



VICINITY MAP

10 0 10 20 30 40 50

SCALE IN MILES

LAMBERT COORDINATE LISTING

POINT	DESCRIPTION	NORTHING	EASTING
TANSY 2	B.C. IN CONC. USC&GS TANSY 2, 1946	938,397.64	1,113,057.40
P12+47.42	B.C. IN CONC. USC&GS BM-21, 1920	938,842.59	1,132,631.43
P13+26.83	1 1/4" I.P. WITH RIVET & WASHER	938,851.68	1,132,552.43
P20+49.32	SURVEY KAP & REBAR	939,313.82	1,131,996.90
P42+24.74	1 1/4" I.P. WITH RIVET & WASHER	940,704.69	1,130,324.02
P58+34.90	PK NAIL & WASHER	941,673.85	1,129,038.07

LIST OF DRAWINGS

DRAWING NO.	SHT. NO	TITLE
CLW-10-5/1	1	SITE PLAN, LOCATION MAP, VICINITY MAP AND INDEX
CLW-10-5/2	2	PLAN, PROFILE AND TYPICAL SECTION
CLW-10-5/3	3	PLAN, PROFILE AND TYPICAL SECTIONS

Notes:

1. *All bearings are from Lambert Projections, Oregon North Zone.*
2. *Elevations are based upon N.G.V.D., 1947 adjustment.*
3. *Reference Survey Books 17925 and 17926.*
4. *Water level is subject to tidal fluctuations, Daily tidal fluctuation is approximately 6 feet August thru December.*
5. *Water surface shown on sheet 2 and sheet 3 is based upon Survey in Oct. 1984.*
6. *Sponsors will remove railroad rails and ties prior to riprap bank protection construction.*

REVISION	DATE	DESCRIPTION	BY

ARCHITECT – ENGINEER | U.S. ARMY ENGINEER, DISTRICT PORTLAND, OREGON

LOWER COLUMBIA RIVER BASIN

BANK PROTECTION WORKS
OREGON AND WASHINGTON

HAMMOND / WARRENTON

TANSY RAILROAD LOCATION

SITE PLAN, LOCATION MAP, VICINITY MAP AND INDEX

SUBMITTED: CHIEF, DESIGN BRANCH

APPROVED: COLONEL, C.E., DISTRICT ENGINEER — DATE: 1985 JUNE 24

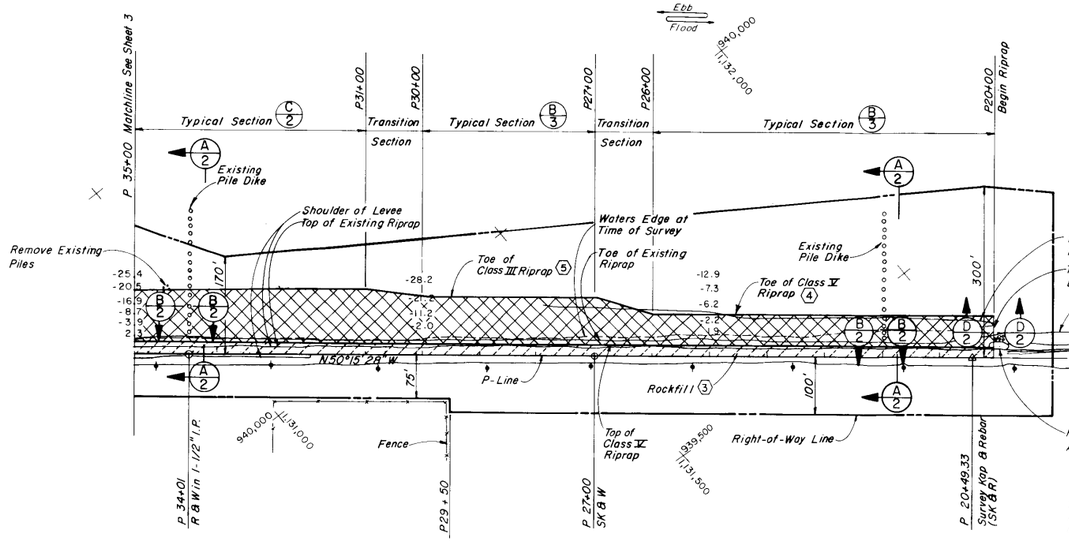
RECOMMENDED: CHIEF, ENGINEERING DIVISION

CLW-10-5/1

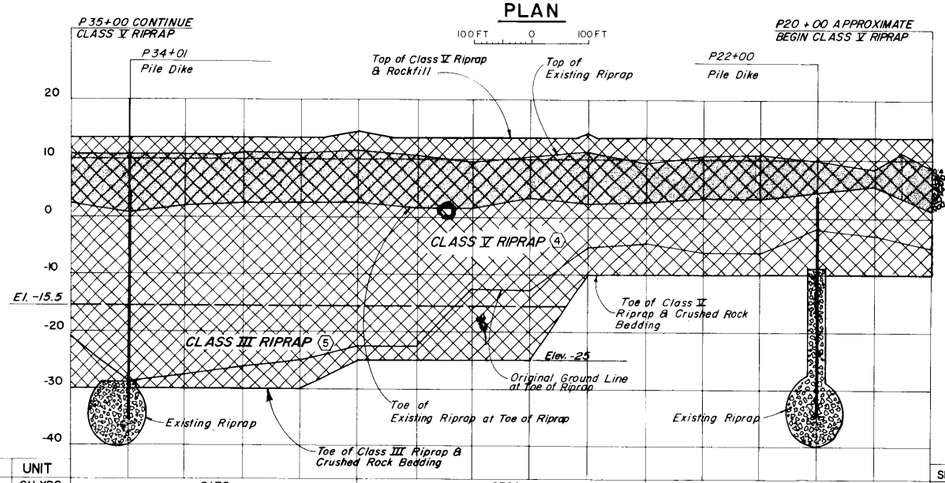
SHEET 1 PLATE 2

Enclosure Page 166 of 247

COLUMBIA RIVER

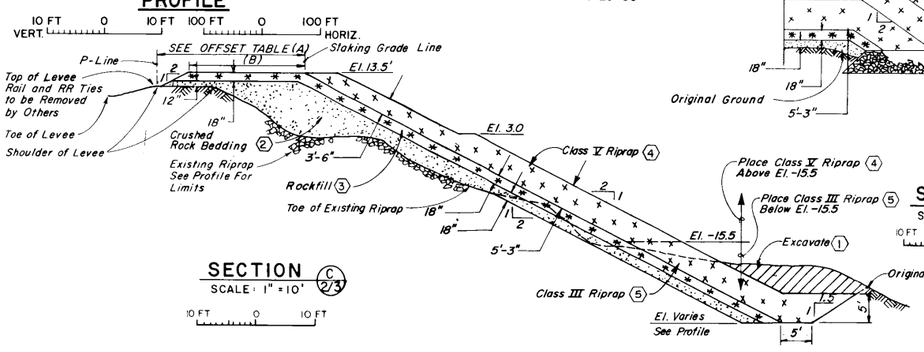


PLAN



ESTIMATED QUANTITIES	UNIT	P 35+00 to P 30+00	P 30+00 to P 25+00	P 25+00 to P 20+00	SHEET TOTAL	
EXCAVATION	CU. YDS.	6170	8320	3400	17,890	(1)
CRUSHED ROCK BEDDING	CU. YDS.	4480	2860	2080	9420	(2)
ROCKFILL	CU. YDS.	2756	2138	1414	6310	(3)
CLASS V RIPRAP	CU. YDS.	4935	5320	4110	14,365	(4)
CLASS III RIPRAP	CU. YDS.	3270	1610		4880	(5)

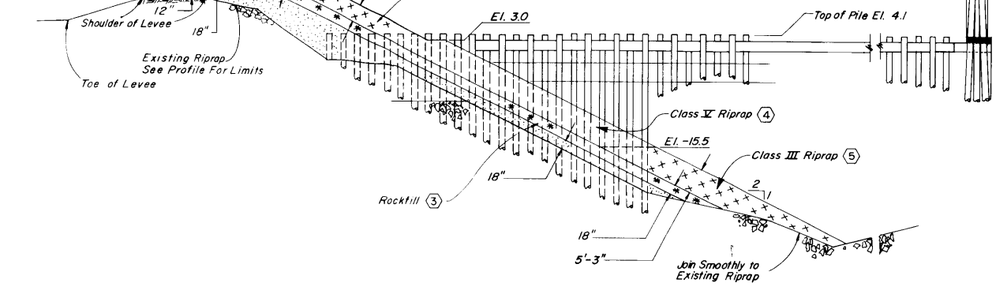
PROFILE



OFFSET TABLE

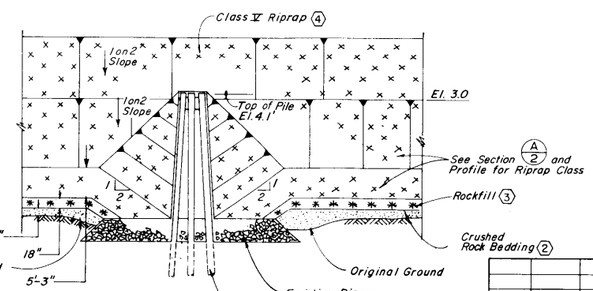
P-LINE	(A)	(B)	P-LINE	(A)	(B)
20+00	21' RT.	9'	33+00	21.3' RT.	15'
20+50	18' RT.	9'	33+50	22.2' RT.	15.5'
21+00	16' RT.	9'	34+00	23.0' RT.	16'
25+00	16' RT.	10'	34+50	23.5' RT.	16.5'
30+00	16' RT.	11'	35+00	24.0' RT.	17'
30+50	17' RT.	11.5'			
31+00	18' RT.	12'			
31+50	18.8 RT.	12.5'			
32+00	19.7 RT.	13'			
32+50	20.5 RT.	14'			

Transition Between Offsets Shall be Smooth and Uniform

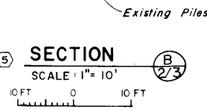


TYPICAL AT ALL EXISTING PILE DIKES

SECTION (A/2) SCALE: 1" = 10'-0"

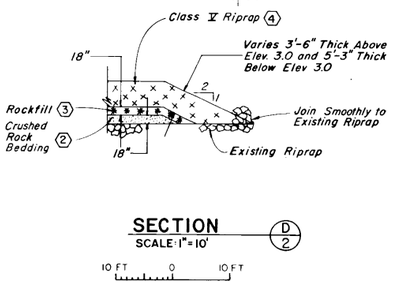


SECTION (B/2) SCALE: 1" = 10'



SECTION (C/2) SCALE: 1" = 10'

SECTION (D/2) SCALE: 1" = 10'



LEGEND

- Right of Way
- Pile
- Power Pole
- Existing Riprap
- Existing Riprap (Plan, Profile & Section)
- Excavation
- Riprap (Plan & Profile)
- Riprap (Section)
- Rockfill (Plan)
- Rockfill (Section)
- Crushed Rock Bedding

REVISION	DATE	DESCRIPTION	BY

kpff CONSULTING ENGINEERS 621 S.W. 5TH, SUITE 511 PORTLAND, OREGON 97204

U. S. ARMY ENGINEER, DISTRICT PORTLAND, OREGON

LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
HAMMOND / WARRENTON

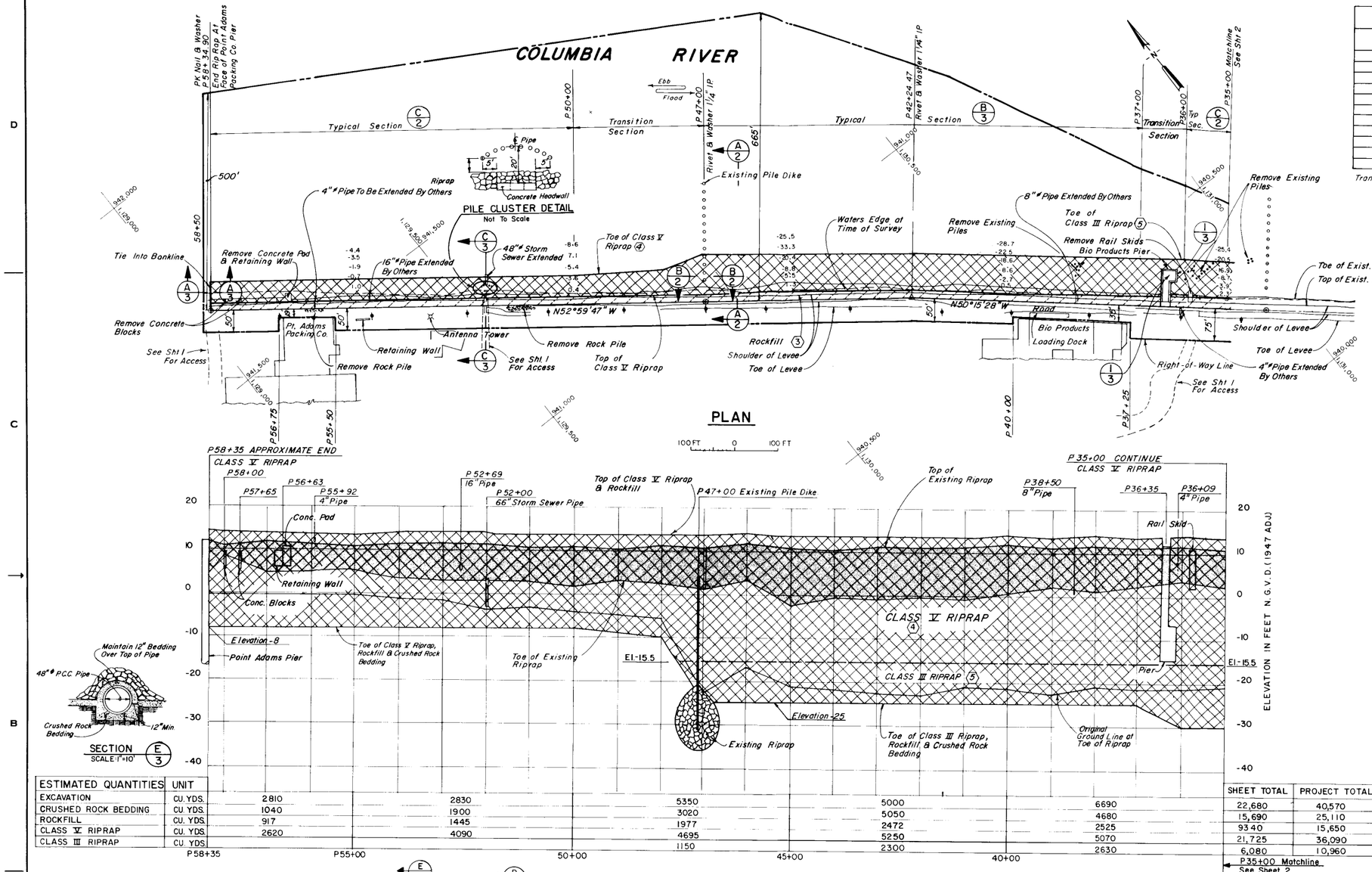
TANSY RAILROAD LOCATION

PLAN, PROFILE AND TYPICAL SECTIONS

SUPERVISED: CHIEF, DESIGN BRANCH	DESIGNED: G. Hartman	DRAWN: D. Jespersen	CHECKED: P Fredericks
DATE: 1985 JUNE 24	SHEET: 2	CLW-10-5/2	PLATE

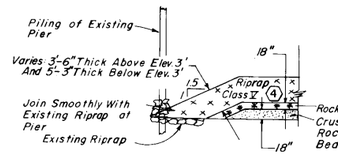
PLATE 3

Enclosure Page 167 of 247

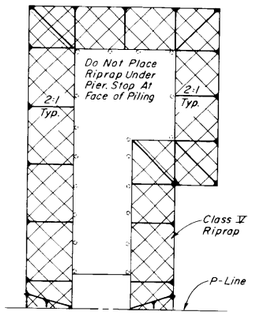


OFFSET TABLE					
P-LINE	(A)	(B)	P-LINE	(A)	(B)
35+00	24.0'RT.	17'	40+00	19.0'RT.	13'
35+50	23.5'RT.	17.5'	42+24.47	19.0'RT.	13'
36+00	23.0'RT.	18'	45+00	19.0'RT.	12'
36+50	22.5'RT.	18'	45+50	18.3'RT.	11.5'
37+00	22.0'RT.	18'	46+00	17.5'RT.	11'
37+50	21.5'RT.	16.5'	46+50	16.7'RT.	10'
38+00	21.0'RT.	15'	47+00	16.0'RT.	9'
38+50	20.5'RT.	13.5'	48+00	16.0'RT.	10'
39+00	20.0'RT.	12'	50+00	16.0'RT.	11'
39+50	19.5'RT.	12.5'	58+34.90	16.0'RT.	11'
40+00	19.0'RT.	13'			

Transition Between Offsets Shall be Smooth and Uniform



SECTION (A/3)
SCALE: 1" = 10'
10 FT 0 10 FT



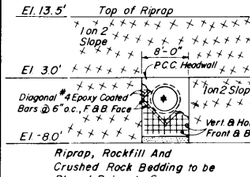
BIO PRODUCTS PIER
DETAIL (1/3) NO SCALE

ESTIMATED QUANTITIES	UNIT						SHEET TOTAL	PROJECT TOTAL	
EXCAVATION	CU. YDS.	2810	2830	5350	5000	6690	22,680	40,570	(1)
CRUSHED ROCK BEDDING	CU. YDS.	1040	1900	3020	5050	4680	15,690	25,110	(2)
ROCKFILL	CU. YDS.	917	1445	1977	2472	2525	9340	15,650	(3)
CLASS V RIPRAP	CU. YDS.	2620	4090	4695	5250	5070	21,725	36,090	(4)
CLASS III RIPRAP	CU. YDS.			1150	2300	2630	6,080	10,960	(5)

P35+00 Matchline See Sheet 2

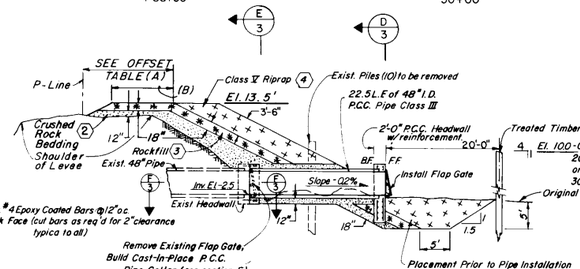
LEGEND
- Right of Way
- Pile
- Power Pole
- Existing Riprap
- Existing Riprap (Plan, Profile & Section)
- Excavation
- Riprap (Plan & Profile)
- Riprap (Section)
- Rockfill (Plan)
- Rockfill (Section)
- Crushed Rock Bedding

SECTION (E/3) SCALE: 1"=10'



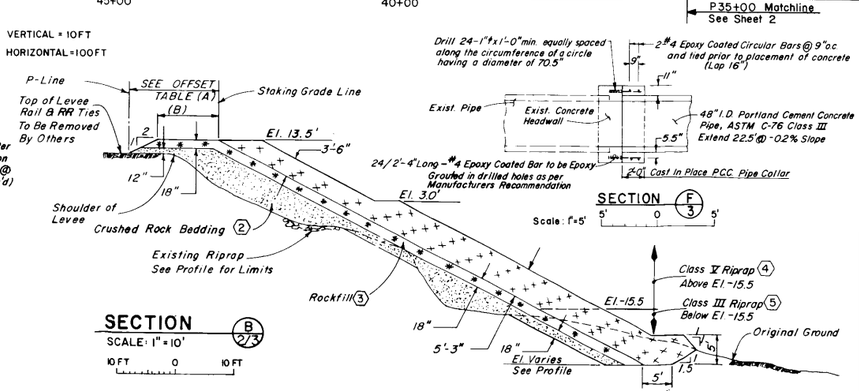
* Flap Gate not Shown for Clarity

SECTION (D/3) SCALE: 1"=10'
10 FT 0 10 FT



SECTION (E/3) SCALE: 1"=10'
10 FT 0 10 FT

SECTION (D/3) SCALE: 1"=10'



SECTION (B/2/3) SCALE: 1"=10'
10 FT 0 10 FT

SECTION (F/3) Scale: 1"=5'
5' 0 5'

REVISION	DATE	DESCRIPTION	BY

kpff CONSULTING ENGINEERS 621 S.W. 8TH, SUITE 613 PORTLAND, OREGON 97205

U.S. ARMY ENGINEER, DISTRICT PORTLAND, OREGON

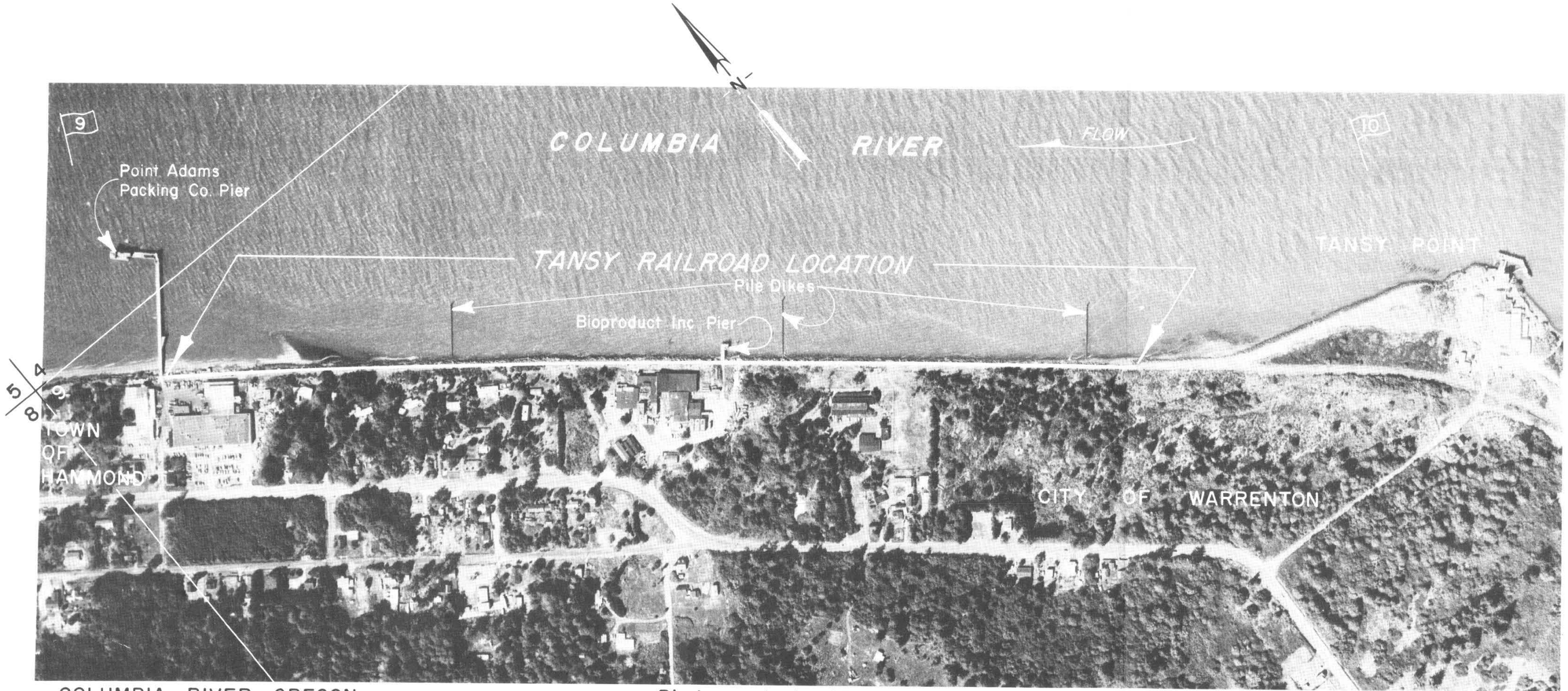
LOWER COLUMBIA RIVER BASIN
BANK PROTECTION WORKS
OREGON AND WASHINGTON
HAMMOND / WARRENTON

TANSY RAILROAD LOCATION

PLAN, PROFILE AND TYPICAL SECTIONS

SUPERVISED: CHIEF, DESIGN BRANCH	DESIGNED: G. Hartman	DRAWN: D. Jespersen	CHECKED: P. Fredericks
DATE: 1985 JUNE 24	SHEET: 3	CLW-10-5/3	PLATE

Enclosure Page 168 of 247



COLUMBIA RIVER, OREGON
T8N, R10W., SECT. 4,5,8,&9

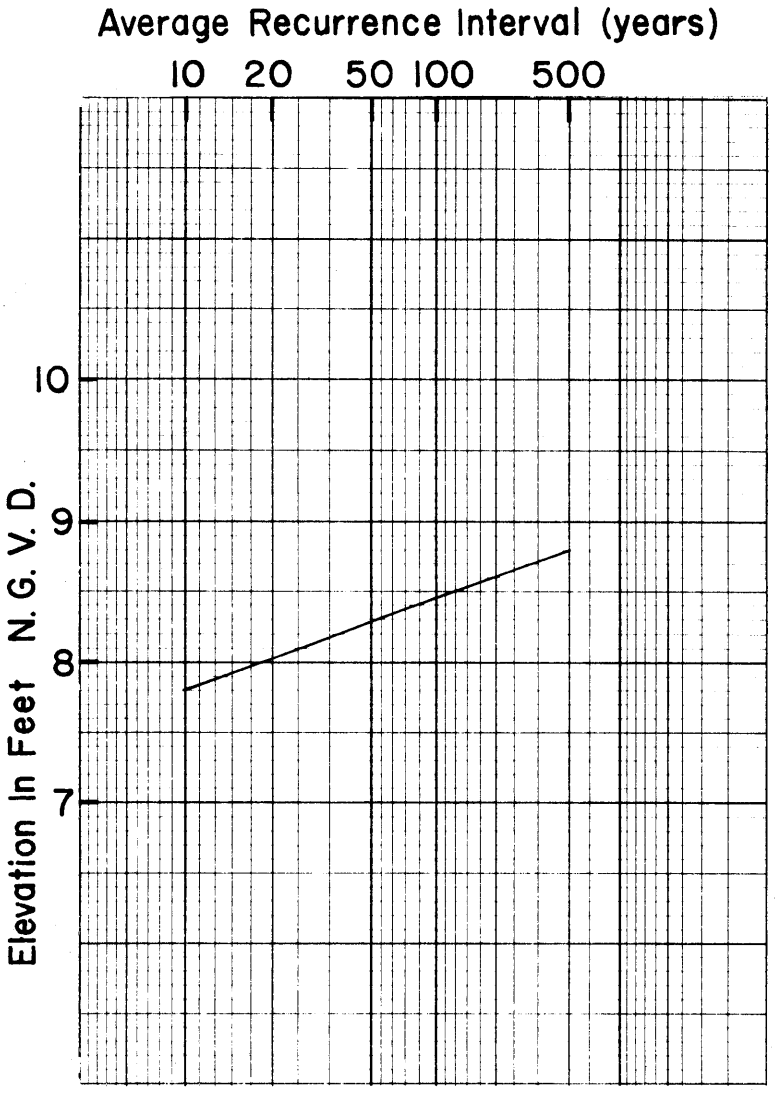
Photographed: 25 Jul 83

Approx. Scale: 1" = 400'

FIGURE 1

NOTE:

Elevations computed using combined probability analysis as directed by NPD.



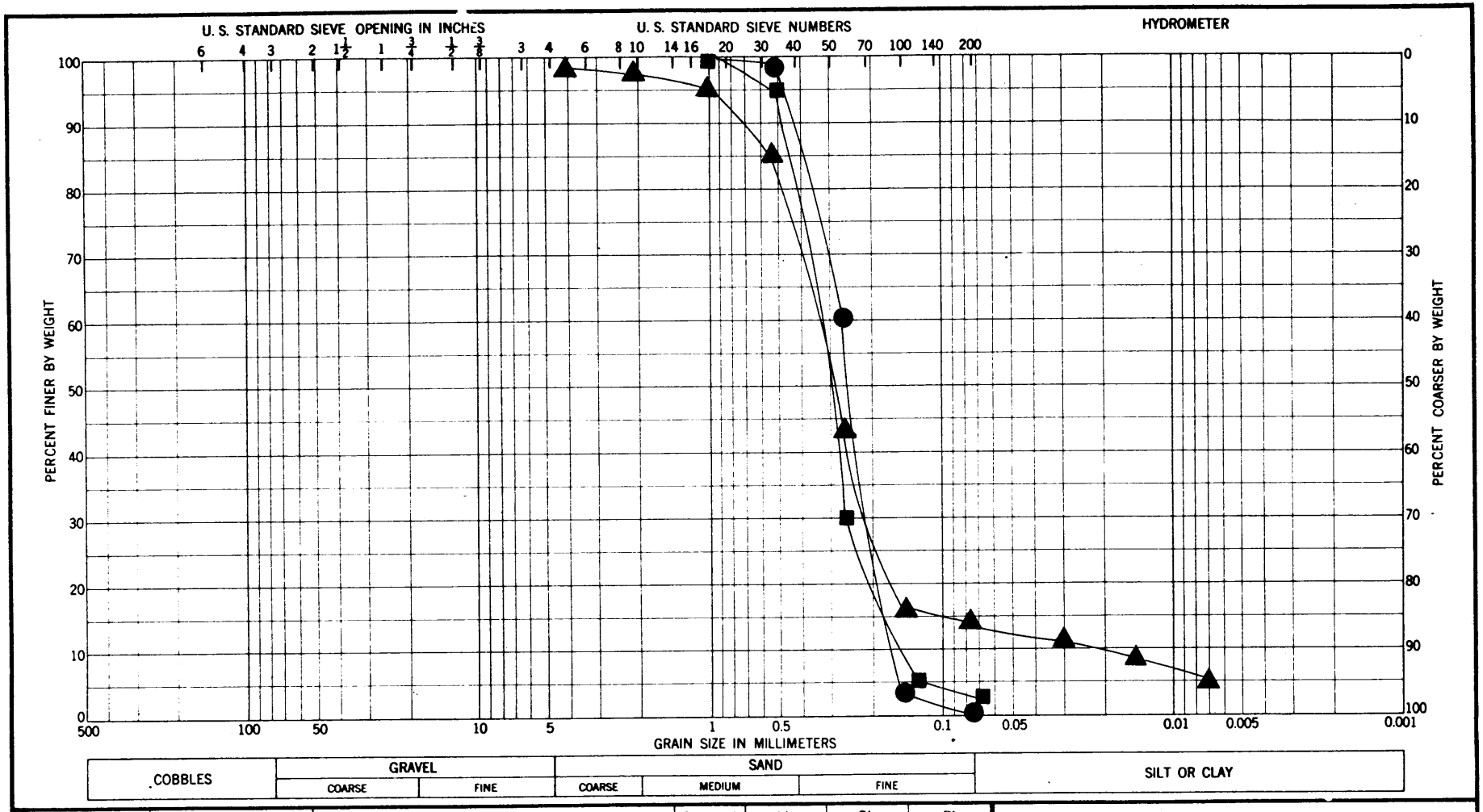
COLUMBIA RIVER

STAGE-FREQUENCY CURVE

RIVER MILE 9

3/6/85 JDT

FIGURE 2



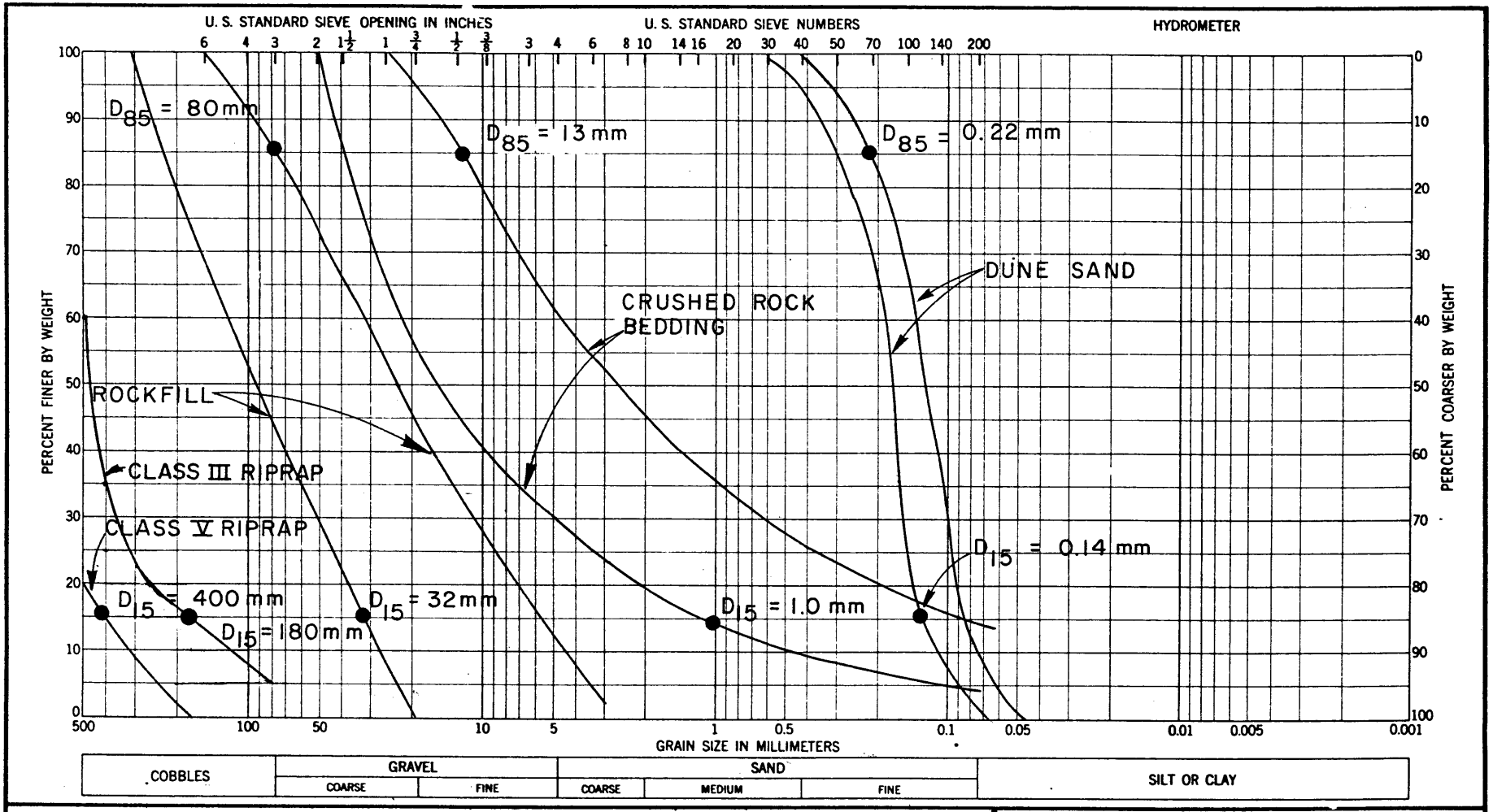
Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
R.M 9.0 ●	So of Channel	Poorly Graded Sand (SP)				
R.M 9.0 ▲	" " "	Silty Sand (SM)				
R.M 10.0 ■	" " "	Poorly Graded Sand (SP)				

GRADATION CURVES

Project COLUMBIA RIVER
DREDGE SEDIMENT STUDY
Area R.M 9.0 , 9.5 & 10.0
Boring No. SAMPLED ON 15 AUG 84
Date TESTED 24 SEPT 84

FIGURE 3

ENG FORM 1 MAY 63 2087



FILTER CRITERIA

(1) $\frac{\text{D15 FILTER}}{\text{D85 SOIL}} \leq 5 \geq \frac{\text{D15 FILTER}}{\text{D15 SOIL}}$

(2) MATERIAL GRADATION CURVES ROUGHLY PARALLEL.

GRADATION CURVES

Project COLUMBIA BANK PROTECTION

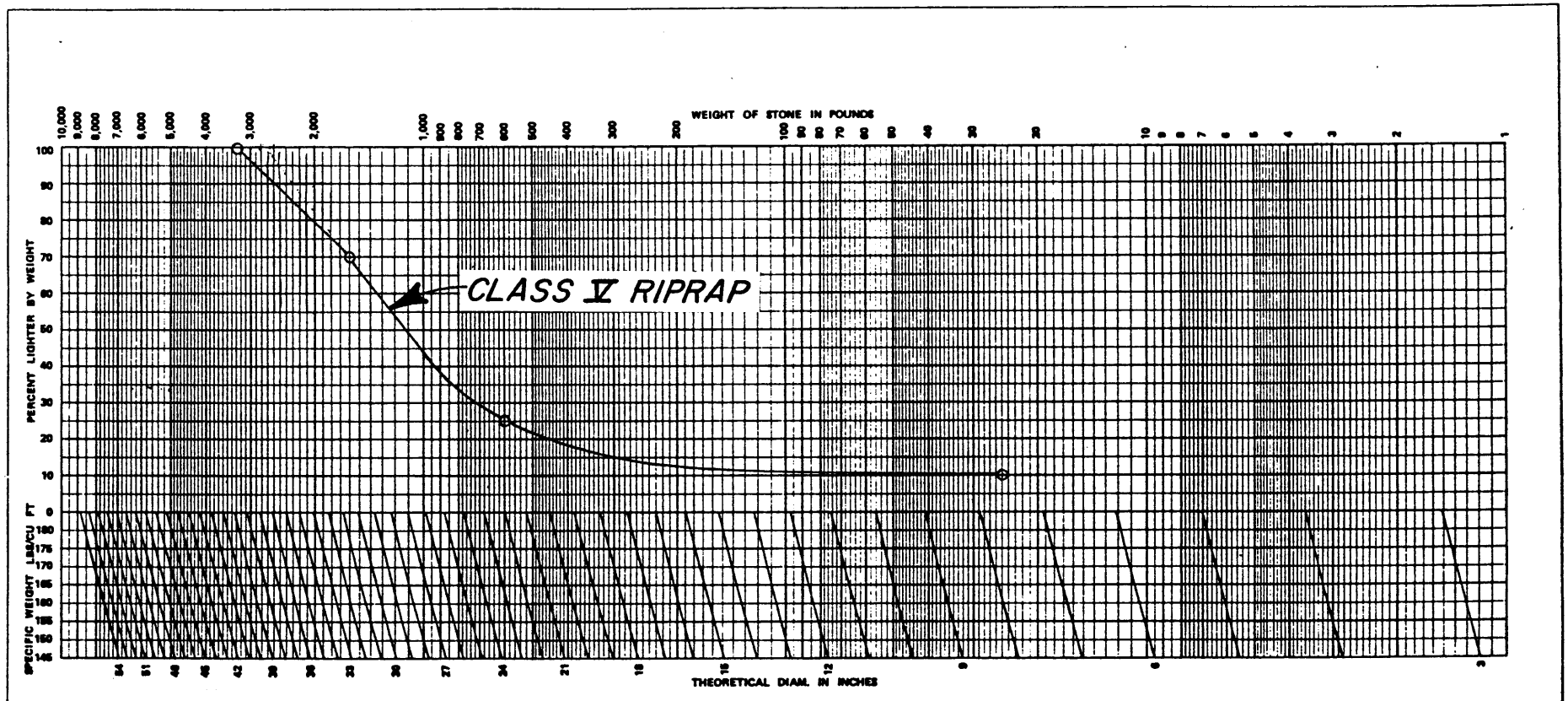
Area TANSY R. R. LOCATION

Boring No. FILTER DESIGN

Date

FIGURE 4

ENG FORM 1 MAY 63 2087



SPECIFIC WEIGHT OF STONE 160 LBS/CU FT

PROJECT Lower Columbia River Basin Bank Protection Works

AREA Tansy Point Railroad Location

RIPRAP GRADATION CURVES

ENG FORM 4794-R, Sep 82 (EM 1110-2-1601) (Proponent: DAEN-CWE-HD)

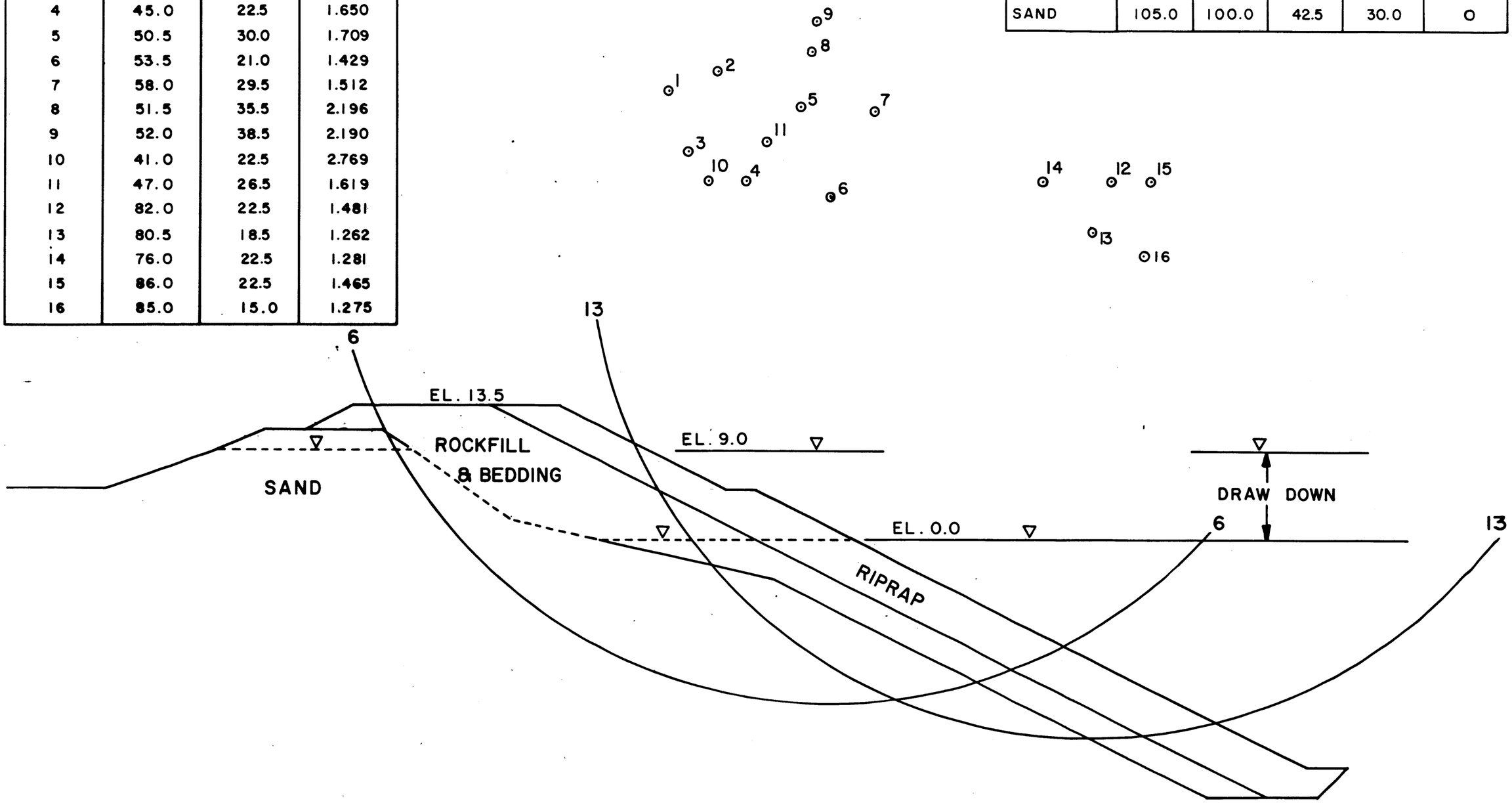
FIGURE 5

Rev Jul 85

Enclosure Page 172 of 247

ARC No.	X	Y	F.S.
1	37.0	31.5	2.372
2	42.0	33.5	2.124
3	39.0	25.5	2.229
4	45.0	22.5	1.650
5	50.5	30.0	1.709
6	53.5	21.0	1.429
7	58.0	29.5	1.512
8	51.5	35.5	2.196
9	52.0	38.5	2.190
10	41.0	22.5	2.769
11	47.0	26.5	1.619
12	82.0	22.5	1.481
13	80.5	18.5	1.262
14	76.0	22.5	1.281
15	86.0	22.5	1.465
16	85.0	15.0	1.275

MATERIALS	UNIT WEIGHT # / FT^3			STRENGTH VALUES	
	SAT.	MOIST	BUOY.	Ø	C
RIP-RAP	115.0	110.0	52.5	37.0	0
ROCKFILL	115.0	110.0	52.5	37.0	0
BEDDING	115.0	110.0	52.5	37.0	0
SAND	105.0	100.0	42.5	30.0	0



STABILITY ANALYSIS SUMMARY

FIGURE 6

APPENDIX A

REVETMENT DESIGN

ENGINEERING DIVISION DESIGN BRANCH

CIVIL & LANDSCAPE ARCHITECTURE
DESIGN SECTION

PROJECT: Tansy	COMPUTED BY: David Brown	DATE: 6 Jun 85
SUBJECT: Revetment Design	CHECKED BY: JDT	SHT. 1 OF 28
		PART:

Determine Wind Speed

Ref: Local Climatological Data, Annual Summary, NOAA.

Data for Astoria Airport for the Fastest Mile was reviewed for the years 1959 through 1984. The fastest speed for the sector from NW to SE was selected. Also, the fastest speed from any direction is shown.

Year	Speed	Direction	Any Direction Speed	Any Direction Direction
1959	29	ESE	40	5
1960	46	E	52	SSW
1961	25	NW	37	WNW/SSW
1962	29	NW	52	SSW
1963	33	NW	46	SSW
1964	28	34	44	19
1965	21	30	40	18
1966	32	31	36	26
1967	23	33	37	19
1968	25	32	38	19
1969	22	07	35	18
1970	23	30	32	17/29
1971	23	10	55	17
1972	21	33	44	24
1973	25	31	30	18
1974	21	31	40	18
1975	23	30	40	24
1976	33	30	37	18
1977	22	31	39	27
1978	21	31/34	35	18
1979	29	09	47	19
1980	—	—	39	18
1981	20	31	41	17
1982	30	05	44	17
1983	32	07	40	25
1984	38	15	39	18

NPP FORM 364 (10 GRID)
MAR 82

Rev 7/85

4.8.2025 Commission Packet
Page 262 of 2163

PROJECT: Tansy
SUBJECT: Revetment Design
COMPUTED BY: David Brown
CHECKED BY: JDT
DATE: 6 Jun 85
SHT. 2 OF 28
PART:

The ordered data is as follows: NW → N → SE only

m	Speed	100 m/(n+1)
1	20	3.8
2	21	7.7
3	21.	11.5
4	21.	15.4
5	21.	19.2
6	22	23.1
7	22.	26.9
8	23	30.8
9	23.	34.6
10	23.	38.5
11	23.	42.3
12	24	46.2
13	25	50.0
14	25.	53.8
15	25.	57.7
16	28	61.5
17	28.	65.4
18	29	69.2
19	29.	73.1
20	30	76.9
21	32	80.8
22	32.	84.6
23	33	88.5
24	33.	92.3
25	96	96.2

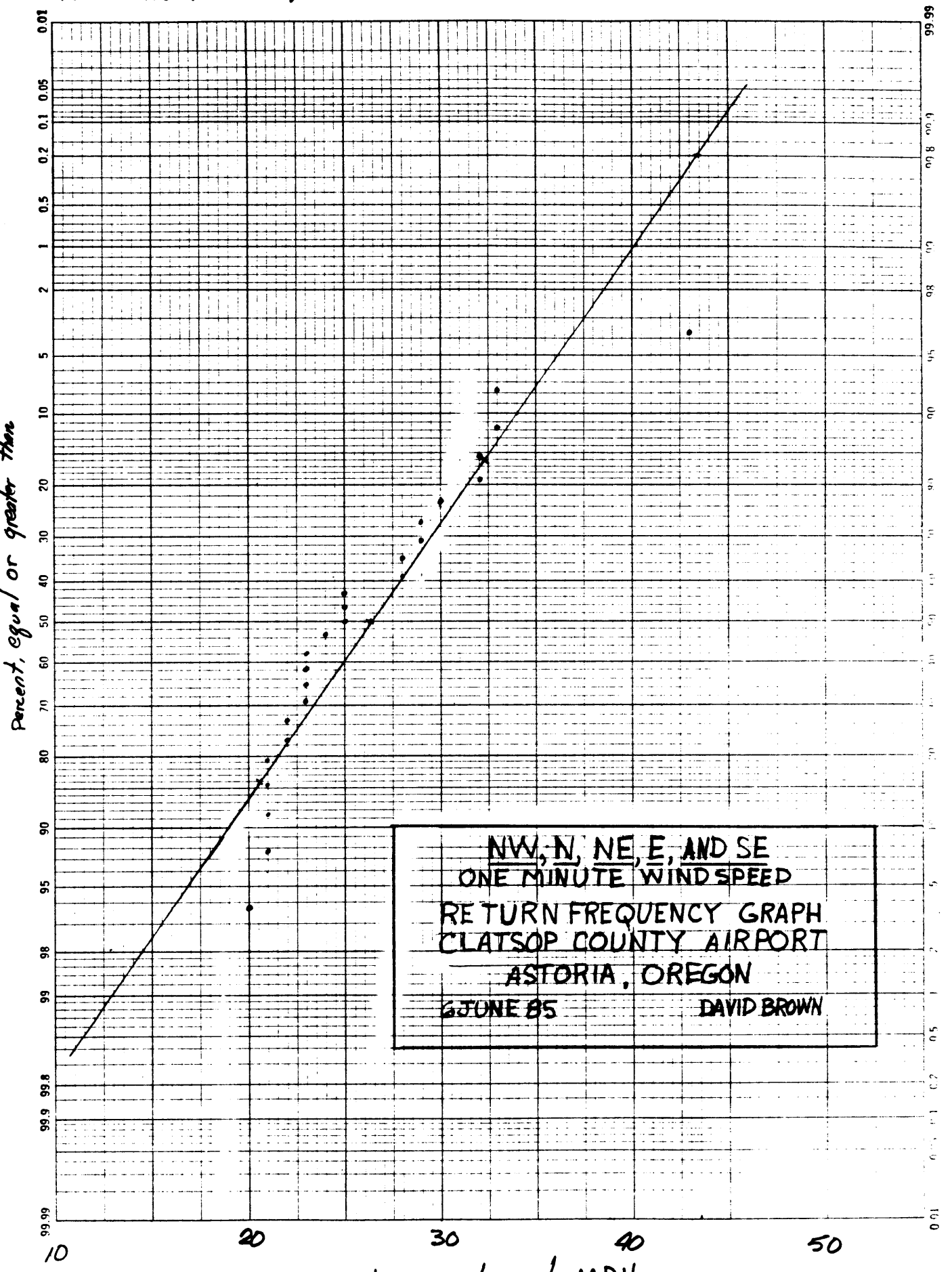
Ref: Introduction to Hydrology p. 120 – 130

Use Weibull distribution.

MAP ON sheet 17

The theoretical normal of best fit is a straight line through $\bar{x}-s$ at 15.9%, $\bar{x}$ at 50%, and $\bar{x}+s$ at 84.1%. Thus:

$\bar{x} - s = 26.36 - 5.84 = 20.5$ — 15.9%
$\bar{x} = 26.36$ — 50%
$\bar{x} + s = 26.36 + 5.84 = 32.2$ — 84.1%



NW → N → NE → E → SE ONLY

Probability Scale - 9" Division

PROJECT: Tansy	COMPUTED BY: David Brown	DATE: 6 Jun 85
SUBJECT: Revetment Design	CHECKED BY: JDT	SHT. 4 OF 28
		PART:

The following data was taken from the graph on sheet 3.

% Chance	10	5	2	1	0.2
Return Frequency	10	20	50	100	500
Windspeed, mph	34	36.2	38.7	40.5	43.5

For design purposes a 100 year return frequency will be used. Thus U_f = 40.5 MPH

Ref. SPM p. 3-32 and 3-33 see ¶3a. through f.

a. The windspeed readings are for Clatsop County Airport, located approximately 4 miles distant. The Airport is adjacent to the water.

b. Values were selected from NOAA records. Discussing with Bud Krepky (503-861-2722) (Local NOAA Rep at Astoria) the wind measurements are made at 20' or. $20\text{ft} \times \frac{0.3\text{m}}{\text{ft}} \doteq 6.1$ meters. Thus,

$$U_{10m} = U_{6.1}\left(\frac{10}{6.1}\right)^{1/7} \quad (3\text{-}26)$$

$$U_{10} = 40.5\left(\frac{10}{6.1}\right)^{1/7} = \underline{43.5\text{ mph}}$$

c. Fetch Length = 13.25 mi = 21.3 Kilometers. The wind measurements are made adjacent to the water so use $\underline{R_L = 0.9}$ for wind > 41.5 mph.

d. Use R_T = 1.1 (Absence of temp. data.)

PROJECT: Tansy
SUBJECT: Revetment Design
COMPUTED BY: David Brown
CHECKED BY: JDT
DATE: 6 Jun 85
SHT. 5 OF 28
PART:

$U = R_T R_L U_{10} = 1.1(0.9)43.5 = \underline{43.1 \text{ mph}}$

c. Develope $U_{10}, U_{20}, U_{40}, U_{50}, U_{60}$ SPM pg. 3-26;

$U_f = 43.1$

$t = \frac{3600}{43.1} = 83.5 \text{ sec}$ (To travel 1 mile)

From Fig. 3-13

$\frac{U_{83.5}}{U_{3600}} = 1.205$

Thus $U_{3600} = \frac{U_{83.5}}{1.205} = \frac{43.1}{1.205} = \underline{35.8 \text{ mph}}$

U_{10m}: U_{600s} $\frac{U_{600}}{U_{3600}} = 1.045$

$U_{600s} = 1.045(35.8) = \underline{37.4 \text{ mph}}$

U_{20}: $\frac{U_{1200}}{U_{3600}} = 1.02$ $\therefore U_{1500} = 1.02(35.8) = \underline{36.5 \text{ mph}}$

U_{40}: $\frac{U_{2400}}{U_{3600}} = 1.005$ $U_{2400} = 1.005(35.8) = \underline{36 \text{ mph}}$

2 Hr: U_{7200}: $\frac{U_{7200}}{U_{3600}} = 0.955$ $U_{7200} = 0.955(35.8) = \underline{34.2 \text{ mph}}$

PROJECT: Tansy
SUBJECT: Revetment Design
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CHECKED BY: JDT
DATE: 6 Jun 85
SHT. 6 OF 28
PART:

3 Hr: $U_{10800} : \frac{U_{10800}}{U_{3600}} = 0.928$ ∴

$$U_{3Hr} = 0.928\ (35.8) = 33.2 \text{ mph}$$

Summary $U_{10m} = 37.4$; $U_{20m} = 36.5$; $U_{40m} = 36$; $U_{60m} = 35.8$; $U_{2hr} = 34.2$; $U_{3Hr} = 33.2$

f. Eq. (3-28b)

$$U_A = 0.589\ U^{1.23}$$

$U_{A_{10m}} = 50.7$ $U_{A_{1Hr}} = 48$

$U_{A_{20m}} = 49.2$ $U_{A_{2Hr}} = 45.4$

$U_{A_{40m}} = 48.4$ $U_{A_{3H}} = 43.8$

Ref. SPM pg. 3-47 - Find Wave heights for the durations listed. Fetch = 13.25 miles = 21.3 Kilometers
See sheets 17, 18, 19, and 20 of these Calc's. for Fetch Determination.
Use Fig. 3-24

For Fetch Lenght 13.25 miles.

Duration min.	U_A	Wave ft	T sec	
10	50.7	1.6'	2.2	
20	49.2	1.6'	2.25	
40	48.4	2.0'	2.5	
60	48.0	2.75'	3.2	
2hr	45.4	4.25'	4.25	
3hr	43.8	4.8'	4.75	Fetch Limited

Tansy
Revetment Design
6 Jun 85

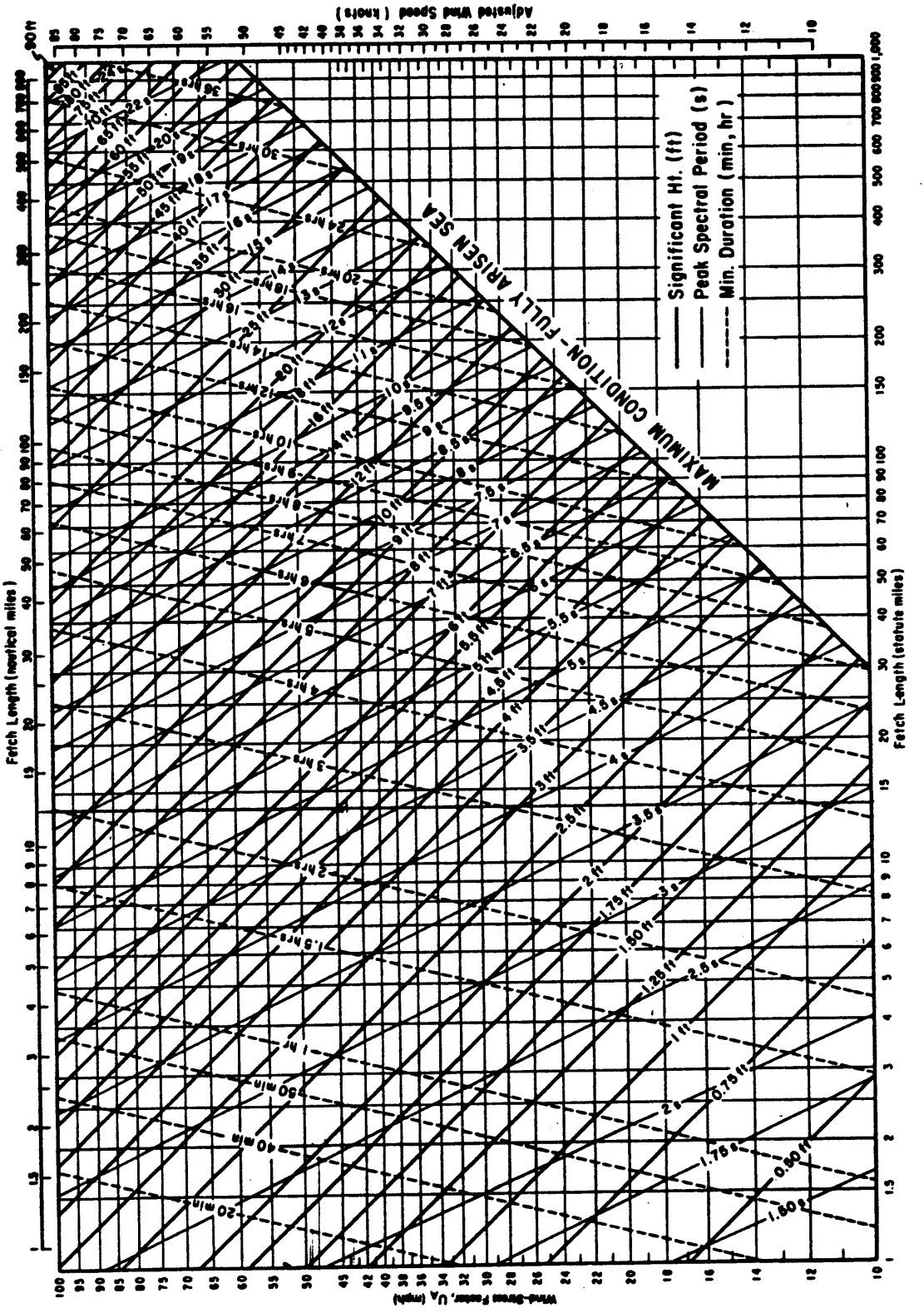


Figure 3-24. Nomograms of deepwater significant wave prediction curves as functions of windspeed, fetch length, and wind duration (English units).

4.8.2025 Commissi et
Page 2 63
Enclosure Page 181 of 247

Rev JUL 85

PROJECT: Tansy
SUBJECT: Revetment Design
COMPUTED BY: David Brown
CHECKED BY: JDT
DATE: 6 Jun 85
SHT. 8 OF 28
PART:

Check w/ Equations in Table 3-2

$$H_{m_o} = 3.01\times10^{-2}\, U_A\, F^{1/2} = 3.01\times10^{-2}(43.8)(13.25)^{1/2} = 4.8'$$

$$T_m = 5.59\times10^{-1}\left(U_A F\right)^{1/3} = 5.59\times10^{-1}\left(43.8\cdot 13.25\right)^{1/3} = 4.7\ \text{sec}$$

$$t = 1.603\left(\frac{F^2}{U_A}\right)^{1/3} = 1.603\left(\frac{13.25^2}{43.8}\right)^{1/3} = 2.54\ \text{hr}$$

Find $U_{A_{2.5hr}} = U_{9144}$

$$\frac{U_{9144}}{U_{3600}} = 0.938 \qquad U_{9144} = 0.938\,(35.8) = 33.58\ \text{mph}$$

$$U_{A_{2.54}} = 0.589\,(33.58)^{1.23} = 44.4$$

$$H_{mo} = 3.01\times10^{-2}(44.4)(13.25)^{1/2} = 4.9'$$

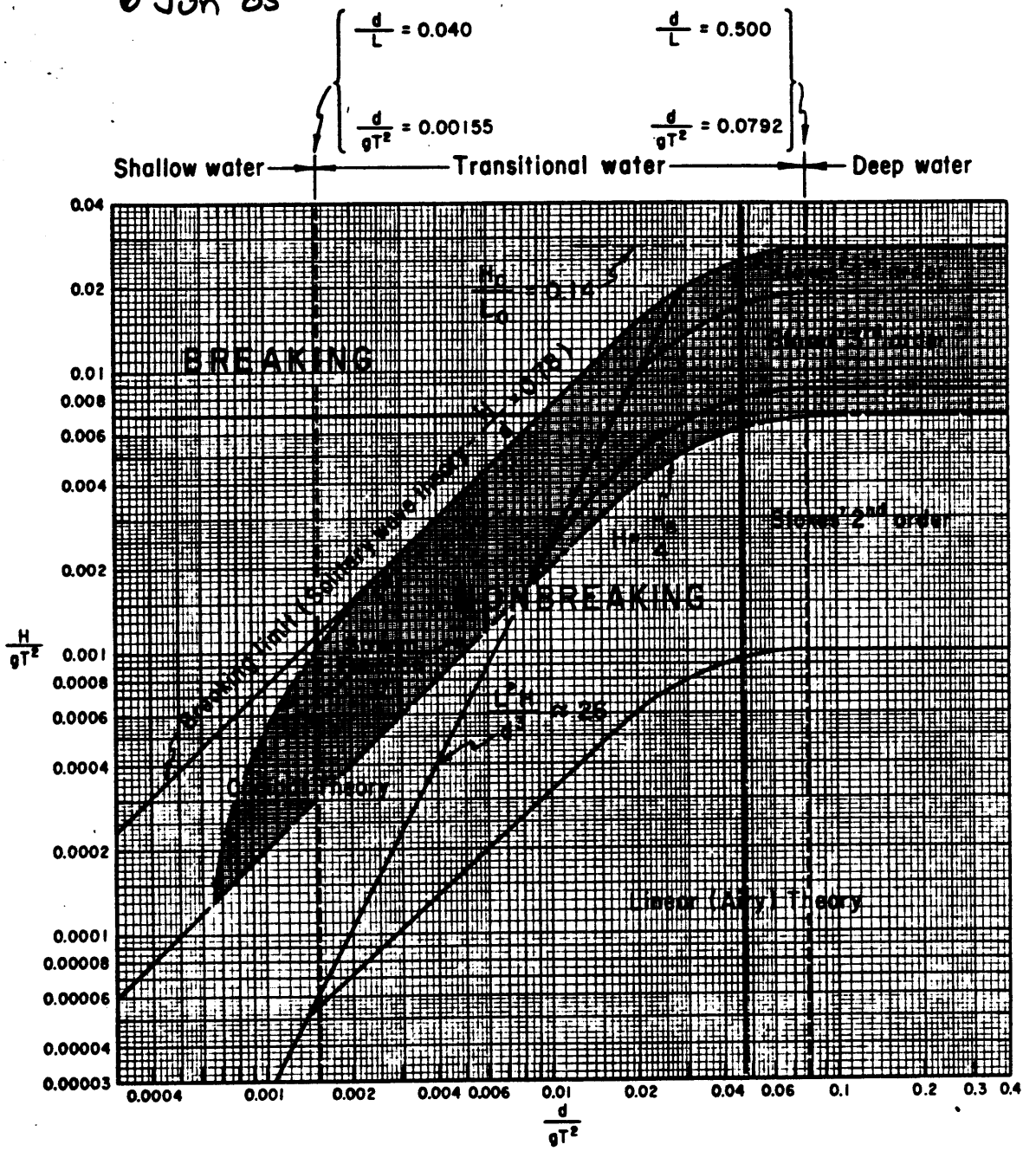
$$T_m = 5.59\times10^{-1}(44.4\cdot 13.25)^{1/3} = 4.7\ \text{sec}$$

$$t = 1.603\left(\frac{13.25^2}{44.4}\right)^{1/3} = 2.53\ \text{hr} \qquad \text{OK}$$

Check to insure <u>Deep-Water Theory</u>:
SPM Fig 2-7 $d = 33.5'$

$$\frac{H}{gT^2} = \frac{4.9}{32.2(4.7)^2} = 0.0069; \quad \frac{d}{gT^2} = \frac{33.5}{32.2(4.7)^2} = 0.047$$

Tarsy
- Revetment Design
6 Jun 85



(after Le Mehaute, 1969)

Figure 2-7. Regions of validity for various wave theories.

Rev 4.8.2020 Commission Page 272 of 21
Enclosure Page 183 of 247

PROJECT:	COMPUTED BY:	DATE: 6 Jun 85
Tansy	David Brown	
SUBJECT:	CHECKED BY:	SHT. 40 OF 28
Revetment Design	JDT	PART:

The plot shows that the wave is actually at the "deep water" end of the "transitional water" zone. For purposes of this design, deep-water theory will be used.

Size Rip Rap

Ref SPM

Eq. (7-117) $$W_{50} = \frac{w_r H^3}{K_{RR}(S_r - 1)^3 \cot\theta}$$

$W_{MAX} = 4 W_{50}$

$W_{MIN} = 0.125 W_{50}$

W_{50} = weight of 50% size in the gradation

K_{RR} = Stability Coefficient, see table 7-8

w_r = Unit weight of rock, lb/ft^3

H = Design wave height

S_r = Specific Gravity of Rock relative to site water

$S_r = w_r / w_w$

w_w = Unit weight of water; fresh: 62.4 lb/ft^3
sea 64.0 lb/ft^3

θ = Angle of structure measured from horizontal in degrees.

PROJECT:	COMPUTED BY:	DATE: 6 Jun 85
Jansy	David Brown	
SUBJECT:	CHECKED BY:	SHT. 11 OF 28
Revetment Design.	JDT	PART:

$w_r = 160\ lb/ft^3$

$H = 4.9'$

$S_r = 160/62.4 = 2.56$

$\cot\theta = 2$

$K_{RR} = 2.5$ Non-Breaking Wave: See Sheet 9 of these calcs.

Check w/ SPM p. 7-4 to 7-8

From survey cross-sections m = Range { 1:6.25, 1:8, 1:4.4

1:6.25	0.160
1:8	0.125
1:4.4	0.227

From Extrapolation of Fig. 7-3

$\frac{H_b}{H_o'} \cong 1.23 \qquad (m = 0.23)$

$\therefore 1.23 H_o' = 1.23(4.9) = 6.03'$

$\frac{H_b}{gT^2} = \frac{6.03}{32.2(4.7)^2} = 0.0085$

From Fig. 7-2 $\alpha = 1.45$ $\beta = 0.85$

$d_{b_{max}} = \alpha H_b = 1.45(6.03) = 8.7'$

$d_{b_{min}} = \beta H_b = 0.85(6.03) = 5.1'$

PROJECT: Tansy	COMPUTED BY: David Brown	DATE: 6 Jun 85
SUBJECT: Revetment Design	CHECKED BY: JDT	SHT. 12 OF 28
		PART:

Since $d_s > d_{MAX}$ the wave is non-breaking,

Thus $K_{RR} = 2.5$.

$$W_{50} = \frac{160\,(4.9)^3}{2.5(2.56-1)^3\,2} = 838 \text{ lb}$$

$$W_{MAX} = 4(838) = 3352 \text{ lb}$$

$$W_{MIN} = .125(838) = 105 \text{ lb}.$$

These requirements vs. standard Class III and Class V gradations are graphed on sheet 13.

Design Rip-Rap Layer Thickness:

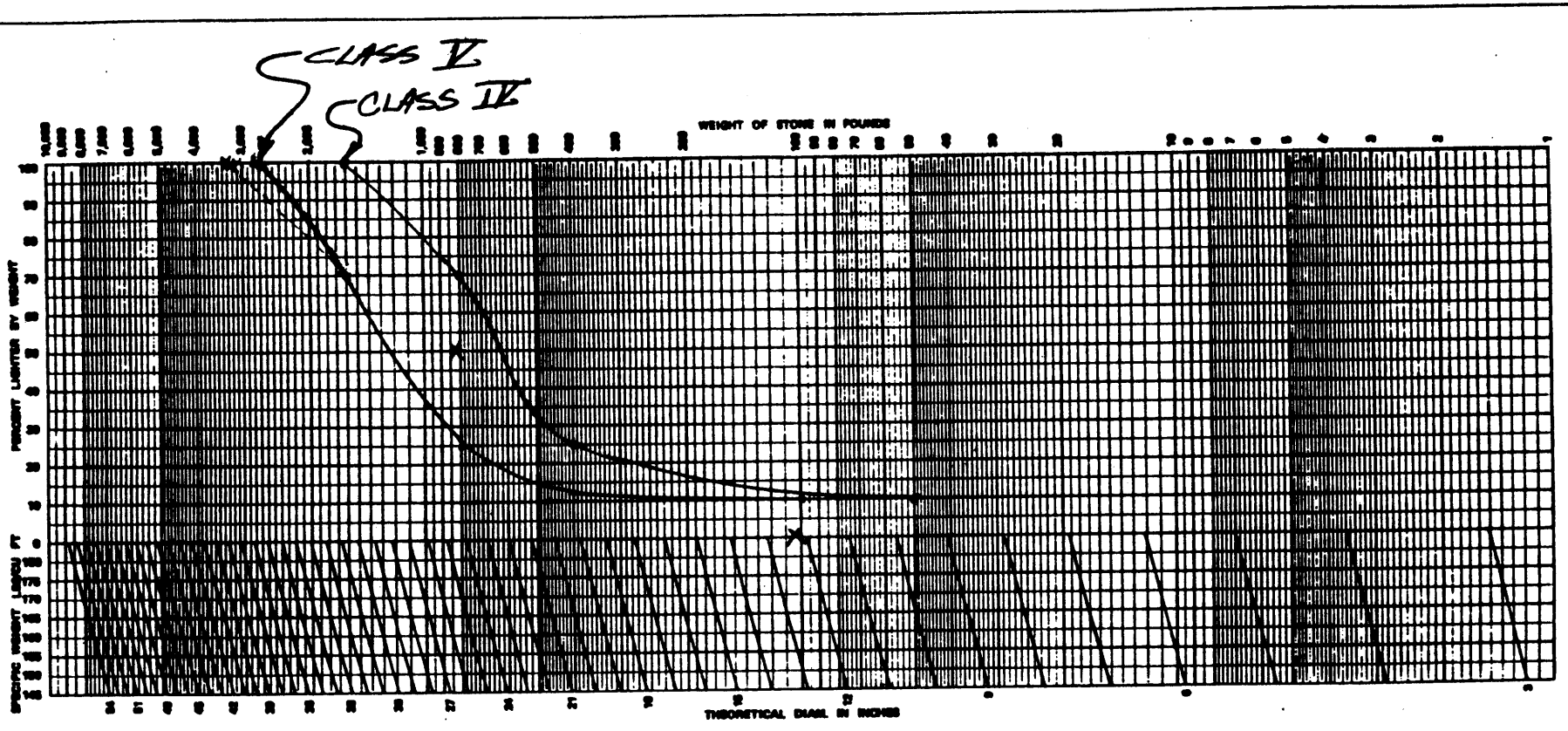
Ref. SPM p. 7-237

$$r = .30\,M$$

$$r = 2.0\left(\frac{W_{50}}{w_r}\right)^{1/3} \quad (7\text{-}123)$$

$$r = 1.25\left(\frac{W_{MAX}}{w_r}\right)^{1/3} \quad (7\text{-}124)$$

} Use the largest r.



SPECIFIC WEIGHT OF STONE 160 LBS/CU FT

x = Calculated Requirements

PROJECT Taney R&R

AREA

DATE 6 June 25 BY David Brown

RIPRAP GRADATION CURVES

(EM 1110-2-1601)

(Proponent: DAEN-CWE-HD)

ENG FORM 4794-R, Sep 82

* U.S. Government Printing Office : 1982 - 522-097/536

Taney Revetment Design 6 Jun 25

Sheet 13 of 28

Rev Jul 25

PROJECT:	COMPUTED BY:	DATE: 6 Jun 85
Tansy	David Brown	
SUBJECT:	CHECKED BY:	SHT. 14 OF 28
Revetment Design	JDT	PART:

$$r = 2.\phi \left(\frac{838}{160}\right)^{1/3} = 3.5'$$

$$r = 1.25 \left(\frac{3352}{160}\right)^{1/3} = 3.4'$$

$\therefore$ Use $r = 3.5'$

Calculate Wave Run-Up

Ref: SPM pg. 7-18

Use Fig. 7-19

$H_o' = 4.9'$ (See sheet 8 of these calc's.)
$T = 4.7$ sec

$$\frac{H_o'}{g T^2} = \frac{4.9}{32.2(4.7)^2} = \phi.\phi\phi 69$$

$$\frac{R}{H_o'} = 1.375 \quad \therefore \quad R = 1.375(4.9) = 6.7'$$

Design Water Surface Elevations

5ΦΦ year = 8.9' MSL
50 year = 8.3' MSL
10 year = 7.8' MSL

} From Combined Frequency Curves

Tansy
Revetment Design
6 Jun 85

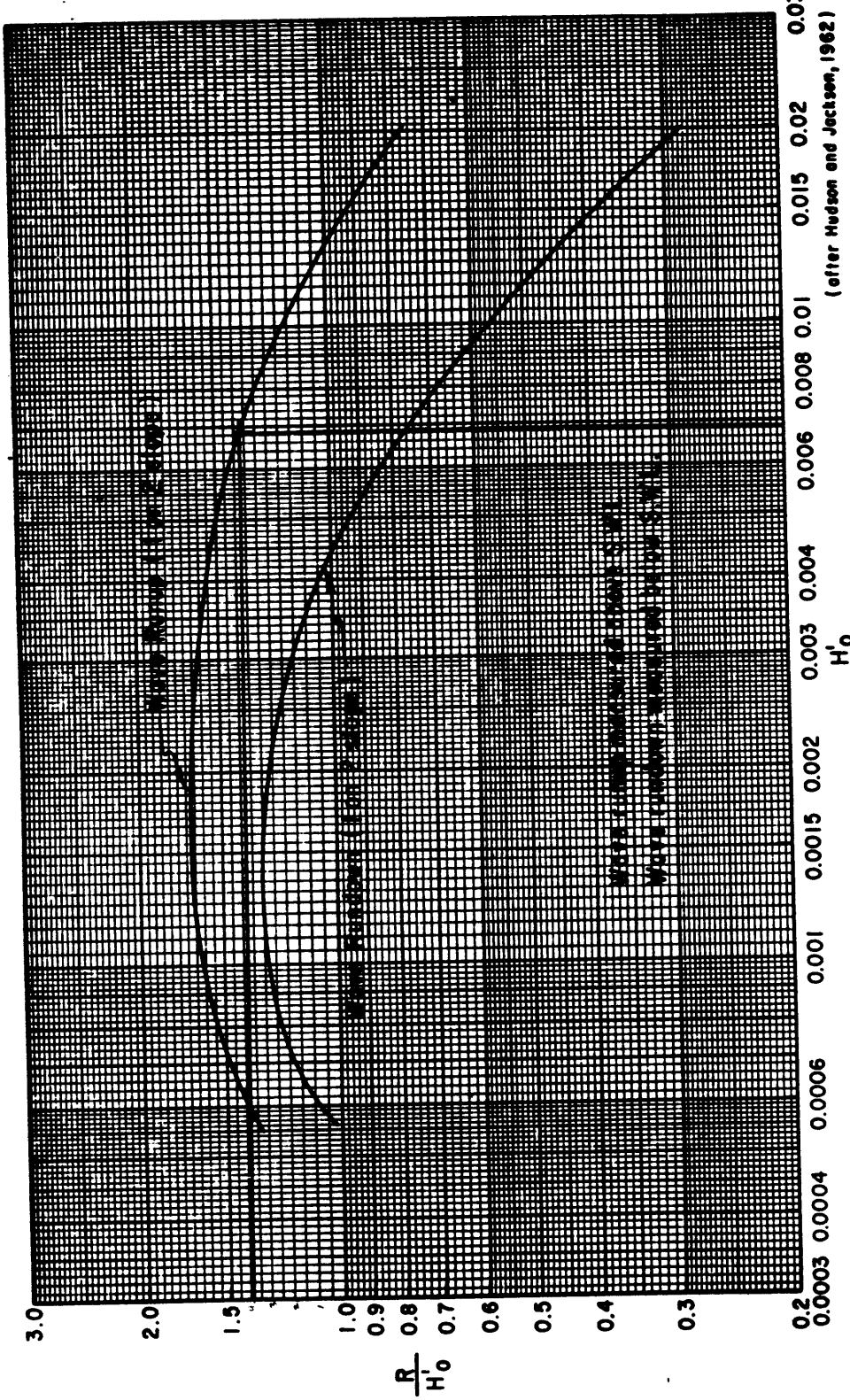


Figure 7-19. Wave runup and rundown on graded riprap, 1:2 slope, impermeable base, versus H'_o/gT^2 (data for $d_g/H'_o > 3.0$).

Rev JUL 85

Page 278 of 2163

PROJECT:	COMPUTED BY:	DATE: 6Jun85
Taney	David Brown	
SUBJECT:	CHECKED BY:	SHT. 16 OF 28
Revetment Design	JDT	PART:

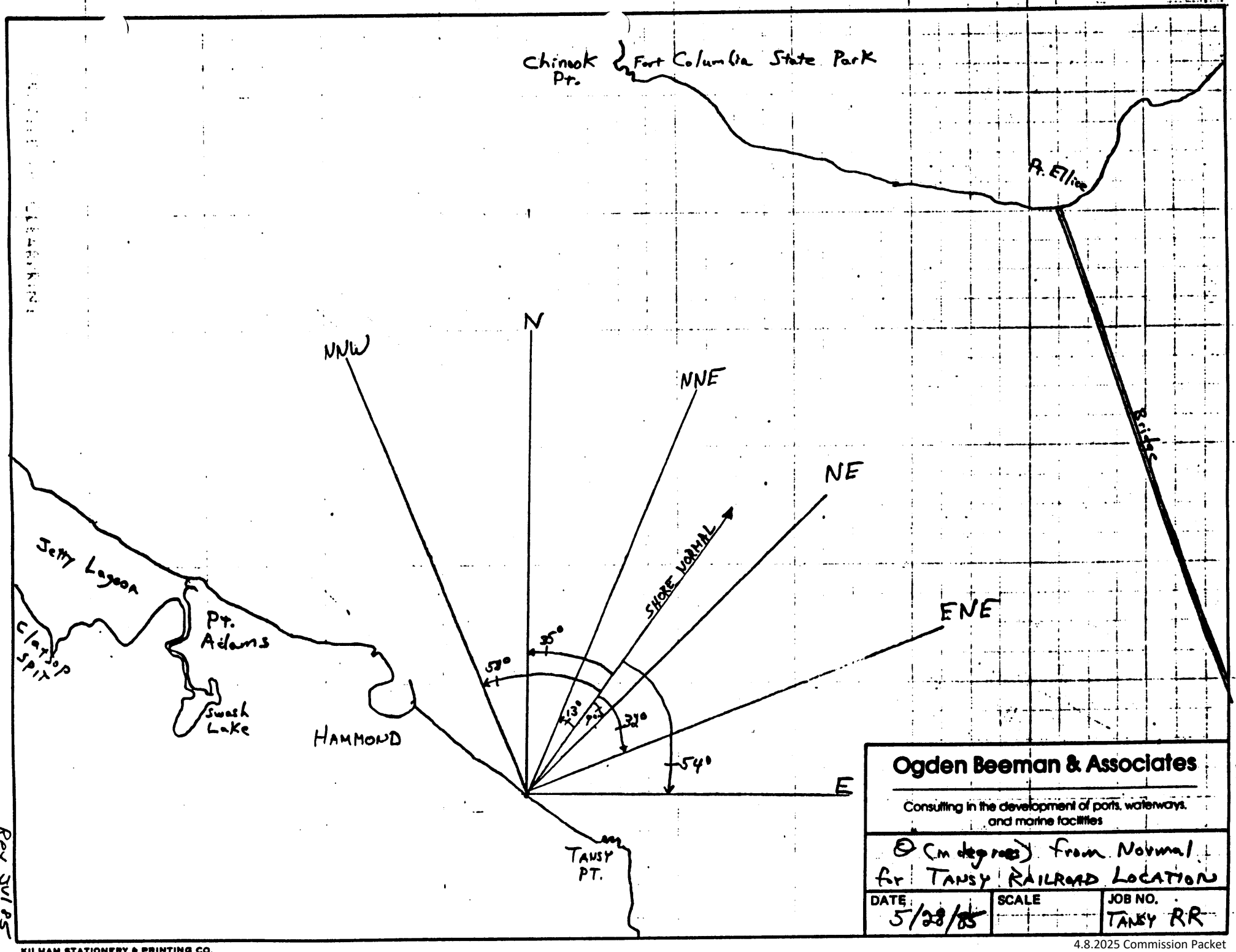
Run-up above SWL

A. 500 year : 8.9 + 6.7 = 15.6

B. 50 year : 8.3 + 6.7 = 15.0

C. 10 year : 7.8 + 6.7 = 14.5

Conclusion: Provide Rock Fill protection on top of levee at elevations less than 15.6' MSL (NGVD).



Ogden Beeman & Associates

Consulting in the development of ports, waterways, and marine facilities

θ (in degrees) from Normal for TANSY RAILROAD LOCATION

DATE	SCALE	JOB NO.
5/28/85		TANSY RR

Sheet 17 of 28

KILHAM STATIONERY & PRINTING CO.

Rev 3/1/85

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JOB LAVEY LAKE RECREATION
SHEET NO. 18 OF 28
CALCULATED BY K² DATE 5/28/85
CHECKED BY GLH DATE 5/31/85
SCALE REVETMENT DESIGN

WAVE ANALYSIS

A. WIND GENERATED WAVES

1. DETERMINE FETCH LENGTH:

Use method for irregular shoreline, ETL 1110-2-305, 16 FEB 1984

WIND DIRECTION = NORTH

#	Δ	X
1	+12	12.5
2	9	13.1
3	6	16.0
4	+3	15.4
5	0	14.6
6	-3	14.0
7	6	13.1
8	9	12.3
9	-12	12.2
		123.2 units

1 unit = 1676.2 ft

Fetch = $\frac{123.2}{9}$ units = 13.69 units

F = (13.69)(1676.2) = 22,945 ft
= 4.35 miles

CHECK OTHER CONDITIONS

WIND DIRECTION = EAST

#	Δ	X
1	+12	46.0
2	9	41.2
3	6	25.5
4	+3	23.6
5	0	20
6	-3	12.1
7	6	10.8
8	9	10.6
9	-12	11.2
		201.0

F = $\left(\frac{201.0}{9}\right)$(1676.2) = 37,435 ft.
= 7 miles

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JOB LAND TRANSPORTATION
SHEET NO. 19 OF 28
CALCULATED BY K² DATE 5/28/85
CHECKED BY GLH DATE 5/31/85
SCALE REVETMENT DESIGN

WIND DIRECTION = NORTH EAST

#	Δ	X
1	+12	12.4
2	9	12.7
3	6	13.0
4	+3	13.4
5	0	23.5
6	-3	29.0
7	6	29.5
8	9	29.7
9	-12	42.0
		205.2 units

$F = \left(\frac{205.2}{9}\right)(1676.2) = 38,217$ ft

$= 7.24$ miles

WIND DIRECTION = EAST NORTH EAST

#	Δ	X
1	+12	31.5
2	9	44.0
3	6	44.0
4	+3	42.5
5	0	43.1
6	-3	44.0
7	6	42.0
8	9	42.0
9	-12	42.4
		375.5

$F = \left(\frac{375.5}{9}\right)(1676.2) = 69,935$ ft

$F = 13.25$ miles

WIND DIRECTION = NORTH NORTH EAST

#	Δ	X	#	Δ	X
1	+12	12.5	8	9	12.2
2	9	12.2	9	-12	12.5
3	6	11.9			108.6
4	+3	11.6			
5	0	11.8			
6	-3	11.9			
7	6	12.0			

$F = \left(\frac{108.6}{9}\right)(1676.2) = 20,226$ ft

$= 3.83$ miles

Rev 7/86

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JOB I-205 / RAILROAD ALIGNMENT
SHEET NO. 20 OF 28
CALCULATED BY K² DATE 5/28/85
CHECKED BY GLH DATE 5/31/85
SCALE REVETMENT DESIGN

WIND DIRECTION = NORTH NORTH WEST

#	Y	X
1	+12	18.4
2	9	17.0
3	6	15.1
4	+3	15.8
5	0	15.4
6	-3	15.6
7	6	16.3
8	9	12.2
9	-12	12.7
		138.5

$$F = \frac{138.5}{9}(1676.2) = 25{,}795 \text{ ft.}$$

$$F = 4.9 \text{ miles}$$

Rev JUL 85

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JOB TANSY RR LOCATION
SHEET NO. 21 OF 28
CALCULATED BY GLH DATE 1/8/04
CHECKED BY JDT DATE 3/22/05
SCALE REVETMENT DESIGN

B. Ship Generated Waves

The Tansy RR location does parallel the navigation channel, and is approximately 1500 feet south of the channel. Depth of water varies from 54' to 30'. Average depth at 38' (MSL datum).

Reference "Water Waves Produced By Ships", Journal of Waterways, Harbors and Coastal Engineering Division, Sorenson, 1973:

Maximum vessel wave heights occur when the Froude Number, $V_s/\sqrt{gd}$, is approximately equal to 1. Multiplier for wave height based on Froude number is: (After Johnson, 1958)

$F = V_s/\sqrt{gd}$	C_{max}
0.6	0.13
0.7	0.20
0.8	0.60
0.9	1.00
1.0	0.87
1.1	0.77
1.2	0.70
1.3	0.63
—	—
1.5	0.57
1.9	0.51
2.0 & up	0.50

Rev 3/16/05

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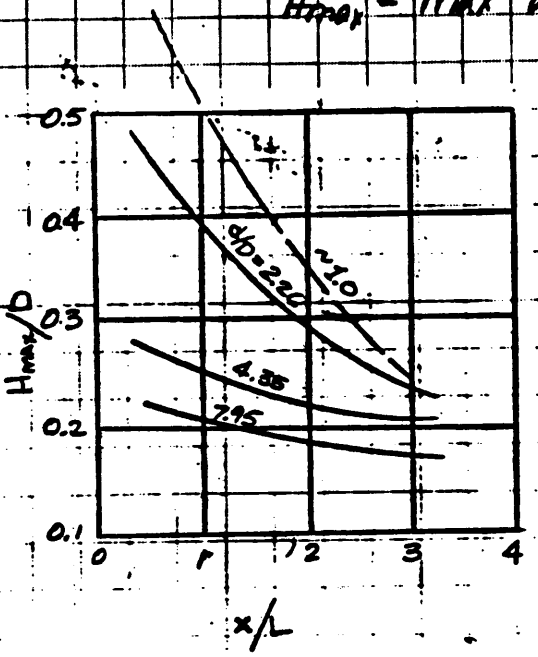
JOB TANSY RR LOCATION
SHEET NO. 22 OF 28
CALCULATED BY GLH DATE 1/8/05
CHECKED BY JDT DATE 3/22/05
SCALE REVETMENT DESIGN

The value of $H_{actual} = (H_{max})(C_{max})$ where

C_{max} = Froude Related Coefficient

H_{max} = Max wave height based on following



D = Draft of vessel
d = Ave depth from sailing line to point of measurement
L = Ship length
x = distance from sailing line

for $V/\sqrt{gL} = 1.1$

Present ship size in channel can have the maximum dimensions as follows:

Type	Length	Width	Draft	Speed
Bulk	750'	105'	40'	12 knots
Container	650	105'	38'	15 knots
* Oil	900'	150'	48'	12 knots

* Note: Oil supertankers will use new 55' channel from Tongue Point to Mouth of Columbia River. Benefit-Cost study for this project now ongoing at Portland District, U.S. Army Corps of Engineers.

Channel Depth - use 42' for Bulk and Container, 55' for Oil. (authorized + overdepth of low tide)

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JOB TANSY KK LOCATION
SHEET NO. 23 OF 28
CALCULATED BY GLH DATE 1/9/85
CHECKED BY JDT DATE 3/27/85
SCALE REVETMENT DESIGN

d = Average depth from channel to bankline:
Bulk & Container ~ 38'
Oil ~ 42'

x = sailing line from bankline
Bulk & Container ~ 1650'
Oil ~ 1950'

Type	V/L	d/D	H_{max}/D	H_{max}	$V_s/\sqrt{gd}$	C_{max}	H_{act}
Bulk	2.20	0.95*	0.35	14'	0.58	0.10	1.4'
Container	2.54	1.0	0.31	11.8	0.72	0.20	2.4'
Oil	2.16	0.87*	0.40	19.2	0.55	0.10	1.9'

(Measurement on site for "Bulk" vessel carrying logs, with draft at 36', moving at 10+ knots: L ≅ 600 ft., tide at +4'. Wave height was 1.5 to 2 feet.)

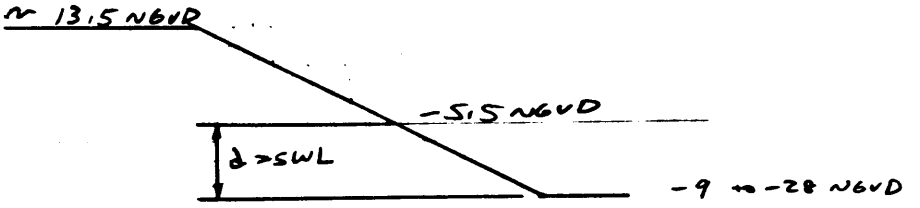
For purpose of design, use **3.0 foot wave height**

PROJECT:	COMPUTED BY:	DATE:
Lwr Columbia River Bank Prot.	JDT	6 Jun 85
SUBJECT:	CHECKED BY:	SHT. 24 OF 28
Tansy Railroad Location	DOB	PART:

BOTTOM ELEVATION OF PRIMARY COVER LAYER

Reference 1984 SPM, Vol II, Chapter 7 pg 7-237

A. Bottom elevations vary between −9 NGVD and −28 NGVD



Low tides are approx −2 mllw = −5.5 NGVD
Therefore, d = 3.5 ft to 22.5 ft

B. Design height (H) = 4.9 ft and 1.5H = 7.4 ft ←

C. In depths > 7.4 ft, armour should be extended below SWL (minimum) the design height H.

D. Bottom elevation = −5.5 + −4.9 = −10.4 NGVD

E. To account for unknowns, and contingencies, increase factor of safety 1.5

F. Bottom Elevation = (1.5)(10.4) = −15.5 NGVD ←

PROJECT:	COMPUTED BY:	DATE:
Lower Columbia Bank Protection	JDT	6 JUN 85
SUBJECT:	CHECKED BY:	SHT. 25 OF 28
Tansy Railroad Location	QOB	PART:

TRACTIVE FORCE
REVETMENT DESIGN (EM 1110-2-1601)

A. Determine Local Boundary Shear (Class V).

B. Determine Riprap Design Shear (Class V).

C. Check Boundary Shear and Riprap Shear for Class III.

D. Conclusions

A. Determine Local Boundary Shear

1. $\tau_o = \dfrac{\gamma \bar{v}^2}{\left(32.6 \log_{10} \dfrac{12.2\,y}{D_{50}}\right)^2}$ pg 40

Given: $\gamma = 64$ lb/ft^3 (salt water)

$D_{50} = \left(\dfrac{6\,W_{50}}{\pi\,\gamma_s}\right)^{1/3}$ Check Class V pg 38

where: $W_{50} = 1{,}100$ lbs (Figure 5)

$\gamma_s = 160$ lbs/ft^3

$D_{50} = \left(\dfrac{6 \times 1100}{\pi \times 160}\right)^{1/3} = 2.36$ ft

$\bar{v} = \dfrac{11.6 + 9.4}{2} = 10.5$ ft/sec

Natural current velocities were based on data collection for "Columbia River Model Study" (1959) and "Columbia River Estuary Hybrid Model Studies" (1983), prepared by Waterways Experiment Station, COE. For a discharge of 578,000 cfs on 6/19/59 a maximum velocity of 11.6 ft/s (other than surface) and an average maximum velocity of 9.4 ft/s (0.5 depth) was recorded. Assume an average of the two velocities at revetment. Therefore, $\bar{v} = 10.5$ ft/s

$y = 33.5$ ft Lowest elevation at revetment (TOP of Toe) is −25 NGVD. Maximum W.S. for 50-yr flood is 8.5 NGVD. Therefore, $y = +25 + 8.5 = 33.5$ ft

PROJECT:	COMPUTED BY:	DATE:
Lower Columbia River Bank Prot.	JDT	6 Jun 85
SUBJECT:	CHECKED BY:	SHT. 26 OF 28
Tansy Railroad Location	QOB	PART:

$$T_o = \frac{(64)(10.5)^2}{\left[32.6 \log_{10} \frac{12.2(83.5)}{2.36}\right]^2}$$

$T_o = 1.32$ lbs/ft²

Include correction factor (1.5) as recommended in ETL 1110-2-120 Pg 4.

$T_o = (1.32)(1.5) = \underline{1.99 \text{ lbs/ft}^2}$ ←

B. Determine Riprap Design Shear

1. $\tau = a(\gamma_s - \gamma) D_{50}$

Given: $a = 0.040$ Pg 41

$\gamma_s = 160$ lbs/ft³

$\gamma = 64$ lbs/ft³ (salt water)

$D_{50} = 2.36$ ft (class V riprap)

$\tau = 0.04 (160 - 64) 2.36$

$\tau = 9.06$ lbs/ft²

2. CORRECT FOR CHANNEL SIDE SLOPE

$$\tau' = \tau \left(1 - \frac{\sin^2 \phi}{\sin^2 \theta}\right)^{1/2}$$

Given: $\tau = 9.06$ lbs/ft²

$\phi = 26.6°$ (angle of side slope)

$\theta = 40°$ (angle of repose)

PROJECT:	COMPUTED BY:	DATE:
Lower Columbia River Bank Prot.	JDT	6 Jun 85
SUBJECT: Tansy Railroad Location	CHECKED BY: JOB	SHT. 27 OF 28
		PART:

$$T' = 9.06\left(1 - \frac{\sin^2(26.6^\circ)}{\sin^2(40^\circ)}\right)^{1/2}$$

$$T' = 9.06\,(1 - .49)^{1/2}$$

$$T' = \underline{6.5 \text{ lbs/ft}^2} \longleftarrow$$

$T' = 6.5 \text{ lbs/ft}^2 > T_o = 1.99 \text{ lbs/ft}^2$ CLASS V OK

C. Check Boundary Shear and Riprap Shear for Class III

1. Assume riprap to be class III below −12 MLLW (−15.5 NGVD), and can be sized for tractive force in lieu of Wave requirements.

2. Determine Local Boundary Shear (class III)

$$T_o = \frac{\rho \bar{v}^2}{\left(32.6 \log_{10} \frac{12.2\,Y}{D_{50}}\right)^2}$$

Given: $\rho = 64 \text{ lbs/ft}^3$

$\bar{v} = 10.5 \text{ ft/s}$

$$D_{50} = \left(\frac{6 \cdot W_{50}}{\pi \rho_s}\right)^{1/3} \quad \text{where } W_{50} = 325 \text{ lbs (class III)}, \quad \rho_s = 160 \text{ lbs/ft}^3$$

$$D_{50} = \left[\frac{6\,(325)}{\pi\,160}\right]^{1/3} = 1.57 \text{ ft}$$

$$T_o = \frac{(64)(10.5)^2}{\left[32.6 \log_{10} \frac{12.2\,(33.5)}{1.57}\right]^2}$$

$$T_o = 1.14 \text{ lbs/ft}^2$$

PROJECT:	COMPUTED BY:	DATE:
Lower Columbia River Bank Prot.	JDT	6 JUN 05
SUBJECT:	CHECKED BY:	SHT. 28 OF 28
Tansy Railroad Location	DAB	PART:

Include Correction factor (1.5) as recommended in ETL 1110-2-120 pg 4.

$T_o = (1.14)(1.5) = 1.71$ lbs/ft^2 ←

3. Determine Riprap Shear (class III)

$T = a(\gamma_s - \gamma) D_{50}$ where $a = 0.04$

$T = .04(160 - 64) 1.57$

$T = 6.03$ lbs/ft^2

$\gamma_s = 160$ lbs/ft^3

$\gamma = 64$ lbs/ft^3

$D_{50} = 1.57$ ft

Correct for Channel Side Slope:

$$T' = T\left(1 - \frac{\sin^2 \phi}{\sin^2 \theta}\right)^{1/2}$$

$T' = 6.03(1 - .49)^{1/2}$

$T' = 4.3$ lbs/ft^2

$T' = 4.3$ lbs/ft^2 > $T_o = 1.71$ lbs/ft^2

Class III Stability ok below -12 mLLW

D. Conclusions

A. Stability of class II riprap is OK.

APPENDIX B

GEOTECHNICAL FEATURES

TANSY RAILROAD LOCATION
CLATSOP COUNTY, OREGON
APPENDIX B
GEOTECHNICAL FEATURES

1. LOCATION OF PROJECT. The proposed project is located in Clatsop County, Oregon along the south shoreline of the Columbia River between river miles 9.2 and 10.0 (Tansy Point). The proposed improvements border a segment of an abandoned railroad line running from the City of Warrenton to the community of Hammond, Oregon. The Columbia River shipping channel is about 1,500 feet riverward of the proposed improvements.

2. SOILS INVESTIGATIONS. A reconnaissance-type inspection was completed along the riverbank within the proposed improvement limits to determine the site material conditions and to assess construction material requirements. Both onsite and offsite borrow sources were considered in the construction material assessment. Laboratory classification test results on samples taken for Columbia River maintenance dredging and from an inland sand borrow source were used to supplement the field evaluation of site conditions.

3. EXISTING SOIL CONDITIONS. The proposed bank protection improvements are situated on alluvial and dune deposits along the south shoreline of the Columbia River. The bankline section within the improvement limits consists of a steep upper bank, a gentle sloped middle bench area and a relatively steep lower bank. Residual bankline materials are fine-grained dune and river sands that are covered with varying thicknesses of previously placed revetment-type materials. The majority of the revetment materials are large block to cobble-size rock fragments. Wave and associated washing action, and probably some piping of sands have caused general armour stone deterioration and left numerous rock fragment accumulations scattered riverward of the upper bankline. Upper river bank slopes vary from 1V on 2H to 1V on 1H or steeper in areas where the worst erosion has occurred. Slopes on the lower bank vary from 1V on 1.5H to 1V on 2H. The middle bench area slopes are 1V on 5H or flatter. Middle bench widths vary from 15 to 30 feet.

4. Required Construction Materials. Typical improvement sections are shown on Plates 3 and 4. Required construction materials include crushed rock bedding, rockfill embankment, Class V Riprap, and Class III Riprap (below El -15.5 NGVD).

5. Construction Material Sources. There are several operating quarries in Clatsop County within 15 miles of the project that are suitable sources for crushed rock bedding, rockfill embankment, and Class III riprap. Young River Falls Quarry, owned by the Crown Zellerbach Corp., is considered the best source for Class V riprap. Obtaining sufficient quantity of the larger stone sizes required for the Class V riprap gradation probably will be more difficult at other operating quarries in the area. A field evaluation of the Youngs River Falls Quarry will be required to determine available quantities prior to construction.

6. Filter Design

6.1 General. The proposed revetment section will be constructed on or adjacent to fine river sands (lower bank), fine dune or river sand (middle bank), and fine dune sands (upper bank). The sequence of materials subject to filter action are Class V riprap, Class III riprap (below EL -15.5 NGVD), rockfill embankment, crushed rock bedding, and dune or river sand. Soil data for dredge river sands and typical dune sands are on Figures 3 and 4. Figure 4 also shows the sequence of materials subject to filter action.

6.2 Design Analysis and Evaluation. Successive filter zones were checked for permeability and piping stability using criteria presented in EN 1110-2-2300. See computations on page B-4. The criteria were met for all stages of filter action.

7. Slope Stability

7.1 Design Conditions. The critical stability analysis condition is sudden drawdown. Drawdown conditions at the improvement site are predominately influenced by tidal fluctuation and surging action-caused wave generation. A river fluctuation from a stage at El 9.0 to a low tide stage at

approximately El 0.0 represents the maximum design drawdown range for a winter occurrence. A similar drawdown range for a summer occurrence is from approximately El 8.0 to El -3.0. Materials specified for the revetment section and the residual foundation materials have very little materials finer than the No. 200 sieve size. All of embankment and foundation material are considered freedraining for stage fluctuations on the Columbia River.

7.2 Material Design Parameters. Estimated design parameters are tabulated below:

MATERIAL	UNIT WEIGHT - #/ft^3			STRENGTH VALUES	
	Sat.	Moist	Buoy	ϕ	C
Riprap	115.0	110.0	52.6	37.0	0
Rockfill	115.0	110.0	52.6	37.0	0
Bedding	115.0	110.0	52.6	37.0	0
Sand	105.0	100.0	42.6	30.0	0

7.3 Design Analysis.

7.3.1 General. Stability Analysis computations were performed for sudden drawdown conditions using a section at Station 41+00. The bankline at this station represents the critical section for the proposed improvements. Calculations were performed assuming that the residual sand in the drawdown range remain in an undrained condition following drawdown. A stablity analysis summary is shown on Figure 6.

7.3.2 Design Calculations. Stablilty analysis calculation results indicate a minimum factor of safety of 1.43 (Arc No. 6) for a series of failure arcs passing through undrained sands in the drawdown zone. If these sands are assumed to be drained, the minimum factor of safety for Arc No. 6 is increased to 1.52. The minimum factor of safety for all calculations performed is 1.26 (Arc No. 13). The residual sands intersected by Arc No. 13 are below water and in a buoyant condition. The minimum factor of safety for

an infinite slope solution for riprap placed on a IV on 2H Slope is 1.51. (See calculations on B-7.)

7.3.3 Design Evaluation. Analysis calculations for Arc No. 6 indicate the drawdown drainage assumptions for the sand result in only a small change in the minimum factor of safety (drained vs. undrained). The factor of safety for Arc No. 13 is a static pool calculation and is not affected by seepage forces developed in the drawdown zone. Stablilty of the improvement section is considered adequate for bankline flows up to the 100-year flood frequency (EL. 9.0).

FILTER DESIGN CALCULATIONS

CONDITION I

Riprap D_{15} = 400 mm (use Class V - worst case)

Protecting Rockfill D_{15} = 13 mm D_{85} = 80 mm

Calculations

$$\frac{D_{15}\ \text{Filter}}{D_{85}\ \text{Soil}} = \frac{400}{80} = 5.0 = 5.0$$ Piping Stability Met

$$\frac{D_{15}\ \text{Filter}}{D_{15}\ \text{Soil}} = \frac{400}{13} = 30.8 > 5.0$$ Permeability Met

CONDITION II

Rockfill D_{15} = 32 mm D_{85} = 80 mm

Protecting Crushed Rock D_{15} = 1.0 mm D_{85} = 13 mm

Calculations:

$$\frac{D_{15}\ \text{Filter}}{D_{85}\ \text{Soil}} = \frac{32}{13} = 2.5 < 5.0$$ Piping Stability Met

$$\frac{D_{15}\ \text{Filter}}{D_{15}\ \text{Soil}} = \frac{32}{1.0} = 32.0 > 5.0$$ Permeability Met

CONDITION III

Crushed Rock	D_{15} = 1.0 mm	D_{85} = 13 mm
Protecting Dune Sand	D_{15} = 0.14 mm	D_{85} = 0.22 mm

Calculations:

$$\frac{D_{15}\ \text{Filter}}{D_{85}\ \text{Soil}} = \frac{1.0}{0.22} = 4.5 < 5.0 \quad \text{Piping Stability Met}$$

$$\frac{D_{15}\ \text{Filter}}{D_{15}\ \text{Soils}} = \frac{1.0}{0.14} = 7.1 > 5.0 \quad \text{Permeability Met}$$

STABILITY ANALYSIS CALCULATIONS

INFINITE SLOPE ANALYSIS

Factor of Safety = b Tan 0

b = Co-tangent of Embankment Slope

0 = Shear Strength Value in Degrees

Case 1: Embankment Slope = 1V on 2H

b = 2 0 = 37°

F.S. = (2) (Tan 37°) = 1.51

APPENDIX C

ENVIRONMENTAL ASSESSMENT

FINDING OF NO SIGNIFICANT IMPACT
LOWER COLUMBIA RIVER BANK PROTECTION
TANSY RAILROAD LOCATION
CLATSOP COUNTY, OREGON

The proposed action is to construct improvements to an existing embankment in order to upgrade the level of flood protection for the residents of Warrenton and Hammond, Oregon. I have reviewed the Environmental Assessment and determined that the proposed action will not have a significant effect on the quality of the human environment and that preparation of an Environmental Impact Statement is not required.

Date: 24 JUNE 85

R. L. FRIEDENWALD
Colonel, Corps of Engineers
District Engineer

ENVIRONMENTAL ASSESSMENT
LOWER COLUMBIA RIVER BANK PROTECTION
TANSY RAILROAD LOCATION
CLATSOP COUNTY, OREGON

1. Introduction.

Tansy Railroad Location is on the south bank of the Columbia River in Clatsop County, Oregon between Point Adams Packing Co. and Tansy Point near the towns of Warrenton and Hammond. The proposed project would be constructed under authority of the Flood Control Act of 1950.

2. Purpose and Need.

The existing site is an embankment which was originally constructed to support a rail line belonging to Burlington Northern. Although this rail line has been abandoned, the embankment functions as a levee for protecting surrounding land from seasonal flooding. The existing embankment is ungraded rock with no filter and has slopes approaching 1 foot horizontal to 1 foot vertical in places. Wave and associated washing action has leached out a great deal of bank material (primarily sand) and much of the ungraded rock riprap has rolled riverward. The existing embankment is expected to breach within the next two years if no further action is taken. Should this occur, flooding would threaten improvements in the city of Warrenton. Structure foundations of two manufacturing firms would be inundated daily, and access roads would be subject to inundation.

The towns of Warrenton and Hammond have jointly requested the Corps to protect the levee from further erosion and adjacent lands from flooding.

3. Proposed Action and Alternatives.

The proposed action would result in stabilization of rock material along the existing embankment, which is 3800 linear feet in length. A set of abandoned rails and ties which are located on top of this embankment would be removed prior to construction. A layer of gravel bedding would be placed on

top of the Tansy embankment (1 foot deep). Another layer of gravel bedding 3800 feet long by 18 inches deep would be applied over the old riprap to fill in the voids on the riverward side. The layer of gravel bedding would then be covered by a layer of rockfill 18 inches deep. Class V riprap would cover the rockfill material from the crown shoulder to five feet beyond the toe. The new bank and revetment would be designed at a 2:1 slope and would extend beyond the top of the existing embankment by approximately 120 ft into the river (see figure 2).

Excavation of river material necessary for construction of a toe trench would be accomplished by either a dragline or crane. Placement of the various layers involved in upgrading the standard of protection for this embankment (gravel bedding, rockfill and Class V riprap) would be accomplished in-water and without the benefit of a cofferdam. New riprap material would be plated for durability. Construction would be completed in increments of 100 feet to minimize the disruptive effects of river currents. Excavated river sediment would be backfilled over the new revetment which extends below waterline in order to provide an additional layer of protection from erosion. This backfilled material would approximate the original slope and grade of the riverbed. In-water work would be scheduled to occur between August 1 and Dec. 31, 1985 in order to minimize impacts to anadromous fish.

The no-action alternative was considered, but was eliminated because it would permit continued erosion of the bank by wave action.

4. Affected Environment.

This portion of the Columbia River Estuary is in the mixing zone, and salinities can vary from less than 5 parts per thousand (ppt) to over 30 ppt. River bottom material is primarily coarse sand, while finer materials are kept suspended by strong currents.

The river functions as a migratory path for adult and juvenile anadromous fish, as well as a rearing or feeding area for numerous species of marine fish and shellfish which use the estuary. In the project area use by most fish species and juvenile Dungeness crabs is considered to be minor because of the

presence of high current velocities. The immediate shoreline, however, is heavily used by juvenile fall salmon on their out migration, and by some bottom dwelling species (eg. Starry Flounder and English Sole in the summer and fall). Work on the toe would have a short-term adverse effect on benthic organisms due to high turbidities associated with in-water work.

The area directly behind the embankment is covered with trees, shrubs, forbs, and grasses which provide habitat for birds and small mammals. Scotch broom is prevalent on the railroad right-of-way. Cormorants, gulls, and scoters are prevalent in the area. Other important species in this habitat are: Kinglets, winter wren, song sparrow, swallows & crow. Common small mammal species are mice and voles.

5. Environmental Effects.

Upgrading the existing embankment with a 2:1 slope would require excavation of riverbed sediment and the placement of rock and gravel fill material 120 feet beyond the top of the existing embankment into the Columbia River. Turbidity would increase as a result of in-water construction and excavation. Benthic organisms such as mollusks, worms, and crustaceans would be temporarily lost during project construction. Large macrobenthic organisms which are mobile would leave the area, but would be expected to return after project completion. Resident fish would also be expected to leave the project area, but would return later. Impact to anadromous fisheries would be minor because project work would be scheduled to avoid periods of fish migration.

Disturbance to vegetation adjacent to the Tansy embankment would be minor, therefore this project is not expected to affect wildlife resources. This project would improve flood protection for the towns of Warrenton and Hammond, protect rural residences and two manufacturing plants, and prevent flooding of access roads.

6. Consultation Requirements.

a. Clean Water Act of 1977 (33 U.S.C. 1344): The attached Section 404(b)(1) Evaluation has been prepared in compliance with the requirements of this Act.

b. Clean Air Act of 1973, as amended: This Environmental Assessment is being provided to EPA for their review and comment in accordance with the provisions of the Act.

c. Coastal Zone Management Act of 1973, as amended: The Oregon Land Conservation and Development Commission has previously acknowledged the comprehensive plans of the cities of Warrenton and Hammond as being in full compliance with the State of Oregon's Statewide Planning Goals as adopted by the commission (pursuant to ORS 197.225 and 197.250). This project is located within areas designated as Water-Dependent Industrial (I-3) and Aquatic Development (A-1) Zones in the comprehensive plans, and is allowed under both zoning designations under the use category of "structural shoreline stabilization." The proposed work is therefore consistent with Oregon's Coastal Zone Management Program.

d. Endangered Species Act of 1973, as amended: The U.S. Fish and Wildlife Service (USFWS) has been consulted to determine if any threatened or endangered species would be affected by this project. The USFWS responded with a letter dated December 20, 1984, which stated that a wintering population of Bald eagles occurs along the Columbia River from Oct 31 - March 31. A biological assessment prepared by the Portland District indicates that this project would not have an impact on eagles.

e. Fish and Wildlife Coordination Act: In compliance with this Act, the proposed projects have been coordinated with the U.S. Fish and Wildlife Service, the Oregon Department of Fish and Wildlife, and the National Marine Fisheries Service.

f. Marine Protection, Research and Sanctuaries Act of 1972, as amended: No marine resources would be affected by the proposed project.

g. Cultural Resources Acts: Field inspection by a staff archeologist has been conducted, including consultation with the Oregon State Historic Preservation Officer, and it has been determined that no cultural resources would be affected by the proposed action. (Letter from State Historic Preservation Officer attached).

h. Executive Order 11988, Flood Plain Management, 24 May 1977: The proposed work is in compliance with this Executive Order. This project would not encourage further development of any flood plain area, nor would it increase flood heights.

i. Executive Order 11990, Protection of Wetlands, 24 May 1977: No wetlands would be impacted.

j. Analysis of Impacts on Prime and Unique Farmlands in EIS, CEQ Memorandum, 30 August 1976: No prime or unique farmlands would be affected.

7. Coordination.

The Corps of Engineers, Portland District, issued a public notice (No. 85-004) for agency and public review of the proposed revetment of the old railroad levee near Tansey Point. Letters of coordination were received from the following agencies (copies attached):

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
City of Warrenton
U.S. Department of Commerce (National Marine Fisheries Service)
Oregon Department of Environmental Quality

The Environmental Protection Agency supports the proposed action as described, with the following conditions:

1) Sand excavated from the toe trench should be sidecast and not rehandled to backfill the trench.

Response: Project design does not require excavated material be backfilled over the new revetment. Technical specifications state that excavated material would be placed adjacent to the toe trench.

2) Existing vegetation on the landward side of the levee will be protected from construction activities.

Response: Technical specifications for the Tansy Location require that landscape damage be restored. Any tree or landscape feature damaged by the contractor shall be restored as nearly as possible to its original condition.

The EPA also recommended establishing shrubs and groundcover on the top and upper slope of the levee to help offset the impacts of levee encroachment on subtidal habitat. The Corps does not support this recommendation because the top and upper levee slope consist of sterile layers of rockfill and Class V riprap. Plantings would be pointless because there is no soil blanket present to support vegetation.

The U.S. Fish and Wildlife Service does not oppose this project provided that no inwater work occurs between March 1 through July 15. The period of inwater construction was changed from 1 August through 31 October to 1 August through 31 December. This date change was coordinated through the U.S. Fish and Wildlife Service.

The governor's letter specified that project approval was conditional on meeting the conditions as outlined in the Erosion Control Permit No. SP 2425. Project design specifies excavation of a toe trench and placement of waste material adjacent to this trench. Excavated material is to remain as placed, allowing river currents to rearrange it over time. All items in the erosion control permit would be met, with the exception of item #3 (placement of waste materials above bankline). Mr. Bill Parks at Division of State Lands was contacted regarding this variance and he agreed with the project as proposed (see attached phone log).

Comments received from the rest of the agencies listed above expressed no objections or conditions upon the proposed project.

SECTION 404(b) EVALUATION
LOWER COLUMBIA RIVER BANK PROTECTION
TANSY RAILROAD LOCATION
CLATSOP COUNTY, OREGON

Introduction:

Section 404 of the Clean Water Act of 1977 requires that civil works projects involving the discharge of dredged or fill material into the waters of the United States be evaluated for water quality effects prior to making the discharge. This evaluation assesses the effects of the discharge described below utilizing guidelines established by the Environmental Protection Agency under the authority of Section 404(b)(1) of the Act.

I. Project Description

a. Proposed Action

The proposed bank stabilization and revetment work is located on the south bank of the Columbia River in Clatsop Co., Oregon between Point Adams Packing and Tansy Point near the towns of Warrenton and Hammond.

The proposed action would increase the level of flood protection for the towns of Warrenton and Hammond through stabilization of the existing embankment. Upgrading the structure of this embankment would involve excavation and placement of gravel and rock fill beyond the top of the existing embankment by approximately 120 feet into the Columbia River (see figure 2).

b. General Description of Dredged or Fill Material

The Tansy railroad embankment would be covered by several layers of material totaling approximately 115,450 cubic yards. This amount of fill would be distributed as: Class V riprap (approximately 41,890 cubic yards), gravel bedding (approximately 22,330 cubic yards), and rock fill (approximately 15,650 cubic yards). Fill material would extend below waterline and require the excavation of about 35,580 cu. yds of riverbed material.

c. Description of the Proposed Discharge Site

The riverbed sediment along the Columbia River where excavation activities would take place is characterized by sandy material. The length of shoreline affected by excavation and placement of fill would be 3800 feet long (same as length of Tansy embankment) and extend approximately 120 feet beyond the top of the existing embankment into waters of the Columbia River.

II. Factual Determinations.

a. Physical Substrate Determinations.

Some excavation and filling would occur in the riverbed of the Columbia River adjacent to the Tansy Railroad embankment. Placement of fill and riprap armor would affect substrate elevation and bottom contours extending up to 120 feet into the river as a direct result of toe and toe trench construction.

b. Water circulation, fluctuation, and salinity determinations.

Water quality characteristics such as salinity, chemistry, taste, odor, and dissolved gas levels would not be affected by the proposed action. There would be a temporary reduction in clarity in the shoreline area due to the turbidity associated with an increase of suspended fines as a consequence of toe trench excavation. Current circulation patterns would be influenced to a small degree in the short-term by the placement of spoil material in a line parallel to the proposed toe trench. Bottom contours would be restored to nearly original conditions by backfilling excavated material to preconstruction locations.

c. Suspended particulate/turbidity determinations.

Construction activities would result in a short-term increase in suspended particulate levels in the project area. In the long-term, turbidity would return to preconstruction levels. The potential changes would not cause violations of applicable water quality standards.

d. Contaminate determinations.

The bank material, excavation, and backfilling of spoil associated with toe construction would not introduce, relocate, or increase contaminants.

e. Aquatic ecosystem and organism determinations.

Other impacts on local fisheries would primarily result from installation of fill material and riprap and result in a degree of avoidance during the period of in-water work. Long-term usage of the site by all fish would remain unchanged. The riverbottom sediment is composed of mostly sandy material which acts as habitat for a variety of benthic organisms such as mollusks, worms, and crustaceans. These organisms would be impacted in the short-term, but are expected to recover to preconstruction levels over time.

The proposed activity would disturb and destroy some benthic organisms. The dominate benthic species present (Corophium salmonis and Macoma balthica) would repopulate the disturbed area after construction is completed.

f. Proposed Disposal Site Determinations.

The suspended particles caused by construction activities would be widely dispersed by river currents and would not result in any significant adverse environmental effects.

The placement of fill material would not violate Environmental Protection Agency or State water quality standards except for a short duration during construction activities. Use of fill material would not introduce toxic substances into surrounding waters or violate the primary drinking water standard of the Safe Drinking Water Act (42 USC 300 et seq.). Human use elements, such as municipal and private water supply, receational and commercial fisheries, water related recreation, and aesthetics would not be affected by the proposed work.

g. Determination of Cumulative Effects on the Aquatic Ecosystem.

The proposed project is not expected to have any cumulative effects on the aquatic ecosystem.

h. Determination of Secondary Effects on the Aquatic Ecosystem.

No secondary effects on the aquatic ecosystem are anticipated.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made regarding this evaluation.

b. The "no-action alternative was considered and subsequently eliminated because it would not arrest erosion of the bank by wave action.

c. The action is in compliance with applicable State water quality standards. Short-term increases in turbidity levels due to construction activities are allowable under the standards.

d. The proposed action would not violate the toxic effluent standards of Section 307 of the Clean Water Act.

e. The project does not jeopardize the continued existence of a species listed as rare or endangered, or result in the destruction or adverse modification of a critical habitat.

f. The proposed action would not result in significant adverse effects on human health and welfare; life stages of aquatic life or other wildlife dependent on the aquatic ecosystem; ecosystem diversity, productivity or stability; or recreational, esthetic, and economic values.

g. Appropriate steps to minimize potential adverse impacts would be specified in the construction contract.

With the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem, the proposed discharge is specified as complying with the requirements of Section 404(b) guidelines.

Date: 24 JUNE 85

R. L. FRIEDENWALD
Colonel, Corps of Engineers
District Engineer

VICTOR ATIYEH
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM, OREGON 97310

May 22, 1985

District Engineer
Corps of Engineers
U. S. Army
Portland District
P. O. Box 2946
Portland, OR 97208

Att: Patrick J. Keough, Chief
Planning Division

Ref: PN NPPPL-NR-85-004
Columbia River - Bank Protection

Dear Sir:

I approve the project subject to the conditions outlined in Erosion Control Permit No. SP 2425 issued by the Division of State Lands.

On April 23, 1985, the Department of Environmental Quality certified there was reasonable assurance that the project, as described, would not violate applicable water quality standards.

Sincerely,

Victor Atiyeh
Governor

VA:df

cc: City of Warrenton
Town of Hammond
Department of Environmental Quality
Department of Fish and Wildlife
U. S. Fish and Wildlife Service
National Marine Fisheries Service
Division of State Lands

ATTACHMENT A

Special Conditions for Erosion Control Permit No. SP 2425

1. This permit authorizes the removal of approximately 35,580 cubic yards of riverbed material, the placement of approx. 41,890 cubic yards of rock riprap, the placement of approx. 22,330 cubic yards of gravel bedding material, and the placement of approx. 15,650 cubic yards of rock fill material in Section 9, T8N, R10W (Columbia River, between miles 9 and 10 Tansy Railroad Location) for stabilization of an existing embankment functioning as a levee as outlined in the attached permit application, map and drawings.

2. Turbidity increase shall be limited to 10% increase above background as measured 100 feet below project.

3. Waste materials and spoils shall be placed above the bankline.

4. There shall be no removal or filling in the permit area between March 1 and July 15.

5. Riprap shall be placed under these conditions:

   a. Only clean, erosion resistant rock from an upland source shall be used as riprap. No broken concrete or asphalt shall be used as riprap.

   b. Riprap shall be placed in a manner that does not appreciably increase the upland surface area.

   c. All riprap rock shall be placed from above the bankline.

   d. The completed revetment shall have a slope no flatter than 2:1.

   e. There shall be no operation of equipment in the water except to dig a toe trench.

6. Areas of streambank disturbance not covered by riprap shall be seeded or planted with grass and/or legumes.

May 10, 1985

VICTOR ATIYEH
GOVERNOR

Department of Environmental Quality

522 S.W. FIFTH AVENUE, BOX 1760, PORTLAND, OREGON 97207 PHONE (503) 229-5696

April 23, 1985

Director
Division of State Lands
1445 State Street
Salem, OR 97310

SUBJECT: Corps of Engineers P.N. #NPPL-NR-85-004
Lower Columbia River Bank Protection

Dear Sir:

The Oregon Department of Environmental Quality hereby certifies that the project listed above will comply with the applicable provisions of the Federal Clean Water Act, Sections 301, 302, 303, 306, and 307; i.e., there is reasonable assurance that it will not violate applicable water quality standards and requirements.

Sincerely,

Glen D. Carter
Water Quality Divison

GDC:bfm

CC: U.S. EPA, Oregon Operations Office
Oregon Department of Fish & Wildlife

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION X

1200 SIXTH AVENUE

SEATTLE, WASHINGTON 98101

APR 05 1985

REPLY TO
ATTN OF: S 423

Colonel Robert L. Friedenwald
District Engineer
Portland District, Corps of Engineers
Attn: NPPPL-NR-EQ
P. O. Box 2946
Portland, Oregon 97208

RE: NPPPL-NR-85-004, Lower Columbia River Bank Protection, Tansy Railroad Location, Clatsop County, Oregon, March 14, 1985

Dear Colonel Friedenwald:

We have reviewed the referenced public notice concerning the proposed stabilization of 3,800 linear feet of embankment on the south bank of the Columbia River between river miles 9 and 10.

The alternatives analysis in the environmental assessment (EA) only addresses the preferred and no action alternatives. It is not clear from the information provided that the least impacting practicable alternative was selected as required by the 404(b)(1) Guidelines. Other design alternatives considered by the Corps should have been identified. These include the use of sand from excavation of the toe trench in conjunction with a gravel layer for bedding material along the upper embankment, and redressing the embankment and using existing on-site materials in conjunction with new materials to cover the slope. The selection of a preferred option should be based on a balance of engineering, economic, and environmental concerns. The EA should contain an alternatives comparison analysis to provide the resource agencies and general public an opportunity to understand the basis for the Corps' decision.

It would be helpful for reviewing future public notices if mean high water (MHW) and mean low water (MLW), or ordinary high water (OHW) and ordinary low water (OLW), were designated on the section drawings.

We understand that the project timing for in-water work has changed from that indicated in the EA. Resource agencies should be formally advised of substantial project alterations (design, timing, etc.) not described in the public notice, and associated environmental documents, so that the merits and impacts of the modified project can be objectively evaluated.

We are not opposed to the project provided the following conditions are implemented:

(1) Sand excavated from the toe trench should be sidecast and not rehandled to backfill the trench (river currents will redistribute sand without need for further human disturbance).

(2) Existing vegetation on the landward side of the levee will be protected from construction activities.

We recommend establishing additional plantings (shrubs and groundcover) on the top and upper slope of the levee to help offset the impacts of levee encroachment on subtidal habitat.

If you have any questions or comments, please contact R. Thomas Rogers of my staff at FTS 399-8511 or (206) 442-8511.

Sincerely,

Ronald A. Lee

Ronald A. Lee, Chief
Water Resources Assessment Section

cc: USFWS-Portland
NMFS
ODFW
ODSL

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
Portland Field Office
727 N. E. 24th Avenue
Portland, Oregon 97232

Reference NE:mm

April 10, 1985

Colonel Robert L. Friedenwald, District Engineer
Portland District, Corps of Engineers
P. O. Box 2946
Portland, Oregon 97208

Re: NPPPL-NR-85-004
Columbia River
Tansy Railroad Location
Bank Protection Project

Dear Colonel Friedenwald:

We have reviewed your public notice containing the Environmental Assessment and Section 404(b) Evaluation for the referenced Lower Columbia River Bank Protection Project. The project consists of sloping and riprapping 3,800 feet of an existing railroad berm between Point Adams Packing Co. and Tansy Point. Our comments on this project have been prepared under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and are consistent with the intent of the National Environmental Policy Act of 1969. They are also consistent with the Service's Fish and Wildlife Coordination Act Report that was prepared for the project.

Environmental Assessment

It should be noted that the proposed inwater work period was August 1 to November 30, but a recent request to extend the period to December 31 has been approved by the Service. Either period is within the allowable inwater work period as recommended in the Coordination Act Report.

404(b) Evaluation

The clam species mentioned in the evaluation (Corbicula manilensis) is a freshwater species, and is not present at this location. Macoma balthica, a marine and brackish species, is present.

The discussion of alternatives appears to be inadequate in its discussion of potential upland alternatives, and therefore may not comply with the 404(b)1 guidelines. However, no significant adverse effects on fish and wildlife, their habitats, or human uses thereof are expected, providing the following condition is adhered to:

1. No inwater work should be done during the period March 1 to July 15.

The above views and recommendations constitute the report of the Department of the Interior on the subject public notice.

Sincerely yours,

Russell D. Peterson

Russell D. Peterson
Field Supervisor
Acting for U.S. Department of
the Interior Coordinator

cc:
EPA
NMFS
ODFW
DSL
DEQ

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Endangered Species
2625 Parkmont Lane SW, B-2
Olympia, Washington 98502

RECEIVED
DEC 03 1985
NPD PL-FW

December 20, 1984

Richard N. Duncan
Chief, Fish and Wildlife Branch
Portland District, Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208

Refer to: 1-3-85-SP-64, 65 & 66

Dear Mr. Duncan:

As requested by your letter, dated November 21, 1984 and received by us on November 26, 1984, I have attached lists of endangered and threatened species (Attachments A) that may be present in the areas of the proposed river bank protection projects for the Tansy Railroad Site, Clatsop County, Oregon; the Lerch and Anderson Sites, Multnomah County, Oregon; and Site 7-A in Lane County, Oregon. The lists fulfill the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, as amended. Your Endangered Species Act requirements are outlined in Attachment B.

Should your biological assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, your agency should request formal Section 7 consultation through this office.

Even if your biological assessment shows a "no effect" situation, we would appreciate receiving a copy of your assessment for our information. If you have any additional questions regarding your responsibilities under the Act, please contact me at (206) 753-9444, FTS 434-9444.

Your interest in endangered species is appreciated.

Sincerely,

James L Mochler
for

Jim A. Bottorff
Project Leader

Attachments

cc: RO (AFA-SE)
ES, Portland
WDG (Nongame)
WNHP

JLM:gb

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED TANSY RAILROAD SITE RIVER BANK PROTECTION PROJECT, CLATSOP COUNTY, OREGON T8N, R10W, S9

1-3-85-SP-64

LISTED

Bald eagle (Haliaeetus leucocephalus) - wintering population occurs along the Columbia River from about October 31 through March 31.

The biological assessment should address the following concerns:

1. The level of use of the project area by bald eagles.

2. The effect of the project on the eagle's food supply.

3. The impacts of the construction activities that may result in the loss of habitat or cause disturbance to bald eagles and/or result in their avoidance of the project area.

PROPOSED

None

CANDIDATE

None

Attachment A

Tam 7

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE, SUITE 350
PORTLAND, OREGON 97232
(503) 230-5400

March 20, 1985 F/NWR5

Colonel Robert L. Friedenwald
District Engineer, Portland District
Corps of Engineers
P.O. Box 2946
Portland, OR 97208

RECEIVED
MAR 2
REGULATORY FUNCTIONS BR.

Dear Colonel Friedenwald:

We have completed our review of the public notices referenced herein and do not object to the issuance of appropriate permits for the activities described. Should you decide to issue such permits, the applicants should be required to (1) comply with Federal and State water quality standards, (2) comply with State coastal management programs, and (3) adhere to all marine, estuarine, anadromous, and inland commercial fishery resource requirements of Federal and State fishery agencies as applicable.

NPPPL-NR-85-003, U.S. Army Corps of Engineers (3/7/85)
NPPPL-NR-85-004, U.S. Army Corps of Engineers (3/14/85)
NPPPL-NR-85-005, U.S. Army Corps of Engineers (3/15/85)
NPPPL-NR-85-006, U.S. Army Corps of Engineers (3/18/85)
071-OYA-1-005654, Beckley & Thomas Rock Products (3/7/85)
071-OYA-A-005663, International Port of Coos Bay (3/18/85)
071-OYA-A-005666, Lakeside Industries (3/21/85)
071-OYA-1-005680, Western Pacific Construction Materials Company (3/7/85)
071-OYA-1-005685, Boeing Agri-Ind. Company (2/20/85)
071-OYA-1-005689, Crown Zellerbach Corp. (3/14/85)

We may reevaluate this position and provide further comment to you if additional information becomes available indicating there would be significant adverse impacts to fishery resources or to the habitat that supports them.

Sincerely,

James B. Lee

for Dale R. Evans
Division Chief

cc: Oregon Department of Fish and Wildlife
Division of State Lands
Fish and Wildlife Service, ES, Portland
Environmental Protection Agency

Department of Transportation
STATE HISTORIC PRESERVATION OFFICE
Parks and Recreation Division
525 TRADE STREET S.E., SALEM, OREGON 97310

April 10, 1985

Owen Mason, Chief
Natural Resources Branch
Portland District Corp of Engineers
PO Box 2946
Portland, OR 97208-2946

Dear Mr. Mason:

RE: Tansy Point/Hammond Levee Reconstruction
Clatsop County

This letter is in response to the cultural resource survey carried out to assess impact of the above-mentioned project on historic and archeological sites.

After a careful review of the cultural resource survey carried out within the project area, our office can offer the following comments. We feel that no cultural resources of National Register potential have been identified which are likely to be impacted by this project. We therefore feel that Public Law 89-665 and Executive Order 11593 have been complied with and the project may go forward as planned.

Thank you for your cooperation and concern. If you have any questions, please call Leland Gilsen at 378-5023.

Sincerely,

D. W. Powers III
Deputy SHPO

DWP/LG:jn
5983C

Form 734-3122

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340–15; the proponent agency is The Adjutant General's Office.

DATE: 7 June 1985

UBJECT OF CONVERSATION

Tansy Railroad Bank Protection

	INCOMING CALL	
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
Craig Bradley	Portland, COE	221-6096
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION
Bill Parks	Salem, ODSL	378-3805
	OUTGOING CALL	
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION

SUMMARY OF CONVERSATION:

Informed Bill that the project condition stated in the Governor's letter required compliance with the items outlined in Erosion Control Permit No. SP 2425 (issued by the Division of State Lands). All of these items would be met by project design except No. 3, dealing with placement of waste materials above the bankline. Bill stated that it was OK to excavate the toe trench in water and sidecast the material, leaving it parallel to the trench for river currents to rearrange. Project acceptable according to DSL.

/s/ Craig Bradley

CRAIG BRADLEY
Soil Conservationist

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

U.S. G.P.O. 1982-564-036/0371

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340–15; the proponent agency is The Adjutant General's Office.

DATE: 1 July 1985

SUBJECT OF CONVERSATION

Tansy Railroad Bank Protection

INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION

OUTGOING CALL		
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
Craig Bradley	NPPPL-NR-EQ	221-6096
PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
Bill Parks	ODSL	378-3805

SUMMARY OF CONVERSATION:

Contacted Bill Parks and requested that item 5(c) of Erosion Control Permit No. SP 2425 be waived to permit use of a barge during project construction. Item 5(c) states: "All riprap rock shall be placed from above the bankline." Bill agreed that waiver of this item is acceptable in order to allow a barge (loaded with riprap) to approach the worksite from the river channel. Riprap could then be placed from the water, as well as from above the bankline. The current 404(b) Evaluation and State 401 certification do not permit dredging to occur in order to facilitate any barge access to the project site. Such dredging would require a new or revised 404(b) Evaluation.

H. Craig Bradley

H. CRAIG BRADLEY
Soil Conservationist

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

☆U.S. G.P.O. 1982-564-036/0371

USACE Evaluation of Pre- and Post-Construction Bathymetry Change in Lower Columbia River Estuary Columbia River Channel Improvement Project

US Army Corps of Engineers®

Columbia River Channel Improvement Project

Evaluation of Pre- and Post-Construction Bathymetry Change in Lower Columbia River Estuary

Background

The Columbia River Channel Improvement (CRCI) Project deepened the 600 foot-wide, 103.5-mile long Columbia River Federal Navigation Channel (FNC) from 40 to 43 feet. The deepening occurred in phases from 2005 to 2010. Dredged material from the deepening was placed at a combination of inwater ocean, inwater estuarine, and upland locations.

Requirement

This evaluation was prepared to meet the State of Washington Department of Ecology 401 Water Quality Certification Order No. 03SEAHQ-5603 for CRCI Project (23 June 2003) requirement for monitoring changes in bathymetry before and after construction in the Lower Columbia River (LCR) estuary. If the monitoring results show any unanticipated, negative CRCI implementation impacts, application of a pre-arranged adaptive management process is required to determine an appropriate response.

Evaluation

Bathymetry surveys data within the LCR estuary was collected in 2004 to represent CRCI pre-construction conditions and 2012 to represent post-construction conditions (Figure 1). For purposes of this evaluation, LCR estuary refers to the area from River Mile 3 to 17 where both surveys have overlapping, comprehensive data coverage.

The bathymetry changes that have occurred within the LCR estuary between 2004 and 2012 far exceed the depth changes induced within the FNC by the CRCI Project (Figure 2). The largest and more spatially coherent changes in depth (+/- 10 to 20 feet accumulation/erosion or more) occurred primarily around the natural North channel, which is not part of or located near the Columbia River FNC.

The volumetric change observed between the 2004 and 2012 surveys (within the overlapping coverage area of both surveys) was **65 million cubic yards (MCY) of *deposition*** and **62 MCY of *erosion***; the net change was 3 MCY of ***deposition***. Within this 14 mile long stretch of the LCR, the estuary is 2-6 miles wide versus with the FNC which is 600 feet wide. During CRCI implementation, approximately 1.5 MCY of sand was dredged from the FNC in the LCR estuary, and a similar volume of dredged sediment was placed in-water adjacent to the FNC (Figure 3). The volume of dredging associated with the CRCI Project within the LCR estuary, is less than 2.5% of the observed bathymetric change that occurred within this reach between 2004 and 2012.

Probable sediment pathways are shown in Figure 4. Solid lines indicate erosion, where material is removed and then deposited along the corresponding dashed line (deposition). The erosion & deposition trends appear to progress in a coherent direction. Looking at a cross section perpendicular to flow, areas of erosion appear adjacent to areas of deposition because deposition constrains flow which causes erosion, and vice versa. Erosion and deposition processes appear to be linked/correlated. It is noted that the prominent sediment pathways (and related volumetric changes) shown in figure 4 are located around the natural North channel.

The two bathymetry data sets were collected 8 years apart, and there are many potential explanations for the changes observed that are not related to the CRCI Project. A primary explanation for bathymetry change observed during 2004-2012 is that the sand-based (shoal) morphology of LCR estuary is still evolving despite hydro-regulation and navigation improvements imposed within the LCR. The scale of the observed bathymetry changes within the LCR estuary along RM 3-17 during 2004-2012 dwarf all integrated navigation improvements/maintenance activity within this area during the past 30 years (1982-2012).

The LCR estuary system is unstable by nature and extremely complex. Navigation structures (MCR Jetty system and LCR pile dikes) have been built in attempts to stabilize the morphology of the LCR system. This system of shoals and sand-based morphology is inherently unstable, and as navigation infrastructure is allowed to degrade, the system responds accordingly.

The tidal prism and high riverine flows are forced through an narrow constriction (1.6 miles wide) between Clatsop Spit in Oregon and Jetty A/Sand Island in Washington. The recent observed deposition occurring south of Sand Island is in deep water. However, the adjacent and associated erosion is occurring at the shallow shelf along Sand Island. This shallow shelf area is being held in place by pile dike structures along Sand Island (Figures 5 and 6). These pile dikes and the morphology of Sand Island function together with MCR jetties to stabilize the entrance and North channel, however, some of these structures are in an extremely deteriorated condition. The changes in bathymetry suggest that this critical function (of Sand Island and pile dikes) is being compromised.

Coastal storms and high, sustained Columbia River flow events (such as 2011) also affect estuary bathymetry, but to an unknown extent.

Conclusion

The bathymetry changes observed within the LCR estuary between 2004 and 2012 are not attributed to the CRCI Project. Therefore, the monitoring action requirement for LCR estuary as required by the referenced WQ Cert has been met in its entirety.

Evaluation by

Hans R. (Rod) Moritz, P.E., Hydraulic Engineer, U.S. Army Corps of Engineers
Jacob Watts, Geographer, U.S. Army Corps of Engineers. Data collected by ODN-NH, with GIS analysis performed by ENC-TG.

Figure 1: Top graphic is 2004 (CRCI Pre-Construction) and bottom graphic is 2012 (CRCI Post-Construction) Bathymetry

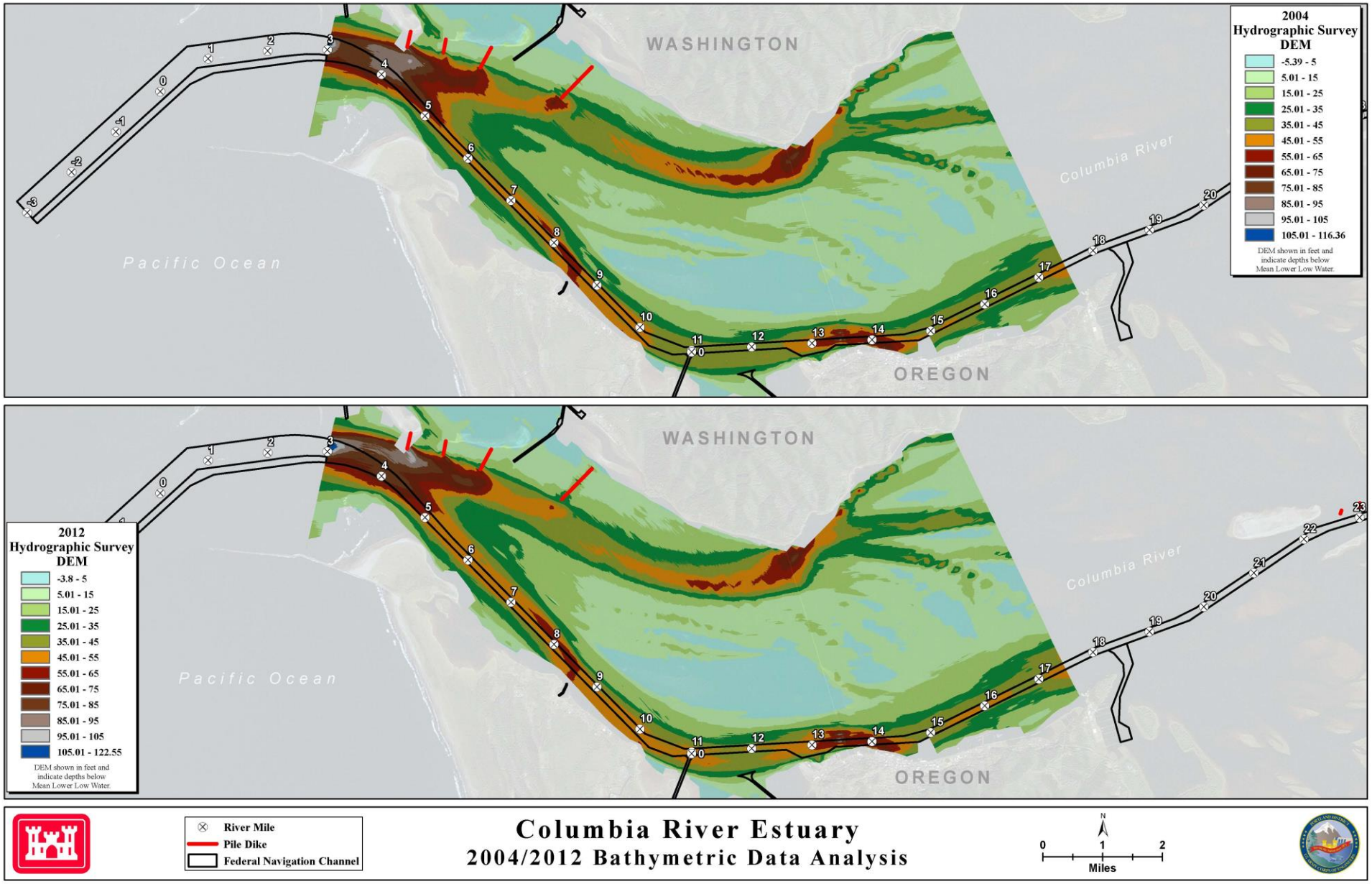


Figure 2: Difference between 2004 (CRCI Pre-Construction) and 2012 (CRCI Post-Construction) Bathymetry

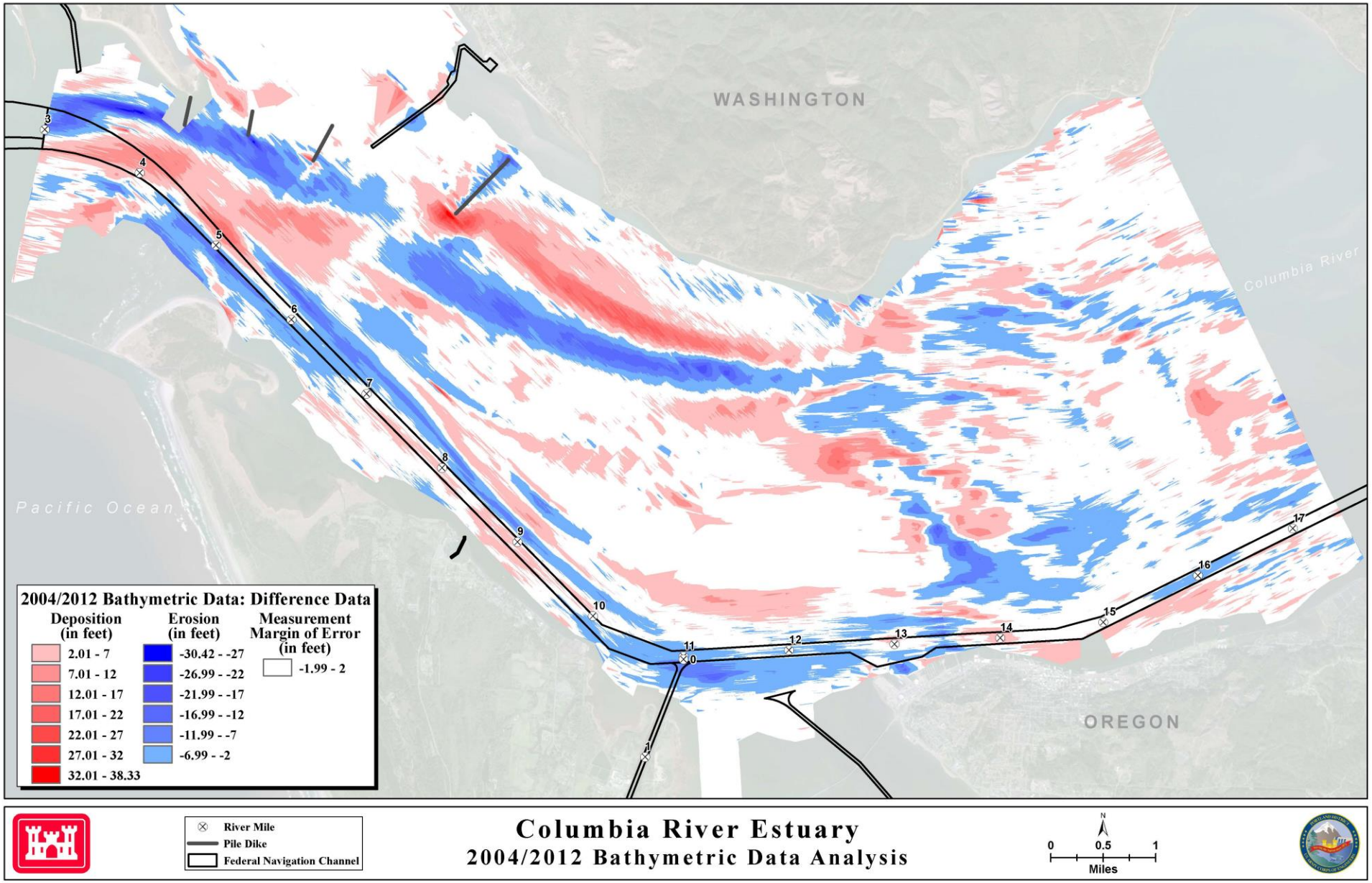


Figure 3: Dredging and placement data super-imposed on 2004-2012 bathymetry change

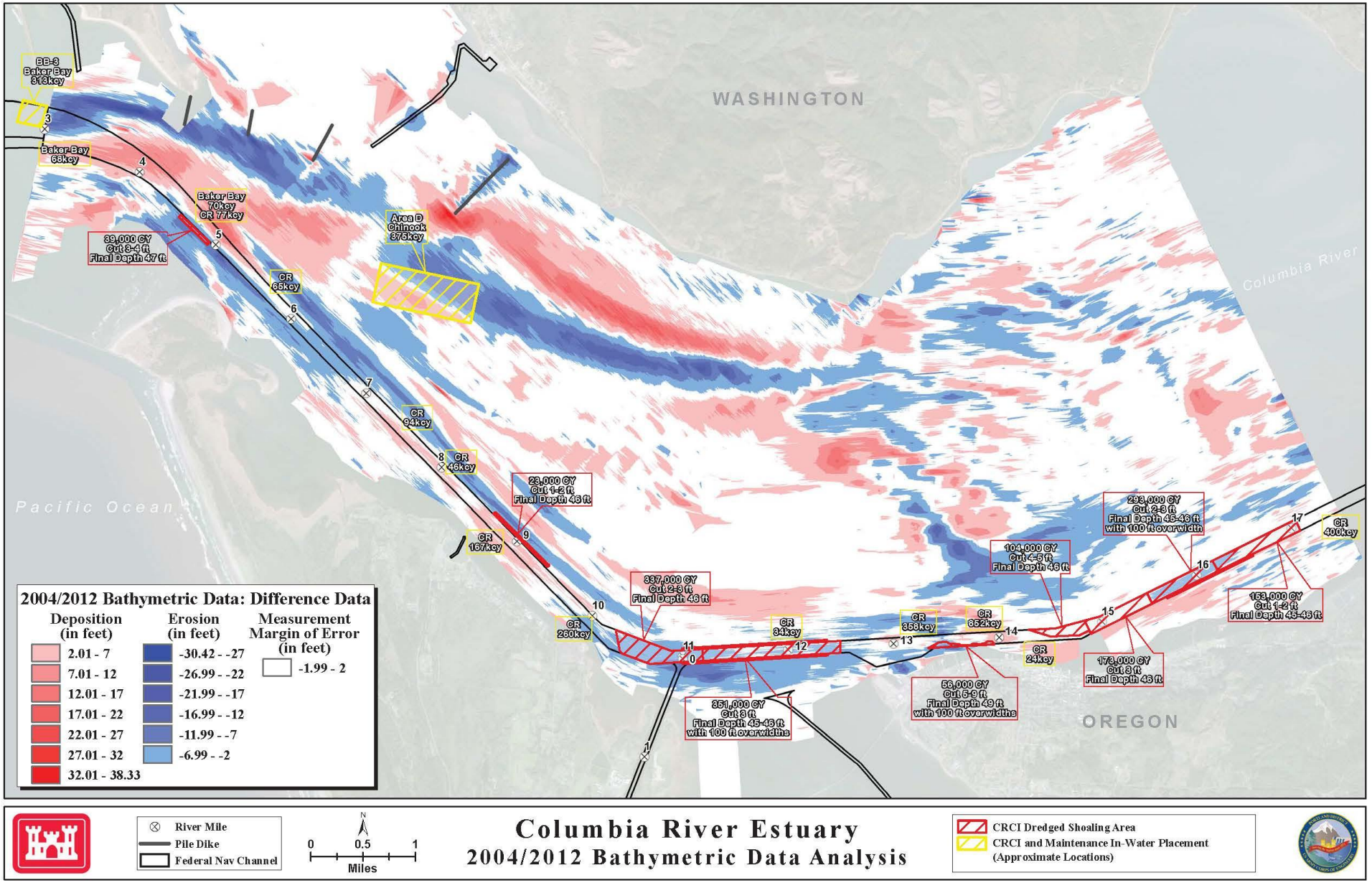


Figure 4: Sediment pathways super-imposed on 2004-2012 bathymetry change

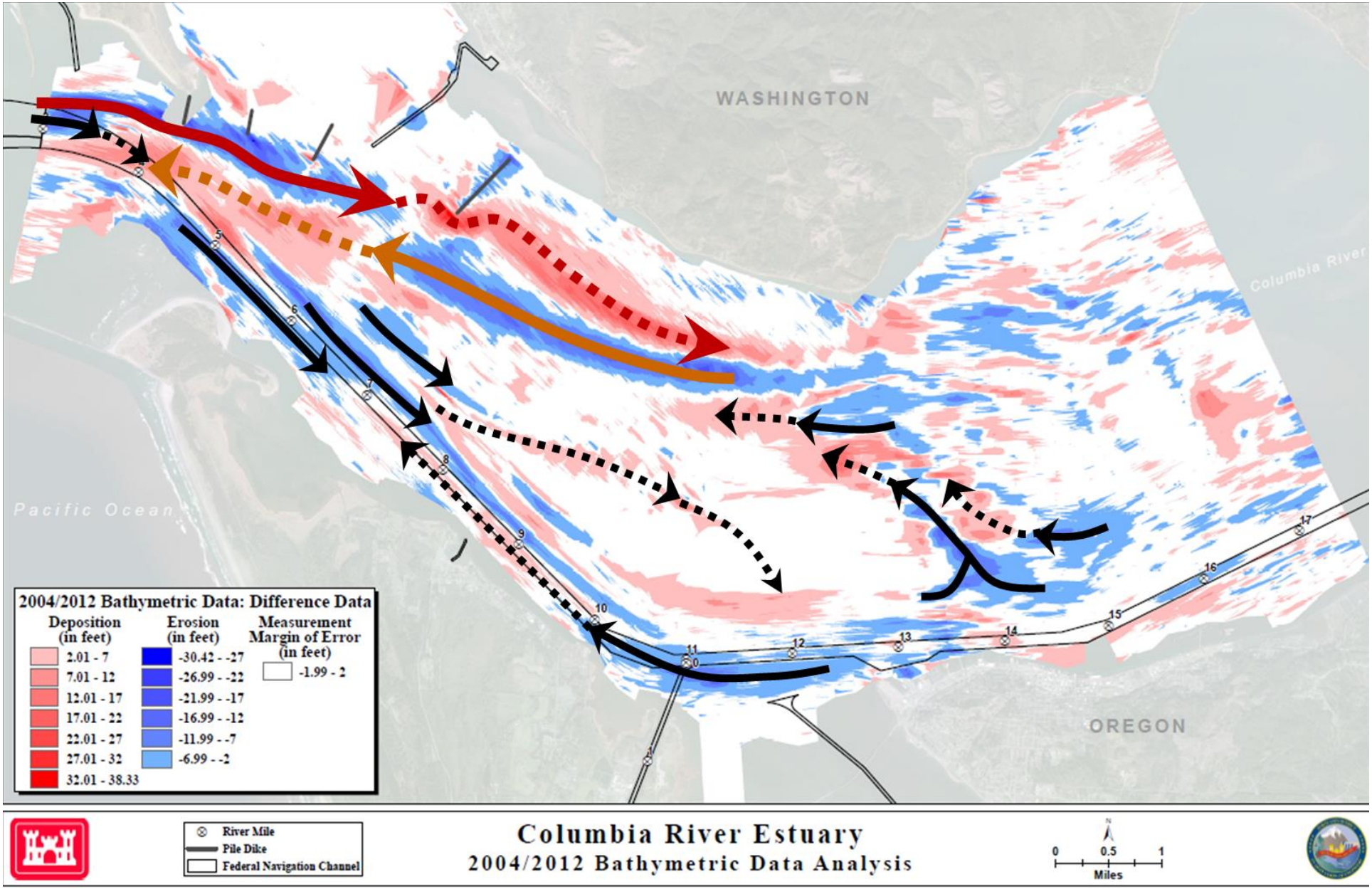


Figure 5: Difference (2004-2012 bathymetry) overlaid with 2004 Bathymetry

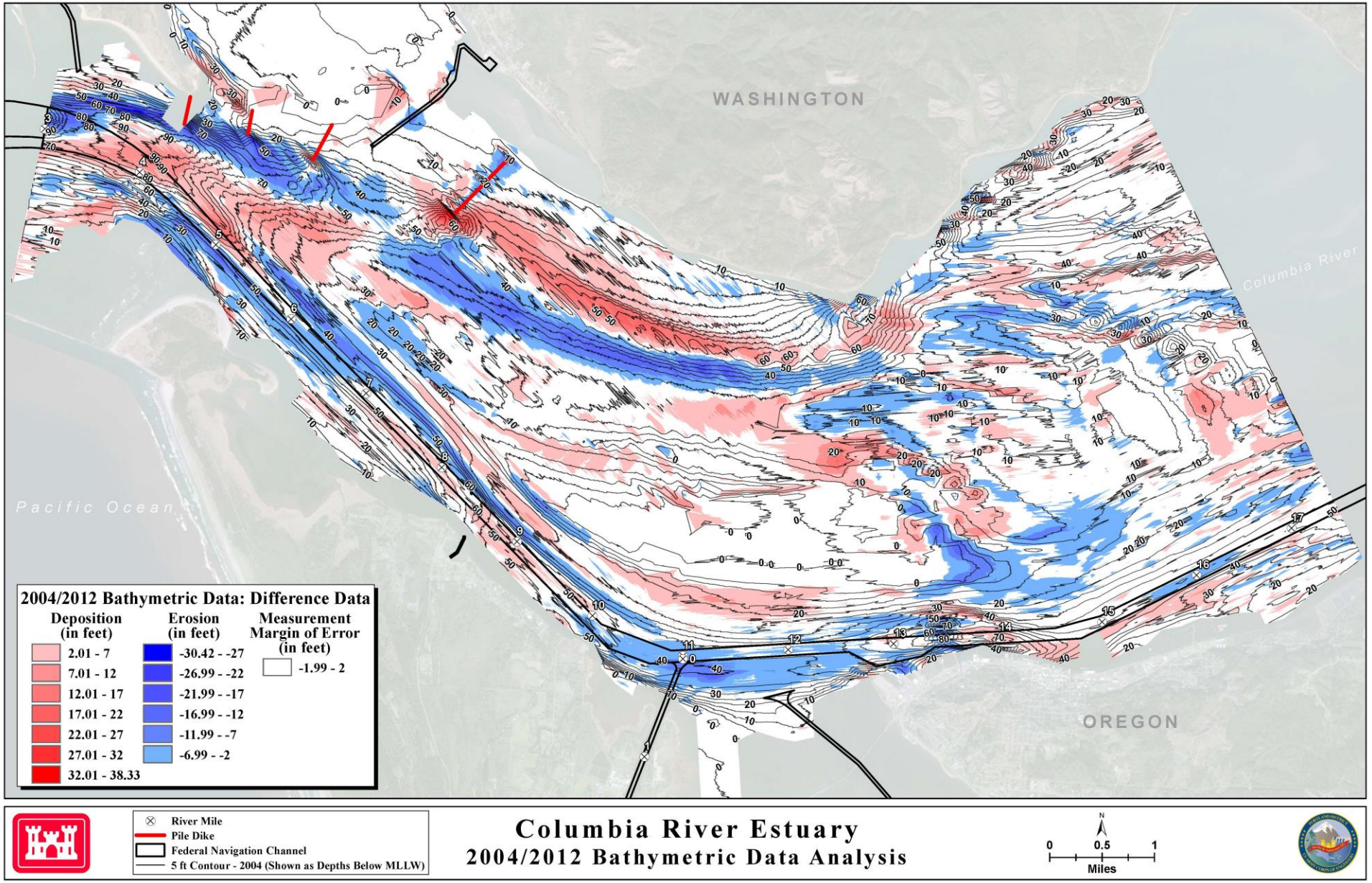
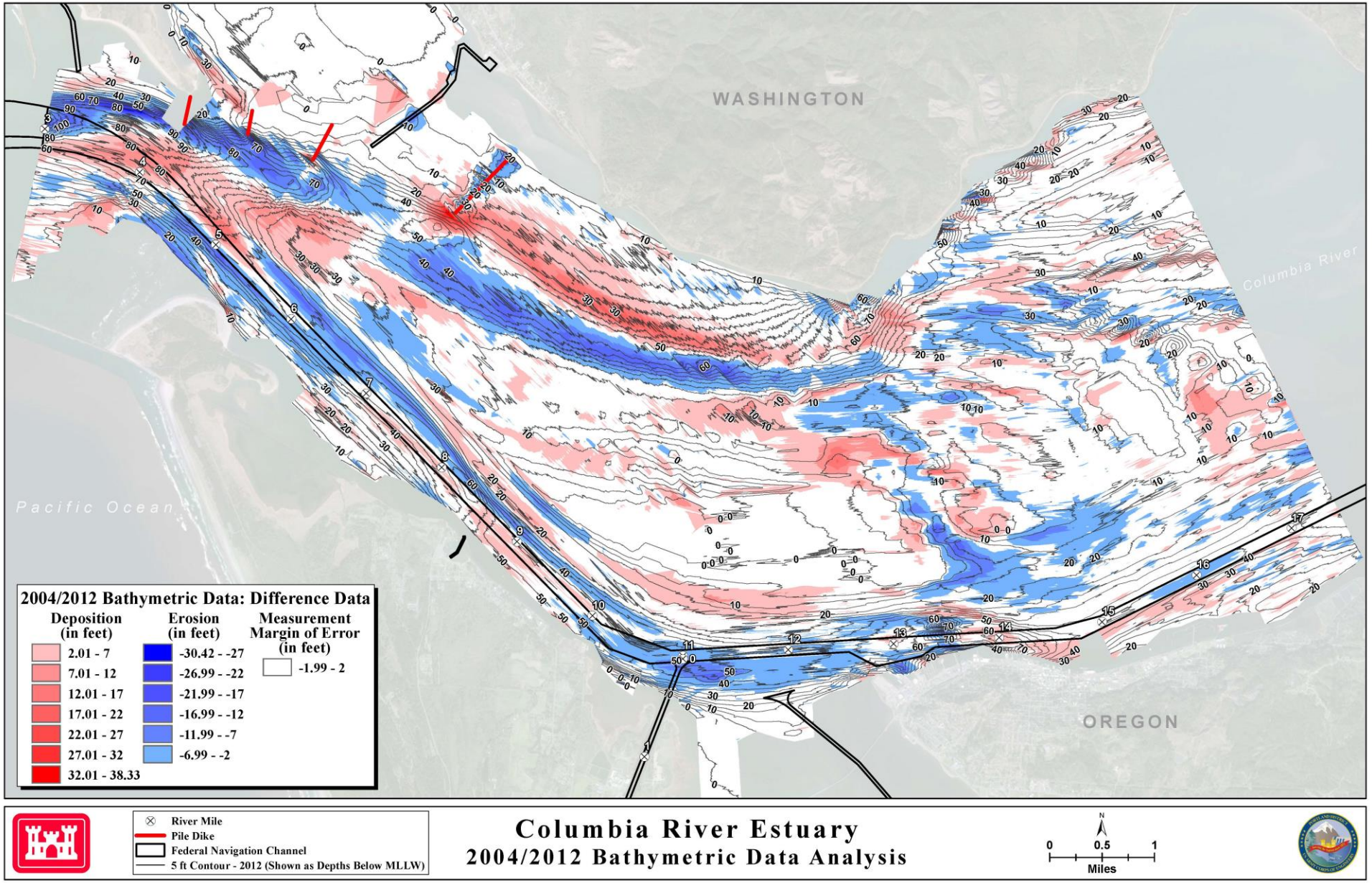


Figure 6: Difference (2004-2012 bathymetry) overlaid with 2012 Bathymetry



USACE Thin-Layer Placement

Thin-layer placement is an existing USACE practice.

NOAA/USACE Research References listed below and poster next page provided for additional details.

Thin-Layer Placement Crab Video. https://www.youtube.com/watch?v=c49s8_f5ivU

Roegner, G. Curtis, et al. “Benthic Video Landers Reveal Impacts of Dredged Sediment Deposition Events on Mobile Epifauna Are Acute but Transitory.” Journal of Experimental Marine Biology and Ecology, vol. 538, 2021, p. 151526., https://doi.org/10.1016/j.jembe.2021.151526

Roegner, Curtis G, and Stephanie A Fields. Mouth of the Columbia River: Beneficial Sediment Deposition Project, https://www.webapps.nwfsc.noaa.gov/assets/26/8494_09082015_155342_Beneficial-dredge-MCR%20.pdf

THE PHYSICS OF DREDGED MATERIAL PLACEMENT WITHIN NEARSHORE WATERS: AS OBSERVED BY CRAB

Hans R. Moritz[1], Jarod Norton[1], Michael Ott[1], Gretchen Smith[1], Curtis Roegner[2]

1. US Army Corps of Engineers-Portland District, 2. NOAA-Northwest Fisheries Science Center

hans.r.moritz@usace.army.mil curtis.roegner@noaa.gov

PROJECT: Dredged sand is being placed within a nearshore location adjacent to the Mouth of the Columbia River (MCR), USA to address a chronic coastal sediment deficit while minimizing impacts to the site's benthic ecology.

MOTIVATION FOR PLACEMENT OF DREDGED MATERIAL IN NEARSHORE ZONE: The nearshore morphology along the south side of the MCR inlet has been receding for many decades compromising the stability of the MCR inlet, jetties, and navigation channel. Progressive loss of shoreface morphology (sand) at the MCR also degrades the benthic substrate for nearshore ecology. **Solution:** Implement **R**egional **S**ediment **M**anagement.

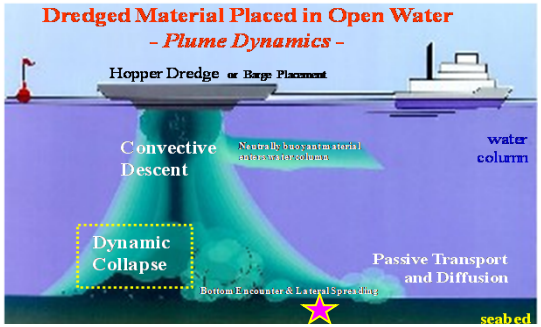
Regional Sediment Management (RSM) sustains water resource projects, that interact with natural sediment processes, by implementing balanced approaches for managing affected sediment. An objective of RSM is to emulate the natural system of sediment transport pathways that may be affected by a project: To Work with Nature, Not Against.

At engineered coastal inlets where navigation channels are maintained through dredging, RSM coordinates dredged material placement activities to:

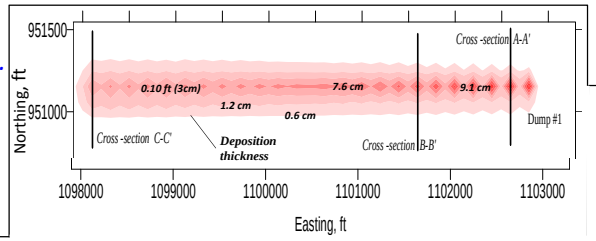
-> Sustain processes affecting the natural sediment budget and morphology,
-> Stabilize Infrastructure dependent upon ephemeral coastal morphology,
-> Improve efficiency of dredging maintenance for navigation projects, and
-> *Protect Ecology affected by natural sediment processes or dredged material placement*.

THIS POSTER: Summarizes In-situ observations of dredged material deposition on the seabed, when placed in nearshore waters of the PAC-NW, USA. Predictions for the physics affecting bottom deposition (of placed dredged material) are consistent with observations. Initial observations indicate that bottom dwellers like Dungeness crab (Metacarcinus magister) may not be adversely affected by dredged material placement.

Deployable "deposition meter", designed for simplified deployment and retrieval similar to crab pots. A video camera, was attached to the deposition meter mount, and recorded in-situ deposition and bottom-encounter physics resulting from dredged material placement. A staff gauge was attached to the center support element of the deposition meter. Three deposition meters were fabricated and deployed; each 13 inch high and 40 inch base dia. Photo, concept, and fabrication by CURTIS ROEGNER-NOAA.

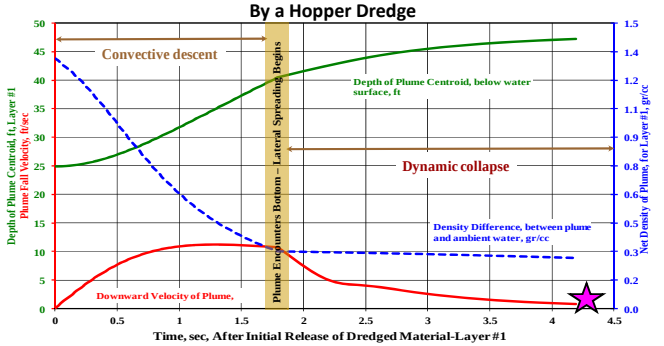


When dredged material is released in open water by a disposal vessel, the material falls through the water column, mixes with ambient water, and forms a plume. This process is called convective descent. **When the dredged material plume encounters the bottom (river bottom or seabed), the downward moving plume slows its descent and spreads radially along the seabed. This process is called dynamic collapse and is the focus of this poster.** After the plume has expended all of its momentum along the seabed, the dredged material slowly settles under the influences of gravity and the ambient current environment. This process is called passive transport and diffusion. The STAR indicates approximate event timing for video frames shown below . Computer models MDFATE (Moritz and Randall 1995) and STFATE (Johnson and Fong 1995) can be used to evaluate plume dynamics and deposition aspects of dredged material placed in open water. Example results are shown to the right and below.

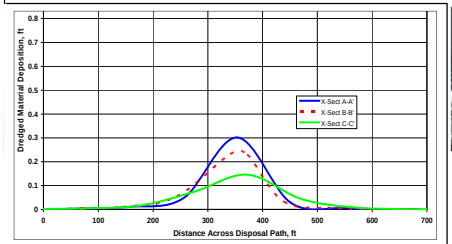


MDFATE simulation of seabed deposition resulting from open water placement of dredged material by the *Essayons*. The amount of dredged material released along a 5,000 ft placement transect was 5,500 cy. Seabed elevation varied from -40 to – 53 ft MLLW along the path of the hopper dredge during disposal run (proceeding from east/right to west/left). Maximum thickness of deposited dredged material, via model simulation, varied from 0.1 to 0.30 ft (3 to 9 cm) along the disposal transect. Three (3) cross-sections: A-A', B-B', and C-C' are shown in the figure to the right. Deposition asymmetry is due to cross-current and *Essayons* draft reduction during dredged material placement. The dredged material originates from the MCR federal navigation channel and is classified as fine-medium sand (average D50 = 0.2 mm), having less than 3% fines content.

Dynamics of Dredged Material During Placement in Open Water By a Hopper Dredge



Summary metrics for a simulated dredged material plume, formed when 3,000 cubic yards (2300 cm) of dredged sand is placed in open water (total depth of 50 ft) by a hopper dredge. Three (3) time-varying metrics are shown at the **START** of a dredged material placement run: Downward velocity of the plume, Net density of the plume, and depth of plume centroid. The initial release point is at the bottom of the hopper dredge hull, 20 ft below the water surface. The computations of dredge material behavior begin with the centroid of the sand plume is 5 ft below the hull. At this point, the dredged material falling out of the hopper dredge has a bulk density of 2.34 g/cc. The plume density is rapidly reduced due to mixing with ambient water during convective descent. When the leading edge of the plume encounters the seabed, **dynamic collapse** begins. At this point, the plume centroid is located 10 ft above the seabed moving with downward velocity of 11 ft/sec (plume bulk density has been reduced to 1.3 gr/cc) . As the plume continues to encounter the seabed, its downward velocity is decelerates and the plume spreads radially outward along the seabed. Toward the END of the dredged material placement activity, the plume dynamics are most active within 5-10 ft of the seabed. The STAR indicates approximate event timing for video frames shown below .



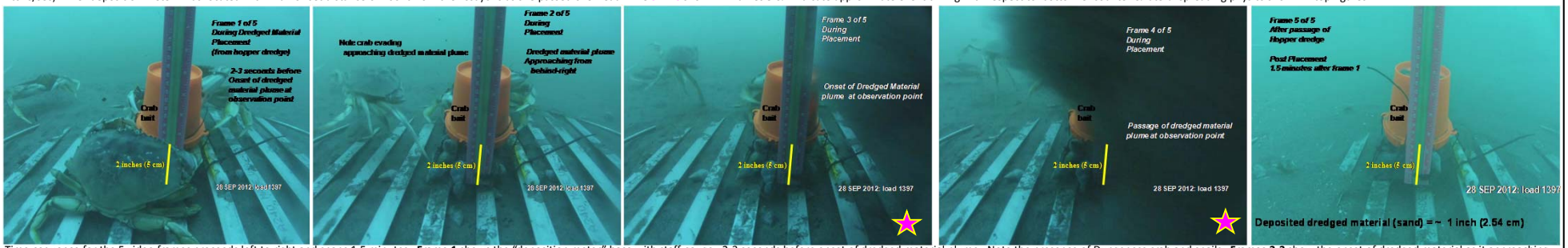
Bottom deposition of dredged material placed in open water , shown in terms of cross-sections: A-A', B-B', and C-C'. Section A-A' is located near the beginning of the disposal run (simulated for the *Essayons*). C-C' is located near the end of the disposal run. The width of the deposition along the disposal transect varies from 350 ft to 500 ft.

The hopper dredge *Essayons* utilizes a series of 12 doors located on the hull bottom to sequentially release each load of dredged material. resulting in a gradual release of dredged material from the vessel.

Bottom doors on bottom hull of *Essayons*.

Each opening is 8ft x 8ft.

The below video images were obtained from NOAAs "deposition meter" positioned below a hopper dredged during placement of dredged material (fine-medium sand) on 28 SEP 2012. The "deposition" meter was deployed on the seabed in water depth of 50 ft, 1 mile south of the Mouth of the Columbia River. The hopper dredge *Essayons* transited over the "deposition meter" as it placed 5,500 cubic yards (4200 cubic meters) of sand in 50 ft water depth for load 1397. Dredged material was released uniformly from the hopper dredge along the 5,100 ft long placement transect, as verified by integrated KDGPS vessel tracking and vessel displacement measurements. The amount of dredged material released into the water column (per unit length along the 5,100-ft placement transect) was 1.1 cubic yard/ft (or 1.3 tons/ft). The rate of dredged material release during the 17-minute placement event was 5.4 cubic yards/sec (or 6.8 tons/sec). The "deposition meter" was located within an offset distance of 100 ft from the Essayons as she passed overhead.. The STARs shown in frames 3 &4 indicate approximate event timing with respect to bottom encounter & lateral spreading physics shown in top figures .



Time-sequence for the 5 video frames proceeds left to right and spans 1.5 minutes. **Frame 1** shows the "deposition meter" base with staff-gauge, 2-3 seconds before onset of dredged material plume. Note the presence of Dungeness crab and snails. **Frames 2-3** show the onset of dredged material as it approaching from the right-hand side of the image. The dredged material has already encountered the seabed after release from the hopper dredge, and is spreading laterally & radially along the seabed as a plume of sediment as it approaches the "deposition meter". **Frame 4** shows passage of the dredged material plume. The plume's lateral speed along the seabed is estimated to be 8-10 ft/sec as it passes through the field of view. Note the crabs evading the approaching sediment plume in frames 1-4. **Frame 5** shows post-placement sediment deposition for load 1397 after passage of sediment plume. Maximum bottom deposition within field of view (due to dredged material placement) is estimated to be 1 inch (2.5 cm). Two other dredged material placement events were also monitored using the NOAA "deposition meter", during 28 SEP 2012. Maximum deposition observed for all 3 events was estimated to be 3.5 inches (9 cm). Crab sensed and evaded the approaching dredged material plume. Previous laboratory testing indicted that Dungeness crab can withstand bottom surging current of 10-13 ft/sec (and related shear) and rapid burial events of 4 to 6 inches depending upon molting stage (Pearson et al 2006).

City of Warrenton

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STAFF REPORT

TO: The Warrenton City Commission
FROM: Scott Fregonese, Interim Planning Director
DATE: January 21, 2025
SUBJ: Comprehensive Plan Amendment CP-24-2

BACKGROUND

The United States Army Corps of Engineers (USACE) operates and maintains the Columbia River Federal Navigation Channels (CR FNCs), which includes dredging and dredged material placement to maintain congressionally-authorized channel dimensions. The 600-foot wide, 43-foot deep navigation channel generally follows the Oregon-Washington border and extends 142 miles from the Mouth of the Columbia River (RM3) to the Bonneville Dam (RM 145). Per information from the USACE, the Columbia-Snake River Navigation System moves over 50 million tons of cargo annually. The estimated value of that cargo is approximately $23 billion. The Lower Columbia River is used to annually transport and/or export commodities including wheat, soy, corn, grain, and forest and mineral bulk exports.

In 2023, the USACE applied to the Oregon Department of Environmental Quality (DEQ) to renew its existing Section 401 Water Quality Certification for the continued Operation and Maintenance (O&M) of the Columbia River FNC. This includes associated disposal of dredged materials in identified locations. As part of ongoing Columbia River management discussion with the USACE, the State had been aware of the Corps' ongoing maintenance included disposing of materials in the "flowlane".

Around 2010, the USACE altered its flowlane disposal practices, such that they were no longer consistent with flowlane definition contained in Clatsop County's or the City of Warrenton's policies. The intent of the changes, as stated by the USACE, was to adaptively manage sediments based on current river conditions and to keep sediments within the riverine sediment budget whenever feasible. To accomplish this goal, the USACE switched from disposing of dredged materials only on the flowlane, to a "thalweg"-based approach that utilizes both the flowlane and contours immediately adjacent to the flowlane that are 20-foot deep or deeper. It is estimated that the annual volume of dredged sediment that is typically placed within the expand flowlane/thalweg is approximately one million cubic yards per year. That estimate does not include future placement by non-USACE users such as the Port of Astoria and the U.S. Coast Guard.

Because the thalweg-based approach is based upon river hydrology and hydraulics, it does not remain in a fixed location. Conversely, the flowlane designated by Clatsop County is a static area. Therefore, USACE's change in practice resulted in a discrepancy between the City's comprehensive plan and the actual work being performed by the Corps.

In 2023, Clatsop County was notified by DEQ that USACE had submitted an application for a 401 Water Quality Certification for continued operations and maintenance in the Lower Columbia River. As part of that review, the state and County became aware that USACE's flowlane disposal practices had evolved and were no longer in compliance with flowlane regulations adopted by Clatsop County in 2005. As a result, County staff were unable to complete the required land use compatibility statement demonstrating consistency with the comprehensive plan and the County's land use regulations. Subsequently, DEQ was unable to approve the 401 Water Quality Certification. The denial led to a series of ongoing meetings between county, state and USACE staff, resulting in these applications. City of Warrenton staff were brought in to the conversation once a path of compliance was identified.

The purpose of this application is threefold:

1. to obtain a reasons-based exception from Goal 16 to allow this practice to continue and to be in compliance with the City of Warrenton's comprehensive plan and implementing ordinances,
2. allow dredged material to be placed in areas 20ft or deeper contiguous with the federal navigation channel and in waters deeper than 65' downstream of the Megler Bridge, and
3. allow the expanded thalweg dredged material disposal area to be available for use by USACE as well as all other dredging users.

PUBLIC PROCESS, PROCEDURES & PUBLIC NOTICE

Notice was provided to DLCD on September 9, 2024. Public hearing notice was published in The Astorian on November 26, 2024. No public comment was received. The Planning Commission held a public hearing on the proposal on December 12, 2024. We published notice of the public hearing before the City Commission on January in the Astorian on January 18, 2025.

CODE PROVISIONS, APPLICANT RESPONSES, AND FINDINGS

Applicable Warrenton Municipal Code (WMC) chapters for this application include:

16.208 TYPES OF APPLICATIONS AND REVIEW PROCEDURES
16.232 AMENDMENTS TO COMPREHENSIVE PLAN TEXT AND MAP, REZONE, AND DEVELOPMENT CODE

Only the applicable standards are addressed below. Portions that do not apply have been omitted.

Chapter 16.208 TYPES OF APPLICATIONS AND REVIEW PROCEDURES
16.208.060 Type IV Procedure (Legislative and Map Amendments).

APPLICANT RESPONSE: None.
STAFF FINDING: The application was submitted with the required materials and the application fee was paid. **This criterion is met.**

Chapter 16.232 AMENDMENTS TO COMPREHENSIVE PLAN TEXT AND MAP, REZONE, AND DEVELOPMENT CODE
16.232.030 Quasi-Judicial Amendments.

B. Criteria for Quasi-Judicial Amendments. A recommendation or a decision to approve, approve with conditions or to deny an application for a quasi-judicial amendment shall be based on all of the following criteria:
   1. Demonstration of compliance with all applicable Comprehensive Plan policies and map designations. Where this criterion cannot be met, a Comprehensive Plan amendment shall be a pre-requisite to approval.

APPLICANT RESPONSE: See application narrative.
STAFF FINDING: The application for a goal exception is compliant with the applicable Warrenton Comprehensive Plan policies and map designations, save for those policies which are being excepted. **This criterion is met.**

   2. Demonstration of compliance with all applicable standards and criteria of this Code, and other applicable implementing ordinances.

APPLICANT RESPONSE: See application narrative.
STAFF FINDING: The application is compliant with the applicable standards of the Warrenton Municipal Code. **This criterion is met.**

   3. Evidence of change in the neighborhood, or community, or a mistake or inconsistency in the Comprehensive Plan or land use district map regarding the property which is the subject of the application; and the provisions of Section 16.232.060, as applicable.

APPLICANT RESPONSE: See application narrative.
STAFF FINDING: The applicant has shown a change in conditions in the Columbia River and has conducted numerous federal, state, and local consultations on the impact of this flowlane disposal. **This criterion is met.**

OREGON ADMINISTRATIVE RULES ON GOAL EXCEPTIONS

OAR 660-004-0000 Purpose

1. The purpose of this division is to interpret the requirements of Goal 2 and ORS 197.732 regarding exceptions. This division explains the three types of exceptions set forth in Goal 2 “Land Use Planning, Part II, Exceptions.” Rules in other divisions of OAR 660 provide substantive standards for some specific types of goal exceptions. Where this is the case, the specific substantive standards in the other divisions control over the more

general standards of this division. However, the definitions, notice, and planning and zoning requirements of this division apply to all types of exceptions.

2. An exception is a decision to exclude certain land from the requirements of one or more applicable statewide goals in accordance with the process specified in Goal 2, Part II, Exceptions. The documentation for an exception must be set forth in a local government's comprehensive plan. Such documentation must support a conclusion that the standards for an exception have been met. The conclusion shall be based on findings of fact supported by substantial evidence in the record of the local proceeding and by a statement of reasons that explains why the proposed use not allowed by the applicable goal, or a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use, should be provided for. The exceptions process is not to be used to indicate that a jurisdiction disagrees with a goal.
3. The intent of the exceptions process is to permit necessary flexibility in the application of the Statewide Planning Goals. The procedural and substantive objectives of the exceptions process are to:
    a. Assure that citizens and governmental units have an opportunity to participate in resolving plan conflicts while the exception is being developed and reviewed; and
    b. Assure that findings of fact and a statement of reasons supported by substantial evidence justify an exception to a statewide goal.
4. When taking an exception, a local government may rely on information and documentation prepared by other groups or agencies for the purpose of the exception or for other purposes, as substantial evidence to support its findings of fact. Such information must be either included or properly incorporated by reference into the record of the local exceptions proceeding. Information included by reference must be made available to interested persons for their review prior to the last evidentiary hearing on the exception.

STAFF FINDING: The proposed exception is being processed as a "reasons" exception, consistent with Statewide Planning Goal 2, Part II, Exceptions, and with OAR 660-004-0018(4) and OAR 660-004- 0020 through 660-004-0022. The request has complied with all required and applicable notices and planning and zoning requirements of OAR 660-004. The documentation for this goal exception will be set forth in the City's comprehensive plan. This documentation will include findings of fact, based upon substantial evidence in the record and concluding that the standards for the exception have been met. As noted elsewhere in this report, the City has complied with all required public notifications to ensure that citizens and governmental units have been provided an opportunity to participate in the process. The findings in this report verify that the justification for a goal exception is supported by substantial evidence. All information and documentation prepared by other groups or agencies used as substantial evidence to support these findings of fact will be included or properly

incorporated by reference into the record of these proceedings. All information included by reference in the record will be made available to interested persons for their review prior to the last evidentiary hearing on the exception. **The proposal satisfies and is consistent with the criteria listed in OAR 660-004-0000.**

OAR 660-004-0015: Inclusion as Part of the Plan

1. A local government approving a proposed exception shall adopt, as part of its comprehensive plan, findings of fact and a statement of reasons that demonstrate that the standards for an exception have been met. The reasons and facts shall be supported by substantial evidence that the standard has been met.
2. A local government denying a proposed exception shall adopt findings of fact and a statement of reasons that demonstrate that the standards for an exception have not been met. However, the findings need not be incorporated into the local comprehensive plan.

STAFF FINDING: Should the City Commission determine that the application meets the standards for an exception to Goal 16, staff would recommend that the Warrenton Comprehensive Plan be amended as shown in Ordinance 1283. The proposed amendments would clearly identify the sub-areas designated Conservation where this goal exception would apply. **This criterion will be met.**

OAR 660-004-0018: Planning and Zoning for Exception Areas

1. Purpose. This rule explains the requirements for adoption of plan and zone designations for exceptions. Exceptions to one goal or a portion of one goal do not relieve a jurisdiction from remaining goal requirements and do not authorize uses, densities, public facilities and services, or activities other than those recognized or justified by the applicable exception. Physically developed or irrevocably committed exceptions under OAR 660-004- 0025 and 660-004-0028 and 660-014-0030 are intended to recognize and allow continuation of existing types of development in the exception area. Adoption of plan and zoning provisions that would allow changes in existing types of uses, densities, or services requires the application of standards outlined in this rule.
4. "Reasons" Exceptions:
    a. When a local government takes an exception under the "Reasons" section of ORS 197- 732(1)(c) and OAR 660-004-0020 through 660-004-0022, OAR 660-014-0040, or OAR 660- 014-0090, plan and zone designations must limit the uses, density, public facilities and services, and activities to only those that are justified in the exception.
    b. When a local government changes the types of intensities of uses or public facilities and services within an area approved as a "Reasons" exception, a new "Reasons" exception is required.
    c. When a local government includes land within an unincorporated community for which an exception under the "Reasons" section of

ORS 197.732(1)(c) and OAR 660-004-0020 through 660-004-0022 was previously adopted, plan and zone designations must limit the uses, density, public facilities and services, and activities to only those that were justified in the exception or OAR 66-022-0030, whichever is more stringent.

STAFF FINDING: The requested goal exception would only apply to areas that are 20' in depth or greater and that are immediately adjacent to the flowlane. The exception would be limited to areas designated aquatic Conservation in the Warrenton Comprehensive Plan and would not apply to areas designated aquatic Natural. Conditions of approval would require dredged material disposal within the expanded flowlane/thalweg to comply with the requirements of Warrenton Development Code Chapter 16.164 Impact Assessment and Resource Capability Determination, with regard to procedure for approval. A further condition of approval would require the informational thalweg map to updated on a five-year schedule when updated by Clatsop County. Should the potential location of the thalweg change significantly during that time, a new exception would be required if the shifted location would not comply with the City's policies and standards. **All applicable requirements of OAR 660-004-0018 are met.**

OAR 660-004-0020 Goal 2, Part II(c), Exception Requirements

1. If a jurisdiction determines there are reasons consistent with OAR 660-004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004- 0000(1), rules in other divisions may also apply.
2. The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:
    a. "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land.

STAFF FINDING: The Department of State Lands, in their application to Clatsop County, cite information provided by the U.S. Army Corps of Engineers as to why anexception to Goal 16 should be approved to allow in-water placement of dredged material within waters designated aquatic Conservation. These reasons include:

1. Maintaining the ability to re-introduce dredged sediment along the river's thalweg, thus sustaining the river's finite sediment budget and increasing the resilience of the Lower Columbia River Estuary morphology.

2. Reducing the seasonal dredging operations required to maintain the Federal Navigation Channel, as dredged material placed into the flowlane more quickly returns to the channel.

3. Reducing shoal encroachments in the Federal Navigation Channel between dredging seasons, which could result in draft restrictions on maritime commerce.

It is estimated that the proposed expanded flowlane/thalweg disposal areas would encompass approximately 23,000 acres within the estuary, from RM 3 to RM 44. It is estimated that 10% of that area, or 2,300 acres, would be used annually for the placement of dredged materials throughout the Columbia River Estuary. Maintaining the finite supply of riverine sediment cannot be accomplished by placement on upland sites or through ocean disposal. Additionally, there is insufficient capacity with the flowlane as currently designated to retain the sediment budget. Continued reduction of riverine sediment could result in riverbank erosion and deepening of the river thalweg, resulting in channel instability over time. **For these reasons, the requirements of OAR 660-004-0020(2)(a) have been met.**

b. "Areas that do not require a new exception cannot reasonably accommodate the use". The exception must meet the following requirements:
   A. The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;
   B. To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:
      i. Can the proposed use be reasonably accommodated on nonresource land that would not require an exception, including increasing the density of uses on nonresource land? If not, why not?
      ii. Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to nonresource uses not allowed by the applicable Goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?
      iii. Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?

iv. Can the proposed use be reasonably accommodated without the provision of a proposed public facility or service? If not, why not?

C. The "alternative areas" standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

STAFF FINDING:

The U.S. Army Corps has considered five possible alternative locations for dredged disposal that would not require a goal exception:

1. Placement within the flowlane as currently defined and designated
2. Placement with Aquatic Development zones, which would include the currently-designated flowlane
3. Placement in areas outside of the Columbia River Estuary
4. Upland disposal
5. Ocean disposal

One of the primary purposes for the USACE's use of adaptive management practices and the reason for these applications is to preserve and retain, to the maximum extent possible, the finite riverine sediment budget. Upland placement or ocean disposal would be inconsistent with the goal of retaining riverine sediment, as that material would either not be able to re-enter the river (upland disposal) or would be permanent lost (ocean disposal). Additionally, upland placement either within an urban growth boundary or on resource land that is already irrevocably committed to nonresource uses would require significant costs, as it would require dredged materials to either be transported overland to those sites or shipped considerable distances as the equipment employed by the USACE is not capable of piping dredged material over distances more than a few miles.

The applicant's response indicates that areas within the flowlane and outside of the estuary do not have adequate capacity to support the amount of materially annually dredged each season.

The informational thalweg map included as Exhibit 1 illustrates the anticipated areas where the thalweg disposal would occur over a five-year period. Because river dynamics continually shift the thalweg location, the map is intended to be advisory in nature. Actual operations and locations of dredged material will be based upon the new definition of "expanded flowlane/thalweg disposal".

The USACE's expanded flowlane/thalweg disposal methods are intended to minimize the rate at which sediment re-enters the Federal Navigation Channel. As sediment builds up, or as shoaling occurs, draft restrictions can be placed of vessels, impacting maritime commerce. As noted by the applicant, ships utilizing the Columbia River FNC transport shipments worth nearly $5.6 billion per year. Maritime commerce is directly and indirectly responsible for approximately 100,000 jobs. If draft restrictions are imposed, there is the potential for significant economic impacts both locally, regionally, nationally and globally.

The proposed use (expanded flowlane/thalweg disposal) can be accommodated without the provision of new public facilities or services.

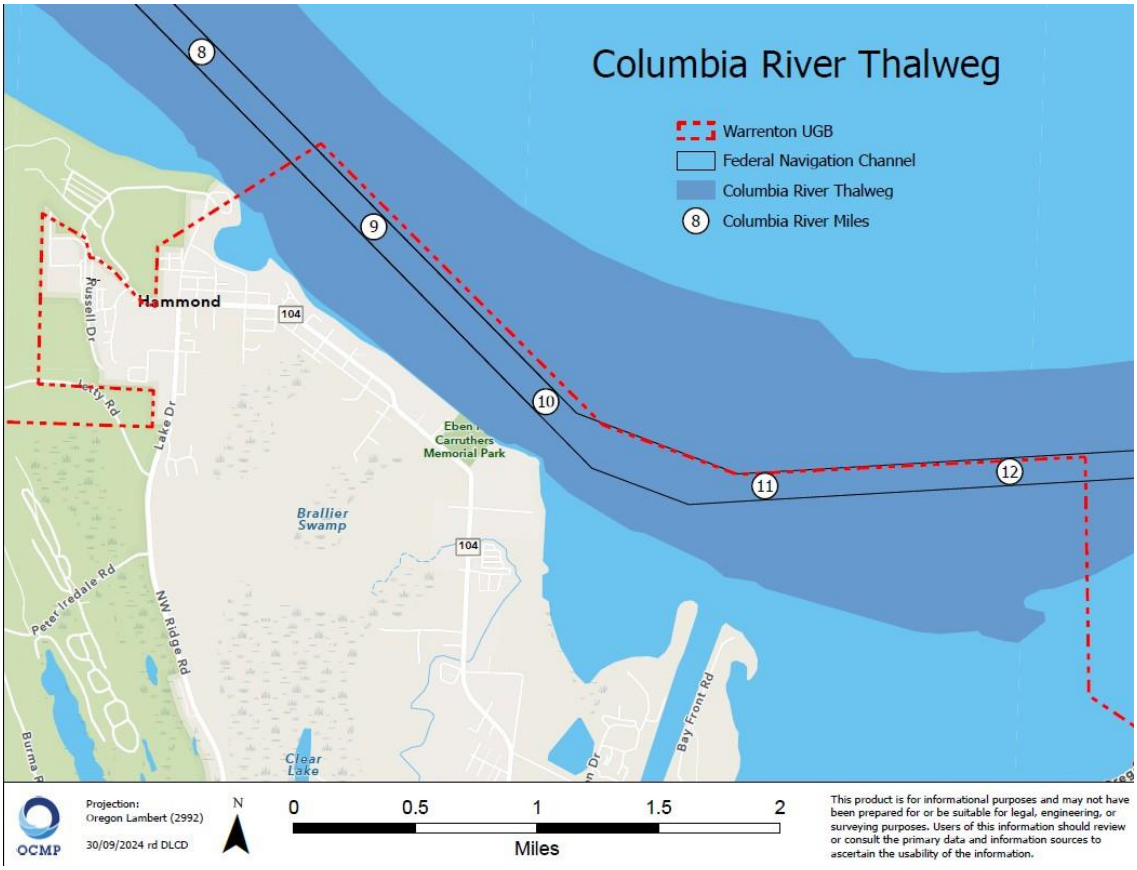


Figure 1 Proposed thalweg for flowlane placement of dredged material in City of Warrenton Urban Growth Boundary and for the whole Columbia River Estuary.

The applications meet the requirements of OAR 660-004-0020(2)(b).

c. "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts;

STAFF FINDING: The long-term environmental, economic, social and energy consequences that might occur if the goal exception is approved are not significantly more adverse than would typically result from the same proposal being located in an area that also requires a goal exception. First, the nature of the work and the intended outcomes are reliant upon an in-water area. Second, the review and approval process for this work by the Army Corps includes monitoring measures, the reasonable and prudent measures from the federal biological opinions, as well as mandated in-water work windows through other permitting processes.

The applicant (DSL) submitted supporting documents to the City of Warrenton that are included as Exhibits 1-12. These exhibits demonstrate that in order to meet the goals of maintaining sediment budget, minimizing dredging operations, reducing shoaling and stabilizing the thalweg in order to prevent draft restrictions, in-water dredged material disposal in an expanded flowlane/thalweg area is required. Upland and ocean disposal would lead to increased riverine sediment loss as those materials would either not re-enter the river or would be permanently lost in the case of ocean disposal. Adequate capacity is not available in the currently-defined flowlane and upstream areas outside of

the estuary also lack sufficient capacity. Additionally, upland disposal or upstream disposal would consume significantly more energy than expanded in-water flowlane/thalweg disposal, which would be inconsistent with the policies in Goal 6: Air, Water and Land Resources Quality. When disposing of dredged materials, the Corps implements best management practices to minimize effects to water quality, including sediment sampling, water quality monitoring, and turbidity monitoring and minimization measures. The Best Management Practices are further defined in the Determination of Compatibility, included as Exhibit 9. Lastly, dredge-equipment limitations in this particular stretch of the Columbia River would not allow for material placement in areas shallower than 20 feet.

The proposed use would not impact the water table and would not require road improvements or impact special districts. **The application meets the requirements of OAR 660-004-0020(2)(c).**

d. "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.

STAFF FINDING: As discussed above, disposal of dredged materials within the expanded flowlane/thalweg, are subject to monitoring measures, the reasonable and prudent measures from the biological opinion, as well as mandated in- water work windows.

The National Marine Fisheries Service's three biological opinions have concluded that the USACE's proposed disposal actions would not jeopardize threatened or endangered species or destroy critical habitat essential to those species. Any other user of the goal exception area would be subject to local, state, and federal permitting.

The in-water disposal would occur in waters that are 20 feet in depth or deeper in areas where benthic activity is not anticipated to occur. As noted by the applicant in the narrative in Exhibit 12, juvenile salmonids are unlikely to utilize these mid-depth areas, preferring shallower habitats closer to the shoreline. **The applications meet the requirements of OAR 660-004-0020(2)(d).**

3. If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

STAFF FINDING: The City of Warrenton is proposing to revise the Comprehensive Plan and Development Code as needed to accommodate this goal exception proposal. The amendments would revise the definition of "flowlane disposal" and would add an informational map to the comprehensive plan illustrating the predicted location of the Columbia River Estuary thalweg over a 5-year period. In cases where the informational map may conflict with the revised definition, the definition would take precedence. **The requirements of OAR 660-004-0020(3) have been met.**

OAR 660-004-0022 Reasons Necessary to Justify an Exception Under Goal 2, Part II(c)

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use…

…(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660- 012- 0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following: There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either:

(a) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this subsection must include an analysis of the market area to be served by the proposed use or activity. That analysis must demonstrate that the proposed exception site is the only one within that market area at which the resource depended upon can reasonably be obtained; or

(b) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

STAFF FINDING: Criteria (1)(a) is not applicable in this request. As provided in the information above and series of exhibits, the Army Corps has shown that terrestrial sediment supply to the Lower Columbia River has been reduced due to floodplain development and hydro-regulation. The river's sediment supply is now finite and is managed to sustain the ecological health of the estuary. The river thalweg is needed for the disposal of dredged material to sustain the river's sediment budget. Therefore, the goal exception area has special features that necessitate its location. Based upon review of the information provided by DSL to the City of Warrenton and the requirements of OAR 660-004-0020, staff has determined that the requested goal exception would comply with the requirements of OAR 660-004-0022(1)(b). **The requirements of OAR 660-004-0022(1) have been met.**

OAR 660-004-0030: Notice and Adoption of an Exception

1. Goal 2 requires that each notice of a public hearing on a proposed exception shall specifically note that a goal exception is proposed and shall summarize the issues in an understandable manner.
2. A planning exception takes effect when the comprehensive plan or plan amendment is adopted by the city or county governing body. Adopted

> exceptions will be reviewed by the Commission when the comprehensive plan is reviewed for compliance with the goals through the acknowledgment or periodic review processes under OAR chapter 660, divisions 3 or 25, and by the Board when a plan amendment is reviewed as a post-acknowledgment plan amendment pursuant to OAR chapter 660, division 18.

STAFF FINDING: These applications are being processed under a Type IV legislative procedure. In accordance with Chapter 16.208, a notice of public hearing was published in the Astorian on November 26, 2024. **The requirements of OAR 660-004-0030 have been met.**

CONCLUSIONS AND RECOMMENDATION

Based on the information provided in the application and supporting materials, staff recommends approval of the request subject to the following Conditions of Approval:

CONDITIONS OF APPROVAL

1. This goal exception only applies to in-water placement of dredged materials. This goal exception does not authorize new dredging activities.
2. No in-water dredge material disposal shall occur outside areas designated Development or outside areas included in this goal exception areas unless a new goal exception is approved.
3. All in-water dredged disposal within the goal exception areas will occur during the in-water work periods established during consultation with the National Marine Fisheries Service under the Endangered Species Act.
4. All in-water disposal within the goal exception areas will follow the Best Management Practices (BMPs) established during consultation with the National Marine Fisheries Service under the Endangered Species Act.
5. Disposal of dredged materials within the expanded flowlane/thalweg exception area shall be subject to the Chapter 16.160 of the Warrenton Municipal Code. Non-federal applicants shall be required to submit all applicable applications and must receive approval prior to commencing work. Federal agencies, consistent with the Oregon Coastal Zone Management Program, must demonstrate consistency with local policies to the maximum extent practicable.
6. Non-federal entities using the expanded flowlane/thalweg exception area for in-water dredged material disposal shall annually submit to the City of Warrenton a copy of the dredging season monitoring and reporting results for the Columbia River that are prepared for the Oregon Department of Environmental Quality to demonstrate compliance with the requirements of the 401 Water Quality Certification. If the user of the goal exception area is a federal agency, the State of Oregon is responsible for requesting the annual report they submit to the Oregon Department of Environmental Quality per the Section 401 Water Quality

Certification and submitting that report annually to the City of Warrenton.

7. The informational thalweg map shall be used for advisory purposes only. In cases where the informational thalweg map conflicts with the definition of "expanded flowlane/thalweg disposal", the definition shall take precedence.
8. A new thalweg map shall be prepared every 5 years and submitted to Clatsop County Community Development and the U.S. Army Corps of Engineers. The City of Warrenton will request the updated map from Clatsop County. When said map is not available, placement activities will continue solely based on the text definition of thalweg placement.
9. Regarding deepwater placement of dredged material within the expanded flowlane/thalweg exception area: Areas deeper than 65 feet below MLLW may be used for thin-layer placement only if the placement does not cause the area to become permanently converted to depths shallower than 65 feet. Thin-layer placement is defined a maximum deposition on the riverbed of 0.25 feet during placement of each hopper dredge or barge load to minimize benthic impacts.

RECOMMENDED MOTION

"Based on the findings and conclusions of this January 28, 2025, staff report, I move to conduct the first reading, by title only, of Ordinance number 1283."

ATTACHMENTS

1. Ordinance No. 1283
2. Application
3. Applicant Narrative Findings
4. Applicant Exhibit 1 Columbia River Estuary Thalweg Informational Map
5. Applicant Exhibit 2 Warrenton Thalweg Map
6. Applicant Exhibit 3 2012 BiOp
7. Applicant Exhibit 4 PSET Memo
8. Applicant Exhibit 5 2021 BiOp
9. Applicant Exhibit 6 2023 BiOp
10. Applicant Exhibit 7 Determination of Compatibility CR O&M
11. Applicant Exhibit 8 Corps ODLCD Clatsop visuals
12. Applicant Exhibit 9 BMPs Excerpt Determination of Compatibility
13. Applicant Exhibit 10 USACE JPA ODEQ 401 ColRiver
14. Applicant Exhibit 11 2014USFWS BiOp

ORDINANCE NO. 1283
INTRODUCED BY ALL COMMISSIONERS

AN ORDINANCE AMENDING THE CITY OF WARRENTON COMPREHENSIVE PLAN AND WARRENTON MUNICIPAL CODE TO ADOPT AN EXCEPTION TO STATEWIDE PLANNING GOAL 16 AND MODIFY STANDARDS REGARDING FLOWLANE DISPOSAL IN THE COLUMBIA RIVER

WHEREAS, the United States Army Corps of Engineers (USACE) is federally mandated to maintain the Federal Navigation Channel of the Columbia River, which includes dredging and disposal of dredged material to maintain the deep draft channel; and

WHEREAS, in 2002, the Columbia River Estuary Study Taskforce (CREST) completed the *Columbia River Estuary Dredged Material Management Plan*, which refined the dredging and disposal policies in the City of Warrenton's Comprehensive Plan and inventoried an adequate number of disposal sites with sufficient capacity to accommodate projected disposal needs for at least a five-year period; and

WHEREAS, the City of Warrenton adopted the necessary provisions from the *Columbia River Estuary Dredged Material Management Plan* in Article 5 of the City of Warrenton Comprehensive Plan and Section 16.160 of the Warrenton Municipal Code; and

WHEREAS, Section 16.160 of the Warrenton Municipal Code currently allows flow lane disposal in areas designated aquatic development; and

WHEREAS, in approximately 2010, the United States Army Corps of Engineers (USACE) altered its dredge material disposal practices to include the river thalweg within contour depths of 20 feet or greater as part of its flowlane disposal area; and

WHEREAS, the expanded flowlane/thalweg area encompasses in-water areas that are designated Conservation Aquatic, which does not allow flowlane disposal; and

WHEREAS, this discrepancy between USACE practices and City of Warrenton policies was identified in 2023; and

WHEREAS, it has been demonstrated that the use of the expanded flowlane/thalweg is required to maintain the river's sediment budget and to reduce shoaling and that no other alternatives are available that would meet these requirements; and

WHEREAS, in September 2024, the Oregon Department of State Lands (DSL) submitted an application for an exception to Goal 16: Estuarine Resources, to allow the disposal of dredged materials in water areas designated Conservation Aquatic; and

WHEREAS, the application meets the criteria outlined in the City of Warrenton Comprehensive Plan and Warrenton Municipal Code and it is in the public's best interest to adopt this exception to Goal 16: Estuarine Resources; and

NOW THEREFORE, the City of Warrenton ordains as follows:

Section 1. Section 5.110 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.110 Estuary Channels Subarea Findings

(1) General Description - This subarea includes the deep water portions of the estuary from Jetty A (RM 3) to the upper end of Rice Island (RM 22.5). The subarea contains the authorized navigation channel. The subarea boundary generally follows the 20-foot bathymetric contour; however, it varies from this contour in the vicinity of cities and other subareas containing deep channels. There are no intertidal wetland or shoreland areas. Portions of Clatsop, Pacific and Wahkiakum Counties, and Astoria and Warrenton are within this subarea. The Warrenton portion comprises only a small portion of this 16,500 acre subarea.

(2) Aquatic Designations - All aquatic areas in the Estuary Channels Subarea in Warrenton are designated Conservation except:

(a) The main navigational channel and a flowlane disposal area on each side of the channel (either 600 feet wide or extending to the 20 foot bathymetric contour, whichever is narrower) is designated Aquatic Development.

(b) Dredged material disposal sites CC-E-8.5 and CC-E-2LO, listed in the *Columbia River Estuary Dredged Material Management Plan*, are designated Aquatic Development.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 2. Section 5.120 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.120 Tansy Point/Alder Cove Subarea Findings

(1) General Description - This subarea includes aquatic areas in Alder Cove and the Columbia River out to the pierhead line, and shorelands between the waterward extension of Railroad Drive (the old Warrenton/Hammond boundary) and the mouth of Alder Creek. This subarea contains about 600 acres of both shorelands and aquatic areas within the City of Warrenton.

(2) Aquatic and Shoreland Designations

(a) Development Aquatic:

- The aquatic area bounded by the shoreline on the South, the pierhead line to the North, the waterward extension of Railroad Drive on the West and Tansy Point on the East.
- The barge moorage area on the East side of Tansy Point.
- The flowlane disposal area south of the main channel (600 feet wide or to the 20-foot bathymetric contour, whichever is narrower).

(b) Conservation Aquatic:

- The area at the southern end of Alder Cove where effluent from the Warrenton sewage ponds is discharged.
- The mouth of Alder Cove from the 3-foot bathymetric contour north to the flowlane disposal area.

(c) Natural Aquatic:

- Remaining aquatic area within Alder Cove.

(d) Water-Dependent Development Shorelands:

- All shoreland areas are designated Water-Dependent Development Shorelands, except for a portion of dredged material disposal site Wa-S-9.4, which is designated Development Shorelands.

(e) The regulatory shoreland boundary is 50 feet from the Columbia River Estuary shoreline, or from the landward toe of dikes and associated toe drains, whichever is greatest, except where it extends further inland to include the following features:

- Shoreland areas designated Water-Dependent Development Shorelands.

- Mitigation site M3 from the *Mitigation and Restoration Plan for the Columbia River Estuary*.

- Dredged material disposal site Wa-S-9.4 from the *Columbia River Estuary Dredged Material Management Plan*.

- A wetland at Tansy Creek identified as significant under Oregon Statewide Planning Goal 17.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic or Natural Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 3. Section 5.150 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.150 Mouth of the Skipanon River Subarea Findings

(1) General Description - This subarea contains filled and diked shorelands north of Harbor Drive and east of Skipanon Drive; the Skipanon River from the Harbor Drive Bridge to its mouth; the East and West Skipanon Peninsulas; and adjacent Columbia River waters out to the navigation channel. Parts of downtown Warrenton are also included.

(2) Aquatic and Shoreland Designations

(a) Development Aquatic:

- The Skipanon waterway between the Harbor Drive Bridge and the main navigation channel.
- Approximately 7.8 acres of tidal marsh and flats on the west side of the West Peninsula.
- The flowlane disposal area south of the main channel (600 feet wide or to the 20-foot bathymetric contour, whichever is narrower).
- The area from the Skipanon Channel to the eastern boundary of the Subarea and from the line of aquatic vegetation on the East Peninsula north to the Columbia River navigation channel.

(b) Conservation Aquatic:

- The aquatic area between the shoreline and the flowlane disposal area west of the Skipanon Channel.

(c) Development Shoreland:

- The area adjacent to the mooring basin east to N.E. Iredale Avenue.
- The area north of Harbor Drive on the east side of the Skipanon waterway.
- An area on the south side of the West Peninsula.
- The area east of Holbrook Slough.

(d) Water-Dependent Development Shorelands:

- All other shorelands are designated Water-Dependent Development.

(e) The regulatory shoreland boundary is 50 feet from the Columbia River Estuary shoreline, or from the landward toe of dikes and associated toe drains,

whichever is greatest, except where it extends further inland to include the following features:

- The East Skipanon Peninsula including all shoreland areas on the northern 96 acres of the East Skipanon Peninsula.

- The West Skipanon Peninsula including all upland adjacent to Alder Cove and east of N. E. Skipanon Drive, with the exception of the area designated commercial by the City of Warrenton Zoning Ordinance; dredged material disposal site Wa-S-10.7 from the Columbia River Estuary Dredged Material Management Plan; and The Holbrook Slough wetland, classified as significant under Oregon Statewide Planning Goal 17.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 4. Section 5.305(10) of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.305 Dredging and Dredged Material Disposal

(10) Flowlane disposal sites shall only be allowed in Development Aquatic areas within or adjacent to a channel where an exception to Goal 16 has been approved. The Development Aquatic area adjacent to the channel shall be defined by a line 600 feet from either side of the channel or the 20-foot bathymetric contour, whichever is closer to the channel. Flowlane disposal within this area shall only be allowed where:

(a) Sediments can reasonably be expected to be transported downstream without excessive shoaling,

(b) Interference with recreational and commercial fishing operations, including snag removal from gillnet drifts, will be minimal or can be minimized by applying specific restrictions on timing or disposal techniques,

(c) Adverse hydraulic effects will be minimal,

(d) Adverse effects on estuarine resources will be minimal, and

(e) The disposal site depth is 20 feet below MLLW or deeper.

(f) An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, has been approved.

Section 5. Section 16.76.030 of the Warrenton Municipal Code is amended to read as follows:

The following uses and activities and their accessory uses and activities may be permitted in the A-2 zone when approved under Chapter 16.220, Conditional Use Permits. The uses and activities are also subject to the provisions of Section 16.76.040, Development Standards. They are also subject to a resource capability determination (Section 16.164.050) and impact assessment (Section 16.164.010).

A. High-intensity water-dependent recreation including boat ramps, marinas, and individual docks.
B. Aquaculture and water-dependent portions of aquaculture facilities.
C. Active restoration for purposes other than protection of habitat, nutrient, fish, wildlife and aesthetic resources.
D. Temporary alterations.
E. Filling in conjunction with listed conditional uses, pursuant to the applicable standards in Section 16.160.060.
F. Minor navigational improvement.
G. Mining and mineral extraction.
H. Dredging in conjunction with any of the listed conditional uses pursuant to the applicable standards in Section 16.160.040.
I. Low-intensity water-dependent commercial or industrial uses requiring occupation of water-surface area by means other than fill.
J. In-water log storage.
K. Communication facilities subject to the standards of Chapter 16.148.
L. Piling in conjunction with any of the listed conditional uses.
M. Flow lane disposal of dredged material where an exception to Statewide Goal 16 has been approved.
N. Similar uses to those listed in this section.

Section 6. Section 16.160.050(E) of the Warrenton Municipal Code is amended to read as follows:

E. Flow lane disposal shall be in aquatic development areas, or areas where an exception to Goal 16 has allowed in-water disposal of dredged material in depths greater than 20 feet and contiguous to the Federal Navigation Channel which encroach into designated Conservation Aquatic areas, that have been identified as low in benthic productivity and use of these areas shall not have adverse hydraulic effects. Use of flow lane disposal areas in the estuary shall be allowed only when no feasible alternative land or ocean disposal sites with less damaging environmental impacts can be identified and the biological and physical impacts of flow lane disposal are demonstrated to be insignificant. The feasibility and desirability of alternative sites shall take into account, at a minimum:

1. Operational constraints such as distance to the alternative sites;
2. Sediment characteristics at the dredging site;
3. Timing of the operation;
4. Environmental Protection Agency constraints on the use of designated ocean disposal sites;
5. The desirability of reserving some upland sites for potentially contaminated material only. Long term use of a flow lane disposal area

may only be allowed if monitoring confirms that the impacts are not significant. Flow lane disposal is contingent upon demonstration that:

a. Significant adverse effects due to changes in biological and physical estuarine properties will not result; and
b. Flow lane disposal areas shall be shown able to transport sediment downstream without excessive shoaling, interference with recreational and commercial fishing operations, including the removal of snags from gillnet drifts, undesirable hydraulic effects, or adverse effects on estuarine resources (fish runs, spawning activity, benthic productivity, wildlife habitat, etc.).

6. When determining whether a proposal is within the expanded flowlane/thalweg disposal area covered by an approved Goal 16 exception, the Columbia River Estuary Thalweg map adopted by Ordinance 1283 shall be consulted. It is important to note that the text description of "expanded flowlane/thalweg disposal" are the regulating boundaries of this exception area. Maps and GIS data layers used by the City are a representation of those boundaries. In cases of any doubt, the text description should be used to resolve any boundary confusion.

Section 7. The Flow Lane Disposal map shown in Exhibit 1 is hereby adopted and incorporated into the Warrenton Comprehensive Plan as Appendix III.

Section 8. This ordinance shall take full force and effect 30 days after its adoption by the Commission of the City of Warrenton.

First Reading: February 11, 2025
Second Reading:

ADOPTED by the City Commission of the City of Warrenton, Oregon this_____day of _____, 2025.

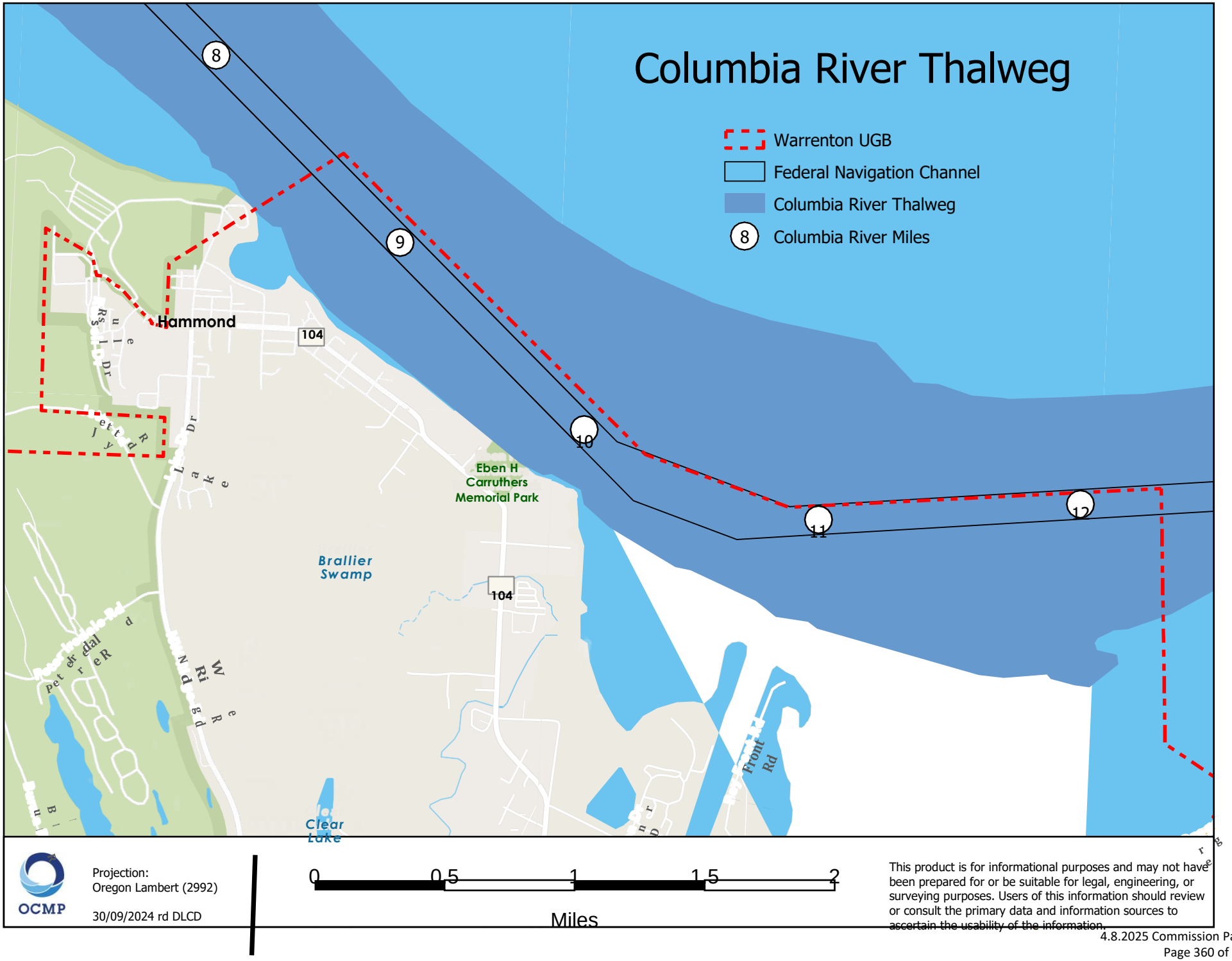
APPROVED:

_____
Henry A. Balensifer III, Mayor

ATTEST:

_____
Dawne Shaw, CMC, City Recorder

Exhibit 1


Columbia River Thalweg
Warrenton UGB
Federal Navigation Channel
Columbia River Thalweg
Columbia River Miles
8
9
10
11
12
Hammond
104
Eben H
Carruthers
Memorial Park
Brallier
Swamp
Clear
Lake
Front
Rd
Projection:
Oregon Lambert (2992)
30/09/2024 rd DLCD
OCMP
0
0.5
1
1.5
2
Miles
This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

City Of Warrenton

Planning Department
Comprehensive Plan Amendment
WMC 16.232

OFFICE USE	
	FEE $2,000
	File# CP -_____ - _____
	Date Received _____
	Receipt#_____

Amendments to the Warrenton Comprehensive Plan may be necessary from time to time to reflect changing community conditions, needs, and desires, to correct mistakes, or to address changes in state law (i.e., ORS, OAR, and Statewide Planning Goals). A property owner or designated representative may initiate a request to amend the Warrenton Comprehensive Plan by filing an application with the Planning Department in accordance with the requirements of WMC 16.208.060. In addition, the applicant shall provide any related plans, drawings, and/or information needed to provide background for the request.

Property

Address: Columbia River Estuary. Please see attached narrative and exhibits.

Tax Lot (s):_____

Zone:_____Flood Zone:_____Wetlands: _____

Applicant

Name (s): Oregon Department of State Lands

Phone: 503-508-4312 E-Mail Address: chris.castelli@dsl.oregon.gov

Mailing Address: 775 Summer Street NE #100, Salem, OR 97301

Applicant Signature(s):_____Date: _____

Property Owner (if different from applicant)

Name (s):_____

Phone:_____E-mail Address: _____

Mailing Address:_____

Owner's Signature:_____Date: _____

I am a record owner of property (person(s) whose name is on the most recently-recorded deed), or contract purchaser with written permission from the record owner and am providing my signature as written authorization for the applicant to submit this application.

Description of Amendment (Include Chapter and Section)

In water dredge material disposal deeper than 20' contiguous with the navigational federal navigational channel. Please see attached narrative.

Comprehensive Plan Amendment Review Criteria

Please provide written responses to each of the criteria below that clearly explain how your proposal meets each item. Attach a separate piece of paper if needed. Be as specific as possible. "Yes" and "No" responses are not sufficient.

1. Does the proposal conform to the applicable Oregon Revised Statutes? Yes ☑ No ☐

Please explain: Please see attached narrative.

2. Does the proposal conform to the Statewide Planning Goals? Yes ☑ No ☐

Please explain: Please see attached narrative.

3. Is there a change of circumstances or further studies justifying the amendment?

Please explain:

This application will not be officially accepted until department staff have determined that the application is filled out and signed, the application fee has been paid, and the submittal requirements have been met.

Narrative and Findings for Goal Exception to Goal 16: Estuarine Resources

Applicant: Oregon Department of State Lands

Date: October 15, 2024

Oregon Administrative Rules (OAR) 660-004-0000 (2): *An exception is a decision to exclude certain land from the requirements of one or more applicable statewide goals in accordance with the process specified in Goal 2, Part II, Exceptions. The documentation for an exception must be set forth in a local government's comprehensive plan. Such documentation must support a conclusion that the standards for an exception have been met. The conclusion shall be based on findings of fact supported by substantial evidence in the record of the local proceeding and by a statement of reasons that explains why the proposed use not allowed by the applicable goal, or a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use, should be provided for. The exceptions process is not to be used to indicate that a jurisdiction disagrees with a goal.*

An exception is a comprehensive plan provision, including an amendment to an acknowledged comprehensive plan, that:

a. is applicable to specific properties or situations and does not establish a planning or zoning policy of general applicability;
b. does not comply with some or all goal requirements applicable to the subject properties or situations; and
c. complies with standards for an exception.

Overview

There are three kinds of goal exceptions. This application is for a "reasons exception" which must meet a four-part test. DSL (the applicant) is submitting this application for a reasons exception to Statewide Planning Goal 16 (Estuarine Resources) for the disposal of dredged material within aquatic zones in the City of Warrenton portion of the Columbia River estuary that would otherwise not allow that activity.

The US Army Corps of Engineers (Corps) operates and maintains the Columbia River Federal Navigation Channels (CR FNCs), which includes dredging and dredged material placement to maintain congressionally authorized channel dimensions. As the owner of submerged lands within the State of Oregon, the Department of State Lands is applying for a goal exception and plan amendment to Warrenton in support of the Corps' efforts to ensure year-round channel access at those dimensions and support safe navigation of vessels through the Columbia River Estuary.

This application pertains to the U.S. Army Corps of Engineers, Portland District's (Corps') operation and maintenance of the lower Columbia River portion of the Columbia and Lower

Willamette Rivers navigation channel and side channels including Baker Bay, Chinook, Skipanon, Tongue Point, Skamokawa Creek, Elochoman Slough, Wahkiakum Ferry and Westport Slough (Projects). Specifically, this application seeks to expand the current area within Warrenton where "flowlane disposal" of dredged materials may occur. Currently, the City of Warrenton Comprehensive Plan defines flowlane disposal as the Federal Navigation Channel (FNC) plus a buffer on either side of the channel 600 feet wide or extending to the 20-foot bathymetric contour, whichever is narrower.

DSL's goal exception request is to allow flowlane disposal within the river thalweg, in an expanded area contiguous to the FNC that is consistent with the 20-foot depth contour (and to delete the qualifier "whichever is narrower" in the current city definition).

The Corps states that this expanded area for flowlane disposal of dredged material would support the feasibility of its ongoing operations and maintenance of the FNC. This thalweg area features river velocities sufficient to move placed sediments downstream within the river's natural system without resulting in significant adverse environmental effects. Because the river thalweg is subject to continual change as fluvial hydrodynamics transport sediment into and out of the estuary system, DSL proposes a text-based definition of the thalweg disposal area based on the factors above, which would be supported by maps of the projected thalweg location updated on a regular interval. Exhibits 1 and 2 provide maps of the proposed thalweg dredged material placement area.

It is proposed that a new thalweg dredged material disposal area would be available to the Corps as well as all other dredging users for flowlane dredged material disposal.

Currently, portions of the thalweg area described above are zoned "Aquatic Conservation" under the City of Warrenton Comprehensive Plan. As will be described elsewhere in this application, the proposed expanded thalweg appears to avoid areas described as "Aquatic Natural" within the estuary subareas of the city's Comprehensive Plan. Goal 16 (Estuarine Resources) specifies uses and activities that are permitted, conditionally permitted, and prohibited within estuarine areas designated aquatic conservation and aquatic natural, which are then implemented through the City's Comprehensive Plan and the Development Code (Title 16). Currently, disposal of dredged material is not permitted in areas zoned as Aquatic Conservation or Aquatic Natural. A goal exception to Statewide Planning Goal 16 is being sought here to allow flowlane/thalweg placement of dredged material in areas where it is not currently allowed in the City of Warrenton's Comprehensive Plan.

Background

In 2023, the Corps applied to the Oregon Department of Environmental Quality (DEQ) to renew its existing Section 401 Water Quality Certification for the continued Operation and Maintenance (O&M) of the Columbia River Federal Navigation Channel, which includes the dredging of the navigation channel from Columbia River Mile 3 to River Mile 145 (Bonneville Dam) and associated disposal of dredged materials in identified locations.

As part of ongoing Columbia River management discussions with the Corps, the State has been aware that the Corps' current practice of maintaining the channel involves disposing of materials in the "flowlane." The flowlane is defined in the City of Warrenton Comprehensive Plan, Goal 16, as the Federal Navigation Channel plus a 600-foot area on either side of the channel, which is designated for Aquatic Development uses, including dredged material disposal. Recently, the Oregon Department of Land Conservation and Development (DLCD) became aware that starting around 2010, the Corps' flowlane disposal practices were not consistent with the flowlane definition contained in City of Warrenton's policies. The Corps' stated intent was to adaptively manage sediments based on current river conditions (i.e., the thalweg) in a highly dynamic environment and keep sediments within the riverine sediment budget whenever feasible. However, because the "thalweg" is not fixed and changes based on riverine hydrology, there is a discrepancy with the fixed flowlane as defined in the City of Warrenton Comprehensive Plan. Within this larger area, described as the "thalweg," the Corps has placed dredged material at varying locations based on its analysis of flow conditions, hydrology, and sediment movement in a given year. While the Corps has asserted that their thalweg placement practice is consistent with Goal 16 of Oregon's Statewide Planning Goals to "protect the estuarine ecosystem, including its natural biological productivity, habitat, diversity, unique features and water quality," this practice is inconsistent with the estuary management zone designations in the City of Warrenton.

Once the State became aware of this disparity in flowlane disposal definitions, the State and the Corps initiated a series of discussions to identify an acceptable path forward to harmonize the Corps O&M actions with Columbia River estuary management policies without endangering critical maintenance of navigation in the lower Columbia River. As a result of those discussions, the Department of State Lands, as the administrative manager of state-owned submerged lands, has initiated this goal exception and plan amendment process with the entities that implement the Columbia River Estuary Management Plan, which includes the City of Warrenton.

Request

The Federal Navigation Channel is a 600-ft wide, 43-ft deep channel from River Mile 3 of the Columbia River to River Mile 145 in the Lower Columbia. Warrenton's jurisdiction over the Columbia River estuary is approximately between RM 8 and 13. The Columbia River Estuary includes the first approximately 40 miles of the river. The average volume of Corps in-water placement between RM 3 to 40 from Project maintenance dredging during the period 2020 to 2022 was 2 million cubic yards per year. The information summarized below focuses on the Corps' dredging and placement activities in relation to the City of Warrenton's estuary policies, which currently limit placement of flowlane disposal of dredged material to within 600 feet of either side the Columbia River FNC or the 20-foot bathymetric contour, whichever is closer to the channel. For the reasons described below, the Corps is unable to constrain its maintenance of the Projects to such a fixed, confined area. Therefore, DSL is requesting a goal exception to sustain continued maintenance of the FNC.

Specifically, this application seeks to modify the current definition of flowlane disposal within the City of Warrenton. The City's Comprehensive Plan states, "flowlane disposal sites shall only be allowed in Development Aquatic areas within or adjacent to a channel. The Development Aquatic area adjacent to the channel shall be defined by a line 600 feet from either side of the channel or the 20-foot bathymetric contour, whichever is closer to the channel."

DSL's request is to allow flowlane disposal within the river thalweg, which is the area contiguous to the FNC that is consistent with the 20-foot bathymetric contour. The Corps states that this expanded area would support the feasibility of its ongoing operations and maintenance of the FNC and features river velocities sufficient to move placed sediments downstream within the river's natural system without resulting in significant adverse environmental effects. Because the river thalweg is subject to continual change as fluvial hydrodynamics transport sediment into and out of the estuary system, DSL proposes a text-based definition of the expanded thalweg disposal area based on the factors above, which would be supported by maps of the projected thalweg location updated on a regular interval. Exhibits 1 and 2 provide maps of the proposed thalweg dredged material placement area along the entire Columbia River Estuary and within the City of Warrenton to support this application.

In addition to FNC maintenance, there are other users of the flowlane for dredged material. The US Army Corps Section 408 Program[1] protects federal infrastructure and prohibits other users from impairing the usefulness of the federally authorized FNC. Requests by non-federal users to place material under the Corps Section 408 program must also comply with Corps requirements for placement adjacent to the federal navigation channel. It is proposed that the expanded thalweg dredged material disposal area would be available to the Corps as well as all other dredging users.

The information provided below seeks to address the applicable criteria for a reasons exception to Goal 16.

Applicable Provisions

1. Oregon Revised Statutes: ORS 197.732, Goal exceptions
2. Oregon Administrative Rules:
    i. OAR 660-004-0000 Purpose
    ii. OAR 660-004-0020 Goal 2, Part II(c), Exception Requirements
    iii. OAR 660-004-0022 Reasons Necessary to Justify an Exception Under Goal 2, Part II(c)
3. Article 5 Columbia River Estuaries and Estuary Shorelands, Warrenton Comprehensive Plan
4. Applicable Sections of the City of Warrenton Development Code

[1] The US Army Corps of Engineers (USACE) Section 408 program allows another party, such as a local government, company, or individual, to alter a USACE Civil Works project, including the Federal Navigation Channel. https://www.usace.army.mil/Missions/Civil-Works/Section408/

Goal Exception

An exception to a Statewide Planning Goal can be adopted by a local jurisdiction when the four standards of Goal 2, Part II(c) are met. The Department of State Lands is requesting a "general" reasons exception using OAR 660-004-0022(1). The other types of goal exceptions or specific reasons exceptions are not applicable in this case. Below, DSL describes how each of the relevant criteria under OAR 660-004 are met.

OAR 660-004-0000 (2): An exception is a decision to exclude certain land from the requirements of one or more applicable statewide goals in accordance with the process specified in Goal 2, Part II, Exceptions. The documentation for an exception must be set forth in a local government's comprehensive plan. Such documentation must support a conclusion that the standards for an exception have been met. The conclusion shall be based on findings of fact supported by substantial evidence in the record of the local proceeding and by a statement of reasons that explains why the proposed use not allowed by the applicable goal, or a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use, should be provided for. The exceptions process is not to be used to indicate that a jurisdiction disagrees with a goal.

Finding: DSL is providing information necessary to meet the requirements of a goal exception as provided in this narrative and supporting documentation.

660-004-0020 Goal 2, Part II(c), Exception Requirements

(1) If a jurisdiction determines there are reasons consistent with OAR 660-004-0022 to use resource lands for uses not allowed by the applicable Goal or to allow public facilities or services not allowed by the applicable Goal, the justification shall be set forth in the comprehensive plan as an exception. As provided in OAR 660-004-0000(1), rules in other divisions may also apply.

(2) The four standards in Goal 2 Part II(c) required to be addressed when taking an exception to a goal are described in subsections (a) through (d) of this section, including general requirements applicable to each of the factors:

> *(a) "Reasons justify why the state policy embodied in the applicable goals should not apply." The exception shall set forth the facts and assumptions used as the basis for determining that a state policy embodied in a goal should not apply to specific properties or situations, including the amount of land for the use being planned and why the use requires a location on resource land*;

Finding: It is our understanding that the Corps' assessment of riverine processes and sediment movement based on bathymetric analyses and hydrodynamic models, along with published studies describing the benefits associated with retaining sediments in the riverine system (Mikhailova 2008, Kaminsky et al. 2010, Stark 2012, Allan 2002) has led to the conclusion that it is more environmentally beneficial to keep dredged material within the estuary river system

than it is to remove it and place it in areas where it would not be reintroduced into the river. Arguments to justify this reason for the goal exception follow below.

As it operates and maintains the FNC, the Corps has communicated that it must manage dredged sediment within the Federal standard (i.e., the least costly alternative, consistent with sound engineering practices, and meeting federal Clean Water Act Section 404 and Marine Protection, Research and Sanctuaries Act (aka Ocean Dumping Act) criteria). The Corps has stated that it is also obligated to manage dredged sediment to maximize its beneficial use, while avoiding (or minimizing) adverse effects to the environment and minimizing dredging requirements.

To achieve the above, Corps policy is to manage dredged material placement within the framework of Regional Sediment Management and Engineering with Nature.[2] Terrestrial sediment supply to the Lower Columbia River has been reduced due to floodplain development and hydro-regulation. The river's sediment supply is now finite and is managed to sustain the ecological health of the estuary.

Construction of dams and reservoirs within the Columbia River Basin during 1934-74 has altered the delivery and downstream movement of sediment from its headwaters to the Lower Columbia River, reducing sediment load into the river below Bonneville Dam (RM 145). Reduction of headwater sediment supply to the LCR can eventually lead to reduction of sediment volume transported from the LCR to the seacoast. Although the total volume of sandy sediment within the active LCR is vast, it is finite with respect to the river's present sediment transport capacity.

In a river where headwater sediment supply has been reduced, the carrying-capacity of the river thalweg to transport sediment will remain constant resulting in a sediment budget deficit for the river. To balance the river's transport capacity with its reduced external sediment supply, the river will source sediment from its in-river morphology (riverbanks and islands). As the river feeds on its own morphology, the displaced sediment is transported toward the thalweg where the sediment is then carried downstream leaving the adjacent morphology and other shallow areas in further sediment deficit. Some of the sediment is deposited within the FNC. Over time, erosion trends become manifest along riverbank areas, submerged morphology, and islands. Initially, the thalweg will remain stable as sediment displaced from other in-river sources acts to maintain the thalweg dynamics. But over time, the thalweg may widen & migrate as in-river sediment supply cannot keep pace with the river's transport capacity. In the later stages of a river's sediment deficit, the thalweg may deepen and become more unstable. These trends have occurred along various reaches of the LCR in different stages of development.

Because the volume of sand annually dredged within the LCR FNC is a sizable fraction of the sand volume annually transported within the entire river, it is important that dredged sand be placed back within the river thalweg where it can sustain the thalweg sediment budget. Some of the relocated sediment will be re-distributed to adjacent river morphology, some of it will

[2] https://experience.arcgis.com/experience/008394d6b24944f0af4499a1511e7b85/

continue moving within the thalweg, and some of the replaced sediment will be deposited within the FNC. The Corps understands that thalweg placement of dredged sand will result in re-dredging some of the sediment over the long-term, but this balanced approach (of thalweg sediment placement) is needed to sustain the river's sediment budget, its morphology, and enable eventual downstream progression of river sediment to the ocean.

The Corps has stated that it has the following options for dredged material placement: upland placement, in-water (flowlane) placement, transfer/rehandle sites, beach nourishment, or ocean placement. Alternatives other than placement of dredged material in the thalweg that were considered were: placement of dredged material in the currently defined flowlane (FNC channel plus 600ft on either side); upland disposal in areas already designated for that purpose; ocean disposal; and a combination of these options. Placement of material in these locations would not require a goal exception but are not feasible for the Corps because of the reasons discussed below.

Current Challenges

The proposed action to create a thalweg-based flowlane disposal area would occur within areas currently zoned as Aquatic Conservation and potentially areas zoned as Aquatic Natural under Statewide Planning Goal 16's three-tiered zoning system, where the disposal of dredged material is not allowed. City of Warrenton's Goal 16 estuary policy Section 5.305(10) limits flowlane placement of dredged material to within 600 feet of the Columbia River federal navigation channel (FNC) or the 20-foot bathymetric contour, whichever is closer to the channel. In most cases, the 20-foot bathymetric contour is further away from the FNC than the 600-foot line. Therefore, DSL is seeking a goal exception to delete the modifier "whichever is closer to the channel" for purposes of disposal of dredged material in the flowlane.

The Corps has stated that the current in-water designated locations (aquatic development zones) allowed for dredged material disposal in City of Warrenton are insufficient for the amount of material dredged from the river annually. If the Corps elected to follow the current policies for flowlane placement (within 600 feet of the FNC), they assert that the thalweg's sediment budget would be reduced and would compromise the river's morphology. Instituting flowlane-confined placement of dredged sediment, as specified in current local policies, would increase the amount of sediment directly contributing to FNC shoaling and reduce opportunity to sustain the LCRE sediment budget, as compared with the requested thalweg placement.

The Corps has stated that the areas currently designated for flowlane placement under existing City of Warrenton policies would:

a) Curtail the Corps' ability to re-introduce dredged sediment along the river's thalweg, compromising the thalweg's sediment budget and resilience of LCRE morphology.
b) Increase the seasonal dredging effort needed to maintain the FNC, as the flowlane-confined dredged material would more quickly return to the FNC.

c) Increase shoal encroachment within the FNC during and between dredging seasons, resulting in ship draft restrictions.

The entire annual volume of dredged sediment that is typically placed along/within the river thalweg is estimated to be approximately 1 million cubic yards per year. If this amount were constrained to within the current City of Warrenton definition of the flowlane, it would directly feed sediment to shoaling pathways adjacent to and within the FNC, progressively loading up the supply of shoaling material each year. Dredged sediment placed within the flowlane would not contribute to the sediment budget within the overall thalweg, reducing the supply of sediment needed to sustain the river's morphology. Alternatively, up to 1 million cubic yards per year of LCRE dredged sediment would be placed in the ocean deep water site offshore of the Mouth of the Columbia River (MCR), permanently removing it from the LCRE/MCR sediment budget.

The Corps states that adverse effects of flowlane-confined placement under current policies would be realized within 1-2 years, as sediment shoaling within the FNC would increase as compared to the present thalweg placement practices. FNC shoaling effects would accrue through time as currently defined flowlane-confined placement continued.

The Corps states that its ability to address increased FNC shoaling is constrained by equipment availability and funding. There would not be sufficient dredging capacity (equipment) available to clear the FNC and accommodate a consistent increased volume of shoaling due to placement within the currently defined flowlane, even if federal funds were increased. The resulting adverse consequences would be draft restrictions on Lower Columbia River deep-draft commerce currently valued at $23 billion per year.

After completing a given dredging season, the FNC would be encroached by increased sediment shoaling before onset of the next year's dredging season, also resulting in draft restrictions. The Corps states that significant adverse economic impacts would occur if the high-use, deep-draft FNC is not maintained, and the impact on states outside the project area if the project is not dredged would be significant because this dredging supports international exports from at least eleven states in the region. Vessels drafting the full authorized channel depth of 43 feet annually carried approximately 20.5 million tons of export shipments worth nearly $5.6 billion (USACE Waterborne Commerce Statistics Center average FY18 to FY20). A one-foot draft restriction will disrupt or delay this traffic because all the ships are loading with an assumption of a draft of 43 feet. Economic losses increase exponentially with increased draft restriction severity.

The Corps states that based on the river hydraulic and sediment transport processes at work and the collective experience of their subject matter experts, restricting dredged material placement in the Lower Columbia River Estuary to the confines of the City's existing flowlane placement area would result in rapid increases in FNC shoaling and a reduction of the thalweg's sediment budget. The Corps has also identified operational effects to the FNC. **Table 1** below outlines some of the key effects anticipated if the current City of Warrenton definition of the allowable flowlane placement area were to be applied to the Corps' current operations.

Explanation of Table 1 Qualitative Estimates (provided by the Corps): The following estimates are based on the relative change that is expected to occur if the Corps were to switch from its current practice of thalweg-based placement to City of Warrenton-defined flowlane placement.

- The rationale for estimating changes in thalweg sediment budget is that those areas within the flowlane will fill up during the short-term scenario, while the thalweg area outside the flowlane will have diminished sediment placement and experience a sediment budget deficit.
- The morphology change is directly related to thalweg sediment budget change.
- The FNC shoaling values assume that it takes some time for additional material placed in the flowlane to migrate into the FNC: The placed sediment will quickly accrue within the flowlane and end up in the FNC.
- The dredging volume represents a portion of FNC shoaling volume that becomes shallow enough to require dredging.
- Ship draft restrictions are based on additional time required to remove increased dredge volumes and limited dredge availability timing. Draft restrictions on the Columbia Snake River System compound quickly and cost stakeholders millions of dollars, affect millions of tons of cargo and future business, and have rippling impacts throughout the economy.
- If additional dredges become available, the Corps assumes cost increases linearly with dredge volume in the short term, but would increase significantly under the long-term scenario, with an additional hopper dredge mobilizing annually from the Gulf or East Coast.
- Note: “Short-term effects” are defined as a period of 1-2 years of constrained operations within currently defined flowlane placement area. “Long-term Effects” are defined as constrained operations within currently defined flowlane placement area for the foreseeable future.

Table 1. Summary of anticipated effects of changing placement actions in the Lower Columbia River from thalweg-based to flowlane-confined.

Factors Affected by Changing Placement Constraints	Short-term Effects	Long-term Effects
Thalweg sediment budget	50-100% reduction	100% reduction
Morphology change affecting thalweg & adjacent areas	localized minor-moderate degradation	reach-wide moderate-severe degradation
FNC shoaling volume	20-50% increase	50-100% increase
Dredging volume	10-30% increase	30-80% increase
FNC ship draft restrictions	2-5 days +	5-20 days +
Threat to LCR port viability	YES	YES
Dredging costs, assuming more dredges became available	10-30% increase	30-200% increase

*These effects are for illustration only and show what would occur if the Corps discontinued its existing thalweg placement practice and elected to follow the more restrictive flowlane-confined placement.

In addition to FNC maintenance, there are other users of the flowlane for dredged material. The US Army Corps Section 408 Program[3] protects federal infrastructure and prohibits other users from impairing the usefulness of the federally authorized FNC. Requests by non-federal users to place dredged material under the Corps Section 408 program must also comply with Corps requirements for placement adjacent to the FNC. As a result, there are other users who have been prohibited by the Corps from disposing of dredged material within the currently defined flowlane area because of concerns about impairment of the FNC.

Proposed Flowlane Thalweg Expansion

The overall purpose of Goal 16 is "to recognize and protect the unique environmental, economic, and social values of each estuary and associated wetlands; and to protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries."

The Corps considers the thalweg to be the "action area" and includes the FNC out to the 20-ft depth contours on both sides of the FNC; this is where the river is moving most of the bed load sediment during the year. The river's thalweg is also where mobilized sediments interact with the river's morphology before migrating downslope toward the deepest part of the thalweg and into the FNC. The Corps has stated that its in-water placement practices strive to emulate natural processes by placing dredged sediment within the river's thalweg to allow sediments to be re-distributed back onto the river's morphology, sustaining the river's sediment budget, and maintaining habitats that rely onsediment.

[3] The US Army Corps of Engineers (USACE) Section 408 program allows another party, such as a local government, company, or individual, to alter a USACE Civil Works project, including the Federal Navigation Channel. https://www.usace.army.mil/Missions/Civil-Works/Section408/

The Corps states that the proposed expansion of the flowlane dredged material placement area within the river thalweg avoids the rapid return of dredged material to the FNC while facilitating reintroduction of dredged material into the river system and maintaining habitat complexity within the river system. Placing material in the thalweg keeps material in the river to stabilize the riverbed and protect habitat. Removing material to uplands or the ocean would remove that sediment from the system and the riverbed and habitat would degrade. The Corps asserts that if this proposal is not adopted, the river will "eat itself alive" and will begin to lose islands, tidal shoals, lagoons, and the living resources that depend on that river morphology. Islands also help the Corps maintain the thalweg and keep the navigation channel stable.

The proposed expanded flowlane disposal area between River Mile (RM) 3 to 44 encompasses approximately 23,000 acres across both Oregon and Washington. Of that, approximately 2,300 acres would be used for Corps in-water dredge material placement annually, or about 10% of the expanded flowlane disposal area. This estimate does not include estimates of future placement by non-Corps users (e.g., Port of Astoria and US Coast Guard) via Corps permits.

The Corps states that their decision-making process for choosing placement areas within the river thalweg is based on the following priorities:

- To not harm living resources,
- To not adversely affect other uses of the river,
- To sustain the thalweg, and
- To not rapidly return sediment to the FNC.

The river continuously relocates the dredged sediment placed in-water each year. Placement areas within the expanded thalweg area would be specified based on an applied understanding of hydrodynamic and sediment transport processes, informed by bathymetric depth surveys and river current velocity data from the Corps' Lower Columbia River adaptive hydraulics model. The placement location must be deep enough for the dredge or scow to safely access based on that vessel's draft below the water surface. Velocity data and bathymetric differencing and evaluation of bedforms can inform sediment movement after placement, to minimize movement into FNC shoals and support movement into areas to counteract riverbed erosion. The estuary and its habitats are dynamic, and sediment is constantly redistributing itself based on tides, currents, flow conditions, currents, and other environmental changes (Jay et al. 2015[4], Marcoe and Pilson 2017[5], Talke et al. 2020[6]). Beneficial placement of dredged material retains sediments in the river system that are essential for maintaining shorelines and habitat complexity.

> *(b) "Areas that do not require a new exception cannot reasonably accommodate the use". The exception must meet the following requirements:*

[4] https://doi.org/10.1007/s12237-014-9819-0
[5] https://doi.org/10.1007/s11852-017-0523-7
[6] https://doi.org/10.1029/2019JC015656

(A) The exception shall indicate on a map or otherwise describe the location of possible alternative areas considered for the use that do not require a new exception. The area for which the exception is taken shall be identified;

(B) To show why the particular site is justified, it is necessary to discuss why other areas that do not require a new exception cannot reasonably accommodate the proposed use. Economic factors may be considered along with other relevant factors in determining that the use cannot reasonably be accommodated in other areas. Under this test the following questions shall be addressed:

> *(i) Can the proposed use be reasonably accommodated on nonresource land that would not require an exception, including increasing the density of uses on nonresource land? If not, why not?*
>
> *(ii) Can the proposed use be reasonably accommodated on resource land that is already irrevocably committed to nonresource uses not allowed by the applicable Goal, including resource land in existing unincorporated communities, or by increasing the density of uses on committed lands? If not, why not?*
>
> *(iii) Can the proposed use be reasonably accommodated inside an urban growth boundary? If not, why not?*
>
> *(iv) Can the proposed use be reasonably accommodated without the provision of a proposed public facility or service? If not, why not?*

(C) The "alternative areas" standard in paragraph B may be met by a broad review of similar types of areas rather than a review of specific alternative sites. Initially, a local government adopting an exception need assess only whether those similar types of areas in the vicinity could not reasonably accommodate the proposed use. Site specific comparisons are not required of a local government taking an exception unless another party to the local proceeding describes specific sites that can more reasonably accommodate the proposed use. A detailed evaluation of specific alternative sites is thus not required unless such sites are specifically described, with facts to support the assertion that the sites are more reasonable, by another party during the local exceptions proceeding.

Finding:

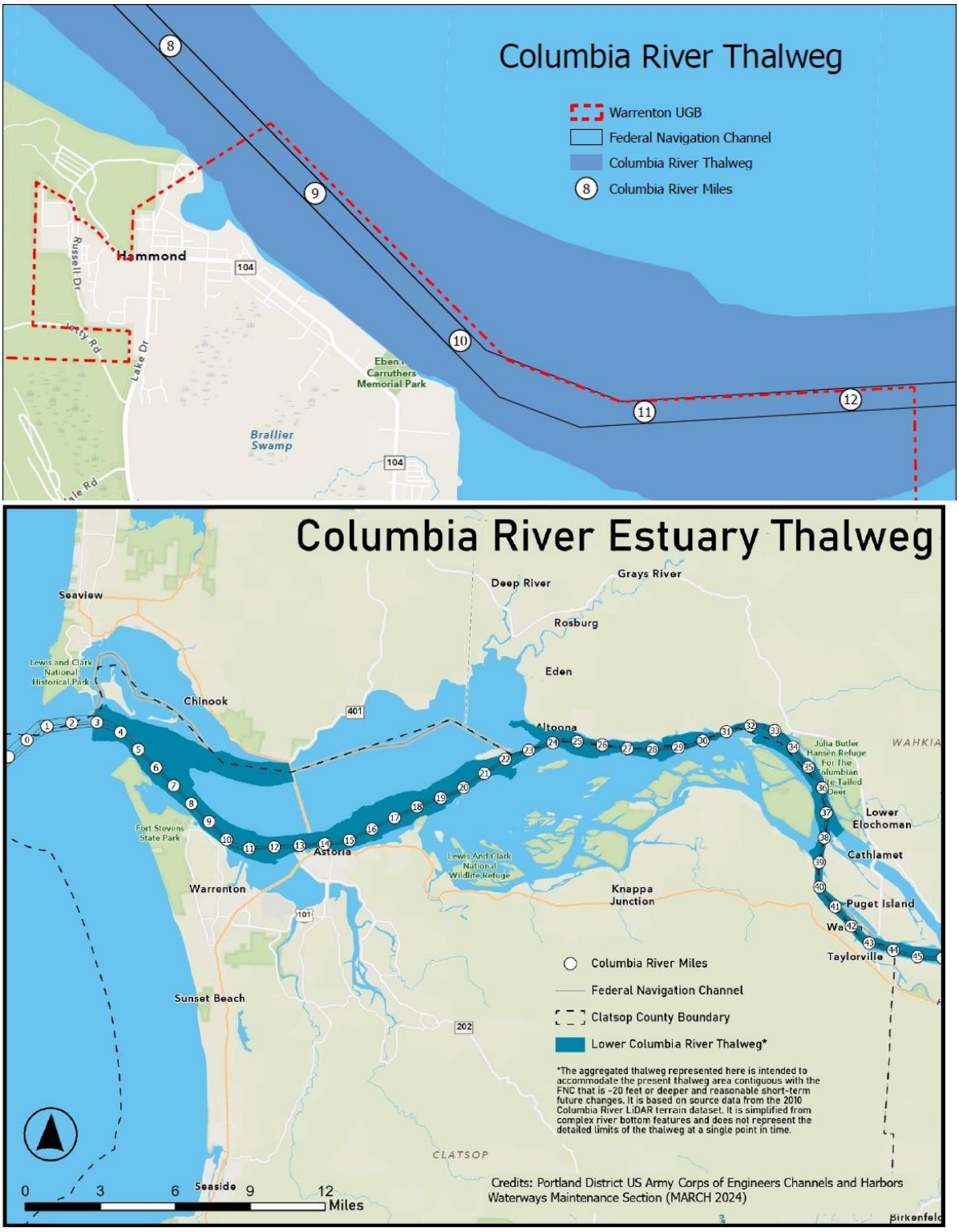


Figure 1 Proposed thalweg for flowlane placement of dredged material in City of Warrenton Urban Growth Boundary and for the whole Columbia River Estuary.

The proposed goal exception application is both within and outside of urban growth boundaries for Warrenton and Astoria as it encompasses the entirety of the Columbia River Estuary[7], it covers resource lands as defined by Clatsop County, since flowlane disposal is already allowed on nonresource lands (aka Aquatic Development) and the application does not include public facilities or services.

"Areas that do not require a new exception cannot reasonably accommodate the use": The Corps has stated that it has five options for dredged material placement: upland placement, in-water (flowlane) placement, transfer/rehandle sites, beach nourishment, or ocean placement. Alternatives other than placement of dredged material in the thalweg that were considered for purposes of this application were: 1) placement of dredged material in the currently defined flowlane (FNC channel plus 600ft on either side); 2) placement of dredged material in designated "Aquatic Development" zones; 3) placement of dredged material outside of the Columbia River Estuary Management Plan; 4) upland disposal in areas already designated for that purpose; and 5) ocean disposal. Placement of material in any of these locations would not require a goal exception but are not feasible for the Corps because of the reasons discussed below.

1) *Placement of dredged material in the currently defined flowlane (FNC channel plus 600ft on either side):* The current flowlane disposal allowance under City of Warrenton policies is considered Aquatic Development zoning, which is nonresource land. The Corps states that there is not sufficient capacity within the Lower Columbia River Estuary (LCRE) flowlane to accept the entire annual volume of dredged sediment that is typically placed along/within the river thalweg. Overuse of flowlane areas by an estimated 1 million cubic yards per year would directly feed sediment to shoaling pathways adjacent to and within the FNC, progressively loading up the supply of shoaling material each year. Dredged sediment placed within the flowlane would not contribute to the sediment budget within the overall thalweg, reducing the supply of sediment needed to sustain the river's morphology. Alternatively, up to 1 million cubic yards per year of LCRE dredged sediment would be placed in the ocean deep water site offshore of the Mouth of the Columbia River (MCR), permanently removing it from the LCRE/MCR sediment budget.

2) *Placement of dredged material in designated "Aquatic Development" zones*: The Corps has stated that the current in-water designated locations (aquatic development zones, considered nonresource lands) allowed for dredged material disposal in Warrenton, Astoria, and Clatsop County are insufficient for the amount of material dredged from the river annually. If the Corps elected to follow the current policies for flowlane placement (within 600 feet of the FNC), they assert that the thalweg's sediment budget would be reduced and would compromise the river's morphology. Instituting flowlane-confined placement of dredged sediment, as specified in current local policies, would increase the amount of sediment directly contributing to FNC

[7] Estuaries extend upstream to the head of tidewater, except for the Columbia River estuary, which, by definition, is considered to extend to the western edge of Puget Island. OAR 660-017-0005.

shoaling and reduce opportunity to sustain the LCRE sediment budget, as compared with the requested thalweg placement.

3) *Placement of dredged material outside of the Columbia River Estuary Management Plan:* The aquatic zoning for estuary waters does not apply in areas upstream of western edge of Puget Island and there are no restrictions on placement of dredged material in the water. The Corps believes there is no capacity available for an additional 1 million cubic yards of material upstream of Clatsop County. There is only one hopper dredge seasonally available in the Columbia River which may be physically capable of pumping material upland, but the additional placement time to stop dredging and pump out each load of material would take the dredge twice as long to remove shoals compared with the proposed amendment for in-water placement.

4) *Upland disposal in areas already designated for that purpose:* Upland placement is not a viable option for material that would otherwise be placed in the thalweg. Upland placement requires local Ports to have or acquire land interests and, as of yet, there have been no lands designated for this purpose in the foreseeable future. Where upland placement is practiced elsewhere in the LCRE/MCR, shoaling occurs in close enough proximity to negate the need for costly material rehandling. Thus, any newly identified placement sites would have to occur within sufficient radius of shoaling to facilitate a pipeline and pump-ashore action, further limiting the selection of sites suitable for upland placement. From an operational standpoint, there is only one hopper dredge seasonally available in the Columbia River which may be physically capable of pumping material upland, but the additional placement time to stop dredging and pump out each load of material would take the dredge twice as long to remove shoals compared with the proposed amendment for in-water placement.

5) *Ocean disposal:* Transporting dredged sediments to the ocean removes those sediments from the estuary system and can contribute to a sediment deficit that may increase erosion of the inner deltas and lead to habitat degradation (Kaminsky et al., 2010). If up to 1 million cubic yards per year of LCRE dredged sediment were placed in the ocean deep water site offshore of the MCR, that material would be permanently removed from the LCR/MCR sediment budget. Use of the ocean disposal site is also not operationally feasible from the Corps' standpoint because the round-trip for a dredging vessel would average greater than 40 miles. Thus, the additional transportation time would equate to more than double the time being needed to complete channel maintenance activities compared with the proposed request to place the material within the thalweg. The Corps would be unable to completely address shoaling in this reach due to these transportation delays.

> *(c) "The long-term environmental, economic, social and energy consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site." The exception shall describe: the characteristics of each alternative area considered by the jurisdiction in which an exception might be taken, the typical advantages and*

disadvantages of using the area for a use not allowed by the Goal, and the typical positive and negative consequences resulting from the use at the proposed site with measures designed to reduce adverse impacts. A detailed evaluation of specific alternative sites is not required unless such sites are specifically described with facts to support the assertion that the sites have significantly fewer adverse impacts during the local exceptions proceeding. The exception shall include the reasons why the consequences of the use at the chosen site are not significantly more adverse than would typically result from the same proposal being located in areas requiring a goal exception other than the proposed site. Such reasons shall include but are not limited to a description of: the facts used to determine which resource land is least productive, the ability to sustain resource uses near the proposed use, and the long-term economic impact on the general area caused by irreversible removal of the land from the resource base. Other possible impacts to be addressed include the effects of the proposed use on the water table, on the costs of improving roads and on the costs to special service districts;

Finding: DSL is requesting a goal exception to place dredged sediment within the thalweg of the Columbia estuary (the 20-foot bathymetric contour and deeper that is contiguous with the FNC), in areas that under current zoning do not allow for the disposal of dredged material.

The Corps asserts that the environmental analyses and consultations it has performed over its years of maintenance of the FNC[8] support a number of conclusions about the effects of dredged material disposal within the Lower Columbia River Estuary, including within the areas proposed for expanded thalweg disposal.[9,10] Allowing dredged material disposal placement in the thalweg emulates the process of river morphology evolution that naturally occurs within the thalweg. Thalweg-based placement sustains river morphology and shorelands that are essential for water dependent uses, while maintaining the viability of the deep-draft FNC.[11] The

[8] 1998 Dredged Material Management Plan and Supplemental Environmental Impact Statement Columbia and Lower Willamette River Federal Navigation Channel; 1999 Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement; 2003 Columbia River Channel Improvement Project Final Supplemental Integrated Feasibility Report and Environmental Impact Statement; 2014 Columbia River Federal Navigation Channel Operations and Maintenance Dredging and Dredged Material Placement Network Update, River Miles 3 to 106.5, Washington and Oregon Final Environmental Assessment.

[9] 2012 Biological Opinion prepared by NOAA-NMFS is based on a definition of the action as follows: "The maintenance activities generally use flowlane sites from 20 to 65 feet in depth with occasional exceptions when disposal may occur in flowlane sites greater than 65 feet in depth."

[10] 2014 Columbia River Federal Navigation Channel Operations and Maintenance Dredging and Dredged Material Placement Network Update, River Miles 3 to 106.5, Washington and Oregon Final Environmental Assessment states: "In-water placement typically occurs adjacent to the FNC at depths between 35 to 65 ft, with occasional exceptions where geologic features situated throughout the Columbia River constrain the channel and require in-water placement in water depths as shallow as 20 ft or deeper than 65 ft. Currently, in-water placement of dredged material occurs within the CR FNC flowlane, adjacent to the CR FNC, or at Harrington Point Sump from RM 20 to 22."

[11] Lower Columbia River Sand Supply and Removal Estimates of Two Sand Budget Components. William J. Templeton and David A. Jay, Ph.D. JOURNAL OF WATERWAY, PORT, COASTAL, AND OCEAN ENGINEERING © ASCE / SEPTEMBER/OCTOBER 2013. https://doi.org/10.1061/(ASCE)WW.1943-5460.0000188.

present river morphology acts to stabilize the thalweg and provides for ecological substrate for the long-term protection and conservation of natural resources. Corps management of dredged material does not degrade the riverbed morphology, substrate, nor adversely affect water dependent uses of the estuary (Ashley 1980; Madej 1999; Kaminsky et al. 2010). Corps management of dredged river sediments sustains the sandy morphology of the coastal margin along Clatsop Plains and Long Beach Peninsula. River sediment dredged from the FNC is managed to emulate the natural downstream movement of river sediment to the estuary's ocean entrance, where much of the sediment is then transported to the coastal margin adjacent to the mouth of the Columbia River, feeding the coastal sediment budget. These benefits of thalweg placement align with the purpose of Statewide Planning Goal 17 Coastal Shorelands.

Placing sediments in deep offshore sites, in conjunction with lower flows and discharge rates that have decreased suspended sediment runoff into the nearshore, have ultimately removed sediments from the Columbia River littoral system that nourishes the nearshore and sustains the beaches of both Washington and Oregon (Mikhailova 2008, Kaminsky et al. 2010, Stark 2012, Allan 2002). The Corps' dredged material management practices in the MCR and LCRE have evolved to focus on retaining sediments in the system and relying less on ocean disposal when in-river placement options are available.

When disposing of dredged materials, the Corps implements best management practices to minimize effects to water quality, including sediment sampling, water quality monitoring, and turbidity monitoring and minimization measures. The Best Management Practices are further defined in the Determination of Compatibility, included as Exhibit 7.

Corps placement does not add to the contamination burden of the Columbia River, nor would it mobilize hazardous materials in the water column. Sediments were sampled and determined to be suitable for unconfined aquatic placement and exposure (Exhibit 4 PSET Documentation). The Corps performs regular dredged material evaluations in the FNC to determine whether sediments are suitable for unconfined in-water placement or exposure, according to the requirements of the Clean Water Act (CWA) or the Marine Protection, Research and Sanctuaries Act (MPRSA), as appropriate. The Corps characterizes sediments present within proposed dredge areas in accordance with national dredged material testing manual protocols (Ocean Testing Manual), Inland Testing Manual, and by using the Sediment Evaluation Framework for the Pacific Northwest (SEF). The Corps, as lead member of the regional Portland Sediment Evaluation Team (PSET), evaluates the discharge of dredged material through the SEF. The Oregon Department of Environmental Quality is also a member of PSET. This framework is based on applicable provisions of CWA Section 404 or MPRSA Section 103. A summary of the most recent results and suitability determinations for locations within Clatsop County (including within Warrenton) is below:

- Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5): A total of 59 stations were sampled within this area. All sediment samples consisted of more than 97 percent coarse-grained sediments (gravel and sand) suitable

for unconfined, aquatic placement. The total organic carbon (TOC) results for all samples is less than 0.2%.

- Skipanon FNC: Dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%) suitable for unconfined, aquatic placement. TOC in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.
- Tongue Point FNC: The outer shoal dredge prism was 96.4% sand and the inner shoal averaged 46.9% sand, 45.7% silt, and 7.3% clay suitable for unconfined, aquatic placement.

The Corps will continue to sample and evaluate sediment periodically in the future in accordance with the SEF. Dredged material would only be placed in water after the Corps, in coordination with PSET, determines that sediments are suitable for unconfined aquatic placement and unconfined aquatic exposure, in accordance with the SEF. Sediments that are tested and deemed to be unsuitable (that is, not suitable for unconfined in-water placement) would not be placed in water but would instead be placed in upland sites.

Past monitoring, both instrument and visual, has shown that turbidity quickly dissipates because the dredged material is predominately sand.[12] Placement only occurs in areas that are deeper than 20 feet where little to no benthic productivity is occurring and where fish may migrate but would avoid any dredged material placement activity. Any juvenile fish in the general vicinity would be closer to the shoreline. The most recent dredged material suitability determinations are included as Exhibit 4.

The City's current policies for flowlane material disposal requires placing dredged sediments atop existing shoals, excessively rehandling material, or placing a greater emphasis on land and ocean disposal that removes sediments from the river system. The Columbia River sediment budget is already imbalanced (there is a sediment supply deficit with respect to river transport capacity)—see the erosion and loss of Fitzpatrick Island in Clatsop County. A flowlane placement requirement consistent with the current City definition would load up material in the FNC as sources of shoal material continue to migrate from the shoulders of the river beyond 600 feet from FNC.

As previously described, the loss of sediment from the thalweg beyond 600 feet from the FNC would cause increased degradation of riverbed morphology, including shallow water habitat, sandbars, riverbanks, and islands. A contrasting scenario for comparison would be to place up to 1 million cubic yards per year on land or in the ocean instead of in the thalweg. This scenario removes additional sediment from the system and ultimately the coastal margin. The Corps only transports dredged material to the ocean if there is no capacity for the material to be placed beneficially within the river sediment budget. For the reasons described above, Corps'

[12] Source: Annual reports provided by USACE to ODEQ as condition of 401 certification (main channel meter-based monitoring from 2005 until 2014 and then visual monitoring thru 2023 and side channel meter-based monitoring thru 2023). Letter from USACE to ODEQ 10 May 2006 providing supporting documents for 401 certification amendment as requested by ODEQ.

thalweg placement practices are beneficial to Columbia River estuary morphology and ecology. The loss of sediment from the thalweg beyond 600 feet from FNC would cause decreased riverbed morphology, including projected losses of shallow water habitat, sandbars, riverbanks, and islands (i.e., see Exhibit8)

The Corps contracted with several external partners to explicitly evaluate the potential effects of dredging and placement on the benthic environment. Studies investigating the entrainment risk to Dungeness crab across multiple age classes found that crab abundance was highly correlated with salinity and the risk of entrainment for crabs age 2+ to 3+ in summer decreased exponentially as you move upstream, such that locations above the Astoria Bridge had rates that were less than 6% of those noted at the MCR (Pierson et al. 2002[13]; Pierson et al. 2005[14]). In assessing the effects of sediment deposition on Dungeness crab and other epifauna based on lab studies, empirical data collected using video sleds, and models, the collective body of evidence suggests that burial of 10 cm or less has only a nominal effect on crabs and other species (Vavrinec et al. 2007[15]; Roegner and Fields 2015[16]); there don't appear to be significant, adverse, long-term effects to the epibenthic community at large (Fields et al. 2019[17]; Roegner et al. 2021[18]); and crabs that may be dislodged by the lateral surge of material plume typically return to areas within 10 minutes (Roegner et al. 2021). An evaluation of potential effects to white sturgeon similarly found no direct adverse effects, with some indication that some individuals are attracted to disposal areas in the short-term (Parsley et al. 2011[19]). In the Corps' most recent consultation with NMFS evaluating the potential effects of placement activities at seven material transfer sites in the flowlane adjacent to the FNC, NMFS

[13] Pearson W.H., G.D. Williams, and J.R. Skalski. 2002. Estimated Entrainment of Dungeness Crab During Dredging for The Columbia River Channel Improvement Project Richland, WA: Pacific Northwest National Laboratory. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-14129.pdf.

[14] Pearson W.H., G.D. Williams, and J.R. Skalski. 2005. Dungeness Crab Dredging Entrainment Studies in the Lower Columbia River, 2002 – 2004: Loss Projections, Salinity Model, and Scenario Analysis Richland, WA: Pacific Northwest National Laboratory. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-15021.pdf.

[15] Vavrinec J., W.H. Pearson, N.P. Kohn, J.R. Skalski, C. Lee, K.D. Hall, and B.A. Romano, et al. 2007; Laboratory Assessment of Potential Impacts to Dungeness Crabs from Disposal of Dredged Material from the Columbia River Richland, WA: Pacific Northwest National Laboratory. https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-16482.pdf.

[16] Roegner, G. C. and S. A. Fields. 2015. Mouth of the Columbia River Beneficial Sediment Deposition Project: Benthic Impact Study 2014. Report of the National Marine Fisheries Service to the U.S. Army Corps of Engineers. Portland, Oregon.

[17] Fields, S., Henkel, S., & Roegner, G. C. 2019. Video sleds effectively survey epibenthic communities at dredged material disposal sites. Environmental monitoring and assessment, 191, 1-25.

[18] Roegner, G. C., Fields, S. A., & Henkel, S. K. 2021. Benthic video landers reveal impacts of dredged sediment deposition events on mobile epifauna are acute but transitory. Journal of Experimental Marine Biology and Ecology, 538, 151526.

[19] Parsley, Michael J., Popoff, Nicholas D. and Romine, Jason G. 2011. Short-Term Response of Subadult White Sturgeon to Hopper Dredge Disposal Operations, North American Journal of Fisheries Management, 31: 1, 1 — 11, First published on: 06 February 2011 (iFirst) DOI: 10.1080/02755947.2010.549033 URL: http://dx.doi.org/10.1080/02755947.2010.549033.

included a table in their opinion that estimated the percentage of the flowlane subject to dredging and placement activities below 20-ft depth relative to the overall area of the flowlane and estimated that the area of habitat potentially affected ranged from 0-15.2%, with an average of roughly 9% per reach (NMFS 2023[20]). NMFS ultimately concluded that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SR steelhead or destroy or adversely modify their designated critical habitat (NMFS 2023). NMFS also concurred with the Corps that adverse effects to green sturgeon and eulachon were unlikely (NMFS 2023).

Other areas requiring a goal exception for in-water dredged material disposal: The Corps has stated that areas shallower than 20 feet would not be appropriate to accommodate this in-water dredged material disposal use because the effects would be greater in those areas than in the proposed thalweg area. Areas shallower than 20 feet would be dredge-equipment limited and would not be consistent with the consultations the Corps has conducted with the NOAA NMFS. Changes to shallow water habitat in the LCRE, specifically vegetated shallows and tidal swamps, raise concerns about potential adverse effects to habitat that is particularly important for migrating juvenile salmonids (Kukulka and Jay 2003a, 2003b, Fresh 2005, NMFS 2012). The existing Biological Opinion (BiOp) issued by the National Marine Fisheries Service in accordance with the Endangered Species Act (ESA) also places strict limitations on shallow water placement of dredged material and any proposal to place material in this zone would require new ESA consultation for potential effects to fish and other aquatic species not considered under the existing BiOp (NMFS 2012). Lastly, dredge-equipment limitations in this particular stretch of the Columbia River would not allow for material placement in areas shallower than 20 feet.

> *(d) "The proposed uses are compatible with other adjacent uses or will be so rendered through measures designed to reduce adverse impacts." The exception shall describe how the proposed use will be rendered compatible with adjacent land uses. The exception shall demonstrate that the proposed use is situated in such a manner as to be compatible with surrounding natural resources and resource management or production practices. "Compatible" is not intended as an absolute term meaning no interference or adverse impacts of any type with adjacent uses.*

Finding: This exception application would include approximately 38 river miles within the Columbia River Estuary. The overall purpose of Conservation units is to preserve long-term uses of renewable resources that do not require major alteration of the estuary, except for the

[20] NMFS. 2023. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower Columbia River Federal Navigation Channel Dredged Material Transfer Sites (HUC170800060500, 170800030900, 170800030200). NMFS Consultation No. WCRO-2022-02520. 16 February 2023. https://doi.org/10.25923/djwp-c334.

purpose of restoration. Areas directly adjacent to the proposed flowlane expansion area, toward the FNC, would be within the current definition of the flowlane, where dredged material disposal is already a permitted use. Those adjacent areas farther away from the FNC would be shallower than 20-ft where it is unlikely that placed sediments in the deeper areas would accumulate. Within the proposed flowlane expansion area, the Corps would take measures to reduce adverse impacts to water quality or benthic habitat suitability, as further described below.

Corps placement of dredged sediment within the thalweg of the Columbia estuary emulates the process of morphology evolution that naturally occurs within the thalweg. Thalweg-based placement sustains river morphology and shorelands that are essential for water dependent uses, while maintaining the viability of the deep-draft FNC. The present river morphology acts to stabilize the thalweg and provides for ecological substrate for the long-term protection and conservation of natural resources.[21] Corps management of dredged material does not degrade the riverbed morphology, substrate, nor adversely affect water dependent uses of the estuary.[22] Corps management of dredged river sediments sustains the sandy morphology of the coastal margin along Clatsop Plains and Long Beach Peninsula. River sediment dredged from the FNCs is managed to emulate the natural downstream movement of river sediment to the estuary's ocean entrance, where much of the sediment is then transported to the coastal margin adjacent to the mouth of the Columbia River feeding the coastal sediment budget.[23]

The Corps implements best management practices to minimize effects to water quality, including sediment sampling, water quality monitoring, and turbidity monitoring and minimization measures. Sediments were sampled and determined to be suitable for unconfined aquatic placement and exposure (please see prior discussion of sediment testing and the PSET Report in Exhibit 4). Corps placement does not add to the contamination burden of the Columbia River, nor would it mobilize hazardous materials in the water column.[24] Past monitoring, both instrument and visual, has shown that turbidity quickly dissipates because the dredged material is predominately sand.[25] Placement only occurs in areas that are deeper than 20 feet where little to no benthic productivity is occurring and where fish may migrate but

[21] Lower Columbia River Sand Supply and Removal Estimates of Two Sand Budget Components. William J. Templeton and David A. Jay, Ph.D. JOURNAL OF WATERWAY, PORT, COASTAL, AND OCEAN ENGINEERING © ASCE / SEPTEMBER/OCTOBER 2013.

[22] See other citations provided re: riverbed morphology stabilization, sediment quality, benthics, and coordination.

[23] Mikhailova 2008, Kaminsky et al. 2010, Stark 2012, Allan 2002.

[24] The most recent dredged material suitability determinations are included as JPA Attachment C and summarized on JPA page 8.

[25] Source: Annual reports provided by USACE to ODEQ as condition of 401 certification (main channel meter-based monitoring from 2005 until 2014 and then visual monitoring thru 2023 and side channel meter-based monitoring thru 2023). Letter from USACE to ODEQ 10 May 2006 providing supporting documents for 401 certification amendment as requested by ODEQ.

would avoid any dredged material placement activity.[26] Most juvenile fish in the general vicinity are anticipated in shallow water habitat and closer to the vegetated shoreline. [27]

(3) If the exception involves more than one area for which the reasons and circumstances are the same, the areas may be considered as a group. Each of the areas shall be identified on a map, or their location otherwise described, and keyed to the appropriate findings.

Finding: Exhibit 1, Columbia Estuary Thalweg Map, describes the expanded geographic area that is proposed to be designated for flowlane disposal. Exhibit 2 shows the map for the area within the Urban Growth Boundary of the City of Warrenton. The goal exception request is an area that is contiguous with the FNC, therefore the goal exception request is for one area within the city's estuary boundary. Within this general area, specific DMD sites would be identified on an annual basis.

Because the Columbia River channel continually moves, the 20-ft depth contour representing the river thalweg likewise will shift on a continual basis. DSL is seeking a text-based definition of thalweg placement that would provide flexibility to adapt to inter-annual changes in the precise location of the thalweg. The maps in Exhibits 1and 2 represent a best-professional-judgment effort by the Corps to physically bound how the extent of the thalweg may change over the next five years. This map is provided as an informational reference to help communicate the likely area where the exception would apply and would need to be updated on a recurring basis.

660-004-0022 Reasons Necessary to Justify an Exception Under Goal 2, Part II(c)

An exception under Goal 2, Part II(c) may be taken for any use not allowed by the applicable goal(s) or for a use authorized by a statewide planning goal that cannot comply with the approval standards for that type of use…

…(1) For uses not specifically provided for in this division, or in OAR 660-011-0060, 660-012-0070, 660-014-0030 or 660-014-0040, the reasons shall justify why the state policy embodied in the applicable goals should not apply. Such reasons include but are not limited to the following: There is a demonstrated need for the proposed use or activity, based on one or more of the requirements of Goals 3 to 19; and either:

> *(a) A resource upon which the proposed use or activity is dependent can be reasonably obtained only at the proposed exception site and the use or activity requires a location near the resource. An exception based on this subsection must include an analysis of the market area to be served by the proposed use or activity. That analysis must*

[26] Vavrinec et al. 2007, Roegner and Fields 2015, Fields et al. 2019, Roegner et al. 2021. Also "In-water restoration between Miller Sands and Pillar Rock Island, Columbia River: Environmental surveys, 1992-93" by Hinton, S.A., G.T. McCabe, Jr., and R.L. Emmett, 1995 from compatibility findings document pages 14-15 response to P20.5(10).

[27] Kukulka and Jay 2003a, 2003b, Fresh 2005, NMFS 2012.

demonstrate that the proposed exception site is the only one within that market area at which the resource depended upon can reasonably be obtained; or

(b) The proposed use or activity has special features or qualities that necessitate its location on or near the proposed exception site.

Finding: As the rule criteria above indicates, an exception to a goal requirement can be based on requirements of other statewide planning goals, but that is not the only reason why a goal exception can be justified. DSL is requesting a reasons goal exception to Statewide Planning Goal 16: Estuarine Resources to allow for in-water disposal of dredged material in areas currently zoned as aquatic conservation and (potentially) aquatic natural[28] in the Columbia River Estuary Management Plan and Warrenton Comprehensive Plan. The reasons why the applicant believes the state policy embodied in Goal 16 for locations appropriate for dredged material disposal should not apply in this case are described in the above sections of this document. In summary, the Corps understands that thalweg placement of dredged sand is a balanced approach and is needed to sustain the river's sediment budget, its morphology, and enable eventual downstream progression of river sediment to the ocean.

Additionally, terrestrial sediment supply to the Lower Columbia River has been reduced due to floodplain development and hydro-regulation. The river's sediment supply is now finite and is managed to sustain the ecological health of the estuary. The river thalweg is needed for the disposal of dredged material to sustain the river's sediment budget. Therefore, the goal exception area has special features that necessitate its location.

City of Warrenton Comprehensive Plan Policies and Requirements

The City of Warrenton Comprehensive Plan contains policies of the city. Those sections of the city's Comprehensive Plan (Article 5. Columbia River Estuary and Estuary Shorelands) that are applicable to the proposed action are addressed below.

It should be noted that the proposed goal exception request is to allow disposal of dredged material in an area where it is currently not allowed, and to allow this disposal for any user. The Army Corps is utilizing this area for their operations and maintenance of the FNC. The following sections for comprehensive plan policies and development code provisions are being addressed through the perspective of the Amry Corps undertaking the action. However, other users of the area for disposal (if this goal exception were to be approved) would need to separately apply for and demonstrate consistency with these same polices and criteria.

Section 5.305 Dredging and Dredged Material Disposal

These policies are applicable to all estuarine dredging and dredged material disposal in the Columbia River Estuary, shall be allowed only:

[28] As mentioned elsewhere in the application, while the zoning map for Warrenton shows some areas as Aquatic Natural as potentially impacted by the proposed goal exception, it does not match the descriptions of the estuary subareas in the Comprehensive Plan that are Aquatic Natural. The proposed goal exception avoids areas that are zoned Aquatic Natural as described in the Comprehensive Plan.

1. *If allowed by the applicable zone and required for one or more of the following uses and activities:*
    (a) *Navigation, navigational access, or an approved water-dependent uses of aquatic areas or adjacent shorelands requiring an estuarine location; and*
    (b) *A need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and*
    (c) *No feasible alternative upland locations exist; and*
    (d) *Adverse impacts are minimized, avoided, and mitigated; and*
    (e) *An approved restoration project; and*
    (f) *Excavation necessary for approved bridge crossing support structures, pipeline, cable, or utility crossing; and*
    (g) *Maintenance of existing tidegates and tidegate drainage channels where a Goal 16 exception has been approved; and*
    (h) *Aquaculture facilities.*

Finding: The proposed action is compatible with the above policy because Congress has authorized the Corps to establish and maintain the CR FNCs. Maintaining the CR FNCs will not unreasonably interfere with public trust rights because activities associated with dredge material disposal within the river thalweg will not materially impede or substantially impair the public rights to use the waters for navigation, fishing, commerce, and recreation. The need for the proposed exception and amendment is described in the justification above within this document. Project activities are temporary and will not preclude public use of the river because river users are able to move around the dredge equipment. Moreover, adverse impacts will be minimized using Best Management Practices (Exhibit 9) and as described elsewhere in this document, no feasible upland or ocean alternatives exist for the disposal of this dredged material. For these reasons, the proposed action is compatible with provision 5.305(1).

2. *The appropriate review/ permitting process for impacts to an ESA-listed species has been followed and is approved/permitted by the appropriate Fisheries agency; and*
3. *The activity abides by all required locale state and federal permits.*

Finding: The proposed action is compatible with the above policy because the Corps consulted with the National Marine Fisheries Service in accordance with the Endangered Species Act (ESA). The National Marine Fisheries Service issued a Biological Opinion (BiOp) for the proposed action after reviewing the action for impacts to ESA-listed species. All state and federal agencies with jurisdiction in the river thalweg have been consulted. This application for a goal exception is to meet local policies to the maximum extent practicable for Corps actions, which will in turn be an important step for the Corps' next 401 water quality certification from the Oregon Department of Environmental Quality. The proposed action is consistent with 5.305(2) and 5.305(3).

4. *Dredging and dredged material disposal shall not disturb more than the minimum area necessary for the project and shall be conducted and timed so as to minimize impacts on wetlands and other estuarine resources. Loss*

or disruption of fish and wildlife habitat and damage to essential properties of the estuarine resource shall be minimized by careful location, design, and construction of:
(a) Facilities requiring dredging; and
(b) Sites designated to receive dredged material disposal; and
(c) Dredging operation staging areas and equipment marshalling yards.

Dredged materials shall not be placed in intertidal or tidal marsh habitats or in other areas that local, state, or federal regulatory agencies determine to be unsuitable for dredged material disposal. Exceptions to the requirement concerning disposal in an intertidal or tidal marsh area include use of dredged material as a fill associated with an approved fill project or placement of dredged materials in the sandy intertidal area of a designated beach nourishment site. Land disposal shall enhance or be compatible with the final use of the site area.

Finding: The proposed action is compatible because as a matter of practice, the Corps only dredges the minimum area necessary to maintain the Columbia River FNCs' dimensions and placement sites are designed to be the smallest acreage needed to accommodate the fill. Dredging and placement activities would occur in areas that minimize loss or disruption of fish and wildlife habitat and damage to estuarine resource properties. Biological resources within the Columba River system are diverse. There are four primary habitats that encompass the Lower Columbia River system: Estuarine, Riverine, Riparian, and Upland. Each of these habitats carries an intricate level of biologic complexity. The FNC O&M operates within each of the habitats to a varying degree. The Corps has already undergone consultation with the National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) for the current O&M dredging of FNCs in the Columbia River, which did evaluate disposal of dredged material deeper than 20ft and contiguous with the FNC. The Corps follows established BMPs to minimize adverse impacts to the aquatic and terrestrial environment; the most recent set of both dredging and placement BMPs were detailed in section 1.3 of the NMFS's Biological Opinion: Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Columbia River Navigation Channel and Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington, NMFS BiOp # 2011/02095 (NMFS 2012 BiOp, Exhibit 3) that included an incidental take statement for salmon, steelhead, green sturgeon, and eulachon for inadvertent take occurring during proposed maintenance of the CR FNCs. These baseline activities associated with maintenance dredging of the CR FNCs have not changed; and implementation of these BMPs has been successful in minimizing potential adverse impacts to the aquatic environment. NMFS also issued a Biological Opinion on June 16, 2021 (2021 BiOp[29], Exhibit 5) titled Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Operations and Maintenance Dredging of the Federal Navigation

[29] https://doi.org/10.25923/5edr-c970

Channels at Tongue Point, Clatsop County, Oregon; Elochoman Slough, Wahkiakum County, Washington; Lake River, Clark County, Washington; and Oregon Slough, Multnomah County, Oregon. NMFS issued a Biological Opinion on February 16, 2023 (2023 BiOp, Exhibit 6) titled Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower Columbia River Federal Navigation Channel Dredged Material Transfer Sites. The Corps will follow the BMPs outlined in the 2012, 2021 and 2023 BiOps unless or until superseded by a later BiOp. The USFWS concurred with the Corps' determination that the action would have no effect on the following listed species: western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, water howellia, and yellow-billed cuckoo and "may affect, but is not likely to adversely affect" bull trout, marbled murrelet, and Columbian white-tailed deer (Service reference# 13420-2010-I-0165). The Corps will follow all of the reasonable and prudent measures in the associated biological opinions, and conservation measures that USACE included in the proposed action. Lastly, dredge-equipment limitations in this particular stretch of the Columbia River would not allow for material placement in areas shallower than 20 feet.

For these reasons, the proposed action is compatible with provision 5.305(4).

5. *The effects of both initial and subsequent maintenance dredging, as well as dredging equipment marshalling and staging, shall be considered prior to approval of new projects or expansion of existing projects. Projects shall not be approved unless disposal sites with adequate capacity to meet initial excavation dredging and at least five years of expected maintenance dredging requirements are available.*

Finding: As written, this policy applies to the "approval of new projects or expansion of existing projects." This policy does not apply to dredging an existing federal navigation channel, to its existing congressionally authorized dimensions (including advanced maintenance dredging) because it is not a "new" project or "expansion" of an existing project. If this policy did apply to the Corps maintaining the existing navigation channel, USACE Engineering Regulation (ER) 1105-2-100 already requires that there be sufficient dredged material placement site capacity for maintaining this project for a minimum of twenty years. The Corps is in the process of developing a new dredged material management plan (DMMP) for continued maintenance of the deep-draft channel. USACE previously submitted a request for water quality certification to ODEQ under Clean Water Act (CWA) Section 401 for continued maintenance dredging and discharges in Oregon. USACE will submit a separate water quality certification for any new discharges/placement sites associated with the next DMMP.

The map provided as Exhibit 1 represents the expanded thalweg area within which the Corps believes sufficient capacity exists to perform flowlane dredged material disposal. Of the approximately 23,000 acres represented by the proposed expanded thalweg area, the Corps estimates that 2,300 acres (10%) would be utilized for DMD each year. The proposed action is compatible with provision 5.305(5).

6. *Dredging subtidal areas to obtain fill material for dike maintenance may be allowed under some circumstances (see the Development Code). Some dikes in the estuary are not accessible by barge-mounted dredges or land-based equipment. Dredging intertidal areas to obtain fill material may be the only option for maintaining these dikes. Approval of intertidal dredging will require an exception to Statewide Planning Goal 16.*

Finding: This policy is not applicable to the proposed action.

7. *Where a dredged material disposal site is vegetated, disposal should occur on the smallest land area consistent with sound disposal methods (e.g., providing for adequate de-watering of dredged sediments, and avoiding degradation of receiving waters). Clearing of land should occur in stages and only as needed. It may, however, be desirable to clear and fill an entire site at one time, if the site will be used for development immediately after dredged material disposal. Reuse of existing disposal sites is preferred to the creation of new sites provided that the dikes surrounding the site are adequate or can be made adequate to contain the dredged materials.*

Finding: This policy is not applicable to the proposed action as this is requesting disposal of dredged material in the water and not on land.

8. *When identifying land dredged material disposal sites, emphasis shall be placed on sites where (not in priority order):*
   (a) The local designation is Development provided that the disposal does not preclude future development at the site;
   (b) The potential for the site's final use will benefit from deposition of dredged materials;
   (c) Material may be stockpiled for future use;
   (d) Dredged spoils containing organic, chemical, and/or other potentially toxic or polluted materials will be properly contained, presenting minimal health and environmental hazards due to leaching or other redistribution of contaminated materials;
   (e) Placement of dredged material will help restore degraded habitat; or where
   (f) Wetlands would not be impacted.

   Important fish and wildlife habitat, or areas with scenic, recreational, archaeological, or historical values that would not benefit from dredged material disposal and sites where the present intensity or type of use is inconsistent with dredged material disposal shall be avoided. The use of agricultural or forest lands for dredged material disposal shall occur only when the project sponsor can demonstrate that the soils can be restored to agricultural or forest productivity after

disposal use is completed. In cases where this demonstration cannot be made, an exception to the Oregon Statewide Planning Goal 3 or 4 must be approved prior to the use of the site for dredged material disposal. The use of shoreland water-dependent development sites for dredged material disposal shall occur only when the project sponsor can demonstrate that the dredged material placed on the site will be compatible with current and future water-dependent development. Dredged material disposal shall not occur in major marshes, significant wildlife habitat and exceptional aesthetic resources designated under Oregon Statewide Planning Goal 17.

Engineering factors to be considered in site selection shall include: size and capacity of the site; dredging method; composition of the dredged materials; distance from dredging operation; control of drainage from the site; elevation; and the costs of site acquisition, preparation and revegetation.

Finding: This policy is not applicable to the proposed action as this is requesting disposal of dredged material in the water and not on land.

9. *Estuarine in-water disposal sites shall be in Development Aquatic areas identified as low in benthic productivity, unless the disposal is to provide fill material for an approved fill project, and where disposal at the site will not have adverse hydraulic effects. Estuarine in-water disposal sites shall only be designated and used when it is demonstrated that no feasible land or ocean disposal sites with less damaging environmental impacts can be identified and biological and physical impacts are minimal. An in-water disposal site shall not be used if sufficient sediment type and benthic data are not available to characterize the site.*

Finding: The proposed action is for estuarine in-water disposal within areas of the river that are deeper than 20 feet and contiguous with the FNC. During this disposal, benthic organisms could be temporarily buried or displaced by the in-water discharge. However, the mid-depth habitat created is expected to provide a suitable substrate for re-colonization by organisms from adjacent benthic communities. The dredged material would also have benthic organisms that would be relocated from the dredging areas and may re-establish at the placement site. Sand disposed of during in-water placement will be spread in thin layers to minimize mortality by burial. Monitoring of dredge material placements at Woodland, Martin, and Bachelor Islands in the LCR by researchers from Pacific Northwest National Laboratory (Nichole K Sather et al. 2022[30]) found that over a relatively short time the food web begins to reestablish with benthic invertebrates.

In-water placement sites are generally located in the flowlane where velocities are high, water is deeper than 20 feet, with naturally unstable or shifting substrate. Lower benthic productivity is expected at these depths. There have been multiple studies to support the conclusion that benthic densities are significantly lower in areas deeper than 20 feet and that benthic primary

[30] Sather, Nichole K, Kailan Mackereth, Jan Irvahn, Rachel Viera, and Jennifer Huckett. 2022. "Action Effectiveness Monitoring and Research of Dredged Material Placement at Woodland Islands," April.

production consists of shallower, subtidal and intertidal habitats. For example, the study "In-water restoration between Miller Sands and Pillar Rock Island, Columbia River: Environmental surveys, 1992-93" by Hinton, S.A., G.T. McCabe, Jr., and R.L. Emmett, 1995. In the Corps' most recent consultation with NMFS evaluating the potential effects of placement activities at seven material transfer sites in the flowlane adjacent to the FNC, NMFS included a table in their opinion that estimated the percentage of the flowlane subject to dredging and placement activities below 20-ft depth relative to the overall area of the flowlane and estimated that the area of habitat potentially affected ranged from 0-15.2%, with an average of roughly 9% per reach (NMFS 2023[LCBCUC(8]). NMFS ultimately concluded that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SRB steelhead or destroy or adversely modify their designated critical habitat (NMFS 2023). NMFS also concurred with the Corps that adverse effects to green sturgeon and eulachon were unlikely (NMFS 2023).

Organisms common to areas of unstable substrates are adapted to physically stressful conditions and have life cycles that allow them to withstand the stresses imposed by dredged material placement activities (Vavrinec et al. 2007; Roegner and Fields 2015; Fields et al. 2019, Roegner et al. 2021). Dredged material discharged at placement sites that have a naturally unstable or shifting substrate due to wave or current action tends to be more quickly dispersed. Also, the Corps minimizes physical impacts by choosing placement sites with a similar substrate as the dredge material. Impacts to benthic organisms are minimized when sand is placed on a sandy bottom, thus avoiding harmful changes in substrate composition. Therefore, the Corps understands that the project sites will be low in benthic productivity and the proposal is compatible with provision 5.305(9).

> *10. Flow lane disposal sites shall only be allowed in Development Aquatic areas within or adjacent to a channel. The Development Aquatic area adjacent to the channel shall be defined by a line 600 feet from either side of the channel or the 20-foot bathymetric contour, whichever is closer to the channel. Flowlane disposal within this area shall only be allowed where:*
> *(a) sediments can reasonably be expected to be transported down-stream without excessive shoaling,*
> *(b) Interference with recreational and commercial fishing operations, including snag removal from gillnet drifts, will be minimal or can be minimized by applying specific restrictions on timing or disposal techniques,*
> *(c) adverse hydraulic effects will be minimal,*
> *(d) adverse effects on estuarine resources will be minimal, and*
> *(e) the disposal site depth is between 20 and 65 feet below MLLW.*

Finding: This provision is intended to ensure that dredged material placement sites are located in particular areas to avoid adverse effects. The City of Warrenton defines the main navigation

channel and a flowlane disposal area on each side of the channel (extending either 600 feet or to the 20-foot bathymetric contour, whichever is narrowest) as designated Development Aquatic. This proposal is seeking an exception to this requirement, mainly the qualifier "whichever is narrowest," in order to allow dredged material disposal to occur in areas contiguous with the FNC to the 20-foot bathymetric contour.

Regarding (a) downstream shoaling, analysis for hydraulics, sedimentation, and morphology change consist of areas within the CR, including in-water and beach nourishment placement locations. General shoaling metrics within the river are defined in terms of how and when shoals are formed by seasonal variation in river flow. The relevance of shoaling metrics is based on how and when the shoaling processes affect CR navigation, motivating the need for dredging or the imposition of navigation restrictions. The purpose of the action is to accommodate maintenance dredging of the CR FNCs. Any effects associated with the proposed action would be temporary, localized, and minor with respect to the hydraulics and sediment transport conditions of the Columbia River. Columbia River dredged sand can be remobilized after placement on the riverbed when river currents exceed 0.35 meter/sec (1.1 ft/sec). As river current speed increases beyond 0.35 m/sec, the associated sediment transport rate increases exponentially.

In-water placement occurs in locations that the Corps has determined will not result in excessive FNC shoaling from remobilized placed sediment. Dredged sediment is placed within the river thalweg to not harm living resources, not adversely affect other uses of the river, sustain the thalweg, and not rapidly return to the FNC. Success requires constant adaptation as the river continuously relocates the dredged sediment placed in-water each year. Placement areas are specified for each event based on an applied understanding of hydrodynamic and sediment transport processes informed by bathymetric depth surveys and river current velocity data from the Corps' Lower Columbia River adaptive hydraulics model. The placement location must be deep enough for the dredge or scow to safely access based on that vessel's draft below the water surface. Velocity data and bathymetric differencing and evaluation of bedforms can inform sediment movement after placement, to minimize movement into FNC shoals and support movement into areas to counteract riverbed erosion.

The proposed action would not (b) interfere with recreational or commercial fishing and will follow the work windows in the most current 2012, and 2021 and 2023 Biological Opinions from National Marine Fisheries Service (NMFS) for the ongoing O&M activities, and (c) would not have adverse hydraulic effects (explained above for 5.305(9)) or (d) adverse effects on estuarine resources. Previous responses within this application have described how the expanded flowlane area would remain compatible with the estuarine resources and the Corps will follow Best Management Practices for the protection of water quality as explained in Exhibit 9.

Regarding (e), DSL is proposing an amendment to this policy to permit in-water dredged material placement in depths 20 feet or greater and contiguous with the FNC.

The Corps contracted with several external partners to explicitly evaluate the potential effects of dredging and placement on the benthic environment. Studies investigating the entrainment

risk to Dungeness crab across multiple age classes found that crab abundance was highly correlated with salinity and the risk of entrainment for crabs age 2+ to 3+ in summer decreased exponentially as you move upstream, such that locations above the Astoria Bridge had rates that were less than 6% of those noted at the MCR (Pierson et al. 2002, Pierson et al. 2005). In assessing the effects of sediment deposition on Dungeness crab and other epifauna based on lab studies, empirical data collected using video sleds, and models, the collective body of evidence suggests that burial of 10 cm or less has only a nominal effect on crabs and other species (Vavrinec et al. 2007; Roegner and Fields 2015); there does not appear to be significant, adverse, long-term effects to the epibenthic community at large (Fields et al. 2019, Roegner et al. 2021); and crabs that may be dislodged by the lateral surge of material plume typically return to areas within 10 minutes (Roegner et al. 2021). An evaluation of potential effects to white sturgeon similarly found no direct adverse effects, with some indication that some individuals are attracted to disposal areas in the short-term (Parsley et al. 2011).

The map provided as Exhibit 1 represents the expanded thalweg area within which the Corps believes sufficient capacity exists to perform flowlane dredged material disposal for a five year period. Of the approximately 23,000 acres represented by the proposed expanded thalweg area, the Corps estimates that 2,300 acres (10%) would be utilized for DMD each year. The thalweg map would be updated on a five-year basis.

11. *Beach nourishment sites shall only be designated on sandy beaches currently experiencing active erosion. Dredged material disposal at beach nourishment sites shall only be used to offset the erosion and not to create new beach or land areas. Beach nourishment sites shall not be designated in areas where placement or subsequent erosion of the dredged materials would adversely impact tidal marshes or productive intertidal or shallow subtidal areas. Designation of new beach nourishment sites shall require an exception to Statewide Planning Goal 16.*

Finding: This policy is not applicable to the proposed action as this is requesting disposal of dredged material in the water and not as beach nourishment.

12. *Dredged material disposal sites with adequate capacity to accommodate anticipated dredging needs for at least a five year period shall be identified and designated.*

Finding: The map provided as Exhibit 1 represents the expanded thalweg area within which the Corps believes sufficient capacity exists to perform flowlane dredged material disposal for a five-year period. Of the approximately 23,000 acres represented by the proposed expanded thalweg area, the Corps estimates that 2,300 acres (10%) would be utilized for DMD each year. The thalweg map would be updated on a five-year basis. This action is consistent with 5.305(12).

13. *In order to ensure the adequacy of identified dredged material disposal site capacities for anticipated five year disposal requirements, an analysis of the*

dredge material disposal site inventory shall be completed every five years. The analysis shall include:
(a) A determination of the sites utilized for dredged material disposal and the volume received by each site during the preceding period, noting also the project source of the dredged material and the interval separating the most recent from the next anticipated dredging event.
(b) A determination of the number and usable volume of sites remaining in the inventory, and the relationship between these sites and present or expected navigation-related dredging or water dependent development projects in the following five-year period.
(c) An analysis of the adequacy of the dredged material site inventory shall include notification of updating inventory information to affected property owners and local, state and federal agencies. Of particular importance, is the addition, and/or deletion, of dredged material disposal sites.
(d) The City of Warrenton shall cooperate with other jurisdictions and CREST on the Columbia River Estuary in monitoring of dredged material site availability and in dredged material disposal plan update.

Finding: This policy is not applicable to the proposed action as it is directed at the City of Warrenton and is for a long term and comprehensive look at all dredged material disposal sites and users. The proposed action is for one type of dredged material disposal.

Section 5.311 Fish and Wildlife Habitat

These policies apply to uses and activities with potential adverse impacts on fish or wildlife habitat, both in Columbia River estuarine aquatic areas and in estuarine shorelands.

1. *Endangered or threatened species habitat shall be protected from incompatible development.*

Finding: In the Corps' most recent consultation with NMFS evaluating the potential effects of dredge material placement activities at seven material transfer sites in the flowlane adjacent to the FNC, NMFS included a table in their opinion that estimated the percentage of the flowlane subject to dredging and placement activities below 20-ft depth relative to the overall area of the flowlane for the Columbia River between RM 3 and 145.3 segmented into nine reaches along its length, and estimated that the area of habitat potentially affected ranged from 0-15.2%, with an average of roughly 9% per reach (NMFS 2023). NMFS ultimately concluded that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SRB steelhead or destroy or adversely modify their designated critical habitat (NMFS 2023). NMFS also concurred with the Corps that adverse effects to green sturgeon and eulachon were unlikely (NMFS 2023). The proposed action is consistent with 5.311(1).

Policies 5.311(2) and (3) are not applicable to the proposed action.

Section 5.331 Significant Areas

These policies are intended to protect certain shoreland and aquatic resources with estuary-wide significance. Significant shoreland resources are identified as such in the area and subarea description. Significant aquatic resources are found in Natural Aquatic areas. This subsection applies only to activities and uses that potential affect significant shoreland or aquatic resources. Other resources without estuary-wide significance are not covered by this subsection. Only those resource identified as significant under Statewide Planning Goal 17 are covered by these policies and standards.

1. *Significant estuarine aquatic and shoreland resources shall be protected from degradation or destruction by conflicting uses and activities.*

Finding: This expanded definition of flowlane disposal would include areas currently zoned as Aquatic Conservation. As described in the subareas of the Columbia River Estuary within the Warrenton Comprehensive Plan, the only place that is zoned Aquatic Natural that may coincide with the proposed expansion of flowlane disposal of dredged material is in the Youngs Bay subarea. In that area, the mud flats, tidal flats, and fringing marshes are designated Aquatic Natural. However, the area that is bounded by the authorized FNC to the north and the 20-foot contour line to the south is designated Aquatic Development. We believe that because this proposal is limited to the 20-foot contour line or deeper and contiguous with the FNC, it will not affect the area that is designated Aquatic Natural as described in the Comprehensive Plan. The other area designated Aquatic Natural within the City of Warrenton is in Alder Cove which would not be impacted by this proposal. Likewise, the proposal will not impact any significant shoreland areas as it is confined to the estuary waters.

Policies 5.331(2) and (3) are not applicable to the proposed action. The proposed action will not be impacting significant riparian vegetation, major marshes, significant wildlife habitat, or exceptional aesthetic resources.

Section 5.339 Federal Consistency

These policies establish procedures for ensuring that federal actions are consistent with this Comprehensive Plan.

1. *Not applicable.*
2. *Federal development projects and other activities that directly affect the estuary and shoreland area in the coastal zone shall be consistent to the maximum extent practicable with the mandatory enforceable policies of Warrenton Comprehensive Plan. Federal agencies address the consistency requirements by submitting a written consistency determination to the Oregon Department of Land Conservation and Development. The local government may review the consistency determination against its plan and communicate comments to Department of Land Conservation and Development. Department of Land Conservation and Development has the authority to make a final decision on the consistency determination. The federal agency has the option of applying for a local permit to demonstrate consistency with the Warrenton Comprehensive Plan.*

3. *Federal activities in the Columbia River Estuary that are most likely to directly affect the coastal zone and require a determination of consistency with the plan include, but are not limited to, the following:*
   (a) dredging or dredged material disposal associated with maintenance or construction of federal navigation projects;
   (b) maintenance or construction of other federal navigation improvements including jetties, grains, breakwaters and pile dikes;
   (c) maintenance or construction of federal flood control projects such as dikes and associated drainageways and structures, and shoreline stabilization projects;
   (d) docks and other in-water structures, dredging, and dredged material disposal associated with federal facilities such as Coast Guard bases and naval installations;
   (e) federal refuge improvements;
   (f) mitigation and restoration actions;
   (g) road construction in the coastal watershed;
   (h) waste discharge in the coastal watershed; and
   (i) land acquisition, disposal, or exchange.
   The consistency requirements apply to both planning and implementing these federal activities.

Finding: This application for a goal exception to expand the area for in-water disposal of dredged material is an attempt to make operations and maintenance dredging of the Columbia River by the Army Corps consistent to the maximum extent practicable with the enforceable policies of the Oregon Coastal Management Program that are within the jurisdiction of the City of Warrenton.

City of Warrenton Development Code Requirements

Chapter 16.232 Amendments to Comprehensive Plan Text and Map, Rezone, and Development Code

16.232.30 Quasi-Judicial Amendments, (B) Criteria for Quasi-Judicial Amendments. A recommendation or a decision to approve, approve with conditions or to deny an application for a quasi-judicial amendment shall be based on all of the following criteria:

1. *Demonstration of compliance with all applicable Comprehensive Plan policies and map designations. Where this criterion cannot be met, a Comprehensive Plan amendment shall be a pre-requisite to approval.*

Finding: See answers above for compliance with applicable comprehensive plan policies. Where not consistent, this application is seeking a goal exception to allow the disposal of dredged material in areas where that activity is not currently allowed in order to become consistent.

2. *Demonstration of compliance with all applicable standards and criteria of this Code, and other applicable implementing ordinances.*

Finding: See answers above and below. The application demonstrates compliance with all applicable standards and criteria of the development code or will be made so through the approval of this goal exception.

3. *Evidence of change in the neighborhood, or community, or a mistake or inconsistency in the Comprehensive Plan or land use district map regarding the property which is the subject of the application; and the provisions of Section 16.232.060, as applicable.*

Finding: See answers above about the need for an expanded area for dredged material disposal to accommodate ongoing maintenance of the FNC and the river's sediment budget, which demonstrates evidence of change in the estuary. Section 16.232.060 is not applicable to this proposal.

Chapter 16.76 Aquatic Conservation (A-2) District

Part of the proposal for the disposal of dredged material within the expanded flowlane/river thalweg comes into areas zoned by the City of Warrenton as A-2. The disposal of dredged material is not currently allowed in this zone which is the basis for this goal exception application.

16.76.040 Development Standards. The following standards are applicable in the A-2 zone:

A. All uses shall satisfy applicable Columbia River Estuary Shoreland and Aquatic Area Development Standards in Chapter 16.160.

B. A proposal involving several uses shall be reviewed in aggregate under the more stringent procedure.

C. All applicable policies in the City's Comprehensive Plan and goal exceptions shall be met.

D. A proposal which requires new dredging, fill, in-water structures, riprap, new log storage areas, water intake, in-water disposal of dredged material, beach nourishment, or other activities which could affect the estuary's physical processes or biological resources is subject to an impact assessment (Section 16.164.010).

E. All other applicable Development Code requirements shall also be satisfied.

F. ~~The maximum height of structures in the A-2 zone shall be 45 feet above MLLW.~~

G. ~~Uses that are not water-dependent shall be located on a floating structure or on pilings, and shall not increase the need for fill if in association with a water-dependent use located on fill.~~

H. ~~Uses that are not water-dependent shall not preclude or conflict with existing or probable future water-dependent development on the site or in the vicinity.~~

I. ~~Uses that are water-dependent and/or water-related must meet the criteria in Section 16.160.080.~~

J. Uses and activities permitted under Section 16.76.020 of this chapter are subject to the public notice provisions of Section 16.208.040 if an impact assessment is required pursuant to Sections 16.164.010 through 16.164.050, or if a determination of consistency with the purpose of the A-2 zone is required pursuant to Section 16.164.020, or if the Community Development Director determines that the permit decision will require interpretation or the exercise of factual, policy or legal judgment.

K. ~~All new sewer and water connections for a proposed development shall comply with all City regulations.~~

Finding: All criteria above are either addressed elsewhere in this application or are not applicable (strikethrough criteria are not applicable to the proposed action). See answers below for Chapter 16.160 and 16.164. See answers above that address all applicable Comprehensive Plan policies and goal exception criteria.

Chapter 16.80 Aquatic Natural (A-3) District

Part of the proposal for the disposal of dredged material within the expanded flowlane/river thalweg comes into areas zoned by the City of Warrenton as A-3 as shown on the city's current Zoning Map. Based on the aquatic zone descriptions for each subarea in the Comprehensive Plan, the applicant does not believe that the proposed goal exception area will fall within Aquatic Natural areas. Regardless, the criteria for this zone are addressed. The disposal of dredged material is not currently allowed in Aquatic Natural areas which is the basis for this goal exception application.

16.80.040 Development Standards.

The following standards are applicable in the A-3 zone:

A. All uses and activities shall satisfy applicable Columbia River Estuary Shoreland and Aquatic Area Development Standards in Chapter 16.160.

B. A proposal involving several uses shall be reviewed in aggregate under the more stringent procedure.

C. All applicable policies in the City's Comprehensive Plan, mediation panel agreement and goal exceptions shall be met.

D. All other applicable Development Code requirements shall also be satisfied.

E. A use which requires new dredging, fill, in-water structures, riprap, new log storage areas, water intake, in-water disposal of dredged material, beach nourishment, or other

activities which could affect the estuary's physical processes or biological resources is subject to an impact assessment (Section 16.164.010).

F. ~~Uses that are not water-dependent shall be located either on a floating structure or on pilings, and shall not increase the need for fill if in association with a water-dependent use located on fill.~~

G. ~~Uses that are not water-dependent shall not preclude or conflict with existing or probable future water-dependent uses on the site or in the vicinity.~~

~~H. Maximum height of structures shall by 35 feet above MLLW~~

~~I. Uses that are water-dependent and/or water-related must meet the criteria in Section 16.160.080.~~

~~J.~~ Uses and activities permitted under Section 16.80.020 of this chapter are subject to the public notice provisions of Section 16.208.040 if an impact assessment is required pursuant to Sections 16.164.010 through 16.164.050, or if a determination of consistency with the purpose of the A-3 zone is required pursuant to Section 16.164.020, or if the Community Development Director determines that the permit decision will require interpretation or the exercise of factual, policy or legal judgment.

~~K. All new sewer and water connections for a proposed development shall comply with all City regulations.~~

Finding: All criteria above are either addressed elsewhere in this application or are not applicable (strikethrough criteria are not applicable to the proposed action). See answers below for Chapter 16.160 and 16.164. See answers above that address all applicable Comprehensive Plan policies and goal exception criteria.

Chapter 16.88 Flood Hazard Overlay (FHO) District

The area for the proposed goal exception is within the "AE" mapped flood hazard area.

16.88.040 Standards for Flood Hazard Reduction

E. Alteration of Watercourses.

1. No watercourse shall be altered until a maintenance plan is provided which assures that the flood-carrying capacity of altered or relocated portions of the watercourse is not diminished.

Finding: The proposed action is for in-water dredged material placement within Warrenton's jurisdiction. The proposed flowlane placement in waters 20 feet or deeper is a relocation of shoal material dredged from the FNC to discrete morphological features that are also located within the active river floodway (like the FNC). No new sediment will be imported to the river under the proposed action. Implementation of in-water dredged material features is not considered an encroachment on the river's floodway and is not anticipated to increase flood

risk because the total volume of dredged material in the floodway remains the same and conveyance capacity of the LCR is not changed.

The Corps recently released a "Draft Integrated Material Management Plan and Environmental Impact Statement" (DMMP-EIS) for the purposes of maintaining the congressionally authorized channel dimensions of the Lower Columbia River FNC. Based on the hydraulic evaluation described in Appendix C.2 of the DMMP-EIS[31], changes to existing patterns of erosion, deposition, and flooding would not be expected. Any effects associated with the proposed action would be temporary, localized, and minor with respect to the flood carrying capacity of the river. Thus, there would be no direct or indirect impacts on the bank full flood carrying capacity as a result of the proposed action relative to the current baseline conditions. Therefore, the flood-carrying capacity of the LCR is not diminished. The applicable standards of 16.88.040 are met.

Chapter 16.104 Dredge Material Disposal Site Locations (DMD)

> *16.104.010 Purpose. The intent of this designation is to show the location of the dredged material disposal (DMD) sites in the City with respect to present and expected water-dependent development and navigational access requirements and to protect these sites for dredged material disposal operations.*
>
> *16.104.020 DMD Site Locations. The dredged material disposal site locations are shown on the DMD map of the Development Code and in the dredged material disposal (DMD) element of the Comprehensive Plan, and the CREST 2002 Management Plan as it references the City of Warrenton and its sites therein. Revisions to the DMD sites or to the DMD language within the Comprehensive Plan shall be through an adoption of an amendment to the Comprehensive Plan.*

Finding: This goal exception application is to designate an expanded area for in-water flowlane disposal of dredged material in depths greater than 20 feet and contiguous to the FNC, and to add this area to the list of sites designated as such. Exhibit 2 shows the map for this proposed disposal area for approximately five years.

Chapter 16.160 Columbia River Estuary Shoreland and Aquatic Area Development Standards

> *16.160.040 Dredging and Dredged Material Disposal*
>
> *C. Undesirable erosion, sedimentation, increased flood hazard, and other changes in circulation shall be avoided at the dredging and disposal site and in adjacent areas.*
>
> *D. The timing of dredging and dredged material disposal operations shall be coordinated with state and federal resource agencies, local governments, and private interests to protect estuarine aquatic and shoreland resources, minimize interference with commercial and recreational fishing, including snag removal from gillnet drifts, and*

[31] https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/26369

insure proper flushing of sediment and other materials introduced into the water by the project.

F. Adverse short-term effects of dredging and aquatic area disposal such as increased turbidity, release of organic and inorganic materials or toxic substances, depletion of dissolved oxygen, disruption of the food chain, loss of benthic productivity, and disturbance of fish runs and important localized biological communities shall be minimized.

Finding: The proposed action is compatible because timing for use of placement sites within the river thalweg is intended to protect estuarine aquatic and shoreland resources. For example, the Corps will follow the work windows in the most current 2012, 2021, and 2023 Biological Opinions from National Marine Fisheries Service (NMFS) for the ongoing O&M activities. The project will minimize interference with recreational or commercial fishing operations; river users would need to avoid dredge equipment in the same manner that they avoid other vessels. The 2014 draft *EA for Columbia River Federal Navigation Channel Operations and Maintenance Dredging and Dredged Material Placement Network Update, River Miles 3 to 106.5, Washington and Oregon* was available for public review from 3 April 2014 through 4 May 2014. During this public review period, the Corps received two written comment letters. No public comments were received related to timing of placement operations for these sites. The dredging contractor also submits a "Notice to Mariners" to the U.S. Coast Guard, who publishes the notice prior to and during dredging operations. Direct effects due to in-water disposal of the proposed action is described in 2.4.1 of the NMFS biological opinion. Studies by NMFS, the Corps, and others on the potential impact of placement to crab found the effects were negligible (i.e., Roegner et al. 2021). Commercial and sport fisheries for salmon will need to avoid dredges and dredge equipment for safe navigation. However, the area directly affected is small and does not appreciably diminish the available space for active fishing.

In-water placement occurs in locations that the Corps has determined will not result in excessive FNC shoaling from remobilized placed sediment. Dredged sediment is placed within the river thalweg to not harm living resources, not adversely affect other uses of the river, sustain the thalweg, and not rapidly return to the FNC. Success requires constant adaptation as the river continuously relocates the dredged sediment placed in-water each year. Placement areas are specified for each event based on an applied understanding of hydrodynamic and sediment transport processes informed by bathymetric depth surveys and river current velocity data from the Corps' Lower Columbia River adaptive hydraulics model. The placement location must be deep enough for the dredge to safely access based on that vessel's draft below the water surface. Velocity data and bathymetric differencing and evaluation of bedforms can inform sediment movement after placement, to minimize movement into FNC shoals and support movement into areas to counteract riverbed erosion.

Changes to existing patterns of erosion, deposition, and flooding would not be expected from the proposed action. Any effects associated with the proposed action would be temporary, localized, and minor with respect to the flood carrying capacity of the river. Thus, there would

be no direct or indirect impacts on the bank full flood carrying capacity as a result of the proposed action relative to the current baseline conditions.

When disposing of dredged materials, the Corps implements best management practices to minimize effects to water quality, including sediment sampling, water quality monitoring, and turbidity monitoring and minimization measures. The Best Management Practices are further defined in the Determination of Compatibility, included as Exhibit 7.

Corps placement does not add to the contamination burden of the Columbia River, nor would it mobilize hazardous materials in the water column. Sediments were sampled and determined to be suitable for unconfined aquatic placement and exposure (Exhibit 4 PSET Documentation). The Corps performs regular dredged material evaluations in the FNC to determine whether sediments are suitable for unconfined in-water placement or exposure, according to the requirements of the Clean Water Act (CWA) or the Marine Protection, Research and Sanctuaries Act (MPRSA), as appropriate. The Corps characterizes sediments present within proposed dredge areas in accordance with national dredged material testing manual protocols (Ocean Testing Manual), Inland Testing Manual, and by using the Sediment Evaluation Framework for the Pacific Northwest (SEF). The Corps, as lead member of the regional Portland Sediment Evaluation Team (PSET), evaluates the discharge of dredged material through the SEF. The Oregon Department of Environmental Quality is also a member of PSET. This framework is based on applicable provisions of CWA Section 404 or MPRSA Section 103. A summary of the most recent results and suitability determinations for locations within Clatsop County (including within Warrenton) is below:

- Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5): A total of 59 stations were sampled within this area. All sediment samples consisted of more than 97 percent coarse-grained sediments (gravel and sand) suitable for unconfined, aquatic placement. The total organic carbon (TOC) result for all samples is less than 0.2%.
- Skipanon FNC: Dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%) suitable for unconfined, aquatic placement. TOC in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.
- Tongue Point FNC: The outer shoal dredge prism was 96.4% sand and the inner shoal averaged 46.9% sand, 45.7% silt, and 7.3% clay suitable for unconfined, aquatic placement.

The Corps will continue to sample and evaluate sediment periodically in the future in accordance with the SEF. Dredged material would only be placed in water after the Corps, in coordination with PSET, determines that sediments are suitable for unconfined aquatic placement and unconfined aquatic exposure, in accordance with the SEF. Sediments that are tested and deemed to be unsuitable (that is, not suitable for unconfined in-water placement) would not be placed in water but would instead be placed in upland sites.

Past monitoring, both instrument and visual, has shown that turbidity quickly dissipates because the dredged material is predominately sand. Placement only occurs in areas that are deeper than 20 feet where little to no benthic productivity is occurring and where fish may migrate but would avoid any dredged material placement activity. Any juvenile fish in the general vicinity would be closer to the shoreline. The most recent dredged material suitability determinations are included as Exhibit 4.

The Corps contracted with several external partners to explicitly evaluate the potential effects of dredging and placement on the benthic environment. Studies investigating the entrainment risk to Dungeness crab across multiple age classes found that crab abundance was highly correlated with salinity and the risk of entrainment for crabs age 2+ to 3+ in summer decreased exponentially as you move upstream, such that locations above the Astoria Bridge had rates that were less than 6% of those noted at the MCR (Pierson et al. 2002 ; Pierson et al. 2005). In assessing the effects of sediment deposition on Dungeness crab and other epifauna based on lab studies, empirical data collected using video sleds and models, the collective body of evidence suggests that burial of 10 cm or less has only a nominal effect on crabs and other species (Vavrinec et al. 2007 ; Roegner and Fields 2015); there do not appear to be significant, adverse, long-term effects to the epibenthic community at large (Fields et al. 2019 ; Roegner et al. 2021); and crabs that may be dislodged by the lateral surge of material plume typically return to areas within 10 minutes (Roegner et al. 2021). An evaluation of potential effects to white sturgeon similarly found no direct adverse effects, with some indication that some individuals are attracted to disposal areas in the short-term (Parsley et al. 2011). In the Corps' most recent consultation with NMFS evaluating the potential effects of placement activities at seven material transfer sites in the flowlane adjacent to the FNC, NMFS included a table in their opinion that estimated the percentage of the flowlane subject to dredging and placement activities below 20-ft depth relative to the overall area of the flowlane and estimated that the area of habitat potentially affected ranged from 0-15.2%, with an average of roughly 9% per reach (NMFS 2023). NMFS ultimately concluded that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SR steelhead or destroy or adversely modify their designated critical habitat (NMFS 2023). NMFS also concurred with the Corps that adverse effects to green sturgeon and eulachon were unlikely (NMFS 2023).

For these reasons, the proposed action meets the applicable criteria in 16.160.040.

16.160.050 Dredged Material Disposal Standards

B. Proposals for in-water disposal of dredged materials, including flow lane disposal, beach nourishment, estuarine open-water disposal, ocean disposal, and agitation dredging, shall:

1. Demonstrate the need for the proposed action and that there are no feasible alternative disposal sites or methods that entail less damaging environmental impacts; and
2. Demonstrate that the dredged sediments meet state and federal sediment testing requirements and water quality standards (see Section 16.160.040(A)(5)); and
3. Not be permitted in the vicinity of a public water intake.

Finding: The section of this application related to "OAR 660-004-0020 Goal 2, Part II(c), Exception Requirements" describes the demonstrated need for the proposed action. Page 13 of this application, under the subsection titled "Areas that do not require a new exception cannot reasonably accommodate the use," contains information to justify why there are no feasible disposal alternatives. The answer above for 16.160.040 Dredging and Dredged Material Disposal describes how the proposed action meets state and federal sediment testing requirements and water quality standards. There are no public water intakes in the vicinity of the proposed action. The proposed action meets these criteria.

C. Proposals for in-water estuary disposal shall be coordinated with commercial fishing interests, including, but not limited to: gillnet drift captains at the dredging and disposal site, the Columbia River Fisherman's Protective Union, Northwest Gillnetters Association, and the state fishery agencies. In-water disposal actions shall avoid gillnet drifts whenever feasible. When it is not feasible to avoid gillnet drifts, impacts shall be minimized in coordination with fisheries interests through:
1. Disposal timing;
2. Gear placement;
3. Choice of disposal area within the drift; and
4. Disposal techniques to avoid snag placement.

Finding: The proposed project will minimize interference with recreational or commercial fishing operations; river users would need to avoid dredge equipment in the same manner that they avoid other vessels. The dredging contractor also submits a "Notice to Mariners" to the U.S. Coast Guard, who publishes the notice prior to and during dredging operations. Commercial and sport fisheries for salmon will need to avoid dredges and dredge equipment for safe navigation. However, the area directly affected is small and does not appreciably diminish the available space for active fishing.

D. Flow lane disposal, estuarine open water disposal and agitation dredging shall be monitored to assure that estuarine sedimentation is consistent with the resource capabilities and purpose of affected natural and conservation designations. The monitoring program shall be established prior to undertaking disposal. The program shall be designed to both characterize baseline conditions prior to disposal and monitor the effects of the disposal. The primary goals of the monitoring are to determine if the disposal is resulting in measurable adverse impacts and to establish methods to

minimize impacts. Monitoring shall include, at a minimum, physical measurements such as bathymetric changes and may include biological monitoring. Specific monitoring requirements shall be based on, at a minimum, sediment grain size at the dredging and disposal site, presence of contaminants, proximity to sensitive habitats and knowledge of resources and physical characteristics of the disposal site. The monitoring requirement shall be discontinued when adequate information has been gathered to determine impacts and establish an agreed-upon disposal volume and methodology. If the agreed-upon volume and methodology is altered, the monitoring requirement may be reestablished. Monitoring may be waived on small projects where the impacts would be undetectable. A decision to waive the requirement shall be made in coordination with state and federal regulatory agencies.

Finding: When disposing of dredged materials, the Corps implements best management practices to minimize effects to water quality, including sediment sampling, water quality monitoring, and turbidity monitoring and minimization measures. The Best Management Practices are further defined in the Determination of Compatibility, included as Exhibit 7. Past monitoring, both instrument and visual, has shown that turbidity quickly dissipates because the dredged material is predominately sand.[32] Placement only occurs in areas that are deeper than 20 feet where little to no benthic productivity is occurring and where fish may migrate but would avoid any dredged material placement activity. Any juvenile fish in the general vicinity would be closer to the shoreline. The most recent dredged material suitability determinations are included as Exhibit 4. The Corps will continue to monitor the disposal of dredged material and a condition of their water quality certification with the Oregon Department of Environmental Quality contains a requirement to submit annual monitoring reports.

E. Flow lane disposal shall be in aquatic development areas identified as low in benthic productivity and use of these areas shall not have adverse hydraulic effects. Use of flow lane disposal areas in the estuary shall be allowed only when no feasible alternative land or ocean disposal sites with less damaging environmental impacts can be identified and the biological and physical impacts of flow lane disposal are demonstrated to be insignificant. The feasibility and desirability of alternative sites shall take into account, at a minimum:

1. Operational constraints such as distance to the alternative sites;
2. Sediment characteristics at the dredging site;
3. Timing of the operation;
4. Environmental Protection Agency constraints on the use of designated ocean disposal sites;
5. The desirability of reserving some upland sites for potentially contaminated material only.

[32] Source: Annual reports provided by USACE to ODEQ as condition of 401 certification (main channel meter-based monitoring from 2005 until 2014 and then visual monitoring thru 2023 and side channel meter-based monitoring thru 2023). Letter from USACE to ODEQ 10 May 2006 providing supporting documents for 401 certification amendment as requested by ODEQ.

Long term use of a flow lane disposal area may only be allowed if monitoring confirms that the impacts are not significant. Flow lane disposal is contingent upon demonstration that:

6. Significant adverse effects due to changes in biological and physical estuarine properties will not result; and

7. Flow lane disposal areas shall be shown able to transport sediment downstream without excessive shoaling, interference with recreational and commercial fishing operations, including the removal of snags from gillnet drifts, undesirable hydraulic effects, or adverse effects on estuarine resources (fish runs, spawning activity, benthic productivity, wildlife habitat, etc.).

Finding: The section of this application related to "OAR 660-004-0020 Goal 2, Part II(c), Exception Requirements" describes the demonstrated need for the proposed action. Page 13 of this application, under the subsection titled "Areas that do not require a new exception cannot reasonably accommodate the use," contains information to justify why there are no feasible disposal alternatives (such as upland and ocean disposal sites), which includes, but is not limited to, operational constraints. In-water placement occurs in locations that the Corps has determined will not result in excessive FNC shoaling from remobilized placed sediment. Dredged sediment is placed within the river thalweg to not harm living resources, not adversely affect other uses of the river, sustain the thalweg, and not rapidly return to the FNC. These standards for flowlane disposal of dredged material have been met.

16.160.080 Fish and Wildlife Habitat.

A. Projects affecting endangered, threatened or sensitive species habitat, as identified by the U.S. Fish and Wildlife Service or Oregon Department of Fish and Wildlife, shall be designed to minimize potential adverse impacts. This shall be accomplished by one or more of the following:

1. Soliciting and incorporating agency recommendations into local permit reviews.

2. Dedicating and setting aside undeveloped on-site areas for habitat.

3. Providing on or off-site compensation for lost or degraded habitat.

4. Retaining key habitat features (for example, roosting trees, riparian vegetation, feeding areas).

B. In-water construction activity in aquatic areas shall follow the recommendations of state and federal fisheries agencies with respect to project timing to avoid unnecessary impacts on migratory fish.

C. Uses and activities with the potential for adversely affecting fish and wildlife habitat may be approved only if the following impact mitigation actions are incorporated into the permit where feasible. These impact mitigation actions are listed from highest to lowest priority:

1. Avoiding the impact altogether by not taking a certain action or parts of an action.

2. Minimizing impacts by limiting the degree or magnitude of an action and its implementation.
3. Rectifying the impact by repairing, rehabilitating, restoring the affected environment (this may include removing wetland fills, rehabilitation of a resource use and/or extraction site when its economic life is terminated, etc.).
4. Reducing or eliminating the impact over time by preservation and maintenance operations.

Finding: State and federal fish and wildlife agencies have been consulted on the proposed action as undertaken by the Army Corps; agency comments have been incorporated. The Corps will follow the work windows in the most current 2012, 2021, and 2023 Biological Opinions from National Marine Fisheries Service (NMFS) for the ongoing O&M activities, including flowlane disposal.

As a matter of practice, the Corps only dredges the minimum area necessary to maintain the Columbia River FNCs' dimensions and placement sites are designed to be the smallest acreage needed to accommodate the fill. The placement of dredged material would occur in areas that minimize loss or disruption of fish and wildlife habitat and damage to estuarine resource properties. Biological resources within the Columba River system are diverse. There are four primary habitats that encompass the Lower Columbia River system: Estuarine, Riverine, Riparian, and Upland. Each of these habitats carries an intricate level of biologic complexity. The FNC O&M operates within each of the habitats to a varying degree. The Corps has already undergone consultation with the National Marine Fisheries Service (NMFS) and the US Fish and Wildlife Service (USFWS) for the current O&M dredging of FNCs in the Columbia River, which did evaluate disposal of dredged material deeper than 20ft and contiguous with the FNC. The Corps follows established BMPs to minimize adverse impacts to the aquatic and terrestrial environment; the most recent set of both dredging and placement BMPs were detailed in section 1.3 of Exhibit 3 that included an incidental take statement for salmon, steelhead, green sturgeon, and eulachon for inadvertent take occurring during proposed maintenance of the CR FNCs. These baseline activities associated with maintenance dredging of the CR FNCs have not changed; and implementation of these BMPs has been successful in minimizing potential adverse impacts to the aquatic environment. NMFS also issued a Biological Opinion on June 16, 2021 (2021 BiOp , Exhibit 5) and on February 16, 2023 (2023 BiOp, Exhibit 6). The Corps will follow the BMPs outlined in the 2012, 2021 and 2023 BiOps unless or until superseded by a later BiOp. The USFWS concurred with the Corps' determination that the action would have no effect on the following listed species: western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, water howellia, and yellow-billed cuckoo and "may affect, but is not likely to adversely affect" bull trout, marbled murrelet, and Columbian white-tailed deer (Service reference# 13420-2010-I-0165). The Corps will follow all of the reasonable and prudent measures in the associated biological opinions, and conservation measures that USACE included in the proposed action. Lastly, dredge-equipment limitations in this particular stretch of the Columbia River would not allow for material placement in areas shallower than 20 feet.

16.160.180 Water Quality Maintenance.

C. The potential adverse impacts on water quality of dredging, fill, in-water dredged material disposal, in-water log storage, water intake or withdrawal, and slip or marina development will be assessed during permit review. Parameters to be addressed include:

1. *Turbidity.*
2. *Dissolved oxygen.*
3. *Biochemical oxygen demand.*
4. *Contaminated sediments.*
5. *Salinity.*
6. *Water temperature.*
7. *Flushing.*

Finding: The Corps includes the above parameters in assessing where and how to place dredged material within the Columbia River estuary in accordance with other regulations, requirements, and best management practices. This standard has been met.

Chapter 16.164 Impact Assessment and Resource Capability Determination

16.164.010 Impact Assessment.

Oregon Statewide Planning Goal 16, dealing with estuarine resources, requires that actions which would potentially alter the estuarine ecosystem must be preceded by an assessment of potential impacts. The impact assessment need not be lengthy and complex, but it should enable reviewers to gain a clear understanding of the impacts expected.

16.164.030 Information Needed for an Impact Assessment.

Information needed to complete the impact assessment may be obtained from sources other than the permit application, such as a Federal Environmental Impact Statement. An assessment of impacts of aquatic area pesticide and herbicide application shall be provided by the Oregon Department of Agriculture and the Oregon Department of Environmental Quality. An assessment of the impacts of new point-source wastewater discharges into the Columbia River Estuary will be provided through the National Pollution Discharge Elimination System (NPDES) permit program. A complete impact assessment includes the following information:

A. Aquatic life forms and habitat, including information on both the extent of and impacts on habitat type and use, species present (including threatened or endangered species), seasonal abundance, sediments, and vegetation.

B. ~~Shoreland life forms and habitat, including information on both the extent of and impacts on habitat type and use, species present, (including threatened or endangered species), seasonal abundance, soil types and characteristics, and vegetation present.~~

C. Water quality, including information on sedimentation and turbidity, dissolved oxygen, biochemical oxygen demand, contaminated sediments, salinity, water temperatures, and expected changes due to the proposed use or activity.

D. Hydraulic characteristics, including information on water circulation, shoaling patterns, potential for erosion or accretion in adjacent areas, changes in flood levels, flushing capacity, and water flow rates.

E. Air quality, including information on quantities of particulates and expected airborne pollutants.

F. ~~Public access to the estuary and shoreline, including information on proximity to publicly-owned shorelands and public street ends; effect on public boat launches, marinas and docks; and impact on inventoried public access opportunities.~~

G. Navigation, including information on distance from navigation channels, turning basins and anchorages; proximity to range markers.

H. ~~Demonstration that proposed structures or devices are properly engineered.~~

I. Demonstration that the project's potential public benefits will equal or exceed expected adverse impacts.

J. ~~Demonstration that non-water dependent uses will not preempt existing or future water-dependent utilization of the area.~~

K. Determination of methods for mitigation and accommodation of the proposed development, based on subsections A through J of this section in order to avoid or minimize preventable adverse impacts.

Finding: The criteria in strikethrough are not applicable to this proposed action. The Corps finalized an Environmental Impact Statement for the Columbia River Improvement Project in 2003, which includes review of flowlane disposal within the river thalweg[33]. Additionally, the Corps issued a supplemental environmental assessment in 2014 for the Columbia River FNC operations and maintenance dredging and dredged material placement, which also includes the disposal of dredged material in the river thalweg[34]. These documents, as well as other sections of this application, include all the criteria as required above in A, C, D, E, and G for an impact assessment for this proposed action.

(I) As demonstrated throughout this application, the disposal of dredged material within the river thalweg has minimal impacts to the estuarine environment and includes some benefits to sustaining the river's sediment budget. Conversely, not being able to maintain the FNC at its authorized depths has cascading detrimental impacts to the economies of not only

[33] https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/727
[34] https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/4924

Washington and Oregon, but many other states and countries as well due to impacts to international shipping. Therefore, the public benefits outweigh the minimal adverse impacts.

(K) The Corps considers the thalweg to be the "action area" and includes the FNC out to the 20-ft depth contours on both sides of the FNC; this is where the river is moving most of the bed load sediment during the year. The river's thalweg is also where mobilized sediments interact with the river's morphology before migrating downslope toward the deepest part of the thalweg and into the FNC. The Corps has stated that its in-water placement practices strive to emulate natural processes by placing dredged sediment within the river's thalweg to allow sediments to be re-distributed back onto the river's morphology, sustaining the river's sediment budget, and maintaining habitats that rely on sediment.

The Corps states that the proposed expansion of the flowlane dredged material placement area within the river thalweg avoids the rapid return of dredged material to the FNC while facilitating reintroduction of dredged material into the river system and maintaining habitat complexity within the river system. Placing material in the thalweg keeps material in the river to stabilize the riverbed and protect habitat. Removing material to uplands or the ocean would remove that sediment from the system and the riverbed and habitat would degrade, losing islands, tidal shoals, lagoons, and the living resources that depend on that river morphology.

16.164.050 Resource Capability Determination.

Some uses and activities may only be approved when consistent with the resource capabilities of the area and the purposes of the zone. This section describes procedures for making this determination. A completed resource capability determination consists of the following elements:

A. Identification of the affected area's zone, and its purpose.

B. Identification of the types and extent of estuarine resources present and expected adverse impacts. This information is included in the impact assessment.

C. A determination of whether the use or activity is consistent with the resource capabilities of the affected zone. A use or activity is consistent with the resource capabilities of the area when either:

1. Impacts on estuarine resources are not significant; or

2. Resources of the area will be able to assimilate the use and activity and their effects and continue to function in a manner which:

a. In natural aquatic zones, protects significant wildlife habitats, natural biological productivity, and values for scientific research and education; or

b. In conservation aquatic zones, conserves long-term use of renewable resources, natural biological productivity, recreation and aesthetic values and aquaculture.

3. For temporary alterations, the resource capability determination must also include:

a. Determination that potential short-term damage to estuary and shoreland resources is consistent with the resource capabilities of the area; and

b. Determination that the area and affected resources can be restored to their original condition.

D. Determining Consistency with the Purpose of the Zone. Certain uses in the Aquatic Development (A-1), Aquatic Conservation (A-2), and Aquatic Natural (A-3) Zones may be permitted only if they are consistent with the purpose of the aquatic zone in which they occur. This determination is made as follows:

1. Identification of the affected zone, and its purpose.

2. Description of the proposal's potential impact on the purposes of the affected zone.

3. Determination that the proposal is either:

a. Consistent with the purpose of the affected zone; or

b. Conditionally consistent with the purpose of the affected zone; or

c. Inconsistent with the purpose of the affected zone.

Finding: (A) The proposed goal exception area includes zones identified by the city as Aquatic Conservation and Aquatic Natural (though as described in (D) below, the proposed action avoids the natural areas as described in the Comprehensive Plan). The purpose of both zones is described in the finding for (D) below.

(B) In the Corps' most recent consultation with the National Marine Fisheries Service (NMFS) evaluating the potential effects of placement activities at seven dredged material transfer sites in the flowlane adjacent to the FNC, NMFS included a table in their opinion that estimated the percentage of the flowlane subject to dredging and placement activities below 20-ft depth relative to the overall area of the flowlane and estimated that the area of habitat potentially affected ranged from 0-15.2%, with an average of roughly 9% per reach (NMFS 2023[35]). NMFS ultimately concluded that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River Chinook salmon, Upper Columbia River (UCR) spring run Chinook salmon, Snake River (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SR steelhead or destroy or adversely modify their designated critical habitat (NMFS 2023). NMFS also concurred with the Corps that adverse effects to green sturgeon and eulachon were unlikely (NMFS 2023).

[35] NMFS. 2023. Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower Columbia River Federal Navigation Channel Dredged Material Transfer Sites (HUC170800060500, 170800030900, 170800030200). NMFS Consultation No. WCRO-2022-02520. 16 February 2023. https://doi.org/10.25923/djwp-c334.

(C) As demonstrated through the Biological Opinions issued for the Corps in 2012, 2021, and 2023, the proposed action is consistent with the resource capabilities of the affected zone because impacts on estuarine resources are not significant. See finding under 16.160.080 Fish and Wildlife Habitat, as well as Exhibits 3, 5, and 6, for additional details from the Biological Opinions.

(D) The city's development code states that "the purpose of the Aquatic Conservation Zone is to conserve designated areas for long-term uses of renewable resources that do not require major alterations of the estuary, except for the purpose of restoration. They are managed for the protection and conservation of the resources found in these areas. The Aquatic Conservation Zone includes areas needed for the maintenance and enhancement of biological productivity, recreational resources, aesthetic features and aquaculture. The Aquatic Conservation Zone includes areas that are smaller or of less biological importance than aquatic natural areas. Areas that are partially altered and adjacent to existing moderate intensity development which do not possess the resource characteristics of other aquatic areas are also included in this zone." The proposed action to allow the disposal of dredged material in this zone is consistent with the zone's purpose because it avoids the rapid return of dredged material to the FNC while facilitating reintroduction of dredged material into the river system and maintaining habitat complexity within the river system. Placing material in the thalweg keeps material in the river to stabilize the riverbed and protect habitat. Removing material to uplands or the ocean would remove that sediment from the system and the riverbed and habitat would degrade. The action also would be implemented so as to avoid or minimize any adverse impacts to existing habitats or species, as outlined in the Biologic Opinions.

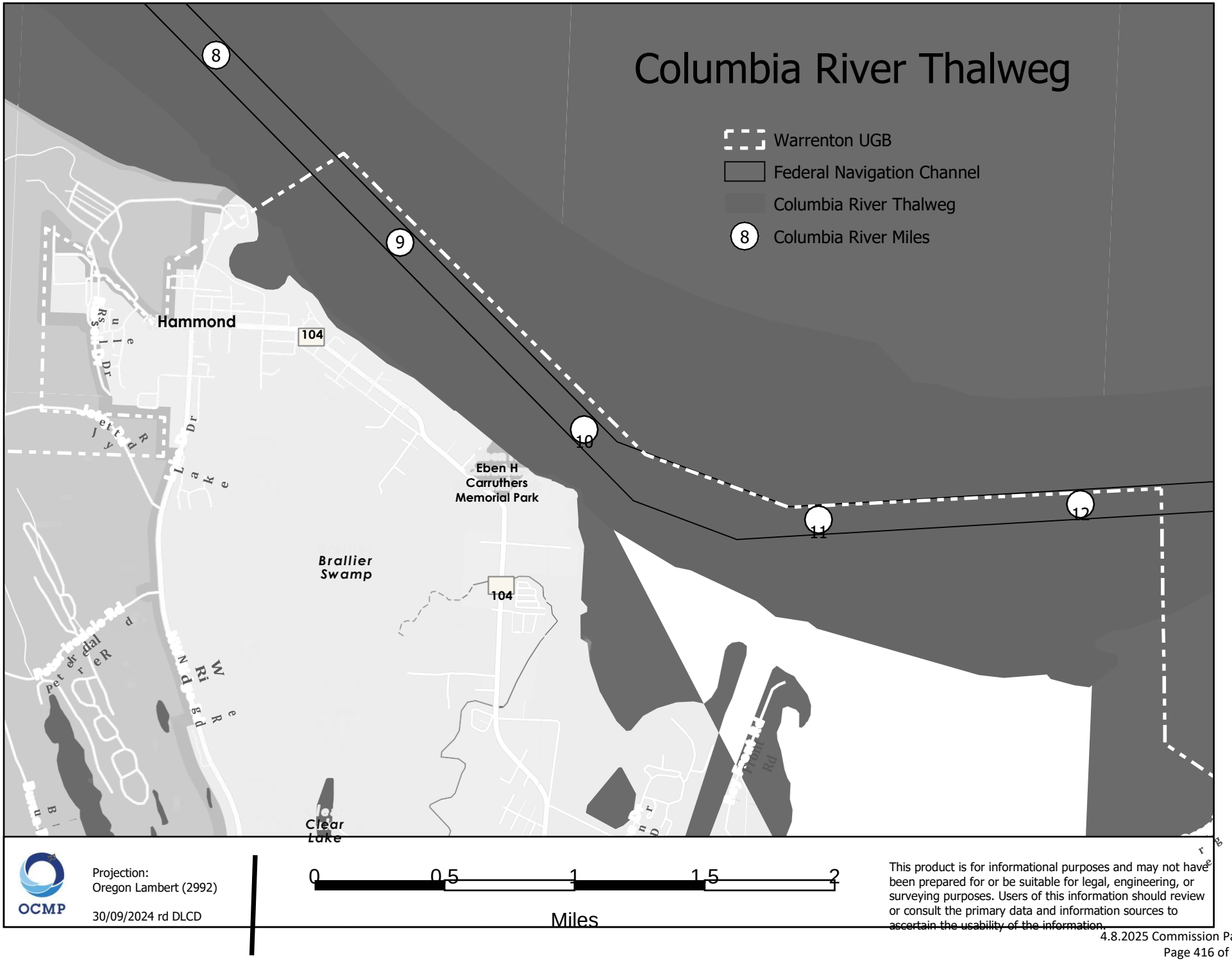
The city's development code states that "the purpose of the Aquatic Natural Zone is to assure the protection of significant fish and wildlife habitats; of continued biological productivity within the estuary; and of scientific, research, and educational needs. These areas are managed to preserve natural resources in recognition of dynamic, natural, geological, and evolutionary processes. Natural aquatic areas include all major tidal marshes, tide flats, and seagrass and algae beds. The designation is intended to preserve those natural aquatic resource systems existing relatively free of human influence." While the city's zoning map does identify some areas as Aquatic Natural that coincide with the approximate area of the river thalweg over a five-year period (Exhibit 2), the descriptions of the boundaries of the zones in estuary subareas of the city's Comprehensive Plan do not include the proposed goal exception area as Aquatic Natural. The goal exception area does not include any areas identified by the city as significant natural resources and does not include major tidal marshes, tide flats, or seagrass and algae beds. Therefore, this proposal is consistent with the purpose of the Aquatic Natural Zone by avoiding significant natural resource areas.

Exhibits

- Exhibit 1: Informational Map – 5-year Estimate of the Columbia River Estuary Thalweg Extent for Purposes of Proposed Flowlane Disposal.
- Exhibit 2: Informational Map – 5-year Estimate of the Columbia River Estuary Thalweg Extent for Purposes of Proposed Flowlane Disposal, City of Warrenton Urban Growth Boundary
- Exhibit 3: 2012 NOAA National Marine Fisheries Service Biological Opinion for Operations and Maintenance of the Columbia River Navigation Channel.
- Exhibit 4: Portland Sediment Evaluation Team Memorandum
- Exhibit 5: 2021 NOAA National Marine Fisheries Service Biological Opinion for Operations and Maintenance of the Columbia River Navigation Channel.
- Exhibit 6: 2023 NOAA National Marine Fisheries Service Biological Opinion for Operations and Maintenance of the Columbia River Navigation Channel.
- Exhibit 7: Determination of Compatibility, including Best Management Practices, for Columbia River Navigation Channel Operations and Maintenance.
- Exhibit 8: Visual Information Slides presented to Clatsop County by the US Army Corps of Engineers, January 2024.
- Exhibit 9: Best Management Practices, excerpt from Exhibit 7: Determination of Compatibility
- Exhibit 10: Corps 2023 application to Oregon DEQ for Section 401 Water Quality Certification
- Exhibit 11: 2014 USFWS Biological Assessment for the Continued Operations and Maintenance Dredging Program for the Columbia River Federal Navigation Channel

Columbia River Estuary Thalweg

CrediD: Portland District US Army Corps of Engineers Channels and Harbors Waterways Maintenance Section (MARCH 2024)


Columbia River Thalweg
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

Refer to NMFS No.:

2011/02095

July 11, 2012

Joyce E. Casey
Portland District, Corps of Engineers
CENWP-OP-GP
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Columbia River Navigation Channel Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington (HUCs 1708000605,1708000307, 1708000108)

Dear Ms. Casey:

On March 11, 2005, the National Marine Fisheries Service (NMFS) issued a biological opinion (opinion) on the effects of the Army Corps of Engineers (Corps) Columbia River Channel Operations and Maintenance Program, Mouth of the Columbia River to Bonneville Dam (refer to NMFS No.: 2004/011041). NMFS had previously issued an opinion to the Corps for the Columbia River Federal Navigation Channel Improvement Project on February 16, 2005 (refer to NMFS No.: 2004/01612). The March 11, 2005 opinion was due to expire on March 11, 2010, but was extended on April 21, 2010 (refer to NMFS No.: 2010/01697) until a new biological opinion was in place. Pursuant to 50 CFR 402.16 the Corps requested consultation for the Columbia River Channel Operations and Maintenance Program as: (a) the action was subsequently modified in a manner that has an effect to the listed species or designated critical habitat that was not considered in the biological opinion; and (b) eulachon and the southern green sturgeon have been listed and critical habitat for the two species has been designated.

The enclosed document contains an opinion prepared by the NMFS pursuant to section 7(a)(2) of the Endangered Species Act (ESA) based on a revised analysis of the effects of the proposed action in light of modification of the proposed action, the listing of eulachon (*Thaleichthys pacificus*) and the southern green sturgeon (*Acipenser medirostris*); as well as the designation of critical habitat for the eulachon and southern green sturgeon. In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Upper Willamette River (UWR) spring-run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, Columbia River chum salmon (*O. keta*), LCR coho salmon (*O. kisutch*), SR sockeye salmon (*O. nerka*), LCR steelhead (*O. mykiss*), UWR steelhead, Middle Columbia River (MCR) steelhead, UCR steelhead, Snake River Basin (SRB) steelhead, southern green sturgeon, or eulachon, or result in the destruction or adverse modification of designated critical habitats of any of those species, except for LCR coho salmon, for which critical habitat has not been proposed or designated.

In addition, NMFS concluded that the proposed action is not likely to adversely affect the leatherback sea turtle (*Dermochelys coriacea*), the Steller sea lion (*Eumetopias jubatus)*, the Southern Resident Killer Whale (*Orcinus orca*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*) sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*) and sperm whale (*Physeter macrocephalus*). The action area includes designated critical habitat for the leatherback sea turtle. NMFS concluded the proposed action is not likely to adversely affect the leatherback sea turtle designated critical habitat.

As required by section 7 of the ESA, NMFS is providing an incidental take statement (ITS) with the opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the Federal action agency and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition. NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened Pacific eulachon. Anticipating that such a rule may be issued in the future, we have included a prospective incidental take exemption for eulachon. The elements of this ITS that relate to eulachon would take effect on the effective date of any future 4(d) rule prohibiting take of eulachon.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These conservation recommendations are a subset of the ESA Terms and Conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the Corps must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of conservation recommendations accepted.

The enclosed opinion, incidental take statement, and EFH conservation recommendations completely replace those issued for this action on February 16, 2005, March 11, 2005 and April 21, 2010 which are withdrawn and now have no further effect.

Please direct questions regarding this opinion to Ken MacDonald, fishery biologist in the Oregon State Habitat Office, at 503.231.2243.

Sincerely,

for William W. Stelle, Jr.
Regional Administrator

cc: Gretchen Smith, U.S. Army Corps of Engineers, Portland District
Jessica Stokke, U.S. Army Corps of Engineers, Portland District
Ross Island Sand and Gravel CO.
HME Construction, Inc
Jeff Steyaert, Knife River
Bryan Wigginton, Northwest Aggregates Company

Endangered Species Act Biological Opinion
and
Magnuson-Stevens Fishery Conservation and Management Act
Essential Fish Habitat Response

for the

Reinitiation of Columbia River Navigation Channel Operations and Maintenance
Mouth of the Columbia River to Bonneville Dam, Oregon and Washington
(HUCS 1708000605, 1708000307, 1708000108)

NMFS Consultation Number: 2011/02095

Federal Action Agency: U. S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect this species or its critical habitat?	Is the Action likely to jeopardize this species?	Is the action likely to destroy or adversely modify critical habitat for this species?
Lower Columbia River Chinook salmon	T	Y	N	N
Upper Willamette River spring-run Chinook salmon	T	Y	N	N
Upper Columbia River Chinook salmon	E	Y	N	N
Snake River spring/summer run Chinook salmon	T	Y	N	N
Snake River fall-run Chinook salmon	T	Y	N	N
Columbia River chum salmon	T	Y	N	N
Lower Columbia River coho salmon	T	Y	N	N/A
Snake River sockeye salmon	E	Y	N	N
Lower Columbia River steelhead	T	Y	N	N
Upper Willamette River steelhead	T	Y	N	N
Middle Columbia River steelhead	T	Y	N	N
Upper Columbia River steelhead	T	Y	N	N
Snake River Basin steelhead	T	Y	N	N
Southern green sturgeon	T	N	N	N
Eulachon	T	Y	N	N
Leatherback sea turtle	E	N	N	N
Eastern Steller sea lion	T	N	N/A	N/A
Southern Resident Killer Whale	E	N	N/A	N/A
Humpback Whale	E	N	N/A	N/A
Blue Whale	E	N	N/A	N/A
Fin Whale	E	N	N/A	N/A
Sei Whale	E	N	N/A	N/A
Sperm Whale	E	N	N/A	N/A

Fishery Management Plan that Describes EFH in the Action Area	Would the action adversely affect EFH?	Are EFH conservation recommendations provided?
Pacific Coast Salmon	Y	Y
Pacific Coast Groundfish	Y	Y
Coastal Pelagic Species	Y	Y

Consultation
Conducted By: National Marine Fisheries Service
Northwest Region

Issued by:

for William W. Stelle, Jr.
Regional Administrator

Date: July 11, 2012

TABLE OF CONTENTS

1. INTRODUCTION 1
1.1 Background 1
1.2 Consultation History 1
1.3 Proposed Action 3
1.3.1 Types of Dredges 5
1.3.2 Advanced Maintenance Dredging (Routine) 6
1.3.3 Dredging of Shoals Outside the Primary Dredging Season (Non-Routine) 6
1.3.4 Description of Disposal Operations 7
1.3.5 Description of Activities Proposed by Reach 13
1.3.6 In-Water Work Periods 17
1.3.7 Interrelated Interdependent Actions 17
1.4 Action Area 18
2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT 21
2.1 Introduction to the Biological and Conference Opinion 21
2.2 Rangewide Status of the Species and Critical Habitat 22
2.2.1 Status of the Species 23
2.2.2 Status of Critical Habitat 49
2.3 Environmental Baseline 66
2.3.1 Species Environmental Baseline - Salmon and Steelhead 66
2.3.2 Species Environmental Baseline - Eulachon 70
2.3.3 Species Environmental Baseline – Green Sturgeon 72
2.3.4 Environmental Baseline – Habitat 73
2.3.4 Environmental Baseline Summary 88
2.4 Effects of the Action on the Species and its Designated Critical Habitat 89
2.4.1 Direct Effects – Entrainment and Burial 90
2.4.2 Habitat Effects 105
2.4.3 Effects on Critical Habitat within the Action Area 119
2.5 Cumulative Effects 122
2.6 Integration and Synthesis 123
2.7 Conclusion 129
2.8. Incidental Take Statement 129
2.8.1 Amount or Extent of Take 130
2.8.2 Effect of the Take 132
2.8.3 Reasonable and Prudent Measures 132
2.8.4 Terms and Conditions 132
2.9. Conservation Recommendations 136
2.10 Reinitiation of Consultation 137
2.11 “Not Likely to Adversely Affect” Determinations 137
2.11.1 Steller Sea Lion 138
2.11.2 Leatherback Sea Turtle 138
2.11.3 Blue Whales, Fin Whales, Sperm Whale, Sei Whale, Humpback Whales and Southern Resident Killer Whales. 140
3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT 141
3.1 Essential Fish Habitat Affected by the Project 141
3.2 Adverse Effects on Essential Fish Habitat 145

3.3 Essential Fish Habitat Conservation Recommendations 145
3.4 Statutory Response Requirement 146
3.5 Supplemental Consultation 146
4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW .. 146
5. LITERATURE CITED 148
6. APPENDICES 160

GLOSSARY

For purposes of this consultation –

Accretion means accumulation of sediment deposited by natural fluid flow processes.

Bar means a ridge or succession of ridges of sand or other substances, especially a formation extending across the mouth of a river or harbor that may obstruct navigation.

Beach erosion means carrying away of beach materials by wave action, tidal currents, littoral currents, or wind

Beach nourishment means process of replenishing a beach by artificial means, such as through deposition of dredged materials; also called beach replenishment or beach feeding.

Bedload means sand that rolls and bounces along the surface of the riverbed, usually downstream, although there may be a small displacement toward deeper water caused by the side slopes of the riverbed. In sandy riverbeds, bedload transport shapes the bed into a series of sand waves

Beneficial use means placement or use of dredged material for some productive purpose. Examples of beneficial uses include habitat development, beach nourishment, aquaculture, parks and recreation, shoreline stabilization, and erosion control

Biological or biochemical oxygen demand means the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period

Deposition means deposit of sediment in an area through natural means, such as wave action or currents, or mechanical means.

Dredging means removal or redistribution of sediments from a watercourse.

Floodplain means a flat tract of land bordering a river, mainly in its lower reaches, and consisting of alluvium deposited by the river during flooding.

Freshet means high stream flow caused by rains or snowmelt and resulting in the sudden influx of a large volume of freshwater in the estuary.

Freshwater means water that is less than 0.5 part salt per thousand.

Intertidal means of or relating to the substrate that is exposed and flooded by tides; includes the associated splash zone.

In-water disposal means placement of dredged material along the riverbed in or adjacent to the navigational channel or in designated in-water sites; commonly referred to as flow-lane disposal.

In-water work means any part of an action that occurs below ordinary high or within the wetted channel, *e.g.*, excavation of streambed materials, fish capture and removal, flow diversion, streambank protection, and work area isolation.

Littoral means of, relating to, or situated or growing on or near a shore; especially of the sea.

Littoral cell means to assess the sedimentary budget the coast has to be divided into two separate morphologies, commonly known as littoral cells and compartments. The 165-km long Columbia River Littoral Cell mainly contains Columbia River sediments and is confined between the rocky headlands of Point Grenville to the north and Tillamook Head to the south (Peterson *et al*.1991 as cited in Sherwood *et al.* 2003).

Littoral current means a current running parallel to the beach and generally caused by waves striking the shore at an angle

Mean higher high water means the average height of the higher of two unequal daily high tides over 19 years.

Mean lower low water means the average height of the lower of two unequal daily low tides over 19 years

Navigational channels means channels in estuaries and other water bodies that are created, deepened, and maintained by dredging to enable vessels to navigate safely between, into and out of ports, harbors, and marinas without running aground.

Nearshore means an indefinite zone extending seaward from the shoreline well beyond the breaker zone.

Ocean-type means of or relating to salmonid juveniles that enter the estuary as fry or fingerlings and stay in the estuary for weeks or months before entering the ocean; examples are chum and subyearling Chinook.

Pelagic means pertaining to the open ocean.

Piling means a long, heavy timber or section of concrete or metal that is driven into the earth or bottom of a water body to serve as a structural support or protection.

Pile dike means two parallel rows of piling that are tied together and extend 300 to 500 feet into the river.

Plume means the layer of Columbia River water in the nearshore Pacific Ocean.

Polychlorinated biphenyls (PCBs) mean a group of synthetic, toxic industrial chemical compounds that are chemically inert and not biodegradable; they once were used in making paint and electrical transformers.

Polycyclic aromatic hydrocarbons (PAHs) means a group of more than 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat.

River Mouth means mouth of the Columbia River between river mile -3 and +3.

Salmonid means any member of the family Salmonidae, which includes the salmon, trout, char, whitefishes, and grayling of North America.

Sand means an unconsolidated mixture of inorganic soil (possibly including disintegrated shells and coral) consisting of small but easily distinguishable grains ranging in size from about 0.062 mm to 2.0 mm.

Sand waves means waves of sand on the bottom of a riverbed that move in response to river discharge and bedload transport. In the Columbia, sand waves cover the riverbed and are typically 4 to 8 feet high and 300 to 400 feet long. When the river discharge is less than 300,000 cfs, sand waves move only a few feet per day; however, when discharge exceeds 400,000 cfs, sand wave movement can reach 20 feet per day or more.

Sediment means material in suspension in water or recently deposited from suspension; in the plural, all kinds of deposits from the waters of streams, lakes, or seas.

Shoaling means a gradual decrease in water depth as the result of the accretion of sediments.

Smolts mean juvenile salmonids that have left their natal stream and are headed downriver toward the ocean.

Stream-type means of or relating to salmonid juveniles that rear in freshwater for a year or more before entering the ocean.

Turbidity means a condition in bodies of water where high sediment loads cause clouding of the water to varying extents; turbidity is an optical phenomenon and does not necessarily have a direct linear relationship to particulate concentration.

LIST OF ABBREVIATIONS

Ac	Acre
AMD	Advanced Maintenance Dredging
AUP	Annual Use Plan
BA	Biological Assessment
BMP	Best Management Practice
BOD	Biological or biochemical oxygen demand
CHART	Critical Habitat Analytical Review Team
Corps	Army Corps of Engineers
CRD	Columbia River Datum
cy	Cubic yards
DO	Dissolved oxygen
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
FNC	Columbia River Federal Navigation Channel
HAPC	Habitat Area of Particular Concern
HUC	Hydraulic Unit Code
LCR	Lower Columbia River
MCR	Middle Columbia River
mcy	Million cubic yards per year
MLLW	Mean lower low water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
PCE	Primary constituent element
RM	River Mile
RSMP	Regional Sediment Management Plan
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
SEF	Northwest Regional Sediment Evaluation Framework
SR	Snake River
SRB	Snake River Basin
TRT	Technical Review Team
UCR	Upper Columbia River
UWR	Upper Willamette River
VSP	Viable Salmonid Population
WLC	Willamette/Lower Columbia

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service (NMFS) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531, *et seq*.), and implementing regulations at 50 CFR 402.

The NMFS also completed an Essential Fish Habitat (EFH) consultation. It was prepared in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, *et seq*.) and implementing regulations at 50 CFR 600.

The opinion and EFH conservation recommendations are both in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

1.2 Consultation History

On October 20, 2009, the NMFS received a biological assessment (BA) from the U.S. Department of the Army, Corps of Engineers, Portland District (Corps) requesting to reinitiate formal consultation for the continued maintenance dredging of the Columbia River Federal Navigation Channel (FNC), including advanced maintenance dredging, from the mouth of the Columbia River at river mile (RM) -3 to Bonneville Dam, at RM 145, eight side channels, and the disposal of dredged material (Corps 2009a).

At that time, the Corps was operating under an opinion due to expire on March 11, 2010 (refer to NMFS No.: 2004/01041, March 11, 2005). The maintenance dredging of the portion of the FNC that was deepened under the Columbia River Channel Improvement Project (CRCIP) was covered by another 2005 opinion (refer to NMFS No.: 2004/01612). The CRCIP opinion did not have an expiration date.

This opinion is intended to supersede both 2005 opinions regarding maintenance of the FNC from the River Mouth to Bonneville Dam and provide the Corps with a comprehensive, up-to-date analysis and guide all future maintenance actions.

The Corps (2009a) also included an assessment of four new beneficial use disposal sites designated in the ocean to improve sediment management at the mouth of the Columbia River (the River Mouth) that were later described in greater detail in *The Mouth of the Columbia River Regional Sediment Management Plan* (or RSMP) (LCSG 2011). The goal of the RSMP is to increase the beneficial use of dredged sediment at the River Mouth to better protect channel jetties, coastal beaches and nearshore habitats from erosion while avoiding and minimizing adverse environmental and navigational safety effects. These four new sites, together with three

ocean sites already in use, provide a network of nearshore and intertidal sediment placement sites with greater flexibility to meet those needs. Further, the Corps proposed to continue to allow limited removal of sand by vendors for commercial use under license agreements with the Corps' Waterways Maintenance Section.

On April 21, 2010 NMFS received a letter from the Corps requesting reinitiation of consultation for the March 11, 2005 opinion. The reinitiation was requested as the March 11 2005 opinion was due to expire and the eulachon and southern green sturgeon were not listed at when the 2005 opinion was issued. In their letter the Corps also requested reinitiation of consultation for the CRCIP project. NMFS issued an incidental take statement for the continued Columbia River Channel Operations and Maintenance Program, Mouth of the Columbia River to Bonneville Dam (refer to NMFS No.: 2010/01697),to be effective while consultation proceeded. The Corps withdrew its October 20, 2009, request for consultation (Larson 2010) on November 1, 2010.

On February 2, 2011, NMFS received a letter and BA dated January 2011(Corps 2011a), from the Corps renewing its request for formal consultation on the effects of continued maintenance and operation of the FNC on 13 species of salmon and steelhead in the Columbia River Basin, the southern distinct population segment of green sturgeon (southern green sturgeon) (*Acipenser medirostris*), the southern distinct population segment of eulachon (eulachon) (*Thaleichthys pacificus*), marine mammals, marine turtles, and their designated critical habitats. The Corps amended the BA in April 2011, and subsequently withdrew the document submitted in February.

On April 27, 2011, the Corps requested consultation with the revised BA (Corps 2011b), which was then amended again in August 2011(Corps 2011c). On November 11 2011, NMFS received information describing the FNC history and authorizing legislation (Appendix 1: FNC History).

On November 15, 2011, NMFS received an email clarifying that the proposed Portland Harbor work was being withdrawn from the consultation (Smith 2011). NMFS and Corps representatives continued to work on refining the proposed action and describing potential effects of the action.

On March 5, 2012, the Corps provided NMFS a final revised proposed action (Smith 2012a). Consultation was initiated at this time.

On March 14, 2012, NMFS received from the Corps an analysis of the amount of area potentially impacted by dredging along with additional best management practices to reduce potential effects to eulachon (Smith 2012b).

On March 20, 2012, NMFS received clarification that the Portland Harbor area which is actually in the Willamette River, should not be included in this consultation but that the Portland - Vancouver Anchorage in the Columbia River is in the proposed action (Smith 2012c).

On January 5, and January 27, 2012, consistent with the Secretarial Order: American Indian Tribal Rights, Federal Tribal Trust Responsibilities and the Endangered Species Act (June 5,1997), NMFS sent letters to eight Indian Tribes within the Columbia River basin to initiate technical level meetings and if desired, formal government to government consultation between

NMFS and the Tribes. NMFS also sent a letter to the Columbia River Intertribal Fish Commission on February 3, 2012.

On January 27, 2012, a technical meeting between NMFS, the Corps, and biologists from the Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife and the Cowlitz Indian Tribe was held to discuss the current knowledge regarding eulachon in the Columbia River.

On February 24, 2012, NMFS participated in a conference call to discuss the proposed action and consultation with representatives of the Confederated Tribes of the Colville Reservation.

On March 5, 2012, NMFS participated in a second conference call to discuss the proposed action and consultation with representatives of the Yakama Nation.

A complete record of this consultation is on file at the Oregon State Habitat Office in Portland, Oregon.

1.3 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The Corps proposes to conduct operations and maintenance of the FNC (*i.e.,* dredging to maintain the authorized channel depth, and from the River Mouth to dredge material disposal) Bonneville Dam, including nine side channel projects and the Portland-Vancouver Anchorage, under its authorities at sections 102 and 103 of the Marine Protection Reserve and Sanctuaries Act of 1972, sections 401 and 404 of the Clean Water Act of 1977, and in accordance with Regulations 33 CFR 335.1 through 338. The proposed action includes use of four new ocean disposal sites; nearshore south jetty, south jetty intertidal, north head nearshore, and Benson Beach described in the RSMP (LCRSG 2011). Further, the Corps proposes to allow private vendors to remove sand from the Westport Slough, within the bounds of its authorized depth, for commercial use under a license agreement with the Corps' Waterways Maintenance Section. The proposed action does not include any further channel improvement or deepening, or maintenance of pile dikes, jetties, navigation locks, or other navigation structures.

The Corps has been responsible for maintaining safe navigation on the Columbia River since the 1877 (see Appendix 1). Maintenance dredging, designed to maintain authorized depths has been performed annually since 1906. During this time, the FNC has been dredged periodically to deepen or widen the channel as authorized by Congress. The channel has also been realigned and hydraulic control structures such as pile dikes and jetties have been constructed to improve navigation and reduce the need for maintenance dredging. A complete chronology of the development of the navigation channel and the Congressional authorizations is included in Appendix 1. The following descriptions in the proposed action include the currently authorized

dimensions of the channel from the River Mouth to Bonneville Dam, the proposed dredging and disposal methods including best management practices (BMPs), and locations.

High flows during the winter and spring erode material from the main channel side slopes and mobilize bottom material creating sand waves along the bottom of the Columbia River. The sand waves in the Columbia River are typically 4 to 8 feet high and 300 to 400 feet long creating shoals in the shipping channel. The Corps performs hydrographic surveys year-round on a monthly basis to determine the exact locations requiring dredging and what disposal capacity is available in the dredged material disposal sites. In addition, the Columbia River Pilots will call the Corps to report any problem areas they encounter while transiting the river. Some areas of shoaling become apparent during the winter months but most areas of obstructive shoaling are generally not known until the water levels begin to recede in late spring.

The Corps prepares an Annual Use Plan (AUP) in consultation with EPA to establish the year's operation and the day-to-day decision framework for the dredging season. The AUP takes into account the previous year's use of the material placement sites at River Mouth, along with current survey data gathered each spring. The plan provides a structure for the most effective use of the disposal sites given their current capacity, and the anticipated amount of dredging needed each year. Future placement of material from the Columbia River in the ocean will be included in the AUP.

The Corps evaluates sediments from the FNC to determine if they are acceptable (any pollutants are within acceptable levels, see Section 2.3.3.5) for in-water disposal according to the requirements of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act. The Corps began collecting sediment quality data in the late 1970s. A tiered sediment evaluation framework has been used since 1986. The tiered framework allows for consistent design of testing programs to maintain statutory compliance while minimizing excessive testing of low-risk projects. The most recent version of this framework is the 2009 Northwest Regional Sediment Evaluation Framework (SEF). Previous to the SEF, the 1998 Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River (LCR) Management Area was in effect. The SEF is a regional manual developed jointly by a variety of Federal and State agencies. If sediments are determined unsuitable for open water disposal, then disposal is limited to confined disposal and is subject to all environmental regulations governing the disposal of sediments not suitable for unconfined disposal.

Project sediment testing is typically performed on the mainstem Columbia River on a 10-year rotational cycle, unless some event occurs that would warrant more frequent sampling. The 10-year rotation allows the continued, even management of both budget and labor while providing sufficiently current sediment quality information to allow dredging to proceed unobstructed. Projects dredged less frequently, such as the side channel projects, are evaluated, sampled, and tested as required by the SEF. Corps staff collects most sediment samples, though contracts also are used in specific cases when special equipment is required to collect samples. Contract laboratories conduct physical, chemical and biological analyses. Complete past and present chemical evaluations on all Columbia River dredging projects, as well as the SEF manual, are available from the Corps Portland District.

During the dredging season the equipment is typically operated seven days a week, 24 hours a day, with four to eight hours of downtime every seventh day for a crew change. The schedule however may be interrupted for equipment repairs and maintenance, unfavorable weather or wave conditions, and to take on fuel and supplies.

1.3.1 Types of Dredges

Two general types of dredging equipment will be used under the proposed action, hydraulic dredges and mechanical dredges. Hydraulic dredging will involve either a hopper dredge or a pipeline dredge. Mechanical dredging includes clamshell dredging or backhoe dredging.

Hopper dredges currently handle about 8.0 million cubic yards per year (mcy) of material from the navigation channel. Hopper dredges provide flexibility for dredging operations because of their maneuverability. They are most often used on small-volume sand wave shoals in the river and on large shoals in the estuary and at the mouths of rivers.

Pipeline dredges are used for large cutline shoals and areas with continuous sand wave shoals. Pipeline dredging in the Columbia River is typically used to remove material from the navigation channel between RM 21 to 106.5. Only the shoals that have formed in a reach are dredged, not the entire reach. A typical shoal would include an area 250 to 300 feet wide by 2,000 to 4,000 feet long. Although many reaches of the navigation channel are annually dredged by pipeline, other reaches may require dredging on a less frequent basis depending upon the hydrographic surveys.

Clamshell dredging is performed using a bucket operated from a crane or derrick that is mounted on a barge or operated from shore. Sediment from the bucket is usually placed on a barge for offloading and disposal to an upland or in-water site. Because clamshell dredges are not self-propelled, they are not typically used in high traffic areas; rather, they are used in tighter spaces such as around docks and piers. Clamshell dredges can be used in restricted areas and shallow areas where draft restrictions may limit other dredges. Clamshell dredges equipped with special buckets are often regarded as being particularly useful in silts or contaminated materials. Clamshell dredges are often used in areas with debris concerns which could damage other dredges. Also, a clamshell may be used if the placement site is very far from the dredging area, because multiple barges can be used to cycle to and from the placement area and keep the dredge working continuously. Clamshell dredges are primarily used for the side-channel projects related to the FNC.

Backhoe dredging is performed using a bucket on the end of a backhoe arm. Although the backhoe is typically mounted on a barge, it also could be a land-based piece of equipment. Backhoes can be used in both shallow- and deep-draft channels. Sediments removed by backhoe are usually placed on a barge for offloading and disposal to an upland or in-water site. Backhoe dredges are often used to remove clays, rock, hard-packed materials, and fine-grained sediments, but also may be used in certain locations to remove sands. Like clamshell dredges, backhoes are often used in restricted areas near docks and in shallow-draft projects.

1.3.2 Advanced Maintenance Dredging (Routine)

Advanced maintenance dredging (AMD) is the practice of dredging deeper and wider than the FNC boundaries. The authority for AMD is included in the dredging authorization. The objective of AMD is to create an area for shoaling to develop below the authorized depth or outside the channel width to maximize time between dredging events and provide safe and adequate depths for vessels throughout the year.

AMD is practiced at the River Mouth, on the FNC and the side channel projects. The amount of AMD varies with the type of shoal and dredge. According to the Corps (2011c), a review of AMD practices found five feet of AMD depth to be sufficient on the FNC from the River Mouth to Vancouver, Washington. For all of the side-channel projects being addressed in Corps (2011c), as well as the main Columbia River navigation channel above Vancouver, WA, the AMD depth is two feet. However, over-depth dredging alone is not well suited for maintaining cutline shoals that have material moving in from the side slopes of the channel. Consequently, the AMD for cutline shoals is done up to 100 feet outside the channel width on the main Columbia River navigation channel and side channel projects to intercept material moving toward the navigation channel. Over-width dredging can occur on one or both sides of the channel depending upon shoaling patterns. AMD is not done to full depth or width at each shoal. The amount of AMD is based on the shoaling history of a particular area.

To minimize the potential effects to eulachon, The Corps plans to complete the estimated AMD during the primary dredging season of June 1 to December 15 (Section 1.3.6). However, there may be years where the dredging season will need to be extended past December 15. For example, the high-water event in 2011 caused such a significant increase in shoaling that AMD could not be completed until the end of January 2012. Similar high-water events causing significant shoaling occurred in 1996 and 1997.

1.3.3 Dredging of Shoals Outside the Primary Dredging Season (Non-Routine)

The Corps performs AMD in the FNC during the routine dredging season with the purpose of maximizing time between dredging events. However, the Columbia River FNC is still in the process of stabilizing after deepening to 43 feet. The Corps anticipated that once the 43-foot channel was created, a longer dredging season would be needed because AMD would not maintain the channel as effectively as before construction. The assumption was verified in 2011 when AMD could not handle all the shoaling that developed as a result of winter storms and the spring freshet. Advanced maintenance channels were filled by winter shoaling before the spring freshet resulting in severe deep vessel draft restrictions. The Corps anticipates AMD only during the primary dredging season will not be sufficient to maintain the FNC (Smith 2012d).

Since shoaling reaches will be variable from season to season until the river system reaches equilibrium, it is very likely that there will be a need for an unknown amount of dredging actions outside the routine dredging season to maintain the 43-foot channel depth throughout the year. The non-routine dredging is needed when:

- Shoaling forms above the authorized channel depth, the Corps plans to dredge such shoals at any time of year to lift or prevent imminent draft restrictions.
- AMD areas are filled by shoaling during winter storms; the Corps will dredge those shoals prior to the spring freshet so that shoaling associated with the freshet develops below the authorized depth and prevent draft restrictions.

1.3.4 Description of Disposal Operations

The Corps has four options for disposal sites: Upland, in-water disposal, beach nourishment, or ocean. Material dredged at the River Mouth is disposed in the ocean disposal sites. From RM 3 to Bonneville Dam, the decision to dispose of material in-water, for beach nourishment or an upland site depends upon the type of dredge used and both the availability and access to the disposal site.

Upland Disposal. Upland disposal is accomplished when using clamshell, hopper, and pipeline dredges. Clamshell-dredged material deposited onto a barge can be off-loaded at a transfer point to be taken to an upland site. Hopper and pipeline dredges pump dredged material in a sand and water slurry directly into a diked, upland site near the dredging area. Discharge of water from upland sites back into the river is controlled by the use of weirs and will follow the conditions of the state water quality certification.

The upland sites (Table 2) have typically been used every two to five years, but some may be used annually for future maintenance of the navigation channel. In 2011, 559,046 cy were disposed on upland sites.

Table 1. BMPs for dredging.

BMP	Justification	Duration	Management Decision
Hopper Dredging			
Drag or cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads (Smith 2012j).	Reduce entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
Dredging in shallow water areas (less than 20 feet) outside of the Columbia River mainstem should occur only during the recommended ESA in-water work periods for the Columbia River as listed in Section 1.3.7.	The top 20 feet of the water column is considered salmon migratory habitat. Dredging or disposal in these areas could delay migration or reduce or eliminate food sources.	Continuous during dredging and disposal operations.	Maintain until new information becomes available that would warrant change.
Pipeline Dredging			
Dragheads or cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads.	Reduce entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
Dredging in shallow water areas (less than 20 feet) only during the recommended ESA in-water work periods for the Columbia River as listed in Section 1.3.7.	The top 20 feet is considered salmon migratory habitat. Dredging or disposal in these areas could delay migration or reduce or eliminate food sources.	Continuous during dredging and disposal operations.	Maintain until new information becomes available that would warrant change.
General Provisions for All Dredging			
The contractor shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.	Protection of water resources.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.
The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Disposal of hazardous waste.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

Table 2. Upland Disposal Sites.

Upland Disposal Site	State	RM	Upland Disposal Site	State	RM
West Sand Island	OR	3	Mount Solo	WA	62.0
Rice Island	OR/WA	21.0	Lord Island (East End)	OR	63.5
Pillar Rock Island	OR	27.2	Dibblee Point	OR	64.8
Skamokawa Vista Park	WA	33.4	Howard Island	WA	68.7
Welch Island	OR	34.0	Cottonwood Island	WA	70.1
Tenasillahe Island	OR	38.3	Port of Kalama Property	WA	71.9
Ostervold Road	WA	38.7	Sandy Island	OR	75.8
Upstream of Coffeepot Island	WA	42.5	Lower Deer Island	OR	77.0
Fort James	OR	42.9	Martin Bar	WA	82.0
Property on Puget Island	WA	44.0	Austin Point	WA	86.5
Brown Island	WA	46.3	Fazio Sand & Gravel	WA	97.1
Crims Island	OR	57.0	Gateway	WA	101.0
Hump Island	WA	59.7	West Hayden Island	OR	105.0

Beach Nourishment. The combination of river flows, waves, and tidal effects erodes material from the shoreline. Replacement of this material on a regular basis is known as beach nourishment. In the last five years, the Corps has placed an average of 100,000 to 500,000 cubic yards (cy) of material annually at beach nourishment sites.

The beach nourishment/shoreline disposal process involves pumping dredged material through a floating discharge pipe from the pipeline dredge to an existing shoreline. The dredge first pumps a landing on the shoreline to establish a point from which further material placement occurs. Dredged material is pumped in a sand and water slurry (about 20 percent sand) and as it exits the shore pipe, the sand settles out on the shoreline while the water returns to the river. Settling rates of Columbia River sands are very quick and turbidity from the operation is minimal. After sufficient sand has settled out and begins to increase in height, it is moved by bulldozers to match the elevation of the existing shoreline at approximately the high water line. During beach nourishment, a temporary sand berm is constructed to retain sand on the beach during pump-out; otherwise, much of the sand would immediately be lost to the river. The temporary berms typically are approximately 5 feet high and 12 feet wide at the base. The berms are built gradually by earth-moving equipment as pump-out continues and are created from existing beach sand, pumped sand, or both.

A typical shoreline disposal operation lasts from 5 to 15 days and the width of the shoreline created is approximately 100 to 150 feet. The process continues by adding to the shore pipe and proceeding longitudinally along the shoreline. The length of shoreline replaced is dependent on the quantity of material to be dredged from the shoal in the channel. After disposal, the slope of the shoreline is groomed to a steepness of 10 to 15 percent to prevent the possibility of creating areas where juvenile fish could be stranded from vessel wakes on the new shoreline. Disposal of material for beach nourishment will always occur at the sand/water interface, not in open water.

The Corps has proposed to place dredge sediment at three beach nourishment sites (Table 3). The volume of material that might be placed at each of the beach nourishment site is difficult to

predict due to the recent deepening of the Columbia River navigation channel and due to the variable use of a given site; which could range from no use, to annual use, to use once every three to five years. Further, the reduction of upland disposal resulting from placement of dredged material at beach nourishment sites is also difficult to predict. Approximately 227,586 cy of material was disposed at beach nourishment sites in 2011.

Table 3. Beach Nourishment Sites.

Potential Site	State	River Mile	Current Use
Miller Sands	OR	23.5	Yes
Skamokawa Vista Park	WA	33.4	Yes
Sand Island at St. Helens	OR	86.2	Yes

In-Water Disposal. Most in-water disposal occurs in the flowlane, within or directly adjacent to the navigation channel, by hopper or pipeline dredges, or by bottom-dump barges used with clamshell dredges. The average annual quantity of material disposed in the flowlane is 4.3 mcy. In-water dredged material disposal is done throughout the deep-draft Columbia River navigation channel from RM 3 to RM 145. The disposal sites vary depending on the condition of the channel each year. As deeper flowlane areas are filled with dredged material, new deep areas are formed elsewhere as a result of natural river processes. The maintenance activities generally use flowlane sites from 20 to 65 feet in depth with occasional exceptions when disposal may occur in flowlane sites greater than 65 feet in depth.

Hopper dredges collect material in the hopper of the vessel until it is near capacity. When filled, the vessel moves to a flowlane site. As the dredge is running, the hopper doors open and the material is discharged at varying rates depending upon how far the hopper doors are opened. The dredge releases the material gradually while moving to avoid mounding. Flowlane discharge from pipeline dredges differs from hoppers in that material is continuously discharged during dredging operations. Placement of material at flowlane sites is done using a down-pipe with a diffuser plate at the end. This down-pipe extends 20 feet below the water surface to minimize or avoid impacts to migrating juvenile salmonids. During placement of dredged material, the down-pipe will be moved often so that mounding on the bottom is minimized.

Harrington Sump is a designated in-water dredged material disposal site along Rice Island from RM 20 to 22. This site is used by hopper dredges and sometimes by pipeline dredges for disposal of dredged material when performing maintenance dredging at Tongue Point Crossing and Miller Sands Channel. Portions of the sump may be dredged annually to provide new capacity. The sump is dredged to 48 feet below MLLW with a pipeline dredge and the material is pumped to Rice Island. On average, a total of approximately 0.2 to 1 mcy of sand is removed from Harrington Sump each time it is dredged.

BB-3 is downstream of RM 3, near the end of Jetty A. The center of the 1,200-foot by 1,050-foot disposal site is at 46° 15’ 38” N, 124° 02’ 18” W. This site is primarily used when dredging side channel projects such as Baker Bay. The site may receive 100,000 to 150,000 cy of material annually.

Area D is within the Columbia River estuary north of the main Columbia River navigation channel at approximately RM 7. The center of the 2,000-foot wide by 5,000-foot long disposal site is at 46° 14’28”N, 123°58’36”W. It is estimated that the 24- to 45-foot deep site will not receive more than 3.5 mcy of material over a 5-year period.

Ocean Disposal. Material dredged from the River Mouth is typically disposed of in the ocean. Material dredged from the Columbia River between RM 3 and RM 30 may also be placed in the ocean. Maintaining the FNC including the construction of jetties at the River Mouth has disrupted the routing of sediment in the Columbia River littoral cell resulting in a depletion of sediment within the cell (LCSG 2011). The depletion in sediment is resulting in beach erosion, loss of habitat associated with the natural sediment composition and potentially undermining the jetties which would severely disrupt navigation. Both the states of Washington and Oregon consider moving naturally deposited sediment from the River Mouth and depositing it outside the littoral cell to be a waste of the sand resource.

According to the BA, the Corps estimates that up to 5.5 mcy of material may be placed annually in RSMP ocean disposal sites using government and contract hopper dredges. Ocean disposal will occur at three existing sites; the Shallow Water Site, the North Jetty Site and Deep Water Site, and four proposed new sites: the South Jetty Nearshore Site, the South Jetty Intertidal Site, the North Head Nearshore Site and the Benson Beach Site. The Corps (2011c) includes coordinates for these sites which are incorporated by reference. The actual coordinates could vary slightly over time through an adaptive management process. At the Benson Beach site, dredged materials will be placed directly onshore via pump-ashore dispersal hopper dredge with the intent of minimizing erosion at Benson Beach and allow for beach accretion. The materials would be naturally and mechanically distributed. The intent is for natural wave action to disperse the sediment within the littoral cell.

The Corps has proposed to use different BMPs to reduce the impact of each type of dredge material disposal (Table 4).

Table 4. BMPs for dredged material disposal.

BMP	Justification	Duration	Management Decision
Flow Lane Disposal			
Dispose of material in a manner that prevents mounding of the disposal material.	Spreading the material out will reduce the depth of the material on the bottom, which will reduce the impacts to fish and invertebrate populations.	Life of contract or action.	Maintain until new information becomes available that would warrant change.
Maintain discharge pipe of pipeline dredge at or below 20 feet of water depth during disposal.	This measure reduces the impact of disposal and increased suspended sediment and turbidity to migrating juvenile salmonids, as they are believed to migrate principally in the upper 20 feet of the water column.	Continuous during disposal operations.	Maintain until new information becomes available that would warrant change.
Upland Disposal			
Berm upland disposal sites to maximize the settling of fines in the runoff water.	This action reduces the potential for increasing suspended sediments and turbidity in the runoff water	Continuous during disposal operations.	Maintain until new information becomes available that would warrant change.
New sites will have a minimum 300 foot buffer from shoreline or other aquatic habitat feature. Existing sites may not have this habitat buffer but currently provide limited habitat value.	Maintains important habitat functions.	Life of contract or action.	Maintain until new information becomes available that would warrant a change.
Shoreline Disposal			
Grade disposal site to a slope of 10 to 15 percent, with no swales, to reduce the possibility of stranding of juvenile salmonids.	Ungraded slopes can provide conditions on the shoreline that will create small pools or flat slopes that strand juvenile salmonids when washed up by wave action.	Continuous during disposal operations.	Maintain until new information becomes available that would warrant change.
Ocean Disposal			
Dispose in accordance with the site management and monitoring plan.	This action minimizes conflicts with users and impacts to ocean resources.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.

BMP	Justification	Duration	Management Decision
General Provisions For All Disposal			
Dispose of hazardous waste.	The contractor, where possible, will use or propose for use materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal of this material will be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Life of contract or action.	If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water discharge will be immediately reported the nearest U.S. Coast Guard Unit for appropriate response.

In addition to the BMPs for dredging and disposal, the potential impacts to ESA-listed fish due to the proposed action are minimized by the in-water work periods (Section 1.3.6). The Corps also requires a Spill Control Plan including the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by 40 CFR 68, 40 CFR 302, 40 CFR 355 and regulated under state or local laws and regulations.

1.3.5 Description of Activities Proposed by Reach

The following section describes the dredging and disposal methods used by the Corps to maintain the FNC, and the authorized channel dimensions for each river reach. Depths are referenced to either Mean Low Low Water (MLLW) or Columbia River Datum (CRD). MLLW is a tidal reference datum used downstream of RM 21+20 at Miller Sands. CRD is also known as the approximate low water plane, and is the reference datum used upstream of RM 21+20.

Mouth of the Columbia River (River Mouth) (RM -3 to +3). The River Mouth channel is where the Columbia River empties into the Pacific Ocean between Oregon and Washington. The River Mouth project provides an entrance channel to access the deep-draft (43 feet) Columbia River navigation channel to Portland, Oregon, other Washington and Oregon ports, and the Columbia/Snake River inland waterway. The River Mouth channel decreases tide-caused delays for commercial ships crossing the sand bar and shoals found at the mouth of the river. It also provides improved safety by reducing the possibility of commercial ship grounding, and allows for compatible use by commercial and non-commercial vessels. The authorized River Mouth channel is 2,640 feet wide and extends from deep water in the ocean, at approximately RM -3 upstream to RM +3. The River Mouth channel connects with the existing 43-foot deep FNC at RM 3. The northern side of the channel is 2,000 feet wide and is maintained to a depth of -55 feet MLLW. The southern 640 feet is maintained to -48 feet MLLW.

Most of the shoaling occurs from RM -2.0 to +2.5 where an average of 4.5 mcy of sediment is dredged each year. The volume dredged is dependent upon the flows in the Columbia River. During a high-flow year, less shoaling occurs and during a drought year, more shoaling occurs.

For example, the amount dredged after the 1996 flood was only 1.9 mcy. Material is dredged using medium-sized hopper dredge due to the sea, tidal, and weather conditions experienced at the River Mouth.

Columbia River Upstream of River Mouth to Vancouver, Washington (RM 3 to 106.5). The Corps annually dredges material from shoaling areas in the Columbia River to maintain the authorized navigation channel. The authorized channel is 43 feet deep and 600 feet wide from RM 3.0 to 101.4; 43 feet deep and 500 feet wide from RM 101.4 to 105.5; 43 feet deep and 400 feet wide in the downstream 1.5 miles of Oregon Slough; and 35 feet deep from RM 105.5 to 106.5 (from the Burlington Northern and Santa Fe Railway Bridge to the Interstate 5 Bridge). Shoaling occurs at various locations within the navigation channel. At each location, a dredge may spend anywhere from 3 days to 3 weeks removing sand from the navigation channel, depending on the size of the shoal. At any time, there may be three or more dredges working at the same time, but in different locations. Timing of dredging in the main channel is relatively inflexible due to the nature of the riverine shoaling process.

Pipeline, hopper, and mechanical dredges may be used depending on several factors including dredge availability, size and location of the shoal, and disposal options available. Disposal areas include shoreline, upland, flowlane and in-water sites. Material dredged between RM 3 to 30 may be disposed in the ocean sites. The amount of dredging required varies annually and is dependent on the amount of shoaling present in the channel.

The Corps also proposes shifting the channel 300 feet to the west at approximately RM 10+15 and 300 feet to the east at approximately RM 4+10 on a continuous bearing through the existing centerline at RM 7. The proposed realignment has been discussed with the Coast Guard and the Columbia River Bar Pilots since 2006. The realignment is likely to reduce future maintenance dredging as the channel will be moved away from shoal areas at RM 5 and RM 9. The realignment will improve transit between the River Mouth and the Columbia River by changing the channel alignment from a curve to tangent lines (Smith 2012g).

Vancouver, Washington to Bonneville Dam (RM 106.5 to 145). The main navigation channel from Vancouver, Washington (RM 106.5) to Bonneville Dam (RM 145) is authorized to a depth of -27 feet CRD. Based on the draft requirements of current users, the channel is maintained below Bonneville Dam to -17 feet CRD. The Corps has performed maintenance dredging using a hopper dredge at two or more locations every year.

Portland/Vancouver Anchorage Project. Anchorage Area "A" is between river miles 102+36.5 and 103+03.5 on the Oregon side of the river adjacent to the -43 feet CRD Federal navigation channel. The anchorage area is 2,000 feet long and varies between 370 to 550 feet wide. This site is used as a deep-draft anchorage. The site will be maintained to -43 feet CRD. If dredging is necessary, a disposal site will be identified, and the necessary environmental clearances will be obtained. No dredging has been required to maintain this anchorage since it has been authorized, the area is naturally deep and no infill has occurred to date.

Anchorage Area "B" is between RMs 103+31 and 103+51 on the Oregon side of the river. The anchorage is approximately 500 feet outside of the -43 feet CRD Federal navigation channel.

The anchorage varies in width from 10 to 550 feet wide and is 2,000 feet long at the longest point. This site is used for light laden or empty vessels. The site will be maintained to -25 feet CRD. If dredging is necessary, a disposal site will be identified, and the necessary environmental clearances will be obtained. No dredging has been required to maintain this anchorage since it has been authorized because the area is naturally deep and no infill has occurred to date.

Side Channels. The Corps is authorized to maintain a number of side-channel projects. Depths and frequency of dredging at these locations vary and are project dependent. The following side-channel projects are maintained by the Corps and are included in the proposed action.

Baker Bay. The West Channel through Baker Bay begins outside the 43-foot FNC in the Columbia River near RM 2.5 and continues along the western edge of the bay for 3 miles to the entrance of Ilwaco Boat Basin. The authorized channel depth is 16 feet below MLLW. The channel width is 200 feet for the first 0.5 miles, then 150 feet for the remaining distance. The Federally maintained channel ends at the turning and mooring basin, which is maintained by local interests. Dredging is typically done using a clamshell dredge, but a hopper or pipeline dredge have been used previously and may be used in the future. Dredged material is placed either in the Columbia River flowlane, BB-3, Area D, or on West Sand Island.

Chinook Channel. The channel leading into Chinook, Washington begins near RM 5 in the Columbia River north of the FNC, and continues to the Port of Chinook. It is a long, narrow channel through an area of extreme shoaling. The authorized depth is 10 feet below MLLW and the width is 150 feet. The two mile long channel ends at the turning and mooring basin, which is maintained by local interests. The Chinook Channel is maintained by clamshell dredge, although it is also possible that a hydraulic dredge may be used. Material removed from this channel may be placed in disposal site Area D or in the flowlane.

Hammond Boat Basin. The Hammond Boat Basin is seven miles from the mouth of the Columbia River on the Oregon side. It was constructed in 1982. The access channel leading into the boat basin is authorized at 10 feet below MLLW and is 1,300 feet long and 100 feet wide. Primarily small boats use the channel. The Columbia River Bar Pilots moor one of their pilot boats in the basin. This boat basin has been maintained historically by pipeline dredge and was last dredged in 1982. Approximately 18,000 cy of material was placed in an upland disposal site near the boat basin. Future maintenance will most likely be by pipeline dredge with associated upland or flowlane disposal, or by clamshell dredge with associated flowlane disposal in the Columbia River.

Skipanon Channel Skipanon Channel begins near RM 10 in the Columbia River and runs up the Skipanon River to Warrenton, Oregon. The channel is authorized to a depth of 30 feet below MLLW, but current users require a depth of only 16 feet. The channel width is 200 feet for the first 1.5 miles, and then it opens up into a turning basin with a width varying from 225 to 475. Shoaling occurs in the turning basin area and from sands that encroach across the mouth of the river. Skipanon Channel is maintained by both hopper and clamshell dredges. A hopper dredge maintains the outer entrance of the channel, and clamshell dredges remove material from throughout the entire channel. Sediment in the Skipanon Channel is primarily sandy silt with 76 percent fines. Dredged material is placed in the flowlane of the Columbia

River downstream of the entrance to Skipanon Channel or at Area D. This project is typically dredged once every five years although Skipanon Channel was last dredged in 2003 when 15,366 cy were removed.

Skamokawa Creek. The channel leading into Skamokawa, Washington begins outside the 43-foot FNC in the Columbia River from RM 33 to 34 and continues toward the town of Skamokawa, ending at the downstream entrance to Brooks Slough. The authorized depth is 6.5 feet below CRD. The area has not been dredged by the Corps since 1992. Material would be placed in the Columbia River flowlane. This area is planned to be dredged once every five years although the channel was last dredged by local interests in 1993 when approximately 5,000 cy of material was dredged and disposed of by flowlane at the mouth of Skamokawa Creek. There has been no subsequent dredging.

Wahkiakum Ferry Channel. The Wahkiakum Ferry Channel runs between Puget Island and Westport Slough near RM 43 in the Columbia River. The channel is authorized to a depth of 9 feet below CRD and a width of 200 feet. Sediment in the Wahkiakum Ferry Channel is predominately sand with about 1.2 percent fines. Future dredging will be done by clamshell dredge with flowlane disposal of the material in the Columbia River or in an upland site. It is anticipated that the ferry channel may be dredged two or three times every five years as funding becomes available.

Westport Slough. Westport Slough is proposed to be dredged to a depth of 20 feet below CRD per the request of river users to allow ocean-going barge access. Westport Slough is authorized to a depth of 28 feet below CRD and a width of 200 feet, but is currently maintained to a depth of 9 feet below CRD for the Wahkiakum Ferry. Future dredging will be done by clamshell or pipeline dredge with flowlane disposal of the material in the Columbia River or in an upland site. It is anticipated that Westport Slough may be dredged two or three times every five years as funding becomes available.

Old Mouth Cowlitz River The Old Mouth Cowlitz River is at RM 67 on the north side of the mainstem Columbia River at Longview, Washington. The site is no longer an active component of the Cowlitz River drainage and serves as an access channel for chip barges at the local Longview Fibre paper mill. The Project channel into the Old Mouth Cowlitz River is authorized at a depth of 8 feet below CRD and 150 feet wide. It runs from deep water in the Columbia River to a point approximately 3,800 feet upstream. The channel has been dredged historically by pipeline, clamshell, and agitation dredging (a type of dredging which is no longer used). Future maintenance will be done using a clamshell dredge with placement of the dredged material in the flowlane of the Columbia River. Dredging occurred three times in the last five years by a private contractor for Longview Fibre. It is anticipated that this area will be dredged two or three times every five years, as funding becomes available.

Upstream Entrance to Oregon Slough The upstream entrance to Oregon Slough (RM 102.5) has been dredged historically by pipeline and clamshell dredges. Future dredging will be done using a clamshell dredge. Placement of the dredged material is in the flowlane of the Columbia River. The upstream entrance to Oregon Slough was last dredged in 2001 when a clamshell dredge removed 55,799 cy. However, it is anticipated that the upstream entrance to

Oregon Slough may be dredged once every five years. The authorized depth is 10 feet below CRD. Advanced maintenance dredging is authorized and commonly practiced. The Upstream Entrance to Oregon Slough is proposed as a side channel project, and the downstream 1.5 miles of Oregon Slough is part of the Columbia River 43-foot FNC.

1.3.6 In-Water Work Periods

The normal operating season for routine AMD and in-water placement for dredging in the River Mouth and Columbia River is June 1 and through December 15. Additional timing restrictions limit dredging in some locations to specific times of the year:

- Use of the South Jetty Nearshore Site for disposal will occur after August 15 when the Oregon crab season ends.
- Until the new 43-foot channel stabilizes, non-routine dredging and in-water placement is likely to be required between December 16 and May 31 to address shoals that significantly obstruct navigation if they are left to the next primary dredging season, such as:
  - Shoals at any location from RM 3-RM 106.5 that are presently or imminently causing draft restrictions will be dredged at any time to provide safe and adequate depths for waterborne commerce.
  - Shoals which require dredging prior to the spring freshet to provide an area for spring freshet shoaling to develop below the authorized depth and prevent draft restrictions will be dredged between April 15 and the start of the routine dredging season (June 1).
- All side channels will be dredged between August 1 and December 15.
- If non-routine dredging is needed near or downstream of the mouth of the Cowlitz River (RM 63-70) between December 16 and May 31 there will be no in-water placement of dredged material.
- When alternate sites are available, there will be no in-water placement near the mouths of the Kalama River (RM 71-75) and Lewis River (RM 85-89) between December 16 and May 31 (Smith 2012m).
- Annual dredging and in-water placement required to calibrate equipment and test dredge repairs will occur between December 16 and May 31. The test and calibration dredging with in-water placement will occur above RM 89, most likely over several days in February and March.
- Dredging and in-water placement between RM 106.5 to RM 145 will be conducted between August 1 and September 30.

1.3.7 Interrelated Interdependent Actions

Based on the review of the BA, the past opinions (NMFS 2005a and 2005b) and continuing discussions with the Corps during the consultation, NMFS considered whether the following actions may be interrelated or interdependent to the continued maintenance of the FNC and concluded that they are not:

- Willamette River Navigation Channel Deepening. This action cannot occur until an approved Superfund plan is in place for the Portland Harbor, but such a plan is only in the investigation phase. Therefore, it is unclear what conditions, if any, would make this action go forward in the future.
- Development of Port Activities and Deep Draft Vessels. These activities depend on private decisions that are currently too speculative to consider, and the current FNC has independent utility regardless of future port or vessel configurations.
- Non-indigenous Species Introductions. This is not an action; it is an environmental baseline condition and, possibly, an indirect effect of the FNC.
- Commercial Dredging for Sand. This is being considered as part of the proposed action, not as a separate action.
- Pile Dike, Buoy and Channel Marker Maintenance. These are explicitly not part of the proposed action and would be necessary regardless of FNC maintenance.
- Development of future upland, in-water or shoreline placement sites. These are Federal actions that would require a separate consultation when they are proposed.
- Ship Strikes. This is not an action; it is an environmental baseline condition and, possibly, an indirect effect of the FNC.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The action area for this Project is defined as the downstream end of the River Mouth at RM -3 and upstream to Bonneville Dam (RM 145) (Figure 1). The lateral extension of the action area extends 300 feet shoreward of mean higher high water (MHHW) as well as a fan-shaped area of the Pacific Ocean extending out 6 miles from the mouth of the river to include the ocean disposal sites.

The action area is occupied by 13 species of anadromous salmonids, the southern green sturgeon, eulachon, seven marine mammals, and the leatherback sea turtle (*Dermochelys coriacea*) listed under the ESA. The action area also includes designated critical habitat for 12 species of anadromous salmonids, the southern green sturgeon, the southern eulachon and leatherback sea turtle; and proposed critical habitat for coho salmon (*O. kisutch*) (Table 5). The action area is considered EFH for Chinook and coho salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. The LCR near the River Mouth is considered a Habitat Area of Particular Concern (HAPC) for Pacific Coast Groundfish (Section 3.1).

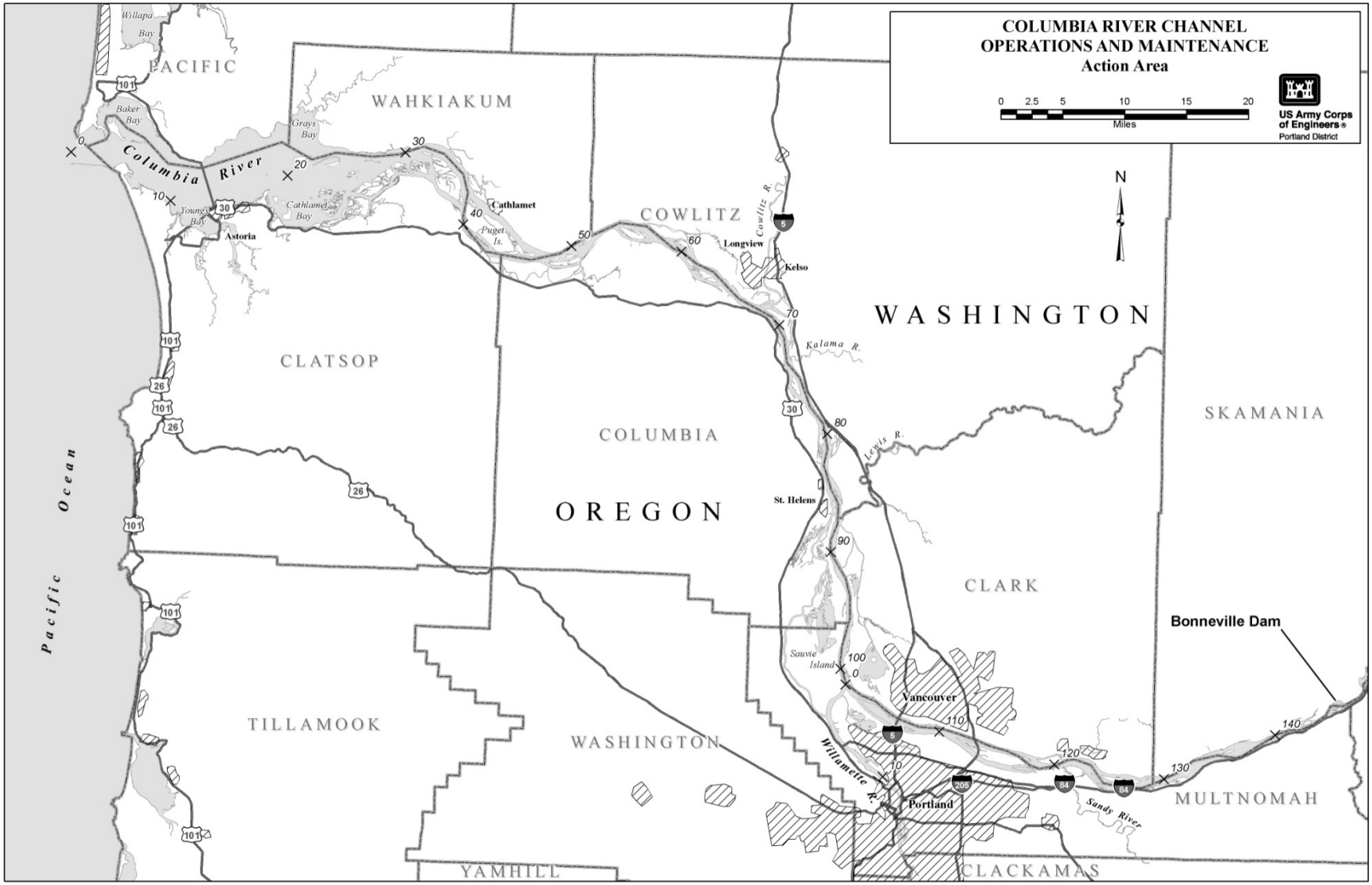

Figure 1. Action Area

Table 5. **F**ederal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: "T" means listed as threatened under the ESA; "E" means listed as endangered; "P" means proposed.

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Chinook salmon (*Oncorhynchus tshawytscha*)			
Lower Columbia River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River spring-run	E 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	ESA section 9 applies
Snake River spring/summer run	T 8/15/11; 76 FR 50448	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 8/15/11; 76 FR 50448	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
Chum salmon *(O. keta*)			
Columbia River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Coho salmon (*O. kisutch*)			
Lower Columbia River	T 8/15/11; 76 FR 50448	N/A	6/28/05; 70 FR 37160
Sockeye salmon (*O. nerka*)			
Snake River	E 8/15/11; 76 FR 50448	12/28/93; 58 FR 68543	ESA section 9 applies
Steelhead (*O. mykiss*)			
Lower Columbia River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Middle Columbia River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Columbia River	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	2/01/06; 71 FR 5178
Snake River Basin	T 8/15/11; 76 FR 50448	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Green sturgeon (*Acipenser medirostris*)			
Southern	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/02/10; 75 FR 30714
Eulachon (*Thaleichthys pacificus*)			
Eulachon	T 3/18/10; 75 FR 13012	10/20/11; FR 65324	Not applicable
Marine Mammals			
Steller sea lion (*Eumetopias jubatus*)			
Eastern	T 5/5/1997; 63 FR 24345	8/ 27/93; 58 FR 45269	11/26/90; 55 FR 49204
Humpback whale (*Megaptera novaeangliae*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Killer whale (*Orcinus orca*)			
Southern Resident	E 11/18/05; 70 FR 69903	11/29/06; 71 FR 69054	ESA section 9 applies
Blue whale (*Balaenoptera musculus*)			
	E 06/02/1970; 35 FR 8491	Not applicable	ESA section 9 applies
Fin Whale (*Balaenoptera physalus*)			
	E 11/18/05; 70 FR 69903	Not Applicable	ESA section 9 applies
Sei whale (*Balaenoptera borealis*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Sperm whale (*Physeter macrocephalus*)			
	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Marine Turtles			
Leatherback turtle (*Dermochelys coriacea*)			
	E 6/02/70 ; 39 FR 19320	3/23/79; 44 FR 17710 1/26/12; 77 FR 4170	ESA section 9 applies

2. ENDANGERED SPECIES ACT BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, section 7(b)(4) requires the provision of an incidental take statement specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Introduction to the Biological and Conference Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat (Hogarth 2005).

We will use the following approach to determine whether the proposed action described in Section 1.3 is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline for the proposed action.
- Analyze the effects of the proposed actions.
- Describe any cumulative effects.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 5, above).

Climate change is likely to play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation contribute little to total streamflow and are likely to be more affected.

During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas (USGCRP 2009). Warming is likely to continue during the next century as average temperatures increase another 3 to 10°F (USGCRP 2009). Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature but more precipitation is likely to occur during October through March and less during summer months, and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures will be warmer (ISAB 2007, USGCRP 2009).

Higher winter stream flows increase the risk that winter floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (USGCRP 2009). Earlier peak stream flows will also flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and the risk of predation (USGCRP 2009). Lower stream flows and warmer water temperatures during summer will degrade summer rearing conditions, in part by increasing the prevalence and virulence of fish diseases and parasites (USGCRP 2009). Other adverse effects are likely to include altered migration patterns, accelerated embryo development, premature emergence of fry, variation in quality and quantity of tributary rearing habitat, and increased competition and predation risk from warm-water, non-native species (ISAB 2007).

The earth's oceans are also warming, with considerable interannual and inter-decadal variability superimposed on the longer-term trend (Bindoff *et al*. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005, Zabel *et al*. 2006, USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel *et al*. 2006).

2.2.1 Status of the Species

Climate change, as described in Section 2.2, is likely to adversely affect the size and distribution of populations of ESA-listed anadromous fish in the Pacific Northwest. The size and distribution of the populations considered in this opinion generally have declined over the past few decades due to natural phenomena and human activity, including the operation of hydropower systems, over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011).

The summaries that follow describe the status of the 13 ESA-listed salmon and steelhead species, the southern green sturgeon and eulachon that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, can be found in the listing regulations and critical habitat designations published in the Federal Register (Table 5, above). The species considered in this opinion are: Snake River Basin (SRB) steelhead (*Oncorhynchus mykiss*), Upper Columbia River (UCR) steelhead, Lower Columbia River (LCR) steelhead, Middle Columbia River (MCR) steelhead, Upper Willamette River (UWR) steelhead, Snake River (SR) spring/summer run Chinook salmon (*O. tschawytscha*), SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR spring-run Chinook salmon, , LCR Chinook salmon, Columbia River chum salmon (*O.keta*), SR sockeye salmon (*O.nerka*), LCR coho salmon (*O.kisutch*), southern green sturgeon (*Acipenser medirostris*), and eulachon (*Thaleichthys pacificus*).

The status of salmon and steelhead species and critical habitat sections below are organized under five recovery domains (Table 6) to better integrate recovery planning information that NMFS is developing on the conservation status of the species and critical habitats considered in this consultation. Recovery domains are the geographically-based areas that NMFS is using to prepare multi-species recovery plans. A recovery team has not yet been convened for eulachon, a species under the jurisdiction of NMFS' Northwest Region.

Table 6. Recovery planning domains identified by NMFS and their ESA-listed salmon and steelhead species considered in this opinion.

Recovery Domain	Species
Willamette-Lower Columbia (WLC)	LCR Chinook salmon UWR Chinook salmon CR chum salmon LCR coho salmon LCR steelhead UWR steelhead
Interior Columbia (IC)	UCR spring-run Chinook salmon SR spring/summer Chinook salmon SR fall-run Chinook salmon SR sockeye salmon UCR steelhead MCR steelhead SRB steelhead

For each recovery domain, a technical review team (TRT) appointed by NMFS has developed, or is developing, criteria necessary to identify independent populations within each species, recommended viability criteria for those species, and descriptions of factors that limit species survival. Viability criteria are prescriptions of the biological conditions for populations, biogeographic strata, and evolutionarily significant units (ESU) that, if met, would indicate that an ESU will have a negligible risk of extinction over a 100-year time frame.

Note that, for Pacific salmon, NMFS uses its 1991 ESU policy, that states that a population or group of populations will be considered a Distinct Population Segment if it is an Evolutionarily Significant Unit. An ESU represents a distinct population segment of Pacific salmon under the Endangered Species Act that: (1) is substantially reproductively isolated from conspecific populations, and (2) represents an important component of the evolutionary legacy of the species. The species *O. mykiss* is under the joint jurisdiction of NMFS and the Fish and Wildlife Service, so in making its listing January, 2006 determinations NMFS elected to use the 1996 joint FWS NMFS DPS policy for this species.

The definition of a population used by each TRT to analyze salmon and steelhead is set forth in the "viable salmonid population" document prepared by NMFS for use in conservation assessments of Pacific salmon and steelhead (McElhany *et al*. 2000). That document defines population viability in terms of four variables: abundance, population growth rate (productivity), population spatial structure, and genetic diversity.

Abundance is of obvious importance since, in general, small populations are at greater risk of extinction than large populations, primarily because many processes that affect population dynamics are likely to operate differently in small populations than in large populations (Shaffer 1987, McElhany *et al*. 2000).

Population growth rate, the productivity over the entire life cycle, and factors that affect population growth rate provide information about how well a population is performing in the various habitats it occupies during the life cycle. Examining population growth rate allows one to assess if populations are able to replace themselves. Populations that consistently fail to replace themselves are at greater risk of extinction than populations that are consistently at or above replacement levels.

Spatial structure refers to the distribution of individuals within a population at a certain life stage throughout the available habitats, recognizing the abiotic and biotic processes that give rise to that structure. McElhany *et al.* (2000) gave two main reasons why spatial structure is important to consider when evaluating population viability: (1) Overall extinction risk at longer time scales may be affected in ways not apparent from short-term observations of abundance and productivity, because of a time lag between changes in spatial structure and the resulting population-level effects, and (2) spatial population structure affects the ability of a population to respond to changing environmental conditions and therefore influence evolutionary processes. Maintaining spatial structure within a population, and its associated benefits to viability, requires appropriate habitat conditions and suitable corridors linking the habitat and the marine environment to be consistently available.

Diversity relates to the variability of phenotypic characteristics such as life histories, individual size, fecundity, run timing, and other attributes exhibited by individuals and populations, as well as the genetic diversity that may underlie this variation. There are many reasons diversity is important in a spatially and temporally varying environment. Three key reasons are: (1) Diversity allows a species to use a wide array of environments, (2) diversity protects a species against short-term spatial and temporal changes in the environment, and (3) genetic diversity provides the raw material for surviving long-term environmental change (McElhany *et al.* 2000).

Although the TRTs operated from the common set of biological principals described in McElhany *et al.* (2000), they worked semi-independently from each other and developed criteria suitable to the species and conditions found in their specific recovery domains. All of the criteria have qualitative as well as quantitative aspects. The diversity of salmonid species and populations makes it impossible to set narrow quantitative guidelines that will fit all populations in all situations. For this and other reasons, viability criteria vary among species, mainly in the number and type of metrics and the scales at which the metrics apply (*i.e.*, population, major population group (MPG), or ESU) (Busch *et al.* 2008).

Overall viability risk scores (high to low) are based on combined ratings for the abundance and productivity (A/P) and spatial structure and diversity (SS/D) metrics. Note that the WLC-TRT provided ratings for diversity and spatial structure risks. The IC-TRT provided spatial structure and diversity ratings combined as an integrated SS/D risk. WLC scores (Table 7) are based on population persistence established by McElhany *et al.* (2006). IC-TRT viability criteria were based on (McElhany *et al.* 2000 and 2006), as well as the results of previous applications in other TRTs and a review of specific information available relative to listed IC ESU populations (IC-TRT 2007). The A/P score considers the TRT's estimate of a populations' minimum threshold population, natural spawning abundance and the productivity of the population. Productivity

over the entire life cycle and factors that affect population growth rate provide information on how well a population is "performing" in the habitats it occupies during the life cycle. Estimates of population growth rate that indicate a population is consistently failing to replace itself are an indicator of increased extinction risk. The four metrics (abundance, productivity, spatial structure, and diversity) are not independent of one another and their relationship to sustainability depends on a variety of interdependent ecological processes (Wainwright *et al.* 2008).

Table 7. Population persistence categories from McElhany *et al.* (2006). A low or negligible risk of extinction is considered "viable" (Ford 2011). Population persistence categories correspond to: 4 = very low (VL), 3 = low (L), 2 = moderate (M), 1 = high (H), and 0 = very high (VH) in Oregon populations, which corresponds to "extirpated or nearly so" (E) in Washington populations (Ford 2011).

Population Persistence Category	Probability of population persistence in 100 years	Probability of population extinction in 100 years	Description
0	0-40%	60-100%	Either extinct or "high" risk of extinction
1	40-75%	25-60%	Relatively "high" risk of extinction in 100 years
2	75-95%	5-25%	"Moderate" risk of extinction in 100 years
3	95-99%	1-5%	"Low" (negligible) risk of extinction in 100 years
4	>99%	<1%	"Very low" risk of extinction in 100 years

Integrated SS/D risk combines risk for likely, future environmental conditions, and diversity (McElhany *et al.* 2000, McElhany *et al.* 2007, Ford 2011). Diversity factors include:

- Life history traits: Distribution of major life history strategies within a population, variability of traits, mean value of traits, and loss of traits.
- Effective population size: One of the indirect measures of diversity is effective population size. A population at chronic low abundance or experiencing even a single episode of low abundance is at a higher extinction risk because of loss of genetic variability, inbreeding and the expression of inbreeding depression, or the effects of mutation accumulation.
- Impact of hatchery fish: Interbreeding of wild populations and hatchery origin fish are a significant risk factor to the diversity of wild populations if the proportion of hatchery fish in the spawning population is high and their genetic similarity to the wild population is low.
- Anthropogenic mortality: The susceptibility to mortality from harvest or habitat alterations will differ depending on size, age, run timing, disease resistance or other traits.
- Habitat diversity: Habitat characteristics have clear selective effects on populations, and changes in habitat characteristics are likely to eventually lead to genetic changes through selection for locally adapted traits. In assessing risk associated with altered habitat diversity, historical diversity is used as a reference point.

The boundaries of each population were defined using a combination of genetic information, geography, life-history traits, morphological traits, and population dynamics that indicate the extent of reproductive isolation among spawning groups. To date, the TRTs have divided the 13 species of salmon and steelhead considered in this opinion into a total of 189 populations. The overall viability of a species is a function of the viable salmonid population (VSP) attributes of its constituent populations. Until a viability analysis of a species is completed, the VSP guidelines recommend that all populations should be managed to retain the potential to achieve viable status to ensure a rapid start along the road to recovery, and that no significant parts of the species are lost before a full recovery plan is implemented (McElhany *et al.* 2000).

The size and distribution of the populations considered in this opinion generally have declined over the last few decades due to natural phenomena and human activity, including climate change (as described in Section 2.2), the operation of hydropower systems, over-harvest, effects of hatcheries, and habitat degradation. Enlarged populations of terns, seals, California sea lions, and other aquatic predators in the Pacific Northwest may be limiting the productivity of some Pacific salmon and steelhead populations (Ford 2011). Viability status is described below for each of the populations considered in this opinion. Information regarding the southern DPS eulachon (eulachon), with is presented with the Willamette and Lower Columbia (WLC) recovery domain.

Willamette-Lower Columbia Recovery Domain. Species in the Willamette-Lower Columbia (WLC) Recovery Domain include LCR Chinook salmon, UWR Chinook salmon, CR chum salmon, LCR coho salmon, LCR steelhead, UWR steelhead, southern green sturgeon, and eulachon. The WLC-TRT has identified 107 demographically independent populations of Pacific salmon and steelhead (Table 8). These populations were further aggregated into strata, groupings above the population level that are connected by some degree of migration, based on ecological subregions. All 107 populations use parts of the mainstem of the Columbia River and the Columbia River estuary for migration, rearing, and smoltification.

Table 8. Populations in the WLC recovery domain. Combined extinction risks for salmon and steelhead based on analysis of Oregon populations only.

Species	Populations
LCR Chinook salmon	32
UWR Chinook salmon	7
CR chum salmon	17
LCR coho salmon	24
LCR steelhead	26
UWR steelhead	4

LCR Chinook Salmon. This species includes all naturally-spawned populations of Chinook salmon in the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River; the Willamette River to Willamette Falls, Oregon, exclusive of spring-run Chinook salmon in the Clackamas River; and progeny of seventeen artificial propagation

programs. LCR Chinook populations exhibit three different life history types base on return timing and other features: fall-run (a.k.a. "tules"), late-fall-run (a.k.a. "brights"), and spring-run. The WLC-TRT identified 32 historical populations of LCR Chinook salmon; seven in the Coast Range, six in the Columbia Gorge, and 19 in the Cascade Range (Table 9).

Table 9. LCR Chinook salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) in Oregon populations. VH corresponds to "extirpated or nearly so" (E) in Washington populations.

Stratum		**Spawning Population (Watershed)**	**A/P**	**Diversity**	**Spatial Structure**	**Overall Viability Risk**
Ecological Subregion	**Run Timing**					
Coast Range	Fall	Grays River (WA)	E	E	L	E
		Elochoman River (WA)	E	H	L	E
		Mill, Germany, and Abernathy creeks (WA)	E	H	L	E
		Young Bay (OR)	H to VH	H	L	VH
		Big Creek (OR)	H to VH	H	L to M	VH
		Clatskanie River (OR)	H	M to H	L	VH
		Scappoose River (OR)	H to VH	M to H	L to M	VH
Columbia Gorge	Spring	White Salmon River (WA)	E	E	E	E
		Hood River (OR)	VH	VH	L	VH
	Fall	Upper Gorge (OR)	E	H	H	VH
		Upper Gorge (WA)	H to VH	H	L to M	E
		White Salmon River (WA)	E	H	H	E
		Lower Gorge (OR)	H to VH	H	L to M	VH
		Lower Gorge (WA)	E	H	H	E
		Hood River (OR)	H to VH	H to VH	L	VH
Cascade Range	Spring	Upper Cowlitz River (WA)	E	M	H	E
		Cispus River (WA)	E	M	H	E
		Tilton River (WA)	E	E	E	E
		Toutle River (WA)	E	H	L	E
		Kalama River (WA)	E	H	L	E
		Sandy River (OR)	M to H	L to M	M	M
		Lewis (WA)	E	M	H	E
	Fall	Lower Cowlitz River (WA)	E	M	M	E
		Upper Cowlitz River (WA)	E	M	E	E
		Lewis River (WA)	E	L	M	E
		Salmon Creek (OR)	E	M	M	E
		Sandy River (OR)	H to VH	H	L	VH
		Toutle River (WA)	E	M	M	E
		Coweeman River (WA)	E	L	M	E
		Kalama River (WA)	E	M	L	E
		Clackamas River (OR)	H to VH	H	L	H
		Washougal River (WA)	E	M	M	E
	Late Fall	Lewis River (WA)	VL	L	L	VL
		Sandy River (OR)	L	L to M	L	L

A/P ratings for most LCR Chinook salmon populations are currently "high" risk to "extirpated or nearly so." Spatial structure was generally rated "low" to "moderate" risk for most populations. Other than the Sandy River, Oregon LCR Chinook salmon populations were rated "high" or "very high" risk for diversity. In 2005, diversity risk for Clackamas River and Lower Gorge tributary fall Chinook salmon was rated "moderate"; now the risk is rated "high." Most Washington LCR Chinook salmon populations are currently at "moderate" or "high" risk for diversity (Table 9).

Of the 32 historical populations in the ESU, 28 are extirpated or at "very high" risk. Based on the recovery plan analyses, all of the tule populations are "very high" risk except one that is considered at "high" risk. The modeling conducted in association with tule harvest management suggests that three of the populations (Coweeman, Lewis and Washougal) are at a somewhat lower risk. However, even these more optimistic evaluations suggest that the remaining 18 populations are at substantial risk because of very low natural origin spawner abundance (<100/population), high hatchery fraction, habitat degradation and harvest impacts. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to LCR Chinook salmon include (LCFRB 2010, NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects
- Hatchery-related effects
- Harvest-related effects on fall Chinook salmon
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- Reduced access to off-channel rearing habitat in the LCR
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

CR Chum Salmon. This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006; Table 10). Unlike other species in the WLC recovery domain, CR chum salmon spawning aggregations were identified in the mainstem Columbia River. These aggregations generally were included in the population associated with the nearest river basin. Three strata and eight historical populations of CR chum salmon occur within the action area (Table 10); of these, only the Lower Gorge population is characterized as "viable"(Ford 2011).

Table 10. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk (Ford 2011). Risk ratings are very low (VL), low (L), moderate (M), high (H), and "extirpated or nearly so" (E).

Stratum		Spawning Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Viability Risk
Ecological Subregion	Run Timing					
Coast Range	Fall	Young's Bay (OR)	*	*	*	*
		Grays River (WA)	VL	L	M	M
		Big Creek (OR)	*	*	*	*
		Elochoman River (WA)	E	E	L	E
		Clatskanie River (OR)	*	*	*	*
		Mill, Abernathy and Germany creeks (WA)	E	E	L	E
		Scappoose Creek (OR)	*	*	*	*
Columbia Gorge	Fall	Lower Gorge (OR)	*	*	*	*
		Lower Gorge (WA)	VL	VL	L	L
		Upper Gorge (OR)	*	*	*	*
		Upper Gorge (WA)	E	E	H	E
Cascade Range	Summer	Cowlitz River (WA)	E	E	H	E
	Fall	Cowlitz River (WA)	E	E	L	E
		Kalama River (WA)	E	E	L	E
		Salmon Creek (WA)	E	E	H	E
		Lewis River (WA)	E	E	L	E
		Clackamas River (OR)	*	*	*	*
		Washougal River (WA)	E	E	L	E
		Sandy River (OR)	*	*	*	*

* No viability risk was completed for Oregon chum salmon populations. Oregon rivers have occasional reports of a few chum salmon. Populations are functionally extinct, or the risk of extinction is very high.

The vast majority (14 out of 17) chum salmon populations remain "extirpated or nearly so". The Grays River and Lower Gorge populations showed a sharp increase in 2002, but have since declined back to relatively low abundance levels in the range of variation observed over the last several decades. Chinook and coho salmon populations in the Lower Columbia and Willamette similarly increased in the early 2000s, then declined to typical recent levels, suggesting the increase in chum salmon is related to ocean conditions. The Grays and Lower Gorge populations were rated "very low" risk for A/P, but all other populations were rated "extirpated or nearly so." Spatial structure was rated "low" for seven populations, one has moderate risk and three have a "high" risk. Diversity risk was "high" for all populations except Grays ("moderate") and Lower Gorge ("very low"). Recent data on the Washougal/mainstem Columbia population are not available, but they likely follow a pattern similar to the Grays and Lower Gorge populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to CR chum salmon include (LCFRB 2010, NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system
- Degraded freshwater habitat, in particular of floodplain connectivity and function, channel structure and complexity, stream substrate, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded stream flow as a result of hydropower and water supply operations
- Loss of access and loss of some habitat types as a result of passage barriers such as roads and railroads
- Reduced water quality
- Current or potential predation from hatchery-origin salmonids, including coho salmon
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity
- Reduced access to off-channel rearing habitat in the LCR
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary
- Juvenile fish strandings that result from ship wakes
- Contaminants affecting fish health and reproduction

LCR Coho Salmon. This species includes all naturally-spawned populations of chum salmon in the Columbia River and its tributaries in Washington and Oregon, and progeny of three artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers *et al.* 2006; Table 10). Unlike other species in the WLC recovery domain, CR chum salmon spawning aggregations were identified in the mainstem Columbia River. These aggregations generally were included in the population associated with the nearest river basin. Three strata and eight historical populations of CR chum salmon occur within the action area (Table 10); of these, only the Lower Gorge population is characterized as “viable”(Ford 2011).

Table 11. LCR coho salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) in Oregon populations. VH corresponds to "extirpated or nearly so" (E) in Washington populations.

Stratum		Spawning Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Viability Risk
Ecological Subregion	Run Type					
Coast Range	N*	Young's Bay (OR)	VH	VH	L	VH
		Big Creek (OR)	VH	H	L to M	VH
		Clatskanie River (OR)	H to VH	M	L	H
		Scappoose River (OR)	M to H	M	L to M	M
		Grays River (WA)	E	E	L	E
		Elochoman Creek (WA)	E	E	L	E
		Mill, Germany, and Abernathy Creeks (WA)	E	H	L	E
Columbia Gorge	N	Lower Gorge Tributaries (OR)	VH	H	L to M	VH
		Lower Gorge Tributaries (WA)	E	E	M	E
	S**	Upper Gorge Tributaries (WA)	E	E	M	E
		Hood River (OR)	VH	H	L	H
Cascade Range	N	Lower Cowlitz River (WA)	E	M	M	E
		Coweeman River (WA)	E	M	L	E
		Salmon Creek (WA)	E	E	M	E
	N and S	Upper Cowlitz River (WA)	E	H	M	E
		Cispus River (WA)	E	H	M	E
		Tilton River (WA)	E	H	M	E
		South Fork Toutle River (WA)	E	M	L	E
		North Fork Toutle River (WA)	E	H	M	E
		Kalama River (WA)	E	M	L	E
		North Fork Lewis River (WA)	E	H	H	E
		East Fork Lewis River (WA)	E	M	L	E
		Washougal River (WA)	E	H	L	E
		Clackamas River (OR)	M	L to M	L	M
		Sandy River (OR)	H	L to M	M to H	H

*"Type N" are late-run fish that tend to undertake oceanic migrations to the north of the Columbia River, extending as far as northern British Columbia and southeast Alaska.
**"Type S" are early coho salmon that spawn in the upper reaches of larger rivers in the LCR and in most rivers inland of the Cascade Crest that tend to migrate to the south of the Columbia River.

Limiting factors and threats to LCR coho salmon include (LCFRB 2010, NOAA Fisheries 2011):

- Degraded estuarine and near-shore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.
- Fish passage barriers that limit access to spawning and rearing habitats.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, stream flow, and

water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Hatchery-related effects.
- Harvest-related effects.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the LCR.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

LCR Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams and tributaries to the Columbia River between and including the Cowlitz and Wind rivers, Washington; in the Willamette and Hood rivers, Oregon; and progeny of ten artificial propagation programs; but excluding all steelhead from the upper Willamette River basin above Willamette Falls, Oregon, and from the Little and Big White Salmon rivers, Washington.

Summer steelhead return to freshwater long before spawning. Winter steelhead, in contrast, return from the ocean much closer to maturity and spawn within a few weeks. Summer steelhead spawning areas in the Lower Columbia River are found above waterfalls and other features that create seasonal barriers to migration. Where no temporal barriers exist, the winter-run life history dominates Four strata and 23 historical populations of LCR steelhead occur within the action area (Table 12).

Table 12. LCR steelhead strata, ecological subregions, run timing, populations, and scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) in Oregon populations. VH corresponds to "extirpated or nearly so" (E) in Washington populations.

Stratum		Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Viability Risk
Ecological Subregion	Run Timing					
Columbia Gorge	Summer	Wind River (WA)	VL	L	VL	L
		Hood River (OR)	H	M	L	VH
	Winter	Lower Gorge (OR)	H	L	L	M to H
		Lower Gorge (WA)	H	M	VL	H
		Upper Gorge (OR)	M	M to H	L	VH
		Upper Gorge (WA)	H	M	M	E
		Hood River (OR)	M	M	L	M
West Cascade Range	Summer	Kalama River (WA)	L	M	VL	M
		North Fork Lewis River (WA)	E	E	E	E
		East Fork Lewis River (WA)	E	M	VL	E
		Washougal River (WA)	M	M	VL	M
	Winter	Cispus River (WA)	E	M	M	E
		Tilton river (WA)	E	H	M	E
		Upper Cowlitz River (WA)	E	M	M	E
		Lower Cowlitz River (WA)	H	M	M	H
		North Fork Toutle River (WA)	E	L	L	E
		South Fork Toutle River (WA)	M	L	VL	M
		Coweeman River (WA)	H	VL	VL	H
		Kalama River (WA)	H	L	VL	H
		North Fork Lewis River (WA)	E	M	M	E
		East Fork Lewis River (WA)	M	M	VL	M
		Salmon Creek (WA)	E	M	VL	E
		Washougal River (WA)	H	M	VL	H
		Sandy River (OR)	H	M	M to H	VH
		Clackamas River (OR)	L	L to M	L	L to M

All of the populations increased in abundance during the early 2000s, generally peaking in 2004. Most populations have since declined back to levels within one standard deviation of the long term mean. Exceptions are the Washougal summer-run and North Fork Toutle winter-run, which are still higher than the long term average, and the Sandy, which is lower. In general, the populations do not show any sustained dramatic changes in abundance or fraction of hatchery origin spawners since the 2005 status review (Ford 2011).

Limiting factors and threats to LCR steelhead include (LCFRB 2010, NOAA Fisheries 2011):

- Degraded estuarine and nearshore marine habitat resulting from cumulative impacts of land use and flow management by the Columbia River hydropower system.

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and recruitment of large wood, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Reduced access to spawning and rearing habitat mainly as a result of tributary hydropower projects and lowland development.
- Avian and marine mammal predation in the lower mainstem Columbia River and estuary.
- Hatchery-related effects.
- An altered flow regime and Columbia River plume has altered the temperature regime and estuarine food web, and has reduced ocean productivity.
- Reduced access to off-channel rearing habitat in the LCR.
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary.
- Juvenile fish strandings that result from ship wakes.
- Contaminants affecting fish health and reproduction.

UWR Chinook Salmon. This species includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River; in the Willamette River and its tributaries above Willamette Falls, Oregon; and progeny of seven artificial propagation programs. All seven historical populations of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table13); only the McKenzie population is characterized as a low extinction risk (Ford 2011).

Table 13. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Clackamas River	M	M	L	M
Molalla River	VH	H	H	VH
North Santiam River	VH	H	H	VH
South Santiam River	VH	M	M	VH
Calapooia River	VH	H	VH	VH
McKenzie River	VL	M	M	L
Middle Fork Willamette River	VH	H	H	VH

Consideration of data collected since the last status review in 2005 has confirmed the high fraction of hatchery origin fish in all of the populations of this species (even the Clackamas and McKenzie rivers have hatchery fractions above WLC-TRT viability thresholds). All of the UWR Chinook salmon populations have “moderate” or “high” risk ratings for diversity. The Clackamas and McKenzie river populations currently have the best risk ratings for A/P, spatial structure, and diversity. Clackamas River Chinook salmon have a “low” risk rating for spatial structure.

The new data have also highlighted the substantial risks associated with pre-spawning mortality. Although recovery plans are targeting key limiting factors for future actions, there have been no significant on-the-ground-actions since the last status review to resolve the lack of access to historical habitat above dams nor have there been substantial actions removing hatchery fish from the spawning grounds. Overall, the new information does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to UWR Chinook salmon include (ODFW and NMFS 2011, NOAA Fisheries 2011):

- Significantly reduced access to spawning and rearing habitat because of tributary dams
- Degraded freshwater habitat, especially floodplain connectivity and function, channel structure and complexity, and riparian areas and large wood recruitment as a result of cumulative impacts of agriculture, forestry, and development
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Hatchery-related effects
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation on, and competition with, native UWR Chinook salmon
- Ocean harvest rates of approximately 30%

UWR Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River. The WLC-TRT identified five historical populations of UWR steelhead, all with winter-run timing (Myers *et al.* 2006). One stratum and four extant populations of UWR steelhead occur within the action area (Table 14). Historical observations, hatchery records, and genetics suggest that the presence of UWR steelhead in many tributaries on the west side of the upper basin is the result of recent introductions. Nevertheless, the WLC-TRT recognized that although these UWR steelhead do not represent a historical population, the west side tributaries may provide juvenile rearing habitat or may be temporarily (for one or more generations) colonized during periods of high abundance. Hatchery summer-run steelhead that are released in the subbasins are from an out-of-basin stock, not part of the DPS. Additionally, stocked summer steelhead that have become established in the McKenzie River were not considered in the identification of historical populations (ODFW *et al.* 2011).

Table 14. Scores for the key elements (A/P, diversity, and spatial structure) used to determine current overall viability risk for UWR steelhead (ODFW and NMFS 2011). All populations are in the Western Cascade Range ecological subregion. Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Spatial Structure	Overall Extinction Risk
Molalla River	VL	M	M	L
North Santiam River	VL	M	H	L
South Santiam River	VL	M	M	L
Calapooia River	M	M	VH	M

Since the last status review in 2005, UWR steelhead initially increased in abundance but subsequently declines and current abundance is at the levels observed in the mid-1990s when the DPS was first listed. The DPS appears to be at lower risk than the UWR Chinook salmon ESU, but continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to UWR steelhead (ODFW and NMFS 2011, NOAA Fisheries 2011) include:

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood recruitment, and stream flow have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Degraded water quality and altered temperature as a result of both tributary dams and the cumulative impacts of agriculture, forestry, and urban development
- Reduced access to spawning and rearing habitats mainly as a result of artificial barriers in spawning tributaries
- Hatchery-related effects: impacts from the non-native summer steelhead hatchery program
- Anthropogenic introductions of non-native species and out-of-ESU races of salmon or steelhead have increased predation and competition on native UWR steelhead.

Eulachon. The southern distinct population segment of eulachon occurs in four salmon recovery domains: Puget Sound, the Willamette and Lower Columbia, Oregon Coast, and Southern Oregon/Northern California Coasts. The ESA-listed population of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Core populations for this species include the Fraser River, Columbia River and (historically) the Klamath River. Eulachon leave saltwater to spawn in their natal streams late winter through early summer, and typically spawn at night in the lower reaches of larger rivers fed by snowmelt. After hatching, larvae are carried downstream and widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly known

although the amount of eulachon bycatch in the pink shrimp fishery seems to indicate that the distribution of these organisms overlap in the ocean.

In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River with no evidence of returning to their former population levels since then (Drake *et al.* 2008). Persistent low returns and landings of eulachon in the Columbia River from 1993 to 2000 prompted the states of Oregon and Washington to adopt a Joint State Eulachon Management Plan in 2001 that provides for restricted harvest management when parental run strength, juvenile production, and ocean productivity forecast a poor return (WDFW and ODFW 2001). Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings have again declined to the very low levels observed in the mid-1990s (JCRMS 2010), and since 2005, the fishery has operated at the most conservative level allowed in the management plan (JCRMS 2010). Large commercial and recreational fisheries have occurred in the Sandy River in the past. The most recent commercial harvest in the Sandy River was in 2003. No commercial harvest has been recorded for the Grays River from 1990 to the present, but larval sampling has confirmed successful spawning in recent years (USDC 2011).

The primary factors responsible for the decline of the southern DPS of eulachon are changes in ocean conditions due to climate change (Gustafson *et al.* 2010, Gustafson *et al*. 2011), particularly in the southern portion of its range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. Additional factors include climate-induced change to freshwater habitats, dams and water diversions (particularly in the Columbia and Klamath Rivers where hydropower generation and flood control are major activities), and bycatch of eulachon in commercial fisheries (NOAA Fisheries 2011).

Other limiting factors include (Gustafson *et al.* 2010, Gustafson *et al*. 2011):

- Adverse effects related to dams and water diversions
- Artificial fish passage barriers
- Increased water temperatures, insufficient streamflow
- Altered sediment balances
- Water pollution
- Over-harvest
- Predation

***Southern Green Sturgeon*.**

Spatial Structure and Diversity. Two DPSs have been defined for green sturgeon (*Acipenser medirostris*), a northern DPS (spawning populations in the Klamath and Rogue rivers) and a southern DPS (spawners in the Sacramento River). Southern green sturgeon includes all naturally-spawned populations of green sturgeon that occur south of the Eel River in Humboldt County, California. When not spawning, this anadromous species is broadly distributed in nearshore marine areas from Mexico to the Bering Sea. Although it is commonly observed in bays, estuaries, and sometimes the deep riverine mainstem in lower elevation reaches of non-natal rivers along the west coast of North America, the distribution and timing of estuarine use are poorly understood. Recovery scenarios are currently being developed for this species.

Limiting factors. The principal factor for the decline of southern green sturgeon is the reduction of its spawning area to a single known population limited to a small portion of the Sacramento River. It is currently at risk of extinction primarily because of human-induced ‘‘takes’’ involving elimination of freshwater spawning habitat, degradation of freshwater and estuarine habitat quality, water diversions, fishing, and other causes (USDC 2010). Adequate water flow and temperature are issues of concern. Water diversions pose an unknown but potentially serious threat within the Sacramento and Feather Rivers and the Sacramento River Delta. Poaching also poses an unknown but potentially serious threat because of high demand for sturgeon caviar. The effects of contaminants and nonnative species are also unknown but potentially serious threats. As mentioned above, retention of green sturgeon in both recreational and commercial fisheries is now prohibited within the western states, but the effect of capture/release in these fisheries is unknown. There is evidence of fish being retained illegally, although the magnitude of this activity likely is small (NOAA Fisheries 2011)

Interior Columbia Recovery Domain. Species in the Interior Columbia (IC) recovery domain include UCR spring-run Chinook salmon, SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, UCR steelhead, MCR steelhead, and SRB steelhead. The IC-TRT identified 82 populations of those species based on genetic, geographic (hydrographic), and habitat characteristics (Table 15). In some cases, the IC-TRT further aggregated populations into “major groupings” based on dispersal distance and rate, and drainage structure, primarily the location and distribution of large tributaries (IC-TRT 2003). All 82 populations identified use the lower mainstem of the Snake River, the mainstem of the Columbia River, and the Columbia River estuary, or part thereof, for migration, rearing, and smoltification.

Table 15. Populations of ESA-listed salmon and steelhead in the IC recovery domain.

Species	Populations
UCR spring-run Chinook salmon	3
SR spring/summer-run Chinook salmon	28
SR fall-run Chinook salmon	1
SR sockeye salmon	1
UCR steelhead	4
MCR steelhead	17
SRB steelhead	24

The IC-TRT also recommended viability criteria that follow the VSP framework (McElhany *et al.* 2006) and described biological or physical performance conditions that, when met, indicate a population or species has a 5% or less risk of extinction over a 100-year period (IC-TRT 2007; see also NRC 1995).

UCR Spring-run Chinook Salmon. This species includes all naturally-spawned populations of Chinook salmon in all river reaches accessible to Chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River), the Columbia River upstream to Chief Joseph Dam, and progeny of six artificial propagation programs. The IC-TRT identified four independent populations of UCR spring-run Chinook salmon in the upriver tributaries of Wenatchee, Entiat,

Methow, and Okanogan (extirpated), but no major groups due to the relatively small geographic area affected (IC-TRT 2003, Ford 2011) (Table 16).

Table 16. Scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for spring-run UCR Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E).

Population	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River				E

The UCR spring-run Chinook salmon is not currently meeting the viability criteria (adapted from the IC-TRT) in the Upper Columbia Recovery Plan. A/P remains at "high" risk for each of the three extant populations in this MPG/ESU (Table 16). The 10 year geometric mean abundance of adult natural origin spawners has increased for each population relative to the levels for the 1981 2003 series, but the estimates remain below the corresponding IC-TRT thresholds. Estimated productivity (spawner to spawner return rate at low to moderate escapements) was on average lower over the years 1987 2009 than for the previous period. The combinations of current abundance and productivity for each population result in a "high" risk rating. The composite SS/D risks for all three of the extant populations in this MPG are at "high" risk. The spatial processes component of the SS/D risk is "low" for the Wenatchee River and Methow River populations and "moderate" for the Entiat River (loss of production in lower section increases effective distance to other populations). All three of the extant populations in this MPG are at "high" risk for diversity, driven primarily by chronically high proportions of hatchery origin spawners in natural spawning areas and lack of genetic diversity among the natural origin spawners (Ford 2011).

Increases in natural origin abundance relative to the extremely low spawning levels observed in the mid-1990s are encouraging; however, average productivity levels remain extremely low. Overall, the viability of Upper Columbia Spring Chinook salmon ESU has likely improved somewhat since the last status review, but the ESU is still clearly at "moderate-to-high" risk of extinction (Ford 2011).

Limiting factors and threats to the UCR spring-run Chinook salmon ESU include (UCSRB 2007, NOAA Fisheries 2011):

- Mainstem Columbia River hydropower–related adverse effects: upstream and downstream fish passage, ecosystem structure and function, flows, and water quality
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water

quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development

- Degraded estuarine and nearshore marine habitat
- Hatchery related effects: including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species
- Harvest in Columbia River fisheries

SR Spring/summer-run Chinook Salmon. This species includes all naturally-spawned populations of spring/summer-run Chinook salmon in the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River subbasins; and progeny of fifteen artificial propagation programs. The IC-TRT identified 28 extant and 4 extirpated populations of SR spring/summer-run Chinook salmon, and aggregated these into major population groups (IC-TRT 2003, Ford 2011). Each of these populations faces a "high" risk of extinction (Ford 2011) (Table 17).

Table 17. SR spring/summer-run Chinook salmon ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SR spring/summer-run Chinook salmon (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E).

Ecological Subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Lower Snake River	Tucannon River	H	M	M	H
	Asotin River				E
Grande Ronde and Imnaha rivers	Wenaha River	H	M	M	H
	Lostine/Wallowa River	H	M	M	H
	Minam River	H	M	M	H
	Catherine Creek	H	M	M	H
	Upper Grande Ronde R.	H	M	H	H
	Imnaha River	H	M	M	H
	Big Sheep Creek	*	*	*	E
	Lookingglass Creek	*	*	*	E
South Fork Salmon River	Little Salmon River	*	*	*	H
	South Fork mainstem	H	M	M	H
	Secesh River	H	L	L	H
	EF/Johnson Creek	H	L	L	H
Middle Fork Salmon River	Chamberlin Creek	H	L	L	H
	Big Creek	H	M	M	H
	Lower MF Salmon	H	M	M	H
	Camas Creek	H	M	M	H
	Loon Creek	H	M	M	H
	Upper MF Salmon	H	M	M	H
	Pistol Creek	*	*	*	E
	Sulphur Creek	H	M	M	H
	Bear Valley Creek	H	L	L	H
	Marsh Creek	H	L	L	H
Upper Mainstem Salmon	N. Fork Salmon River	H	L	L	H
	Lemhi River	H	H	H	H
	Pahsimeroi River	H	H	H	H
	Upper Salmon-lower mainstem	H	L	L	H
	East Fork Salmon River	H	H	H	H
	Yankee Fork	H	H	H	H
	Valley Creek	H	M	M	H
	Upper Salmon main	H	M	M	H
	Panther Creek	*	*	*	E

* Insufficient data.

Population level status ratings remain at high risk across all MPGs within the ESU, although recent natural spawning abundance estimates have increased, all populations remain below minimum natural origin abundance thresholds (Table 17). Spawning escapements in the most recent years in each series are generally well below the peak returns but above the extreme low

levels in the mid 1990s. Relatively low natural production rates and spawning levels below minimum abundance thresholds remain a major concern across the ESU.

The ability of SR spring/summer-run Chinook salmon populations to be self-sustaining through normal periods of relatively low ocean survival remains uncertain. Factors cited by Good *et al.* (2005) remain as concerns or key uncertainties for several populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to the SR spring/summer-run Chinook salmon ESU include (NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large wood supply, stream substrate, elevated water temperature, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Mainstem Columbia River and Snake River hydropower impacts
- Harvest-related effects
- Predation

SR Fall-run Chinook Salmon. This species includes all naturally-spawned populations of fall-run Chinook salmon in the mainstem Snake River below Hells Canyon Dam, and in the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River, and progeny of four artificial propagation programs. The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT 2003, Ford 2011).

The recent increases in natural origin abundance are encouraging. However, hatchery origin spawner proportions have increased dramatically in recent years – on average, 78% of the estimated adult spawners have been hatchery origin over the most recent brood cycle. The apparent leveling off of natural returns in spite of the increases in total brood year spawners may indicate that density dependent habitat effects are influencing production or that high hatchery proportions may be influencing natural production rates. The A/P risk rating for the population is "moderate." The population is at moderate risk for diversity and spatial structure. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011). Given the combination of current A/P and SS/D ratings summarized above, the overall viability rating for Lower SR fall Chinook salmon would be rated as "maintained." "Maintained" population status is for populations that do not meet the criteria for a viable population but do support ecological functions and preserve options for ESU/DPS recovery.

Limiting factors and threats to SR fall-run Chinook salmon include (NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, and channel structure and complexity have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Harvest-related effects
- Lost access to historic habitat above Hells Canyon and other Snake River dams
- Mainstem Columbia River and Snake River hydropower impacts
- Hatchery-related effects
- Degraded estuarine and nearshore habitat

SR Sockeye Salmon. This species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, and artificially-propagated sockeye salmon from the Redfish Lake captive propagation program. The IC-TRT identified historical sockeye salmon production in at least five Stanley Basin and Sawtooth Valley lakes and in lake systems associated with Snake River tributaries currently cut off to anadromous access (*e.g.,* Wallowa and Payette Lakes), although current returns of SR sockeye salmon are extremely low and limited to Redfish Lake (IC-TRT 2007).

This species is still at extremely high risk across all four basic risk measures (abundance, productivity, spatial structure and diversity. Although the captive brood program has been successful in providing substantial numbers of hatchery produced *O. nerka* for use in supplementation efforts, substantial increases in survival rates across life history stages must occur in order to re-establish sustainable natural production (Hebdon *et al.* 2004, Keefer *et al.* 2008). Overall, although the risk status of the SR sockeye salmon ESU appears to be on an improving trend, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

The key factor limiting recovery of SR sockeye salmon ESU is survival outside of the Stanley Basin. Portions of the migration corridor in the Salmon River are impeded by water quality and temperature (Idaho Department of Environmental Quality 2011). Increased temperatures likely reduce the survival of adult sockeye returning to the Stanley Basin. The natural hydrological regime in the upper mainstem Salmon River Basin has been altered by water withdrawals. In most years, sockeye adult returns to Lower Granite suffer catastrophic losses (*e.g.*, > 50% mortality in one year; Reed *et al.* 2003) before reaching the Stanley Basin, although the factors causing these losses have not been identified. In the Columbia and lower Snake River migration corridor, predation rates on juvenile sockeye salmon are unknown, but terns and cormorants consume 12% of all salmon smolts reaching the estuary, and piscivorous fish consume an estimated 8% of migrating juvenile salmon (NOAA Fisheries 2011).

MCR Steelhead. This species includes all naturally-spawned steelhead populations below natural and artificial impassable barriers in streams from above the Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington, excluding steelhead from the Snake River basin; and progeny of seven artificial propagation programs. The IC-TRT identified 17 extant populations in this DPS (IC-TRT 2003). The populations fall into four major population groups: the Yakima River Basin (four extant

populations), the Umatilla/Walla Walla drainages (three extant and one extirpated populations); the John Day River drainage (five extant populations) and the Eastern Cascades group (five extant and two extirpated populations) (Table 18) (NMFS 2009a, Ford 2011).

Table 18. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for MCR steelhead (NMFS 2009, Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH) and extirpated (E). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Ecological Subregions	Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Cascade Eastern Slope Tributaries	Fifteenmile Creek	L	L	L	Viable
	Klickitat River	M	M	M	MT?
	Eastside Deschutes River	L	M	M	Viable
	Westside Deschutes River	H	M	M	H*
	Rock Creek	H	M	M	H?
	White Salmon				E*
	Crooked River				E*
John Day River	Upper Mainstem	M	M	M	MT
	North Fork	VL	L	L	Highly Viable
	Middle Fork	M	M	M	MT
	South Fork	M	M	M	MT
	Lower Mainstem	M	M	M	MT
Walla Walla and Umatilla rivers	Umatilla River	M	M	M	MT
	Touchet River	M	M	M	H
	Walla Walla River	M	M	M	MT
Yakima River	Satus Creek	M	M	M	Viable (MT)
	Toppenish Creek	M	M	M	Viable (MT)
	Naches River	H	M	M	H
	Upper Yakima	H	H	H	H

* Re-introduction efforts underway (NMFS 2009).

There have been improvements in the viability ratings for some of the component populations, but the MCR steelhead DPS is not currently meeting the viability criteria (adopted from the IC-TRT) in the MCR steelhead recovery plan (NMFS 2009a). In addition, several of the factors cited by Good *et al.* (2005) remain as concerns or key uncertainties. Natural origin spawning estimates of populations have been highly variable with respect to meeting minimum abundance thresholds. Straying frequencies into at least the Lower John Day River population are high. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. Out-of-basin hatchery stray proportions, although reduced, remain very high in the

Deschutes River basin. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

The limiting factors and threats to MCR steelhead include (NMFS 2009a, NOAA Fisheries 2011):

- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas, fish passage, stream substrate, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, tributary hydro system activities, and development
- Mainstem Columbia River hydropower–related impacts
- Degraded estuarine and nearshore marine habitat
- Hatchery-related effects
- Harvest-related effects
- Effects of predation, competition, and disease

UCR Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Columbia River Basin upstream from the Yakima River, Washington, to the U.S.-Canada border, and progeny of six artificial propagation programs. Four independent populations of UCR steelhead were identified by the IC-TRT in the same upriver tributaries as for UC spring-run Chinook salmon (*i.e.*, Wenatchee, Entiat, Methow, and Okanogan; Table 19) and, similarly, no major population groupings were identified due to the relatively small geographic area involved (IC-TRT 2003, Ford 2011). All extant populations are considered to be at high risk of extinction (Table 19; Ford 2011).

Table 19. Summary of the key elements (A/P, diversity, and SS/D) and scores used to determine current overall viability risk for UCR steelhead populations (Ford 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH).

Population (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk
Wenatchee River	H	H	H	H
Entiat River	H	H	H	H
Methow River	H	H	H	H
Okanogan River	H	H	H	H

UCR steelhead populations have increased in natural origin abundance in recent years, but productivity levels remain low. The proportions of hatchery origin returns in natural spawning areas remain extremely high across the DPS, especially in the Methow and Okanogan River populations. The modest improvements in natural returns in recent years are probably primarily the result of several years of relatively good natural survival in the ocean and tributary habitats. With the exception of the Okanogan population, the Upper Columbia populations rated as “low” risk for spatial structure. The “high” risk ratings for SS/D are largely driven by chronic high levels of hatchery spawners within natural spawning areas and lack of genetic diversity among

the populations. Overall, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

The limiting factors and threats to the UCR steelhead DPS include (UCSRB 2007, NOAA Fisheries 2011):

- Mainstem Columbia River hydropower–related adverse effects.
- Impaired tributary fish passage.
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development.
- Effects of predation, competition, and disease mortality: Fish management, including past introductions and persistence of non-native (exotic) fish species continues to affect habitat conditions for listed species.
- Hatchery-related effects.
- Harvest-related effects.

SRB Steelhead. This species includes all naturally-spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho, and progeny of six artificial propagation programs. The IC-TRT identified 25 historical populations in five major groups (Table 20) (Ford 2011, IC-TRT 2011,).

Table 20. Ecological subregions, populations, and scores for the key elements (A/P, diversity, and SS/D) used to determine current overall viability risk for SRB steelhead (Ford 2011, NMFS 2011). Risk ratings range from very low (VL), low (L), moderate (M), high (H), to very high (VH). Maintained (MT) population status indicates that the population does not meet the criteria for a viable population but does support ecological functions and preserve options for recovery of the DPS.

Ecological subregions	Spawning Populations (Watershed)	A/P	Diversity	Integrated SS/D	Overall Viability Risk*
Lower Snake River	Tucannon River	**	M	M	H
	Asotin Creek	**	M	M	MT
Grande Ronde River	Lower Grande Ronde	**	M	M	Not rated
	Joseph Creek	VL	L	L	Highly viable
	Upper Grande Ronde	M	M	M	MT
	Wallowa River	**	L	L	H
Clearwater River	Lower Clearwater	M	L	L	MT
	South Fork Clearwater	H	M	M	H
	Lolo Creek	H	M	M	H
	Selway River	H	L	L	H
	Lochsa River	H	L	L	H
Salmon River	Little Salmon River	**	M	M	MT
	South Fork Salmon	**	L	L	H
	Secesh River	**	L	L	H
	Chamberlain Creek	**	L	L	H
	Lower MF Salmon	**	L	L	H
	Upper MF Salmon	**	L	L	H
	Panther Creek	**	M	H	H
	North Fork Salmon	**	M	M	MT
	Lemhi River	**	M	M	MT
	Pahsimeroi River	**	M	M	MT
	East Fork Salmon	**	M	M	MT
	Upper Main Salmon	**	M	M	MT
Imnaha	Imnaha River	M		M	MT

* Uncertainty due to a lack of population-specific data.

** Insufficient data.

The level of natural production in the two populations with full data series and the Asotin Creek index reaches is encouraging, but the status of most populations in this DPS remains highly uncertain. Population-level natural origin abundance and productivity inferred from aggregate data and juvenile indices indicate that many populations are likely below the minimum combinations defined by the IC-TRT viability criteria. The relative proportion of hatchery fish in natural spawning areas near major hatchery release sites is highly uncertain. There is little evidence for substantial change in ESU viability relative to the previous BRT and IC-TRT reviews. Overall, therefore, the new information considered does not indicate a change in the biological risk category since the last status review (Ford 2011).

Limiting factors and threats to the SRB steelhead DPS include (IC-TRT 2006, NOAA Fisheries 2011):

- Mainstem Columbia River hydropower–related adverse effects
- Impaired tributary fish passage
- Degraded freshwater habitat: Floodplain connectivity and function, channel structure and complexity, riparian areas and large woody debris recruitment, stream flow, and water quality have been degraded as a result of cumulative impacts of agriculture, forestry, and development
- Impaired water quality and increased water temperature
- Related harvest effects, particularly for B-run steelhead
- Predation
- Genetic diversity effects from out-of-population hatchery releases

Threats from natural or man-made factors have worsened in the past 5 years, primarily due to four factors: small population dynamics, climate change, multi-year drought, and poor ocean survival conditions (NOAA Fisheries 2011).

2.2.2 Status of Critical Habitat

The action area for this consultation has been designated as critical habitat for all salmon and steelhead species considered in this consultation except LCR coho salmon. The area has also been designated as critical habitat for eulachon and southern green sturgeon.

The status of critical habitat was based primarily on a watershed-level analysis of conservation value that focused on the presence of listed ESA-listed species and physical features (*i.e.*, the primary constituent elements (PCEs) that are essential to their conservation. The analysis for the 2005 designations of salmon and steelhead species was completed by Critical Habitat Analytical Review Teams (CHARTs) that focused on large geographical areas corresponding approximately to recovery domains (NOAA Fisheries 2005). The CHARTs completed assessed factors of PCEs for species of ESA-listed salmon and steelhead in the Willamette-Lower Columbia, and Interior Columbia recovery domains. Each CHART consisted of Federal biologists and habitat specialists from NMFS, the Fish and Wildlife Service, the Forest Service, and the Bureau of Land Management, with demonstrated expertise regarding salmon and steelhead habitat and related protective efforts within that domain. NMFS has designated critical habitat for all salmon species considered in this opinion, except LCR coho salmon for which critical habitat has not been proposed or designated.

Each watershed was ranked using a conservation value attributed to the quantity of stream habitat with PCEs, the present condition of those PCEs, the likelihood of achieving PCE potential (either naturally or through active restoration), support for rare or important genetic or life history characteristics, support for abundant populations, and support for spawning and rearing populations. In some cases, our understanding of these interim conservation values has been further refined by the work of TRTs and other recovery planning efforts that have better explained the habitat attributes, ecological interactions, and population characteristics important to each species.

Climate change, as described in Section 2.2, is likely to reduce the conservation value of designated critical habitats in the Pacific Northwest. Other influences on the conservation value of critical habitats in the various recovery domains are discussed below.

Eulachon Critical Habitat. Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). All of these areas are designated as migration and spawning habitat for this species. In Oregon, 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek have been designated. The mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles is also designated as critical habitat.

Table 21 delineates the designated physical and biological features for eulachon. The physical or biological features of freshwater spawning and incubation sites, include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after the yolk sac is depleted, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

Table 21. Physical and Biological Features of critical habitats designated for eulachon and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	Site Attribute	
Freshwater spawning and incubation	Flow Water quality Water temperature Substrate	Adult spawning Incubation
Freshwater migration	Flow Water quality Water temperature Food	Adult and larval mobility Larval feeding

The range of eulachon in the Pacific Northwest completely overlaps with the range of several ESA-listed stocks of salmon and steelhead as well as green sturgeon. Although the habitat requirements of these fishes differ somewhat from eulachon, efforts to protect habitat generally focus on the maintenance of watershed processes that would be likely to benefit eulachon. The BRT identified dams and water diversions as moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia

and Klamath systems, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods (Gustafson *et al.* 2010). Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown (Gustafson *et al.* 2010). The BRT identified dredging as a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental because eggs could be destroyed by mechanical disturbance or smothered by in-water disposal of dredged materials.

The LCR mainstem provides spawning and incubation sites, and a large migratory corridor to spawning areas in the tributaries. Before the construction of Bonneville Dam, eulachon ascended the Columbia River as far as Hood River, Oregon. Major tributaries that support spawning runs include the Grays, Skamokawa, Elochoman, Kalama, Lewis, and Sandy rivers.

Salmon and Steelhead Critical Habitat. Each CHART assessed biological information pertaining to areas under consideration for designation as critical habitat to identify the areas occupied by listed salmon and steelhead, determine whether those areas contained PCEs essential for the conservation of those species (Table 22-23), and whether unoccupied areas existed within the historical range of the listed salmon and steelhead that are also essential for conservation. The CHARTs assigned a 0 to 3 point score for the PCEs in each HUC5 watershed for:

Factor 1. Quantity,
Factor 2. Quality – Current Condition,
Factor 3. Quality – Potential Condition,
Factor 4. Support of Rarity Importance,
Factor 5. Support of Abundant Populations, and
Factor 6. Support of Spawning/Rearing.

Thus, the quality of habitat in a given watershed was characterized by the scores for Factor 2 (quality - current condition), which considers the existing condition of the quality of PCE's in the HUC5 watershed; and Factor 3 (quality – potential condition), which considers the likelihood of achieving PCE potential in the HUC5 watershed, either naturally or through active conservation/restoration, given known limiting factors, likely biophysical responses, and feasibility.:

Each CHART then scored each habitat area based on the quantity and quality of the physical and biological features; rated each habitat area as having a ''high,'' ''medium,'' or ''low'' conservation value; and identified management actions that could affect habitat for salmon and steelhead.

Table 22. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, and SR sockeye salmon), and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	Site Attribute	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Table 23. PCEs of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site	Site Attribute	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook, coho) Spawning gravel Water quality Water temp (sockeye) Water quantity	Adult spawning Embryo incubation Alevin growth and development Fry emergence from gravel Fry/parr/smolt growth and development
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Nearshore juvenile rearing Subadult rearing Adult growth and sexual maturation Adult spawning migration

Willamette-Lower Columbia Recovery Domain. Critical habitat for salmonids has been designated in the WLC recovery domain for UWR spring-run Chinook salmon, LCR Chinook salmon, LCR steelhead, UWR steelhead, and CR chum salmon. In addition to the Willamette and Columbia River mainstems, important tributaries on the Oregon side of the WLC include Youngs Bay, Big Creek, Clatskanie River, and Scappoose River in the Oregon Coast subbasin; Hood River in the Gorge; and the Sandy, Clackamas, Molalla, North and South Santiam, Calapooia, McKenzie, and Middle Fork Willamette rivers in the West Cascades subbasin.

Land management activities have severely degraded stream habitat conditions in the Willamette River mainstem above Willamette Falls and associated subbasins. In the Willamette River mainstem and lower sub-basin mainstem reaches, high density urban development and widespread agricultural effects have reduced aquatic and riparian habitat quality and complexity, and altered sediment and water quality and quantity, and watershed processes. The Willamette River, once a highly braided river system, has been dramatically simplified through channelization, dredging, and other activities that have reduced rearing habitat by as much as 75%. In addition, the construction of 37 dams in the basin blocked access to more than 435 miles

of stream and river spawning habitat. The dams alter the temperature regime of the Willamette River and its tributaries, affecting the timing and development of naturally-spawned eggs and fry. Logging in the Cascade and Coast Ranges, and agriculture, urbanization, and gravel mining on valley floors have contributed to increased erosion and sediment loads throughout the WLC domain.

The mainstem Willamette River has been channelized and stripped of large wood. Development began to encroach on the riparian forest beginning in the 1870s (Sedell and Froggatt 1984). Gregory *et al.* (2002a) calculated that the total mainstem Willamette River channel area decreased from 41,000 to 23,000 acres between 1895 and 1995. They noted that the lower reach, from the mouth of the river to Newberg (RM 50), is confined within a basaltic trench, and that due to this geomorphic constraint, less channel area has been lost than in upstream areas. The middle reach from Newberg to Albany (RM 50 to 120) incurred losses of 12% primary channel area, 16% side channels, 33% alcoves, and 9% islands. Even greater changes occurred in the upper reach, from Albany to Eugene (RM 187). There, approximately 40% of both channel length and channel area were lost, along with 21% of the primary channel, 41% of side channels, 74% of alcoves, and 80% of island areas.

The banks of the Willamette River have more than 96 miles of revetments; approximately half were constructed by the Corps. Generally, the revetments were placed in the vicinity of roads or on the outside bank of river bends, so that while only 26% of the total length is revetted, 65% of the meander bends are revetted (Gregory *et al.* 2002b). The majority of dynamic sections have been armored, reducing adjustments in channel bed and sediment storage by the river, and thereby diminishing both the complexity and productivity of aquatic habitats (Gregory *et al.* 2002c).

Riparian forests have diminished considerably in the lower reaches of the Willamette River (Gregory *et al.* 2002d). Sedell and Froggatt (1984) noted that agriculture and cutting of streamside trees were major agents of change for riparian vegetation, along with snagging of large wood in the channel. The reduced shoreline, fewer and smaller snags, and reduced riparian forest comprise large functional losses to the river, reducing structural features, organic inputs from litter fall, entrained allochthonous materials, and flood flow filtering capacity. Extensive changes began before the major dams were built, with navigational and agricultural demands dominating the early use of the river. The once expansive forests of the Willamette River floodplain provided valuable nutrients and organic matter during flood pulses, food sources for macroinvertebrates, and slow-water refugia for fish during flood events. These forests also cooled river temperatures as the river flowed through its many channels.

Gregory *et al.* (2002d) described the changes in riparian vegetation in river reaches from the mouth to Newberg, from Newberg to Albany, and from Albany to Eugene. They noted that the riparian forests were formerly a mosaic of brush, marsh, and ash tree openings maintained by annual flood inundation. Below the City of Newberg, the most noticeable change was that conifers were almost eliminated. Above Newberg, the formerly hardwood-dominated riparian forests along with mixed forest made up less than half of the riparian vegetation by 1990, while agriculture dominated. This conversion has reduced river shading and the potential for

recruitment of wood to the river, reducing channel complexity and the quality of rearing, migration and spawning habitats.

Hyporheic flow in the Willamette River has been examined through discharge measurements and found to be significant in some areas, particularly those with gravel deposits (Wentz *et al.* 1998, Fernald *et al.* 2001). The loss of channel complexity and meandering that fosters creations of gravel deposits decreases the potential for hyporheic flows, as does gravel mining. Hyporheic flow processes water and affects its quality on reemerging into the main channel, stabilizing variations in physical and chemical water characteristics. Hyporheic flow is important for ecological functions, some aspects of water quality (such as temperature and dissolved oxygen), and some benthic invertebrate life stages. Alcove habitat, which has been limited by channelization, combines low hydraulic stress and high food availability with the potential for hyporheic flows across the steep hydraulic gradients in the gravel separating them from the main channel (Fernald *et al.* 2001).

On the mainstem of the Columbia River, hydropower projects, including the Federal Columbia River Hydropower System (FCRPS), have significantly degraded salmon and steelhead habitats (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, and LCFRB 2010). The series of dams and reservoirs that make up the FCRPS block an estimated 12 million cubic yards of debris and sediment that would otherwise naturally flow down the Columbia River and replenish shorelines along the Washington and Oregon coasts.

Industrial harbor and port development are also significant influences on the Lower Willamette and Lower Columbia rivers (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, and LCFRB 2010). Since 1878, 100 miles of river channel within the mainstem Columbia River, its estuary, and Oregon's Willamette River have been dredged as a navigation channel by the Corps. Originally dredged to a 20-foot minimum depth, the Federal navigation channel of the Lower Columbia River is now maintained at a depth of 43 feet and a width of 600 feet. The Lower Columbia River supports five ports on the Washington State side: Kalama, Longview, Skamania County, Woodland, and Vancouver. In addition to loss of riparian habitat, and disruption of benthic habitat due to dredging, high levels of several sediment chemicals, such as arsenic and polycyclic aromatic hydrocarbons (PAHs), have been identified in Lower Columbia River watersheds in the vicinity of the ports and associated industrial facilities.

The most extensive urban development in the Lower Columbia River subbasin has occurred in the Portland/Vancouver area. Outside of this major urban area, the majority of residences and businesses rely on septic systems. Common water quality issues with urban development and residential septic systems include higher water temperatures, lowered dissolved oxygen, increased fecal coliform bacteria, and increased chemicals associated with pesticides and urban runoff.

The Columbia River estuary has lost a significant amount of the tidal marsh and tidal swamp habitats that are critical to juvenile salmon and steelhead, particularly small or ocean-type species (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, and LCFRB 2010). Edges of marsh areas provide sheltered habitats for juvenile salmon and steelhead where food, in the form of amphipods or other small invertebrates which feed on marsh detritus, is plentiful, and larger

predatory fish can be avoided. Historically, floodwaters of the Columbia River inundated the margins and floodplains along the estuary, allowing juvenile salmon and steelhead access to a wide expanse of low-velocity marshland and tidal channel habitats. In general, the riverbanks were gently sloping, with riparian and wetland vegetation at the higher elevations of the river floodplain becoming habitat for salmon and steelhead during flooding river discharges or flood tides. Sherwood *et al.* (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps, 10,000 acres of tidal marshes, and 3,000 acres of tidal flats between 1870 and 1970. This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production.

Habitat and food-web changes within the estuary, and other factors affecting salmon population structure and life histories, have altered the estuary's capacity to support juvenile salmon (Bottom *et al.* 2005, Fresh *et al.* 2005, NMFS 2006, and LCFRB 2010). Diking and filling activities have reduced the tidal prism and eliminate emergent and forested wetlands and floodplain habitats. These changes have likely reduced the estuary's salmon-rearing capacity. Moreover, water and sediment in the Lower Columbia River and its tributaries have toxic contaminants that are harmful to aquatic resources (LCREP 2007). Contaminants of concern include dioxins and furans, heavy metals, polychlorinated biphenyls (PCBs) and organochlorine pesticides such as DDT. Simplification of the population structure and life-history diversity of salmon possibly is yet another important factor affecting juvenile salmon viability. Restoration of estuarine habitats, particularly diked emergent and forested wetlands, reduction of avian predation by terns, and flow manipulations to restore historical flow patterns have likely begun to enhance the estuary's productive capacity for salmon, although historical changes in population structure and salmon life histories may prevent salmon from making full use of the productive capacity of estuarine habitats.

The WLC Recovery Domain CHART determined that very few watersheds have PCEs in good to excellent condition (3), with no potential for additional improvement for salmon or steelhead. Only the upper McKenzie River and its tributaries were rated "3" with no potential for improvement for Chinook salmon PCEs. Most HUC5 watersheds are in fair-to-poor (score 1) or fair-to-good (score 2) condition. However, most watersheds with currently low or moderate habitat quality have some (score 1), or high (score 2), potential for improvement (Table 24).

Table 24. **Willamette-Lower Columbia Recovery Domain:** Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK), chum salmon (CM), and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name(s) and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Columbia Gorge #1707010xxx			
Wind River (511)	CK/ST	2/2	2/2
East Fork Hood (506), & Upper (404) & Lower Cispus (405) rivers	CK/ST	2/2	2/2
Plympton Creek (306)	CK	2	2
Little White Salmon River (510)	CK	2	0
Grays Creek (512) & Eagle Creek (513)	CK/CM/ST	2/1/2	1/1/2
White Salmon River (509)	CK/CM	2/1	1/2
West Fork Hood River (507)	CK/ST	1/2	2/2
Hood River (508)	CK/ST	1/1	2/2
Unoccupied habitat: Wind River (511)	Chum conservation value "Possibly High"		
Cascade and Coast Range #1708000xxx			
Lower Gorge Tributaries (107)	CK/CM/ST	2/2/2	2/3/2
Lower Lewis (206) & North Fork Toutle (504) rivers	CK/CM/ST	1/3/1	2/1/2
Salmon (101), Zigzag (102), & Upper Sandy (103) rivers	CK/ST	2/2	2/2
Big Creek (602)	CK/CM	2/2	2/2
Coweeman River (508)	CK/CM/ST	2/2/1	2/1/2
Kalama River (301)	CK/CM/ST	1/2/2	2/1/2
Cowlitz Headwaters (401)	CK/ST	2/2	1/1
Skamokawa/Elochoman (305)	CK/CM	2/1	2
Salmon Creek (109)	CK/CM/ST	1/2/1	2/3/2
Green (505) & South Fork Toutle (506) rivers	CK/CM/ST	1/1/2	2/1/2
Jackson Prairie (503) & East Willapa (507)	CK/CM/ST	1/2/1	1/1/2
Grays Bay (603)	CK/CM	1/2	2/3
Upper Middle Fork Willamette River (101)	CK	2	1
Germany/Abernathy creeks (304)	CK/CM	1/2	2
Mid-Sandy (104), Bull Run (105), & Lower Sandy (108) rivers	CK/ST	1/1	2/2
Washougal (106) & East Fork Lewis (205) rivers	CK/CM/ST	1/1/1	2/1/2
Upper Cowlitz (402) & Tilton rivers (501) & Cowlitz Valley Frontal (403)	CK/ST	1/1	2/1
Clatskanie (303) & Young rivers (601)	CK	1	2
Rifle Reservoir (502)	CK/ST	1	1
Beaver Creek (302)	CK	0	1
Unoccupied Habitat: Upper Lewis (201) & Muddy (202) rivers; Swift (203) & Yale (204) reservoirs	CK & ST Conservation Value "Possibly High"		

Watershed Name(s) and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Willamette River #1709000xxx			
Upper (401) & South Fork (403) McKenzie rivers; Horse Creek (402); & McKenzie River/Quartz Creek (405)	CK	3	3
Lower McKenzie River (407)	CK	2	3
South Santiam River (606)	CK/ST	2/2	1/3
South Santiam River/Foster Reservoir (607)	CK/ST	2/2	1/2
North Fork of Middle Fork Willamette (106) & Blue (404) rivers	CK	2	1
Upper South Yamhill River (801)	ST	2	1
Little North Santiam River (505)	CK/ST	1/2	3/3
Upper Molalla River (905)	CK/ST	1/2	1/1
Abernethy Creek (704)	CK/ST	1/1	1/2
Luckiamute River (306) & Yamhill (807) Lower Molalla (906) rivers; Middle (504) & Lower (506) North Santiam rivers; Hamilton Creek/South Santiam River (601); Wiley Creek (608); Mill Creek/Willamette River (701); & Willamette River/Chehalem Creek (703); Lower South (804) & North (806) Yamhill rivers; & Salt Creek/South Yamhill River (805)	CK/ST	1	1
Hills (102) & Salmon (104) creeks; Salt Creek/Willamette River (103), Hills Creek Reservoir (105), Middle Fork Willamette/Lookout Point (107); Little Fall (108) & Fall (109) creeks; Lower Middle Fork of Willamette (110), Long Tom (301), Marys (305) & Mohawk (406) rivers	CK	1	1
Willamina Creek (802) & Mill Creek/South Yamhill River (803)	ST	1	1
Calapooia River (303); Oak (304) Crabtree (602), Thomas (603) & Rickreall (702) creeks; Abiqua (901), Butte (902) & Rock (903) creeks/Pudding River; & Senecal Creek/Mill Creek (904)	CK/ST	1/1	0/1
Row River (201), Mosby (202) & Muddy (302) creeks, Upper (203) & Lower (205) Coast Fork Willamette River	CK	1	0
Unoccupied habitat in North Santiam (501) & North Fork Breitenbush (502) rivers; Quartzville Creek (604) and Middle Santiam River (605)	CK & ST Conservation Value "Possibly High"		
Unoccupied habitat in Detroit Reservoir/Blowout Divide Creek (503)	Conservation Value: CK "Possibly Medium"; ST Possibly High"		
Lower Willamette #1709001xxx			
Collawash (101), Upper Clackamas (102), & Oak Grove Fork (103) Clackamas rivers	CK/ST	2/2	3/2
Middle Clackamas River (104)	CK/ST	2/1	3/2
Eagle Creek (105)	CK/ST	2/2	1/2
Gales Creek (002)	ST	2	1
Lower Clackamas River (106) & Scappoose Creek (202)	CK/ST	1	2
Dairy (001) & Scoggins (003) creeks; Rock Creek/Tualatin River (004); & Tualatin River (005)	ST	1	1
Johnson Creek (201)	CK/ST	0/1	2/2
Lower Willamette/Columbia Slough (203)	CK/ST	0	2

Interior Columbia Recovery Domain. Critical habitat has been designated in the IC recovery domain, which includes the Snake River Basin, for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, SR sockeye salmon, MCR steelhead, UCR steelhead, and SRB steelhead.

Habitat quality in tributary streams in the IC recovery domain varies from excellent in wilderness and roadless areas to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994, NMFS 2009a). Critical habitat throughout much of the IC recovery domain has been degraded by intense agriculture, alteration of stream morphology (*i.e.*, channel

modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Migratory habitat quality in this area has been severely affected by the development and operation of the FCRPS dams and reservoirs in the mainstem Columbia River, Bureau of Reclamation tributary projects, and privately owned dams in the Snake and Upper Columbia River basins. For example, construction of Hells Canyon Dam eliminated access to several likely production areas in Oregon and Idaho, including the Burnt, Powder, Weiser, Payette, Malheur, Owyhee, and Boise river basins (Good *et al.* 2005), and Grand Coulee and Chief Joseph dams completely block anadromous fish passage on the upper mainstem Columbia River. Hydroelectric development modified natural flow regimes, resulting in higher water temperatures, changes in fish community structure leading to increased rates of piscivorous and avian predation on juvenile salmon and steelhead, and delayed migration for both adult and juveniles. Physical features of dams such as turbines also kill migrating fish. In-river survival is inversely related to the number of hydropower projects encountered by emigrating juveniles.

Similarly, development and operation of extensive irrigation systems and dams for water withdrawal and storage in tributaries have altered hydrological cycles. A series of large regulating dams on the middle and upper Deschutes River affect flow and block access to upstream habitat, and have extirpated one or more populations from the Cascades Eastern Slope major population (IC-TRT 2003). Similarly, operation and maintenance of large water reclamation systems such as the Umatilla Basin and Yakima Projects have significantly reduced flows and degraded water quality and physical habitat in this domain.

Many stream reaches designated as critical habitat in the IC recovery domain are over-allocated under state water law, with more allocated water rights than existing streamflow. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence *et al.* 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this recovery domain except SR fall-run Chinook salmon and SR sockeye salmon (NMFS 2007, NOAA Fisheries 2011).

Many stream reaches designated as critical habitat are listed on the state of Oregon's Clean Water Act section 303(d) list for water temperature. Many areas that were historically suitable rearing and spawning habitat are now unsuitable due to high summer stream temperatures. Removal of riparian vegetation, alteration of natural stream morphology, and withdrawal of water for agricultural or municipal use all contribute to elevated stream temperatures. Contaminants such as insecticides and herbicides from agricultural runoff and heavy metals from mine waste are common in some areas of critical habitat.

The IC Recovery Domain is a very large and diverse area. The CHART determined that few watersheds have PCEs in good to excellent condition (score 3), with no potential for additional improvement for Chinook salmon or steelhead. In Washington, the Upper Methow, Lost, White

and Chiwawa watersheds were rated "3" for current and potential quality. In Oregon, only the Lower Deschutes, Minam, Wenaha, and Upper and Lower Imnaha Rivers HUC5 watersheds were rated "3" with no potential for improvement. In Idaho, a number of watersheds in the Upper Middle Salmon, Upper Salmon/Pahsimeroi, Middle Fork Salmon, Little Salmon, Selway, and Lochsa rivers were rated "3" for current and potential quality for steelhead PCEs. Additionally, several Lower Snake River HUC5 watersheds in the Hells Canyon area, straddling Oregon and Idaho, were highly rated. However, most HUC5 watersheds in the recovery domain are in fair-to-poor (score 1) or fair-to-good (score 2) condition. Most watersheds with currently low or moderate habitat quality have some (1), or high (2), potential for improvement (Table 25).

Table 25. **Interior Columbia Recovery Domain:** Current and potential quality of HUC_5 watersheds identified as supporting historically independent populations of ESA-listed Chinook salmon (CK) and steelhead (ST) (NOAA Fisheries 2005). Watersheds are ranked primarily by "current quality" and secondly by their "potential for restoration."

Current PCE Condition	Potential PCE Condition
3 = good to excellent	3 = highly functioning, at historical potential
2 = fair to good	2 = high potential for improvement
1 = fair to poor	1 = some potential for improvement
0 = poor	0 = little or no potential for improvement

Watershed Name and HUC_5 Code(s)	Listed Species	Current Quality	Restoration Potential
Upper Columbia # 1702000xxx			
White (101), Chiwawa (102), Lost (801) & Upper Methow (802) rivers	CK/ST	3	3
Upper Chewuch (803) & Twisp rivers (805)	CK/ST	3	2
Lower Chewuch River (804); Middle (806) & Lower (807) Methow rivers	CK/ST	2	2
Salmon Creek (603) & Okanogan River/Omak Creek (604)	ST	2	2
Upper Columbia/Swamp Creek (505)	CK/ST	2	1
Foster Creek (503) & Jordan/Tumwater (504)	CK/ST	1	1
Upper (601) & Lower (602) Okanogan River; Okanogan River/Bonaparte Creek (605); Lower Similkameen River (704); & Lower Lake Chelan (903)	ST	1	1
Unoccupied habitat in Sinlahekin Creek (703)	ST Conservation Value "Possibly High"		
Upper Columbia #1702001xxx			
Entiat River (001); Nason/Tumwater (103); & Lower Wenatchee River (105)	CK/ST	2	2
Lake Entiat (002)	CK/ST	2	1
Columbia River/Lynch Coulee (003); Sand Hollow (004); Yakima/Hansen Creek (604), Middle Columbia/Priest Rapids (605), & Columbia River/Zintel Canyon (606)	ST	2	1
Icicle/Chumstick (104)	CK/ST	1	2
Lower Crab Creek (509)	ST	1	2
Rattlesnake Creek (204)	ST	0	1
Yakima #1703000xxx			
Upper (101) & Middle (102) Yakima rivers; Teanaway (103) & Little Naches (201) rivers; Naches River/Rattlesnake Creek (202); & Ahtanum (301) & Upper Toppenish (303) & Satus (305) creeks	ST	2	2
Umtanum/Wenas (104); Naches River/Tieton River (203); Upper Lower Yakima River (302); & Lower Toppenish Creek (304)	ST	1	2
Yakima River/Spring Creek (306)	ST	1	1

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Lower Snake River #1706010xxx			
Snake River/Granite (101), Getta (102), & Divide (104) creeks; Upper (201) & Lower (205) Imnaha River; Snake River/Rogersburg (301); Minam (505) & Wenaha (603) rivers	ST	3	3
Grande Ronde River/Rondowa (601)	ST	3	2
Big (203) & Little (204) Sheep creeks; Asotin River (302); Catherine Creek (405); Lostine River (502); Bear Creek (504); & Upper (706) & Lower (707) Tucannon River	ST	2	3
Middle Imnaha River (202); Snake River/Captain John Creek (303); Upper Grande Ronde River (401); Meadow (402); Beaver (403); Indian (409), Lookingglass (410) & Cabin (411) creeks; Lower Wallowa River (506); Mud (602), Chesnimnus (604) & Upper Joseph (605) creeks	ST	2	2
Ladd Creek (406); Phillips/Willow Creek (408); Upper (501) & Middle (503) Wallowa rivers; & Lower Grande Ronde River/Menatche Creek (607)	ST	1	3
Five Points (404); Lower Joseph (606) & Deadman (703) creeks	ST	1	2
Tucannon/Alpowa Creek (701)	ST	1	1
Mill Creek (407)	ST	0	3
Pataha Creek (705)	ST	0	2
Snake River/Steptoe Canyon (702) & Penawawa Creek (708)	ST	0	1
Flat Creek (704) & Lower Palouse River (808)	ST	0	0
Upper Salmon and Pahsimeroi #1706020xxx			
Germania (111) & Warm Springs (114) creeks; Lower Pahsimeroi River (201); Alturas Lake (120), Redfish Lake (121), Upper Valley (123) & West Fork Yankee (126) creeks	ST	3	3
Basin Creek (124)	ST	3	2
Salmon River/Challis (101); East Fork Salmon River/McDonald Creek (105); Herd Creek (108); Upper East Fork Salmon River (110); Salmon River/Big Casino (115), Fisher (117) & Fourth of July (118) creeks; Upper Salmon River (119); Valley Creek/Iron Creek (122); & Morgan Creek (132)	ST	2	3
Salmon River/Bayhorse Creek (104); Salmon River/Slate Creek (113); Upper Yankee Fork (127) & Squaw Creek (128); Pahsimeroi River/Falls Creek (202)	ST	2	2
Yankee Fork/Jordan Creek (125)	ST	1	3
Salmon River/Kinnikinnick Creek (112); Garden Creek (129); Challis Creek/Mill Creek (130); & Patterson Creek (203)	ST	1	2
Road Creek (107)	ST	1	1
Unoccupied habitat in Hawley (410), Eighteenmile (411) & Big Timber (413) creeks	Conservation Value for ST "Possibly High"		

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Middle Salmon, Panther and Lemhi #1706020xxx			
Salmon River/Colson (301), Pine (303) & Moose (305) creeks; Indian (304) & Carmen (308) creeks, North Fork Salmon River (306); & Texas Creek (412)	ST	3	3
Deep Creek (318)	ST	3	2
Salmon River/Cow Creek (312) & Hat (313), Iron (314), Upper Panther (315), Moyer (316) & Woodtick (317) creeks; Lemhi River/Whimpey Creek (402); Hayden (414), Big Eight Mile (408), & Canyon (408) creeks	ST	2	3
Salmon River/Tower (307) & Twelvemile (311) creeks; Lemhi River/Kenney Creek (403); Lemhi River/McDevitt (405), Lemhi River/Yearian Creek (406); & Peterson Creek (407)	ST	2	2
Owl (302) & Napias (319) creeks	ST	2	1
Salmon River/Jesse Creek (309); Panther Creek/Trail Creek (322); & Lemhi River/Bohannon Creek (401)	ST	1	3
Salmon River/Williams Creek (310)	ST	1	2
Agency Creek (404)	ST	1	1
Panther Creek/Spring Creek (320) & Clear Creek (323)	ST	0	3
Big Deer Creek (321)	ST	0	1
Mid-Salmon-Chamberlain, South Fork, Lower, and Middle Fork Salmon #1706020xxx			
Lower (501), Upper (503) & Little (504) Loon creeks; Warm Springs (502); Rapid River (505); Middle Fork Salmon River/Soldier (507) & Lower Marble Creek (513); & Sulphur (509), Pistol (510), Indian (511) & Upper Marble (512) creeks; Lower Middle Fork Salmon River (601); Wilson (602), Upper Camas (604), Rush (610), Monumental (611), Beaver (614), Big Ramey (615) & Lower Big (617) creeks; Middle Fork Salmon River/Brush (603) & Sheep (609) creeks; Big Creek/Little Marble (612); Crooked (616), Sheep (704), Bargamin (709), Sabe (711), Horse (714), Cottonwood (716) & Upper Chamberlain Creek (718); Salmon River/Hot Springs (712); Salmon River/Kitchen Creek (715); Lower Chamberlain/McCalla Creek (717); & Slate Creek (911)	ST	3	3
Marsh (506); Bear Valley (508) Yellow Jacket (604); West Fork Camas (607) & Lower Camas (608) creeks; & Salmon River/Disappointment Creek (713) & White Bird Creek (908)	ST	2	3
Upper Big Creek (613); Salmon River/Fall (701), California (703), Trout (708), Crooked (705) & Warren (719) creeks; Lower South Fork Salmon River (801); South Fork Salmon River/Cabin (809), Blackmare (810) & Fitsum (812) creeks; Lower Johnson Creek (805); & Lower (813), Middle (814) & Upper Secesh (815) rivers; Salmon River/China (901), Cottonwood (904), McKenzie (909), John Day (912) & Lake (913) creeks; Eagle (902), Deer (903), Skookumchuck (910), French (915) & Partridge (916) creeks	ST	2	2
Wind River (702), Salmon River/Rabbit (706) & Rattlesnake (710) creeks; & Big Mallard Creek (707); Burnt Log (806), Upper Johnson (807) & Buckhorn (811) creeks; Salmon River/Deep (905), Hammer (907) & Van (914) creeks	ST	2	1
Silver Creek (605)	ST	1	3
Lower (803) & Upper (804) East Fork South Fork Salmon River; Rock (906) & Rice (917) creeks	ST	1	2

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
Little Salmon #176021xxx			
Rapid River (005)	ST	3	3
Hazard Creek (003	ST	3	2
Boulder Creek (004)	ST	2	3
Lower Little Salmon River (001) & Little Salmon River/Hard Creek (002)	ST	2	2
Selway, Lochsa and Clearwater #1706030xxx			
Selway River/Pettibone (101) & Gardner (103) creeks; Bear (102), White Cap (104), Indian (105), Burnt Knob (107), Running (108) & Goat (109) creeks; & Upper Selway River (106); Gedney (202), Upper Three Links (204), Rhoda (205), North Fork Moose (207), Upper East Fork Moose (209) & Martin (210) creeks; Upper (211), Middle (212) & Lower Meadow (213) creeks; Selway River/Three Links Creek (203); & East Fork Moose Creek/Trout Creek (208); Fish (302), Storm (309), Warm Springs (311), Fish Lake (312), Boulder (313) & Old Man (314) creeks; Lochsa River/Stanley (303) & Squaw (304) creeks; Lower Crooked (305), Upper Crooked (306) & Brushy (307) forks; Lower (308), Upper (310) White Sands, Ten Mile (509) & John's (510) creeks	ST	3	3
Selway River/Goddard Creek (201); O'Hara Creek (214) Newsome (505) creeks; American (506), Red (507) & Crooked (508) rivers	ST	2	3
Lower Lochsa River (301); Middle Fork Clearwater River/Maggie Creek (401); South Fork Clearwater River/Meadow (502) & Leggett creeks; Mill (511), Big Bear (604), Upper Big Bear (605), Musselshell (617), Eldorado (619) & Mission (629) creeks, Potlatch River/Pine Creek (606); & Upper Potlatch River (607); Lower (615), Middle (616) & Upper (618) Lolo creeks	ST	2	2
South Fork Clearwater River/Peasley Creek (502)	ST	2	1
Upper Orofino Creek (613)	ST	2	0
Clear Creek (402)	ST	1	3
Three Mile (512), Cottonwood (513), Big Canyon (610), Little Canyon (611) & Jim Ford (614) creeks; Potlatch River/Middle Potlatch Creek (603); Clearwater River/Bedrock (608), Jack's (609) Lower Lawyer (623), Middle Lawyer (624), Cottonwood (627) & Upper Lapwai (628) creeks; & Upper (630) & Lower (631) Sweetwater creeks	ST	1	2
Lower Clearwater River (601) & Clearwater River/Lower Potlatch River (602), Fivemile Creek (620), Sixmile Creek (621) and Tom Taha (622) creeks	ST	1	1
Mid-Columbia #1707010xxx			
Wood Gulch (112); Rock Creek (113); Upper Walla Walla (201), Upper Touchet (203), & Upper Umatilla (301) rivers; Meacham (302) & Birch (306) creeks; Upper (601) & Middle (602) Klickitat River	ST	2	2
Glade (105) & Mill (202) creeks; Lower Klickitat River (604); Mosier Creek (505); White Salmon River (509); Middle Columbia/Grays Creek (512)	ST	2	1
Little White Salmon River (510)	ST	2	0
Middle Touchet River (204); McKay Creek (305); Little Klickitat River (603);Fifteenmile (502) & Fivemile (503) creeks	ST	1	2
Alder (110) & Pine (111) creeks; Lower Touchet River (207), Cottonwood (208), Pine (209) & Dry (210) creeks; Lower Walla Walla River (211); Umatilla River/Mission Creek (303) Wildhorse Creek (304); Umatilla River/Alkali Canyon (307); Lower Butter Creek (310); Upper Middle Columbia/Hood (501); Middle Columbia/Mill Creek (504)	ST	1	1
Stage Gulch (308) & Lower Umatilla River (313)	ST	0	1

Watershed Name and HUC$_5$ Code(s)	Listed Species	Current Quality	Restoration Potential
John Day #170702xxx			
Middle (103) & Lower (105) South Fork John Day rivers; Murderers (104) & Canyon (107) creeks; Upper John Day (106) & Upper North Fork John Day (201) rivers; & Desolation Creek (204)	ST	2	2
North Fork John Day/Big Creek (203); Cottonwood Creek (209) & Lower NF John Day River (210)	ST	2	1
Strawberry (108), Beech (109), Laycock (110), Fields (111), Mountain (113) & Rock (114) creeks; Upper Middle John Day River (112); Granite (202) & Wall (208) creeks; Upper (205) & Lower (206) Camas creeks; North Fork John Day/Potamus Creek (207); Upper Middle Fork John Day River (301) & Camp (302), Big (303) & Long (304) creeks; Bridge (403) & Upper Rock (411) creeks; & Pine Hollow (407)	ST	1	2
John Day/Johnson Creek (115); Lower Middle Fork John Day River (305); Lower John Day River/Kahler Creek (401), Service (402) & Muddy (404) creeks; Lower John Day River/Clarno (405); Butte (406), Thirtymile (408) & Lower Rock (412) creeks; Lower John Day River/Ferry (409) & Scott (410) canyons; & Lower John Day River/McDonald Ferry (414)	ST	1	1
Deschutes #1707030xxx			
Lower Deschutes River (612)	ST	3	3
Middle Deschutes River (607)	ST	3	2
Upper Deschutes River (603)	ST	2	1
Mill Creek (605) & Warm Springs River (606)	ST	2	1
Bakeoven (608) & Buck Hollow (611) creeks; Upper (701) & Lower (705) Trout Creek	ST	1	2
Beaver (605) & Antelope (702) creeks	ST	1	1
White River (610) & Mud Springs Creek (704)	ST	1	0
Unoccupied habitat in Deschutes River/McKenzie Canyon (107) & Haystack (311); Squaw Creek (108); Lower Metolius River (110), Headwaters Deschutes River (601)	ST Conservation Value "Possibly High"		

Southern DPS Green Sturgeon. A team similar to the CHARTs, referred to as a Critical Habitat Review Team (CHRT), identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas they felt are necessary to ensure the conservation of the species (USDC 2009). The CHRT did not identify those particular areas using hydrologic unit code (HUC) nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For freshwater rivers north of and including the Eel River, the areas upstream of the head of the tide were not considered part of the geographical area occupied by the southern DPS. However, the critical habitat designation recognizes not only the importance of natal habitats, but of habitats throughout their range. Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt

Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor) and freshwater (USDC 2009). Table 26 below delineates PCEs for southern green sturgeon.

Table 26. PCEs of critical habitat designated for southern green sturgeon and corresponding species life history events

Primary Constituent Elements		**Species Life History Event**
Site Type	**Site Attribute**	
Freshwater riverine system	Food resources Migratory corridor Sediment quality Substrate type or size Water depth Water flow Water quality	Adult spawning Embryo incubation, growth and development Larval emergence, growth and development Juvenile metamorphosis, growth and development
Estuarine areas	Food resources Migratory corridor Sediment quality Water flow Water depth Water quality	Juvenile growth, development, seaward migration Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas, upstream spawning movement, and seaward post-spawning movement
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas, and spawning migration

The CHRT identified several activities that threaten the PCEs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of southern green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon). In addition, petroleum spills from commercial shipping activities and proposed alternative energy hydrokinetic projects are likely to affect water quality or hinder the migration of green sturgeon along the coast (USDC 2009).

2.3 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

2.3.1 Species Environmental Baseline - Salmon and Steelhead

The action area includes what is known as the Columbia estuary. The estuary is the portion of the Columbia River under tidal influence from the River Mouth at RM 0.0 to Bonneville Dam (RM 145) where flow and habitat are influenced by tidal actions (ISAB 2000, Bottom *et al.* 2005). Salt water intrusion usually does not extend more than RM 23 (near Harrington Point); however at the lowest flows salt intrusion can extend to Pillar Point (RM 28) (Neal 1972 as cited in ISAB 2000). The term Columbia River estuary, estuary and Lower Columbia River are used interchangeably in this opinion.

The action area also extends beyond the River Mouth into the Pacific Ocean nearshore environment and into what is known as the Columbia River plume. The Columbia River enters the Pacific through a relatively narrow opening, shooting a powerful jet of water, or plume, into the North Pacific that can be traced southward to San Francisco, California (Bottom *et al.* 2005).

All ESA-listed salmonids must pass through the estuary twice; once as juveniles outmigrating to the Pacific Ocean and again as adults when they return to spawn. The majority of adult salmon and steelhead move through the River Mouth from early spring through autumn but upstream migrating adults are present year around. Adult salmon and steelhead are generally found in mid-channel, throughout the water column to depths of 50 feet, but are usually within the upper 25 feet of the water column (NMFS 2011a). There is some limited LCR Chinook salmon and Columbia River chum salmon spawning in the mainstem Columbia River between RM 113 to RM 142.

The Columbia River estuary serves three primary roles for outmigrating juveniles as they transition from shallow, freshwater environments to the ocean: (1) A place where juvenile fish can gradually acclimate to salt water; (2) a feeding area; and (3) a refuge from predators while fish acclimate to salt water. While the estuarine processes that affect salmon survival are not well defined it appears that duration of estuarine residency, total growth in the estuary, and size at ocean entry are key determinants of salmon survival (Bottom *et al.* 2005).

Salmon species are grouped into two juvenile life history strategies based upon how long they rear in freshwater, when they out-migrate, and how long they spend in estuarine habitats (Table 26). A salmon population is referred to as ocean-type if most individuals migrate to the sea after spending only a short period (or no time) rearing in freshwater. These populations are associated with extensive use of estuarine and ocean habitats for rearing. Stream-type populations migrate to sea after rearing for at least a year in freshwater. The different life histories use different habitats; therefore the effects to the different species due to changes in estuary habitat or the

plume may affect species in different ways depending upon the life history strategy (Bottom *et al*. 2005, Fresh *et al.* 2005).

Table 27. A summary of the juvenile characteristics of stream and ocean life history types (Adapted from Fresh *et al.* 2005)

Stream-Type Fish	Ocean-Type Fish
Species	
Coho Salmon	Coho salmon
Some Chinook Populations	Some Chinook populations
Steelhead	Chum
Sockeye	Pink
Attributes	
Long freshwater rearing (>1 yr.)	Short freshwater rearing
Shorter ocean residence	Longer ocean residence
Short estuarine residence	Longer estuarine residence
Larger size at time of estuarine entry	Smaller size at time of estuarine entry
Mostly use deeper, main channel estuarine habitats	Mostly use shallow water estuarine habitats, especially vegetated ones

Even within the ocean-type and stream type life histories there is variability, especially within the ocean-type depending upon the size of fish, the time of entry to the estuary, and the length of time spent in the estuary. Fresh *et al.* (2005) define six general life history strategies that historically used the estuary: (1) Early fry, (2) late fry, (3) early fingerling, (4) late fingerling, (5) subyearling, and (6) yearling. Fry are defined as fish less than 60 millimeters (mm) when they enter the estuary. Early fry generally enter the estuary in March and April and late fry in May and June. Fingerlings are larger than fry when entering the estuary indicating some degree of freshwater rearing but they have not yet begun the physiological transition to a smolt. Early fingerlings enter the estuary between January and July and late fingerlings enter from August to December.

The highest densities of subyearling salmon and steelhead in the estuary occur in the spring when all species are present with the second highest densities occurring in the winter and lowest densities in the summer and fall. Juvenile densities of 0.07 fish/square meter (m^2) have been recorded in the spring, dropping to approximately 0.02 fish/m^2 in the winter and less than 0.005 fish/m^2 in the summer and fall, presumably due to high water temperatures (25ºC) and low water-surface elevations (Johnson *et al* 2011). Juvenile Chinook and coho salmon may be present throughout the year while chum salmon are present during the winter and spring months. Steelhead juveniles have been observed during the spring, fall and winter periods (Johnson *et al* 2011). Yearlings rear for at least one year in freshwater before migrating to the ocean, spending less time in the estuary than either fry or fingerlings.

Subyearlings generally rear in freshwater for less than a year, spend little time in the estuary and smolt as they out-migrate during their first year. In this opinion when referring to the juveniles of the ocean-type life history collectively the term subyearling will be used.

Regardless of the residence time of an individual fish, juvenile salmon may be found in the estuary all year as different species and life history types move downstream from multiple upstream sources (Bottom *et al.* 2005, Johnson *et al.* 2011).

The estuary is important to the survival and recovery of all Columbia River ESA-listed salmonids, particularly to ocean-type salmon. These populations may be particularly sensitive to ecosystem changes because of their longer residence times in the estuary and dependence on this portion of the river for growth and survival. Ocean-type ESA listed salmon species in the Columbia River include three Chinook species (Lower Columbia River, Snake River fall, and Upper Willamette River) and Columbia River chum salmon. Ocean-type salmon migrate downstream to and through the estuary, generally leaving the spawning area where they hatched within days to months following their emergence from the gravel. Consequently, the ocean-type fish commonly spend weeks to months rearing within the action area before reaching the size at which they migrate to the ocean.

Young salmonids must undergo a physiological transition and develop enough strength, energy, and reserve capacity to adapt to and survive the physical and biological challenges of the ocean environment. Juvenile salmonids appear to reach the threshold for this transitional state at a size of 70 to 100 mm.

The earliest ocean-type migrants can be as small as 30 to 40 mm fork length (*i.e.*, from snout to fork in the tail) when they arrive because some of these fish hatch only a short distance upstream from the action area (or in the case of some LCR Chinook and chum within the action area). Later spring migrants are generally larger, ranging up to 50 to 80 mm. Subyearlings from the mid-Columbia and Snake Rivers tend to be substantially larger (70 to 100 mm) by the time they reach the Lower Columbia River. The larger juveniles from the Snake River can likely use a greater range of depth and current velocities than the juveniles from of the LCR.

As discussed in Bottom *et al*. (2005), subyearling salmon tend to inhabit shallow waters while migrating through the estuary until they reach a size that they can exploit deeper channels and open water habitat and associated prey. Chum salmon and Chinook salmon fry between 30-60 mm occupy tidal wetland sloughs and side channels, mud and sand flats or beaches. Chum fry often move to deeper offshore waters at 55-60 mm while Chinook fry and fingerlings may remain in estuarine marsh and other shallow-water habitats until they exceed 100 mm.

Subyearlings are commonly found within a few meters of the shoreline at water depths of less than one meter but have been observed at depths of 20 feet (NMFS 2005b, Bottom *et al.* 2005, Fresh *et al.* 2005). Although subyearlings may move over deeper water between rearing areas, they generally remain close to the water surface and near the shoreline during rearing, favoring water no more than 2 meters deep and currents below 0.3 meters per second. Subyearlings seek lower energy areas where waves and currents do not require them to expend considerable energy to remain in position while they consume invertebrates that live on or near the substrate. These

areas are characterized by relatively fine grain substrates. However, it is not uncommon to find young salmonids in areas with steeper and harder substrates, such as sand and gravel.

Stream-type juvenile salmon migrating to the ocean as yearlings are generally present in the action area from March through June with peak abundances in April and June although some yearlings may appear in February (Fresh *et al.* 2005, Johnson *et al.* 2011) (Figure 2). Larger yearlings are actively migrating as smolts and spend little time in shallow estuarine habitats. The yearlings primarily use deepwater channels, although they may be found in side channels and shallow-water areas (Bottom *et al.* 2005, Fresh *et al.* 2005, Johnson *et al.* 2011). The yearling salmonids can be found to depths over 30 feet but usually within the upper 20 feet (Fredrick 2012). NMFS (2005a) reviewed the results of a hydroacoustic study that found during the greatest ESA-listed salmonid abundance in the Lower Columbia River, only 0.0017% were within three feet of the FNC bottom where dredging would occur during daylight hours; 0.0249% where beside the dredging zone during evening hours; and 0.0107% at night Yearling steelhead are generally migrating higher in the water column and yearling Chinook salmon in deeper portions of the water column.

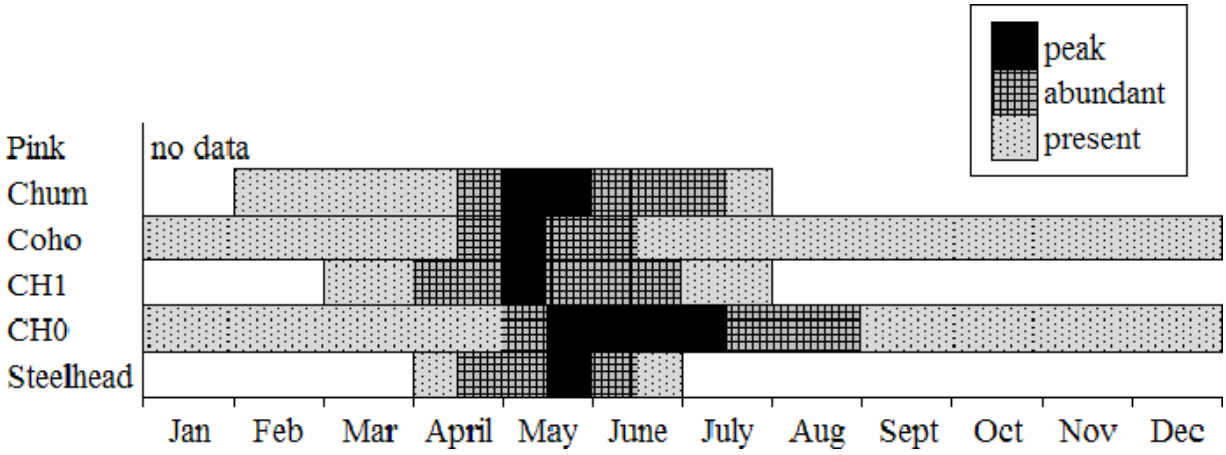

Figure 2. General trends in presence and abundance of juvenile salmonids in the LCR estuary at and downstream of Jones Beach (river kilometer [RKM] (75); (Table obtained from NMFS (2011a).

Recovery plans for ESA listed salmonids identify key threats and limiting factors for the recovery of the species. Limiting factors are defined in LCR recovery plan (NMFS 2010a, NMFS 2011b) as the physical, biological, or chemical conditions and associated ecological processes and interactions (*e.g.*, population size, habitat connectivity, water quality, water quantity) experienced by the fish that may influence the VSP parameters (*i.e*. abundance, productivity, spatial structure, and diversity). Threats are defined as the human actions, past or present (*e.g*. habitat alterations, hydro system operations, fishing, hatchery operations, and predation) that cause or contribute to limiting factors. Limiting factors or threats to salmon and steelhead were briefly discussed in Section 2.2.2 of this opinion. Limiting factors and threats to salmon and steelhead that are common to multiple populations within the Lower Columbia, and are directly or indirectly related to the maintenance of the FNC (the proposed action, dredging, is

identified as a threat) include: the loss of complex habitats through channelization, diking and other development practices; the hydropower system and flood control especially as related to changes in the hydrograph and sediment routing; impaired water quality due to toxins; avian predation; and stranding. These limiting factors and threats will be discussed in more detail in Section 2.3.4 of this opinion.

2.3.2 Species Environmental Baseline - Eulachon

The southern DPS of eulachon is composed of those eulachon populations south of the Skeena River (inclusive), British Columbia. The Columbia River and its tributaries support the largest eulachon population in the world. Eulachon regularly spawn in the mainstem Columbia River and in the Cowlitz River with spawning also occurring in the following Columbia River tributaries: Grays River (common use), Skamokawa Creek (infrequent use), Elochoman River (periodic use), Kalama River (common use), Lewis River (common use), and Sandy River (common use in large run years). During years of low abundance, all spawning may occur in the mainstem Columbia and during large returns they may spawn in all of the LCR tributaries (Gustafson *et al*. 2010). Before the construction of Bonneville Dam, eulachon were reported to spawn up to the Hood River. During times of great abundance eulachon migrate up to Bonneville Dam and may ascend above Bonneville Dam by passing through the ship locks (Gustafson *et al.* 2010).

Adult eulachon weigh an average of 0.1 pounds each and are 15 to 20 cm long with a maximum recorded length of 30 cm. Eulachon are an important link in the food chain between zooplankton and larger organisms. Small salmon and other fish feed on eulachon larvae near river mouths. As eulachon mature, they are eaten by a wide variety of predators (Gustafson *et al.* 2010). The majority of adult eulachon return to the Columbia River at age 3, although some have been reported to be up to nine years old.

Eulachon typically enter the Columbia River system from mid-December to May with peak entry and spawning during February and March (Gustafson *et al*. 2010). However, eulachon have historically appeared in Portland markets as early as November 23. It is important to note that commercial landings occur when eulachon are of sufficient abundance to be economically harvested and as such some fish likely have entered the river prior to the commencement of commercial fishing (Reynolds 2012). Generally, eulachon spawning occurs in the LCR and downstream tributaries early in the run and progresses upstream. For example, using the average dates of commercial harvest as an indicator of run timing, the average dates of initial landings in the commercial fishery in the Cowlitz River are January 25, the Greys River February 20, the Kalama River April 1, and March 21 in the Sandy River (Reynolds 2012).

It appears that eulachon spawning is mainly confined to coastal rivers that have a distinct spring freshet, often draining major glaciers or snowpacks. In many rivers, eulachon spawning appears to be timed so that egg hatching will coincide with peak spring river discharge (Gustafson *et al.* 2010). Eulachon eggs, averaging one mm in size, are broadcast over and attach to a variety of substrates from sand to pea-sized gravel.

Mature eggs are reported to have an outer sticky membrane that turns inside out after the broadcast spawned eggs are fertilized. The eggs have a short stalk which serves to adhere the egg

to particles of sand or other substrates. There is some indication that in rivers with a high sand bedload the eggs will be encrusted in sand particles and thus possibly protected from abrasion (Romano 2012). The eulachon eggs appear to develop while being actively carried downstream by river currents. One study indicates that eulachon eggs would hatch in 30–40 days, given the usual water temperatures in February and March in the Cowlitz River (Gustafson *et al.* 2010).

Young eulachon appear to be feeble swimmers and are rapidly carried downstream to estuarine portions of rivers and inlets within hours or days of hatching. In the Columbia River, larval eulachon are usually near the bottom during their downstream migration but may be found throughout the water column (Romano 2011). The small, four to six millimeter larval eulachon may be retained for weeks or months in estuaries feeding on pelagic plankton after the yolk sac is depleted. Due to their small size, eulachon larvae may not be physiologically capable to imprint on the freshwater natal spawning river. Eulachon larvae may spend weeks to months in the estuarine environments where they grow significantly in size and may develop the capacity to imprint on large estuaries and eventually home to these areas as adults. These considerations suggest that large river estuaries, inlets, and fjords may serve as the smallest stock structure unit for eulachon (see Gustafson *et al.* 2010).

The marine distribution of eulachon is poorly understood. There is no directed harvest of eulachon in the ocean and the species is not actively monitored or managed, resulting in little available information. Eulachon appear to inhabit a wide range of depths. They are reported to be present in coastal, open marine waters of the continental shelf between 20 m and 150 m depth. Eulachon have been caught at depths of 500 m in Alaskan waters. Research trawl surveys in British Columbia indicate that most eulachon were taken at around 100 m depth, although some were taken as deep as 500 m and some at less than 10 m. Eulachon have been harvested in the otter trawl fishery off the mouth of the Columbia River as the fish are returning to spawn (Gustafson *et al.* 2010). Eulachon often occur as bycatch in West Coast groundfish fisheries and more commonly in the California and Oregon ocean shrimp fishery (Gustafson *et al.* 2010). In their study of juvenile salmon distribution off the Columbia River, Emmett *et al.* (2004) found eulachon were the dominant forage fish found in subsurface waters (12 to 24 meters).

Specific threats to the persistence of eulachon in the LCR include the modification of freshwater habitat due to dams and water diversions, sediment dredging, shoreline construction and chemical contaminants (Gustafson *et al.* 2010).

Hydroelectric dams block access to historical eulachon spawning grounds and affect the quality of spawning substrates through flow management, reduced delivery of coarse sediments, and siltation. As will be discussed in Section 2.3.4, the operation of dams on the mainstem Columbia River and tributaries have significantly altered the natural flow regime. The magnitude of the spring freshet has been reduced and the timing of the spring freshet occurs earlier than before development. The presence of the dams and changes in the flow regime has also reduced the transport of sands and gravels to the lower river affecting the quantity and quality of estuarine habitat. Bonneville Dam greatly impedes eulachon migration to historical spawning habitat in the Hood River and possibly the Klickitat River. Dams on the Cowlitz and Lewis River have also blocked access to eulachon habitat (Gustafson *et al.* 2010).

2.3.3 Species Environmental Baseline – Green Sturgeon

Green sturgeon occupy freshwater rivers from the Sacramento River up through British Columbia, Canada but spawning has been confirmed in only three rivers, the Rogue River in Oregon and the Klamath and Sacramento Rivers in California. The green sturgeon are comprised of at least two distinct species under ESA: (1) A northern species consisting of populations originating from coastal watersheds northward of and including the Eel River; and (2) a southern species consisting of populations originating from coastal watersheds south of the Eel River, with the only known spawning population in the Sacramento River (74 CFR 52300). The southern green sturgeon was listed as threatened under the ESA on April 7, 2006 (71FR 17757).

Like all sturgeons, green sturgeon are anadromous, but they are also the most marine oriented sturgeon species (Adams *et al*. 2007). Green sturgeon spawn from March to July, with peak activity from mid-April to mid-June. Juvenile green sturgeon rear and feed in fresh and estuarine waters from one to four years prior to dispersing into marine waters as subadults. Green sturgeon spend a large portion of their lives in coastal marine waters as subadults (sexually immature) and adults (sexually mature). The subadults and adults occupy coastal estuaries adjacent to their natal rivers, as well as throughout the West coast marine waters within 110 m depth (74 CFR 52300) often traveling up to nearly 1000 km (Moser and Lindley 2007). While in the ocean green sturgeon migrate in deep waters with occasional rapid vertical assents (Kelly *et al.* 2006)

Green sturgeon individuals from both the northern and southern species use the Columbia River estuary (Lindley *et al.* 2011). Green sturgeon can be found in the Columbia River estuary from the River Mouth to Bonneville Dam during the summer and early autumn, with higher concentrations in the lower portions of the estuary. Lindley *et al* (2011) observed green sturgeon entering the Columbia River in May with peak abundance in August. The studied fish had moved out the river by the end of September. However Moser and Lindley (2007) report green sturgeon may be present in the Columbia River until October.

Compared to the white sturgeon (*A. transmountanus*) little is known about the green sturgeon (Kelly *et al.* 2006). Green sturgeon feeding habits are poorly understood though they are believed to feed primarily on benthic organisms similar to other sturgeon (Kelly *et al.* 2006) Citing earlier stomach analysis studies, Kelly *et al.*(2006) report juvenile green sturgeon in San Francisco Bay feed primarily on benthic crustaceans, clams, annelid worms, crabs and fishes. Green sturgeon in Willapa Bay, Washington, were found to feed on burrowing shrimp (Moser and Lindley 2007). Adult green sturgeon diet is not well understood but in the Sacramento-San Joaquin delta adult green sturgeon feed on benthic invertebrates including shrimp, mollusks, amphipods and small fish (Adams *et al.* 2002).

The specific green sturgeon habitat preferences in the Columbia estuary are also not well known although green sturgeon may be found throughout the LCR (Rien 2012). Green sturgeon in the Rogue River preferred sites that were greater than 5 m deep with low current, low gradient reaches or off-channel coves during the summer months (Erickson *et al.* 2002). Erickson *et al*. (2002) suggest the fish hold in the deep pools to conserve energy and feed on readily available food resources. In the LCR, white sturgeon tracking studies indicate the fish occupied shallower areas during the night but that they were active during all times of the day. Green sturgeon may

act like white sturgeon or as suggested by Moser and Lindley (2007), green sturgeon may respond to the tidal cycle moving into bottom sediment as it becomes available in high tide. While green sturgeon are thought to primarily feed on the bottom, Kelly *et al.* (2006) observed that when moving directionally, the fish tended to swim in the upper 2 m of the water column and rarely were below 5m.

The population abundance and status of the southern green sturgeon in not well understood although the species is considered to become an endangered species in the near future (Adams *et al*. 2002 and Adams *et al*. 2007). The loss of spawning habitat in the Sacramento River, entrainment into water diversions and contamination of the Sacramento River are also considered threats to the species (Adams *et al*. 2007, 71 FR 17757). Harvest in commercial and sport fisheries targeting other species (Moser and Lindley 2002, Adams et al 2007). As will be discussed in Section 2.3.4 of this opinion, wetland filling, dredging of shipping lanes and anchorages, dredge spoil disposal, and municipal and industrial effluent discharge are human activities that may be detrimental to the species (Lindley *et al* 2011).

2.3.4 Environmental Baseline – Habitat

The action area includes critical habitat for Columbia River salmon, steelhead, eulachon, and southern green sturgeon. As discussed in Section 2.2.2, critical habitat includes PCEs or essential features that are essential to various life histories of the ESA listed fish The use and application of the terms PCEs and physical and biological features are nearly identical, therefore the term PCEs will be used when discussing the Primary Constituent Elements of salmon and steelhead critical habitat and the Physical and Biological Features of eulachon critical habitat in the following narrative. The term used in the critical habitat designation will be used in any tables referring to critical habitat.

Tables 28-31 list the PCEs for Columbia River eulachon, salmon and steelhead that will be discussed in the following environmental baseline and the proposed action effects assessment. The impacts to critical habitat within the LCR due to creation of the FNC for commercial shipping, flood control, urban and agricultural development, and the Federal hydropower system were briefly discussed in Section 2.2.2. The following narrative will provide more detail with an emphasis on the elements of the habitat baseline and critical habitat potentially affected by the proposed action.

Table 28. Physical and Biological Features of critical habitats designated for eulachon and corresponding species life history events most germane to the proposed action.

Physical and Biological Features		**Species Life History Event**
Site Type	**Site Attribute**	
Freshwater spawning and incubation	Water quality Substrate	Adult spawning Incubation
Freshwater migration	Water quality Food	Adult and larval mobility Larval feeding

Table 29. PCEs of critical habitats designated for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon), and corresponding species life history events most germane to the proposed action.

Primary Constituent Elements		Species Life History Event
Site Type	Site Attribute	
Freshwater spawning (LCR Chinook and CR chum)	Substrate Water quality	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Water quantity	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Natural cover Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing

Table 30. PCEs of critical habitats designated for SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon, and corresponding species life history events most germane to the proposed action.

Primary Constituent Elements		Species Life History Event
Site	Site Attribute	
Adult and juvenile migration corridors	Cover/shelter Food (juvenile) Safe passage Space Substrate Water quality	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration

Table 31 PCEs of critical habitat designated for southern green sturgeon and corresponding Species life history events most germane to the proposed action.

Primary Constituent Elements		Species Life History Event
Site Type	Site Attribute	
Estuarine areas	Food resources Migratory corridor Sediment quality Water depth Water quality	Subadult growth, development, seasonal holding, and movement between estuarine and marine areas Adult growth, development, seasonal holding, movements between estuarine and marine areas.
Coastal marine areas	Food resources Migratory corridor Water quality	Subadult growth and development, movement between estuarine and marine areas, and migration between marine areas Adult sexual maturation, growth and development, movements between estuarine and marine areas, migration between marine areas.

The Columbia River estuary is a former river valley that was carved to 360 feet below current sea level during the last ice age. As sea levels subsequently rose during the end of the ice age, the floor of the valley was submerged and began to fill with sediments; initially from eastern drainages and then from the Cascade Range. The Missoula Floods, which occurred roughly 15,000 to 13,000 years ago, filled the valley with sand. The continued rapid sea level rise increased the size of the estuary and allowed further accumulation of mud and sand. The rate of sea level rise declined about 9,500 years ago and the former river valley had filled with sediments. Suspended sediment and bed load sand from the Columbia River was transported through the estuary to marine areas via tidal action and spring freshets, with some suspended sediment being deposited in floodplains and peripheral bays (Petersen *et al.* 2003 as cited in NMFS 2011b).

Development of the estuary to facilitate shipping and the construction of 11 major dams and 162 smaller dams with reservoirs throughout the basin has altered the natural flow regime. The

development has changed seasonal flow rates, reduced sediment transport and discharge to the nearshore ocean environment, and degraded water quality and aquatic habitat within the estuary (ISAB 2000).

Dams on the mainstem Columbia River and tributaries regulate the flow and have changed the hydrograph. Diking and development of wetlands, the development and deepening of the FNC, and the use of jetties to stabilize dredged channels have profoundly altered aquatic habitat in the Columbia River estuary. Construction of the FNC and lower Willamette River navigation channels was authorized in 1878 with a minimum depth of 20 feet. Over the next 100 years the channel was expanded to a 40-foot deep and 600-foot wide channel (NMFS 2005a) and more recently to the current 43- foot depth with a 5-foot allowable over-depth for a total of 48 feet (NMFS 2005b). The FNC has been realigned and hydraulic control structures, such as in-water fills, channel constrictions, and pile dikes, have been built to improve navigation and reduce maintenance dredging. Most of the present-day pile dike system was built in the periods of 1917-23 and 1933-39, with an additional 35 pile dikes constructed between 1957 and 1967. The existing navigation channel pile dike system consists of 256 pile dikes, totaling 45.5 miles (NMFS 2005b). Creation of the dikes, navigation structures and artificial islands has facilitated increased numbers of avian predators such as Caspian terns (*Sterna caspia*), the double-crested cormorant (*Phalacrocorax auritus*) and Brandt's cormorants (*P. penicillatus*).

After reviewing the PCEs of critical habitat, limiting factors and threats to ESA listed species and past opinions (NMFS 2005a and NMFS 2005b) NMFS determined the habitat components most likely to be affected by the proposed action include the physical structure of habitat and prey base, sediment and turbidity, contaminants, avian predation and stranding of juvenile salmon on beaches by ship wakes. Consistent with Fresh *et al*. (2005), the existing habitat environmental baseline for salmon, steelhead and eulachon will be described in the context of three geographical areas within the action area; the Columbia River estuary (RM +3 to RM 145), the River Mouth and nearshore environment (RM -3 to +3), and the Columbia River plume. In addition to describing the general environmental baseline within the three geographic areas, sediment/turbidity, contaminants, avian predation and ship wake stranding will be discussed.

Columbia River Estuary (RM +3 to RM 145) The Columbia River has the largest annual discharge of any river on the Pacific coast of North America and is the second largest river in the United States. The Columbia River drains an area of 259,000 square miles flowing 1,243 miles from its headwaters in British Columbia to its mouth in the Pacific Ocean near Astoria, Oregon (ISAB 2000) The river strongly affects regional seawater properties of the northeast Pacific Ocean contributing between 60% (winter) to 90% (summer) of the total freshwater input between San Francisco and the Strait of Juan de Fuca (Bottom *et al.* 2005).

Climate changes have influenced river-flow since the pre-development period, but changes in flow due to development have had the greatest influence on the current hydrograph. The magnitude of the spring-freshet flow has decreased by more than 40% with the development of hydropower and irrigation. Approximately 75% of this loss is due to flow regulation, with irrigation withdrawal accounting for approximately 20%, and climate change for approximately 5% (Bottom *et al.* 2005). The timing of maximum spring-freshet flow also has changed due to hydropower and irrigation development, flood control and climate warming, resulting in an

approximate two-week shift to earlier in the year (mean pre-development date of 12 June compared to modern mean date of 29 May). The spring freshet has become longer, weaker, and earlier while winter flows are less sharply peaked than before flow regulation (Bottom *et al*. 2005). The total discharge has also changed from the pre-development period. The annual average flow at the mouth has been reduced from about 8,500 cubic meters per second (m3s-1) to less than 7,000 m3s-1, with climate change and water withdrawal each responsible for approximately 50% of the reduction (Bottom *et al* 2005).

The historical peak flows transported greater amounts of sediment and caused more flooding of wetlands resulting in a more complex ecosystem than the present (ISAB 2000). There has been a major loss of emergent marsh, tidal swamp, and forested wetlands in the Columbia River estuary. It is estimated that 43% of tidal marshes and 77% of tidal swamps have been lost since 1870 due to dikes and filling (Fresh et *al.* 2005). Suppression of winter- and spring- freshet flows combined with flood control dikes and wetland reclamation below Bonneville Dam has greatly reduced overland flows and isolated the historic tidal and floodplain habitats from the river. The creation of dikes severs the connection between floodplain and marsh habitats with the river, eliminating juvenile fish access to these habitats and preventing the export of organic matter important to the food web (Fresh *et al.* 2005). Historic flooding provided juvenile salmonids access to a wide expanse of low velocity marshland and tidal channel habitats (Bottom *et al* 2005). These habitats provided feeding and resting areas during the freshet season and supported a variety of salmon life history strategies that are no longer present in the river (Bottom *et al.* 2005, Fresh *et al* 2005). Lindley *et al* (2011) state wetland filling may also be detrimental to green sturgeon populations but no Columbia River specific information was presented.

Marshes, tidal creeks and the associated channel networks may be particularly important to small subyearling salmonids as sources of invertebrate prey, sources and sinks for detritus, and as potential refuge from predators (Bottom *et al.* 2005, Johnson *et al.* 2011). The historic wetlands were an important source of macrodetritus that is consumed by salmonid and green sturgeon prey species. With the loss of wetlands and the associated macrodetritus, the food-web has changed from a macrodetritus to a microdetritus base favoring organisms not typically consumed by salmonids. The microdetritus favors production of organisms that are prey for forage fishes such as northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea harengus pallasi*) and longfin smelt (*Spirinchus thaleichthys*) which in turn are consumed by salmon in the nearshore ocean. The net effects to salmonid carrying capacity from these food web changes is not fully understood (Bottom *et al.* 2005) although Johnson *et al.*(2011) found available food does not appear to be limiting the growth and survival of juvenile salmonids. The effects on green sturgeon due to changes in the food web are also not understood.

The shallow marsh habitats are primarily important for the species exhibiting the ocean-type life history, although stream-type Chinook salmon do use marsh and forested wetland habitats (Fresh *et al*. 2005). While the outmigrating yearling salmonids are not reliant on the shallow water habitats to the degree of ocean-type salmonids, the export of prey and materials supporting aquatic food webs from the shallow, tidal freshwater habitats likely benefits all juvenile salmonid life history forms (Johnson *et al.* 2011). Green sturgeon may also move with the tide into the shallower waters to feed. Gustafson *et al.* (2010) identified the loss of nutrient outflow from marshes and swamps as a potential threat to eulachon in the Columbia River. The combination of

floodplain diking and hydrologic changes has created a fundamental shift in the physical state of the Columbia River estuary ecosystem (Fresh *et al* 2005).

River Mouth and Nearshore Environment (RM -3 to +3) As described in the Corps (2011c), the Columbia littoral cell extends from Tillamook Head, Oregon north to Point Greenville, Washington. The littoral cell environment is comprised of wide, sandy shelves, and dune fields backed by sea cliffs. Climate, environmental, and anthropogenic factors have modified the movement of sediment throughout the region. Shoreline erosion has increased due to an increase in wave action and the reduction of sediment input to the littoral cell.

The Oregon shore of the River Mouth consists of a coastal plain called the Clatsop Spit, while the Washington shore at Cape Disappointment is a narrow, rocky headland. The River Mouth experiences large waves, and strong nearshore currents. The strong currents combined with an asymmetric, changing bottom create a dynamic environment at the River Mouth.

The north and south jetties were constructed at the River Mouth to create hydraulic controls to maintain a fixed navigation channel for commercial traffic at the interface of the Columbia River and the Pacific Ocean. The north jetty is approximately 2.5 miles long and was constructed between 1915 and 1917. The south jetty is approximately 6.6 miles long; the first 4.5 miles constructed between 1885 and 1895, with the last 2.1 miles constructed between 1913 and 1914 (NMFS 2005a). Construction of the jetties narrowed a broad and treacherously variable five-mile wide inlet into a stable two-mile wide inlet allowing a suitable navigation channel (LCSG 2011) The jetties modified the already complex and agitated wave environment at the River Mouth; affecting nearshore circulation patterns, shoreline accretion and erosion rates. The changes to the Columbia River flow regime and River Mouth have reduced sediment transport (see sediment/turbidity below) into to the littoral cell depleting accreted sediment around the jetty shoals resulting in a rapidly degrading nearshore environment (LCSG 2011). The continued reduction in sediment input to the littoral cell may result in significant ecosystem and physical effects including potential jetty failure. Additionally, the jetties have restricted the marine flow of nutrients into the estuary (NMFS 2011b).

Salmon and steelhead occur near the River Mouth throughout the year. Adult occurrence is primarily correlated with their period of upstream migration. Juvenile salmon may be present in the lower estuary during rearing as described in Section 2.3.1.1 and during outmigration. Peak times juvenile salmonids are present near the river mouth are March through mid-July depending upon the species. Green sturgeon are also found at the River Mouth and may be present from May through October.

At the River Mouth, there is more wave and current energy than other portions of the estuary. Yearling salmon and steelhead tend to be actively migrating through the River Mouth spending little time in the vicinity and are oriented towards the navigation channel. Subyearling salmon tend to occupy shallower areas than yearlings and may spend up to several days at the River Mouth and move with the tides (see NMFS 2011a).

Columbia River Plume The Columbia River plume is a freshwater/saltwater interface where freshwater exiting the Columbia River meets and rises above the denser saltwater of the

Pacific Ocean. The plume's location varies seasonally with discharge, prevailing near-shore winds, and ocean currents. In summer, the plume extends far to the south and offshore along the Oregon coast. During the winter, it shifts northward and inshore along the Washington coast. Strong density gradients between ocean and plume waters create fronts where organic matter and organisms are concentrated (Fresh *et al.* 2005).

While juvenile salmonid use of the plume is not completely understood, the plume is the first area salmon encounter during ocean entry and changes in plume structure may significantly influence the distribution and survival of salmon (De Robertis *et al*. 2005). The Columbia River plume may serve juvenile salmon in several ways including; distributing juvenile salmon in the coastal environment away from predation pressure closer to the shore, concentrating food resources, and providing cover from predators in the more turbid, low salinity waters (Fresh *et al.* 2005). When flows are high, such as in May and June, juveniles are found further offshore in low saline waters than when flows are lower. During years of a reduced freshet juvenile salmon are more localized around the mouth of the Columbia River (Fresh *et al.* 2005). De Robertis *et al*. (2005) report that during the two years of their study there was substantial interannual variability in the distribution patterns, growth and feeding of juvenile salmon in the vicinity of the Columbia River plume. Higher river flows and a larger plume resulted in greater prey availability, and better juvenile fish condition. The densities of juvenile salmonids were higher in the plume during the time of outmigration than in the adjacent higher salinity ocean waters.

The plume provides a high turbidity refuge from predation, provides fronts and eddies where prey become concentrated and facilitates primary production during the spring freshet (Fresh *et al*. 2005). Emmett *et al*.(2004) found age 1.0 Chinook salmon were found more often in turbid waters and Hongsheng *et al.* (2007) found juvenile salmon tended to be found in areas of the ocean with high levels of chlorophyll *a* which generally are relatively turbid. During years of low flows the amount of chlorophyll *a* observed within the plume was much lower than that observed when more normal flows occurred (Thomas *et al.* 2003 cited in Fresh *et al* 2005).

Emmett *et al.* (2004) found yearling Chinook and coho salmon off the Columbia River were distributed primarily within the upper 12 meters of the water column. Significant numbers of sub-yearling Chinook salmon appear to be "flushed" into the plume during the ebb tide, however Emmett *et al.* (2004) citing past studies, speculate that these fish probably swim to shallow, nearshore waters just off the surf zone. The subyearling fish may also inhabit the surf zone of dissipative sandy beaches (see Marin Jarrin *et al*. 2009). Dissipative beaches as described in Marin Jarrin *et al.* (2009) are flat beaches in which wave energy is dissipated in the surf zone rather than reflected from the beach face.

The change to the Columbia River flow regime has likely reduced the plume size, shape and intensity including; the surface area volume and the extent and distance of plume waters offshore. These changes probably have the most effect on populations expressing the stream-type or yearling life history although much is still uncertain (Fresh *et al.* 2005).

The plume also provides important habitat for forage fish preyed upon by salmon and steelhead. Emmett *et al* (2004) found Pacific herring, whitebait smelt (*Allosmerus elongates*) and northern

anchovy to be common in the surface waters of the plume with eulachon the most dominant forge species in subsurface waters (12-24 meters).

Green sturgeon spend a significant amount of time in the marine environment. Green sturgeon adults and subadults utilize the action area for foraging, growth and development and as a migration corridor.

Sediment and turbidity. Sediment transport processes are important determinates of habitat conditions for salmon and other species in the estuary. The fine sediment supply (silts and clays) include an organic component that supports a detritus-based food web that provides the bulk of estuarine secondary production. Turbidity caused by fine sediment may protect juvenile salmonids from predators but excessive levels may cause injury to juveniles and damage spawning habitat.

Most of the estuary's sediments are composed of sand, with silt and clay sediments dominating the peripheral bays (Bottom *et al.* 2005). The sediment transport regime of the Columbia River is sensitive to changes in the annual flow cycle (Bottom *et al.* 2005). Sediment transport varies with the power of flow so decreased flows and a decrease in the incidence of high flow days decreases the total amount of sediment transport (Fresh *et al* 2005). Sediment transport, especially transport of sand, has been decreased due to climate change and human factors. The diminished transport of sand is primarily the result of a reduction in the spring freshet due to power generation, flood control and irrigation (Bottom *et al.* 2005). It is estimated that the annual average change in sediment transport at Vancouver, Washington for 1945-1999 has been approximately 50-60% of the pre-development transport with a greater reduction in sands and gravels (>70%) than for silts and clays (Bottom *et al.* 2005). Coarse sands and gravels are important for natural habitat creation in the estuary. The consequences of reduced sediment transport through the Columbia River estuary and plume are not currently known, however the magnitude of the decrease has likely impacted habitat forming processes.

Sherwood *et al.* (1990) estimate that between 1909 and 1982 one-third to one-half of the annual fluvial sediment supply to the estuary was removed each year. While there has been a decrease in sediment delivery there is still considerable sand in the LCR that is transported as bedload during high flows. The Corps (2011c) describes sand waves downstream of Vancouver, Washington as generally large, six to 12 feet high and up to 500 feet long. In the lower reaches of the estuary bedload transport is not only influenced by river bathymetry and discharge but by ocean waves and tidal currents. Main channel sand waves from RM 18 to RM 25 are downstream oriented but become progressively smaller moving downstream. Between RM 12 and RM 18 sand waves are generally less than 50 feet long but can be oriented either upstream or downstream depending on flow conditions. Downstream of RM 12 the main channel sand waves are small and reverse direction with the tide. In more shallow areas adjacent to the main channel between RM 7 to RM 12 small, downstream sand waves can form even when the main channel sand waves are reversing. Small, reversing sand waves have been found at the River Mouth during both high and low discharge seasons.

According to the Corps (2011c), flow regulation has reduced the two-year recurrence interval peak discharge from 580,000 cfs to 360,000 cfs. The bedload transport rate at discharges below

300,000 is low and sand wave movement along the river bottom is only a few feet per day. When flows exceed 400,000 cfs the bedload transport rate increases and sand waves can move downstream at 20 feet per day.

Suspended sediment loads and turbidity conditions in the LCR are characterized in the Corps (2011c). Suspended sediment concentrations range from less than 10 milligrams/liter (mg/l) at 100,000 cfs; about 20 mg/l at 200,000 cfs; from 20 to 50 mg/l at 300,000 cfs and 20 to 60 mg/l at 400,000 cfs. Levels of turbidity generally follow the hydrograph with turbidity rising during the spring freshet and winter floods. Turbidity levels are below 10 nephelometric turbidity units (NTU) most of the year and only exceed 20 NTU during high flows although turbidity can exceed 70.0 NTUs during flood flows. Tidal hydraulics influence turbidity by creating a traveling zone of higher turbidity referred to as the estuarine turbidity maximum (ETM) that is associated with the upstream portion of the salt wedge. The ETM shifts with the tide and river discharge. The decrease in sediment transport during the freshet season may have reduced turbidity making juvenile salmonids more visible to predators (Bottom *et al.* 2005, Fresh *et al.* 2005).

Increased suspended sediments and turbidity can affect all life stages of fish that prefer clear over turbid water. Excessive fine sediment in the channel substrate can reduce the survival of embryos and emerging fry (Chapman 1988) and adversely affect the growth and survival of juvenile salmonids (Suttle *et al*. 2004).

Suspended sediment and turbidity can affect primary production by reducing light transmission resulting in decreased phytoplankton and periphyton abundance (Spence *et al.* 1996). If the suspended sediment results in an increased amount of sediment deposited on the natural substrate the diversity and benthic community can be changed. Increased deposition of fine sediment can reduce the diversity of aquatic insects especially if fine sediment is deposited on gravel (Spence *et al.* 1996 Newcombe and MacDonald 1991). The particulate material in suspended sediment can physically abrade and mechanically disrupt fish gills and reduce the ability of site feeding such as salmonids to capture prey (see Wilbur and Clark 2001).

An indirect effect of turbidity is an increase in biological oxygen demand when sediments with a high organic content are mobilized. That is as organic material, especially fine material is mobilized in the water column dissolved oxygen is used to decompose the material.

Bjornn and Reiser (1991) in their review of the habitat requirements of salmonids summarized the results of studies regarding decreases in dissolved oxygen (DO) and salmonid life history functions: including swimming performance; migration; fish embryo development and survival; and growth rates. The potential harmful effects to salmonids due to reduced DO are increased with increasing water temperatures. As water temperatures rise DO becomes less soluble in water while at the same time the metabolic needs of aquatic organisms for oxygen increase.

Steelhead and coho salmon embryos and alevins need dissolved oxygen to average 8 mg/l to survive well. In their review, Bjornn and Reiser (1991) found rainbow trout survived laboratory tests at DO concentrations less than 2 mg/l but growth rates are probably limited by concentrations less than 5 mg/l. The review stated that salmonids would not be impaired at

concentrations near 8 mg/l (76-95% saturation) and initial symptoms of DO deprivation would occur at about 6 mg/l (57-72% saturation). Adult salmonid migration ceased when DO fell below 4.5 mg/l and did not resume until DO levels rose above 5 mg/l. In summary, salmonids may be able to survive when DO concentrations are relatively low (5 mg/l), but growth, food conversion efficiency, and swimming performance will be adversely affected (Bjornn and Reiser 1991).

Dissolved oxygen concentrations in the LCR range between 9.0 and 15.8 mg/l (ODEQ 2008a and ODEQ 2008b). In the shallow water areas inhabited by subyearling salmon the lowest dissolved oxygen concentrations coincide with high summer water temperatures (Johnson *et al* 2011).

Contaminants The survival and productivity of both ocean-type and stream-type salmonid populations may be affected by exposure to waterborne and sediment associated contaminants. Stream-type salmonid ESUs are most affected by short-term exposure to currently used pesticides and dissolved metals that disrupt olfactory function; interfering with feeding, predator avoidance, imprinting, and homing (Fresh *et al.* 2005).

Degradation of water quality in the Columbia River estuary began in the early 1800s due to agriculture, logging, mining, industrial discharges, and storm water runoff. The estuary includes the major urban areas of Portland, Oregon and Vancouver, Washington with numerous small cities such as Longview, Washington and Astoria, Oregon. The Portland and Vancouver sewage treatment plants and sewer overflows in the Willamette River and the Columbia Slough are major sources of effluent into the estuary (Fresh *et al* 2005) although the city of Portland is in the final stages of upgrading the sewage treatment system. Contaminants may also be transported from areas upstream of Bonneville Dam such as the Yakima River, Lake Roosevelt, and other tributaries.

Fresh *et al*. (2005) summarize a number of studies identifying potentially toxic contaminants detected in the estuary. Currently used water-soluble pesticides present in the water column include simazine, atrazine, chlorpyrifos, metoachlor, diazinon, and carbaryl. The greatest concentrations and detection frequencies have been at the Willamette/Columbia River confluence with frequent detections also at the Beaver Army Terminal (RM 53.8). Trace metals that have been detected include iron and manganese (especially near the Willamette/Columbia River confluence) and high levels of arsenic. The presence of the trace materials can be due to both natural and anthropogenic sources. Probably most pertinent to the proposed action, a number of contaminants have been found in Columbia estuary sediments including trace metals (cadmium, copper, and zinc), dioxins, furans, chlorinated pesticides and other chlorinated compounds (*e.g*. dieldrin, lindane, chlordane, PCBs), DDT and its metabolites, polycylic aromatic hydrocarbons (PAHs), and other semivolatile compounds. Many of these compounds are rarely detected in the water column but tend to bind to organic carbon or particulate materials associated with fine-grained sediment in the streambed or in suspension. The Columbia River is currently classified under the Clean Water Act, section 303(d) as water quality limited for DDE (a DDT metabolite), PCB and arsenic (ODEQ 2008a and ODEQ 2008b).

The fine-grained sediments that adsorb these contaminants are usually deposited in areas of slower water velocities such as backwater areas associated with side channels and along the

river's margins. There is little deposition of fine grain material in the FNC due to high river velocities. In most cases within the estuary PCB and DDT concentrations have been within guidelines for protecting aquatic life however a few hotspots for these chemicals have been identified near Longview, Washington, West Sand Island, the Astoria Bridge, and Vancouver, Washington. Concentrations of PAHs considered to be hazardous to humans and aquatic life have been detected in the lower Willamette River in the Portland area (outside the action area) (see Fresh *et al*. 2005).

Mobilization and transport of suspended sediment during extreme stream flow events or when the substrate is disturbed, such as through dredging, can make the adsorbed contaminants available to aquatic organisms. The exposure and potential effects of these compounds likely varies with life history type. Stream-type species that have a short residency in the estuary as they migrate are less likely to accumulate high levels of bioaccumulative, sediment derived, contaminants such as PCBs and DDTs. They may be susceptible to short-term exposure to contaminants such as organophosphate pesticides and dissolved metals in the water column (Fresh *et al.* 2005).

The longer residence time within the estuary places the ocean-type species at a higher risk of exposure to bioaccumulative toxins (DDT and PCBs) that they may absorb through their diet. The risk may be greatest for those ocean-type, naturally produced wild salmon that are commonly found in side-channels, tidal marshes and forested marsh habitats where fine sediments are most likely to accumulate (Fresh *et al* 2005).

Fresh *et al*. (2005) report studies have shown juvenile salmon exposure levels for some contaminants in the estuary are approaching concentrations that could affect their health and survival. PCBs have been found in juvenile fish exceeding levels that may cause health effects. Potentially toxic concentrations of DDT have been detected in juvenile Chinook salmon at sites sampled between East and West Sand Islands, Desdemona Sands and west Trestle Bay in the LCR. There is additional concern as DDT could work additively with other contaminants to interrupt reproductive processes or other physiological functions. Salmonid prey species such as invertebrates are quite susceptible to impact by DDT. Dissolved metals and current use pesticides are also a potential hazard to fish. A number of pesticides and copper have been found to disrupt olfactory function in salmon that can adversely alter normal anti-predator responses or homing behavior.

The true magnitude of potential effects to salmonids in the Columbia estuary from contaminants is not fully understood (Fresh *et al.* 2005). Studies in Puget Sound have found contaminated sites similar to those in the LCR. Those studies have shown adverse effects to juvenile salmon due to immunosuppression, reduced disease resistance, and reduced growth rates (Fresh *et al.*2005).

Contaminants are a concern for eulachon and green sturgeon as well. Eulachon have been found to carry high levels of chemical pollutants (EPA 2002), and although it has not been demonstrated that high contaminant loads in eulachon have increased mortality or reduced reproductive success, such effects have been shown in other fish species. The resuspension of harmful contaminants during dredging has been identified as a threat to eulachon in the Columbia River (Gustafson *et al.* 2010).

While green sturgeon spend more time in the marine environment than white sturgeon and therefore are less exposed to contaminants in freshwater, there is some degree of risk to green sturgeon from contaminants particularly in the Sacramento River system (17 FR17757).

The proposed action (Section 1.3) describes the Corps sediment monitoring program that is implemented to determine if sediments to be dredged from the FNC and side channels meet the requirements for in-water disposal according to the Clean Water Act and the Marine Protection, Research and Sanctuaries Act. As reported in the Corps (2011c), the most recent testing for sediment borne contaminants in the FNC was completed in 2008-2009. The analysis showed no significant changes from previous sampling efforts. The sampling confirmed that 95% of the material to be dredged in the FNC is sand. Twenty-three samples were tested for metals and none exceeded the SEF screening level for in-water disposal. Pesticides and PCBs were found in four of 23 samples but none exceeded the screening level. PAHs were detected in all of the 23 samples submitted for chemical analysis but concentrations were also below the screening level (Corps 2009b). Similar results were reported for sediment sampling between Vancouver, Washington and The Dalles, Oregon (Corps 2009c). The results of both sampling efforts determined the FNC sediment meets the SEF standards for dredging and unconfined in-water placement. Under the SEF (2009), further characterization is not required for a period of 10 years (2019).

NMFS (2011a) and the Corps (2011c) report that in 2000, the Corps contracted a sediment analysis at the River Mouth. The analysis indicates >99% of the substrate consists of sand. Some of the sediment samples were analyzed for physical and chemical contamination with no contaminants detected at or near the SEF levels. In 2008, surface grab samples were collected from sites sampled during the 2000 study. No chemical analyses were conducted but the physical results from the two studies were compared. The mean percent sand for the 2000 samples was 98.11% and for the 2008 study 98.45% mean percent sand.

The greatest level of concern that dredging may potentially expose aquatic life to sediment bound contaminants is when the fine-grained sediments in the side channels are disturbed. Below is a summary provided in the Corps (2011c) discussing the containment loads in the side channels based upon the most recent sampling.

Baker Bay West Channel. Sediment analysis in 2009 detected low levels of metals in all samples analyzed and low levels of chemical contaminants including total DDT, PCB, PAH and phthalates. All contaminant levels were below SEF screening levels and the material was determined to be suitable for unconfined in-water disposal without further testing.

Chinook Channel. Chinook channel sediments have been sampled in 1980, 1986, 1987, 1992, 1997, 2004, 2006 and 2008. Levels of metals were consistent with historical data and no pesticides, PCBs, chlorinated hydrocarbons, phenols, phthalates were detected. The material was determined to be suitable for unconfined in-water placement.

Hammond Boat Basin. Sediment samples were last collected from the Hammond Boat Basin in 1994. The analysis showed that there was little change in metals and PAHs since the previous testing in 1987. At that time it was determined that in-water or upland disposal would

not result in unacceptable water column, benthic toxicity, or benthic bioaccumulation impacts. As stated in the Corps (2011c) a new sediment analysis is required before future dredging to ensure that the sediment is in compliance with more recent SEF (2009) requirements.

Skipanon Channel. DDT contamination was detected in 2001 sediment sampling. Due to that result, bioassay analyses were conducted on sediment sampled in 2003. One sample exceeded existing screening levels and material in the area of the sample was determined unacceptable for in-water placement. The sediment from other areas sampled within Skipanon channel was determined to be suitable for unconfined, in-water placement. As stated in the BA, a new sediment analysis is required before future dredging to ensure that the sediment is in compliance with more recent SEF (2009) requirements.

Skamokawa Creek. Analysis of sediment sampled in 2003 resulted in no exceedences of the screening levels in place at that time. As stated in the BA, a new sediment analysis is required before future dredging to ensure that the sediment is in compliance with more recent SEF (2009) requirements.

Wahkiakum Ferry. Sediment at the Wahkiakum Ferry site was sampled in 1994 and again in 2005. In both cases all material was determined to be suitable for unconfined in-water placement based on the existing criteria.

Westport Slough. Chemical analyses of sediment samples conducted in 2006 indicated very low levels of PCBs, pesticides, PAHs, phenol and hexachlorobutadiene. All the samples were below 2006 screening standards and determined to be suitable for unconfined in-water placement.

Old Mouth Cowlitz. The Old Mouth Cowlitz side channel was last sampled for contaminated sediments in 2006. Only very low levels of contaminants were detected and all were well below SEF (2009) screening levels. The results were consistent with historic data and all samples were determined to be suitable for unconfined, in-water placement.

Upstream Entrance to Oregon Slough. When last sampled in 2001, sediment in the Upstream Entrance to Oregon Slough were determined to be suitable for unconfined, in-water placement as defined by the existing screen criteria. As stated in the Corps (2011c) a new sediment analysis is required before future dredging to ensure that the sediment is in compliance with more recent SEF (2009) requirements.

Portland-Vancouver Anchorage. There has been no recent Portland-Vancouver Anchorage sediment contaminant testing.

Avian Predation. Predation is a major source of mortality for all salmonid populations. Predation on salmonids may have increased from historical levels due to both native and introduced predators. Native predators include California sea lions (*Zalophus californianus*), Steller sea lions, northern pikeminnow (*Ptychocheilus oregonensis*), double-crested cormorants and Caspian terns. The smallmouth bass (*Micropterus salmoides*) is a common non-native

predator. The increased avian predation by Caspian terns and to some extent double-crested cormorants can be attributed to the creation and maintenance of the FNC.

Caspian terns have a worldwide distribution. The western North American population more than doubled between 1980 and 1999 substantially due to an increase in human-created, high quality nest sites. Before 1984, there was no known Caspian tern nesting in the Columbia River estuary. Caspian tern nesting now occurs in the estuary as the birds were drawn to islands created or augmented with material dredged from the FNC. The birds first established a nest site on material newly deposited on East Sand Island when approximately 1,000 pairs apparently moved from Willapa Bay. The birds then moved to man-made Rice Island in 1986. The Caspian tern nesting population in the estuary has since expanded to between 9,000 and 10,000 pairs. By 2001, the majority of Caspian terns on the west coast were nesting on East Sand Island (Fresh *et al.* 2005).

Caspian tern nesting begins soon after the birds' arrival in the estuary in March through April. The birds prefer to nest on islands with barren sands to avoid predators. The arrival of the piscivorous birds coincides with the outmigration of many salmonid populations. When the terns were nesting on Rice Island, over 80% of their diet during the peak outmigration of steelhead, yearling Chinook salmon, and coho salmon consisted of the juvenile salmonids (Fresh *et al*. 2005). Stream-type juvenile salmonids are most vulnerable to predation by Caspian terns because the juveniles migrate through low turbidity, deep-water habitats near the tern nesting islands. Efforts to relocate the terns from Rice Island downstream to East Sand Island, which has an abundance of alternative prey including Pacific herring and anchovies, have reduced the tern consumption of juvenile salmonids.

The Corps in 1999 initiated actions to relocate the terns. The actions included installing silt fence on the Rice Island nesting site to reduce suitable nesting habitat, limited hazing, constructing suitable habitat on East Sand Island and using calls and decoys to attract the birds. The relocation efforts have been successful as all Caspian terns in the Columbia River estuary have nested on East Sand Island since 2001. Vegetation has over grown the Rice Island site and the Corps continues hazing as necessary to preclude Caspian terns from nesting on Rice Island, Miller Sands Spit, and Pillar Point (NMFS 2005b). The relocation efforts appear to have been successful in reducing salmonid mortality due to Caspian terns. Fresh *et al.* (2005 citing Collis *et al* 2001a and Roby *et al* 2003), reports that salmonid consumption by Caspian terns was estimated at 7.3 million smolts in 2000 which was 4.4 million less than 1999 and by 2001 had dropped to 5.9 million smolts. The Caspian tern consumption rate of smolts remained somewhat steady through 2006, as according to the Corps (2011c), between 5.8 and 7.5 million smolts are estimated to have been consumed by terns in 2006. In 2009 and 2010 tern consumption has remained steady between 6.5 and 5 million smolts respectively. In 2011, 7,000 tern pairs are estimated to have consumed 4.8 million smolts (Bird Research Northwest 2012).

Predation on juvenile salmonids by double–crested cormorants has been an increasing concern. The East Sand Island breeding population of double-crested cormorants has increased from zero in 1977 to 91 pairs in 1989, 4,500 pairs in 1997 and was estimated at 11,000 pairs by 2003. Double crested cormorant breeding population on East Sand Island increased to 12,000 and 14,000 breeding pairs consuming 11.2 and 18 million smolts in 2009 and 2010 respectively. The

East Sand Island now supports the largest double-crested cormorant nesting colony on the west coast of North America (Lyons *et al* 2011). In 2011, 13,000 double-crested cormorant pairs consumed an estimated 22.6 million smolts. A nearby colony of Brandt's cormorants has also increased to 510 breeding pairs (Bird Research Northwest 2012).

Pile dikes constructed for the FNC provide resting, loafing and feeding platforms for the birds. In 2000, the Corps installed avian spike strips (bird excluders) on nine dikes between RM 22.75 and RM 38.26. Bird excluders were placed on an additional eight dikes between RM 4.01 and RM 51.2 in 2001. Monitoring showed the excluders were effective in reducing the number of cormorants foraging near the dikes upstream of RM 22.75. The excluders also worked in downstream areas, where installed, but the birds merely shifted to pile dikes without the excluders. The excluders were not installed on the remaining pile dikes in the lower river due to concerns regarding the small Brandt's cormorant colony and the presence of brown pelicans. Subsequently, the installation of the bird excluders was determined to be not cost effective due to the rising double-crested cormorant population and the birds are not reliant on the structures for loafing or perching as they will forage in open water (NMFS 2005b). The Corps is currently preparing a double-crested cormorant management plan.

Stranding. Large, deep-draft vessels produce wakes that have been observed to strand juvenile salmon on beaches and have been identified as a threat to recovery of several salmon species (NMFS 2011b). This threat is most detrimental to ocean-type fry that are less than 60 mm long, rear inches from shore and may become stranded as waves recede from the shore. The extent of this problem is unclear but there have been three studies suggesting that under certain conditions, deep-draft vessels can produce wakes that strand juvenile fish (Pearson and Skalski 2010 and NMFS 2011b). Pearson and Skalski (2010) observed 126 vessels passing in the lower Columbia of which 46 resulted in stranding events at three beach sites. Subyearling Chinook salmon were the most common species stranded.

No single factor appears to be the cause of juvenile salmon stranding. Larger, fast traveling ships increase the incidence of stranding as they produce greater extent of drawdown and run-up along the beach. Tides are another factor. Lower tidal heights tend to increase the stranding as wave height tends to decrease with increasing tidal height (Pearson and Skalski 2010). Other factors that increase the potential for stranding include beaches with low slopes and distance to the FNC; as the closer a beach is to the FNC, the greater potential for stranding. Naturally, fish presence and use of the near-beach habitat is another important factor.

NMFS (2011b) reports that a study examining wave characteristics and beach geomorphology in the LCR estimated approximately 33 miles of shoreline, between the River Mouth and Vancouver, Washington, exhibit traits that may cause stranding. The study however did not look at fish densities adjacent to the beaches. Restoring some manmade beaches to more natural conditions may help reduce the incidence of stranding (Pearson and Skalski 2010).

Disposal of dredge material at beach nourishment sites could increase the incidence of stranding if habitat is provided for juvenile salmonids and the resulting beaches have low slopes that are geomorphically conducive to stranding.

2.3.4 Environmental Baseline Summary

The development of the Columbia River including the construction of the FNC, dams throughout the Columbia River basin, flood control structures, urban development and climate change have impacted the PCE of critical habitat for green sturgeon, eulachon, and the 13 species of salmon considered in this opinion. The combined effect of flow and habitat changes on estuarine habitat has been to reduce the amount of shallow-water habitat (especially vegetated habitat such as swamps and marshes). The changes that have occurred that reduce stream flows and sediment routing into the ocean have impacted the nearshore ocean environment and have unknown effects on the extent of plume habitat. The habitat changes and development of the Columbia River for hydropower have altered the food-web in the estuary but the potential impacts to ESA listed species are not fully understood. However, the available prey base does not appear to be limiting the growth and survival of juvenile salmon and steelhead. The changes to the estuary habitat have been most pronounced on salmon expressing ocean-type life histories that rely on the shallow water habitats. Flow changes affecting the plume and avian predation are probably more significant for stream-type salmonids. The potential impacts to eulachon due to changed habitat conditions in the Columbia River estuary are poorly understood.

Contaminants in the sediment and water column are a concern for the salmon and steelhead species as well as eulachon and green sturgeon. The small ocean-type juveniles are also susceptible to beach stranding as they are washed ashore by ship wakes.

Bonneville Dam and dams on Columbia River tributaries below Bonneville Dam have blocked eulachon access to historical spawning habitat. The alteration of flows, reduced nutrient outflow from marshes, and swamps, and exposure to contaminants has likely diminished the habitat quality for eulachon.

The development and maintenance of the FNC has contributed to limiting factors and threats to both individuals and PCEs of critical habitat that inhibit the recovery of the ESA listed species identified in Section 2.2.2 of this opinion (Tables 32, 33 and 34).

Table 32. Limiting Factors and Threats identified in Section 2.2.2 and Gustafson (2010) related to the FNC that may affect Eulachon Physical and Biological Features

Physical and Biological Features	Limiting Factor or Threat
Freshwater spawning rearing and incubation Freshwater Migration	Altered sediment balances, Water pollution Dredging

Table 33. Limiting Factors and Threats identified in Section 2.2.2 related to the FNC that may affecting the Estuarine and Neashore PCEs for ESA-listed salmon and steelhead species considered in the opinion (except SR spring/summer-run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon),

Limiting Factor or Threat	Species
Degraded estuarine and near-shore marine habitat	LCR Chinook salmon, UCR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum; LCR coho salmon; LCR, MCR steelhead
Degraded freshwater habitat; reduced complexity and access to off-channel rearing habitat in the LCR	LCR Chinook salmon, CR chum, LCR coho salmon, LCR steelhead
Reduced productivity resulting from sediment and nutrient-related changes in the estuary	LCR Chinook salmon, CR chum, LCR coho salmon, LCR steelhead
Juvenile fish strandings that result from ship wakes	LCR Chinook salmon, CR chum, LCR coho salmon
Contaminants affecting fish health and reproduction	LCR Chinook salmon, CR chum, LCR coho salmon, LCR steelhead
Avian predation	LCR, MCR UCR and SRB steelhead

Table 34 Threats identified in Section 2.2,.2 and Lindley *et al* (2011) related to the FNC That may affect the Estuarine and Coastal Marine Area PCEs for Green Sturgeon

Primary Constituent Elements		Threat
Site Type	Site Attribute	
Estuarine areas	Food resources Migratory corridor Sediment quality Water quality	Disturbance of bottom substrates adversely affecting prey resources. Disposal activities burying food resources. Re-suspension of contaminated sediments. Wetland filling Disposal activities burying green sturgeon.
Coastal marine areas	Food resources Migratory corridor Water quality	Disposal activities burying food resources Disposal activities burying green sturgeon

2.4 Effects of the Action on the Species and its Designated Critical Habitat

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are

those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The following effects analysis was conducted based on the dredging program in 2011, the one year of information available since completion of the 43 foot FNC. NMFS believes 2011 provides a good indication of potential future impacts as 2011 was a high flow year with significant shoaling. The 2011 discharge was the 13th highest flow year since 1989 placing it almost exactly at the 10% exceedence level, meaning that only one in ten years was as high (Domingue 2012). Therefore, the 2011 dredging should be represent a high level of potential future impacts and may be indicative of future impacts given potential changes in the hydrograph due to climate change. The Corps also proposes to shift the channel approximately 300 feet to the west at approximately RM 10+15 and 300 feet to the east at approximately RM 4+10. The proposed shift is still within the authorized channel. Little change in overall channel morphology is expected as the area is within a wide reach of the River so any additional channel adjustment is expected to be minimal; and therefore the effects of the shift are not expected to be significantly different than the effects due to the 2011 operations.

2.4.1 Direct Effects – Entrainment and Burial

Entrainment occurs when organisms are trapped during the uptake of sediments and water by dredging machinery. The potential for entrainment depends upon the likelihood of fish occurring during the dredge period, the dredge depth, fish densities at the time and location of dredging operations, how the dredge is operated, and the species' life stage. Juvenile salmonids, green sturgeon and eulachon adults, eggs and larvae may be entrained by pumps used to intake water during dredging or disposal. Burial may occur if fish are trapped when the dredge material is deposited within the flow lane. Chinook and chum salmon spawning and incubation in the Columbia River are not likely to be affected due to the in-water work period limits dredging and in-water disposal between Columbia River RM 106.5 and RM 145 to between August 1 and September 30, prior to spawning.

Salmon and Steelhead. Adult salmon and steelhead may be migrating upstream through the River Mouth and estuary at any time of the year with the majority of fish moving through the area between early spring and autumn. The adult fish are generally migrating mid-channel and may be found throughout the water column, usually within the upper 25 feet but may be found to depths of 50 feet. Adult fish are primarily migrating above the depths dredges are operated but it would not be uncommon for adult fish to be found at the dredging depth. Adult salmon and steelhead are strong swimmers however and should be able to avoid dredges, discharge plumes and burial, NMFS is confident any potential for adult fish to be entrained or buried by the dredges is discountable.

Dredging in the FNC is most likely to affect outmigrating yearling salmonids (smolts) while subyearling salmonids are most susceptible to potential entrainment in the side channels.

Effects to yearling salmonids (smolts.) NMFS (2009b and 2011a) reviewed the information regarding entrainment of juvenile salmon and steelhead due to dredging in the

Columbia River. Those studies included Buell (1992) and R2 (1999). Buell 1992 implemented a study to determine the potential for entrainment if a dredging operation continued past an in-water work period ending March 31, thus during the smolt migration. Buell (1992) conducted their study between RM 102.2 and 102.5 of the Columbia River. Dredging 700,000 cy of material between March 24 and April 10 resulted in no salmonids entrained. They also reported on a study in the Fraser River, Canada, where in certain areas, under certain conditions, salmon smolts were entrained by hopper dredge operations. Most of the fish were entrained during start up and clearing operations when the dredge was operated near the water surface. The Fraser River entrainment problem was greatly reduced by conducting startup and clearing operations within five feet of the channel bottom. Timing recommendations were also made to avoid areas where juvenile salmon were known to concentrate. Buell (1992) added the most important precaution to avoid entraining salmon is to engage startup and clearing operation near the bottom.

The R2 (1999) study included a sample site between Columbia River RM 70.7 and 71.9 in May. Out of 42 samples, two salmonids were entrained. The study included another Columbia River site and sites in five coastal rivers. The two fish entrained in the Columbia River were the only salmonids entrained out of 391 samples in their study. The R2 (1999) report also cited a study in Grays Harbor, Washington where 798 samples resulted in the entrainment of one chum salmon.

In addition to entrainment, juvenile salmonids could potentially be buried during in-water disposal. Both hopper and pipeline dredges will dispose material within the flowlane in waters at least 20 feet deep. Pipeline dredges continually discharge the material during operations through a downpipe with a diffuser at the end. The downpipe extends 20 feet below the surface and is moved during discharge to minimize mounding. Hopper dredges operate until the hopper is near capacity. The vessel then moves to the placement area where disposal occurs while the vessel is moving. The rate of disposal depends upon how many hopper doors are open or, with split hull hoppers how far the hull is opened. Dredges normally draw between 19 to 20 feet when fully loaded rising to about 13 to 22 feet when empty.

Depending upon the vessel disposal from the hopper dredged result in a discharge plume of 1,134 ft^2 (0.03 acres) per minute to 4,806 ft^2 (0.11 acres) per minute (Smith 2012c). Disposal from the hopper dredges takes approximately five minutes.

The Corps assessed the potential effects of the discharge plume from a hopper dredge on smolt-sized fish for the previous dredging operations and maintenance consultation (Corps 2005, NMFS 2005b). Material discharged from a hopper dredge creates a plume as it falls through the water. As the plume descends it is diluted by mixing with the river water, spreading out along the bottom until the energy is expended. The downward velocity is greatest as the initial material is released. The density and velocity diminish as the material is released during the five minutes of discharge. The first layer of the plume hits the bottom two to three seconds after release.

As the plume mixes with water, the density and downward acceleration decrease. According to the Corps analysis, a six-inch fish will experience a sustained downward force if it resists being entrained by the plume. If a fish does not resist the force it would most likely displaced by the leading edge or boundary layer of the plume. The Corps analysis also states the boundary layer

will likely prevent a fish from becoming caught in the plume and that even if a fish is entrained by the plume the boundary layer established as the plume hits the bottom will displace the fish laterally, preventing the fish from directly impacting on the bottom. This suggests that fish are likely to be injured rather than killed by entrainment in the plume. However, there is still considerable uncertainty regarding the effects of this type of entrainment.

Outmigrating smolts may be present in the LCR in February with peak abundances occurring in April and June. The smolts tend to be found in the deeper channels such as the FNC and side channels. The migrating smolts can be found at depths over 30 feet but are generally higher in the water column. Outmigrating steelhead are usually found in the upper portions of the water column while Chinook salmon smolts will migrate deeper in the water column.

The FNC normal or routine dredging operating season is June 1 through December 31; however non-routing dredging may occur any time of the year. Therefore dredging is likely to occur when the smolts are present in the FNC. In 2011, the only year of dredging since completion of the 43 foot deep channel, dredging occurred in during the smolt out migration in March and May as well as June for a total of 23.6 days.

Based upon the above mentioned entrainment studies, the potential number of smolts entrained by dredging operations is likely to be very small in any one year but over the time period of this consultation (50 years) the potential for entrainment of a small number of smolts cannot be discounted. NMFS also is of the opinion that some smolts, again a very few in any one year, are likely to be buried or injured upon impact with the bottom by the initial discharge of the disposal.

NMFS cannot accurately quantify the number of smolts likely to be killed or injured in any one year as the abundance and distribution of smolts at a dredging site at the time of operations is not known. However, based on previous estimates (NMFS 2005a and 2005b), the very small number of smolts that may be killed or injured will not appreciably reduce the abundance of any affected population. NMFS (2005a) reviewed the results of a hydroacoustic study that found during the greatest ESA-listed salmonid abundance in the Lower Columbia River, only 0.0017% were within three feet of the FNC bottom where dredging would occur during daylight hours; 0.0249% were beside the dredging zone during evening hours; and 0.0107% at night.

NMFS, using a dredging impact analysis provided by the Corps, conducted an analysis (impact analysis) to better quantify the potential duration, frequency, intensity and severity of dredging effects on both smolts and habitat. The analysis is documented in Appendix 2 of this document. The Corps divides the FNC into river segments to manage the dredging operations (Table 35).

Table 35. River Segments and Main Tributaries.

River Segment	Channel	Length*		Tributaries
		D/S RM	U/S RM	
1	43-foot	3	25.2	Grays River (RM 22)
2	43-foot	25.2	48.2	-
3	43-foot	48.2	67.1	-
4	43-foot	67.1	83.8	Cowlitz (RM 68) & Kalama (RM 73)
5	43-foot	83.8	97.8	Lewis (RM 87)
6	43-foot	97.8	105.3	-
7	17-foot	105.3	125.3	Sandy (RM 120)
8	17-foot	125.3	136.4	-
9	17-foot	136.4	145.3	-

* D/S RM means downstream river mile; U/S means upstream river mile.

The Corps provided information describing the dredge and disposal production rates as well as the area impacted per minute for both dredging and disposal from different vessels. The Corps also provided a history of the 2011 dredging and disposal operations as well as the dimensions of the navigation channel needing dredging, the area of the navigation channel that does not need dredging, the flowlane and total channel area. NMFS is assuming that the total area of the navigation channel and flowlane deeper than 20 feet is within the main river flow that outmigrating smolts are most likely to occupy. NMFS calculated the percentage of the smolt habitat potentially affected compared to the total habitat area likely to be occupied by smolts (Table 36).

Table 36. Estimated Lower Columbia Smolt Migratory Corridor (estimated smolt habitat equals the sum of the flowlane used for placement + the flowlane not used for placement)

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)	Area of navigation channel that does NOT need dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour NOT used for placement (acres)	Total Estimated Smolt Migratory Habitat (acres)	Estimated Percent Habitat Potentially Affected
1	1,208	138	1,790	23,383	23,521	6%
2	885	358	1,110	8,631	8,989	14%
3	438	330	1,270	4,870	5,200	15%
4	412	248	1,222	4,393	4,641	14%
5	315	193	955	3,158	3,351	15%
6	42	28	656	2,113	2,141	3%
7	81	110	910	3,200	3,310	6%
8	12	28	438	2,123	466	9%
9	1	0	339	1,220	1,220	0.08%

Up to 15% of the available smolt habitat could potentially be affected by dredging and flowlane disposal activities (Table 36). However, only a portion of the available habitat is affected by dredging and disposal during the smolt outmigration, so equating the potential harm from dredging and flowlane disposal to the total potentially occupied habitat affected overestimates the duration, frequency, intensity, and severity of potential effects to smolts. In addition, the vessels are not actively dredging or disposing material 24-hours a day, so the effects only occur over a fraction of the time that smolts may be present in the habitat. Using the cycle times provided by the Corps and the amount of dredging that occurred in 2011, NMFS assessed the relative potential for smolts to be entrained or buried based upon the amount of potentially occupied habitat affected by dredging and disposal activities that occurred during the 2011 outmigration relative to the total potentially occupied habitat; and the amount of time dredging and disposal activities occurred compared to the total time (March – June) smolts are likely to have been present.. Tables 37 and 38 display the percentage of smolt rearing and migration habitat where fish would be exposed to the risk of entrainment and burial at any one time during the migration period each year.

Table 37. Dredging Impacts to Smolt Outmigration Habitat March-June 2011(% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.07	1,045	23,521	175,680	.002%
2	0.06	16,840	8,989	175,680	.064%
3	0.03	1,152	5,200	175,680	.004%
5	0.04	909	3,351	175,680	.006%
6	0.002	23,421	2,720	175,680	.01%
7					
8					
9					

Table 38. Disposal Impacts to Smolt Outmigration Habitat March-June 2011(% Affected= affected area per disposal minute x total disposal minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Disposal Minute (acres)	Total Disposal Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.67	88	23,521	175,680	.001%
2	0.66	1,416	8,989	175,680	.059%
3	0.62	96	5,200	175,680	.007%
5	0.64	76	3,351	175,680	.008%
6	0.019	308	2,720	175,680	.001%
7					
8					
9					

Thus, the amount of area impacted compared to the available habitat and time of the impacts compared to the total time of smolt outmigration (Tables 37 and 38) results in a very low potential for the smolts to be entrained (.002% - .064%) or buried (.001% - .059%) in the reaches actually dredged during the 2011 outmigration period. It is also worth noting that there was no dredging activity in river segments 7, 8, and 9 during the outmigration. Stated slightly differently, the area affected by dredging at any one time during the duration of the proposed action is extremely small when compared to the total amount of habitat available to the affected species within the action area. The chance that individual fish will be within this area and killed or injured by entrainment is small but not discountable. This conclusion is supported by the results of the Buell (1992) and R2 (1999) studies. Since only a small number of smolts are likely to be entrained or buried during any given year, the proposed action will not cause appreciably reductions in population abundance or productivity for any of the affected salmon steelhead species.

A similar analysis was completed to estimate the potential impact to smolts at the River Mouth. Information regarding the 2011 dredging operation at the River Mouth (RM -3 to RM +3) was provided to NMFS in Smith (2012n) and Smith (2012o). At the River Mouth, the smolts are primarily outmigrating through the FNC. Therefore, the amount of potentially occupied smolt habitat is approximately six miles multiplied by the width of the FNC, 2,640 feet or 1,920 acres. As with the other river segments, the whole FNC is not dredged each year and most of the shoaling at the River Mouth occurs between RM -2.0 to RM +2.5 (Corps 2011c). Dredging the River Mouth typically begins in mid-June or early July (Smith 2012o). In 2011, the River Mouth was dredged in June by the *Essayons* for 126 hours and 49 minutes. The remainder of the River Mouth dredging occurred in and in August and September outside the primary smolt migration time period. Conducting an analysis similar to that outlined in Appendix 2 to assess the potential for smolts to be entrained, the relative amount of area impacted by the June dredging operation compared to the total habitat potentially occupied by smolts and the time the smolts may be present was .001% (Table 39)

Table 39. Dredging Impacts to River Mouth Smolt Outmigration Habitat -June 2011(% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes)*.

Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area Smolt Habitat (acres)	Total Time available June, 2011 (min)	% Affected/Total
0.07	7,609	1,920	43,200	.001

*According to Smith (2012n and 2012o) in 2012 the River mouth was dredged in August through October, although dredging could start in June. For this analysis it was assumed the *days of Essayons* operation at the River Mouth are assumed to have occurred in June

NMFS believes the potential for smolts to be buried by disposal activities at the River Mouth is discountable (see ocean disposal discussion below).

In summary, we believe there is a very small potential for an unquantifiable number of individual salmonid smolts to be entrained or buried in one year. The potential for smolts to be entrained or

buried is minimized do to the very small amount of potential occupied habitat affected (Tables 37 – 39) and due to:

- Studies indicating very few smolts are likely to be entrained during Columbia River dredging operations.
- The very small percentage of time and area dredging and disposal occur compared to the amount of potentially occupied habitat and time the smolts may be migrating.
- BMPs that call for dragheads and cutterheads to be buried in the substrate during operations and raised no more than three feet off the bottom if reverse purging or cleaning is necessary.
- The whole water column is not affected by the discharge plume during disposal. The bottom of the hoppers are 19 to 20 feet below the surface when the material with the greatest discharge velocity is released and pipeline dredge downpipes will be at least 20 feet deep when discharging.
- Most of the dredging operations occur after the smolt outmigration is complete and there is to be no dredging and disposal between RM 106.5 to RM 145 during the smolt outmigration.

Yearling salmon may be affected by ocean disposal of the dredged material. The outmigrating smolts are most likely to be in the vicinity of the Deep Water disposal site within the Columbia River plume. The fish are likely to be spread out in the plume and we cannot predict how many fish may be present in the vicinity of the disposal site in any one year. The yearling Chinook and coho salmon are found primarily within the upper 12 meters of the water column. The Deep Water site lies 6 miles off shore in waters 190 to 300 feet deep. The 5.0 square nautical mile placement area is extremely small compared to the area of available habitat. We believe the potential for yearling salmonids to be killed or injured during ocean disposal is discountable due to:

- The small area affected compared to the potentially occupied off shore habitat.
- The Deep Water site is only to be used when the other off shore sites are at capacity or weather conditions prevent their use.
- The depth of the water should allow for any fish encountering the initial disposal plume to be dispersed out of the disposal plume by boundary forces or able to escape as the downward acceleration slows before they impact the bottom.

Effects to Sub-Yearling Salmonids. The proposed action includes dredging in nine Columbia River side channels. The dredging depths for the side channels range from 9 to 20 feet deep (Table 40). Yearling salmon generally do not spend significant amounts of time rearing in side channels except during their outmigration from streams that are tributary to the side channels. The proposed action in-water work period for the side channels is from August 1 through December 15, so the potential impacts to yearling salmon and steelhead outmigrating as smolts is likely to be very small as few if any smolts are likely to be present. The side channel projects may directly impact subyearling salmon that favor the shallow water habitats.

Table 40. Side channel dredging (Smith 2012f).

River Segment	Side Channel	Project Depth (feet)	Total Dredging/shoaling acres
1	Baker Bay West Channel (RM 2.5)	16	42.4
1	Chinook Channel (RM 5)	10	25.6
1	Hammond Boat Basin (RM 7)	10	2.4
1	Skipanon Channel (RM 10)	16	42.0
2	Skamokawa Creek (RM 33)	6.5	4.0
2	Wahkiakum Ferry Channel (RM 43)	9	5.2
2	Westport Slough (RM 43)	20	12.0
3	Old Mouth Cowlitz (RM 67)	8	5.2
7	Upstream Entrance to Oregon Slough (RM 109)	10	13.8

Subyearling salmon tend to inhabit shallow waters such as tidal wetlands side channels, mud and sand flats and beaches until they attain sufficient size to exploit deeper channels and open water habitat. The subyearling fish are commonly found near the shoreline in low velocity currents at depths from 1 to 2 meters although they have been observed at depths of 20 feet.

The highest densities of juvenile salmonids occupying shallow-water habitats occur in the spring (0.07 fish/m^2) when all species are present with the second highest densities occurring in the winter (0.02 fish/m^2) and lowest densities in the summer and fall (less than 0.005 fish/m^2). Chinook and coho salmon are found year-round, chum salmon in the winter and spring and juvenile steelhead are the least common salmonid observed in the Columbia River shallow-water habitats. The spring is when the average size of the fish was smallest while in winter there was a bimodal size distribution of larger and smaller fish (Johnson *et al* 2011).

Dredging during the August 1 through December 15 side channel in-water work period will occur when the subyearling salmon densities in shallow-water habitat are the lowest; although there is a movement of fingerling Chinook salmon into the estuary during August that tapers off through the fall (Fresh *et al* 2005). This is especially true near the Cowlitz River as the peak subyearling outmigration occurs in August (West 2012a and West 2012b). The juvenile salmon in the estuary in November and December tend to be larger fish, approaching 100 mm mean length (Johnson *et al* 2011). The larger juveniles are more likely to occupy the more open water habitats of the side channels and main FNC adjacent to the shallow water habitats. The Johnson *et al* (2011) study was focused on shallow water habitats using beach seines, so how well the above densities reflect the potential densities in the more open portions of the side channels is uncertain.

Not all the side channels require dredging on an annual basis. Skipanon was last dredged in 2003, Skamokawa Creek in 1993, Wahkiakum Ferry Channel Westport Slough and Old Mouth Cowlitz River are likely to require dredging two or three times every five years and the Upstream Entrance to Oregon Slough was last dredged in in 2001. Clamshells are typically used to dredge the side channels although hopper and pipeline dredges may also be used.

Disposal of material from the side channels occurs in the Columbia River flowlane, Area D, BB-3 or at upland sites. The disposal areas are locations where the potential occupancy by subyearling salmon is very low and thus the potential for subyearling salmon to be killed or injured by disposal is discountable.

Eulachon. The potential impacts of dredging on eulachon is a concern. Entrainment of eulachon by dredging has been documented at the River Mouth (Corps 2007). Gustafson *et al.* (2010) citing Romano *et al* (2002) and Anderson (2009) discusses potential threats of dredging activities in the Cowlitz and Columbia Rivers. The risk to eulachon due to dredging depends upon the timing, location, and life stage of eulachon present. According to the information presented in Gustafson *et al* (2010), the Washington Department of Fish and Wildlife considers dredging to be a low risk to adult eulachon and larvae in the mainstem Columbia; however, the risk to eggs from dredging and disposal is considered risk. It has been suggested eulachon eggs may not survive along the bottom of the FNC due to the dynamic nature of the substrate. However, eulachon are adapted to glacial rivers with high sand loads and there is some indication that the eggs may become encrusted in sand particles offering some protection (Romano 2012).

NMFS convened a meeting with biologists from the Oregon and Washington Departments of Fish and Wildlife and Cowlitz Indian Tribe to discuss the current state of knowledge regarding Columbia River eulachon on January 27, 2012. During the meeting, some concern was expressed regarding the potential entrainment of adult eulachon by hopper and pipeline dredges; however, the greatest concern was over entrainment and burial of larvae and eggs during dredging and disposal operations. The biologists present at the meeting could not identify specific portions of the river more likely to be occupied by eulachon. The fish spawn in the mainstem Columbia River, Grays River, Skamokawa Creek, Elochoman River, Kalama River, Lewis River and Sandy River. Current knowledge suggests the eggs and larvae can be present throughout the water column. The consensus method to avoid killing or injuring eulachon expressed at the meeting is to avoid dredging and disposal operations when any life stage is potentially present within the action area.

Eulachon typically enter the Columbia River from mid-December through May but the fish have appeared as early as November. Spawning occurs soon after the fish arrive. The average initial commercial landing date is January 25 in the Cowlitz River and March 21 in the Sandy River and April 1 in the Kalama River. The eggs are believed to hatch in 30-40 days so it is reasonable to expect some life stage to be present from February through May.

NMFS has no way to estimate how many eulachon, especially eggs and larvae may be killed by dredging and disposal. Therefore, NMFS conducted an impact analysis similar to that completed for salmon and steelhead smolts. The analysis was based upon the 2011 dredging activities. The Corps proposed in-water work period for routine operations ends December 15 (Smith 2012b), prior to the normal peak migration. However, non-routine dredging can occur at any time outside the routine in-water period. Acknowledging that in some years there may be an uncertain portion of the eulachon spawning population entering the Columbia River in late November, the analysis was based upon the 2011 activities from December through May to account for the time eulachon adults and eggs are most likely to be present. NMFS believes the December – May

period provides a conservative (for the fish) approach to assessing the potential impacts. The full analysis is documented in Appendix 2.

Since eulachon eggs and larvae and potentially adults may be spread throughout the Columbia River, the total river channel was considered to be potential habitat (Table 41).

Table 41. Federal Navigation Channel and Potential Eulachon Habitat.

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20 ft contour used for placement (acres)	Total Estimated Eulachon Habitat (acres)(From Table A2-9	% Potentially Affected Area
1	1,208	138	76,100	2%
2	885	358	23,220	5%
3	438	330	9,690	8%
4	412	248	6,840	10%
5	315	193	5,060	10%
6	42	28	2,720	3%
7	81	110	10,350	2%
8	12	28	6,200	1%
9	1	0	2,780	.04%

Table 41 indicates that up to 10% of the available habitat potentially occupied by eulachon during dredging and disposal may be affected resulting in some killed or injured eulachon of some life stage. The greatest potential impacts occur in river segments 4 and 5 coinciding with the mouths of the Cowlitz, Kalama and Lewis rivers, important spawning streams.

The whole river channel is not dredged, nor is the dredging and disposal activity continuous during operations. As with the smolt analysis, NMFS assessed the potential for dredging and disposal impacts to eulachon individuals based upon the amount of potentially occupied habitat impacted and time those impacts occurred between December and May, relative to the total potentially occupied habitat and total time some eulachon life stage, particularly adults or eggs may be present (Tables 42 and 43).

Table 42. Dredging Impacts to Eulachon Habitat December-May2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.07	1,045	76,100	262,080	.0004
2	0.06	15,985	23,220	262,080	.0158
3	0.03	1,152	9,690	262,080	.0014
4	0.003	18,265	6,840	262,080	.0003
5	0.06	624	5,060	262,080	.0028
6	0.002	25,403	2,720	262,080	.0071

Table 43. Disposal Impacts to Eulachon Habitat December-May 2011(% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes)

River Segment	Affected Area per Disposal Minute (acres)	Total Disposal Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.67	88	76,100	262,080	.0003
2	0.66	1,344	23,220	262,080	.0146
3	0.62	96	9,690	262,080	.0023
4	0.03	18,265	6,840	262,080	.0334
5	0.66	204	5,060	262,080	.0102
6	0.55	341	2,720	262,080	.0263

The potential for directly killing or injuring eulachon occurs only during active dredging and disposal. The above analysis shows the potential impacts that may result in killed or injured eulachon due to dredging (.0003 % to .0158%) and disposal (.003% to .0334%) is very small compared to the amount of time and area eulachon may be present. Therefore, we assume the potential population effects are proportional to the total impact resulting in a very small percentage of the population being killed or injured.

The small percentage of fish potentially killed or injured is likely to be less than indicated by the analysis as the whole water column is not affected by the activities. Adult fish migrating in the upper water column are unlikely to be affected by dredging or disposal. Likewise, larval fish drifting in the upper water column are unlikely to be affected by the proposed action. BMPs that call for dragheads and cutterheads to be buried in the substrate during operations and raised no more than three feet off the bottom if reverse purging or cleaning is necessary help limit the potential impacts. The bottom of the hoppers are 19-20 feet below the surface when the material with the greatest discharge velocity is released and pipeline dredge downpipes will be at least 20 feet deep when discharging.

The proposed in-water work periods also help minimize the potential direct effects to eulachon including:

- The normal operating season is June 1 through December 15 so routine dredging avoids most of the returning adults and much of the potential for eggs and larvae to be impacted.
- Dredging and in-water placement between RM 106 to RM 145 will be conducted between August 1 and September 30 thus protecting any spawning and rearing fish within that river segment including the Sandy River.
- All side channels will be dredged between August 1 and December 15 avoiding most potential for impacts due to side channel activities however there is still potential to kill or injure some eulachon in the early portions of the spawning run.
- No in-water placement if non-routine dredging is required near or just downstream of the mouth of the Cowlitz River (RM 63-70) between December 16 and May 31 will help avoid impacts to adult eulachon entering the Cowlitz River and eggs and larvae being transported out of the Cowlitz River.
- No in-water placement near the mouths of the Kalama River (RM 71-75) and Lewis River (RM 85-89) when alternative site are available will help protect eulachon utilizing those streams if alternative sites are available.
- Testing and calibrating dredges with in-water placement between December 16 and May 31 will occur above RM 89 will protect most of the eulachon population.

Eulachon are common within the Columbia River in waters below 12 meters deep and therefore may be affected by ocean disposal of the dredged material at the Deep Water Site. However, the fish are likely to be spread out in the plume and nearshore area. NMFS cannot predict how many fish may be present in the vicinity of the disposal site in any one year. The Deep Water site lies in waters 190 to 300 feet deep. The 5.0 square nautical mile placement area is extremely small compared to the area of available habitat. NMFS believes the potential for eulachon to be killed or injured during ocean disposal is very small due to:

- The small area impacted compared to the potentially occupied offshore habitat.
- The Deep Water Site is only to be used when the other off shore sites lack capacity or weather conditions prevent their use.
- The depth of the water should allow for any fish encountering the initial disposal plume to be dispersed out of the disposal plume by boundary forces or able to escape as the downward acceleration slows before they impact the bottom.

Green Sturgeon Lindley *et al* (2012) include the dredging of shipping lanes and anchorages, and dredge spoil disposal as human activities that may have detrimental impacts on green sturgeon although such activities were not identified as a principal factor for the southern green sturgeon population decline (71 FR 17757). Buell (1992) noted white sturgeon were commonly entrained during their Columbia River entrainment and mortality study. The entrainment rate was highest when the dredge was operating in a "sturgeon hole" ranging from 63 to 71 feet (deeper than dredging in the FNC). Although there was a significant entrainment, the mortality rate was only 3.4% (Buell 1992).

The fish entrained in the Buell (1992) study ranged in size from about 4.5 inches to approximately 31 inches fork length (FL) with the vast majority less than approximately 26 inches FL. Based on recent tagging studies, the majority of the green sturgeon tagged in the Columbia may be significantly larger than the white sturgeon entrained in the Buell (1992). Fifty

nine green sturgeon were tagged in the Columbia River in 2011. The fish ranged between approximately 35 inches FL to about 55 inches FL with an average length of 52 inches FL (Woodbury 2012a). The green sturgeon in the Columbia River may be large enough to escape from the dredges although actual entrainment rates for Columbia River dredging operations are unknown. One may assume that because the green sturgeon have migrated from the Sacramento River, the fish would tend to be relative large and strong swimmers. However. the smaller green sturgeon tagged in 2011 are close to the largest fish entrained in the Buell (1992) study and close to the size sturgeon provided in photographs that have been entrained during dredging operations in the eastern United States (Woodbury 2012b) suggesting at least the smaller green sturgeon in the Columbia River may be susceptible to entrainment.

Woodbury (2012c) provided data from a dredge entrainment study in San Francisco Bay, CA where soupfin sharks (*Galeorhinus galeus*) up to about 30 inches total length were entrained, again indicating at least the smaller green sturgeon in the Columbia River could be entrained. The behavior of fish that live along the bottom also may make green sturgeon susceptible to entrainment as opposed to pelagic fish such as salmon that will swim away from danger; the more demersal species may "freeze" along the bottom (Woodbury 2012d).

The actual effects of dredging and flowlane disposal on green sturgeon in the Columbia River are not known. Based upon the above information, the potential for entrainment of at least the smaller green sturgeon cannot be discounted as the routine dredging season overlaps the time when green sturgeon are in the Columbia River. The effects of flowlane and ocean disposal however based upon the studies of disposal on other bottom-dwelling fish in the LCR and ocean disposal sites (Corps 2007) and a study conducted by Parsley *et a*l (2011), NMFS believes the strong swimming green sturgeon should not be adversely affected during disposal and can escape becoming buried.

Parsley *et a*l (2011) did a study of flowlane disposal operations on the behavior of seven white sturgeon before, during and after a series of hopper dredge disposal operations in the lower Columbia River. The fish were between 19 inches and 39 inches FL. The results of the study indicated the disposal had little effect on the fish. The study findings indicated that hopper dredge disposal did result in a slight increase in individual fish activity that could indicate disturbance. However, the increased activity may have been due to the fish investigating the disposed material as a potential food source. Anglers often fish for white sturgeon that congregate near the dredges during operations; termed the 'dredge bite' (Parsley *et al.* 2011).

Green sturgeon may also be stuck by the propellers of dredge vessels causing injury or death. Woodbury (2012e) provided a photograph of a white sturgeon stuck by the propeller of the *Essayons* in San Pablo Bay, CA. How often such events occur is not known and NMFS is not aware of any documentation of ship strikes in the Columbia River during dredging operations. Green sturgeon may be particularly vulnerable as they tend to swim in the upper 2 m to 5 m of the water column in fresh water during directional movement (Kelly *et al* 2006). The potential for a dredge vessel propeller to strike a green sturgeon is probably greatest during freshwater dredge and disposal activities as green sturgeon tracked in the ocean did not appear to move at the surface although did make occasional rapid vertical ascents (see Kelly *et al.* 2006).

NMFS has no information to accurately estimate the number of green sturgeon harmed or killed by dredging and disposal. Therefore, we conducted an impact analysis similar to that completed for salmon and steelhead smolts and eulachon. Green sturgeon enter the Columbia River in May and can be present in the River through October therefore the potential to entrain green sturgeon is during the May through October time period. The Corps proposed action in-water work period for routine operations begins June 1 and runs through the summer into early fall therefore green sturgeon will occur in the action area during dredge and disposal operations. Non-routine dredging may also occur in May when green sturgeon are first entering the Columbia River. The impact analysis was based upon the 2011 activities from May through October for dredging operations in the Columbia River. The full analysis is documented in Appendix 2.

Table 44. Federal Navigation Channel and Potential Green Sturgeon Habitat.

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)	Total Estimated Green Sturgeon Habitat (acres)(From Table A2-9	% Potentially Affected Area
1	1,208	138	76,100	2%
2	885	358	23,220	5%
3	438	330	9,690	8%
4	412	248	6,840	10%
5	315	193	5,060	10%
6	42	28	2,720	3%
7	81	110	10,350	2%
8	12	28	6,200	1%
9	1	0	2,780	.04%

As displayed in Table 44, between .04% and 10% or potential green sturgeon habitat, depending upon the river segment, may be impacted if the whole FNC was dredged. However, as was discussed in the above smolt assessment, the whole FNC is not dredged every year and the potential habitat impacts as well as the potential for green sturgeon to be entrained during dredging only occurs during the time the area and time the dredges are actually operating. NMFS believes green sturgeon in the Columbia River should be able to avoid burial during disposal activities so the following impact analysis only considers the relative potential for entrainment. The time period for the assessment is May through October.

Table 45 Dredging Impacts to Green Sturgeon Habitat May - October 2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	.04	26,530	76,100	264,960	.005
2	.023	132,459	23,220	264,960	.05
3	.033	10,433	9,690	264,960	.013
4	.015	8,962	6,840	264,960	.007
5	.062	9,52	5,060	264,960	.004
6	.002	23,421	2,720	264,960	.006
7	.03	2,784	10,350	264,960	.003
8	.03	1,008	6,200	264,960	.002

The above analysis shows the potential impacts that may result in killed or injured green sturgeon due to dredging operations ranges between .002% an 0.5% of the total potentially occupied habitat when green sturgeon are expected to be present.

As for the analysis of the potential to impact outmigrating smolts, the information provided by (Smith 2012n) and (Smith 2012o) was used to estimate the relative potential for green sturgeon to be entrained at the River Mouth. Assuming the green sturgeon could occupy all the available river habitat, the potentially occupied area is the six mile length of the FNC multiplied by the total width at the River Mouth, approximately two miles, for a total potentially occupied area of 7,680 acres. In 2011, the River Mouth was dredged in June by the *Essayons* for 126 hours and 49 minutes. The remainder of the River Mouth dredging occurred using a contract hopper dredge for a total of 48 hours of dredging time in August and September with no dredging during July and October. We conducted an analysis similar to that outlined in Appendix 2 to assess the potential for green sturgeon to be entrained, by comparing the amount of area impacted by the June, August and September dredging operation compared to the total habitat potentially occupied by green sturgeon and the total time during June, August and September.

Table 46. Dredging Impacts River Mouth Green Sturgeon Habitat -June – October 2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area Green Sturgeon Habitat (acres)	Total Time available June, August, September 2011 (min)	% Affected/Total
0.11	34,654	7,680	131,040	.4

The above analysis shows the potential impacts that may result in killed or injured green sturgeon due to dredging is very small (0.08%) compared to the amount of time and area where

green sturgeon may be present. Also, the total abundance of southern green sturgeon is low and members of this species disperse throughout areas of California, the Pacific Northwest and Canada during the spring and summer. Therefore, the total number of individuals expected to be in the Columbia River during dredging is expected to be relatively low. This further reduces the likelihood that green sturgeon will be entrained during dredging or disposal. The total number of fish expected to be killed or injured by the proposed action should not exceed more than a few individuals at most. This analysis may need to be repeated in the future if more information regarding green sturgeon habitat preferences in the Columbia River becomes available.

2.4.2 Habitat Effects

Dredging and disposal operations in the FNC, as described in Section 2.4.1, may directly kill or injure eulachon or juvenile salmonids. Additionally, the proposed action may affect salmonids green sturgeon and eulachon by diminishing the quality and function of critical habitat and contributing to limiting factors and threats. The environmental baseline described the current condition of habitat components within the action area that the proposed action may affect. Those habitat components were then confirmed as the appropriate ones to assess for the effects of the proposed action on ESA-listed fish by reviewing the effects of dredging documented in previous Columbia River dredging consultations (NMFS 2005a, NMFS 2005b, NMFS 2009), and the potential threats to ESA-listed fish and habitat that have been identified due to dredging (Gustafson *et al.* 2010 and NMFS 2011b).

Physical Habitat and Prey Base. The FNC substrate is composed primarily of sand. The transport and deposition of sand and coarse gravel is important for creating aquatic habitat in the LCR. The transport of sand and coarse gravel through the river system has been decreased by greater than 70% due to climate changes and human factors that have reduced the magnitude of the spring freshet. The extent of shallow-water habitat in the LCR has been reduced due to decreased transport of sand, the creation of the FNC including the construction of pile dikes, as well as diking for flood control, and filling. The changes to the spring freshet and construction of jetties at the River Mouth have also depleted the sediment within the Columbia River littoral cell. The loss of sediment contributes to beach erosion, and loss of habitat associated with the natural sediment composition in the nearshore environment. There is still a substantial amount of sand in the river channel and the transport of the material, though reduced, still creates a dynamic environment. Large sand waves create shoals during high flows and even during low fall flows the substrate within the FNC is constantly moving (Meyer 2012).

NMFS (2011b) identified reducing the export of sand and gravels during dredging by using dredged material beneficially as a management action to diminish a threat to salmon and steelhead recovery. Most of the sand dredged in the Columbia River FNC is maintained within the system. Of the close to 8 mcy of material dredged in 2011, only about 10% was disposed in upland sites and thus lost to the system The bulk of the material was disposed in the flowlane with a small amount disposed on beaches (Smith 2012c). The material dredged from the River Mouth is typically disposed in the ocean. Four new nearshore disposal sites in combination with three existing near shore sites have been identified as part of the proposed action. The nearshore sites are to be used for dredge disposal as a beneficial use of the material in the littoral cell and nearshore environment and may help restore nearshore habitat. The disposal of dredge material

at the Deep Water Site, where it would be lost to the littoral cell, is only to occur if the nearshore sites are at capacity or conditions prevent safe disposal nearshore.

Dredging the FNC is not likely to significantly impact the physical habitat. Salmonids are not closely associated with the bottom substrate and tend to migrate through the area quickly. Eulachon eggs and larvae may be found throughout the water column therefore dredging the FNC impacts a very small amount of the available eulachon habitat. Green sturgeon may be found along the bottom of the FNC. Dredging the FNC moves material in the channel and deepens the channel but does not fundamentally alter the substrate composition or green sturgeon habitat other than deepening the channel. The physical habitat impacts are short-term, limited in extent.

As discussed in Section 2.4.1, dredging the side channels has the potential to affect the rearing habitat for subyearling salmonids. The subyearling salmonids make extensive use of the shallow water areas. The geographic extent of the potential impact to shallow water habitat is limited. Dredging the side channels potentially disturbs and deepens 153 acres of shallow-water habitat out of approximately 88,000 acres of shallow water habitat in the LCR. Additionally, most of the side channels are not dredged every year allowing the habitat to recover thus reducing the duration and severity of the disturbance. The in-water work period proposed by the Corps helps minimize effects to shallow water habitat. The side channel disturbance occurs in the summer and late fall when juvenile salmonid densities are relatively low, although the peak Chinook salmon fingerling movement into the LCR fingerling Chinook salmon occurs in August. The proposed action in-water work period allows for some level of recovery prior to the higher densities of fish occupying the habitat in the spring.

The construction of the FNC, including pile dike fields, has contributed to the loss of shallow-water habitat. The Corps does not propose restoration of any habitat influenced by the construction of pile dike fields in the proposed action. However the Corps, the Bonneville Power Administration and the U.S. Bureau of Reclamation are implementing habitat restoration management actions as required in the opinion for operation of the Federal Columbia River Power System (FCRPS) (refer to NMFS consultation number: 2005/05883). The FCRPS includes three reasonable and prudent alternatives (RPA) (numbers 36, 37, and 38) to improve juvenile salmonid habitat in the Columbia River estuary and RPA 38 is titled Piling and Piling Dike Removal Program. A number of restoration actions have been implemented through the FCRPS and the Lower Columbia salmon recovery plan (Smith and Marcoe 2012) and restoration efforts, are likely to continue for some time. The amount of habitat ultimately restored will depend upon the degree to which landowners are willing to allow restoration efforts on their properties, public safety concerns and navigation constraints.

Loss of the prey base (benthic invertebrates) is another potential indirect effect associated with any changes to the physical habitat due to dredging and disposal operations. Dredging and disposal can potentially disrupt the food web in the estuary and thus impact green sturgeon and juvenile salmonid growth and survival. Dredging may disrupt the food web for ESA listed species by removing and altering the substrate and associated species composition. Dredging will also entrain benthic fauna that is consumed by juvenile salmon and green sturgeon.

ESA-listed salmon with ocean-type life histories and green sturgeon are the most dependent upon the estuary, rearing in the LCR for up to several months. NMFS (2005a and 2005b) determined the greatest potential effects to the food web for salmonids would be likely to occur in the more productive, shallow draft side channels where subyearling salmon are likely to occur. The shallow water areas also produce food sources that are used by outmigrating yearling salmon in the main FNC. The deeper waters of the FNC and the associated coarse, mobile substrate is not considered to be highly productive or supply an important prey base for juvenile salmonids.

As described in previous opinions (NMFS2005a and NMFS 2005b) dredging, as proposed by the Corps, is not likely to significantly affect the prey base for ESA listed salmonids. And while not assessed in the earlier opinions, the prey base for green sturgeon is also not likely to be significantly affected. Maintenance dredging in the side channels may temporarily reduce the suitability of sediment and hinder prey species recolonization by reducing the organic matter content of the sediment and altering the sediment size. The tube-dwelling amphipods, midges, other insects, and crustaceans inhabiting the side channels are able to rapidly recolonize a site after disturbance through active movement or passive drift; however recolonization may take 6 to 12 month (NMFS 2005b). Therefore, some juvenile salmonid prey species in the disturbed area, up to approximately 153 acres of habitat, may be temporarily lost until recolonization occurs.

Beach nourishment may also alter the substrate and impact the prey base if the material used is different than the natural material at the site. There may also be a loss of prey if benthic organisms are buried during disposal. The three identified beach nourishment sites in the Columbia River are highly disturbed, erosive areas with little or no benthic prey populations and subsequently few salmonids (Corps 2001, ODEQ 2008b); therefore the effects to the physical habitat and prey base due to beach nourishment is likely to be insignificant.

The potential reduction in salmonid prey base is likely to be insignificant because:

- The growth and survival of juvenile salmonids in the estuary is not limited by food.
- The FNC is not a productive food source for juvenile salmonids.
- The intensity and severity of the effects to the salmonid prey base in shallow-water are relatively low as:
    - The area of side channels that may be dredged is very small relative to the amount of productive shallow water habitat, only about 153 acres of 88,000 acres of shallow water habitat.
    - Most of the side channels are not dredged on an annual basis allowing the impacted areas to recover.

Bottom fish and invertebrates that may be consumed by green sturgeon are commonly entrained during dredging operations (Buell 1992, Woodbury 2012c) and bottom dwelling organisms may be buried during disposal. NMFS is confident the potential effects to the green sturgeon prey base during dredging and disposal in the FNC are insignificant because:

- The area dredged and used for disposal activities is small compared to the total habitat occupied by green sturgeon prey.

- Disposal activities are expected to have minor, short term impacts on benthic species' populations (Corps 2007).

The proposed action also includes dredging the River Mouth (RM -3 to RM +3) and ocean disposal. DeRobertis *et al*. (2005) found juvenile chum salmon in the Columbia plume fed exclusively on planktonic prey including small copepods, northern anchovy (*Engraulis mordax*) and sanddab (*Citharichthys* spp) eggs, larval euphausids, and larvaceans. Depending upon the study year, yearling coho salmon fed primarily on Dungeness crab (*Cancer magister*) megalopae, other crab megalopae, adult euphausids, and amphipods. In other years, yearling coho salmon primarily consumed fish with less planktonic prey. Yearling Chinook salmon diets were comprised primarily of fishes but also included Dungeness crab megalopae, amphipods and pteropods (DeRobertis *et al*. 2005). Eulachon are planktivorous, feeding on a variety of phytoplankton and zooplankton such as polychaete larvae, early planktonic stages of barnacles and copepods, amphipods, crustaceans, cumaceans (Gustafson *et al* 2010). Larval eulachon are often still consuming their yolk sacs while drifting downriver toward the Pacific Ocean.

Dredging the River between RM -3 and RM +3 is not likely to have any significant effect on fish species or the food web (LCSG 2011). The Corps has conducted numerous studies regarding the potential effects of dredging at the River Mouth including the disposal of material in the ocean (Corps 2007). The area offshore of the River Mouth as well as in the River Mouth is inhabited by benthic communities typical of those found in similar shallow-water, sand-bottom habitats including polychaetes (marine annelid worms), molluscs, and crustaceans. The species in these communities have adapted to high energy environments by evolving to be highly motile rapid burrowers, quick tube builders, or rapid colonizers and will rapidly recover from dredge disposal (Corps 2007). LCSG (2011) states disposal in the new nearshore disposal locations should have inconsequential effects on benthic invertebrates as long as the sediment is dispersed, and, as is the case with the proposed action, is similar in size to the native sediments. Increasing the sand to the littoral cell through the ocean disposal could be beneficial to some species (LCSG 2011).

The potential effects to the Dungeness crab population from dredge and disposal operations are a concern, primarily for commercial reasons (LCSG 2011), but as mentioned, crab larvae (megalopae) can be an important food source for juvenile salmon in the ocean environment. Dungeness crab are found in the nearshore environment including at all the disposal sites, and in the Columbia River up to about RM 17.

Dungeness crabs may be vulnerable to entrainment and burial during dredge and disposal operations. Corps (2007) reports young-of-the-year crab are most often entrained whereas older crabs were entrained in lesser numbers. Dungeness crab are also susceptible to injury from burial. Dungeness crab are able to survive burial but the depth, sex and age of the crabs are important variables determining their survival. However, no significant effects to Dungeness crab population abundance that would affect the salmonid prey base are likely as the amount of Dungeness crab habitat affected is a very small fraction of the available coastal habitat (LCSG 2011).

Green sturgeon feeding habits are poorly understood but in the ocean it is assumed, as discussed in Section 2.3.3, that sturgeon are feeding on benthic organisms including crabs, other

invertebrates and fish. The total area potentially affected by ocean disposal is very small compared to the total area of habitat that may be occupied by green sturgeon and their prey; and ocean disposal is not expected to significantly affect benthic species populations (Corps 2007, LCSG 2011).

Dredging and disposal activities that may impact the physical habitat and prey base could contribute to the limiting factors and threats identified in Tables 32-34 including:

- Dredging and altered sediment balances (eulachon).
- Degraded estuarine and near-shore marine habitat (salmonids)
- Degraded freshwater habitat including reduced complexity and access to off-channel rearing habitat in the LCR (salmonids)
- Reduced productivity resulting from sediment and nutrient-related changes in the estuary (salmonids).
- Disturbance of bottom substrates adversely affecting prey resources (green sturgeon)
- Disposal activities burying food resources (green sturgeon).

However, NMFS is confident, based upon the above analysis, that the Corps' proposed action to maintain the FNC will not significantly affect the physical habitat or prey base for ESA-listed salmonids, eulachon, or green sturgeon. Upland disposal, approximately 10% of the dredged material in 2011, will result in some loss of sand within the river system but the extent to which the lost material will affect habitat forming processes is unknown. The proposed action is consistent with the management recommendation to reduce the export of sand and gravels via dredge operations by using dredged materials beneficially as the majority of the dredged material is disposed within the system. Overall, the effects to the physical habitat and prey base are geographically limited compared to the available habitat and the adverse effects are of short duration.

Suspended Sediment/Turbidity. Dredging and disposal operations can increase suspended sediments. Not all sediment is captured by the dredges; some will be redeposited on the bottom while some will be suspended in the water column increasing turbidity (Hayes *et al.* 2000). In-water disposal such as ocean disposal and flowlane disposal deposit the dredge material directly into the water column and thus are potentially the greatest contributors of suspended sediment and turbidly due to dredging. Beach nourishment and upland disposal may also increase turbidity as deposited material washes back into the water.

Little is known concerning the biological responses of fish to suspended sediment doses associated with dredging and much of the available information concerns salmonids (Wilber and Clarke 2001). Eulachon are known to spawn, and larvae survive, in naturally turbid glacial rivers. While turbidity from dredging may be a threat to eulachon, and turbidity from dredging has been found to be potentially harmful to fish with similar egg and larval life histories (Wilber and Clark 2001).

Green sturgeon are found near the bottom of the FNC, however, we do not believe green sturgeon will be significantly affected by suspended sediment and turbidity generated during dredge and disposal operations. Green sturgeon are naturally found in the main Columbia River

channel near the bottom. Flow velocities along the bottom of the FNC range from 5 ft./sec. to 10 feet/sec. with moving sand waves. The suspended sediment and associated turbidity plumes produced by dredging and disposal should rapidly be dispersed and settle to background levels. Parsley *et al.* (2011) did not specifically quantify suspended sediment produced during hopper disposal but based upon the response of the tagged white sturgeon the disposal did not significantly affect the fish.

With no other specific information, the primary focus of the following discussion will be on the effects of increased suspended sediment and turbidity on salmonid growth and survival.

Increased suspended sediments and turbidity can affect all life stages of fish that prefer clear over turbid water. The particulate material in suspended sediment can physically abrade and mechanically disrupt fish gills and reduce the ability of site feeding species such as salmonids to capture prey (see Wilber and Clarke 2001).

The potential effects of increased suspended sediment on the growth and survival of juvenile salmonids depends not only on the amount of suspended sediment generated in an aquatic environment but the dosage. The dosage is the concentration combined with the exposure or the amount of time a fish is exposed to elevated levels of suspended sediment (Newcombe and MacDonald 1991). The type of dredge, characteristics of the substrate and environmental conditions including local hydrodynamics all influence the potential sediment dosage that may be experienced by aquatic species (Wilber and Clark (2001).

Increased suspended sediment can result in four general responses by salmonids; no response, behavioral, sublethal, or lethal responses (Suttle *et al*. 2004, Wilbur and Clarke 2001, Servizi and Martens 1992, Newcombe and Jensen 1996, Newcombe and MacDonald 1991). Wilber and Clarke (2001) describe behavioral and sublethal responses as:

- Behavioral responses include alarm reaction, the abandonment of cover, and avoidance response.
- Sublethal responses include short-term reduction in feeding rates, or success, minor physiological stress such as increased coughing or respiration rates, moderate physiological stress, moderate habitat degradation, impaired homing, and indications of major physiological stress such as long-term reduction in feeding rate or success.

Generally speaking, mechanical dredges (*e.g.* bucket or clamshell) increase suspended sediment concentrations more than hydraulic (hopper or cutterhead) dredges. Mechanical dredges generate suspended sediment through impact and withdrawal of the bucket from the bottom, the material washing from the bucket as it moves through the water column and above the water surface, and the loss of water when the material is loaded onto the barge. Suspended sediment concentrations of 1,100 mg/l extending as far as 1,000 meters along the bottom of a clamshell dredge may occur (Wilber and Clark 2001).

Hydraulic dredges mix water with sediment to form a slurry that is either pumped through a pipeline or into a hopper bin. Turbidity produced by a cutterhead (pipeline) dredge depends upon the rate of the cutterhead rotation, the vertical thickness of the dredge cut and the swing rate of

the dredge. The maximum suspended sediment concentrations produced by pipeline dredges are generally less than 500 mg/l and bottom suspended sediment plumes are usually no more than 500 meters from the dredge.

Hopper dredges generate suspended sediment and bottom turbidity as the dragheads are pulled through the bottom sediments. Surface turbidity may occur if the hoppers overflow during loading in order to increase the sediment load in the hopper bins. Suspended sediment plumes may extend 1,200 meters along the bottom at concentrations as great as 800 mg/l (Wilbur and Clark 2001).

Simple sediment severity models have been developed to help managers estimate potential impacts of suspended sediment on freshwater fishes (see Wilber and Clark 2011). The sediment severity models however have not always provided accurate predictions of the response of fish to sediment in natural settings, potentially over stating effects at least at a population level. Smedley *et al* (2011) in their study of streams draining agricultural areas in Canada found the sediment dosage (or severity of ill effects) models did not provide good predictor of fish population response to sediment. Natural variability in flow and sediment regimes are not easily incorporated into the models and other indicators such as water temperature and avoidance behavior may play a role in observed fish population responses. The suspended sediment caused by dredging may also be substantially less than concentrations caused by major storms. Estimates of suspended sediments displaced by major storms in the Thames River, Connecticut were nearly an order of magnitude greater than that produced by dredging (Bohlen *et al.* 1979 as cited in Wilbur and Clark 2001).

The potential effects to salmonids and other fish due to suspended sediment depends whether the exposure is continuous or intermittent (Wilber and Clark 2001). Suspended sediment doses as a result of hopper dredges may be similar to the intermittent exposures due to tidal flushing as the hopper dredge operation is discontinued to off-load the material. Flowlane disposal would be likely to result in greater suspended sediment than the actual dredging. Flowlane disposal from a pipeline dredge may result in a continuous exposure while the dredge is operating, although stream current and tidal flushing may alleviate the exposure to sediment plumes (Wilber and Clark 2001). In areas with little flow, a fluff zone in which the settling of particles is inhibited as the concentration of suspended sediment lower in the water column increases may develop. In some situations, a fluff zone may continue to exist for a few weeks after the end of dredge operations (Wilber and Clark 2001).

Wilber and Clark (2001) stated that under most dredging scenarios, fishes and other motile organisms encounter suspended sediment plumes for exposures of minutes to hours unless the organism is attracted to the plume. Wilber and Clark (2001) estimated that the most likely suspended sediment doses encountered by out-migrant salmonids would be up to 1,000 mg/l for one day. Such dosages primarily result in sublethal responses but mortality may occur at concentrations above about 500 mg/l for a day. Exposures at concentrations from about 100 mg/l to almost 1,000 mg/l for less than two hours may result in either behavioral or sublethal responses. Concentrations of around 50 mg/l and higher up to about 1,000 mg/l for 2 hours may result in behavioral or sublethal responses.

Natural suspended sediment concentrations in the LCR range from less than 10 mg/l at 100,000 cfs; about 20 mg/l at 200,000 cfs; from 20 to 50 mg/l at 300,000 cfs and 20 to 60 mg/l at 400,000 cfs. Levels of turbidity generally follow the hydrograph with turbidity rising during the spring freshet and winter floods. Turbidity levels are below 10 nephelometric turbidity units (NTU) most of the year and only exceed 20 NTU during high flows, although they can exceed 70.0 NTUs during flood flows.

The Corps (2001) estimated sand resuspended during dredging would redeposit on the substrate in one to two minutes. The resuspended sediment from hopper dredge overflow is mostly fine sediment and individual particles may remain in suspension up to four months depending on flow condition. The actual increase in suspended sediment due to maintenance dredging the FNC will depend on the number of dredges (there was no estimate provided for mechanical dredges) working at one time but is generally estimated to be less than 2 mg/l when flow is at 100,000 cfs (Corps 2001).

The Corps (2001) also discussed potential suspended sediment and turbidity increases due to disposal. Flowlane disposal by hopper dredges will begin in the bottom 19 -29 feet of the water column. Subsequent suspended sediment concentrations are estimated to be between zero and 20 mg/l diminishing to background levels as the predominately sandy material settles and the turbidity plume is dispersed downstream (Corps 2001). The Corps (2001) did not anticipate salmonids to be greatly affected by pipeline disposal. The Corps assessment was based on a pipeline discharge 20 feet or more below the water surface. The bulk of the disposed material is sand likely to settle to the substrate in about five minutes while any fine material would remain in the water column. The total downstream suspended sediment increase at a river discharge of 100,000 cfs was estimated to be only 1 mg/l.

Shoreline disposal or beach nourishment involves a pipeline discharging a water/sediment slurry on to a beach. The beach is built out into the river with the return water flowing into the river. Suspended sediment increases adjacent to the beach and dissipates as it is dispersed downstream. The Corps (2001) reported increased turbidity of 5 to 15 NTUs 50 feet offshore from a beach nourishment site. The increased NTUs were estimated to equal increased suspended sediment from 10 to 30 mg/l based upon the relationship between NTUs and silt/clay concentrations observed in the Columbia River (Corps 2001). The increased turbidity and suspended sediment was not likely to be detrimental to fish as the turbidity plume will diminish to background levels as it moves downstream. Also, the beach nourishment sites are highly disturbed, erosive areas with little or benthic productivity and subsequently few salmonids (Corps 2001). Corps (2001) expected no turbidity increase from upland disposal at that time due to the use of settling ponds.

Dredging at the River Mouth and associated ocean disposal are not likely to expose ESA listed fish to adverse concentrations of suspended sediment or turbidity. The dredged material at the River Mouth is primarily sand that will rapidly settle or be dispersed in the naturally turbid and dynamic nearshore environment. Dredge material disposed at the Deep Water Site will also rapidly settle to the bottom and while in suspension will be diluted by the volume of ocean water.

Water quality standards for turbidity allow no more than a ten percent cumulative increase in natural stream turbidity relative to a control point upstream of a turbidity causing activity.

Limited exceedences may be allowed to accommodate essential dredging (ODEQ 2008b). Monitoring results of the FNC maintenance operations appear to support the Corps (2001) estimates that suspended sediment and turbidity levels created by the operations are small and short term with the largest potential increases occurring during beach nourishment. No turbidity increases due to dredging operations have been recorded at the River Mouth (ODEQ 2008a). ODEQ (2008b) reports that in two years of turbidity monitoring during dredging in the FNC the water quality criteria for turbidity were exceeded 12 times in 336 turbidity measurements. No turbidity exceedences were recorded by Corps in the 2011 (Casey 2012).

Based upon the above analysis, we believe the potential increased suspended sediment and turbidity during dredging and disposal in the FNC will be short term and localized. Fish caught directly in a discharge plume may experience short-term behavioral responses. Generally the short term effects are likely to be infrequent and limited in area. The effects to eulachon are unknown. The Corps (2001) estimates of suspended sediment created by maintaining the FNC are one to two orders of magnitude below the dosage where sublethal or lethal effects to salmonids are likely to occur. The increase turbidity due to dredging the FNC is likely to be negligible compared to the naturally variable turbidity levels in the Columbia River (ODEQ 2008a and ODEQ 2008b). Some minor short term water quality standards for turbidity are likely to be exceeded, but within the allowances for dredging (ODEQ 2008b).

Short term behavioral or sublethal responses due to suspended sediment created by channel maintenance operations in the FNC are not likely to injure or kill any individual fish. Any sublethal responses are likely to be limited to a short term reduction in feeding rates or minor physiological stress such as increased coughing or respiration rates. The number of fish potentially affected is unquantifiable. The potential for adverse effects is further reduced in that the initial discharge plume from a hopper dredge will begin 19 to 29 feet below the surface and pipeline dredges are required to discharge below depths of twenty feet. Juvenile outmigrating salmonids are generally higher in the water column. The potential for adverse effects is further diminished in that most routine dredging occurs after the main smolt outmigration and ends before the usual peak migration of eulachon into the Columbia River and non-routine dredging affects a small part of the habitat potentially occupied by ESA-listed species for a small amount of time (see Section 2.4.1).

Adult salmon and steelhead may be migrating upstream during dredging operations. Effects to migrating adult fish are likely to be insignificant as the adult fish should simply avoid any sediment plumes and any increase in suspended sediment and turbidity is within the natural range of conditions commonly encountered by both upstream migrating adults and downstream migrating smolts.

The greatest increases in suspended sediment and turbidity within the FNC are likely at the three beach nourishment sites. These erosive sites are generally not favored habitat for juvenile salmonids and any fish that may be moving within the vicinity are likely to avoid any sediment plume.

Dredging caused turbidity levels that are potentially harmful to fish are a greater concern in the side channels due to the fine-grained substrate that may stay suspended in the water column

(ODEQ 2008b). NMFS currently has no information to estimate the concentration of suspended sediment dredging the side channels may generate, or the length of time different concentrations may be likely to persist. The amount of suspended sediment will also depend on the type of dredge used. Both mechanical and hydraulic dredges may be used in the side channels depending upon availability and the amount of work required. The amount of suspended sediment may be closer to the high end created by the different methods as reported in Wilbur and Clarke (2001) due to the fine material. The duration suspended sediment caused by dredging the side channels is likely to be longer than in the FNC due to the combination of fine material and lower flow rates. The potentially higher dosages in the side channels may approach the potential for lethal effects, especially if they persist for a day or more. It is also not known if a "fluff" zone will develop although tidal action will dissipate the material.

The nature of the potential effects to individuals and habitat are somewhat diminished in that Corps' proposed in-water work period for side channel dredging occurs during the period of lowest yearly juvenile salmonid densities and prior to the usual peak eulachon outmigration. The quality of juvenile salmon rearing habitat and eulachon migratory habitat may be reduced due to side channel dredging as juvenile salmon may be subjected to sublethal to lethal concentrations of suspended sediment when the side channels are dredged. The area affected and suspended sediment dosage within any side channel will depend on the type of dredge used plus the flow and tidal conditions. The effects to eulachon, especially upstream migrating adults, are unknown; however eulachon are found in naturally turbid rivers and the effects are likely to be minor.

Disposal of dredge material from the side channels occurs in the flowlane or upland sites so are similar to those effects described for the FNC above.

Dissolved Oxygen. Dredging sediment with a high organic content can cause a decrease in dissolved oxygen due to higher BOD. As the organic material, especially fine material increases in the water column the more dissolved oxygen is used to decompose the material. The potential for dredging to reduce DO to levels harmful to ESA listed fish are greatest in the side channels during the summer when water temperatures are high, the solubility of DO in water is decreased, and the metabolic needs of fish increase.

Eulachon are not present in the Columbia River during the summer and green sturgeon are usually found in deeper water so the concern regarding the potential for decreased dissolved oxygen is greatest for the ESA-listed salmonids. While salmonids should not be adversely affected at DO concentrations down to 8 mg/l, juvenile salmon sustained swimming speeds are sharply decreased at DO concentrations of 6.5-7.0 mg/l. Salmonids may be able to survive DO concentrations as low as 5 mg/l but growth, food conversion efficiency and swimming performance are all adversely affected.

The State of Oregon LCR dissolved oxygen water quality standard for cold-water aquatic life is not less than 8.0 mg/l as an absolute minimum. Where natural conditions of barometric pressure, altitude and temperature preclude attainment of 8.0 mg/l dissolved oxygen may not be less than 90% saturation. At the discretion of the Oregon Department of Environmental Quality, the dissolved oxygen may not fall below 8.0 mg/l as a 30-day mean minimum, 6.5 mg/l as a seven-day minimum mean and, may not fall below 6.0 mg/l as an absolute mean (ODEQ 2008a).

Dissolved oxygen concentrations in the LCR naturally range between 9.0 and 15.8 mg/l (ODEQ 2008b). The lowest dissolved oxygen concentrations coincide with high summer water temperatures (Johnson *et al*. 2011).

Decreases in DO as a result of dredging and disposal are not a concern in the FNC or at the River Mouth (ODEQ 2008a and ODEQ 2008b). The FNC and River Mouth substrate is primarily sand with little fine organic material. The volume of water flow through the FNC and River Mouth will quickly dissipate the little organic material that may be present so a significant increase in BOD will not occur. For the same reasons, ocean disposal will also not cause adverse declines in DO.

Dredging the side channels during the summer and early fall presents the greatest threat to ESA-listed salmonids, particularly subyearling Chinook salmon. The potential for high water temperatures, naturally low DO concentrations, approaching 8.0 mg/l, and the fine substrates create the conditions where a localized increase in BOD could cause adverse reduction in DO.

Most side channels are not dredged each year and the timing depends on dredge availability so NMFS cannot predict how often the dredging may cause DO concentrations to fall below 8.0 mg/l. Based upon temperature and DO graphs in Johnson *et al* (2011), adverse reductions in DO may be a realistic possibility when the water temperatures in the side channels are above 15ºC. The frequency that dredging side channels may cause adverse reductions is likely to be low as the side channels are dredged on an intermittent basis. The severity of adverse reductions in DO is also relatively low because DO concentrations should recover as either water temperatures drop, or the suspended material settles or is dissipated by river flow and tidal action.

The type of dredge used, river flow and tidal conditions will influence the potential for reduced DO if a side channel is dredged during warm water periods. Clamshell dredges generally produce higher suspended sediment concentrations and larger turbidity plumes. Hopper dredge may produce a turbidity plume similar to a clamshell dredge. Pipeline dredges generally mobilize less sediment and create a smaller turbidity plume than either clamshell or hopper dredges. River flow and tidal action determine the rate the suspended sediment is dissipated and water re-oxygenated.

The fish caught directly in the turbidity plume are most likely to be affected by a decrease in the DO concentration. The Corps proposed in-water work period should avoid exposing eulachon to decreased dissolved oxygen. Eulachon are not likely to be present in the action area during the summer and operations during November and December when water temperatures are cold and DO levels naturally high are less likely to result in harmful reductions in DO. The relatively large green sturgeon should be able to avoid any areas of low DO concentration. Salmonids exposed to DO concentrations below 8.0 mg/l may suffer an increase in metabolic stress and decreased swimming performance making the affected fish more susceptible to predation until the DO concentrations return to normal. If dredging results in extreme reductions in DO exposed juvenile salmonids may be killed. Fish outside the area affected by the low DO concentrations are likely to be able to avoid waters with a low DO concentration. There is also the possibility that some adult fish could encounter the low DO concentrations while migrating to streams tributary to the side channels in fall. The adult fish are likely to swim around areas of low DO or

possibly delay the migration. The dredges are not operating at all times so any possible delays are likely to be very minor.

Adverse decreases in DO are not likely due disposal of the side channel material. Material dredged in the side channels is disposed in the flowlane where the material should be quickly dispersed and diluted; or at upland sites.

Dredging the side channels during the summer and fall may injure or result in the death of some subyearling salmonids. Similar to the effects of suspended sediment, NMFS cannot quantify the amount of habitat or number of fish that may be affected by reduced DO. Factors such as water temperature during dredging, the organic content of the sediment, and river and tidal flows during dredging all influence the DO concentration during dredging. However due to the small amount of shallow water habitat potentially affected in any year we believe there will not be any population level effects due to dredging caused reductions in DO.

Contaminants. The Columbia River is currently classified as water quality limited under the Federal Clean Water Act, section 303(d), for DDE (DDT metabolite); PCB; and arsenic. Other contaminants of concern that have been detected in the Columbia River include dioxin, a number of metals and PAHs. Dredging has the potential to resuspend contaminants which may be present in sediment, making them bioavailable and thereby degrading the ecological integrity of the direct area as well as areas downstream (Fresh *et al*. 2005, ODEQ 2008a, ODEQ 2008b). PCBs and DDT have been found in juvenile fish that exceed levels that may cause health effects and could be toxic to juvenile salmonids.

Stream-type, yearling salmonids may be most susceptible to contaminants in the water column such as organophosphate pesticides and dissolved metals while ocean-type subyearlings may also be susceptible to sediment derived contaminants such as PCBs and DDTs. Contaminants are a concern for eulachon as the species have been found to carry high levels of chemical pollutants. The potential resuspension of harmful contaminants during dredging has been identified as a threat to eulachon in the Columbia River. Re-suspension of contaminants is also a potential threat to green sturgeon.

It is unlikely that dredging the coarse-grained materials in the FNC, including the River Mouth, will release contaminants at levels harmful aquatic organisms (ODEQ 2008a and ODEQ 2008b). The results of the most recent sediment sampling in the FNC confirmed that most of the material to be dredged in the FNC is sand. Twenty-three samples were tested for metals and none exceeded the SEF (2009) screening levels. Pesticides and PCBs were found in four of 23 samples but no sample exceeded the screening levels. PAHs were detected in all of the 23 samples submitted for chemical analysis but the concentrations were below the SEF screening level (Corps 2009b). Similar results were reported for sediment sampling between Vancouver, Washington and The Dalles, Oregon (Corps 2009c). As reported by the Corps (2011c), the analysis showed no significant changes from previous sampling efforts and FNC sediment meets the SEF (2009) very-low category; suitable for dredging and unconfined in-water placement with no further testing required for ten years.

Unlike the mainstem FNC, fine sediment and organic material that may contain contaminants are more likely to be present in the side channels and Portland-Vancouver Anchorage. The results of the most recent sediment sampling for contaminants in the side channels were summarized in the environmental baseline. Sediment contaminant levels in the side-channels, except one sample from Skipanon Channel, met the unconfined in-water placement screening criteria in place at the time of sampling. Only Baker Bay sediments have been analyzed under the current SEF (2009) screening criteria (Corps 2011c). The Corps (2011c) states sediment sampling utilizing the current screening criteria will occur prior to dredging in the side channels and Portland - Vancouver Anchorage. If concentrations of contaminants in the sediment exceed SEF (2009) screening criteria and are determined to be unsuitable for open water disposal, according to the requirements of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act, then disposal is limited to confined disposal; subject to the applicable environmental regulations for confined disposal.

While the contaminant levels in side channel sediment has been within screening levels, most of the side channels have not been tested using the current screening criteria and the potential for synergistic or cumulative effects remains a question. The Columbia River Basin is heavily developed and contaminants will continue to enter the system from industrial, urban and agricultural sources. The side channels with their low water velocities and fine-grained, organic sediment are potential areas for contaminants to accumulate then be resuspended during dredging.

A number of factors determine whether toxic substances are present in amounts that are detrimental to aquatic life including: bioavailability of the form; dilution; the uptake mechanism; duration of exposure, any synergistic effects between the different contaminants, local environmental conditions and cumulative concentrations of the chemicals (ODEQ 2008a and 2008b). This complex array of factors makes predicting the potential effects from toxics liberated due to sediment disturbance during dredging difficult to effectively isolate (ODEQ 2008b).

Water pollution is a limiting factor for eulachon (Table 31) and contaminants are considered a limiting factor for many ESA-listed salmonids (Table 32). NMFS cannot predict the potential effects to salmonids and eulachon of contaminants being released by dredging operations and either directly exposing ESA-listed fish to the contaminants or indirectly exposing the fish to contaminants through their food web. We believe, based upon current information, that following the processes outlined SEF (2009) and any future revisions, combined with the results of past testing and the small amount of side channel habitat that may be dredged; the potential re-suspension of contaminated sediment due to dredging operations is not expected to affect more than a few fish. The potential exposure of fish to resuspended sediments is low as; the contaminant levels in the side channel substrates have been within screening criteria, a very small amount of potentially contaminated sediment is disturbed in any year and the protective measures outlined in SEF (2009).

Accidental spills are another potential pathway for ESA-listed fish to be exposed to contaminants. Dredging equipment will be operating in and over water. The use of mechanized equipment on and in proximity to water creates the potential for toxins to be introduced into the water column (ODEQ 2008a). The equipment requires the use of fuel, lubricants, and other

petroleum products, which, if spilled into the water during project activities could injure or kill aquatic organisms. The Corps proposed action includes requirements for a spill control plan including immediate cleanup. All contractors are also required to submit a spill control plan to the Corps before beginning operations (Smith 2012a).

A spill control plan requiring a rapid response and cleanup in case of an accidental spill of fuel, lubricants and other petroleum products should help limit the adverse effects to fish and habitat if a spill occurs. There is always potential for a spill when dredges or other machinery are operating in or near water so the risk to ESA-listed fish and aquatic habitat is always present during the dredging. NMFS believes that the probability of a spill is low but cannot be discounted over the life of the proposed action. We cannot predict the frequency or severity of a potential spill. However, adherence to BMPS reduces the probability of a large spill such that we expect only minor effects from small releases of contaminants.

Upland Disposal – Avian Predation. The construction, operations and maintenance of the FNC has in part been responsible for increased predation on juvenile salmonids by Caspian terns and double-crested cormorants. The disposal of dredge material created islands and suitable nesting habitat for the terns and cormorants. Pile dikes constructed to help maintain the FNC provide resting, loafing and feeding platforms, especially for the cormorants. Before 1984, there was no known Caspian tern nesting in the LCR and by 2001, the majority of Caspian terns on the west coast were nesting on East Sand Island. East Sand Island also supports the largest double-crested cormorant nesting colony on the west coast of North America.

Predation on juvenile salmonids by Caspian terns and double-crested cormorants has been identified as a limiting factor for the recovery of ESA listed salmon and steelhead. Management actions identified by NMFS (2011b) to reduce predation on juvenile salmonids include:

- Implement projects to redistribute part of the Caspian tern colony currently nesting on East Sand Island.
- Implement projects to reduce double-breasted cormorant habitat and encourage dispersal to other habitats.

The Corps does not describe any avian predation management activities in the proposed action. The Corps, the Bonneville Power Administration and the U.S. Bureau of Reclamation are however implementing avian predation management actions as required in the opinion for operation of the FCRPS. The opinion includes two reasonable and prudent alternatives specifically addressing Caspian tern and double-crested cormorant predation:

- RPA 45 – Reduce Caspian terns on East Sand Island in the Columbia River Estuary.
- RPA 46 – Develop a cormorant management plan.

Implementation of RPA 45 includes reducing the amount of nesting habitat on East Sand Island and construction of new nesting habitat in historically occupied areas outside the Columbia Estuary. The Corps is developing a cormorant management plan in compliance with RPA 46. A draft environmental impact statement for the plan was released in February 2012.

Disposing the dredge material at upland sites does have the potential to create new nesting habitat for Caspian terns and possibly double-crested cormorants if the sites are not monitored and measures immediately implemented to discourage nesting. The Corps has been monitoring the upland sites. Based upon the monitoring, Caspian terns and double-crested cormorants are not known to be nesting where dredged material is currently disposed. Therefore we do not expect significant predation due to the potential creation of nesting habitat at the upland disposal sites. Management actions are being implemented or planned consistent with the FCRPS and the recovery plan but the success of those actions is not yet known.

Beach Nourishment – Stranding Beach nourishment involves disposing dredge material on selected river banks to restore eroding shorelines and to prevent juvenile salmon from becoming stranded due to ship wakes. Beach nourishment can affect ESA listed species, particularly subyearling salmon, by increasing turbidity, pump entrainment, or altering the habitat and prey base if the disposed material is different than the natural substrate(discussed above); and by creating conditions that may enhance or prevent juvenile stranding due to ship wakes.

The proposed action will continue beach nourishment at three locations; Miller Sands, Skamokawa Vista Park, and Sand Island at St Helens. The new Bensen Beach ocean disposal site is also a beach nourishment site. BMPs for beach nourishment include grading the disposal site to a slope of 10 to 15 percent with no swales to reduce the possibility of stranding. Beach nourishment as described with the BMPs should not result in stranding, will help restore shoreline and nearshore habitat and is consistent with recovery actions to address the beach stranding threat to the recovery of ESA listed salmon.

2.4.3 Effects on Critical Habitat within the Action Area

The action area includes designated critical habitat for ESA-listed salmon and steelhead, eulachon and southern green sturgeon. The primary constituent elements of salmon and steelhead critical habitat considered in this opinion include: freshwater spawning, rearing and migration; estuarine areas, nearshore marine areas and offshore marine areas. Designated critical habitat for eulachon includes freshwater spawning and rearing and freshwater migration. Southern green sturgeon designated critical habitat within the action area includes estuarine areas and coastal marine areas. The southern green sturgeon freshwater riverine system component of critical habitat is not found within the action. The life history events tied to the freshwater riverine system are: spawning; embryo incubation, growth and development; larval emergence growth and development; and juvenile metamorphosis, growth and development. For the southern green sturgeon, these life history events occur in the Sacramento River system.

The information provided below provides a synopsis of the discussion in Section 2.4.2

Pacific salmon and steelhead

1. Freshwater spawning sites
   a. Substrate. No effect, freshwater spawning sites are avoided.
   b. Water Quality. No effect, in-water work windows avoid spawning periods.
   c. Water quantity. No effect

2. Freshwater rearing
    a. Floodplain connectivity. No effect
    b. Forage. *Direct* – A very small proportion of the forage base may be entrained and killed when the side channels are dredged. The amount of forage potentially killed is small as the area of shallow water habitat inhabited by forage organisms is very small compared to the total shallow water habitat and the affected species typically are able to recolonize quickly. Forage does not appear to be limiting growth and survival of juvenile salmonids. *Indirect* – A limited amount of rearing habitat will be disturbed when the side channels are dredged. The affected habitat is very small compared to the total available habitat and the effects are short –term as the habitat recovers quickly and most of the side channels are not dredged annually. The vast majority of the dredged material is disposed in the flowlane thus maintained in the system. Beach nourishment may help restore forage habitat over time. The main FNC is not a productive forage habitat. Resuspension of contaminants in the water column may exposure juvenile salmonids harmful, sublethal dosages of toxins however the potential impacts are reduced by adhering to the SEF (2009) process and framework.
    c. Natural Cover. No effect
    d. Water quality. *Direct* – Dredging will increase turbidity, and dredging the side channels may reduce dissolved oxygen. Increased suspended sediment and any reduction in dissolved oxygen should be short-term and limited in extent. *Indirect* – Resuspension of contaminants in the substrate may expose salmonid prey to toxins that may harm the prey or bioaccumulate in juvenile salmonids that feed on the contaminated organisms. The potential impacts are reduced by adhering to the SEF (2009) process and framework.
    e. Water quantity. No effect.

3. Freshwater migration**.**
    a. Free of artificial obstruction. *Direct* – Adult salmon and steelhead may be exposed to dredging and disposal. The adult fish should be able to avoid the dredging and escape or avoid any turbidity plumes. Turbidity created when the side channels are dredged may delay migration into tributary streams for a very short duration.
    b. Natural cover. No effect
    c. Water quality. See freshwater rearing above
    d. Water quantity. No effect.

4. Estuarine areas
    a. Forage. See fresh water rearing, above.
    b. Free of artificial obstruction. See freshwater migration above
    c. Natural cover. No effect
    d. Salinity. No effect
    e. Water quality. See freshwater rearing above.
    f. Water quantity. No effect.

5. Nearshore marine areas
    a. Forage. *Direct* - The prey species that may potentially be buried during disposal operations in the nearshore environment are adapted to a dynamic environment and

are able to rapidly recolonize. The ability of most prey species to rapidly recolonize and the amount of habitat and thus the forage base is very small compared to the area of nearshore habitat. *Indirect*- Ocean disposal in the nearshore environment is considered a beneficial use of the dredged material. Disposal in the littoral cell may help restore degraded nearshore habitat.

b. Free of artificial obstruction. No effect
c. Natural cover. No effect
d. Water quantity. No effect
e. Water quality. *Direct* – Increased turbidity due to dredge material disposal in the nearshore environment will be short –term. The material disposed in the nearshore environment is primarily sand that will settle rapidly or be dispersed in the dynamic environment. The sandy material is very unlikely to result in decreased DO, especially in the ocean environment and the material is largely free of contaminants.

6. Offshore marine areas.
   a. Forage. *Direct* – Some forage species may be entrained in the disposal plume but the Deep water ocean disposal site is very small so the amount of prey potentially affected is very small compared to the available prey base.
   b. Water quality. *Direct* – See nearshore marine areas, above.

Eulachon

1. Freshwater spawning and incubation
   a. Flow. No effect
   b. Water quality. See salmon and steelhead fresh water rearing, above.
   c. Water temperature. No effect.
   d. Substrate. *Direct* - Dredging and disposal will disturb spawning and incubation habitat. The amount of habitat impacted is very small compared to the available habitat. In-water work windows reduce the amount of spawning and incubation habitat that may be impacted and the duration of the impact is very short and the habitat will recover quickly. *Indirect* – Most of the dredged material is disposed in the flowlane where it is available to create habitat.

2. Freshwater migration
   a. Flow. No effect
   b. Water quality. See salmon and steelhead freshwater rearing, above.
   c. Water temperature. No effect
   d. Food. The construction of dams on the mainstem Columbia River, and the loss of historic freshwater marshes due to development in the lower Columbia River may have altered the forage base for eulachon. The extent of the effect whether beneficial or detrimental is not understood. The proposed action will have no effect.

Southern Green Sturgeon

1. Estuarine areas
   a. Food Resources. *Direct* – Dredging may entrain bottom dwelling organisms
   b. Migratory corridor. No effect
   c. Sediment quality. No effect

d. Water flow. No effect.
e. Water depth. *Direct* – Dredging by nature increases the depth of a channel. Increasing the depth in the dynamic shoaling areas is not expected to fundamentally alter the habitat at the scale of a river segment and increasing depth does not necessarily diminish to conservation value of the habitat. Disposal may decrease depth but flowlane disposal affects a very small amount of the deep water habitat.
f. Water quality. See salmon and steelhead rearing, above.

2. Coastal marine areas.
   a. Food resources. *Direct* - Ocean disposal may bury some sturgeon prey but a population level effect is not expected as the numbers of individual prey species that may be affected is very small compared to the total prey populations. The affected populations are expected to rapidly recover. *Indirect* – Benthic habitat should not be affected as the material being disposed is similar to the substrate material that would be naturally present.
   b. Migratory corridor. No effect
   c. Water quality. See salmon and steelhead nearshore areas, above.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Future state and private actions are likely to continue to affect ESA-listed species in the Columbia River, although it is not possible to predict which specific actions will be significant given the broad geographic landscape covered by the action area, the geographic and political variation in the action area, uncertainties associated with Tribal, state, and local governments, and private actions.

Actions to restore the LCR estuary habitat are a high priority for all parties working for the recovery of salmon and steelhead in the Columbia River estuary. The states of Oregon and Washington, in partnership with Columbia River Basin Indian Tribes are likely to continue restoration of shallow-water habitats and reduction of avian predation. Commercial activities related to shipping and port development are important to the regional economy, but cannot proceed independently from unforeseeable trends in international trade.

Human population in the LCR, especially the Portland-Vancouver area, is likely to continue to grow and increase demand for commercial and residential development or redevelopment beside the river. However, the level of environmental protection provided by development codes and standards continues to improve.

The adverse effects of agriculture, forestry, and development were discussed in the environmental baseline, and are likely to continue. However, the net impact of such those activities combined with restorative redevelopment and active restoration efforts is likely to be a gradual reduction in the legacy problems of problems created by earlier patterns of state and private use of land and water in the LCR, and a gradual improvement in aquatic habitat conditions.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step of NMFS' assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5) to formulate the agency's opinion as to whether the proposed action is likely to: (1) Result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 2.2).

The status of the species affected by the proposed action varies from very high risk (SR sockeye salmon) to moderate risk (MCR steelhead). The status of critical habitat at the designation-wide scale varies. Critical habitat within the action area has been degraded by human activities including; the construction and operation of dams in the Columbia basin, construction of the FNC, flood protection, and urban development Many salmonid species complete the entire freshwater part of their life history there, and others encounter the action area a primary migration corridor connecting their natal tributaries to the Pacific Ocean.

As described in Section 2.2, all Columbia River salmon and steelhead species, and eulachon migrate through the action area twice, once as out-migrating juveniles and then again as adult fish on their upstream spawning migration. The LCR is an important summer habitat for the southern green sturgeon. The viability of the various populations that comprise the 13 salmon and steelhead species considered in this opinion ranges from extirpated or nearly so to populations that are a low risk for extinction. The eulachon population abundance has declined significantly since the early 1990s and at this time, there is no evidence of their returning to former population levels. The viability status of the green sturgeon is not completely understood but this species currently has very low abundance levels.

Adult upstream migrating ESA-listed salmonids are present in the Lower Columbia River primarily from early spring through autumn but upstream migrating fish may be found year-around. The adult fish are generally migrating in the upper 25 feet of the water column but may be found to depths of 50 feet. There is a limited amount of LCR Chinook salmon and CR chum salmon spawning in the mainstem Columbia between RM 113 to RM 142.

The Lower Columbia River is an important rearing habitat for juvenile salmonids. The shallow water habitats are especially important for species expressing an ocean-type life history that spend an extended amount of time in the estuary. The highest densities of juvenile salmon and

steelhead in the estuary occurs in the spring when individuals of all the species may be present, with the lowest densities occurring in the summer and fall. The juvenile fish tend to inhabit shallow waters near the shoreline but have been observed at depths of 20 feet.

Outmigrating stream-type salmonids spend little time in the estuary, migrating downstream through the main channel. The stream-type individuals are generally present from March through June with peak abundances in April and June. The stream-type individuals are usually actively migrating spending little time in the shallow-water habitats although the shallow waters although food produced in the shallow waters may be important to the migrating fish.

The action area also includes the Columbia River plume, the freshwater interface where freshwater exiting the Columbia River meets and rises above the denser ocean saltwater. The plume habitat is especially important for the stream-type out-migrants. The turbid plume waters may benefit early ocean survival by; distributing the juvenile salmon and steelhead away from predation pressure closer to shore, concentrating food resources, and providing cover from predators in the more turbid, low salinity waters.

Eulachon typically enter the Columbia River from mid-December to May with peak entry and spawning during February and March. The eulachon spawn in the mainstem Columbia River, Cowlitz River, Grays River, Skamokawa Creek, Elochoman River, Kalama River Lewis River and Sandy River. Eulachon eggs are believed to hatch in 30 to 40 days. The young eulachon are feeble swimmers, usually near the bottom as they are transported downstream but may be found throughout the water column. Eulachon are frequently found in the Columbia River plume.

Southern green sturgeon enter the Columbia River in May with their peak abundance occurring in August and then the fish move out of the LCR by the end of October. The habitat preferences of the green sturgeon within the Columbia River are not completely understood and current information suggests they may be found in both the deep and shallow water habitats. The ocean environment within the action area provides both foraging and migratory habitat.

The Lower Columbia River is designated as critical habitat for eulachon the Columbia River salmon and steelhead species and green sturgeon. The physical and biological features of eulachon critical habitat that are provided by the Lower Columbia River that may be impacted by the proposed action are freshwater spawning and incubation habitat and freshwater migration. Freshwater spawning, freshwater rearing, adult and juvenile migration corridors estuarine habitat and nearshore marine areas are PCEs of salmon and steelhead critical habitat within the action area. Critical habitat for green sturgeon in the action area includes the PCEs for estuarine areas and coastal marine areas. Climate change and human development have and continue to adversely impact critical habitat creating limiting factors and threats to the recovery of the ESA listed species.

Information in Section 2.3 described the environmental baseline in the action area as a product of development of the Columbia River. Flow regulation and irrigation withdrawals above Bonneville dam have reduced the magnitude of the spring freshet. The Columbia River has been diked for flood control, wetlands filled for development, and pile dikes constructed to help maintain the FNC. The combined effect of flow and habitat changes on estuarine habitat has

been to reduce the amount of shallow-water habitat (especially vegetated habitat such as swamps and marshes). These shallow water habitats are especially important for ocean-type salmon species.

The reduce spring freshet and subsequent reduction in sediment routing into the ocean have impacted the nearshore ocean environment and have unknown effects on the extent of plume habitat. The construction of jetties has narrowed the River Mouth modifying nearshore circulation patterns, shoreline sediment accretion and erosion rates affecting the nearshore habitat. The jetties have also restricted the flow of marine nutrients into the estuary.

The habitat changes and development of the Columbia River for hydropower have altered the food-web in the estuary by reducing nutrient outflow from shallow-water habitat and changing the food web from a macrodetritus to a microdetritus base. The potential impacts to ESA listed species are not fully understood, however the available prey base does not appear to be limiting the growth and survival of juvenile salmon and steelhead.

Upland disposal of dredge material has increased nesting habitat for Caspian terns and cormorants. The enhanced habitat has resulted in higher populations of the avian predators and thus increased mortality to juvenile salmonids due to predation. Another indirect effect of the FNC is juvenile salmon being stranded on beaches by the wakes of large vessels.

Agriculture, mining, industrial discharges and storm water runoff from urban areas has resulted in high levels of contaminants in the Columbia River. The Columbia River is classified as water quality limited under the Clean Water Act section 303(d) for DDE, PCB and arsenic. The concentrations of currently used pesticides and trace metals are also a concern. The true magnitude of the contaminant effects to ESA-listed fish are not fully understood but studies in areas similar to the LCR have shown contaminants to cause immunosuppression, reduced disease resistance and reduced growth rates.

The changes to the estuary habitat have been most pronounced on salmon expressing ocean-type life histories that rely on shallow-water habitats. Flow changes affecting the plume and avian predation are probably more significant for stream-type salmonids. The potential impacts to eulachon due to changed habitat conditions in the Columbia River estuary are poorly understood although the flow alterations, reduced nutrient outflow from marshes, and swamps, and exposure to contaminants has likely diminished the habitat quality for eulachon.

Habitat improvement projects are being actively implemented through salmon recovery efforts and the FCRPS. At the same time, development pressures on the Columbia River may be increasing. The ports of Portland, Vancouver, Longview St Helens and Astoria may be looking to develop additional capacity for grain, coal and liquefied natural gas exports. A growing human population base may increase pressure for development adjacent to the river for both commercial and recreational interests such as boating. The extent to which such activities may further degrade the Lower Columbia River habitat, by increasing dredging needs, especially non-routine dredging, increasing the development of berths and other shipping infrastructure, or preclude some restoration actions is unknown.

As described in Section 2.4, the most important effects of FNC maintenance to ESA-listed fish and critical habitat include entrainment, when fish are trapped during the uptake of sediment and water by dredging machinery, and burial, when fish are trapped by deposition of dredge material in the flowlane or ocean. The risk of entrainment depends upon the likelihood of fish occurring during the dredging and disposal period, dredge depth, dredge operation, and location of the dredging operation. Juvenile salmonids, green sturgeon, and all life stages of eulachon are at risk of entrainment during dredging. Juvenile salmonids and the egg and larval stages of eulachon are likely at greatest risk of burial. Adult salmonids are likely to be able to avoid being entrained or buried and juvenile green sturgeon and adult eulachon are likely to avoid being buried.

Dredging as described in the proposed action, including BMPs to have dragheads and cutterheads buried in the substrate and only raised three feet above the substrate while operating under limited situations, pose a small risk of entraining juvenile salmonids. Entrainment of adult eulachon has been documented at the mouth of the Columbia River and eulachon eggs and larvae on the substrate may also be entrained. Entrainment of green sturgeon has not been documented but based upon a study in the Columbia, documented entrainment of other sturgeon species in other parts of the country, and documented entrainment of other bottom-dwelling fish species, it appears that the smaller subadult green sturgeon in the Columbia River may be at risk. The risk of juvenile salmon being buried during disposal is felt to be small; however the potential risk to eulachon eggs and larvae may be high. Green sturgeon are not expected to be significantly affected by burial at this time.

NMFS was not able to estimate the number of ESA-listed fish potentially killed or injured by entrainment or burial. Therefore, NMFS, using information provided by the Corps, conducted a relative impact analysis to assess the potential duration, frequency, intensity and severity of effects to juvenile salmon, eulachon and green sturgeon. The analysis was conducted based on the time period that the fish may be expected to be in the proximity of dredging and disposal operations. Salmon and steelhead smolts and subadult sturgeon are most likely to be affected by dredge and disposal operations in the main channel, subyearling salmonids in the side channels, and eulachon by dredging either in the FNC or the side channels.

The analysis showed that the amount of time and area dredging operations could potentially kill or injure ESA-listed fish is extremely small compared to the amount of time the fish may actually be present and area of potentially occupied habitat. Therefore, NMFS concluded individuals of ESA-listed fish potentially may be killed or injured, but the number of individual fish actually killed or injured is likely to be extremely small and would not significantly affect the abundance or productivity of any ESA-listed fish population. The risk of impacts resulting in population level effects is also very small because:

- Dredging operations will avoid most of the smolt outmigration period and will occur when juvenile densities in the shallow side channels are lowest.
- Most the side channels are not dredged annually, thus allowing recovery time between impacts.
- Very few smolts are likely to be near the bottom of the FNC so only a very small number of individuals of any population will be exposed to dredging.

- The timing of most dredge and disposal activities avoids the peak migration time of eulachon and when eulachon eggs and larvae are likely to be present
- Flowlane disposal below the mouth of the Cowlitz is prohibited outside the normal dredging season thus minimizing, but not totally avoiding burial of eulachon eggs or larvae.
- The habitat affected by dredging and disposal operations and the short duration of potential effects is extremely small compared to the total available habitat for green sturgeon and the other the ESA-listed species.

The FNC and River Mouth are dynamic environments, used primarily as a migration corridor for adult and juvenile ESA-listed fish. The effects of dredging are not expected to adversely affect the migratory habitat. The very nature of dredging, deepening a channel, changes the physical habitat for some time period. The FNC substrate is primarily sand. The transport and deposition of coarse material such as sand and gravel is important for creating aquatic habitat in the Lower Columbia River. Flow regulation and climate change have decreased the magnitude of the spring freshet and thus reduced the transport of coarse material within the river and out into the Columbia River littoral cell.

Reducing the export of sand and gravel by disposing dredged material within the system, either through flowlane disposal, beach nourishment or ocean disposal is an identified management to reduce limiting factor s and threats to ESA-listed fish.

The most severe effects of the dredging program will occur in the shallow-water side channels. Shallow water habitats are very important rearing habitat for subyearling salmonids and eulachon eggs and larvae may be present, but will only affect approximately 153 acres of over 88,000 acres of available shallow water habitat. Moreover, side channels are not dredged annually so the habitat has time to recover after the disturbance. Dredging and disposal also causes a proportionate disruption in the food web in the estuary and marine environment while dredging the highly dynamic River Mouth and nearshore disposal will not significantly affect the prey base for ESA-listed fish.

Further, less than 10% of the dredged material is likely to be placed in upland sites and will result in some loss of sand within the river system. The extent to which the lost material will affect habitat forming processes is unknown but available information leads us to conclude that the effects will be minor. The majority of the dredge material will be disposed in the flowlane where it will continue to be resorted by hydrological processes that create or maintain habitat conditions in the Lower Columbia River.

Minor adverse effects of the action are increased suspended sediments, reduced DO, and contaminant resuspension, conditions that are largely limited to side channels and the Portland-Vancouver Anchorage. These effects will be minimized by limiting operations to period of lowest yearly juvenile salmonid densities and before the usual eulachon migration. Sturgeon are less sensitive to these effects and, in any event, are likely to avoid any areas with short-term adverse increases in suspended sediment or reductions in DO.

Beach nourishment is another minor effect pathway that can create conditions that increase the likelihood of juvenile stranding due to ship wakes. Subyearling salmon are most susceptible to stranding.

The proposed action will continue beach nourishment at three locations; Miller Sands, Skamokawa Vista Park, and Sand Island at St Helens. The new Bensen Beach ocean disposal site is also a beach nourishment site. The Corps' BMPs for beach nourishment include grading the disposal site to a slope of 10 to 15 percent with no swales to reduce the possibility of stranding. Beach nourishment as proposed by the Corps will help restore shoreline and nearshore habitat and is consistent with recovery actions to address the beach stranding threat to the recovery of ESA listed salmon.

As noted in Sections 2.2 and 2.3, climate change is likely to affect all species considered in this opinion and their habitat in the Lower Columbia River. These effects are expected to be positive and negative, but are likely to result in a generally negative trend for stream flow and temperature.

As described in Section 2.5, the cumulative effects of state and private actions within the action area are also variable over such a large action area, but are likely to reflect continued population growth in urban areas and continued use of current agricultural and forestry practices in rural areas. Federal efforts to improve aquatic habitat conditions throughout the Columbia River basin, especially in the Lower Columbia River, are likely to moderate any adverse cumulative effects, as well as leverage beneficial ones, so that the action area will trend toward improved habitat conditions overall. However, the extent to which development and human uses combined with restoration activities will affect ESA listed species' habitat in the Lower Columbia River is not known. Regardless of whether the ameliorative Federal actions occur, NMFS believes the effects of the proposed action will not cumulatively jeopardize any of the ESA-listed species or adversely modify designated critical habitat.

In summary, the proposed action will result in relatively intense, annual disturbances to a very small and variable area within the Lower Columbia River, but these disturbances will not appreciably reduce or prevent the increase of abundance or productivity of the populations addressed by this consultation. The same disturbances will cause minor, transitory effects to aquatic habitats in the Lower Columbia River, but those impacts to habitat will not appreciably reduce or prevent the increase of abundance or productivity of the populations addressed by this consultation. Similarly, the proposed action will have no effect on the population spatial structure or diversity of any species affected, and will not affect their habitat's contribution to recovery. By avoiding or minimizing contact with species over time, the proposed action is consistent with the recovery strategy of increasing juvenile fish survival within the Lower Columbia River, a critical step toward recovery of these species as whole.

The conservation value of critical habitat within the action area for salmon and steelhead varies by life history strategy, and is higher for species with ocean-type histories than for the stream-type. That is because the former group is more reliant on shallow-water habitats that are easily affected by a wide range of natural and human disturbances. The conservation value of critical habitat for sturgeon is greatest in the lower portions of the action area within the deeper portions

of the river channel. The conservation value of critical habitat for eulachon in the Lower Columbia River is very high because the Columbia River produces most of the world's eulachon. The proposed action will have minor effects on the quality and function of critical habitat PCEs. The full set of management measures proposed by the Corps will ensure that effects to PCEs remain minimal. As channel conditions in the newly improved FNC stabilize over time and less annual maintenance is required, habitat conditions may further improve over time and critical habitat will be able to better serve its intended conservation role, supporting viable populations of ESA-listed salmon, steelhead, southern green sturgeon, and eulachon. The proposed action will not impair the ability of critical habitat in the action area to play its intended conservation role of providing migration and rearing habitat to the affected species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of SRB steelhead, UCR steelhead, LCR steelhead, MCR steelhead, UWR steelhead, SR spring/summer Chinook salmon, SR fall-run Chinook salmon, UCR spring-run Chinook salmon, UWR spring-run Chinook salmon, LCR Chinook salmon, Columbia River chum salmon, SR sockeye salmon, LCR coho salmon, the southern eulachon, the southern green sturgeon species; or to destroy or adversely modify critical habitat designated for those species.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.

NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering," 50 CFR 17.3. The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, if that action is performed in compliance with the terms and conditions of this incidental take statement.

NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened Pacific eulachon. Anticipating that such a rule may be issued in the future, we have included a prospective incidental take exemption for eulachon. The elements of this ITS that relate to eulachon would take effect on the effective date of any future 4(d) rule prohibiting take of eulachon.

2.8.1 Amount or Extent of Take

Dredging and dredge material disposal necessary to complete the proposed maintenance of the Columbia River navigation channel, including dredging or dredge disposal at sites identified in the RSMP, the nine side channels, and in the Portland-Vancouver Anchorage, will occur when ESA-listed salmon and steelhead, southern green sturgeon and eulachon will be present. Those actions are reasonably certain to cause incidental take when juvenile salmon, steelhead, or green sturgeon, or juvenile or adult eulachon, are entrained and injured or killed by dredge suction, captured and injured or killed in a mechanical dredge, or when injured or killed by contact with dredged material as it falls through the water column during in-water disposal. Additional incidental take is reasonably likely to occur due to harm caused by adverse alteration of channel substrate and prey resources, and reduced DO, increased turbidity, and other impaired water quality conditions caused by maintenance of the side channels and anchorage.

This incidental take will occur in the Columbia River, between RM -3.0 and 145.0, at disposal sites identified in the RSMP, in the nine side channels, and in the Portland-Vancouver Anchorage. Incidental take within those areas that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action. In such circumstances, NMFS uses the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Here, the best available indicators for the extent of take are: (1) The area likely to be disturbed each year by active dredging and disposal operations relative to the routine (preferred) dredging period, measured as acres; (2) the time that will be required to complete dredging and disposal operations, measured as day of actual active dredging or disposal operations relative to the routine dredging period; and (3) the total number of side channels dredged in a year. Because the

amount of take increases with the time spent dredging and the area disturbed by dredging and disposal, these indicators are proportional to extent of incidental take attributable to this project. The extent of take indicators in the following tables were derived using the salmon, eulachon and green sturgeon impact analyses and additional information received from the Corps regarding their operations (Smith 2012p). Although the Corps' proposed action would have authorized dredging to occur the entire length of the river, year-around, with some timing and area restrictions; the following extent of take indicators limit the potential effects to ESA-listed species and designated critical habitat to those effects assessed in this opinion.

Table 47. Amount and Extent of Take - Days Dredging and Disposal

River Segment	Annual Operation Duration -Dredging (Days of actual dredging)		Annual Operation Duration - Disposal (Days of actual disposal)	
	Completed During Routine Dates	Completed During Non-Routine Dates	Completed During Routine Dates	Completed During Non-Routine Dates
River Mouth RM-3 to RM +3	52	0	NA*	NA
RM +3 to RM 145	160	30	105	16

*NMFS determined the potential effects to ESA listed fish due to ocean disposal are insignificant.

Table 48. Amount and Extent of Take - Acres

River Segment	Annual Dredging Area (acres)		Annual Disposal Area (acres)	
	Impacted During Routine Dates	Impacted During Non-Routine Dates	Impacted During Routine Dates	Impacted During Non-Preferred Dates
River Mouth RM-3 to RM +3	6,100	0	NA	NA
RM +3 to RM 145	7,000	1,400	12,000	1,800

Historically, not all the side channels and Portland-Vancouver Anchorage are dredged each year, allowing the habitat to recover. Here the best indicator for the extent of take is the amount of side channel habitat disturbed in a given year. This disturbance is best expressed as, an average of three side channels (including Portland-Vancouver Anchorage) dredged per year in a five year period, other than Baker Bay which may be dredged every year.

Exceeding any of these limits will trigger the reinitiation provisions of this opinion.

2.8.2 Effect of the Take

In the accompanying opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). "Terms and conditions" implement the reasonable and prudent measures (50 CFR 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

The following reasonable and prudent measures are necessary and appropriate to minimize take of listed species resulting from implementation of the proposed action. These reasonable and prudent measures will also minimize adverse effects to critical habitat. The Corps shall:

1. Minimize incidental take caused by maintenance of the Columbia River navigation channel by limiting the time and manner of dredging, and dredged material disposal.

2. Ensure completion of a comprehensive monitoring and reporting program to confirm this opinion is meeting its objective of minimizing take from the proposed action.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the following terms and conditions are not complied with, the protective coverage of section 7(o)(2) will likely lapse.

1. To implement Reasonable and Prudent Measure #1 (dredging and dredge material disposal), the Corps shall:
    a. Apply these terms and conditions to its own actions when carrying out FNC O&M work, to the actions of any contractor hired by the Corps for that purpose, and to the actions of any party licensed by the Corps to dredge sand from the FNC for commercial purposes.
    b. Complete all dredging and in-water placement during the following times (the "routine" or "preferred" O&M season):
        i. The mouth of the Columbia River at RM -3.0 to the Interstate 5 Bridge at RM 106.5 from June 1 through December 15.
        ii. I-5 Bridge at 106.5 to the Bonneville Dam at RM 145 from August 1 through September 30.
        iii. All side channels except the Old Mouth Cowlitz River from August 1 through December 15 (i.e., Baker Bay/West Channel, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek,

Wahkiakum Ferry Channel, Westport Slough, and Upstream Entrance to Oregon Slough and Portland-Vancouver Anchorage.

iv. Old Mouth Cowlitz River from September 1 through December 1

c. Dredging and in-water placement may be completed outside the preferred O&M season as necessary to resolve shoaling conditions that cause, or are likely to cause, significant draft restrictions for commercial vessels if left unmanaged until the next preferred O&M season.

i. Whenever possible, limit dredging outside the preferred O&M season to April 1 through May 31.

ii. No in-water disposal is allowed between December 1 and May 31Cowlitz River at RM 63 to 70,

iii. When alternative sites are available, there will be no in-water placement near the mouths of the Kalama River at RM 71 to 75, or the Lewis River at RM 85-89 December 1 and May 31.

iv. Testing and calibration of dredge equipment outside the preferred O&M season must occur upstream the Lewis River at RM 89.

d. Prior to any dredging taking place, the Corps must develop and implement a Water Quality Sampling and Monitoring Plan for dredging and disposal that has been reviewed and approved by NMFS. The plan must include the following minimum requirements for turbidity monitoring during periods of active dredging, disposal, and dewatering of upland facilities.

i. A properly and regularly calibrated turbidimeter is recommended, however visual gauging is acceptable

ii. Locations of turbidity samples or observations must be identified and described in the plan. At a minimum, monitoring must take place at the following distance, and within any visible plumes:

1. Dredging and in-water disposal activities (flowlane and beach placement) – Upcurrent (background) and 900 feet down current from the point of discharge (bucket, cutterhead, draghead, or pipeline) and no more than 150 feet laterally from the vessel or shoreline.
2. Other disposal activities (upland) – Upcurrent (background) and 300 feet downcurrent from the discharge point.
3. If a meter is used the Corps must identify a depth between 10 and 20 feet, or at mid-depth if in shallow areas (less than 20 feet in depth), to collect all samples.

iii. Monitoring must occur when dredging and disposal is being conducted and must meet the following requirements;

1. Active Dredging – once a day during a flood tide and once a day during an ebb tide.
2. In-Water Disposal (Flowlane and Beach Placement) – once a day during a flood tide and once a day during an ebb tide during a disposal activity.
3. Background turbidity NTU or observation, location, tidal stage, and time must be recorded prior to monitoring downcurrent

iv. Compliance:

1. Turbidity must be measured or observed and recorded as described above during periods of active dredging, disposal, and dewatering of upland facilities. Results must be compared to the background sample or observation taken during that monitoring event.
2. If an exceedance over the background level (as defined below Table 49) occurs at the second monitoring interval the activity must stop until the turbidity levels return to background. At that time, activity may resume with the minimum frequency of monitoring while maintaining compliance

Table 49. Turbidity Exceedance and Actions Required

TURBIDITY CAUSING ACTION	ALLOWABLE EXCEEDANCE TURBIDITY LEVEL			ACTION REQUIRED AT 1ST MONITORING INTERVAL	ACTION REQUIRED AT 2ND MONITORING INTERVAL
	TURBIDIMETER		VISUAL		
	Background < 50 NTU	Background ≥ 50 NTU			
DREDGING & IN-WATER DISPOSAL	0 to 5 NTU above background	10% over background	Visible plume	Modify activity and continue to monitor at ebb or flood tide	Stop activity until levels return to background and continue to monitor at ebb or flood tide
UPLAND DISPOSAL				Modify activity and continue to monitor every 4 hours	Stop activity until levels return to background and continue to monitor every 4 hours

e. Water quality limits on side channel and Portland-Vancouver Anchorage dredging:

i. DO will be sampled at the mid-point of the water column 300 feet down current from the dredge and in the turbidity plume if visible.

ii. Samples will be collected during daylight hours during active dredging at the following frequency; once a day during a flood tide and once a day during an ebb tide.

iii. DO concentrations must be sampled with a dissolved oxygen meter properly and regularly calibrated according to the owner's manual.

iv. Dredging may not begin if DO concentrations at the dredge site are less than 6.5 mg/l

v. If the level of DO measured is below 8 mg/l, the monitoring frequency must increase to every four hours until the level returns above 8 mg/l.

vi. If the level of DO is measured below 6.5 mg/l, or if distressed or dead fish are observed in or beside the dredge, the activity must be stopped until the level returns to above 6.5 mg/l.

vii. Restricted visibility: During periods of restricted visibility that could cause an unsafe condition, the Corps may postpone required compliance

monitoring until conditions improve if confirmation is made by a third party, such as the Coast Guard Watch Stander or the National Weather Service, that the visibility in the area to be monitored is considered to be restricted and is unsafe to conduct the required monitoring. If monitoring is postponed due to restricted visibility and unsafe conditions, the weather condition, time of determination, and verification route must be recorded. Regular monitoring must resume once the visibility returns to safe levels.

f. Keep dragheads and cutterheads at or buried in the substrate when suction dredges are working, and no more than 3.0 feet above the substrate for the minimum time necessary to clean or purge the dragheads.

g. Discharge material from a pipeline dredge at depths of 20.0 feet or more below the water surface.

h. Require use of an enclosed-bucket whenever a clamshell dredge or back-hoe will be used to dredge materials that are not approved for in-water disposal due to contaminant concerns.

i. Use the SEF (2009; or the most recent version) to determine the suitability of sediment for in-water disposal or beneficial use.

j. Grade all shoreline disposal or beach nourishment sites to between 10 to 15% with no swales to reduce the potential to strand juvenile salmonids.

k. Monitor upland disposal sites during the nesting season. Discourage any avian predators that are found nesting at an upland disposal site, consistent with the Migratory Bird Act.

l. Construct any new upland disposal site at least 300 feet from the shoreline, and include a berm designed to minimize sediment in return flow.

m. Provide this notice to all Corps project managers or contractors engaged in FNC maintenance, and to all private vendors licensed to remove sand from the FNC for commercial purposes:

> NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found, the finder must notify the Vancouver Field Office of NMFS Law Enforcement at 360.418.4246. The finder must take care in handling of sick or injured specimens to ensure effective treatment, and in handling dead specimens to preserve biological material in the best possible condition for later analysis of cause of death. The finder also has the responsibility to carry out instructions provided by law enforcement to ensure that evidence intrinsic to the specimen is not disturbed unnecessarily.

2. To Implement Reasonable and Prudent Measure #2 (monitoring), the Corps shall:

a. Prepare a monitoring report for NMFS by February 15 each year that describes the Corps' efforts in carrying out these terms and conditions. The report must include

i. An assessment of overall channel maintenance activity.

ii. An assessment of dredging and disposal activities by river segment, including the dredged area in acres, dredging time in minutes, date, dredge type, disposal site.

iii. DO and turbidity observations before and during side channel dredging.
iv. A summary of all observations of upland disposal sites that may be used for nesting use by avian predators, especially Caspian terns and double-crested cormorants.
v. The finished beach gradient at any beach nourishment site used during the year.
vi. The location, time and amount of any reported spills, the cleanup response time and actions as well as effectiveness.
vii. A copy of any warning, notice of noncompliance, penalty notice, violation, or other enforcement action taken by a Federal, state or local agency.

b. Submit the annual monitoring report to:

State Director
Oregon State Habitat Office
Attn: 2011/02095
1202 NE Lloyd Boulevard, Suite 1100
Portland, Oregon 97232-2778

c. The Corps must attend an annual coordination meeting with NMFS by March 1 each year to discuss the annual report and any actions that can improve conservation under this opinion, or make the maintenance program more efficient or accountable. The Corps is also encouraged to invite representatives from the Oregon Department of Environmental Quality, the Washington Department of Ecology, the Oregon Department of Fish and Wildlife, the Washington Department of Fish and Wildlife and the U.S. Environmental Protection Agency to attend.

2.9. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). The following conservation recommendation is a discretionary measure that NMFS believes is consistent with this obligation and therefore should be carried out by the Federal action agency:

- Decrease the proportion of dredged material disposed of at upland sites.
- Implement projects to reduce double-breasted cormorant habitats and encourage dispersal to other locations.
- Remove or modify pilings and pile dikes with low economic value when removal or modification would benefit juvenile salmonids and improve ecosystem health.
- Reduce the effects of vessel wake stranding in the estuary.

- As the Corps explores options for future disposal sites, beach nourishment or other locations that maintain the dredged material in the Columbia River system should be emphasized over upland disposal.
- Prior to non-routine dredging the Corps should, in coordination with the Oregon Department of Fish and Wildlife and the Washington Department of Fish Wildlife, and the National Marine Fisheries Service sample the area to be dredged for the presence eulachon adult eggs and larvae presence so more information can be collected regarding potential dredging effects on the species.
- The Corps should in cooperation with the Oregon Department of Fish and Wildlife the Washington Department of Fish and Wildlife and the National Marine Fisheries Service develop and implement a study to estimate the entrainment rate of green sturgeon during FNC dredging operations.

Please notify NMFS if the Federal action agency carries out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.10 Reinitiation of Consultation

As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal action agency involvement or control over the action has been retained, or is authorized by law, and if: (1) The amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

An action is not likely to adversely affect (NLAA) a species or critical habitat if the effects are all likely to be discountable, insignificant, or completely beneficial (USFWS and NMFS 1998). Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur. Beneficial effects are wholly positive, without any adverse effects to the species or designated critical habitat.

The proposed action is NLAA the leatherback sea turtle, the eastern Steller sea lion (*Eumetopias jubatus)*, the Southern Resident Killer Whale (*Orcinus orca*), the humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*) sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*) and sperm whale (*Physeter macrocephalus*) for the following reasons. The proposed action is also NLAA designated critical habitats for the leatherback sea turtle, but the action area does not include designated critical habitat for the eastern Steller sea lion, or the Southern Resident Killer Whale. Critical habitat has not been designated for the humpback whale, the blue whale, the sei whale or the fin whale.

2.11.1 Steller Sea Lion

Listed as an ESA threatened species (63 FR 24345), the eastern Steller sea lion is commonly observed in the LCR. The eastern Steller sea lion species includes sea lions born on rookeries from California north through Southeast Alaska. The eastern Steller sea lion population has increased at about 3% per year numbering 45,000 to 51,000 animals in 2002 (NMFS 2008).

Steller sea lions are generalist predators that eat a variety of fishes and cephalopods, occasionally other marine mammals and birds. Steller sea lions will prey upon eulachon when abundant during spawning migrations (NMFS 2008). The mouth of the Columbia River, especially the South Jetty, is a haulout site for Steller sea lions but there are no rookeries near the action area and the action area is not designated as critical habitat (58 FR 45269). Haulout means terrestrial areas used by adult sea lions during times other than the breeding season and by non-breeding adults and subadults throughout the year.

Steller sea lions are present at the South jetty haulout site year around with up to 1,146 individuals being observed (NMFS 2011a). Steller sea lions are now commonly observed up to the tailrace of Bonneville Dam preying on salmon and white sturgeon (Stansell *et al*. 2009). Steller sea lions probably also prey on green sturgeon in the lower reaches of the Columbia estuary.

The proposed action could potentially impact Steller sea lions by disturbance during dredge and disposal activities, diminishing prey and exposing sea lions to resuspended contaminants associated with suspend sediments. Disturbance to Steller sea lions will be an insignificant effect. The sea lions can easily move away from dredge and disposal activities. Dredging at the River mouth will not significantly increase ship traffic near the South Jetty haulout site and the, consistent use of the haulout site indicates current vessel traffic is not adversely disturbing the sea lions. The dredging activities are not likely to cause significant reductions in available sea lion prey. The proposed action is not likely to adversely affect green sturgeon or jeopardize salmon, steelhead and eulachon populations. The sea lions should not be exposed to harmful concentrations of contaminants as management practices associated with the proposed action and the opinion to avoid exposure of ESA-listed fish to contaminants will be make any Steller sea lion exposure to contaminants insignificant. NMFS has determined that the proposed action is NLAA the eastern Steller sea lion population.

2.11.2 Leatherback Sea Turtle

The leatherback sea turtle is listed as an endangered species (6/02/70: 39 FR 19320) and the ocean portion of the action area is within designated critical habitat (1/05/2010: 77 FR 417). The following species and habitat information was obtained from 77 FR 417.

The leatherback sea turtle is the largest marine turtle and has the most extensive range of any living reptile, having been reported circumglobally throughout all the world's oceans. The leatherback sea turtle nests in tropical to subtropical latitudes but can forage in cold temperate regions of the oceans having been found in latitudes as high as 71° N and 47°S. In the Pacific

Ocean, significant nesting aggregations occur primarily in Mexico, Costa Rica, Indonesia, the Solomon Islands, and Papua New Guinea.

Leatherbacks are largely a pelagic species foraging primarily on cnidarians (jellyfish and siphonophores) and to a lesser extent on tunicates (pyrosomas and salps). Leatherbacks forage widely in temperate waters especially in areas upwelling and convergence zones in the open ocean and in archipelagic waters.

Research has documented leatherback sea turtle migrations from the western tropical Pacific to the California current off the western coast of the United States. The sea turtles are most frequently observed off the coasts of California, Oregon and Washington during summer and late fall foraging on dense aggregations of the brown sea nettle (*Chrysaora fuscescens*) and other scyphomedusae, particularly moon jellies (*Aurelia labiata*). Leatherbacks are capable of deep diving but are usually found foraging at or near the surface.

Jellyfish blooms are seasonally and regionally predictable but at finer scales the local distribution is patchy and dependent upon oceanographic conditions. The seasonal and annual population variation in jellyfish is largely dependent upon the benthic polyp stages, about which little are known of their coastal populations. In the open ocean jellyfish tend to collect along boundaries such as oceanic fronts, local circulation patterns and upwelling as created along the western coast of the United States by the California Current. The Columbia River plume is known to aggregate jellyfish in the northern California Current.
The proposed critical habitat within which the action area includes the nearshore area from Cape Flattery, Washington to Winchester Bay, Oregon and extends offshore to a line approximating the 2000 meter isobath. One PCE essential for the conservation of leatherback sea turtles have been identified in marine waters off the western United States:

1. Occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (*Chrysaora, Aurelia, Phacellophora*, and *Cyanea*) of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development of leatherbacks.

Specific, range-wide threats to leatherback sea turtles the harvest of eggs and nesting females, and incidental capture in fishing gear. The critical habitat review team did not consider vessel traffic as a potential threat to passage.

Leatherback turtles are not found in the Columbia River or in the dynamic environment associated with the nearshore dredge disposal sites. Leatherback turtles may be found in the ocean near the Deep Water site as their prey is fairly common off the River Mouth and associated with the plume. As discussed above, the Columbia River plume is known to aggregate jellyfish. Sea nettles were commonly collected by Emmett *et al.* (2004) in their study of the vertical distribution of juvenile salmon in the Columbia River plume. Moon jellies were also collected as were other jellyfish.

A review of the studies summarized in Corps (2007) found that polychaetes (marine worms) mollusks and crustaceans are the most common invertebrates found on the bottom of the Deep Water Site with no mention of the jellyfish polyps.

Jellyfish are found in the ocean off the mouth of the Columbia River and are aggregated in the plume therefore if jellyfish are under the ship when dredge material is deposited they will likely be entrained and buried by the discharge plume. However given the patchy nature of jelly fish distribution and the small area impacted by the dredge disposal NMFS believes the activities will not significantly affect the condition, distribution, diversity, and abundance of leatherback prey necessary to support individual as well as population growth, reproduction, and development.

Individual leatherback turtles may be in the vicinity of the Deepwater Site. NMFS believes the patchy distribution of prey within the broad distribution of the leatherback sea turtle makes the potential for a dredge to strike a turtle discountable.

One threat common to all sea turtles is contaminates in the water. The predominately sandy dredged material that will be deposited in the ocean under the proposed action has been found to be free of contaminants and therefore the proposed action will not contribute further to the contaminated water threat.

NMFS has determined that the proposed action is NLAA the leatherback sea turtle.

2.11.3 Blue Whales, Fin Whales, Sperm Whale, Sei Whale, Humpback Whales and Southern Resident Killer Whales.

NMFS reviewed the proposed action and recently concluded consultations (NMFS 2010b, 2010c) involving ocean disposal of dredge material or activities associated with maintaining the FNC at the River Mouth (NMFS 2011a) to assess the potential effects to the above ESA-listed whale species.

NMFS concurs with the Corps "may affect, not likely to adversely affect' determination for the whale species. The whales all occur as migrants in waters off the Oregon and Washington coasts. The whales are not present in the Columbia River but could potentially occur in the vicinity of the dredge disposal routes particularly the Deep Water Site. However, blue whales, fin whales, sperm whales, and sei whales are generally not found in the nearshore environments and are unlikely to be present in the action area. Humpback whales and killer whales may occur closer to shore but killer whales are the only ones observed of the mouth of the Columbia River on a somewhat regular basis. As reviewed in NMFS (2011a), Southern Resident Killer Whales have been observed feeding off the Columbia River plume in the vicinity of the jetties during the peak spring Chinook migration in March and April which is outside the primary dredging season.

The two potential impacts of the proposed action on ESA listed whales are the potential for ship strikes as dredges move to the ocean disposal sites, a reduction in prey: salmon and eulachon for killer whales; eulachon and northern anchovy for humpback whales, and release of contaminated sediment into the ocean environment. The potential for vessel strikes is extremely unlikely (LCSG 2011). The dredge vessels are extremely slow moving, follow a predictable course and

should be easily avoided by whales making the potential for a ship strike due to a dredge vessel discountable (NMFS 2010c).

As described in the effects analysis for salmon, the magnitude of anticipated adverse effects to juvenile salmon individuals is not quantifiable but is not likely to result in an appreciable reduction in the abundance of adult salmon that are prey for the killer whales.

The material dredged at the River Mouth that will be deposited in the ocean is predominately sand with little fine material and organic content and free of contaminants therefore the disposal will not increase the potential for the whales to be exposed to contaminants as the material is disposed into the water column.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

The Corps did not specifically request MSA consultation or assess the effects of the action on EFH. The Corps (2011c) did however provide enough information to allow NMFS to conduct its own EFH effects assessment. This analysis is based, in part, on the proposed action and other information in the Corps (2011c) provided by the Corps; the assessment of the current environmental baseline and habitat effects of the action as described in this B.O.; and descriptions of EFH contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC) and approved by the Secretary of Commerce for coho salmon and Chinook salmon (1999), Pacific coast groundfish (PFMC 2006) and coastal pelagic species (PFMC 1998).

3.1 Essential Fish Habitat Affected by the Project

The proposed action will affect EFH designated for the various life-history stages of Pacific salmon, groundfish species, and coastal pelagic species, including the LCR estuary, an area that is also designated as HAPC.

Table 50. Species of fish and life stages with designated EFH that may occur within the action area, activities and prey.

Groundfish Species	Life stage	Activity	Prey
Arrowtooth flounder	Adults	All	Gadids, *Theragra chalcogramma*, krill, clupeids, shrimp
	Eggs	Unknown	
	Larvae		
Big skate	Adults	All	Crustaceans, fish
Black rockfish	Juveniles	Feeding, growth to maturity	
	Adults	All	
Blue rockfish	Juveniles	All	
	Adults	All	
	Larvae	Feeding	
Bocaccio	Juveniles	Feeding	Euphausiids, copepods
Butter sole	Adults	All	Polychaetes, molluscs, fish, decapod crustaceans, amphipods, shrimp, sea stars
Cabezon	Adults	All	Fish eggs, lobsters, molluscs, small fishes, crabs
California skate	Eggs	Unknown	
Canary rockfish	Juveniles	Feeding, growth to maturity	
Chilipepper	Adults	All	Clupeids, euphausiids, *Merluccius productus*, squids, copepods, euphausiids
	Juveniles	Feeding, growth to maturity	
Copper rockfish	Adults	All	Crustaceans, fish, shrimp, molluscs
Curlfin sole	Adults	All	Crustacean eggs, *Echiurid proboscises*, nudibranchs, polychaetes
Dusky rockfish	Adults	All	
English sole	Juveniles	Feeding, growth to maturity	Polychaetes, molluscs, cumaceans, copepods, amphipods, mysids
	Adults	All	Polychaetes, ophiuroids, molluscs, cumaceans, amphipods, crustaceans
Flathead sole	Adults	All	Polychaetes, mysids, shrimp, molluscs, clupeids, fish
Kelp greenling	Adults	All	Worms, crabs, octopi, shrimp, small fishes, brittle stars, snails
	Larvae		

Groundfish Species	Life stage	Activity	Prey
Lingcod	Adults	All	Juvenile crab, demersal fish, squid, octopi
	Larvae	Feeding	Decapod larvae, copepods, euphausiids, copepod nauplii, copepod eggs, amphipods
Longnose skate	Adults	All	
Pacific cod	Juveniles		Amphipods, shrimp, copepods, crabs
	Larvae		Copepods
Pacific hake	Juveniles		Euphausiids
	Adults	All	
Pacific sanddab	Adults	All	Squids, octopi, crab larvae, clupeids
Petrale sole	Adults	All	Shrimp, *Eopsetta jordani*, euphausiids, ophiuroids, pelagic fishes
Quillback rockfish	Adults	All	Amphipods, molluscs, euphausiids, polychaetes, fish juveniles, shrimp, clupeids, crabs
Redstripe rockfish	Adults	All	Fish juveniles, squid, clupeids
Rex sole	Adults	All	Cumaceans, euphausiids, larvacea, polychaetes
Rock sole	Adults	All	Tunicates, echinoderms, fish, molluscs, polychaetes, echiurans
Rosy rockfish	Adults	All	Crabs, shrimp
Sablefish	Adults		Octopi, clupeids, euphausiids, shrimp, rockfish
	Juveniles	Growth to Maturity	Krill, small fishes, squids, euphausiids, demersal fish, tunicates, cephalopods, amphipods, copepods
	Larvae	Feeding	
Sand sole	Adults	All	Polychaetes, clupeids, crabs, fish, mysids, shrimp, molluscs
	Juveniles	Growth to Maturity, feeding	Euphausiids, molluscs, mysids, polychaetes, shrimp
Silvergray rockfish	Adults	All	
Soupfin shark	Adults	All	Fish, invertebrates
	Juveniles	Growth to Maturity	Invertebrates, fish
Spiny dogfish	Adults	All	Pelagic fishes, invertebrates

Groundfish Species	Life stage	Activity	Prey
Splitnose rockfish	Juveniles	Feeding	Copepods, cladocerans, amphipods
	Larvae		
Spotted ratfish	Adults	All	Amphipods, annelids, brittle stars, fish, algae, molluscs, squids, small crustacea, ostracods, opisthobranchs, nudibranchs
	Juveniles	Growth to Maturity	Small crustacea, squids, ostracods, ophisthobranchs, nudibranchs, molluscs, fish, brittle stars, amphipods, algae, annelids
Starry flounder	Adults	Growth to Maturity	Molluscs, fish juveniles, polychaetes, crabs
	Juveniles	Feeding	Polychaetes, copepods, amphipods
Stripetail rockfish	Adults	All	Euphausiids, copepods
	Juveniles	Growth to Maturity	Copepods
Tiger rockfish	Adults	All	Juvenile rockfish, amphipods, fish juveniles, shrimp, clupeids, crabs
Vermilion rockfish	Adults		Clupeids, juvenile rockfish, krill, octopi, squids
Widow rockfish	Juveniles	Growth to Maturity, feeding	Copepods, copepod eggs, euphausiid eggs
Yellowtail rockfish	Adults	All	Clupeids, euphausiids, tunicates, mysids, salps, squid, krill, *Merluccius productus*

Coastal Pelagic Species	Life stage	Activity*	Prey
Northern anchovy	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton
Pacific sardine	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton
Pacific mackerel	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Zooplankton, micronekton
Jack mackerel	Adult		Krill, small crustacea
Market squid	Eggs		
	Larvae		
	Juvenile		
	Adult	All	Plankton, small crustacea, euphausiids, copepods

Pacific Salmon			
Coho salmon**	Juvenile		
	Adults	Feeding	
Chinook salmon	Juvenile		Plankton, insects, small fish
	Adults	Feeding	

3.2 Adverse Effects on Essential Fish Habitat

As described more fully in the effects analysis above, the primary adverse effects of dredging and dredge material disposal necessary to complete the proposed maintenance of the Columbia River navigation channel, when the dredges create suction that will entrain, or other mechanical conditions that will grab, and injure or kill juvenile, salmon, groundfish, coastal pelagic species or their prey. Additional adverse effects are reasonably likely to occur due to modification of channel substrate and impairment of prey resources, and reduced water quality conditions caused by maintenance of the side channels and anchorage.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS expects that full implementation of these EFH conservation recommendations would protect approximately 154,000 acres of designated EFH for Pacific Coast salmon, groundfish and coastal pelagic species by avoiding or minimizing the adverse effects described in Section 3.2 above.

1. Protect EFH from the effects of maintaining the FNC by limiting the time and manner of dredging, and dredged material disposal as described in Term and Condition 1, above.

2. Ensure that the effects of maintaining the FNC do not exceed those predicted by completing a comprehensive monitoring and reporting program as described in Term and Condition 2, above.

These conservation recommendations are a subset of the ESA terms and conditions above, plus the ESA section 7(a)(2) conservation recommendation given above.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Federal action agency must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation from NMFS. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations, unless NMFS and the Federal action agency have agreed to use alternative time frames for the Federal action agency response. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS Conservation Recommendations, the Federal action agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects, 50 CFR 600.920(k)(1).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations, 50 CFR 600.920(l).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these Data Quality Act (DQA) components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users are the Corps and their dredging contractors or licensees.

An individual copy was provided to the Corps. The format and naming adheres to conventional standards for style.

4.2 Integrity: This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in

Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity:

Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01, *et seq*., and the MSA implementing regulations regarding EFH, 50 CFR 600.920(j).

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the Literature Cited section. The analyses in this opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with Northwest Region ESA quality control and assurance processes.

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Woodbury, D. 2012d. Telephone conversation between David Woodbury, NMFS Ken MacDonald, NMFS and Eric Murry, NMFS. (May 16, 2012). (Discussion of potential dredging effects on green sturgeon).

Woodbury, D. 2012e. Email from David Woodbury, NMFS to Ken MacDonald, NMFS. (May 16, 2012) (Vessel Props).

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6. APPENDICES

Appendix 1

FNC History

(Amendment to the Biological Assessment 11-7-2011)

In the River and Harbor Act of 18 June 1878, Congress authorized the Columbia River Navigation Channel Project and directed the Corps to establish and maintain a 20-foot minimum channel depth. Maintaining this depth required dredging in only a few shallow reaches of the river where the natural controlling depths were in the 12 to 15 foot range (Corps 1999). In the River and Harbor Act of 13 July 1892, Congress increased the authorized navigation channel depth to 25 feet. The maintenance dredging associated with this increase was still limited to a few particularly shallow reaches where sporadic dredging was conducted as needed (Corps 1999). In the River and Harbor Act of 13 June 1902, Congress adopted a 25-foot channel to the sea.

In the River and Harbor Act of 25 July 1912, Congress increased the navigation channel depth to 30 feet. At that time, the navigation channel width was established at 300 feet. Increasing the channel depth to 30 feet resulted in the need for increased maintenance dredging to ensure that authorized navigation depths were safe for shipping and to address shoaling associated with the new depth (Corps 1999).

In the River and Harbor Act of 3 July 1930, House Document 195, Congress increased the authorized depth from Portland to the sea to 35 feet. The navigation channel width also was increased to 500 feet and was realigned in certain reaches. The channel modifications were completed in 1935. From 1936 to 1957, Congress authorized additional channel alignment adjustments that added to the dredging requirements. During this period, dredging averaged 6.7 million cubic yards (mcy) per year.

By 1958, the channel alignment had stabilized, but maintenance dredging was augmented to increase the advanced maintenance dredging (AMD) depth from 2 to 5 feet in areas of active shoaling. This AMD approach enhances navigational safety by maintaining the authorized channel depth (which is necessary to ensure adequate under-keel clearance) during periods of channel shoaling that occur between maintenance dredging events. AMD in the navigation channel is done at the same time as routine maintenance dredging.

The 40-foot navigation channel was authorized by the River and Harbor Act of 23 October 1962, and construction took place in stages from 1964 to 1976.

The current 43-foot deep channel in the Columbia and Lower Willamette (C&LW) was authorized by the Water Resources Development Act of 17 August 1999 (Public Law 106-53). The channel is 43 feet deep and 600 feet wide from RM 3.0 to 101.4; 43 feet deep and 400 feet wide from RM 101.4 to 105.5; 43 feet deep and 400 feet wide in the downstream 1.5 miles of Oregon Slough; and 35 feet deep from RM 105.5 to 106.5 (from the Burlington Northern and Santa Fe Railway Bridge to the Interstate 5 Bridge). The navigation channel generally follows the deepest part of the natural river channel. Most of the channel is naturally deeper than 43 feet;

however, shoals tend to form in channel reaches where natural depth is less than 43 feet. This reach also includes the Portland/Vancouver Anchorage (River and Harbor Act of 1960, Section 107 project), which consists of one deep-draft anchorage and one anchorage used primarily for empty vessels. From 1976 to the onset of the most recent channel improvement, maintenance dredging has averaged approximately 5.5 to 6.5 mcy per year excluding emergency dredging related to the 1980 eruption of Mount St. Helens (Corps 1999). Since channel improvement activities began in June 2005, average annual volume dredged has been greater than prior to improvement activities. It is difficult to predict volumes dredged over the next 5 years as the new channel comes into equilibrium.

The MCR Project was authorized separately from the LCR navigation channel under the River and Harbor Act of 5 July 1884; however, the originally authorized project depth of 40 feet was not completed until 1918. The South Jetty was completed in 1914 and the North Jetty completed in 1917. A spur jetty (Jetty A) was completed in 1939 for the purpose of channel stabilization. The River and Harbor Act of 3 September 1954 authorized a 48-foot channel depth. Public Law 98-63 (30 July 1983) authorized deepening of the northernmost 2,000 feet of the channel to 55 feet. Four to 5 mcy of sand are dredged at the MCR Project annually and placed at U.S. Environmental Protection Agency (EPA) approved disposal sites and one Clean Water Act site. In 2008, sand was placed on the north side of the MCR North Jetty for the purpose of protecting the jetty from scouring resulting from storm surges. The South Jetty and North Jetty at the MCR were constructed to secure the FNC though the ocean entrance to the Columbia River. The South Jetty is about 6.6 miles long. The first 4.5 miles of the South Jetty were constructed from 1885 to 1895. It was extended to its present footprint length from 1913 to 1914; however, about 6,200 feet (head loss) have eroded. The North Jetty is about 2.5 miles long and was constructed from 1915 to 1917. About 1,900 feet of head loss has occurred. These existing project features were authorized by the River and Harbor Acts of July 5, 1884; March 3, 1905; and September 3, 1954. Portions of the South Jetty were repaired in 1982.

The jetties were constructed at the entrance to the Columbia River to confine tidal currents, to obtain scouring velocities in the bar and entrance channels to help maintain the authorized channel dimensions, and to help protect vessels entering and exiting the river. The North and South Jetties at the MCR have experienced damage to both jetty heads and along the jetties at several locations. Damage along both jetties has been repaired in 2005-2007.

The portion of the Columbia River navigation channel from Vancouver, Washington to The Dalles, Oregon (RM 106.5-192), was authorized by the River and Harbor Acts of 26 August 1937 and 24 July 1946. The portion of the navigation channel from Vancouver to Bonneville Dam is authorized for maintenance to a depth of 27 feet. Currently, this portion of the navigation channel is maintained for barge traffic only. Based on draft requirements of current users, the channel is maintained to a depth of 17 feet, with 2 feet of AMD (depth 19 feet).

The side-channel projects included in this BA were first authorized at various times, as shown below. More detailed descriptions for the side channel projects, as well as their recent dredging history, can be found in the biological assessment submitted for this consultation

1933 –Columbia River at Baker Bay, first authorized by the River and Harbor Act of 11 December 1933. The Baker Bay West Channel is authorized by the River and Harbor Act of 2 March 1945.

1938 –Chinook Channel, authorized by the River and Harbor Act of 20 June 1938.

1975 –Hammond Boat Basin, authorized under Section 107 of the River and Harbor Act of 1960.

1930 –Skipanon Channel authorized by the River and Harbor Act of 3 July 1930.

1919 –Skamokawa Creek, authorized by the River and Harbor Act of 2 March 1919.

1993 –Wahkiakum Ferry, authorized under Section 107 of the River and Harbor Act of 1960.

1937 –Westport Slough, authorized by the River and Harbor Act of 26 August 1937.

1945 –Old Mouth Cowlitz River, as part of the C&LW project, authorized by the River and Harbor Act of 2 March 1945.

1946–Upstream Entrance to Oregon Slough, as part of the Columbia River from Vancouver to The Dalles project, authorized by the Rivers and Harbors Act of 24 July 1946.

Appendix 2

Impact Analysis

The NMFS ESA listed species jeopardy analysis and analysis of potential take due to dredging required information that was not available in the BA. On February 2, 2012, Mark Liverman and Ken MacDonald (NMFS) met with Jessica Stokke and Gretchen Smith (Corps) to discuss potential approaches to better quantify the potential effects of the proposed action on eulachon, salmon and steelhead, and designated critical habitat. To determine the potential intensity or magnitude of effects, NMFS requested the Corps to determine the amount of habitat potentially affected by dredging and disposal activities compared to the amount of habitat available in the Columbia River. NMFS also asked the Corps if it would be possible to quantify the potential timing and duration of effects.

The Corps responded with an impact analysis via email on March 14, 2012 (Smith 2012c). This appendix documents the NMFS' effects analysis based upon the information provided by the Corps. The complete information provided by the Corps is included in the record of the biological opinion. The information provided by the Corps used in this analysis will be presented first followed by the NMFS' analysis of effects using the information.

Corps Impact Analysis

The Corps typically dredges the Columbia River Federal Navigation Channel with two hopper dredges owned by the Corps, the *Essayons* and *Yaquina*, contract hopper dredges and the *Oregon*, a pipeline dredge owned by the Port of Portland. The dimensions and production rates of the hopper dredges are displayed in Table A2-1.

Table A2-1. Hopper Dredges.

	Essayons	Yaquina	Contract Hopper
Dump bay size (ft^2)*	3,348	888	in between , may be split hull
Width (ft)	31	24	-
Length (ft)	108	37	-
Average length of placement event (ft)	2,500	1,500	2,500
Load size/volume (CY)	5,500	998	3,500-5,000
Total cycle time (min)	164	77	115
Pumping time (min)	95	48	45
Placement time (min)	8	4	10
Turning/Transit (min)	61	25	60
Average production (CY/day)	48,000	19,000	50,000
*dump bay size = max area as the load is released from the vessel			

The pipeline dredge *Oregon* may be dispose of dredged material in the flowlane, at upland sites or at beach nourishment sites. The Oregon dredges an approximately 400 foot wide area advancing about 450 feet downstream per day. During flowlane disposal a slurry is discharged at approximately 9 feet/second into the channel flowing about 3 feet/second. The sand settles quickly creating an immediate prism of less than 40 feet in diameter (1300 square feet). The slurry is discharged through a 30 inch discharge pipe at least 20 feet below the water surface. The discharge pipe has a diffuser on the end to evenly displace the material. The discharge area for a dredging site is usually 2500 feet by 400 feet as the pipe is moved several times per day to prevent mounding. The *Oregon* can dredge approximately 2500 cubic yards (cy) per day.
The Corps next calculated the area potentially affected per minute by dredging (Table A2-2) and the area potentially affected per minute through disposal (Table A2-3).

Table A2-2. Area affected by dredging/minute.

Vessel	Acres/minute
Essayons	0.07
Yaquina	0.03
Contract Hopper	0.11
Oregon	0.003

Table A2-3. Area affected by flowlane disposal/minute.

Vessel	Acres/minute
Essayons	0.67
Yaquina	0.62
Contract Hopper	0.77
Oregon	0.03

A Clamshell was used to dredge river segment 6. The Corps provided the NMFS the following information regarding clamshell dredges (Smith 2012f) (Clamshell rate was based on use of a large scow capable of 1.4 loads/day at 3,150 cy/load):

- Clamshell dredging time is based on 3.8 cy material removed per 60 second cycle when dredging.
    - Clamshell dredges typically spend 50%-75% of the shift time actively dredging and not all contractors work 24 hour shifts.
- In-water placement when clamshell dredging depending upon the scow used (equipment varies depending upon availability) (Smith 2012h).
    - Large scow = 3,150 cy/load; small scow = 1,050 cy/load
    - Large scow = 11 min (sand), 30 min (silt) to empty one load; small scow = 8 min (sand) 20 min (silt) to empty one load.
    - Large scow approximately 1.4 loads/day; small scow approximately 3.5 loads/day (placement occupies approximately 3% of the time each day)
    - Approximately 6 acres affected/load

The Corps records the annual amount of material dredged and disposed, including disposal method (flowlane, ocean disposal, upland disposal and beach nourishment) by river segment and vessel used. Tables A3-4 and A3-5 display an example of the dredging and disposal information the Corps provided for the impact analysis. Dredging information for 2011 is used in this analysis as it is the only year the FNC has been dredged since completion of the 43 foot channel. The Corps expects it will take several years before the new 43 foot channel stabilizes and a new "baseline" of annual dredging needs is established. However, NMFS believes the one year of data available for 2011 provides for a reasonable analysis of effects to ESA listed species and designated habitat. The Columbia River runoff flows were high so creation of shoals and dredging needs experienced in 2011 may be towards the high end of potential effects into the future.

Table A2-4. 2011 Columbia River – detailed dredging by reach.

Month - Year	Dredge Name	Dredge Type	Dredging Location	Dredging (CY)
RIVER SEGMENT 1				
September-2011	Essayons	Hopper	Flavel Bar	94,408
October-2011	Yaquina	Hopper	Flavel Bar	22,265
March-2011	Essayons	Hopper	Tongue Point Crossing	62,101
September - 2011	Terrapin	Hopper	Tongue Point Crossing	250,000
October-2011	Essayons	Hopper	Tongue Point Crossing	233,363
August - 2011	Terrapin	Hopper	Miller Sands	75,330
October-2011	Essayons	Hopper	Miller Sands	167,899
October-2011	Yaquina	Hopper	Miller Sands	80,641
October-2011	Oregon	Pipeline	Miller Sands	227,586
RIVER SEGMENT 2				
May - 2011	Yaquina	Hopper	Pillar Rock	52,019
August/September-2011	Oregon	Pipeline	Pillar Rock	551,064
September-2011	Essayons	Hopper	Pillar Rock	111,660
October - 2011	Essayons	Hopper	Pillar Rock	112,834
October/November - 2011	Essayons	Hopper	Pillar Rock	47,028
August-2011	Oregon	Pipeline	Brookfield Welch	231,958
September/October-2011	Oregon	Pipeline	Brookfield Welch	844,773
May-2011	Essayons	Hopper	Skamokawa Bar	98,460
September/October - 2011	Terrapin	Hopper	Skamokawa Bar	248,726
November-2011	Essayons	Hopper	Skamokawa Bar	24,413
March-2011	Essayons	Hopper	Puget Island Bar	101,859
May-2011	Essayons	Hopper	Puget Island Bar	129,339
October/November-2011	Essayons	Hopper	Puget Island Bar	358,556
May-2011	Essayons	Hopper	Wauna/Driscoll	77,564
August-2011	Essayons	Hopper	Wauna/Driscoll	45,457
October - 2011	Terrapin	Hopper	Wauna/Driscoll	125,827
November-2011	Essayons	Hopper	Wauna/Driscoll	12,630
May/June-2011	Essayons	Hopper	Westport Bar	374,604
June-2011	Essayons	Hopper	Westport Bar	47,911
July/August-2011	Oregon	Pipeline	Westport Bar	204,922
August-2011	Essayons	Hopper	Westport Bar	89,226
October - 2011	Terrapin	Hopper	Westport Bar	364,927
October/November-2011	Oregon	Pipeline	Westport Bar	181,140
November-2011	Essayons	Hopper	Westport Bar	61,283
November-2011	Essayons	Hopper	Westport Bar	50,250
RIVER SEGMENT 3				
July-2011	Oregon	Pipeline	Eureka Bar	41,238
November-2011	Essayons	Hopper	Eureka Bar	78,644
May - 2011	Yaquina	Hopper	Stella-Fisher Bar	24,200
August-2011	Essayons	Hopper	Stella-Fisher Bar	166,685
November-2011	Essayons	Hopper	Stella-Fisher Bar	165,505
November-2011	Oregon	Pipeline	Stella-Fisher Bar	182,996
September-2011	Essayons	Hopper	Slaughters Bar	80,350
November-2011	Essayons	Hopper	Slaughters Bar	65,216

Tables A2-5 A3-7 display the river segment, dredge and disposal information for the different river segments by the actual minutes of the dredging operations in 2011.

Table A2- 5. River Segments and Main Tributaries (D/S RM means downstream river mile; U/S RM means upstream river mile).

River Segment	Channel	Length		Tributaries
		D/S RM	U/S RM	
1	43-foot	3	25.2	Grays River (RM 22)
2	43-foot	25.2	48.2	-
3	43-foot	48.2	67.1	-
4	43-foot	67.1	83.8	Cowlitz (RM 68) & Kalama (RM 73)
5	43-foot	83.8	97.8	Lewis (RM 87)
6	43-foot	97.8	105.3	-
7	17-foot	105.3	125.3	Sandy (RM 120)
8	17-foot	125.3	136.4	-
9	17-foot	136.4	145.3	-

Table A2-6. Total Dredging (Minutes) by River Segment – 2011.

River segment	Channel	Length		Tributaries	Essayons	Yaquina	Contract Hopper	Oregon	Total
		D/S RM	U/S RM						
1	43-foot	3	25.2	Grays River	8,491	5,956	3,870	10,055	28,372
2	43-foot	25.2	48.2	-	28,622	2,113	215,460	96,447	342,642
3	43-foot	48.2	67.1	-	12,791	1,829		14,945	29,565
4	43-foot	67.1	83.8	Cowlitz	4,599	4,080		31,660	40,339
5	43-foot	83.8	97.8	Lewis (RM 87)	3,410	1,048			4,458
6	43-foot	97.8	105.3	-					0
7	17-foot	105.3	125.3	Sandy (RM 120)		4,152			4,152
8	17-foot	125.3	136.4	-		1,655			1,655
9	17-foot	136.4	145.3	-					0

Table A2-7. Total Flowlane Disposal (Minutes) by River Segment – 2011.

River Segment	Channel	Length		Tributaries	Essayons	Yaquina	Contract Hopper	Oregon	Total
		D/S RM	U/S RM						
1	43-foot	3	25.2	Grays River	1,041	464	860		2,365
2	43-foot	25.2	48.2	-	2,702	203	1,210	67,317	71,432
3	43-foot	48.2	67.1	-	652	82	1,070	33,835	35,639
4	43-foot	67.1	83.8	Cowlitz	209	297		4,535	5,041
5	43-foot	83.8	97.8	Lewis	198	76			274
6	43-foot	97.8	105.3	-					0
7	17-foot	105.3	125.3	Sandy		231			231
8	17-foot	125.3	136.4	-		73			73
9	17-foot	136.4	145.3	-					0

Table A2-8 displays the Corps calculations of the dimensions of the Columbia River, the area FNC that is expected need dredging, and the area that may potentially be affected by flowlane disposal.

Table A2-8. Columbia River channel dimensions (Smith 2012i).

River Segment	Channel	Length		Bank to bank river surface area at average water level (acres)	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)
		D/S RM	U/S RM			
1	43-foot	3	25.2	76,100	1,208	138
2	43-foot	25.2	48.2	23,220	885	358
3	43-foot	48.2	67.1	9,690	438	330
4	43-foot	67.1	83.8	6,840	412	248
5	43-foot	83.8	97.8	5,060	315	193
6	43-foot	97.8	106.5	2,720	42	28
7	17-foot	106.5	125.3	10,350	81	110
8	17-foot	125.3	136.4	6,200	12	28
9	17-foot	136.4	145.3	2,780	1	0

Table A2-8. Columbia River channel dimensions (cont'd).

River Segment	Channel	Length		Area of navigation channel that does NOT need dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour NOT used for placement (acres)	Outer Channel Area shallower than 20-ft contour NOT dredged or used for placement (acres)
		D/S RM	U/S RM			
1	43-foot	3	25.2	1,790	23,383	52,580
2	43-foot	25.2	48.2	1,110	8,631	14,232
3	43-foot	48.2	67.1	1,270	4,870	4,490
4	43-foot	67.1	83.8	1,222	4,393	2,200
5	43-foot	83.8	97.8	955	3,158	1,710
6	43-foot	97.8	106.5	656	2,113	580
7	17-foot	106.5	125.3	910	3,200	7,040
8	17-foot	125.3	136.4	438	2,123	4,050
9	17-foot	136.4	145.3	339	1,220	1,560

With the above information the Corps analyzed the habitat area affected by dredging and disposal compared to the total aquatic habitat area of the Columbia River (Table A2-9)

Table A2-9. Total effects analysis for 1 year: (Maintenance area + Placement area)/Total area = impact over 1 year.

River Segment	Channel	Length		Tributaries	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane below 20-ft contour used for placement (acres)	Total Area (acres)	% Affected/Total
		D/S RM	U/S RM					
1	43-foot	3	25.2	Grays River	1,208	138	76,100	2%
2	43-foot	25.2	48.2	-	885	358	23,220	5%
3	43-foot	48.2	67.1	-	438	330	9,690	8%
4	43-foot	67.1	83.8	Cowlitz	412	248	6,840	10%
5	43-foot	83.8	97.8	Lewis (RM	315	193	5,060	10%
6	43-foot	97.8	105.3	-	42	28	2,720	3%
7	17-foot	105.3	125.3	Sandy (RM	81	110	10,350	2%
8	17-foot	125.3	136.4	-	12	28	6,200	1%
9	17-foot	136.4	145.3	-	1	0	2,780	0%

Table A2-9 shows that the area affected by the 2011dredging and disposal activities ranged from 0% to 10% of the total wetted area depending upon the reach. The potential effects however are

not constant so the Corps next analyzed the relative impact of dredging and disposal over the course of a year (Table A2-10 and Table A2-11).

Table A2-10. Dredging Impact (minutes) over One Year (Affected area per pumping minute x Total dredging minutes)/(Total Area available per minute x Total minutes). Affected Area per pumping is from Table A2-2 weighted by the amount dredging each vessel completed in a river segment. Total pumping minutes is the sum of the total minutes by vessel. Total area available is the surface area of the segment (Table A2-8). Total minutes equals the minutes in a year.

River Segment	Channel	Length		Tributaries	Affected Area per Pumping Minute (acres)	Total Pumping Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
		D/S RM	U/S RM						
1	43-foot	3	25.2	Grays	0.04	28,372	76,10	525,600	0.000003%
2	43-foot	25.2	48.2	-	0.08	342,642	23,22	525,600	0.000212%
3	43-foot	48.2	67.1	-	0.03	29,565	9,690	525,600	0.000019%
4	43-foot	67.1	83.8	Cowlitz	0.01	40,339	6,840	525,600	0.000013%
5	43-foot	83.8	97.8	Lewis	0.06	4,458	5,060	525,600	0.000010%
6	43-foot	97.8	105.3	-		0	2,720	525,600	0.000000%
7	17-foot	105.3	125.3	Sandy	0.03	4,152	10,35	525,600	0.000002%
8	17-foot	125.3	136.4	-	0.03	1,655	6,200	525,600	0.000002%
9	17-foot	136.4	145.3	-		0	2,780	525,600	0.000000%

Table A2-11. Disposal Impact (minutes) over One Year (Affected area per placement minute X Total placement minutes)/ (Total area available per minute X Total minutes) = impact over 1 year.

River Segment	Channel	Length		Tributaries	Affected Area per Placement Minute (acres)	Total Placement Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
		D/S RM	U/S RM						
1	43-foot	3	25.2	Grays	0.70	2,365	76,10	525,600	0.000003%
2	43-foot	25.2	48.2	-	0.07	71,432	23,22	525,600	0.000212%
3	43-foot	48.2	67.1	-	0.07	35,639	9,690	525,600	0.000019%
4	43-foot	67.1	83.8	Cowlitz &	0.09	5,041	6,840	525,600	0.000013%
5	43-foot	83.8	97.8	Lewis	0.66	274	5,060	525,600	0.000010%
6	43-foot	97.8	105.3	-		0	2,720	525,600	0.000000%
7	17-foot	105.3	125.3	Sandy	0.62	231	10,35	525,600	0.000002%
8	17-foot	125.3	136.4	-	0.62	73	6,200	525,600	0.000002%
9	17-foot	136.4	145.3	-		0	2,780	525,600	0.000000%

NMFS Impact Analysis

The Corps analysis provides a reasonable assessment of the potential magnitude, timing, duration and severity of effects to habitat due to the dredging operations. However the Corps calculated the potential impacts over the course of a year which does not account for impacts when vulnerable species or life stages may be present. Dredging the FNC is most likely to impact salmon and steelhead smolts and eulachon. Subyearling steelhead are most likely to be rearing in the tributary streams although some may be present in the more shallow water habitats of the Columbia estuary. Subyearling salmon may occur in the FNC but are most likely to be present in the shallow water habitats so dredging impacts to the subyearling life are most likely to occur due to dredging and disposal in the side channels. Salmon and steelhead smolts primarily migrate through the main Columbia River channel and eulachon, especially the eggs and larvae may be found throughout the channel and therefore may be impacted by FNC dredging. In order to better estimate the potential magnitude, timing, duration and severity of effects, NMFS conducted the following impact analysis based upon the time the fish are most likely to be in the proximity of the dredging and disposal operations.

Salmon and Steelhead Impact Analysis

Salmon and steelhead smolts begin migrating through the LCR in February with the peak abundances in April and June (Fresh *et al* 2005). The potential impacts to salmon and steelhead smolts were assessed following a similar process as the Corps but limiting the assessment to the March through time period (while the smolt out migration may begin in February there was no dredging during the month in 2011) . NMFS developed Table A2-13 beginning with the detailed dredging and disposal by reach information for 2011 (Tables A2-4 and A2-5 display examples of the information) but only including the data for February-June. NMFS also divided the volume dredged by the average production rate of the dredge (Table A2-1) to estimate the number of days the dredging occurred.

Table A2-12. 2011 Columbia River – Detailed dredging operations by reach: Smolt Out-Migration March – June.

Month - Year	Dredge Name	Dredge Type	Dredging Location	Dredging (CY)	Days
RIVER SEGMENT 1					
March-2011	*Essayons*	Hopper	Tongue Point Crossing	62,101	1.3
Total				**62,101**	**1.3**
RIVER SEGMENT 2					
May – 2011	*Yaquina*	Hopper	Pillar Rock	52,019	2.7
May-2011	*Essayons*	Hopper	Skamokawa Bar	98,460	2.1
March-2011	*Essayons*	Hopper	Puget Island Bar	101,859	2.1
May-2011	*Essayons*	Hopper	Puget Island Bar	129,339	2.7
May-2011	*Essayons*	Hopper	Wauna/Driscoll	77,564	1.6
May/June-2011	*Essayons*	Hopper	Westport Bar	374,604	7.8
June-2011	*Essayons*	Hopper	Westport Bar	47,911	1.0
Total				**881,756**	**20.0**
RIVER SEGMENT 3					
May – 2011	*Yaquina*	Hopper	Stella-Fisher Bar	24,200	1.3
Total				**24,200**	**1.3**
RIVER SEGMENT 4					
				0	**0**
RIVER SEGMENT 5					
March – 2011	*Yaquina*	Hopper	St. Helens Bar	11,750	0.6
March – 2011	*Yaquina*	Hopper	Willow Bar	2,154	0.1
March-2011	*Essayons*	Hopper	Willow Bar	11,923	0.3
Total				**25,827**	**1.0**
RIVER SEGMENT 6					
March/September – 2011*	*Hickey*	Clamshell	Lower Vancouver Bar	89,000	16.3
Total				**89,000**	**16.3**
RIVER SEGMENT 7					
				0	**0**
RIVER SEGMENT 8					
				0	**0**

*The Corps did not provide information separating the amount dredged in March versus December therefore the total dredging was assumed to occur in March to describe maximum potential impacts for this analysis.

Out-migrating smolts are typically moving through the main Columbia channel with the flowlane. To estimate the habitat most smolts are expected to occupy NMFS used the dimensions of the navigation channel and flowlane (Table A2-13) to estimate the smolt migratory corridor (Table A2-14).

Table A2-13. Estimated Lower Columbia Smolt Migratory Corridor (estimated smolt habitat equals the sum of the flowlane used for placement + the flowlane not used for placement).

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)	Area of navigation channel that does NOT need dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour NOT used for placement (acres)	Total Estimated Smolt Migratory Habitat (acres)	Estimated Percent Habitat Potentially Affected
1	1,208	138	1,790	23,383	23,521	6%
2	885	358	1,110	8,631	8,989	14%
3	438	330	1,270	4,870	5,200	15%
4	412	248	1,222	4,393	4,641	14%
5	315	193	955	3,158	3,351	15%
6	42	28	656	2,113	2,141	3%
7	81	110	910	3,200	3,310	6%
8	12	28	438	2,123	466	9%
9	1	0	339	1,220	1,220	0.08%

The information in Table A2-13 and the cycle time for the dredges presented in Table A2-1was used to calculate the amount of time each vessel was dredging and disposing during the out-migration period (Table A2-14 and Table A2-17).

Table A2-14. *Essayons* Dredging Impacts March-June 2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes)	Cycles	Minutes Dredging	Minutes Disposal
1	1.3	1,872	164	11	1,045	88
2	17.3	24,912	164	152	14,440	1,216
5	0.3	432	164	3	285	24

Table A2-15. *Yaquina* Dredging Impacts March-June 2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes	Cycles	Minutes Dredging	Minutes Disposal
2	2.7	3,888	77	50	2,400	200
3	1.3	1,872	77	24	1,152	96
5	0.7	1008	77	13	624	52

Table A2-16. Clamshell Dredging Impacts - March 2011.

River Segment	Volume Dredged (cy)	Dredging Minutes (89,000cy/3.8cy/min)	Navigation Channel Needing Dredging (acres)	Acres Affected/minute
6	89,000	23,421	42	0.002

Table A2-17. Clamshell Disposal Impacts March 2011 (for this analysis the load capacity and number of loads per day for the large scow was were used and the 11 minutes per disposal was used assuming the navigation channel is predominately sand).

River Segment	Loads Disposed (89,000 cy/3,150 cy/load)	Disposal Minutes (11 min/load as assuming predominately sand)	Acres Affected/minute (6 acres/load)
6	28	308	0.019

Finally NMFS conducted analysis of the potential relative impacts to smolt habitat during the outmigration period (March-June 2011). The analysis is similar to the annual impact analysis conducted by the Corps displayed in Table A3-11 and Table A2-12. When two dredges were used in a reach the acres affected/minute from Table A2-2 and A2-3 was weighted by the amount of time each dredge was dredging or disposing (Table A2-16 and Table A2-17).

Table A2-18. Dredging Impacts to Smolt Outmigration Habitat March-June 2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.07	1,045	23,521	175,680	.002%
2	0.06	16,840	8,989	175,680	.064%
3	0.03	1,152	5,200	175,680	.004%
5	0.04	909	3,351	175,680	.006%
6	0.002	23,421	2,720	175,680	.01%

Table A2-19. Disposal Impacts to Smolt Outmigration Habitat March-June 2011(% Affected= affected area per disposal minute x total disposal minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Disposal Minute (acres)	Total Disposal Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.67	88	23,521	175,680	.001%
2	0.66	1,416	8,989	175,680	.059%
3	0.62	96	5,200	175,680	.007%
5	0.64	76	3,351	175,680	.008%
6	0.019	308	2,720	175,680	.001%

Eulachon Impact Analysis

Eulachon typically enter the Columbia River in mid-December with peak spawning during February and March. Eulachon have been documented in the Columbia River as early as November and the average date of commercial landings in the Sandy River is March 21. Eulachon eggs are estimated to hatch in 30-40 days. Assuming March 21 as an “average” peak spawning time in the upper Columbia River then eggs and larvae may be present into May. The eulachon impact analysis followed the same steps as outlined in the smolt impact analysis.

Table A2-20. 2011 Columbia River – Detailed dredging operations by reach: Eulachon December – May.

Month - Year	Dredge Name	Dredge Type	Dredging Location	Dredging (CY)	Days
RIVER SEGMENT 1					
March-2011	*Essayons*	Hopper	Tongue Point Crossing	62,101	1.3
Total				62,101	1.3
RIVER SEGMENT 2					
May - 2011	*Yaquina*	Hopper	Pillar Rock	52,019	2.7
May-2011	*Essayons*	Hopper	Skamokawa Bar	98,460	2.1
March-2011	*Essayons*	Hopper	Puget Island Bar	101,859	2.1
May-2011	*Essayons*	Hopper	Puget Island Bar	129,339	2.7
May-2011	*Essayons*	Hopper	Wauna/Driscoll	77,564	1.6
May/June-2011	*Essayons*	Hopper	Westport Bar	374,604	7.8*
Total				833,845	19
RIVER SEGMENT 3					
May - 2011	*Yaquina*	Hopper	Stella-Fisher Bar	24,200	1.3
				24,200	1.3
RIVER SEGMENT 4					
December-2011	*Oregon*	Pipeline	Kalama Bar	297,555	11.9
December-2011	*Oregon*	Pipeline	Lower Martin Is. Bar	80,351	3.2
				377,906	15.1
RIVER SEGMENT 5					
March - 2011	*Yaquina*	Hopper	St. Helens Bar	11,750	0.6
March - 2011	*Yaquina*	Hopper	Willow Bar	2,154	0.1
March-2011	*Essayons*	Hopper	Willow Bar	11,923	0.3
November/December-2011	*Essayons*	Hopper	Willow Bar	35,286	0.7**
November/December-2011	*Essayons*	Hopper	Willow Bar	72,830	1.5
				98,657	3.2
RIVER SEGMENT 6					
March/September-2011	*Hickey*	Clam	Lower Vancouver Bar	89,000	20.2
December-2011	*Ross Is.*	Clam	Lower Vancouver Bar	7,530	1.7
				96,530	21.9
RIVER SEGMENT 7					
				0	0
RIVER SEGMENT 8					
				0	0

*Although the row includes dredging into June, how much was completed in June is not known so the full dredging time is assumed to potentially impact eulachon for this analysis

**Although the row includes dredging in November how much was completed in November vs. December is not known and since eulachon may be present in the latter part of November the full dredging time is assumed to potentially impact eulachon for this analysis

Unlike smolts which are primarily outmigrating through the main Columbia River channel and thus the FNC, eulachon, especially the eggs and larvae may be found throughout the whole river channel, therefore the area potentially impacted is the navigation channel but the whole Columbia wetted channel is considered potential habitat (Table A2-19) .

Table A2-21. Federal Navigation Channel and Potential Eulachon Habitat.

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)	Total Estimated Eulachon Habitat (acres)(From Table A2-9	% Potentially Affected Area
1	1,208	138	76,100	2%
2	885	358	23,220	5%
3	438	330	9,690	8%
4	412	248	6,840	10%
5	315	193	5,060	10%
6	42	28	2,720	3%
7	81	110	10,350	2%
8	12	28	6,200	1%
9	1	0	2,780	.04%

As described for Tables A2-14 and A2-15 NMFS used the number of days the vessel were operating in a river segment and the cycle times presented in Table A2-1 to calculate the amount of time each vessel was dredging and disposing material during the time the December – May time period (Tables A2-22 and Table A2-26).

Table A2-22. *Essayons* Dredging Impacts December-May 2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes)	Cycles	Minutes Dredging	Minutes Disposal
1	1.3	1,872	164	11	1,045	88
2	16.3	23,472	164	143	13,585	1,144
5	2.2	3,168	164	19	1,805	152

Table A2-23. *Yaquina* Dredging Impacts December – May 2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes	Cycles	Minutes Dredging	Minutes Disposal
2	2.7	3,888	77	50	2,400	200
3	1.3	1872	77	24	1,152	96
5	0.7	1,008	77	13	624	52

In addition to the *Essayons* and *Yaquina*, the pipeline dredge *Oregon* and two clamshell dredges, *Hickey* and *Ross Island* were in operation during the eulachon out analysis time period. The information regarding the potential impacts due to the *Oregon's* operations was provided in the Corps' March 14, 2012 impact analysis. The information for clamshell dredges was provided in a second email from Gretchen Smith, Corps on March 29, 2012 (Smith 2012i).

Table A2-24. *Oregon* Dredging Impacts December – May 2011.

River Segment	Dredging and Disposal Operations (days)	Dredging and Disposal Operations assuming dredge operates 84% of the time(minutes)
4	15.1	18,265

Table A2-25. Clamshell Dredging Impacts December – May 2011.

River Segment	Volume Dredged (cy)	Dredging Minutes (96,530cy/3.8cy/min)	Navigation Channel Needing Dredging (acres)	Acres Affected/minute
6	96,530	25,403	42	0.002

Table A2-26. Clamshell Disposal Impacts December – May 2011 (for this analysis the load capacity and number of loads per day for the large scow was were used and the 11 minutes per disposal was used assuming the navigation channel is predominately sand).

River Segment	Loads Disposed (96,530 cy/3,150 cy/load)	Disposal Minutes (11 min/load as assuming predominate	Acres Affected/minute (6 acres/load)
6	31	341	.055

NMFS then calculated a eulachon relative impact analysis similar to the smolt impact analysis. When two dredges were used in a reach the impacted acres and the dredging and disposal times were weighted by the amount of time each dredge was dredging or disposing.

Table A2-27. Dredging Impacts to Eulachon Habitat December-May2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.07	1,045	76,100	262,080	.0004
2	0.06	15,985	23,220	262,080	.0158
3	0.03	1,152	9,690	262,080	.0014
4	0.003	18,265	6,840	262,080	.0003
5	0.06	624	5,060	262,080	.0028
6	0.002	25,403	2,720	262,080	.0071

Table A2-28. Disposal Impacts to Eulachon Habitat December-May 2011(% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Disposal Minute (acres)	Total Disposal Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	0.67	88	76,100	262,080	.0003
2	0.66	1,344	23,220	262,080	.0146
3	0.62	96	9,690	262,080	.0023
4	0.03	18,265	6,840	262,080	.0334
5	0.66	204	5,060	262,080	.0102
6	0.55	341	2,720	262,080	.0263

Green Sturgeon Impact Analysis

Green sturgeon enter the Columbia River in May and can be present in the River through October therefore the potential to impact green sturgeon is during the May through October time period. The 2011 dredging record from May through October was used to calculate the relative impact to green sturgeon and their habitat. The green sturgeon impact analysis followed the same steps as outlined in the smolt impact analysis.

Table A2-29 2011 Columbia River – Detailed dredging operations by reach: Green Sturgeon May – October.

Month - Year	Dredge Name	Dredge Type	Dredging Location	Dredging (CY)	Days
RIVER SEGMENT 1					
October-2011	Yaquina	Hopper	Flavel Bar	22,265	1.2
September - 2011	Terrapin	Hopper	Tongue Point Crossing	250,000	5.0
October-2011	Essayons	Hopper	Tongue Point Crossing	233,363	4.9
August - 2011	Terrapin	Hopper	Miller Sands	75,330	1.5
October-2011	Essayons	Hopper	Miller Sands	167,899	3.5
October-2011	Yaquina	Hopper	Miller Sands	80,641	4.2
October-2011	Oregon	Pipeline	Miller Sands	227,586	9.1
Total				**1,057,084**	**29.4**
RIVER SEGMENT 2					
May - 2011	Yaquina	Hopper	Pillar Rock	52,019	2.7
August/September-2011	Oregon	Pipeline	Pillar Rock	551,064	22.0
September-2011	Essayons	Hopper	Pillar Rock	111,660	2.3
October - 2011	Essayons	Hopper	Pillar Rock	112,834	2.4
October/November – 2011*	Essayons	Hopper	Pillar Rock	47,028	1.0
August-2011	Oregon	Pipeline	Brookfield Welch	231,958	9.3
September/October-2011	Oregon	Pipeline	Brookfield Welch	844,773	33.4
May-2011	Essayons	Hopper	Skamokawa Bar	98,460	2.1
September/October - 2011	Terrapin	Hopper	Skamokawa Bar	248,726	5.0
May-2011	Essayons	Hopper	Puget Island Bar	129,339	2.7
October/November-2011*	Essayons	Hopper	Puget Island Bar	358,556	7.5
May-2011	Essayons	Hopper	Wauna/Driscoll	77,564	1.6
August-2011	Essayons	Hopper	Wauna/Driscoll	45,457	0.9
October - 2011	Terrapin	Hopper	Wauna/Driscoll	125,827	2.5
May/June-2011	Essayons	Hopper	Westport Bar	374,604	7.5
June-2011	Essayons	Hopper	Westport Bar	47,911	1.0
July/August-2011	Oregon	Pipeline	Westport Bar	204,922	8.2
August-2011	Essayons	Hopper	Westport Bar	89,226	1.9
October - 2011	Terrapin	Hopper	Westport Bar	364,927	7.3
October/November-2011*	Oregon	Pipeline	Westport Bar	181,140	7.2
Total				**4,297,995**	**128.5**
RIVER SEGMENT 3					
July-2011	Oregon	Pipeline	Eureka Bar	41,238	1.6
May - 2011	Yaquina	Hopper	Stella-Fisher Bar	24,200	1.3
August-2011	Essayons	Hopper	Stella-Fisher Bar	166,685	3.5
September-2011	Essayons	Hopper	Slaughters Bar	80,350	1.7
Total				**312,473**	**8.1**
RIVER SEGMENT 4					
July-2011	Oregon	Pipeline	Lower Dobelbower Bar	99,780	4.0
September - 2011	Yaquina	Hopper	Kalama Bar	28,239	1.5
October-2011	Yaquina	Hopper	Kalama Bar	28,460	1.5
September - 2011	Yaquina	Hopper	Upper Martin Island Bar	30,287	1.6
Total				**186,766**	**8.6**

Month - Year	Dredge Name	Dredge Type	Dredging Location	Dredging (CY)	Days
RIVER SEGMENT 5					
August-2011	Essayons	Hopper	St. Helens Bar	42,488	0.9
September - 2011	Yaquina	Hopper	Willow Bar	1,024	0.1
September - 2011	Yaquina	Hopper	Willow Bar	1,045	0.1
Total				**44,557**	**1.1**
RIVER SEGMENT 6					
March/September-2011*	Hickey	Clam	Lower Vancouver Bar	89,000	
Total					
RIVER SEGMENT 7					
September - 2011	Yaquina	Hopper	Upper Vancouver Bar	7,050	0.4
September - 2011	Yaquina	Hopper	Airport Bar	25,518	1.3
September - 2011	Yaquina	Hopper	Washougal Ranges	26,401	1.4
Total				**58,969**	**3.1**
RIVER SEGMENT 8					
September - 2011	Yaquina	Hopper	Fashion Reef	**21,475**	**1.1**

*Although the dredging in portions of River Segment 2 extended into November and River Segment 6 included dredging in March how much occurred outside the May through October time period was not provided so the for the purpose of the analysis it is assumed all the dredging occurred during the green sturgeon analysis period.

The green sturgeon habitat use in the lower Columbia River is not fully understood. While the may prefer water depths below 5 meters they also may be present in the deeper portions of the FNC and may move with the tide into shallow water habitats. Therefore as with the eulachon impact analysis, for the green sturgeon impact analysis the whole wetted channel is considered to be potential habitat.

Table A2-30. Federal Navigation Channel and Potential Green Sturgeon Habitat.

River Segment	Area of navigation channel that needs dredging to maintain depth (acres)	Area of flow lane deeper than -20-ft contour used for placement (acres)	Total Estimated Eulachon Habitat (acres)(From Table A2-9	% Potentially Affected Area
1	1,208	138	76,100	2%
2	885	358	23,220	5%
3	438	330	9,690	8%
4	412	248	6,840	10%
5	315	193	5,060	10%
6	42	28	2,720	3%
7	81	110	10,350	2%
8	12	28	6,200	1%
9	1	0	2,780	.04%

As was done for the smolt and eulachon analysis, NMFS used the number of days the vessel were operating in a river segment and the cycle times presented in Table A2-1 to calculate the amount of time each vessel was dredging and disposing material during the May – September time period (Tables A2-31 Table A2-35).

Table A2-31. *Essayons* Dredging Impacts May – October 2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes)	Cycles	Minutes Dredging	Minutes Disposal
1	8.4	12,096	164	74	7,030	592
2	28.8	41,472	164	253	24,035	2,024
3	5.2	7,488	164	46	4,370	368
5	0.9	1,296	164	8	760	64

Table A2-32. *Yaquina* Dredging Impacts May - October2011.

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes	Cycles	Minutes Dredging	Minutes Disposal
1	5.4	7,776	77	101	4,848	404
2	2.7	3,888	77	50	2,400	200
3	1.3	1,872	77	24	1,152	96
4	4.6	6,624	77	86	4,128	344
5	0.2	288	77	4	192	768
7	3.1	4,464	77	58	2,784	232
8	1.1	1,584	77	21	1,008	84

Table A2-33. *Terrapin* Dredging Impacts May – October 2011

River Segment	Dredging Operations (days)	Dredging Operations (minutes)	Cycle Time (minutes)	Cycles	Minutes Dredging	Minutes Disposal
1	6.5	9,360	115	81	3,645	810
2	14.8	23,312	115	203	9,135	2,030

Table A2-34. *Oregon* Dredging Impacts December – May 2011.

River Segment	Dredging and Disposal Operations (days)	Dredging and Disposal Operations assuming dredge operates 84% of the time(minutes)
1	9.1	11,007
2	80.1	96,889
3	1.6	1,935
4	4.0	4,834

Table A2-35. Clamshell Dredging Impacts May – October 2011.

River Segment	Volume Dredged (cy)	Dredging Minutes (89,000 cy/3.8cy/min)	Navigation Channel Needing Dredging (acres)	Acres Affected/minute
6	89,000	23,421	42	0.002

Table A2-36. Clamshell Disposal Impacts May – October 2011 (for this analysis the load capacity and number of loads per day for the large scow was were used and the 11 minutes per disposal was used assuming the navigation channel is predominately sand).

River Segment	Loads Disposed (89,000 cy/3,150 cy/load)	Disposal Minutes (11 min/load as assuming predominate sand	Acres Affected/minute (6 acres/load)
6	28	308	.02

NMFS then calculated a relative green sturgeon relative impact analysis similar to the smolt and eulachon impact analysis. When two dredges were used in a reach the impacted acres and the dredging and disposal times were weighted by the amount of time each dredge was dredging or disposing.

Table A2-37. Dredging Impacts to Green Sturgeon Habitat May - October 2011 (% Affected= affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Dredging Minute (acres)	Total Dredging Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	.04	26,530	76,100	264,960	.005
2	.023	132,459	23,220	264,960	.05
3	.033	10,433	9,690	264,960	.013
4	.015	8,962	6,840	264,960	.007
5	.062	9,52	5,060	264,960	.004
6	.002	23,421	2,720	264,960	.006
7	.03	2,784	10,350	264,960	.003
8	.03	1,008	6,200	264,960	.002

Table A2-38. Disposal Impacts to Green Sturgeon Habitat May - October 2011 (% Affected = affected area per dredging minute x total dredging minutes)/total habitat area available per minute x total minutes).

River Segment	Affected Area per Disposal Minute (acres)	Total Disposal Time 2011 (min)	Total Area (acres)	Total Time available 2011 (min)	% Affected/Total
1	.12	12,813	76,100	264,960	.008
2	.06	101,143	23,220	264,960	.099
3	.15	2,399	9,690	264,960	.014
4	.07	5,178	6,840	264,960	.02
5	.19	104	5,060	264,960	.001
6	.02	308	2,720	264,960	.001
7	.62	232	10,350	264,960	.005
8	.62	84	6,200	264,960	.003

EPA-Region 10 5 July 2017
Office of Environmental Review & Assessment (Sediment Management Unit)

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-OD-NW, Stokke)

Subject: Portland Sediment Evaluation Team (PSET) Level 2 dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging of the Lower Columbia River (LCR) deep-draft Federal Navigation Channel (FNC) in the Columbia River from River Mile (RM) 3 to 106.5 in Oregon and Washington.

Introduction: Per the *Sediment Evaluation framework for the Pacific Northwest* (SEF)', this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic placement. The PSET reviewed the Corps' 21 April 2017 "Sediment Quality Evaluation Report: Lower Columbia River Federal Navigation Channel (River Miles 3 to 106.5)" (SQER), prepared by Corps' Sediment Quality Team (SQT)[2]. Sediment physical testing results are summarized in the SQER; the analytical results were compared to the physical screening levels published in the 2016 SEF.

Suitability Summary:

Surface Sediments:	Îf Suitable	O Unsuitable
Post-Dredge Surface (PDS):	Îf Suitable	O Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

i2J James Holm (Corps, Lead)	i2J Bridgette Lohrman (EPA, Co-Lead)	
i2J James McMillan (Corps)	i2J Pete Anderson (ODEQ)	UJ Laura Inouye (Ecology)
in Tom Hausmann (NMFS)	O Jeremy Buck (USFWS)	

Table 1. PSET Review Timeline

Sampling and analysis plan (SAP) received	9 March 2016
SAP consistency determination	9 March 2016'
Sampling date(s)	22-31 March 2016
SQER received by PSET	24 April 2017
Suitability determination memorandum issued	5 July 2017
Management area ranking	Very Low (deep-draft federal navigation channel)
Recency of data*	10 years from sampling date (expires March 2026)

*If site conditions or the proposed project change, or if new information related contaminants of concerns are discovered, additional project coordination with PSET may be required to determine the validity of this SDM.

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2016. *Sediment Evaluation Franie»ork for the Pacific Northwest.* Published July 2016, by the U.S. Army Corps of Engineers, Northwestern Division, 172 pp + Appendices.

[2] U.S. Army Corps of Engineers — Portland District. 2017. *Sediment Quality Evaluation Report — Lower Columbia River Federal Navigation Channel (Kbs 3 to 106.5).* Prepared by the Portland District Sediment Quality Team, 21 April 2017. 89 pp.

[3] Portland Sediment Evaluation Team (PSET). 2016. *PSET - SAP Approval for the LCR FNC and RSV Dredging.* Email issued 9 March 2016, by PSET. 2 pp.

Federal Regulatory Authorities:
UJ Section 10, Rivers and Harbors Act
UJ Section 404, Clean Water Act (CWA)
iZi Section 401, CWA
iZi Section 7, Endangered Species Act
UJ Section 305 of the Magnuson-Stevens Act
in Fish and Wildlife Coordination Act
iZi Section 103, Marine Protection, Research and Sanctuaries Act
O Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 summarizes the O&M dredging program details for the LCR FNC project. Dredging is needed to provide reliable commercial and recreational navigation.

Table 2. Project Details

Waterbody / river miles (RMs)	Columbia River / +3.0 to +l06.5
Dredged volume	=6.7 million cubic yards annually
Deep-draft channel dimensions	600 ft. wide + 100 ft. over-dredge width, 103 miles long
Max. proposed dredging depth	-48 ft. (43 ft. + 5 ft. advanced maintenance depth, MLLW/CRD)
Dredging method	Pipeline, Hopper Dredge
Dredged material transport	Pipeline, Hopper Dredge
Placement locations	Ocean, in-river, shoreline, upland
Dredging dates	Typically April through October

Sampling and Analysis Description: The Corps' sampling and analytical program for the LCR FNC is summarized in Table 3. Dredge prism surface grab (power grab sampler) samples were collected from 22 through 31 March 2016. Sample station locations are shown in Figures 2 through 6 of the SQER.

Table 3. LCR FNC Sampling and Analysis Description

Sampling Description		
Sample collection methods		Power grab sampler
Dredged material management unit (DMMU)		N/A
Averaged DMMU volume (cy)		On average, each sample represents =l 14,000 cy
Subsamples (SS)/DMMU		
DP	Depth range (ft. MLLW/CRD)	-22.6 to -74.5
	Composite (Y/N)	N
	SS archive (Y/N)	N
	Composite archive (Y/N)	N
PDS	Not Proposed	
Sediment Physical and Chemical Analysis (no. analyses/decision unit)		
Decision unit (DMMU ID)		59 discrete stations
Station ID(s)		CR-2 to CR-299
ASTM Dredge Analyses		
Grain size		1
Bulk Density		1
Total volatile solids		
Total organic carbon		1
Sulfides		
Ammonia		
Metals		

2

Semi volatile organic compounds (polynuclear aromatic hydrocarbons, chlorinated hydrocarbons, phthalates, phenols, misc. extractables)	
Pesticides	
Polychlorinated biphenyls (Aroclors)	
Butyltins	
Total petroleum hydrocarbons	
Dioxins/furans	
Biological Testing Description	
Bioassays planned (Y/N)	N

Deviations from the SAP: Five (5) deviations from the PSET-approved SAP occurred.

1. The Corps simplified the sample ID by removing the date of collection from the sample ID and relied on the station ID because each station was discretely analyzed.
2. No fine-grained sediments were visually observed in the FNC grab samples. Therefore, no chemical analyses were necessary.
3. The Corps sampled 59 stations within the LCR FNC, 4 more than proposed in the PSET-approved SAP.
4. To achieve cost efficiencies, the Corps proposed the LCR FNC survey in conjunction with a larger regional sediment management survey. This combined survey effort and unpredictable shoaling resulted in only 44% (26) of samples representing dredge prism material and 56% (33) of the stations were below the advanced maintenance depth of— 48 feet. For 6.7 MCY of dredging, a minimum of 22 stations are needed in very low ranked project (300,000 CY per DMMU) per the 2016 SEF. The 26 samples the Corps collected within the dredge prism meets the sampling density for a very low ranked project.
5. Even though approximately half of the stations were below maintenance depth (-48', AMD included), the majority of dredged material in the FNC consists of coarse-grained bedload material instead of fine-grained suspended sediment load. Bedload material typically form the sand waves that shoal (each typically less than 50,000 CY) within the FNC and trigger localized dredging. Sand waves move downstream as bedload sediment erodes from the upstream face, deposits in the downstream trough and is then buried by additional material eroded from the upstream face. This movement occurs in a layer only a few sand grains thick. Through this mechanism, all the individual grains in a sand wave are exposed to flow, eroded, transported, deposited, buried, and then eventually exposed again as the sand wave migrates downstream. The height of sand waves is dependent on higher river flows (spring freshets) that shapes the bedload material into taller sand waves. The suspended sediment load stays suspended by high flows and does not interact with the bedload materials that form sand waves. Therefore, even the bedload sediments sampled below -48' have the potential to form sandwave shoals that require dredging and are represented of dredged materials in LCR FNC.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. The analytical results from the SQER were compared to the 2016 SEF SLs.

Table 4. LCR FNC Sediment Analytical Summary

Sediment Physical Results	
DMMU ID and Sample ID(s):	59 discrete sampling stations
Sample type (dredge prism, adv. main. depth)	dredge prism + advanced maintenance depth*
Grain size, minimum % gravel and sand / maximum % silt and clay	>97 / 2.6
Bulk density, range (g/cm')	1.27 to 2.15
Total organic carbon, range (%)	0.1 to 0.29

* 33 of the 59 stations (56%) were sampled below the maximum depth of -48' due the location of the regional sediment management transects every =two river miles. This broader survey effort dictated where LCR FNC stations were placed.

There have been no substantive changes in the complex hydrologic (riverine, tidal) regimes of the lower Columbia River, hydropower operations within the Columbia River Basin, or the LCR federal navigation channel since the completion of the Columbia River Channel Improvement Project that deepened the LCR FNC to -43+5 feet in 2010. The grain size, bulk density, and total organic carbon results from the March 2016 sampling event are representative of the bedload sediments within the LCR FNC regardless of the sampling surface elevation relative to the project depth. The 2016 physical results confirm the LCR FNC sediments are very similar to previous testing results (2008).

Dredge Prism: The LCR deep-draft FNC is assigned a "very low" rank because the project is dominated by coarse sands, low total organic carbon content (<0.5%), and strong river and tidal currents. Per the Section 3.5.3 of the 2016 SEF, chemical testing is not required. Therefore, the LCR deep-draft FNC dredge prism material is suitable for unconfined, aquatic placement per the SEF guidance through March 2026.

Post-Dredge Surface: The dredge prism materials were determined to be suitable and the LCR deep-draft FNC is assigned a "very low" rank. As such, the PSET assumes that the LCR deep-draft FNC post-dredge surface is suitable for unconfined, aquatic exposure per the SEF guidance through March 2026.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET Co-Lead) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Stokke, Jessica B CIV USARMY CENWP (USA)

From:	Lohrman, Bridgette <lohrman.bridgette@epa.gov>
Sent:	Friday, July 8, 2022 2:28 PM
To:	Stokke, Jessica B CIV USARMY CENWP (USA)
Cc:	Holm, James A CIV USARMY CENWP (USA); Yballe, Dominic P CIV USARMY CENWP (USA); Pete Anderson; Inouye, Laura (ECY); Jeremy_Buck@fws.gov; Tom Hausmann - NOAA Federal (tom.hausmann@noaa.gov)
Subject:	[Non-DoD Source] PSET - LCR FNC Transfer Sites - suitability
Attachments:	20220707 LCR DM Transfer Sites Lvl 1_Plates.pdf

Hello Jessica,

This email correspondence constitutes the Portland Sediment Evaluation Team's (PSET's) determination regarding the June 2022 No Test request for the U.S. Army Corps of Engineers – Portland District (Corps) transfer sites for the Lower Columbia River (LCR) deep draft federal navigation channel (FNC). The LCR FNC is located in the Columbia River from river mile (RM 3 to 106.5) along the boundary between the states of Oregon and Washington. This determination was made in accordance with the May 2018 Sediment Evaluation Framework for the Pacific Northwest (SEF) and after reviewing the Corps 28 June 2022 "MEMORANDUM FOR THE RECORD – Re: SEF Level 1 No Test Request for the Lower Columbia River Federal Navigation Project – In- Water Dredged Material Transfer Sites" (Level 1 memo), prepared by the Corps' Sediment Quality Team. The scope of the PSET's sediment evaluation includes placement of previously determined suitable LCR FNC dredged material in the aquatic transfer sites and the subsequent dredging for shoreline or upland placement, including minimal over-dredging of the transfer sites when removing LCR FNC sediments. This email documents the PSET's decision to not require sediment testing per Subpart G of the Clean Water Act section 404(b)(1) guidelines (see 40 CFR 230.60 - 230.61).

PROJECT DESCRIPTION: The Corps dredges 6 to 8 million cubic yards of sand from the LCR FNC each year. The eight LCR FNC transfer sites are in water holding areas for temporary storage of suitable dredged materials. The Corps proposes to modify one existing site and add seven new sites. Transfer sites are necessary when shoaling forms beyond the reach of the pipeline DREDGE Oregon that is used to place sediments along shorelines or in upland sites. Dredged materials would typically be placed by a hopper dredge. Transfer sites are located in water deeper than 20 feet and in locations which have been previously used by the Corps for placement of dredged material. The Corps anticipates placing and removing the material into/from these eight sites annually.

SOURCES OF CONTAMINATION: In 2017, the PSET evaluated potential sources of contamination for the LCR FNC sediments and issued a suitability determination memo (SDM) stating the dredged materials are suitable for unconfined aquatic placement without chemical testing. The PSET confirmed a "very low" management area ranking for these sediments.

Once the material is within the transfer sites, the potential for contamination is very low given the 8 sites are subject to high river flows which transport large bed loads of material. Based on the Corps' LCR FNC sediment sampling in 2017, an analysis of stations in close proximity to the transfer sites indicates that any material that may be transported into the transfer sites by the riverine processes is predominately sand and gravel (>95%) with less than 5% fines. Thus, the potential for the sediments to be carriers of contamination is very low. Also, the 8 transfer sites are not in close proximity to known land-based sources of contamination that could cause contamination while the sediments are "stored" at the transfer sites.

MANAGEMENT AREA RANK: The PSET assigns a "very low" management area ranking to these 8 transfer sites due to the previous review of the LCR FNC, and no reason to believe that the project sediments have chemicals of concerns at concentrations above SEF SLs.

REGULATORY REQUIREMENTS FOR SEDIMENT EVALUATION: In accordance with the CWA section 404(b)(1) guidelines (40 CFR 230.60), when provided information indicates the material is sufficiently removed from sources of contamination, with reasonable assurances that the dredged material is not a carrier of contaminants, then testing is unnecessary. Project sediments are most likely not a carrier of contaminants because they are composed primarily of sand, gravel, or other naturally occurring inert material and if dredged materials are found in areas of high current or wave energy. Less than 5% of the material is fine grained sediment.

NO TEST DETERMINATION: Based on the information provided, the PSET has determined that the transfer sites project areas do not require additional sediment physical or chemical evaluation per the CWA section 404(b)(1) guidelines. If the project changes or if additional information is available, then this "no test" determination must be re evaluated, and sediment testing may be required. The PSET has assigned a "very low" site management area ranking to this project with this analysis being valid until March 2026, which aligns with the recency of the data collected by the Corps for the LCR FNC in 2016. If there are project changes or new information regarding sources of contamination are available, PSET would re evaluate the suitability determination.

REVIEWING PSET AGENCIES: U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Oregon Department of Environmental Quality, Washington Department of Ecology, U.S. Fish and Wildlife Service, National Marine Fisheries Service.

CONTACT: If you have questions regarding this PSET determination, please email or call me.

Take care,
-Bridgette

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EPA-Region 10 Water Division, Wetlands and Oceans Section 08 May 2023

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Downstream Deep Draft Federal Navigation Channel (entrance to mile 1.5) in Portland, Multnomah County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (USACE) operations and maintenance (O&M) dredging for the Oregon Slough Downstream (OSD) Deep Draft Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 102 to 104 (project mile entrance to 1.5).

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) , this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the OSD deep draft FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the April 2023 *"Sediment Characterization. Oregon Slough Downstream Deep-Draft Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon"* (SQER)' prepared by ANAMAR for the USACE's Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs[3]

Suitability Summary:

Dredge Prism (DP) Sediments:	& Suitable	OUnsuitable
Post-Dredge Surface (PDS):	Suitable	OUnsuitable

' U.s. Army Corps of Engineers, U.s. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific North»est.* Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers (USACE) — Portland District. 2023. *Sediment Characteri--ation.' Oregon Slough Do›1'nstream Deep-Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon.* Prepared by ANAMAR, April 2023. 25 pp with Maps, Tables, and Appendices.

Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccunuilative Chemicals of Concern in Sediment.* Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

Reviewers: The PSET agencies include the USACE, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

I8i James Holm (USACE, Lead)	*S* Bridgette Lohrman (EPA, Co-Lead)
Hi Pete Anderson (ODEQ)	*S* Laura Inouye (Ecology)
I8i Dominic Yballe (USACE)	*S* Tom Hausmann (NMFS)
UJ Jeremy Buck (USFWS)	I8i Samantha Lynch (USACE)

PSET/SEF Conditions:

Data Recency Expiration — Based on a "Low" rank, the data recency for sediments in the Oregon Slough Downstream Deep Draft Federal Navigation Channel expires in November 2029

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP) submitted to PSET	30 August 2022
SAP revisions requested by PSET	31 August 2022
Revised SAP submitted to PSET	31 August 2022
Revised SAP revisions requested by PSET	7 September 2022
Final SAP[4] submitted to PSET	13 September 2022
Final SAP approved by PSET'	19 September 2022
Sampling date(s)	14 November 2022
Draft SQER submitted to PSET	4 April 2023
Draft SQER edits requested by PSET	18 April 2023
Final SQER submitted to PSET	25 April 2023
Suitability Determination Memorandum (SDM) issued by PSET	08 May 2023
Management area ranking	Low
Recency of data	November 2029 (7 years)

Federal Regulatory Authorities:

Section 10, Rivers and Harbors Act
& Section 404, Clean Water Act (CWA)
& Section 401, CWA
Section 7, Endangered Species Act
Section 305 of the Magnuson-Stevens Act
Fish and Wildlife Coordination Act
O Section 103, Marine Protection, Research and Sanctuaries Act
⊏ Comprehensive Environmental Response, Compensation, and Liability Act

[4] USACE — Portland District. 2022. *Oregon Slough Do»nstreani Deep-Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon, Sediment Sampling and Analyses Plan.* Prepared by SQT, 13 September 2022. 16 pp with Attachments.
Portland Sediment Evaluation Team (PSET). 2022. *PSET - Oregon Slough SAP Approval.* Email issued by B. Lohrman (EPA) for PSET, 19

September 2022. 2 pp with Attachment.

Project Description: Table 2 provides a summary of the dredging project details for the OSD deep draft FNC. Maintenance dredging is needed to provide navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 102 to 104
Total proposed dredging volume (cy)	=l00,000 to 250,000
Max. proposed dredging depth (includes overdepth allowance)	-48 feet CRD (43+5 ft overdredge)
Dredging area (acres, approx.)	=l25
Dredge dimensions	Triangular turning basin: =l,000 ft. wide by 3,000 ft long; Deep draft channel: 400 ft wide by 1.5 miles
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	August 1 through December 15
Dredged material mgmt. units (DMMUs)	3

Sampling and Analysis Description: The USACE sampling and analytical program for the OSD deep draft FNC is summarized in Table 3. Actual grab sample station locations are shown in SQER Table 1 and Map 1 (SDM Figure 1).

Deviations from the SAP: One lab deviation from the PSET-approved SAP was identified in SQER Section 4.3.5, regarding the SVOCs.

In all three composite samples, bis(2-ethylhexyl) phthalate was L-qualified (QC recovery was off scale high and the concentration exceeded the linear range) and V-qualified (detected in the sample and blank). Benzoic acid was HP-qualified (the time between prep and analysis was outside the method specified hold time) and V-qualified. Di-n-buty1 phthalate and phenol were V-qualified. Therefore, the USACE had frozen archive samples analyzed at ARI for bis(2-ethylhexyl) phthalate and benzoic acid. The ARI results were below SEF SLs for both analytes.

Table 3. Sampling and Analysis Description

Sample collection method	Standard Ponar		
DMMU IDs (location)	OSDS-1 (triangular turning basin)	OSDS-2 (mile 0+05 to 0+48)	OSDS-3 (mile 0+48 to 1+26)
DMMU Rank	Low		
Station/Sample ID	OSDS-1A, OSDS-IB, OSDS-2A, OSDS-2B, OSDS-3A, OSDS-3B, OSDS-1C, OSDS- lD OSDS-2C, OSDS-2D OSDS-3C, OSDS-3D ll22-OSDS-1-		
Composite Sample ID	COMP 1122-OSDS-2-COMP 1122-OSDS-3-COMP		
DMMU volume (cy)	=l00,000 to 250,000		
Dredge Prism: Mudline range (ft CRD)	-40.8 to -45.7	-36.2 to -45.5	-31.8 to -41.6
Dredge Prism: Composite(Y/N)	Y	Y	Y
Dredge Prism: Subsample /DMMU	4	4	4
Dredge Prism: Subsample Archive	Y	Y	Y
PDS Layer: Depth range (ft CRD)	N/A	N/A	N/A
PDS Layer: Composite (Y/N)			
PDS Layer: Subsample /PDS			
PDS Layer: Subsample Archive			
Sediment Physical and Chemical Analysis (No. DP samples / No. PDS samples analyzed)			
Grainsize	1/-	1/-	1/-
Totalorganiccarbon	1/-	1/-	1/-
Totalsolids	1/-	1/-	1/-
Ammonia	1/-	1/-	1/-
Totalsulfides	1/-	1/-	1/-
Metals,freshwater	1/-	1/-	1/-
PAHs	1/-	1/-	1/-
SVOCs (phthalates, phenols, misc. extractables)	1/-	1/-	1/-
Pesticides	1/-	1/-	1/-
PCBs (Total Aroclors)	1/-	1/-	1/-
Butyltins	1/-	1/-	1/-
TPH (diesel [dx], residual [rx] range)	1/-	1/-	1/-
Dioxin/Furans	-/-	-/-	-/-
Biological Analysis (No. DP samples / No. PDS samples analyzed)			
Freshwater Bioassays	-/-	-/-	-/-

Results and Discussion: Analytical results for the USACE sampling event are summarized in Table 4. The chemical analytical results were compared to the 2018 SEF freshwater SLs and to ODEQ's fish based freshwater SLV (22 ug/kg) to evaluate PCBs (total Aroclors). There were no exceedances of ODEQ's fish-based, freshwater bioaccumulative SLV (22 ug/kg) for total PCB Aroclors because all samples were between 5.75 and 8.81 ug/kg.

All analytes were detected below SEF freshwater SLs or were non-detections (U) with method reporting limits (MRLs) below SLs. The composite samples consisted of 73 to 82% sand and 18 to 27% fines with trace gravel (+0.4%). The total organic carbon (TOC) ranged from 0.62 to 1.27%. Total solids ranged from 60.7 to 63.8%.

4

Site Ranking: Based on the results, the PSET confirms a "low" rank to the Oregon Slough Downstream deep draft sediments.

PSET Suitability Determination:
Dredge Prism —Chemical concentrations in OSD dredge prisms are below the SEF freshwater SLs and ODEQ SLV as discussed above. As such, the OSD deep draft FNC dredged prism material is suitable for unconfined, aquatic disposal per the 2018 SEF guidance without additional testing.

Post-Dredge Surface — Based on a "Low" rank and multiple rounds of suitable sediments, the post-dredge surfaces are expected to be of similar quality to the dredge prisms. As such, the OSD deep draft FNC post-dredge surfaces are suitable for unconfined, aquatic exposure per the 2018 SEF guidance without additional testing.

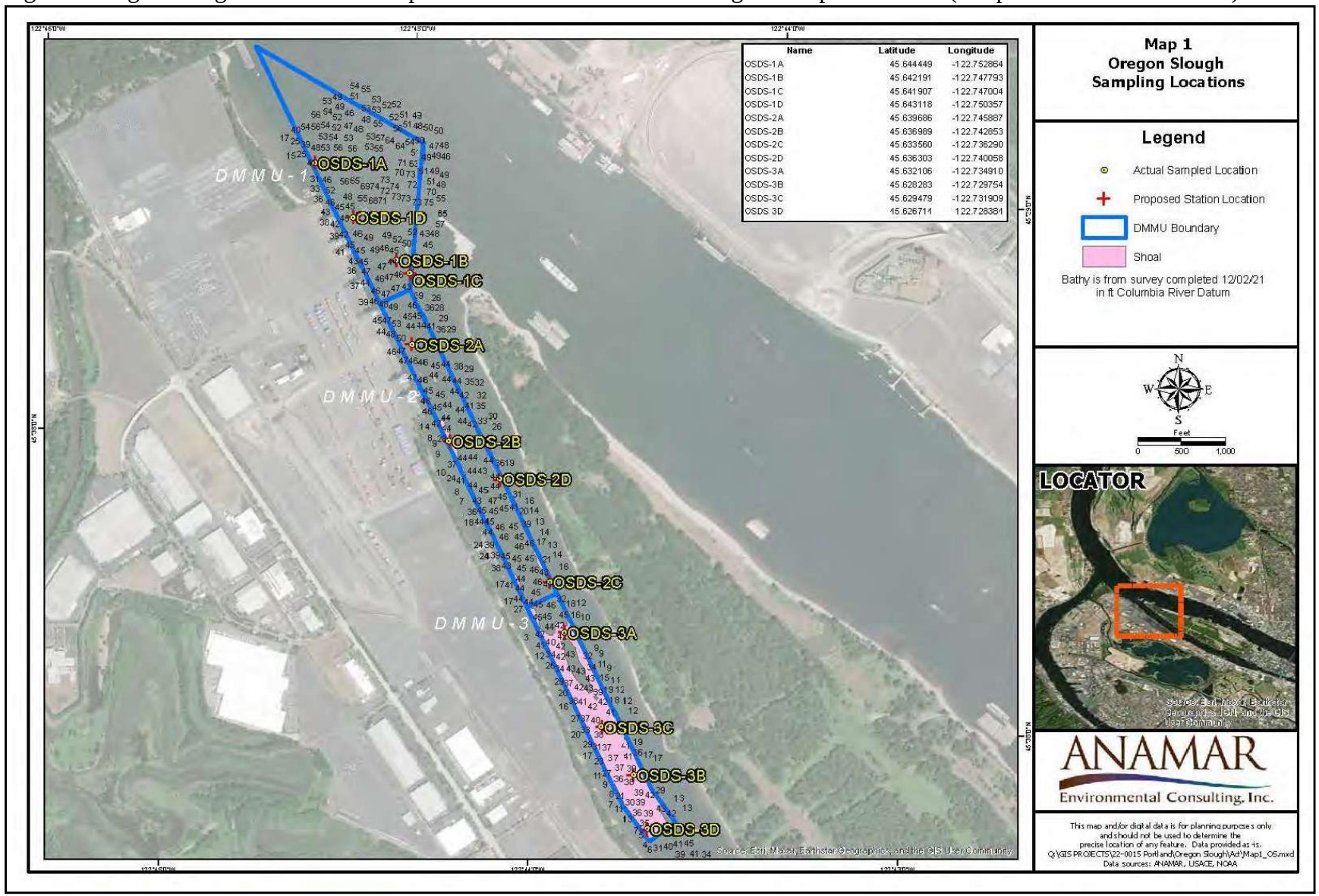
Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, USACE) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 4. Project Sediment Analytical Summary – Dredge Prism (sampled November 2022)

Sediment Physical and Chemical Results				
Composite Sample ID: Parameter	1122-OSDS-1-COMP	1122-OSDS-2-COMP	1122-OSDS-3-COMP	SEF SU, freshwater (SLV)
Grain size: gravel, sand, silt + clay (%)	0.4, 81.4, 18.2	0.2, 72.8, 26.9	0.1, 81.8, 18.0	
Total Solids (%)	60.7	61.9	63.8	
Total Organic Carbon(%)	1.27	0.98	0.62	
Ammonia(mg/kg)	72.8	78.8	51.5	230
TotalSulfides(mg/kg)	0.54U	0.68U	0.37U	39
Metals (mg/kg)	Non-detect, Detect <SLs U, J, V	Non-detect, Detect <SLs U, J, V	Non-detect, Detect <SLs U, J, V	Varies
Total PAHs (ug/kg)	31.7 J	27.8 J	17.6 J	17,000
SVOCs (ug/kg) (phenols, phthalates, misc. extractables)	Non-detect, Detect <SLs U, J, V, C+	Non-detect, Detect <SLs U, J, V, C+	Non-detect, Detect <SLs U, J, V, C+	Varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
2,4'+4,4'-DDD	1.65 HP, U	1.62 HP, U	1.57 HP, U	310
2,4'+4,4'-DDE	1.05 J	0.60 J, P	1.57 HP, U	21
2,4'+4,4'-DDT	1.65 HP, U	1.62 HP, U	1.57 HP, U	100
PCBs, Total Aroclors (ug/kg)	5.75 C	8.81 C	7.23 C	110 (22a)
Butyltins (ug/kg)	Non-detect +SLs U	Non-detect +SLs U	Non-detect +SLs U	Varies
TPH (dx/rx) (ug/kg)	25 U / 15.8 J	25 U / 21.7 J	25 U / 25 U	340 / 3,600

U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (MDL in parenthesis); J = Estimated value between MDL and MRL; V = analyte detected is sample and blank; HP = time between prep and analysis was outside the method holding time; P = difference between GC column results greater than method requirement - higher result reported; C = associated calibration QC is outside the established QC criteria for accuracy; C+ = associated calibration QC is outside the established QC criteria for accuracy - no hit in sample - data not affected and acceptable to report; = ODEQ (2007) freshwater fish-based bioaccumulation screening level value.

Figure 1.Oregon Slough Downstream deep draft FNC DMMUs and actual grab sample locations (sampled 14 November 2022).



EPA-Region 10 Water Division, Wetlands and Oceans Section 17 April 2019

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Vancouver to The Dalles Federal Navigation Channel

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Vancouver to The Dalles Federal Navigation Channel (VTD FNC) in the Columbia River from river mile (RM) 106 to 192.5.

Introduction: Per the Sediment Evaluation Framework for the Pacific Northwest (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic disposal. The PSET reviewed the Corps' 20 March 2019 "Sediment Quality Evaluation Report: Vancouver to The Dalles Federal Navigation Channel" (SQER)[2], prepared by Corps' Sediment Quality Team (SQT). Sediment testing consisted of physical analysis of sediments to confirm very low rank. If the sediment testing did not confirm a "very low rank", additional testing would be pursued.

Suitability Summary:

Surface Sediments:	☒Suitable	☐ Unsuitable
Post-Dredge Surface (PDS):	☒Suitable	☐ Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒James Holm (Corps, Lead) ☒ Bridgette Lohrman (EPA, Co-Lead)
☒Pete Anderson (ODEQ) ☒Laura Inouye (Ecology) ☒ Dominic Yballe (Corps)
☒Tom Hausmann (NMFS) ☒ Jeremy Buck (USFWS)

PSET/SEF Condition:

☒ Data Recency Expiration – The data recency of this SDM expires for the VTD FNC in January 2029.

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 278 pp with Appendices.

[2] U.S. Army Corps of Engineers – Portland District. 2019. Sediment Quality Evaluation Report – Vancouver to the Dalles Federal Navigation Channel. Prepared by the Portland District Sediment Quality Team, 20 March 2019. 22 pp

Table 1. PSET Review Timeline

Sampling and analysis plan (SAP) received	18 December 2018
SAP Approval	27 December 2018[3]
Sampling date(s)	10 January 2019
SQER received by PSET	25 March 2019
Suitability Determination Memo issued	17 April 2019
Management area ranking	Very Low
Recency of data*	January 2029 (10 years)

* If site conditions or the proposed project change, or if new information related contaminants of concerns are discovered, additional project coordination with PSET may be required to determine the validity of this SDM.

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 summarizes the O&M dredging program details for the VTD FNC project. Dredging is needed to provide reliable commercial and recreational navigation.

Table 2. Project Details

Waterbody / river miles (RMs)	Columbia River (106-192.5)
Dredged volume (cy)	~406,960 (2019 volume for RM 106-136; dredged annually)
Channel dimensions	300 ft wide by 84.5 miles long
Dredge area	~1,090 acres
Max. proposed dredging depth + advanced maintenance depth	-27 ft Columbia River Datum (CRD) (authorized); Maintained to -19 ft CRD (-17+2)
Dredging method	Hopper dredge
Dredged material transport	Hopper dredge
Disposal locations	In-water placement in off-channel areas
Dredging dates	Typically June through December
Dredged material management units (DMMUs): No. of stations	DMMU 1: 4 grabs, 1 composite sample DMMU 2: 5 grabs, 1 composite sample DMMU 3: 2 grabs, 1 composite sample

Sampling and Analysis Description: The Corps' sampling and analytical program for the VTD FNC is summarized in Table 3. Actual sample station locations are shown in SQER Table 3 and Figures 2, 3, and 4.

[3] Portland Sediment Evaluation Team (PSET). 2018. [E-mail correspondence] PSET – SAP Approval for LCR FNC and RSM Dredging. *Bridgette Lohrman*. 27 December 2018. 2 pages.

Table 3. Project Sampling and Analysis Description

Sampling Description				
Sample collection methods		Double van Veen grab sampler		
DMMU ID		VTD-01	VTD-02	VTD-03
Proposed DMMU volume (cy)		~122,467	~258,049	~26,444
Subsamples per DMMU		4	5	2
Dredge Prism	Depth range (ft. CRD)	-5.8 to -21.7	-13.4 to -20.5	-13.8 to -18.7
	Composite (Y/N)	Y	Y	Y
	SS archive (Y/N)	N	N	N
	Composite archive (Y/N)	N	N	N
PDS		Not proposed		
Sediment Analytical Parameters (No. Analyses by DMMU)				
Grain Size		1 (triplicate analysis)	1	1
Total Solids		1	1	1
Total Organic Carbon		1	1	1

Deviations from the SAP: There were two minor deviations from the sampling and analysis plan. These minor deviations do not affect the sediment suitability.

- Samples were collected using a double van Veen grab sampler provided by the contractor instead of the Grey-O'hara box corer.
- Five of the 11 stations were deeper than the proposed dredge prism (-19 ft. CRD) as listed in SQER Table 3; however, at least two samples in each DMMU are representative of the dredge prism. Surficial sediments within the VTD FNC are consistently dominated by coarse-grain particles.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. Sediment testing consisted of physical analysis of sediments to confirm a very low rank (minimum 80% sand, less than 0.5% total organic carbon (TOC)). As expected, the sampling results confirmed a "very low rank", therefore, analytical chemistry testing was not triggered.

Table 4. Sediment Analytical Summary

Sediment Physical and Conventional Results – Dredge Prism			
Sample ID:	011019VTD-COMP01	011019VTD-COMP02	011019VTD-COMP03
DMMU ID: Parameter	DMMU 1 (triplicate analysis)	DMMU 2	DMMU 3
Total Organic Carbon (%)	0.04	0.16	0.03
Total Solids (%)	85.3	73.2	74.2
	85.4		
	76.7		
Gravel (%)	17.7	0.1	0.2
	17.4		
	20.8		
Sand (%)	81.2	98.0	99.6
	81.2		
	76.7		
Fines (%), silt + clays	1.1	1.9	0.1
	1.4		
	2.5		

PSET Suitability Determination:

Dredge Prism

The VTD FNC maintains a "very low" management area rank because the project sediments are still dominated by coarse sands and gravels (>98%) with low total organic carbon content (<0.2%) in strong river and tidal currents. The VTD FNC dredge prism material is suitable for unconfined, aquatic disposal without further testing per the 2018 SEF guidance.

Post-Dredge Surface

Based on a "very low" management area rank and confirmed coarse grain size with low total organic carbon for the dredge prism, chemical testing of the post-dredge surface sediments is not required. The VTD FNC post-dredge surface is suitable for unconfined, aquatic exposure without further testing per the 2018 SEF guidance.

Contact: This memorandum was prepared by Bridgette Lohrman (EPA, PSET Co-Lead), James Holm (USACE, PSET Lead) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

EPA-Region 10 Water Division, Wetlands and Oceans Section 17 March 2021

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Groth), Skipanon River Federal Navigation Channel (Mile 0.0 to 2.0), near Warrenton, Clatsop County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Skipanon River (SKIP) Federal Navigation Channel (FNC) at river mile (RM) 10.7 of the Columbia River.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) , this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the SKIP FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the February 2021 *"Sediment Characterization. 'Skipanon Channel Federal Navigation Project, Skipanon River Miles 0.0 to 2.0, Clatsop County, Oregon"* (SQER)[2], prepared by ANAMAR for the Corps' Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the marine benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for marine fish to evaluate PCBs'.

Suitability Summary:
Dredge Prism (DP) Sediments:
Ö Suitable OUnsuitable
Post-Dredge Surface (PDS):
& Suitable &Unsuitab1e (DMMU SKIP-04-Z, -17 to -19 ft MLLW)

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

I8i James Holm (Corps, Lead)	*S* Bridgette Lohrman (EPA, Co-Lead)	
Hi Pete Anderson (ODEQ)	*S* Laura Inouye (Ecology)	Hi Dominic Yballe (Corps)
I8i Tom Hausmann (NMFS)	*S* Jeremy Buck (USFWS)	

' U.s. Army Corps of Engineers, U.s. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers — Portland District. 2021. *Sediment Characteri-ation. Skipanon Channel Federal Navigation Project, Skipanon River Miles 0.0 to 2.0, Clatsop County, Oregon.* Prepared by ANAMAR, February 2021. 23 pp with Maps, Tables, and Appendices.

[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment.* Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

PSET/SEF Conditions:
& Data Recency Expiration:

- Based on a "Moderate" rank, the data recency for DMMUs 2, 3, 4, and 5 in the Skipanon FNC expires in September 2025
- Based on a "Low" rank, the data recency for DMMUs 1 and 6789 in the Skipanon FNC expires in September 2027

☒ Biological testing per the 2018 SEF is required for the post-dredge surface in DMMU 4 to assess the suitability of these sediments for unconfined, aquatic exposure. If biological testing is not performed or if biological tests fail, then the following is required:

- Upland disposal of post-dredge surface sediments (-17 to -19 feet MLLW) from DMMU 4 with full characterization of underlying sediments and/or placement of 12 inches of sand; or
- Post-dredge surface management in DMMU 4 in coordination with PSET. Post-dredge surface management may include one or more of the following:
  - Under dredging to -15 feet MLLW or shallower;
  - Post-dredge sampling for pesticides;
  - Placement of 12 inches of sand; and/or
  - Monitored natural recovery.

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP)[4] submitted to PSET	24 August 2020
SAP approved by PSET[S]	4 September 2020
Sampling date(s)	8 and 9 September 2020
Draft SQER submitted to PSET	11 December 2020
SQER revisions requested by PSET	14, 16 December 2020
Core correction discussion	23 December 2020
SQER revisions requested by PSET	6 January 2021
Corps submits re-analysis results	9 February 2021
Final SQER submitted to PSET	25 February 2021
Suitability Determination Memorandum (SDM) issued by PSET	17 March 2021
Management area ranking	Moderate — DMMUs 2-5 Low — DMMUs 1 & 6789*
Recency of data	DMMUs 2-5 — September 2025 DMMUs 1 & 6789* — September 2027

* - Naming convention for DMMU "6789" represents DMMUs 6 through 9 sampled in 2014.

Federal Regulatory Authorities:

Section 10, Rivers and Harbors Act
Section 404, Clean Water Act (CWA)
Section 401, CWA

[4] U.S. Army Corps of Engineers. 2020. *Skipanon Channel Federal Navigation Project, Skipanon River, whiles 0.0 to 2.0, Clatsop County, Oregon, Sediment Sampling and Analysis Plan.* Prepared by Corps SQT, 24 August 2020. 21 pp with Attachments.
Portland Sediment Evaluation Team (PsET). 2020. [E-mail correspondence] *PSET — Skipanon FNC SAP Approval.* Bridgette Lohrman, EPA, sent 4 September 2021. 3 pp.

& Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the SKIP FNC. Maintenance dredging is needed to provide reliable navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Skipanon River / 0.0 to 2.0 (Enters the Columbia River at RM 10.7)
Total proposed dredging volume (cy)	=l60,000 (range: 65,000 to 355,000)
Max. proposed dredging depth (includes overdepth allowance)	-17 feet MLLW (-16 + 1 ft)
Dredge dimensions	Channel: 2.0 miles long by 200 feet wide with a turning basin from RM 1.5 to 1.8 that is 220 to 480 feet wide
Dredging method	Pipeline, clamshell, or hopper
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMUs) / stations	6 / 2 per DMMU

Sampling and Analysis Description: The Corps' sampling and analytical program for the SKIP FNC is summarized in Table 3. Actual sample station locations are shown in the SQER Table 1 and Map 1 (SDM Figure 1) with full delineation of all DMMUs in Figures 3 and 4 of SAP.

Deviations from the SAP: Deviations from the PSET-approved SAP are listed in SQER section 3.1 and noted in SQER Tables 1 (core summary). Deviations included the following:

1. Core station VC-04 for DMMU SKIP-02 was relocated to avoid rocks (potentially rip rap) that caused shallow refusal. The Corps was only able to penetrate to -18 feet MLLW, one foot short of the full Z-layer interval (-17 to -19 ft MLLW).
2. Seven cores (VC-06 to VC-12) were over-penetrated by 1 to 4 feet to improve retention of the soft silty surface layer and minimize sample loss from the bottom of the core sampler. Consolidated sediments at depth prevented sample loss. The over-penetrated section of the core was discarded after completing the linear core compaction correction. See SQER section 2.2.2 (Vibracore Sampling Methods) and SQER Exhibit 2-3.
3. Low percent core recovery (<75%) occurred on multiple core attempts at core stations VC-02, VC-04, VC-05, VC-06, VC-07, VC-08, VC-09, VC-11, and VC-12 as shown in SQER Table 1. The field team processed the core with highest recovery.

Table 3. Sampling and Analysis Description

Sample collection method		Vibracore					
DMMU ID		SKIP-01	SKIP-02	SKIP-03	SKIP-04	SKIP-05	SKIP-6789
Project mile		1+50 to 2+00	1+40 to 1+50	1+37 to 1+40	1+32 to 1+37	1+30 to 1+32	0+00 to 1+30
DMMMU volume (CY)		=50,000	=20,000	=l7,000	=22,000	=l4,000	=37,000
DMMU rank		Low	Moderate	Moderate	Moderate	Moderate	Low
DP composite sample ID (mudline to -17 ft MLLW)		SKIP-01-COMP	SKIP-02-COMP	SKIP-03-COMP	SKIP-04-COMP	SKIP-05-COMP	SKIP-6789-COMP
PDS composite sample ID (-17 to -19 ft MLLW)		SKIP-01-COMP-Z	SKIP-02-COMP-Z	SKIP-03-COMP-Z	SKIP-04-COMP-Z	SKIP-05-COMP-Z	SKIP-6789-COMP-Z
Dredge Prism	Depth range (ft MLLW)	-6.4, -7.2 to -17	-7.4, -8.5 to -17	-12.3, -13.0 to -17	-12.0, -12.6 to -17	-12.1, -15.3 to -17	-14.6, -15.0 to -17
	Composite(Y/N)	Y	Y	Y	Y	Y	Y
	Subsamples/DMMU	2	2	2	2	2	2
	SubsampleArchive	y	y		y		y
PDS Layer	Depth range (ft MLLW)	-17 to -19	-17 to -19, -17 to -18°	-17 to -19	-17 to -19	-17 to -19	-17 to -19
	Composite (Y/N)	Y	Y	Y	Y	Y	Y
	Subsample/PDS-layer	2	2	2	2	2	2
	Subsample Archive						

Sediment Physical and Chemical Analysis per DMMU (No. DP/ No. PDS)						
Grain size	l/1	1/l	l/1	1/l	l/1	1/l
Total organic carbon	l/1	1/l	l/1	1/l	l/1	1/l
Total solids	l/1	1/l	l/1	1/l	l/1	1/l
Ammonia	l/1	1/l	l/1	1/l	l/1	1/l
Total sulfides	l/1	1/l	l/1	1/l	l/1	1/l
Metals, marine	l/1	1/l	l/1	1/l	l/1	1/l
PAHs	l/1	1/l	l/1	1/l	l/1	1/l
SVOCs (chlorinated hydrocarbons, phthalates, phenols, misc. extractables)	l/1	1/l	1/1	1/1	1/1	1/1
Pesticides	1/1	1/l	l/1	1/l	l/1	1/l
PCBs(Total Aroclors)	1/1	1/l	l/1	1/l	l/1	1/l
Tributyltin	1/1	1/l	l/1	1/l	l/1	1/l
Dioxin/Furans	-/-	-/-	-/-	-/-	-/-	-/-

= refusal meet, 1-ft Z-layer sample collected

C-21

Results and Discussion: Dredge prism analytical results for the Corps' sampling event are summarized in Table 4. Post-dredge surface analytical results for the Corps' sampling event are summarized in Table S. The chemical analytical results from the SQER were compared to the 2018 SEF marine SLs and to ODEQ's SLV for marine fish (47 ug/kg) to evaluate PCBs.

The dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%). Total organic carbon (TOC) in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.

In all dredge prism composite samples, no parameters had detections, estimated concentrations (I) or non-detections (U) with elevated detections or reporting limits above SEF marine SLs or the ODEQ SLV for PCB Aroclors.

The post-dredge surface sediments are predominantly silt (56-79%) with clay (15-42%) and lesser amounts of sand and gravels (2 to 29%). Total organic carbon (TOC) in the post-dredge surface sediments ranged from 1.66 to 3.13%. Total solids in the dredge prism sediments ranged from 44 to 52%.

In the post-dredge surface composite sample for DMMU 4 (SKIP-04-COMP-Z), 4,4'-DDD was detected at a concentration of 48.2 ug/kg which exceeds the SEF marine SL of 16 ug/kg. In the 2014 dredged material evaluation, 4,4'-DDD was also detected at a concentration of 19 ug/kg in the post-dredge surface layer of DMMU 4. Based on the continued presence of elevated DDD concentrations, the post-dredge surface is not suitable for unconfined aquatic exposure without further testing. If testing is not conducted or fails, management of the post-dredge surface in DMMU 4 is required. The Corps may choose upland disposal of the post-dredge surface sediments and conduct post-dredge sampling for pesticides to inform placement of a 12-inch sand layer. The Corps shall prepare a dredging and disposal quality control plan for the project and coordinate with PSET for implementation prior to dredging DMMU 4.

N-nitrosodiphenylamine was detected in 3 PDS samples (IZ, 3Z, and 4Z). However, the concentration only minimally exceeded the SEF marine SL (28 ug/kg) in the lZ (29 ug/kg) and 4Z (30 ug/kg) samples. The sample 3Z concentration of 17 ug/kg is below the SEF SL. To confirm the concentration in the post-dredge surface of DMMU 1, the Corps re-analyzed the initial composite sample twice and an archived jar of the composite sample. All three re-analyses were non-detections for n-nitrosodiphenylamine with a sufficiently low MRL (5.0 ug/kg) below the SEF SL. There is "no reason to believe" that n-nitrosodiphenylamine is present in the post-dredge surface sediments in DMMU 1 at concentrations exceeding the SEF SL.

No other parameters had detections, estimated concentrations (I) or non-detections (U) with elevated detections limits above SEF marine SLs or ODEQ SLV for PCB Aroclors.

PSET Suitability Determination:
Dredge Prism — Chemical concentrations in all dredge prism samples were below the SEF marine SLs and ODEQ SLV as discussed above. As such, the Skipanon FNC dredged prism

material is suitable for unconfined, aquatic disposal per the 2018 SEF guidance without additional testing.

Post-Dredge Surface — Chemical concentrations in five of the six post-dredge surface samples were below the SEF marine SLs and ODEQ SLV as discussed above. As such, the Skipanon FNC post-dredge surfaces excluding DMMU 4, are suitable for unconfined, aquatic exposure per the 2018 SEF guidance without additional testing.

The post-dredge surface (-17 to -19 ft MLLW) in DMMU 4 has elevated n-nitrosodiphenylamine and 4,4'-DDD above SEF marine SLs. Therefore, the DMMU 4 post-dredge surface is not suitable for unconfined, aquatic exposure without biological testing per the 2018 SEF. If additional testing is not completed or fails, management of the post-dredge surface is required in coordination with the PSET.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 4. Project Sediment Analytical Summary – Dredge Prism

Dredge Prism Sediment Physical and Chemical Results							
Decision unit/Sample ID: Parameter	Mile 1+50 to 2+00 / SKIP-01-COMP	Mile 1+40 to 1+50 / SKIP-02-COMP	Mile 1+3 7 to 1+40 / SKIP-03-COMP	Mile 1+32 to 1+37 / SKIP-04-COMP	Mile 1+30 to 1+32 / SKIP-05-COMP	Mile 0+00 to 1+30 / SKIP-6789-COMP	SEF SL1 marine (SLV)
Grain size: gravel, sand, silt, clay (%)	0.3, 1.5, 86.0, 12.5	0.3, 2.3, 84.8, 12.9	0.5, 2.0, 82.4, 15.5	0.3, 1.6, 79.8, 18.6	0.3, 2.2, 79.2, 18.7	0.5, 3. 1, 76.9, 19.8	
Total Solids (%)	59.41	42.42	55.09	39.59	38.8	40.01	
Total Orgaiiic Carbon (%)	2 76	2. 14	2 79	2 5	2 53	2 22	
.1mmouia (uig/kg)	344	281	278	300	255	205	
Total Sulfides (uig/kg)	2,940	2,710	2,720	2,610	2,030	2,080	
Metals (pig/kg)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	varies
LPAHs (ug/kg)	13 1	32 1	7.7 1	22 I	8.6 1	20 U	5,200
HPAHs (ug/kg)	248 1	329 1	129 1	200 1	152 1	89 I	12,000
SVOCs (ug/kg) (phenols, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	varies
N-nitrosodiphenylainine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	28
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4"-DDD	4.20)	2.86	2.69	4.00	3.91	2.12 1	16
4,4"-DDE	2.99)	2.22	3.31	1.75	1.81	1.43	9
4,4'-DDT	0.99 U	1.0 U	1.0 U	1.0 U	1.02 U	1.0 U	12
PCBs, Total Aroclors (ug/kg)	27.8 I	16.7	17.9	20.5	12.9 J	11.2 1	130 (47a)
Tribu9 ltin (ug/kg)	1.5 I	1.8 J	1.6 I	1.8 J	0.83 J	0.85 1	73

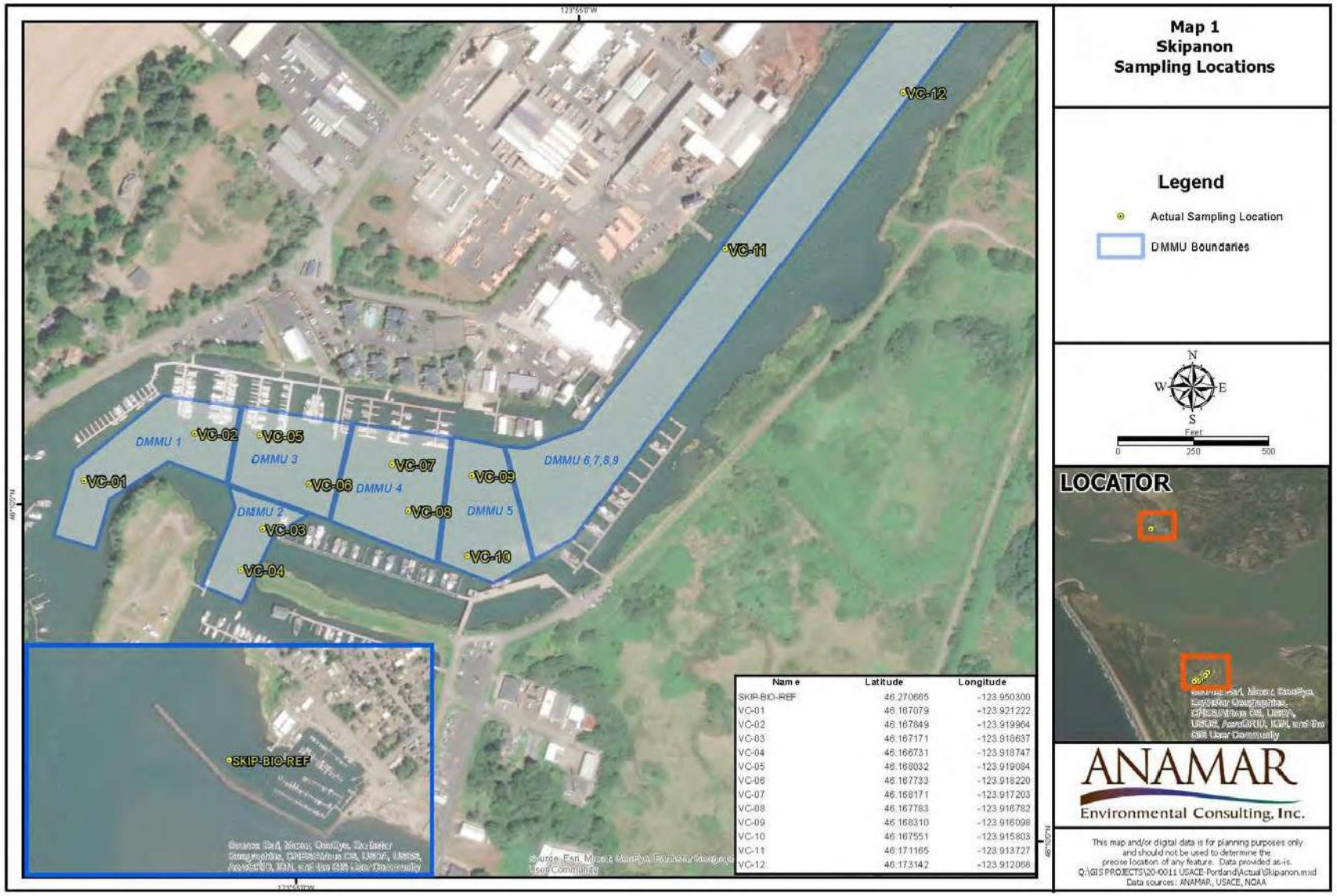
BOLD= Detection exceeds SEF marine screening level (SL); U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; I = Estimated value between MDL and MRL; = ODEQ (2007) Marine fish-based bioaccumulation screening level value.

Table 5. Project Sediment Analytical Summary – Post-Dredge Surface

Post-Dredge Surface Sediment Physical and Chemical Results							
Decision unit/Sample ID: Parameter	Mile 1+50 to 2+00 / SKIP-01-COMP-Z	Mile 1+40 to 1+50 / SKIP-02-COMP-Z	Mile 1+37 to 1+40 / SKIP-03-COMP-Z	Mile 1+32 to 1+37 / SKIP-04-COMP-Z	Mile 1+30 to 1+32 / SKIP-05-COMP-Z	Mile 0+00 to 1+30 / SKIP-6789-COMP-Z	SEF SL1 marine (SLV)
Grain size: gravel, sand, silt, clay (%)	0.3, 1.5, 57.0, 41.8	0.7, 28.0, 56.3, 15.0	0.9, 1.5, 79. 1, 19.2	0.3, 1.4, 74.8, 24.0	0.3, 3.5, 78.0, 18.7	0.3, 2.9, 77.0, 20.0	
Total Solids (%)	48.05	52.35	45. 12	44.96	44. 35	44. 17	
Total Orgaiiic Carbon (%)	3. 13	1 66	2 62	2 73	2 36	2 22	
.1mmouia (uig/kg)	707	257	463	630	457	409	
Total Sulfides (uig/kg)	1, 150	1,660	2,830	2,080	2,060	1,930	
Metals (nig/kg)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	varies
LPAHs (ug/kg)	151 1	159 1	102 1	107 1	16 I	9.5 I	5,200
HPAHs (ug/kg)	1,271 1	485 1	532 1	700 1	258 1	147 I	12,000
SVOCs (ug/kg) (phenols, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, I	varies
N-nitrosodiphenylamine Re-analysis in triplicate	29 5.0 U	5.0 U	17	30	5.0 U	5.0 U	28
Pesticides (ug/kg)	Non-detect *-SLs U	Non-detect <SLs U	Non-detect *-SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4'-DDD	15.8	3.32	15.3	48.2	11.6	2.3 2 1	16
4,4'-DDE	2. 11	1.64	3.58	3.37	2.71	1.75	9
4,4'-DDT	1.0 U	1.0 U	1.0 U	0.99 U	1.0 U	0.99 U	12
PCBs, Total Aroclors (ug/kg)	23 .8	24.8	33.3 I	28.9 1	37. 1 I	11.3 1	130 (47a)
Tribute ltin (ug/kg)	3.8 U	1.2 I	1.2 I	0.49 1	0.78 I	0.76 1	73

BOLD= Detection exceeds SEF marine screening level (SL); U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; I = Estimated value between MDL and MRL; t = ODEQ (2007) Marine fish-based bioaccumulation screening level value.

Figure 1.Skipanon River Federal Navigation Channel, actual sample locations and DMMUs (sampled 8-9 September 2020).



EPA-Region 10 Water Division, Wetlands and Oceans Section 11 January 2021

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Cathlamet Bay (Tongue Point) Federal Navigation Channel (Station 0+00 to 1+24), near Astoria, Clatsop County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2B dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Cathlamet Bay (CBY) Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 18.5.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) , this Level 2B suitability determination memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the CBY FNC dredged material from DMMUs CBY-54-B and CBY-67-A for unconfined, aquatic disposal. The PSET reviewed the December 2020 *"Sediment Characterization and Bioassays of Cathlamet Bay Federal Side Channel (Tongue Point), Lower Columbia River, Clatsop County, Oregon"* (2B SQER)', prepared by ANAMAR for the Corps' Sediment Quality Team (SQT). Sediment chemical and bioassay testing results are summarized in the 2B SQER; chemical analytical results were compared to the marine benthic toxicity screening levels (SLs) published in the 2018 SEF; bioassay results were compared to the SEF interpretive criteria for dispersive sites (SEF Table 7-1). The PSET also used Oregon DEQ's sediment screening level value (SLV) for marine fish to evaluate PCBs'.

Suitability Summary:

Dredge Prism (DP) Sediments:

fi Suitable (DMMUs CBY 54-B and 67-A)

OUnsuitable

Post-Dredge Surface (PDS):

Previously determined suitable.

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

UJ James Holm (Corps, Lead) *S* Bridgette Lohrman (EPA, Co-Lead)

' U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers—Portland District (Corps). 2020. *Sediment Characteri--ation and Bioassays of the Cathlamet Bay Federal Side Channel (Tongue Point), Longer Columbia River, Clatsop County, Oregon.* Prepared by ANAMAR, December 2020. 24 pp with Maps, Tables, and Appendices.

[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment.* Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

Hi Pete Anderson (ODEQ) *S* Laura Inouye (Ecology) Hi Dominic Yballe (Corps)
I8i Tom Hausmann (NMFS) *S* Jeremy Buck (USFWS)

PSET/SEF Condition:

Data Recency Expiration: Based on a "Moderate" rank, the data recency for DMMUs 54-B and 67-A in Shoal B of the Cathlamet Bay Federal Navigation Channel expires concurrent with the rest of Shoal B in November 2024

Table 1. Review Timeline – CBY FNC

LEVEL 2A	
Draft Sampling and analysis plan (SAP) submitted to PSET	1 October 2019
SAP revisions requested by PSET	2 October 2019
Revised Draft SAP submitted	8 October 2019
Revised SAP revisions requested by PSET	11 October 2019
Final SAP submitted	15 October 2019
Final SAP approved by PSET	31 October 2019
Sampling date(s)	11 to 19 November 2019
Draft SQER submitted to PSET	10 March 2020
SQER revisions requested by PSET	11 March 2020
Final SQER submitted to PSET	22 April 2020
Level 2A SDM issued by PSET	31 July 2020
LEVEL 2B	
Draft Supplement SAP (SSAP) submitted to PSET	20 August 2020
SSAP comments given during PSET call	26 August 2020
Revised SSAP[4] submitted to PSET	1 September 2020
SSAP approved by PSET'	2 September 2020
Sampling date(s)	10 September 2020
Level 2B SQER submitted to PSET	8 December 2020
Level 2B SDM issued by PSET	11 January 2021
Management area ranking	Shoal A — Very Low Shoal B — Moderate
Recency of data	Shoal A — November 2029 (10 years) Shoal B — November 2024 (5 years)

Federal Regulatory Authorities:

Section 10, Rivers and Harbors Act
Section 404, Clean Water Act (CWA)
& Section 401, CWA
& Section 7, Endangered Species Act
& Section 305 of the Magnuson-Stevens Act
& Fish and Wildlife Coordination Act
Section 103, Marine Protection, Research and Sanctuaries Act

Corps. 2020. *Supplemental Sediment Sampling and Analysis Plan (SSAP) for the Cathlamet Bay Federal Navigation Side Channel.* Prepared by Corps SQT, 1 September 2020. 6 pp.

Portland sediment Evaluation Team (PsrT). 2020. [E-mail correspondence] *PSET — Cathlamet Bay — Bioassay SAP Approval.* Bridgette Lohrman, EPA, sent 2 September 2020. 3 pp with attachment.

O Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the Corps' dredging project details for the CBY FNC. Maintenance dredging is needed to provide navigation access. The CBY turning basin (Station 1+24 to 1+40) will not be dredged, was not characterized in the Level 2A or 2B SQER and is not evaluated in this 2B SDM.

Table 2. Project Details – CBY FNC

Waterbody/river mile (RM)	Columbia River, 18.5
Total proposed dredging volume (cy)	=585,000 (Shoal A = =80,000, Shoal B = =465,000, Shoal B side slopes = =40,000)
Max. proposed dredging depth (includes overdepth allowance)	-36 feet MLLW (34 + 2 ft overdredge)
Dredging area (acres, approx.)	=l20
Dredge dimensions	=2,200 ft. wide narrowing to 350 ft. wide for =3,000 ft., then 350 ft. wide for 1 mi. (turning basin excluded)
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMUs)	Level 2A: 94 + 16 side slope stations Level 2B: 2 (CBY-54-B, CBY-67-A)

Sampling and Analysis Description: The Corps' Level 2B sampling and analytical program for DMMUs CBY-54-B and CBY-67-A and the reference site sediments are summarized in Table 3. Actual sample station locations are shown in the 2B SQER Table 1 and Map 1 (Level 2B SDM Figure 1).

Deviations from the SSAP: One deviation from the PSET-approved SSAP was necessary. The reference site was relocated from outside the Chinook Channel breakwater to within the breakwater to collect reference sediments with grain size similar to the Cathlamet Bay FNC test sediments.

Table 3. Sampling and Analysis Description – Level 2B, CBY FNC

Sampling Description				
Sample collection method		Vibracore		PONAR
Shoal ID		B	B	Reference Site
DMMU ID		CBY-54-B	CBY-67-A	N/A
DMMU Rank		Moderate	Moderate	N/A
Proposed DMMU volume (cy)		=5,000	=5,000	N/A
Sample ID (planned interval, ft MLLW)		200910-CBY-54-B-BIO-COMP (-32 to -36)	200910-CBY-67-A-BIO-COMP (mudline to -32)	200910-CBY-REF-COMP (mudline)
Dredge Prism	Depth range (ft MLLW)	-32 to -36	Mudline (-27.1) to -32	Mudline at -6
	Composite (Y/N)	Y	Y	N
	Subsamples /DMMU	2	2	1
	Subsample Archive (Y/N)	Y	Y	N
PDS Layer	Depth range (ft MLLW) / Composite (Y/N) / Subsample /PDS-layer / Subsample Archive (Y/N)	N/A	N/A	N/A
Sediment Physical, Chemical and Biological Analyses per DMMU (No. DP/ No. PDS)				
Grain size		1/--	1/--	1/--
Total organic carbon		1/--	1/--	1/--
Total solids		1/--	1/--	1/--
Ammonia		1/--	1/--	1/--
Total sulfides		1/--	1/--	1/--
Metals, marine		1/--	1/--	1/--
PAHs		1/--	1/--	1/--
SVOCs (chlorinated hydrocarbons, phthalates, phenols, misc. extractables)		1/--	1/--	1/--
Pesticides		1/--	1/--	1/--
PCBs (Total Aroclors)		1/--	1/--	1/--
Tributyltin		1/--	1/--	1/--
Bioassays, marine		3/--	3/--	3/--

Results and Discussion: Analytical results for the Corps' Level 2B sampling event are summarized in Table 4. The chemical analytical results were compared to the 2018 SEF marine SLs and to ODEQ's SLV for marine fish to evaluate PCBs (47 ug/kg). The marine bioassay results were compared to the 2018 SEF performance standards and interpretive criteria for dispersive disposal sites as shown in Tables 5, 6, 7, and 8.

The initial November 2019 concentrations of diethyl phthalate detected in DMMUs CBY-54-B (254 ug/kg) and CBY-67-A (223 ug/kg) were not replicated in the Level 2B test sediments (19 ug/kg I, 15 ug/kg I). No other parameters had detections, estimated concentrations (I) or non-detections (U) with elevated detections limits above SEF marine SLs or ODEQ SLV for PCBs.

Table 4. DMMUs CBY-54-B and CBY-67-A and Reference Site Analytical Summary

Sediment Physical and Chemical Results				
Decision unit/sample ID: Parameter	200910-CBY-54-B-BIO-COMP	200910-CBY-67-A-BIO-COMP	200910-CBY-REF-COMP	SEF SL1 marine (SLV)
Grain size: gravel, sand, silt, clay (%)	0.7, 8.9, 80.8, 9.8	0.3, 31.5, 59.7, 8.7	0.3, 19, 61.7, 19	
TotalSolids(%)	47.5	58.7	61.3	
TotalOrganicCarbon(%)	2.12	1.54	1.18	
Ammonia(mg/kg)	5.27	187	46.1	
TotalSulfides(mg/kg)	599	646	514	
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Detect <SLs J	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
LPAHs (ug/kg)	103 J	65 J	307 J	5,200
HPAHs (ug/kg)	331 J	314 J	1,149 J	12,000
SVOCs (ug/kg) (phenols, phthalates, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4'-DDD	1.4	0.52 J	0.87 J	16
4,4'-DDE	0.84 J	0.42 J	0.85 J	9
4,4'-DDT	1.0 U	1.0 U	0.50 U	12
PCBs, Total Aroclors (ug/kg)	10.2 J	1.2 J	6.6 J	130 (47)
Tributyltin (ug/kg)	7.0	0.83 J	3.8 U	73

U = Non-detection at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; J = Estimated value between MDL and MRL; = ODEQ (2007) Marine fish-based bioaccumulation screening level value for PCBs.

Table 5. DMMUs CBY-54-B and CBY-67-A Bioassay Summary

Treatment	1-Hit Rule			2-Hit Rule		
	Amphipod	Polychaete	Larval	Amphipod	Polychaete	Larval
200910-CBY-54-B-BIO-Comp	Pass	Pass	Pass	Pass	Pass	Pass
200910-CBY-67-A-BIO-Comp	Pass	Pass	Pass	Pass	Pass	Pass

Table 6. 10-day Amphipod Mortality Comparison for Eohaustorius estuarius

Treatment	Mean Mortality (%)	Statistically Different than Reference? (P=0.05)	Mortality Comparison to Control MT-Mc (%)	Mortality Comparison to Reference MT-MR (%)	Fails 2-Hit?'	Fails l-Hit?'
Control	2					
200910-CBY-REF-Comp	18					
200910-CBY-54-B-BIO-Comp	5	No	3	-13	No	No
200910-CBY-67-A-BIO-Comp	10	No	8	-8	No	No

'2-Hit Rule: Statistical Significance and M_{T-Mc} >20% 21-Hit Rule: Statistical Significance and MT-Mq >20% and MT-MR >10% (dispersive); MT - Treatment Mortality;' M_R - Reference Mortality; Mq = Control Mortality

Table 7. 20-day Polychaete Mortality and Growth Comparison for Neanthes arenaceodentata

Treatment	MIG (mg/ind/day) AFDW	Statistically Less than Reference? (p=0.05)	MIG Relative to Control MIGT/MIGc	MIG Relative to Reference MIGT/MIGR	Fails 2-Hit?'	Fails 1-Hit?'
Control	0.552					
200910-CBY-REF-Comp	0.445					
200910-CBY-54-B-BIO-Comp	0.543	No	0.98	1.22	No	No
200910-CBY-67-A-BIO-Comp	0.623	No	1.13	1.40	No	No

'2-Hit Rule: Statistical Significance and MIGT/MIGc <0.80; 2l-Hit Rule: Statistical Significance and MIGT/MIGc <0.80 and MIGT/MIGR <0.70; MIGT = Treatment Mean Individual Growth; MIGR = Reference Mean Individual Growth; MIGc = Control Mean Individual Growth

Table 8. Larval Development Comparison for Mytilus galloprovincialis

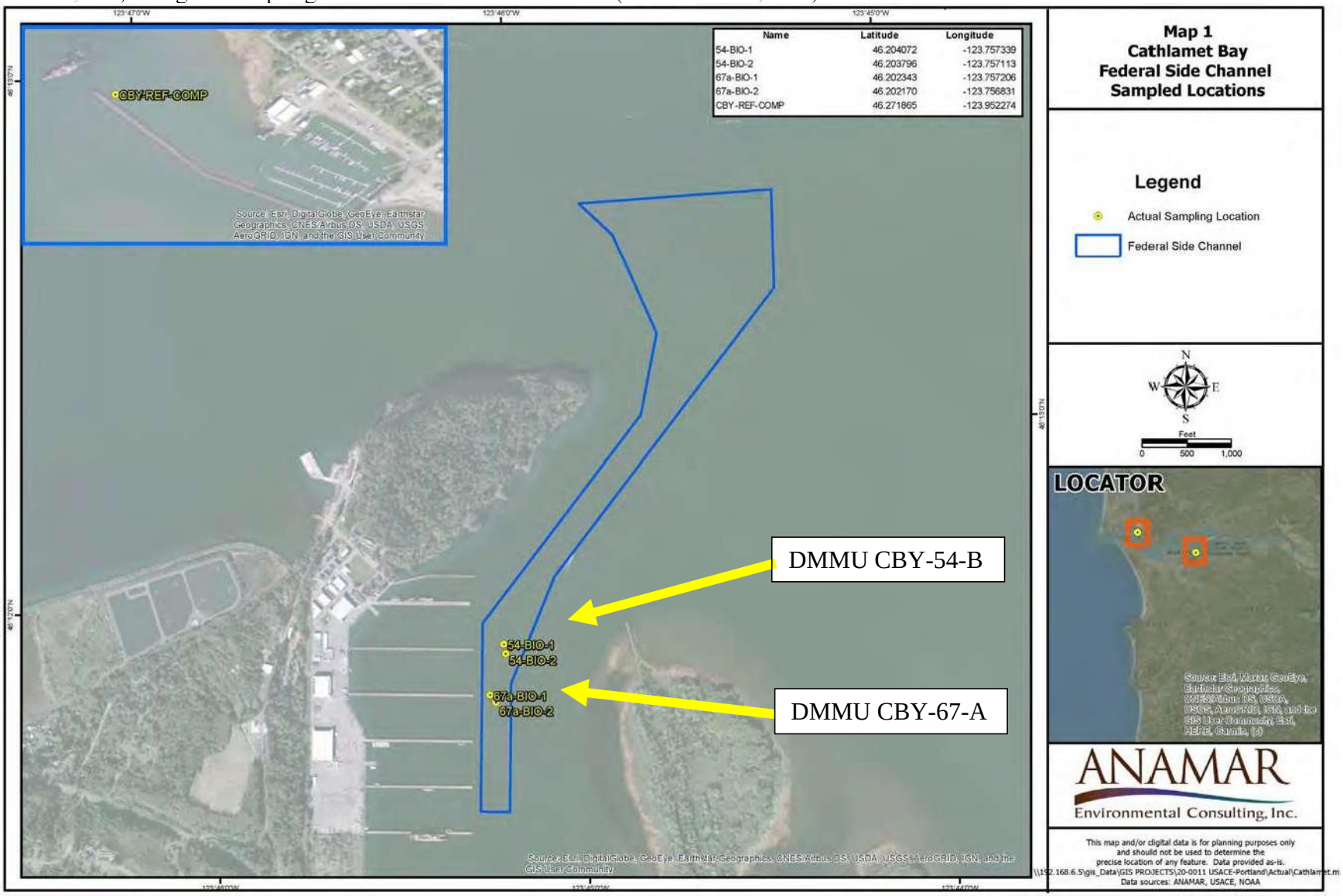
Treatment	Mean Number Normal	Statistically Less than Reference? (p=0.10)	Normal Survival to Seawater Control NT C	NR/Nc - NTSC	Fails 2-Hit?'	Fails 1-Hit?'
Seawater Control	244.6					
Sediment Control	252.0					
200910-CBY-REF-Comp	252.6					
200910-CBY-54-B-BIO-Comp	235.0	Yes	0.96	0.07	No	No
200910-CBY-67-A-BIO-Comp	226.0	Yes	0.92	0.11	No	No

'2-Hit Rule: Statistical Significance and (NTSC) <0.80; ' 1-Hit Rule: Statistical Significance and (NTSC) +0.80 and NR C - NT C 0.15; NT =Treatment Mean Number Normal; NR =Reference Mean Number Normal; Nc =Control Mean Number Normal

PSET Suitability Determination:
Based on both l-hit and 2-hit rules for dispersive disposal site criteria, both DMMU CBY-54-B and DMMU CBY-67-A pass all marine bioassay tests. Therefore, dredged materials from DMMUs CBY-54-B and CBY-67-A are suitable for unconfined, aquatic disposal per the 2018 SEF.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Figure 1. Cathlamet Bay Federal Navigation Channel, actual core sampling stations for DMMUs CBY-54-B and CBY-67-A (near Astoria, OR) and grab sampling stations for the reference site (near Chinook, WA).



CENWP-EC-HR March 5, 2014

Memorandum for: Portland District, Waterways Maintenance, (CENWP-OD-NW, Stokke)

Subject: Portland Sediment Evaluation Team (PSET) Level 2 dredged material suitability determination for maintenance dredging at the Wahkiakum Ferry and Westport Slough side channel projects.

Reviewers: The PSET includes the U.S. Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). The reviewers for this project included James McMillan and James Holm (Corps), Laura Inouye (Ecology), Jeff Lockwood (NMFS), Jeremy Buck (USFWS), Pete Anderson (ODEQ), and Jonathan Freedman and Bridgette Lohrman (EPA).

The PSET reviewed the Portland District (District) Sediment Quality Team's February 3, 2014 "Wahkiakum Ferry Channel Realignment — Westport Slough Dredging Project, Sediment Quality Evaluation Report" (SQER). This technical memorandum documents the consensus of the reviewing agencies regarding the suitability of sediments at the Wahkiakum Ferry and Westport Slough side channels for unconfined, aquatic placement. Sediment quality data collected from these side channel projects was evaluated using guidance found in the 2009 *Sediment Evaluation Framework for the Pacific Northwest* (SEF).

Applicable Authorities Governing the Project: Congressional authorization under the Rivers and Harbors Act of 1937; sections 401 and 404 of the Clean Water Act; section 7 of the Endangered Species Act; section 305 of the Magnuson-Stevens Act; et al.

Project Description: The Lower Columbia River (LCR) deep draft navigation channel bisects the Wahkiakum Ferry channel into two side channel projects: the Westport Slough side channel (Oregon) and Wahkiakum Ferry side channel (Washington). These side channel projects are located at Columbia River mile (RM) 43.5. Side channel project figures appear in the SQER.

Wahkiakum Ferry Side Channel. The existing Wahkiakum Ferry side channel project is currently maintained for ferry traffic only, and provides for a channel 9 ft. deep, 200 ft. wide, and 1,900 ft. long, with a 100-ft. over-width on each side of the channel. The Corps performs advanced maintenance dredging on the project to -11 ft. Columbia River Datum (CRD); the project was last dredged in 2010 and the sediment was placed in the Columbia River flow lane. The Corps proposes to widen and realign the Puget Island segment of the ferry channel; the channel centerline would be shifted upstream and the channel will be widened from 200 to 300 ft. and shifted upstream. The downstream channel boundary would shift upstream approximately 70 ft. while the upstream channel boundary would shift upstream approximately 170 ft. The 100-ft. over-width will shift upstream as well. The Wahkiakum Ferry side channel depth would remain the same (-11 ft. CRD). The new area to be dredged is approximately 300 ft. by 400 ft., and the

total volume of sediment to be dredged is estimated between 22,000 and 33,000 cubic yards

Westport Slough Side Channel. The Westport Slough side channel project was authorized by Congress for a channel 28 ft. deep, 200 ft. wide, and 1,600 ft. long, with a 100-ft. over-width on each side of the channel. A single user may ultimately need the channel maintained to -22 ft. CRD, but funding has not been available for the Corps to maintain the channel to that depth. However, the Corps currently maintains the Westport Slough side channel to -11 ft. CRD for the ferry. The project was last maintained to -11 ft. CRD in 2010 and the sediment was placed in the Columbia River flow lane. The area to be dredged (to -11 ft. CRD) is approximately 200 ft. by 500 ft., and the total volume to be dredged is estimated between 30,000 and 40,000 CY. The estimated volume of sediment to be dredged for the -22 ft. CRD project would be 75,000 to 100,000 CY.

Dredging Methods: Both side channel projects will be dredged with a clamshell dredge.

Dredged Material Transport and Placement: A tug and bottom dumping scow are typically used to transport the dredged material. Dredged material will be placed near the Wahkiakum Ferry channel in the Columbia River flow lane.

Site History and Management Area Ranking: Based on prior sediment characterization, sediment grades from coarse-grained material in the LCR federal navigation channel to fine-grained material in the Westport Slough side channel. The Wahkiakum Ferry side channel is composed of coarse-grained material. There are no known sources of contamination in the project area or immediately upstream of the ferry. Georgia Pacific (formerly James River paper mill) is located at Wauna, Clatsop County, Oregon, approximately 2 miles downstream. Sediments in both side channel projects have been characterized multiple times. Sediment concentrations of metals, semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) have never exceeded the SEF freshwater benthic toxicity screening levels (SLs). Based on the previous testing, SVOC analysis was not included in the CoC list for this round of testing.

Management Area Ranking: The PSET has assigned a "very low" management area ranking to the Wahkiakum Ferry side channel. The Wahkiakum Ferry side channel sediments must be re-characterized 10 years from the sampling date, by September 2023. A "low" management area ranking is assigned to the Westport Slough side channel project. The Westport Slough side channel sediments must be re-characterized 7 years from the sampling date, by September 2020.

Sampling and Analysis Description: The Wahkiakum Ferry federal project was sampled on September 26, 2013; samples were collected with a petite ponar grab sampler. Sample stations appear in Figures 3 and 4 of the SQER; the grab sample log form appears in Attachment A of the SQER. The laboratory chain of custody form appears in Attachment B of the SQER.

Wahkiakum Ferry Side Channel. Three dredge prism subsamples were collected at the Wahkiakum Ferry dredged material management unit (DMMU) to form one composite sample (092613CRWF-COMP-1). Although metals were not originally proposed for analysis, the District instructed the contract laboratory to analyze the Wahkiakum Ferry composite sample for total solids, total organic carbon, grain size, and metals.

Westport Slough Side Channel. The Westport Slough side channel was split into two DMMUs that were defined by depth. Sample 092613CRWS-COMP-1 was composited from four grabs to characterize material above -11 ft. CRD (the typical maintenance depth). Sample 092613CRWS-COMP-2 was composited from four grabs to characterize material from -11 ft. to -22 ft. CRD (the depth that would be required for ocean-going barges that could potentially use the channel in the future). The District instructed the contract laboratory to analyze the Westport Slough composite samples for total solids, total organic carbon (TOC), grain size, metals, pesticides, PCBs, and total petroleum hydrocarbons.

Results: Sediment chemical results appear in Table 2 of the SQER. The District compared bulk sediment concentrations to the 2006 SEF freshwater SLs.

Wahkiakum Ferry Side Channel. The Wahkiakum Ferry shoal is composed of 96.2% sand and 3.5% fines (silt + clay); the TOC content of the shoal material is 0.768%. Antimony, mercury, and silver were not detected in sample 092613CRWF-COMP-1. Concentrations of detected metals were below the respective SLs.

Westport Slough Side Channel. The Westport Slough material is composed of an average of 83.1% sand and 15.2% fines; the TOC content is 0.698%. Antimony, mercury, and silver were not detected in either of the composite samples (092613CRWS-COMP-1, 092613CRWS-COMP-2). Concentrations of detected metals were below the respective SLs in both samples. Pesticides and PCBs were not detected in either sample. Diesel-range organics ranged from 7.8 to 35 mg/kg. Lube oil was only detected in the deep composite sample (092613CRWS-COMP-2; -11 to -22 ft. CRD) at 130 mg/kg; it was not detected in 092613CRWS-COMP-1.

Suitability Determination: The PSET's suitability determination is based on comparison of the District's sediment quality data to the 2006 SEF freshwater SLs.

Wahkiakum Ferry Side Channel. Material in the current and realigned Wahkiakum Ferry side channel configurations is suitable for unconfined, aquatic placement. The PSET assumes that the quality of sediments exposed after dredging will be similar to the dredge prism material.

Westport Slough Side Channel. Material in the Westport Slough side channel project is suitable for unconfined, aquatic placement. Materials from the mudline to -11 ft. CRD and from -11 ft. to -22 ft. CRD may be placed in the Columbia River flow lane. The PSET assumes that the quality of sediments exposed after dredging will be similar to the dredge prism material.

Contact: This memorandum was prepared by James McMillan, and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to James McMillan (Lead—Portland Sediment Evaluation Team) at (503) 808-4376 or e-mail to: james.m.mcmillan@usace.army.mil.

References:

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2009. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2009, by the U.S. Army Corps of Engineers, Northwestern Division, 128 p. plus Appendices.

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2006. Interim Final *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2009, by the U.S. Army Corps of Engineers, Northwestern Division, 194 p. plus Appendices.

U. S. Army Corps of Engineers. 2014. Wahkiakum Ferry Channel Realignment—Westport Slough Dredging Project, Sediment Quality Evaluation Report. February 3, 2014; *prepared by* Portland District—Sediment Quality Team; 12 p. plus figures and attachments.

EPA-Region 10 Water Division, Wetlands and Oceans Section 08 September 2021

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Downstream Shallow Draft Federal Navigation Channel (miles 1.5 to 3.8) in Portland, Multnomah County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (USACE) operations and maintenance (O&M) dredging for the Oregon Slough Downstream (OSD) Shallow Draft Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 101.4 to 104.6 (project mile 1.5 to 3.8).

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) , this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the OSD shallow draft FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the December 2020 *"Sediment Characterization. Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon"* (2020 SQER)[2] and the August 2021 *"Supplemental Sediment Characterization. Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon"* (2021 SQER)', prepared by ANAMAR for the USACE's Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs and dioxins and furans[4].

Suitability Summary:

Dredge Prism (DP) Sediments:	& Suitable	OUnsuitable
Post-Dredge Surface (PDS):	& Suitable	OUnsuitable

Reviewers: The PSET agencies include the USACE, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

' U.s. Army Corps of Engineers, U.s. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers (USACE) — Portland District. 2020. *Sediment Characteri--ation Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Mulmomah County, Oregon.* Prepared by ANAMAR, December 2020. 25 pp with Maps, Tables, and Appendices.

[3] USACE — Portland District. 2021. *Supplemental Sediment Characteri-ation Oregon Slough Downstream Shallow Draft Channel (Miles I.5 to 3.8), Multnomah County, Oregon.* Prepared by ANAMAR, August 2021. 27 pp u'ith Maps, Tables, and Appendices

[4] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment.* Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

UJ James Holm (USACE, Lead) S Bridgette Lohrman (EPA, Co-Lead)
I8i Pete Anderson (ODEQ) X Laura Inouye (Ecology)
Hi Dominic Yballe (USACE) S Tom Hausmann (NMFS)
I8i Jeremy Buck (USFWS)

PSET/SEF Conditions:
X Data Recency Expiration — Based on a "Low" rank, the data recency for sediments in the Oregon Slough Downstream Shallow Draft Federal Navigation Channel expires in May 2028.

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP) submitted to PSET	1 September 2020
SAP revisions requested by PSET	4 September 2020
Revised SAP' submitted	5 September 2020
Revised SAP approved by PSET[6]	10 September 2020
Sampling date(s)	11-13 September 2020
Draft SQER submitted to PSET	11 December 2020
Sonic drill sampling concept submitted to PSET	19 January 2021
Supplemental SAP submitted to PSET[7]	29 January 2021
Supplemental SAP approved by PSET'	25 February 2021
Sonic drill sampling date(s)	10-12 May 2021
Supplemental SQER submitted to PSET	24 August 2021
Suitability Determination Memorandum (SDM) issued by PSET	08 September 2021
Management area ranking	Low
Recency of data	May 2028 (7 years)

Federal Regulatory Authorities:
Section 10, Rivers and Harbors Act
X Section 404, Clean Water Act (CWA)
Section 401, CWA
& Section 7, Endangered Species Act
X Section 305 of the Magnuson-Stevens Act
X Fish and Wildlife Coordination Act
— Section 103, Marine Protection, Research and Sanctuaries Act
— Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the OSD shallow draft FNC. Maintenance dredging is needed to provide navigation access.

' UsACE — Portland District. 2020. *Oregon Slough Downstream Shallow Draft Channel (mile 1.5 to 3.8) Mulmomah County, Oregon, Sediment Sampling and Analysis Plan (v2.1).* Prepared by SQT, 5 September 2020. 29 pp with Attachment.

6 Portland Sediment Evaluation Team (PSET). 2020. *Oregon Slough Downstream FNC — SAP Approval.* Email issued by B. Lohrman (EPA) for PSET, 10 September 2020. 3 pp with Attachment.

7 USACE — Portland District. 2021. *Supplemental Sampling and Analysis Plan (SSAP) for Level 2A and contingency sediment characteri--ation and sampling north a sonic drill at the Oregon Slough Do»nstream, Shallow Draft Federal Navigation Channel.* Prepared by SQT, 29 January 2021. 6 pp.

PsET. 2021. *PSET - Oregon Slough Downstream FNC (SSAP Approval).* Email issued by B. Lohrman (EPA) for PSET, 25 February 2021. 2 pp with Attachment.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 101.4 to 104.6
Total proposed dredging volume (cy)	=425,000
Max. proposed dredging depth (includes overdepth allowance)	-22 feet CRD (20+2 ft overdredge)
Dredging area (acres, approx.)	=55
Dredge dimensions	=200 ft. wide for 2.3 miles
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	August 1 through December 15
Dredged material mgmt. units (DMMUs)	11

Sampling and Analysis Description: The USACE sampling and analytical program for the OSD FNC is summarized in Table 3. Actual grab sample station locations are shown in the 2020 SQER Table lA and Map 1 (SDM Figure 1). Based on the inability to collect deeper-dredge prism material, a SSAP was prepared, approved by PSET, and implemented by the USACE. The USACE' significantly modified their sampling approach by using a sonic core sample to penetrate deeper through the dredge prism and into the post-dredge surface. The PSET agreed to the USACE' approach of considering the grab samples to represent the top 4-feet of dredge prism material because of the likelihood of those materials being more recently deposited coarse Columbia River sand. Actual sonic core sample station locations are shown in the 2021 SQER Table IC and Map 1 (SDM Figure 2). The conceptual DMMU layout is shown in Figure 2 of the PSET-approved SSAP (SDM Figure 3).

Deviations from the SAP: Deviations from the PSET-approved SAP are identified in the 2020 SQER sections 2.1.1, 2.2.2, and 2.2.3 and are noted in SQER Tables lA (grab sample summary) and lB (core sample summary).

1. Core sampling with a standard vibracore sample and core catcher was not possible due to the presence of unconsolidated, coarse sand and gravel in the upper 6 to 9 feet of the dredge prism. Coarse sediments resulted in core refusals above project depth (-24 ft CRD) or core recoveries of 0 to 16%. After many coring attempts across the project and coordinating with Ecology staff from the field, the USACE switched to a standard Ponar grab sampler to characterize the surface layer DMMUs (OSD-01, OSD-02, OSD-03, OSD-06, OSD-09 and OSD-11) of the project.
2. Due to the coarse character of the surface sediments, the reference site for the contingency bioassays was relocated from Elk Rock Island in the Willamette River (CRM 16) to sandy sediments along Sauvie Island in the Columbia River (CRM 100).

Deviations from the SSAP: Deviations from the PSET-approved SSAP are listed in the 2021 SQER Table lC for stations OSD-06D, OSD-06E, OSD-09D, and OSD-09E. The deviations included the inability to collect surface material from DMMUs 6 and 9 because the mudline elevation encountered in the field during sampling was deeper than what was encountered in 2020. This deviation did not result in a lack of data collection because the 2020 sampling collected sediment from the shallower depths.

Table 3. Sampling and Analysis Description

Sample collection method			Standard Ponar (}) or Sonic Drill ( )			
DP sample IDs / DMMU IDs	OSD-01	OSD-02	OSD-03J (rnudline to -14 ft) OSD-04r	OSD-06} (mudline to -14 ft) OSD-07r	OSD-09{ (mudline to -18 ft)	OSD-11}
(DP interval in ft CRD)	(mudline to -22 ft)	(mudline to -22 ft)	(-14 to -18 ft) OSD-05r (-18 to -22 ft)	(-14 to -18 ft) OSD-08r (-18 to -22 ft)	OSD-l0r (-18 to -22 ft)	(mudline to -22 ft)
PDS sample IDs (-22 to -24 ft CRD)	OSD-01Z{	OSD-02Z	OSD-03Z	OSD-06Z	OSD-09Z	OSD-HZ
DMMU volume (CY)	=45,000	=45,000	=35,000 to =40,000	=35,000 to =40,000	=40,000	=25,000
Dredge Prism) Mudline range (ft CRD)	-15.5 to -17.3	-14.5 to -18.3	-11.0 to -12.5}	-7.8 to -9.8	-10.9 to -14.4}	-19.1 to -21.4
Dredge Prism) Composite (Y/N)	Y	Y	Y	Y	Y	Y
Dredge Prism Subsample /DMMU	3	3	3 / 2r	3 / 2r	3 / 2r	3
Dredge Prism Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
PDS Layer) Depth range (ft CRD)	-22 to -24	-22 to -24	-22 to -24	-22 to -24	-22 to -24	-22 to -24
PDS Layer) Composite (Y/N)	Y	Y	Y	Y	Y	Y
PDS Layer Subsample /PDS-layer	2r	2r	2r	2r	2r	2r
PDS Layer Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
Sediment Physical and Chemical Analysis (No. DP samples / No. PDS samples analyzed)						
Grain size	1/1	1/1	3/1	3/1	2/1	1/1
Total organic carbon	1/1	1/1	3/1	3/1	2/1	1/1
Total solids	1/1	1/1	3/1	3/1	2/1	1/1
Ammonia	1/1	1/1	3/1	3/1	2/1	1/1
Total sulfides	1/1°	1/1^	3/1°	3/1	2/1°	1/1^
Metals, freshwater	1/1	1/1	3/1	3/1	2/1	1/1
PAHs	1/1	1/1	3/1	3/1	2/1	1/1
SVOCs (phthalates, phenols, misc. extractables)			3/1	3/1	2/1	
Pesticides	1/1	1/1	3/1	3/1	2/1	1/1
PCBs (Total Aroclors)	1/1	1/1	3/1	3/1	2/1	1/1
Butyltins	1/1	1/1	3/1	3/1	2/1	1/1
TPH (diesel [dx] and residual [rx] range)	1/1	1/1	3/1	3/1	2/1	1/1
Dioxin/Furans	1/1	1/1	3/1	3/1	2/1	1/1
Contingency Biological Analysis– dredge prism only, three DMMUs maximum						
Freshwater Bioassays	1*	1*	3*	3*	2*	1*

t = Ponar grab samples; = sonic drill core samples; ° = sulfides analysis removed by USACE since no biological test are needed on the PDS; * = contingency bioassays not required based on sediment chemistry.

Total sulfides were removed from analysis by the USACE on the six Z-layer composite samples because biological tests are not necessary on the post-dredge surface and the overlying DMMUs were analyzed for sulfides. Only one of the 11 overlying DMMUs detected elevated sulfides (39.1 mg/kg, DMMU OSD-5r) above the SEF freshwater SL (39 mg/kg).

Results and Discussion: Analytical results for the USACE sampling event are summarized in Tables 5a (dredge prism) and 5b (post-dredge surface). The chemical analytical results from both SQERs were compared to the 2018 SEF freshwater SLs and to ODEQ's freshwater fish-based SLV (22 ug/kg) to evaluate PCBs (total aroclors) and SLV (5.6 ng/kg) for dioxins and furans.

Total sulfides in DMMU OSD-05r (39.1 mg/kg) was the only DMMU or post-dredge surface sample with an analyte detected above an SEF SL (39 mg/kg). All other analytes were detected below SEF freshwater SLs or were non-detections (U) with method reporting limits (MRLs) below SLs. Sulfides are generally used to inform bioassay testing for potential non-treatment effects. When total sulfides are the sole parameter detected above an SEF SL, the PSET may determine sediments are suitable for unconfined, aquatic disposal and exposure.

Except for DMMU OSD-05r, all dredge prism samples (Table 5a) consisted of at least 91% sand with a total organic carbon (TOC) of 0.1% or less. DMMU OSD-05r was 67% sand, 26% silt, and 6% clay with a TOC of 0.3%.

Except for samples OSD-03Z and OSD-09Z, all post-dredge surface samples (Table 5b) consisted of at least 80% sand with a TOC of less than 0.19%. OSD-03Z consisted of 38% sand, 51% silt, and 11% clay with a TOC of 0.89%. OSD-09Z consisted of 3% gravel, 72% sand, 22% silt, and 3% clay with a TOC of 0.9%. DMMU OSD-05r is directly on top of OSD-3Z layer.

There were no exceedances of ODEQ's bioaccumulative SLV for PCBs because all samples were non-detections (U) with an MRL (4.0 ug/kg) below the SLV (22 ug/kg). There were no exceedances of ODEQ's bioaccumulative SLV for dioxins and furans because all samples had 2,3,7,8 TCDD TEQ results below the SLV (5.6 ng/kg).

No other parameters had detections, estimated concentrations (I) or non-detections (U) with elevated MRLs above an SEF freshwater SLs or an ODEQ SLVs.

Site Ranking: The sampling design was based upon a "moderate" rank due to the lack of dredging and agency concerns about CoCs at depth. Based on the dredge prism and post-dredge surface results and similar physical characteristics to surrounding projects, the PSET has assigned a "low" rank to the OSD shallow-draft sediments.

PSET Suitability Determination:
Dredge Prism —Chemical concentrations in OSD dredge prisms are below the SEF freshwater SLs and ODEQ SLVs as discussed above. As such, the OSD shallow draft FNC dredged prism material is suitable for unconfined, aquatic disposal per the 2018 SEF guidance without additional testing.

Post-Dredge Surface — Chemical concentrations in OSD post-dredge surface samples are below the SEF freshwater SLs and ODEQ SLVs as discussed above. As such, the OSD shallow draft FNC post-dredge surfaces are suitable for unconfined, aquatic exposure per the 2018 SEF guidance without additional testing.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, USACE) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 5a. Project Sediment Analytical Summary – Dredge Prism(sampled September 2020 and May 2021)

Sediment Physical and Chemical Results							
Sample Location (sample year)	Surface (2020)	Subsurface (2021)					SEF SL1, freshwater
DMMU ID / Sample ID: Parameter	OSD-01, OSD-02, OSD-03, OSD-06, OSD-09, OSD-11	OSD-04r	OSD-05r	OSD-07r	OSD-08r	OSD-10r	(SLV†)
Grain size: gravel, sand, silt, clay (%)	Range: 2.8 to 8.2, 91.4 to 94.2, 0.6 to 4.3, 0.3 to 0.4	1.0, 95.7, 3.5, 0.3	0.5, 67.0, 26.3, 6.2	3.1, 95.1, 1.7, 0.1	1.5, 95.3, 3.0, 0.2	6.6, 92.7, 0.8, 0.1	
Total Solids (%)	Range: 76.1 to 88.2	79.0	74.55	80.62	84.30	79.78	
Total Organic Carbon (%)	Range: 0.04 to 0.1	0.05	0.30	0.06	0.05	0.05	
.-Ammonia (nig/kg)	Range: 0.45 U to 0.52 U	22.0	52.5	8.58	7.01	3.19	230
Total Sulfides (mg/kg)	Range: 1.15 U to 1.26 U	Range: 1.16 U to 1.26 U	Range: 1.21 U to 39.1	Range: 1.21 U to 1.24 U	Range: 1.23 U to 1.25 U	Range: 1. 17 U to 1.20 U	39
Metals (mg/kg)	Non-detect, Detect LSLs U, J	Non-detect, Detect <SLs TJ, J	Detect LSLs J	Non-detect, Detect <SLs TJ, J	Detect ?SLs J	Non-detect, Detect <SLs U, I	Varies
Total PAHs (uglg)	Range: 4.8 I to 39.8 U Non-detect, Detect SSL	39.9 U	62.7	39.9 TJ	40.0 U	40.0 U	17,000
SVOCs (ug/kg) (phenols, phthalates, iiiisc. extractables)	Non-detect, Detect CSLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Varies
Pesticides (ng/kg)	Non-detect ?SLs U	) Non-detect ?SLs U	) Non-detect *SLs U	Non-detect *SLs U	) Non-detect *SLs U	Non-detect *SLs U	) Varies
4,4"-DDD							) 310
4,4"-DDE	1.0 U	1.0 U	1.0 U	1.0 U	1.0U	1.0 U	21
4,4'-DDT							100
PCBs, Total Aroclors (ug/kg)	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	
Butyltins (ug/kg)	3.69 U to 5.73 U Non-detect <SLs U	3.84 U to 5.74 U Non-detect <SLs U	3.83 U to 5.74 U Non-detect *-SLs U	3.83 U to 5.73 U Non-detect *-SLs U	3.86 U to 5.78 U Non-detect <SLs U	3.86 U to 5.78 U Non-detect *-SLs U	Varies
TPH (dx/rx) (ug/kg)	Range: 5.55 U to 6.9/ 11.1 U to 37.8	6.05 U / 12.1 U	6.47 U / 17.3	6.10 U / 12.2 U	5.94 U / 11.9 U	6.08 U / 12.2 U	340 / 3,600
Dioxins/Furans, 2,3,7,8 TCDD TEQ (ng/kg) ND=0 / ND = ½ EDL	Range: 0.0056 to 0.0268 / 0.0666 to 0.1030	0.0183 / 0.1620	0.0118 / 0.1470	0.0593 / 0.1840	0.0240 / 0.1920	0.0154 / 0.1620	(5.6J)

BOLD= Detection exceeds SEF freshwater screening level; U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (if DL in parenthesis); I = Estimated value between MDL and MRL ; = ODEQ (2007) freshwater fish-based bioaccumi3lation screening level value.

7

Table 5b. Project Sediment Analytical Summary – Post-Dredge Surface(sampled May 2021)

Sediment Physical and Chemical Results							
PDS Sample ID: Parameter	**OSD-01Z**	OSD-02Z	OSD-03Z	**OSD-06Z**	**OSD-09Z**	OSD-11Z	SEF SL1, freshwater (SLV†)
Grain size: gravel, sand, silt, clay (%)	0.4, 95.6, 4.0, 0.1	0.5, 92.5, 7.0, 0.1	0.3, 38.1, 50.8, 10.6	1.0, 86.6, 11.0, 1.5	3.2, 71.9, 21.8, 3.1	2.4, 80.0, 16.1, 1.5	
Total Solids (%)	76.1	75.4	68.7	82.0	74.5	74.7	
Total Organic Carbon (%)	0.06	0.06	0.89	0.08	0.90	0.19	
Ammonia (mg/kg)	28.4	20.6	169	51.5	29.5	18.6	230
Total Sulfides (ing/kg)							39
Metals (mg/kg)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Detect <SLs I	Detect <SLs I	Detect <SLs I	Detect <SLs I	Varies
Total PAHs (ug/kg)	40.0 U	39.9 U	39.9 U	20.4	66.6 I	39.8 U	17,000
SVOCs (ug/kg) (phenols, phthalates, misc. extractables)	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Non-detect, Detect <SLs U, I	Varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect *-SLs U	Non-detect *-SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
4,4'-DDD	1.0 U	1.0 U	1.0 U	1.0 U	1.15 J	1.0 U	3 10
4,4'-DDE					**0.36]**		21
4,4'-DDT					1.0 U		**100**
PCBs, Total Aroclors	4.0 LI	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	110(22$)
Dioxins (•g/*g) (ug/kg)	Non-detect <SLs U	Non-detect *-SLs U	Non-detect *-SLs U	Non-detect, Detect <SLs LI	Non-detect, Detect <SLs TJ	Non-detect *SLs U	Varies
Butyltins							
TPH (dx/rx) (ug/kg)	6.71 U / 13.4 U	6.68 U / 13.4 U	11.9 / 40.5	6.09 U / 12.2 U	6.92 U / 20.8	6.82 U / 13.6 U	340 / 3,600
Dioxins/Furans, 2,3,7,8TCDD TEQ(rig/kg) ND=0 / ND = /: EDL	0.0304 / 0. 1790	0.0124 / 0. 1240	0.0289 / 0. 1510	0.0304 / 0. 1980	2.68 / 2.78	0.0216 / 0. 1850	(5.6J)

BOLD= Detection exceeds SEF freshwater screening level; U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (hiDL in parenthesis); I = Estimated value between MDL and MRL; = ODEQ (2007) freshwater fish-based bioaccumulation screening level value.

Figure 1.Oregon Slough Downstream shallow draft Federal Navigation Channel, actual grab sample locations (sampled 11-13 September 2020).

Figure 2.Oregon Slough Downstream shallow draft Federal Navigation Channel, actual sonic drill sample locations (sampled 10-12 May 2021).

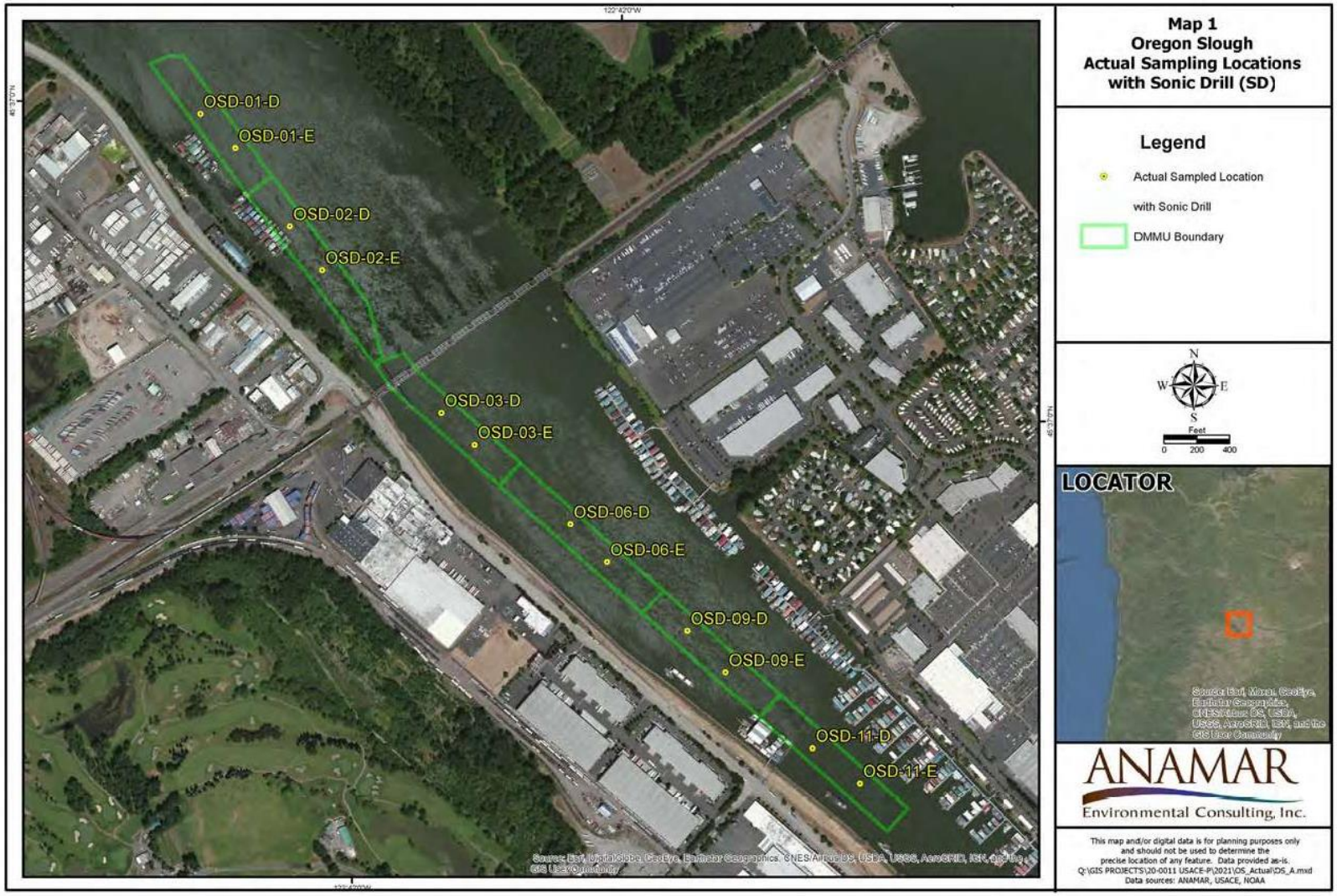
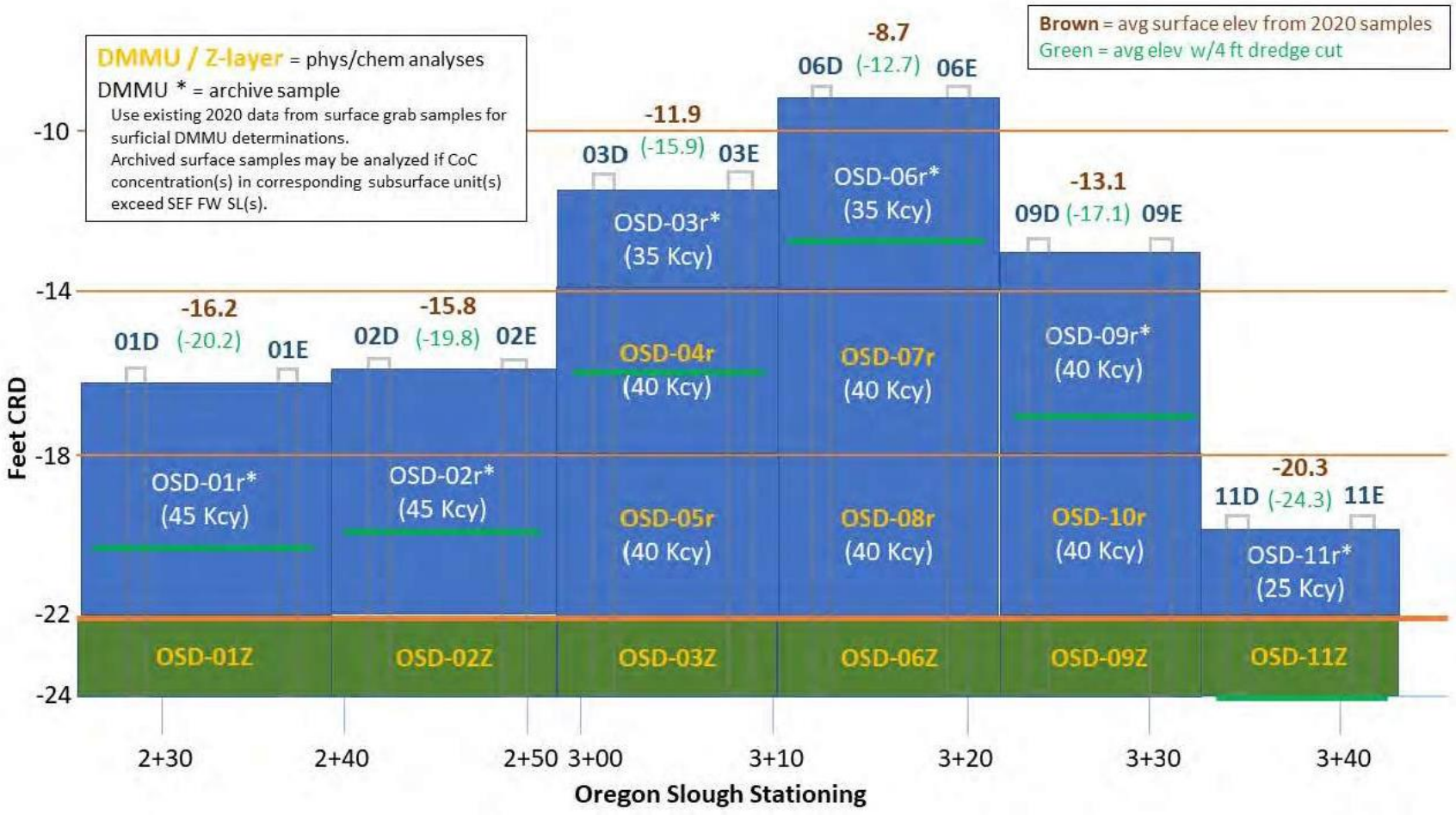


Figure 3.Oregon Slough Downstream shallow draft conceptual DMMU and Z-layer diagram (USACE SSAP, 2021).



EPA-Region 10 Water Division, Wetlands and Oceans Section 1 August 2019

Memorandum for: U.S. Army Corps of Engineers — Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Federal Navigation Side Channel, Upstream Entrance.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Oregon Slough Federal Navigation Side Channel, Upstream Entrance (OSU FNC) in the Columbia River at river mile (RM) 108.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF) , this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic disposal. The PSET reviewed the Corps' 18 July 2019 *"Oregon Slough Upstream Federal Navigation Side Channel, Sediment Quality Evaluation Report"* (SQER)[2], prepared by Corps' Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs'.

Suitability Summary:

Surface Sediments:	& Suitable	O Unsuitable
Post-Dredge Surface (PDS):	& Suitable	O Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency — Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

X James Holm (Corps, Lead)	X Bridgette Lohrman (EPA, Co-Lead)	
Pete Anderson (ODEQ)	X Laura Inouye (Ecology)	Dominic Yballe (Corps)
X Tom Hausmann (NMFS)	— Jeremy Buck (USFWS)	

PSET/SEF Conditions:

X Data Recency Expiration — The data recency of this SDM for the OSU FNC expires in April 2026.

' U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest.* Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

2 U.S. Army Corps of Engineers — Portland District. 2019. *Oregon Slough Upstream Federal Navigation Side Channel, ' Multnomah County, Oregon, Columbia River (River Mile 108), ' Sediment Quality Evaluation Report.* Prepared by the Corps SQT, 18 July 2019. 14 pp plus Attachments.

3 Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment.* Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

Table 1. Review Timeline

Sampling and analysis plan (SAP) submitted to PSET	12 February 2019
SAP revisions requested by PSET (verbal)	13 February 2019
Revised SAP submitted	22 February 2019
Final SAP[4] submitted	11 March 2019
Final SAP approved by PSET	26 March 2019 [5]
Sampling date(s)	5 April 2019
Draft SQER submitted to PSET	18 July 2019
Final SQER	18 July 2019
Suitability Determination Memorandum (SDM) issued by PSET	01 August 2019
Management area ranking	Low
Recency of data*	April 2026 (7 years)

Federal Regulatory Authorities:

Section 10, Rivers and Harbors Act
& Section 404, Clean Water Act (CWA)
& Section 401, CWA
& Section 7, Endangered Species Act
Section 305 of the Magnuson-Stevens Act
Fish and Wildlife Coordination Act
O Section 103, Marine Protection, Research and Sanctuaries Act
O Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the OSU FNC. Maintenance dredging is needed to provide navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 108
Total proposed dredging volume (cy)	=l33,000
Max. proposed dredging depth (includes overdepth allowance)	-12 ft. CRD
Dredging area (acres, approx.)	=40
Dredge dimensions	300 ft. wide by 5,800 ft. long
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMU)	2 (3-station composite samples)

[4] US Army Corps of Engineers. 2019. *Oregon Slough Federal Navigation Channel—Upstream Entrance (Columbia River, River Miles 108-109), Mulmomah County, Oregon,' Sediment Sampling and Analysis Plan.* Prepared by Corps SQT 11 March 2019. 14 pp with Attachments.

Portland Sediment Evaluation Team (PsET). 2019. [E-mail correspondence] *PSET—Oregon Slough Federal Project (SAP Approval).* Bridgette Lohrman, EPA, sent 26 March 2019. 2 pp.

Sampling and Analysis Description: The Corps' sampling and analytical program for the OSU FNC is summarized in Table 3. Actual sample station locations are shown in the SQER Table 3 and Figure 1, and SDM Figure 1.

Table 3. Sampling and Analysis Description

Sample collection method		Standard PONAR Grab		
DMMU ID		OSU-01	OSU-02	BOTH
DMMU Rank		Low	Low	Low
DP sample ID		040519-OSU-01-COMP	040519-OSU-02-COMP	040519-OSU-COMP-TIN
PDS sample ID		NA	NA	NA
Proposed DMMU volume (cy)		70,000	63,000	133,000
Dredge Prism	Depth range (ft CRD)	-6.42 to -6.81	-4.75 to -8.23	-4.75 to -8.23
	Composite (Y/N)	Y	Y	Y
	Subsamples (SS)/DMMU	3	3	6
	SS Archive (Y/N)	Y	Y	Y
PDS Layer	Depth range (ft CRD)	N/A		
	Composite (Y/N)			
	SS/PDS-layer			
	SS Archive (Y/N)			

Sediment Physical and Chemical Analysis (No. DP/ No. PDS)

Grainsize	1/-	1/-	-/-
Total organic carbon	1/-	1/-	-/-
Total solids	1/-	1/-	-/-
Total volatile solids	1/-	1/-	-/-
Metals, freshwater	1/-	1/-	-/-
TotalPAHs	1/-	1/-	-/-
SVOCs (phthalates, phenols, misc. extractables)	1/-	1/-	-/-
Pesticides	1/-	1/-	-/-
PCBs (Total Aroclors)	1/-	1/-	-/-
Butyltins	-/-	-/-	1/-
Total petroleum hydrocarbons (dx, rx)	1/-	1/-	-/-

Deviations from the SAP: There were no deviations from the PSET-approved SAP.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. The chemical analytical results from the SQER were compared to the 2018 SEF freshwater SLs and ODEQ's SLV for freshwater fish to evaluate PCBs. There were no detections or non-detection exceedances (U) of freshwater SEF SLs or applicable ODEQ SLV.

Table 4. Project Sediment Analytical summary

Decision unit (Sample ID): Parameters	040519-OSU-01-COMP	040519-OSU-02-COMP	040519-OSU-COMP-TIN	SEF freshwater SL1
Grain size (%)				
Gravel	1.0	0.0		
Sand	96.8	78.6		
Silt and clay	2.0	21.3		
Total organic carbon (%)	0.03	0.47		
Total solids (%)	99.97	71.8		
Metals (mg/kg)	<SLsJ,U	<SLsJ,U		Varies
Total PAHs (ug/kg)	93.9J	39.7U		17,000
SVOCs (ug/kg) (phthalates, phenols, misc. extractables)	<SLs J, U	+SLs U		Varies
Pesticides (ug/kg)				
DDDs	0.99U	0.98U		310
DDEs	0.99U	0.98U		21
DDTs	0.99U	0.98U		100
Other pesticides	+SLsU	+SLsU		Varies
Total Aroclors — PCBs (ug/kg)	4.0U	3.9U		110 (22)
Butyltins (ug/kg)				
Monobutyltin			3.85U	540
Dibutyltin			5.45U	910
Tributyltin			3.64U	47
Tetrabutyltin			4.7lU	97
Total Petroleum Hydrocarbons (mg/kg)				
Diesel range	6.1 U	27.7		340
Residual range	12.2 U	55.7		3,600

U = Non-detection at the method reporting limit (MRL) or method detection limit (MDL), MRL reported;
J = Estimated value between MDL and MRL; = ODEQ (2007) freshwater fish-based SLV

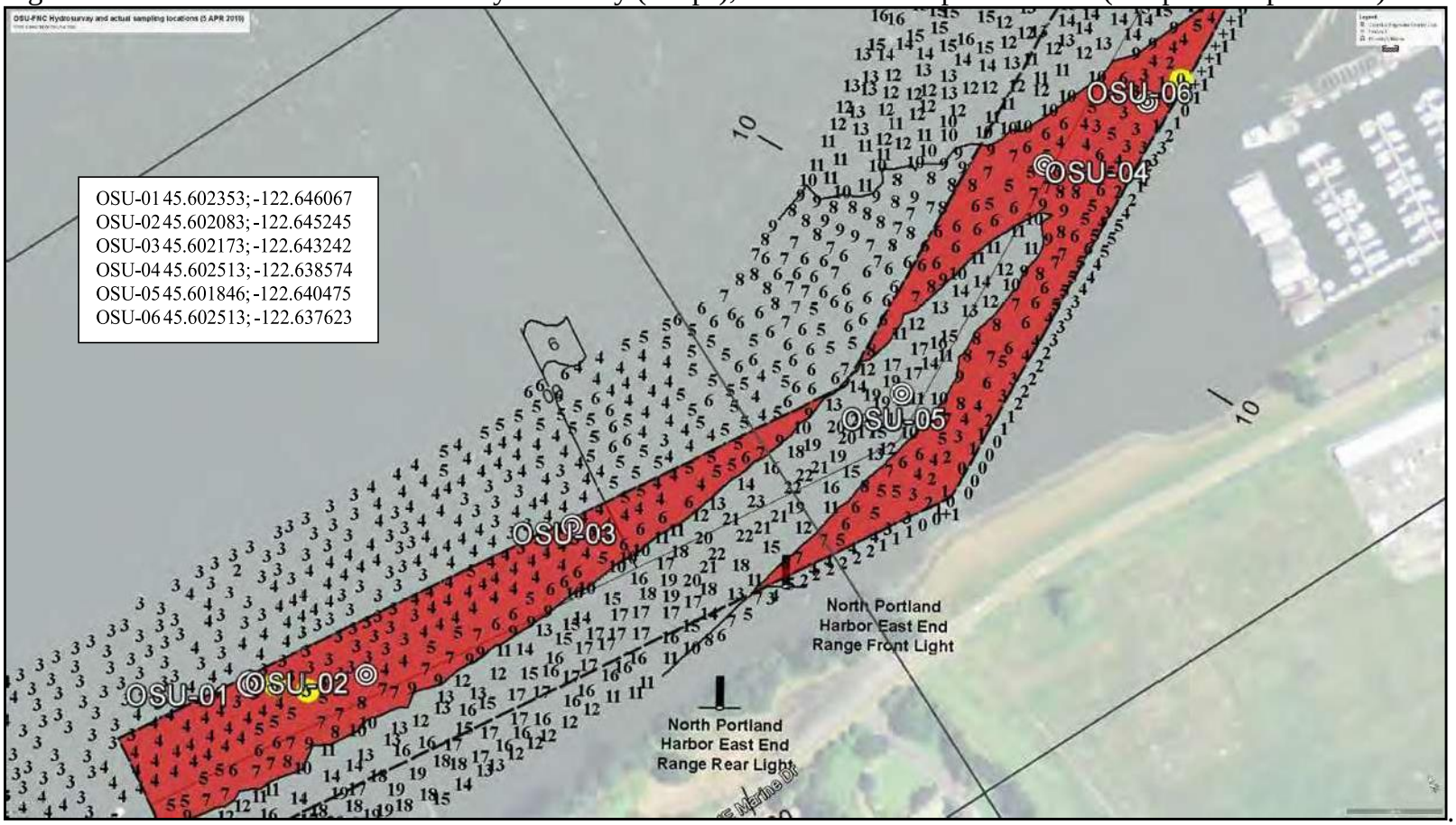
PSET Suitability Determination:

Dredge Prism—Chemical concentrations in both dredge prism composite samples were below the SEF freshwater SLs as discussed above. As such, the OSU FNC dredged prism material is suitable for unconfined, aquatic disposal per the 2018 SEF guidance.

Post-Dredge Surface — The dredge prism materials were determined to be suitable and the Oregon Slough Upstream Entrance has a "low" management area rank. As such, the PSET assumes that the OSU FNC post-dredge surface is suitable for unconfined, aquatic exposure per the 2018 SEF guidance.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Figure 1. OSU FNC – December 2018 hydrosurvey (Corps), 2019 actual sample locations (sampled 5 April 2019)



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2020-02918

June 16, 2021

Christopher Page
Chief, Environmental Resources Branch
United States Army Corps of Engineers
Portland District
333 SW 1st Ave.
Portland, Oregon 97204

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Operations and Maintenance Dredging of the Federal Navigation Channel at Tongue Point, Clatsop County, Oregon; Elochoman Slough, Wahkiakum County, Washington; Lake River, Clark County, Washington; and Oregon Slough, Multnomah County, Oregon.

Dear Mr. Page:

Thank you for your letter of October 16, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the operations and maintenance dredging of the four Federal navigation channels referenced above. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action.

In the attached biological opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of:

- *Oncorhynchus tshawytscha:* Lower Columbia River (LCR) Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, SR (SR) spring/summer Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Snake River fall Chinook salmon;
- *O. keta:* Columbia River (CR) chum salmon;
- *O. kisutch:* LCR coho salmon;
- *O. nerka:* SR sockeye salmon;
- *O. mykiss:* UCR steelhead (*O. mykiss*), LCR steelhead, UWR steelhead, Middle Columbia River (MCR) steelhead, Snake River Basin (SRB) steelhead;

- *Acipenser medirostris:* Southern DPS green sturgeon; or
- *Thaleichthys pacificus:* Southern DPS Pacific eulachon;

or result in the destruction or adverse modification of their critical habitats.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the U.S. Army Corps of Engineers or any applicant must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes six conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

If the response is inconsistent with the EFH conservation recommendations, the Corps must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

Please contact Scott Hecht, Branch Chief, Oregon Washington Coastal Area Office in Lacey, Washington, 360-545-7490, Scott.Hecht@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Elizabeth Santana
David Griffith

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Federal Navigation Channel Operations and Maintenance Dredging
Tongue Point, Clatsop County, Oregon
Elochoman Slough, Wahkiakum County, Washington
Lake River, Clark County, Washington
and
Oregon Slough, Multnomah County, Oregon

NMFS Consultation Number: WCRO-2020-02918

Action Agency: U.S. Army Corps of Engineers – Portland District

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Chinook salmon *(Oncorhynchus tshawytscha)*					
Lower Columbia River Chinook salmon	Threatened	Yes	No	Yes	No
Upper Columbia River spring-run Chinook salmon	Endangered	Yes	No	Yes	No
Snake River spring/summer Chinook salmon	Threatened	Yes	No	Yes	No
Upper Willamette River Chinook salmon	Threatened	Yes	No	Yes	No
Snake River fall Chinook salmon	Threatened	Yes	No	Yes	No
Columbia River chum salmon (*O. keta*)	Threatened	Yes	No	Yes	No
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Snake River sockeye salmon (*O. nerka*)	Endangered	Yes	No	Yes	No

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Upper Columbia River steelhead *(Oncorhynchus mykiss)*	Threatened	Yes	No	Yes	No
Lower Columbia River steelhead	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead	Threatened	Yes	No	Yes	No
Middle Columbia River steelhead	Threatened	Yes	No	Yes	No
Snake River Basin steelhead	Threatened	Yes	No	Yes	No
Southern DPS of green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No
Southern DPS of Pacific eulachon (*Thaleichthys pacificus*)	Threatened	Yes	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes
Pacific Coast Groundfish	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service,
West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: June 16, 2021

TABLE OF CONTENTS

1. INTRODUCTION 1
1.1. Background 1
1.2. Consultation History 1
1.3. Proposed Federal Action 3
1.4. Action Area 12
2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT 12
2.1. Analytical Approach 13
2.2. Rangewide Status of the Species and Critical Habitat 14
2.2.1 Status of Critical Habitat 16
2.2.2 Status of the Species 22
2.3. Environmental Baseline 37
2.3.1. Habitat Conditions in the Action Area 37
2.3.2. Species in the Action Area 47
2.4. Effects of the Action 48
2.4.1 Entrainment 49
2.4.2. Degraded Water Quality 53
2.4.3 Altered Benthic Habitat and Reduced Foraging Opportunity 58
2.5. Cumulative Effects 62
2.6. Integration and Synthesis 63
2.6.1 Salmonids and their Designated Critical Habitat 63
2.6.2 Southern DPS of Green Sturgeon and Designated Critical Habitat 66
2.6.3 Southern DPS of Eulachon 67
2.7. Conclusion 68
2.8. Incidental Take Statement 68
2.8.1. Amount or Extent of Take 68
2.8.2 Effect of the Take 71
2.8.3 Reasonable and Prudent Measures 71
2.8.4 Terms and Conditions 71
2.9. Conservation Recommendations 74
2.10. Reinitiation of Consultation 75
3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE 75
3.1. Essential Fish Habitat Affected by the Project 76
3.2. Adverse Effects on Essential Fish Habitat 76
3.3. Essential Fish Habitat Conservation Recommendations 77
3.4. Statutory Response Requirement 78
3.5. Supplemental Consultation 78
4. FISH AND WILDLIFE COORDINATION ACT 78
5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW 79
6. REFERENCES 81
APPENDIX 94

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600 .

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Oregon Washington Coastal Office in Lacey, Washington.

1.2. Consultation History

This biological opinion is in response to the U.S. Army Corps of Engineers – Portland District (USACE) request for formal consultation on ESA listed species detailed in Table 1 for maintenance dredging of four navigation side channels.[1] The USACE also requested consultation on Essential Fish Habitat (EFH) for Pacific salmon. Although the USACE did not request consultation on EFH for West Coast groundfish, we know that some of these are present in a portion of the action area and provide an effects analysis in Section 3. The USACE's proposed maintenance dredging and in-water placement of the dredged sediments will be conducted under Sections 102 and 103 of the Marine Protection Reserve and Sanctuaries Act (MPRSA) of 1972, Sections 401 and 404 of the Clean Water Act (CWA) of 1977, and in accordance with Regulations 33 CFR Parts 335 through 338 ("Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving Discharge of Dredged or Fill Material into Waters of the U.S. or Ocean Waters" and affiliated procedures, etc.).

[1] The USACE's original request for formal consultation did not include SDPS green sturgeon or SDPS eulachon, or their designated critical habitat, which the USACE considered not likely to be adversely affected (NLAA). NMFS considers these resources likely to be adversely affected, and includes them in the table and in the formal consultation.

On October 16, 2020, NMFS received the USACE's request for consultation and the Biological Assessment (BA) (USACE 2021):

- On November 17, 2020, NMFS sent an insufficiency letter to the USACE. NMFS' project biologist worked with the USACE's project lead to identify the missing information over the next few weeks.
- On December 17, 2020, NMFS received the revised BA and notified USACE that it was initiating consultation.
- On February 24, 2021, NMFS sent letters to the Columbia River Inter-Tribal Fish Commission, the Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Warms Springs Reservation of Oregon, Cowlitz Indian Tribe, Confederated Tribes and Bands of the Yakama Indian Reservation, the Nez Perce Indian Tribe, and the Confederated Tribes of the Siletz Indians of Oregon to gauge their interest in this project on.
- On March 11, 2021, NMFS received a letter from the Nez Perce Tribe asking for more information about the project. The Tribe was interested in NOAA's analytical method for assessing effects of the proposed action on listed fish, and the likelihood that toxic materials would be mobilized during flow lane disposal of excavated sediments. They also expressed concern about juvenile lamprey, stating that the Tribe has requested, for other dredging activity, that monitoring take place to identify the presence of lamprey in the dredging areas, along with monitoring of the dredge spoils as it is loaded on the barge. Should lamprey be present, a work-around plan should be implemented to avoid harm to the species. NMFS, USACE, and USFWS (for lamprey concerns), met with the Tribe on April 19, 2021, to discuss these concerns.
- On March 12, 2021, NMFS received an email from Amy Boyd, a Policy Analyst with the Cowlitz Indian Tribe, stating that the Tribe would like to provide feedback regarding natural and cultural resources. NMFS offered the Tribe an opportunity to provide this feedback during a web-based meeting on March 29, 2021.
- On May 17, 2021, NMFS and the USACE discussed concerns about the potential frequency of dredging in the Elochoman Slough and Lake River channels and the need to better understand effects on benthic prey organisms for salmonids. As a result, the USACE revised its proposed action to reduce the frequency of dredging in these two project areas to no more than once every three years.
- During consultation, the USACE amended its BA in response to our questions about the maximum volume of sediment to be dredged from each side channel and their turbidity monitoring and management actions. We received draft amendments on April 14, 15, 16; May 25, 2021, and the final amended BA (USACE 2021) on June 7, 2021.

Table 1. List of species included in the consultation for the maintenance dredging of four side channels that are part of the Federal Navigation Channel.

ESU or DPS Species	Listing Notice	Listing Status	Critical Habitat Listing
LCR[a] Chinook salmon	6/28/2005; 70 FR 37160	Threatened	9/2/2005; 70 FR 52630
UCR[ć] Chinook salmon	6/28/2005; 70 FR 37160	Endangered	9/2/2005; 70 FR 52630
SR[a] spring/summer Chinook salmon	6/28/2005; 70 FR 37160	Threatened	10/25/1999; 64 FR 57399
UWR[a] Chinook salmon	6/28/2005; 70 FR 37160	Threatened	9/2/2005; 70 FR 52630
SR fall Chinook salmon	6/28/2005; 70 FR 37160	Threatened	10/25/1999; 64 FR 57399
CR[ć] chum salmon	6/28/2005; 70 FR 37160	Threatened	9/2/2005; 70 FR 52630
LCR coho salmon	6/28/2005; 70 FR 37160	Threatened	2/24/2016; 81 FR 9252
SR sockeye salmon	4/14/2014; 79 FR 20802	Endangered	12/28/1993; 58 FR 68543
UCR steelheac	1/5/2006; 71 FR 834	Threatened	9/2/2005; 70 FR 52630
LCR steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005; 70 FR 52630
UWR steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005; 70 FR 52630
MCR[a] steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005; 70 FR 52630
SRB[a] steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005; 70 FR 52630
Southern DPS of green sturgeon	4/7/2006; 71 FR 17757	Threatened	10/9/2009; 74 FR 52300
Southern DPS of eulachon	3/18/2010; 75 FR 13012	Threatened	10/20/2011; 76FR 65324

[a] LCR: Lower Columbia River; UCR: Upper Columbia River; SR: Snake River; UWR: Upper Willamette River; CR: Columbia River; MCR: Middle Columbia River; SRB: Snake River Basin.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The USACE proposes maintenance dredging in four side channels of the lower Columbia River Federal navigation channel (FNC) over a period of 25 years (USACE 2021). The USACE proposes to dredge the Tongue Point, Oregon, channel annually, but expects to dredge the other three sites (Elochoman Slough and Lake River, Washington, and Oregon Slough, Oregon) an average once every 5 years. For example, the USACE could dredge at any of the three sites 2 years in a row depending on changes in shoaling over time, dredging priorities, and available funding, but will not dredge any of them more than five times over the term of the proposed action (USACE 2021).

The dimensions of each dredging prism are shown in Table 2 and the dredging prisms themselves are shown in Figures 1 through 4. The USACE expects to dredge areas only that have become too shallow within each prism during any dredging event, but cannot predict where this will happen over the 25-year term of the proposed action. NMFS therefore considers the entire area and depth of each dredging prism to be within the action area for this consultation. The USACE proposes to conduct dredging using either mechanical dredges (clamshell or backhoe) or

hydraulic dredges (hopper or pipeline), depending on equipment availability and cost. The equipment used at each site will therefore vary from year to year. Locations for in-water disposal also will vary, depending on the depth of the river bottom each year (i.e., disposal sites will be at least 20-feet deep). The in-water work window (IWWW) at each site is 1 August to 15 December. The estimated number of days the USACE will dredge at each site is also shown in Table 2.

The USACE conducts maintenance dredging and in-water placement of dredged sediments to maintain these authorized navigation channels under Sections 102 and 103 of the Marine Protection Reserve and Sanctuaries Act (MPRSA) of 1972, Sections 401 and 404 of the Clean Water Act (CWA) of 1977, and in accordance with Regulations 33 CFR Parts 335 through 338 ("Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving Discharge of Dredged or Fill Material into Waters of the U.S. or Ocean Waters" and affiliated procedures, etc.). In the BA, the USACE describes the authorizing legislation and history of each project site as:

- Channelization to create the Tongue Point Channel was approved by the Chief of Engineers on June 14, 1989, under the authority of Section 107 of the River and Harbor Act of 1960, as amended. The most recent dredging at Tongue Point Channel was for initial construction in 1989.
- Channelization to create the Elochoman Slough was authorized by the River and Harbor Act of 26 August 26, 1937. The Elochoman Slough FNC was initially constructed in 1939 and was maintained by the Corps in 1964 and 1989. The channel was most recently dredged by Wahkiakum Port District No. 1 in 2019.
- Channelization to create the Lake River FNC was authorized by the Rivers and Harbors Act of July 3, 1930. Lake River FNC was initially constructed in 1932 and most recently maintained by the Corps in 1980.
- Channelization to create the Oregon Slough (20-foot deep channel) was authorized by the Rivers and Harbors Act of 25 July 1912. This FNC was most recently maintained by the Corps in 1963.[2]

[2] There are multiple authorized Federal Navigation Channel segments within Oregon Slough. The proposed dredge prism in the BA for this project is the 20-foot deep channel from Oregon Slough RM 1.5 to RM 3.8 (USACE 2021).

Table 2. Proposed dredging activities, frequency, and duration at each of the four side channels (USACE 2021).

Project	River Mile	Authorized Dimensions[a]	Amount of Material to be Dredged[b]	Dredge Frequency	Duration[c]
Tongue Point	18.5	34 feet deep 350 feet wide 1.6 miles long Approx. 60 acres	Initial deferred maint. max of 800,000 CY, then future annual maint. need decreasing to 119,000 CY if maintained regularly[d] Up to 75 acres per dredging event	Annually, as needed	Estimated 105 to 137 days
Elochoman Slough	38	10 feet deep 100 feet wide ~2,200 feet long Approx. 5 acres	7,000 to max of 25,000 CY each event Up to 5 acres per dredging event	Average of 1 year out of each 5, but no more than once every 3 years and not to exceed 5 times.	Estimated 3 to 14 days
Lake River	87.5	6 feet deep 100 feet wide 3 miles long Approx. 5 acres	5,000 to max of 34,000 CY each event Up to 5 acres per dredging event	Average of 1 year out of each 5, but no more than once every 3 years and not to exceed 5 times.	Estimated 4 to 15 days
Oregon Slough	104 (south side of Hayden Island)	20 feet deep 200 feet wide 2.3 miles long Approx. 35 acres	Initial deferred maint. max of 600,000 CY, then maintain as needed Up to 50 acres per dredging event	Average of 1 year out of each 5, but not to exceed 5 times.	Estimated 80 to 137 days

[a] All channels may have an additional 2 feet deep and 100 feet outside of the authorized dimensions of advanced maintenance.

[b] Amounts shown include the volumes needed for advanced maintenance and account for dredging inaccuracies. These are the USACE's best estimates based on existing conditions. Higher end of range represents initial dredging of a larger volume, resulting from deferred maintenance; lower end of range for subsequent dredging activities over the 25-year term of the proposed action.

[c] The USACE estimated the number of days required to dredge at each site assuming that a clamshell dredge would be used. This is a conservative assumption because the clamshell removes the smallest amount of material per day (typically 2,000 to 4,000 CY per day).

[d] For Tongue Point, the USACE refers to future annual volumes to be dredged "if maintained regularly" because funding to perform maintenance dredging comes from Congressional appropriations, which vary from year to year (USACE 2021).

Based on information that NMFS provided during consultation, which described uncertainty about benthic prey recolonization rates, the USACE proposes to dredge Elochoman Slough and Lake River no more frequently than once every 3 years. The channel at Tongue Point could need to be dredged annually because it is vulnerable to "side-slope adjustment" (the authorized depth is deeper than the surrounding area, so that sediment slumps into the navigation channel). Under the proposed action, the USACE could dredge the channel in Oregon Slough as frequently as 2 years in a row, but no more than five times over the term of the proposed action.

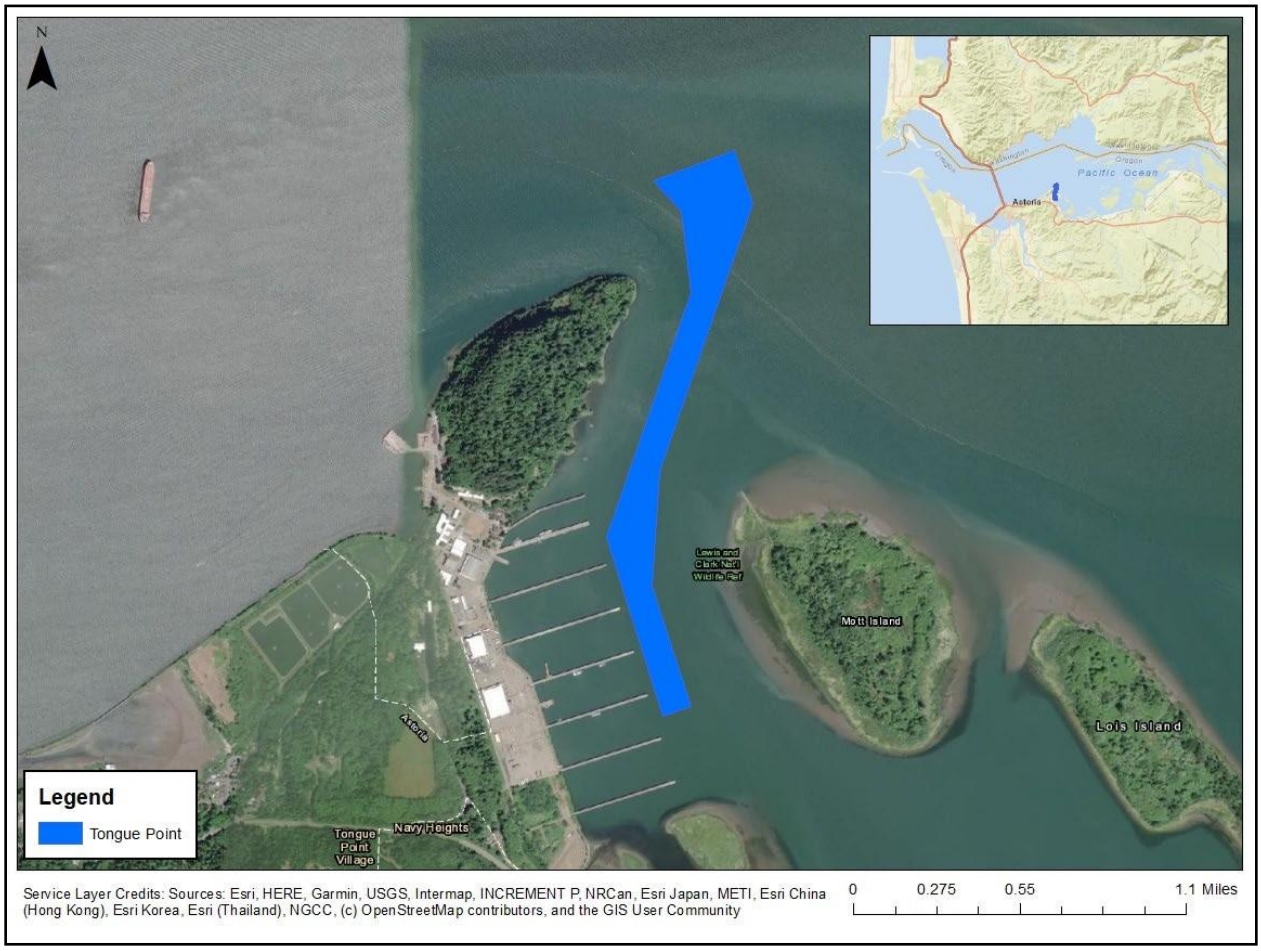


Figure 1. Location of the area to be dredged at Tongue Point, Oregon.

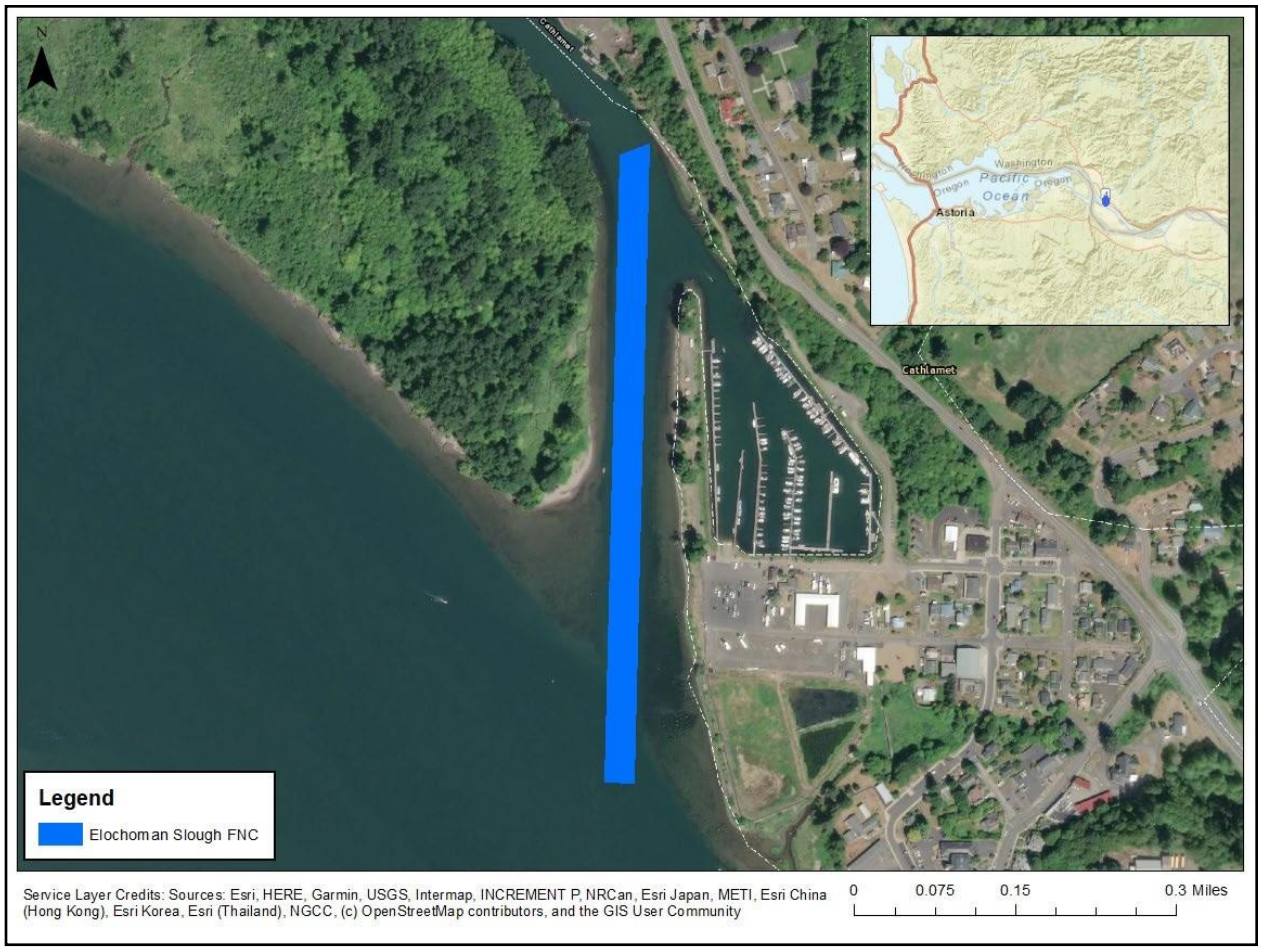


Figure 2. Location of the area to be dredged at Elochoman Slough, Washington.

Figure 3. Location of the area to be dredged at Lake River, Washington.

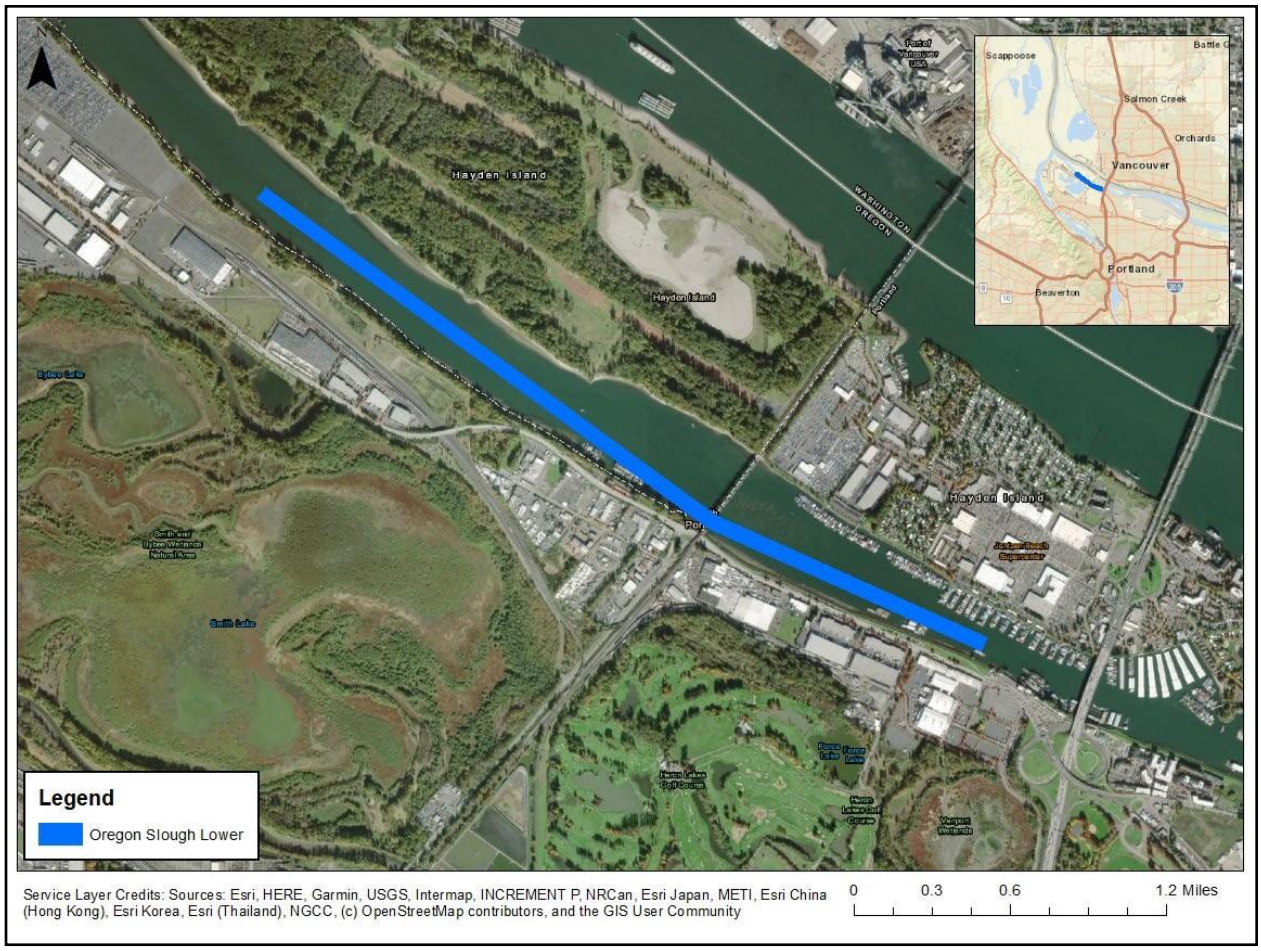


Figure 4. Location of the area to be dredged at Oregon Slough, Oregon.

Two of 93 Dredged Material Management Units (DMMUs) at Tongue Point contained concentrations of diethyl phthalate that exceeded the 200 µg/kg screening level for unconfined aquatic placement. The USACE has further evaluated these sediments using bioassays, but results were not available when the USACE prepared the BA. If the interagency Portland Sediment Evaluation Team (PSET) concludes that, based on the bioassay results, these sediments are not suitable for unconfined aquatic placement (i.e., per the Sediment Evaluation Framework), the USACE will evaluate upland disposal options. The USACE will continue to sample and evaluate material in each side channel periodically over the term of the proposed action and will place dredged material in water only if the PSET concludes that it is suitable for unconfined aquatic placement. Sediments that are determined not to be suitable for unconfined in-water disposal will be placed at upland sites.

Suitable dredged materials from these four side channels will be released in the flow lane between RM 3 and 145, in water deeper than 20 feet. Locations for in-water disposal vary, depending on the depth of the river bottom each year. As deeper areas in the river are filled with

dredged material over time, new deep areas are formed elsewhere through natural river processes.

The USACE also proposes the following conservation measures and best management practices, intended to minimize adverse effects on water quality and ESA-listed species and their habitat (Table 3).

Table 3. Proposed **measures** to avoid and minimize effects on ESA-listed species and critical habitat.

Measure	Purpose	Duration and Management Determination
Hopper dredging – dragheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads.	Minimize or eliminate entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations. Maintain until new information becomes available that would warrant change.
Pipeline dredging – cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom when cleaning or reverse purging.	Minimize or eliminate entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations. Maintain until new information becomes available that would warrant change.
All dredging – in shallow-water areas (less than 20 feet) outside of the Columbia River mainstem should occur only during the recommended ESA in-water work periods for the Columbia River listed in the 2012 BiOp.	The top 20 feet of the water column is considered salmon migratory habitat. Dredging or disposal in these areas could adversely impact salmonids, delay migration, or reduce or eliminate food sources.	Continuous during dredging operations. Maintain until new information becomes available that would warrant change.
All dredging – floating containment and absorbent booms kept on site.	Contain toxic substances in case of accidental spill.	Continuous during dredging operations. Maintain until new information becomes available that would warrant change.

Measure	Purpose	Duration and Management Determination
All dredging – the dredge operator shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.	Protect water resources.	Life of contract or action. If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water releases shall be immediately reported to appropriate agencies as detailed in contract specifications.
All dredging – the dredge operator, where possible, will use, or propose for use, materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR 260-272 and 49 CFR 100-177.	Accepted disposal of hazardous wastes.	Life of contract or action. If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water releases shall be immediately reported to appropriate agencies as detailed in contract specifications.
All dredging – monitor turbidity levels during dredging in accordance with the NMFS 2012 BiOp or state water quality certification requirements (if more protective).[a]	Limits the time over which turbidity levels that could be harmful to aquatic life can persist in the water column.	Dredging must stop if exceedance over background level occurs at the second monitoring interval; dredging may continue once turbidity levels return to background level.[a]
All dredging – monitor dissolved oxygen levels during dredging in accordance with the current water quality certifications and the NMFS 2012 BiOp to ensure that dissolved oxygen levels do not drop below acceptable levels.[b]	Prevents dissolved oxygen levels from dropping to levels that are harmful to aquatic life.	At least daily. Dredging may not occur if dissolved oxygen is less than 6.5 milligrams per liter. More frequent monitoring if dissolved oxygen is below 8 milligrams per liter.

[a] This measure refers to the turbidity monitoring and responsive actions in Term and Conditions 1.d.iii. and 1.d.iv., including Table 49, in NMFS (2012).

[b] This measure refers to the dissolved oxygen monitoring and responsive actions in Term and Condition 1.e.i through 1.e.vii in NMFS (2012).

We considered whether or not the proposed action would cause any other activities and determined that associated activities are maintenance of current levels of commercial and recreational boating access.

1.4. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The USACE proposes to dredge four distinct side channels in the lower Columbia River as described in Section 1.3 (Proposed Federal Action). In three cases (Tongue Point, Elochoman Slough, and Lake River), the dredge prism includes an area within the side channel and a connection to the mainstem Federal Navigation Channel (Figures 1-4), but dredging the portions of the fourth channel, Oregon Slough, that connect to the mainstem is not part of this consultation. All dredged material that meets sediment quality criteria will eventually be released in the flow lane between RM 3.0 and RM 145. The locations for in-water disposal will vary, depending on the depth of the river bottom each year, but will be more than 20-feet deep in all cases. The action area therefore includes the four dredge prisms and the mainstem river downstream of RM 145. The mainstem will be affected by increased turbidity for up to 900 feet downstream of each side channel during dredging as well as during flow lane disposal of the excavated sediments. Assuming tidal influence, elevated suspended sediments/turbidity will also extend up to 900 feet upstream of excavated areas within each side channel, during dredging.

All four side channels include critical habitat for salmonids and eulachon. Critical habitat for green sturgeon extends from the mouth of the river through RM 46 (74 FR 52300, October 9, 2009). The action area also includes areas designated as EFH for two Pacific Coast salmon species: Chinook salmon and coho salmon (PFMC 2014) and for groundfish (PFMC 2020). For both salmon and groundfish, the habitat area of particular concern (HAPC) within the action area is "estuaries."

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The USACE determined the proposed action is not likely to adversely affect southern DPS green sturgeon or southern DPS eulachon or their critical habitat. We find that these species and their critical habitats are likely to be adversely affected by water quality reductions, perturbations to prey, and risk of entrainment, and therefore include them in our formal analysis.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or

indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote et al. 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life

stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7°C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing

of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). Table 4, below, summarizes the general status of critical habitat, range-wide, for each species considered in this analysis.

Physical and Biological Features of Salmon and Steelhead Critical Habitat

The NMFS designated critical habitat for three different groups of salmonids that occupy the lower Columbia River on three different dates. For each designation, NMFS used slightly different descriptions of the physical and biological features (PBFs) of critical habitat. In addition, NMFS identified the essential elements of the PBFs using slightly different terminology. This section presents each of the approaches to terminology used for each of the subsequent designations and attributes those to the specific salmonids covered by each designation. For convenience, in the remainder of the document we will refer to these attributes as PBFs, even though the original designations used different terminologies. Many of the PBFs and their essential elements actually overlap across designations.

The NMFS designated critical habitat for several Snake River salmonids on October 25, 1999 (64 FR 57399): the SR sockeye and SR spring/summer and fall Chinook salmon ESUs. The PBFs (which we originally termed "essential features") of critical habitat for Snake River salmon are (1) spawning and juvenile rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; and (4) adult migration corridors. The essential elements of the spawning and rearing PBFs are: 1) Spawning gravel; (2) water quality; (3) water quantity; (4) water temperature; (5) food; (6) riparian vegetation; and (7) access. The designation also breaks down the migration corridor for juvenile and adult salmonids as follows: Essential features of the juvenile migration corridors include adequate: (1) Substrate (2) water quality; (3) water quantity; *(4)* water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space; and (10) safe passage conditions. The adult migration corridors are the same areas

included in juvenile migration corridors. Essential features would include those in the juvenile migration corridors, excluding adequate food.

Subsequently, NMFS designated critical habitat for 10 more ESUs and DPSs of Columbia River basin salmon and steelhead, including SRB steelhead, on September 2, 2005 (70 FR 52630), and for lower Columbia River coho salmon on February 24, 2016 (81 FR 9252) (Table 2). The PBFs are referred to as Primary Constituent Elements (PCE) in 70 FR 52630 and in 81 FR 9252, and those terms may be used interchangeably in this document. Specific PBFs, and essential features for salmonids designated in 2005 and in 2016 include:

- Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;
- Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
- Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;
- Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;
- Nearshore marine areas[3] free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and
- Offshore marine areas[4] with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

[3] NMFS designated nearshore marine areas as critical habitat for Columbia basin salmon and steelhead only from the mouth of the river to an imaginary line connecting the outer extents of the north and south jetties.
[4] NMFS did not designate any offshore marine areas as critical habitat for Columbia basin salmon and steelhead.

Physical and Biological Features of Green Sturgeon Critical Habitat

Designated critical habitat for southern DPS green sturgeon includes the lower Columbia River estuary from the river mouth to RM 46 (October 9, 2009; 74 FR 52300), which supports aggregations of southern DPS green sturgeon during summer. Specific PBFs, and the essential features associated with the PBFs for Green sturgeon designated in 2009 include:

- Freshwater riverine systems which provide food resources, and water quality including depth and flow for embryo, larval and juvenile growth and development. Adult spawning requires appropriate substrate and sediment quality, in addition to migratory corridors free of obstruction.
- Estuarine areas which provide food resources, migratory corridors, and appropriate water and sediment quality, flow and depth to support growth of juvenile, sub-adult, and sexually mature green sturgeon.
- Coastal marine areas with adequate food resources are necessary for sub-adult and sexually mature green sturgeon growth. These areas also provide migratory corridors with appropriate water quality to spawning streams.

Physical and Biological Features of Eulachon Critical Habitat

The NMFS designated critical habitat for the southern DPS of eulachon on October 11, 2011 (76 FR 65324). Critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington. We designated all of these areas as migration and spawning habitat for this species. Specific PBFs, and the essential features associated with the PBFs for eulachon designated in 2011 include:

- Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.
- Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.
- Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant 1999), cumaceans (Smith and Saalfeld 1955), mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001). These features are essential to conservation because they allow juvenile fish to survive, grow, and reach maturity, and they allow adult fish to survive and return to freshwater systems to spawn.

Table 4. Critical habitat designation date, Federal Register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and FR Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.

Species	Designation Date and FR Citation	Critical Habitat Status Summary
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015a). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Southern DPS green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in

Species	Designation Date and FR Citation	Critical Habitat Status Summary
		California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays, as listed in Table 1 in 74 FR 52300. The CHRT identified several activities that threaten the PBFs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern DPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon).
Southern DPS eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

2.2.2 Status of the Species

Table 5, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and VSP (Viable Salmonid Population).

Table 5. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River spring/summer Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	ODFW and NMFS 2011	NWFSC 2015	This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River fall Chinook salmon	Threatened 6/28/05	NMFS 2017b	NWFSC 2015	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Dam complex.	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners .Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015a	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	ODFW and NMFS 2011	NWFSC 2015	This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River Basin steelhead	Threatened 1/5/06	NMFS 2017a	NWFSC 2015	This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018a	NMFS 2015b	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	Gustafson 2016	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years.	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

2.2.2.1 Information on the Status of Salmon and Steelhead since the 2016 Status Review

The status information presented above is from the 2015 status review. NMFS is developing a new 5-year status review for listed salmonids, green sturgeon, and eulachon. In the biological report for the previous status review, NWFSC (2015) considered population level estimates of spawning adults through about 2013. We included revised 5-year geometric means of abundance (through 2018 or 2019) for listed salmon and steelhead in the 2020 Columbia River System biological opinion (NMFS 2020) and summarize those findings in the following paragraphs, and have included the most current information here. Similar information was not available for the southern DPS of green sturgeon or the southern DPS of eulachon.

Lower Columbia River Chinook Salmon
The best available scientific and commercial data on population-level abundance indicated a mix of recent increases, decreases, and relatively static numbers of natural-origin and total spawners in 2014 to 2018 compared to the 2009 to 2013 period (Table 2.10-2 in NMFS 2020). The direction of the percent change between 5-year geometric means was even mixed within run types. For fall-run Chinook salmon, the percent change increased for the Kalama River; Lower Cowlitz River; Washougal River; Grays and Chinook Rivers; and Lower Gorge Tributaries populations and decreased for the Coweeman River; Upper Cowlitz River; White Salmon River; Clatskanie River; and Mill, Abernathy, and Germany Creek populations.

Observations of coastal ocean conditions since 2016 indicated that recent out-migrant year classes experienced below-average ocean survival during a marine heatwave and its lingering effects (Werner et al. 2017). Some of the negative effects on juvenile salmonids had subsided by spring 2018, but other aspects of the ecosystem (e.g., temperatures below the 50-m surface layer) had not returned to normal (Harvey et al. 2019). However, the degree to which abundance has been driven by below-average ocean survival or by a variety of environmental conditions and management actions in freshwater, appeared to have varied between populations of LCR Chinook salmon.

Upper Columbia River Spring-run Chinook Salmon
The best available scientific and commercial data on the adult abundance of UCR spring-run Chinook salmon indicated a substantial downward trend in the abundance of natural-origin spawners at the ESU level from 2015 to 2019 (Figure 2.6-2 in NMFS 2020). This downturn was thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River could also be a contributing factor.

Population-level abundance estimates of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 also showed recent and substantial downward trends in abundance when compared to the 2009 to 2013 period (Table 2.6-3 in NMFS 2020). All populations remained considerably below the minimum abundance thresholds established by the ICTRT and included substantial numbers of hatchery-origin adults.

Snake River Spring/summer Chinook Salmon
The best available scientific and commercial data on the adult abundance of SR spring/summer Chinook salmon as of 2020 indicated a substantial downward trend in the abundance of natural-origin spawners at the ESU level from 2014 to 2019 (Figure 2.2-3 in NMFS 2020). The past 3-year period, 2017 to 2019, showed the lowest returns since 1999. This recent downturn was thought to be driven by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River also could have been a contributing factor.

Population-level estimates of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 (Table 2.2-4 in NMFS 2020) also showed recent and substantial downward trends compared to the 2009 to 2013 period for most of the MPGs and populations (exceptions were the Lemhi River, Camas Creek, and Upper Grande Ronde Mainstem). All populations except Chamberlain Creek remained considerably below the minimum abundance thresholds established by the ICTRT. For many populations, the total spawner counts included substantial numbers of hatchery-origin adults. Exceptions were the entirety of the Middle Fork MPG and several populations in the Upper Salmon MPG, where no hatchery fish are included in the spawner counts.

Upper Willamette River Chinook Salmon
The best available scientific and commercial data for UWR Chinook salmon as of 2020 were counts from the Willamette Falls adult fishway. The 2015 run was relatively large, with 51,046 total adults (9,954 natural origin), but a more recent 5-year geometric mean (2015 to 2019) indicated a decline in both natural-origin and total numbers of adults compared to the previous 5-year period (2010 to 2014; Table 2.13-1 in NMFS 2020). This recent downturn was thought to be driven by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River also could have been a contributing factor.

Snake River Fall Chinook Salmon
The best available scientific and commercial data for SR fall Chinook salmon indicated a substantial downward trend in the abundance of natural-origin spawners at the ESU level from 2013 to 2019 (Figure 2.5-2 in NMFS 2020). This downturn was thought to be driven by marine environmental conditions and a decline in ocean productivity. Even with this decline, overall abundance remained higher than before 2005. This ESU appears to have been less negatively affected by ocean conditions than SR spring/summer Chinook salmon.

Columbia River Chum Salmon
The best available scientific and commercial data for CR chum salmon indicated increasing trends in the abundance of both natural-origin and total spawners when compared to the 2009 to 2013 period (Table 2.9-2 in NMFS 2020). The exception was the Upper Gorge Tributaries population, which decreased in abundance. The relationship between ocean conditions and chum salmon survival is an area of active investigation. A preliminary model suggested increased adult returns in response to the same environmental indicators that predicted higher Chinook and coho salmon returns, but it failed to predict the substantial adult returns in 2016 and significantly under-predicted returns in 2017 and 2018 (Hillson 2020, Homel 2020). The above average ocean survival of chum salmon in 2016 through 2018 may have been due to their unique consumption

of the types of gelatinous organisms (jellies, salps, larvaceans) that were abundant during those warm ocean conditions (Brodeur et al. 2019, Morgan et al. 2019).

Lower Columbia River Coho Salmon
The best available scientific and commercial data for LCR coho salmon were at the population level. These indicated a mix of recent increases, decreases, and relatively static numbers of natural-origin and total spawners in 2014 to 2018 compared to the 2009 to 2013 period (see (Table 2.12-2 in NMFS 2020). These findings indicated that the degree to which abundance had been driven by below average ocean survival varied between populations, as described for LCR Chinook salmon.

Snake River Sockeye Salmon
The best available scientific and commercial data for SR sockeye salmon as of 2020 indicated a substantial downward trend in the returns of hatchery-origin and natural-origin adults to the Sawtooth Valley. The 5-year geometric mean of total spawner counts declined 6 percent in 2014 to 2018 when compared to 2009 to 2013 (Tables 2.4-2 and 2.4-3 in NMFS 2020). The recent downturn was thought to be driven by marine environmental conditions and a decline in ocean productivity. However, adult returns to the Sawtooth Valley were also significantly affected by earlier than average warm water temperatures in the mainstem in 2015. And hatchery operations faced significant water chemistry issues in 2015 to 2017, which resulted in very poor survival of outplanted juveniles as they made their way through the Columbia River hydrosystem. Those hatchery practices were modified significantly, and indications were positive that water chemistry is no longer a significant source of mortality during outmigration through the hydrosystem.

Upper Columbia River Steelhead
The best available scientific and commercial data for UCR steelhead indicated a substantial downward trend in the number of natural-origin spawners at the DPS level from 2014 to 2019 (see Figure 2.7-2 in NMFS 2020). This recent downward trend is thought to be driven primarily by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River also could have been a contributing factor.

Population level estimates of natural-origin and total (natural- and hatchery-origin) spawners during 2014 through 2018 also showed substantial downward trends in abundance for most of the populations (the percent change was negative, but of a smaller magnitude for the Methow population) when compared to the previous 5-yr period (Table 2.7-3 in NMFS 2020). All populations remained considerably below the minimum abundance thresholds established by the ICTRT.

Lower Columbia River Steelhead
The best available scientific and commercial data for LCR steelhead as of 2020 indicated a mix, at the population level, of recent increases, decreases, and relatively static numbers of natural-origin and total spawners in 2014 to 2018 compared to 2009 to 2013 (Table 2.11-2 in NMFS 2020). However, in all cases where available, abundance estimates for 2019 were lower than the most recent 5year geometric means indicating a common driver such as poor ocean conditions.

Upper Willamette River Steelhead
The best available scientific and commercial data for UWR steelhead were from the Willamette Falls adult fishway. Fishway counts had declined dramatically since the last status review, with 2017 and 2018 counts reaching only 15 to 30 percent of the 5-year geometric mean for the years 2010 through 2014 (Table 2.14-1 in NMFS 2020). It is likely that any recent downturn was linked to poor ocean conditions, as described for other steelhead species.

Middle Columbia River Steelhead
The best available scientific and commercial data for MCR steelhead indicated a substantial downward trend in the abundance of natural-origin spawners at the DPS level from 2014 to 2019 (Figure 2.8-2 in NMFS 2020). This recent downturn was thought to be driven by marine environmental conditions and a decline in ocean productivity. Increased abundance of sea lions in the lower Columbia River also could have been a contributing factor.

Population level estimates of natural-origin and total (natural- plus hatchery-origin) spawners through 2018 or 2019 also showed recent and substantial downward trends for most MPGs and populations (exceptions were the Klickitat and Yakima River populations) when compared to the 2009 to 2013 period (Table 2.8-4 in NMFS 2020). In many cases, the most recent 5-year geometric mean in natural-origin abundance was considerably below the minimum abundance thresholds established by the ICTRT. A relatively limited number of hatchery fish was present on the spawning grounds within this DPS.

Snake River Basin Steelhead
The best available scientific and commercial data for SRB steelhead indicated a substantial downward trend in the number of natural-origin spawners at the DPS-level from 2014 to 2019 (Figure 2.3-2 in NMFS 2020). The number of natural-origin spawners in the Upper Grande Ronde Mainstem population appeared to have been at or above the minimum abundance threshold established by the ICTRT, while the Tucannon River and Asotin Creek populations remained below their respective thresholds (Table 2.3-4 in NMFS 2020). At the MPG level, SRB steelhead generally increased in abundance after the 1990s, but experienced reductions during the more recent period when ocean conditions were poor.

2.2.2.2 Summary – Status of the Listed Species

Each species of salmon and steelhead considered in this opinion is at risk of becoming endangered in the foreseeable future, with the exception of two species (UCR spring Chinook salmon, and SR sockeye salmon), which are currently endangered. Each species is ESA-listed due to a combination of low abundance and productivity, reduced spatial structure, and decreased genetic (and life history) diversity. Many of the component populations of these ESUs and DPSs are also at low levels of abundance or productivity; in many cases, decreases in the last few years are associated with poor ocean conditions. Several species have lost some of their historical population structure due to human activities, and the populations that remain in the available habitat face multiple limiting factors. Individuals from all of the ESA-listed component populations must move through or use parts of the action area at some point during their life history. Being exposed to poor baseline conditions in the action area (see Section 2.3, below) may make individual fish more vulnerable to the effects of the action.

The abundance of the southern DPS of green sturgeon is now estimated at 2,106 spawning adults, but no data are available to establish trends in population growth or decline. The greatest extinction risk for the DPS is that it consists of a single known population that spawns in a limited portion of the Sacramento River, which has been degraded by land use activities and water diversions.

The abundance of the southern DPS of eulachon is at very low levels throughout its range, including the population segment in the lower Columbia River. There was an abrupt decline in the numbers of eulachon returning to the Columbia River in the early 1990s. These improved briefly in the early 2000s, and then returned to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013 to 2015 return years, recent poor ocean conditions, and the concern that these conditions will persist into the future, suggest that populations may continue to decline.

2.3. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.3.1. Habitat Conditions in the Action Area

The action area encompasses the four side channels to be dredged, and disposal locations in the flow lane. For this reason, the action area is includes the four dredge prisms and the mainstem river downstream of RM 145, which will be affected by increased turbidity downstream of each side channel during dredging as well as flow lane disposal of the excavated sediments. We consider the entire action area to be estuarine habitat because it is affected by the tides, although the upstream extent of salinity intrusion is approximately RM 34 (Bottom et al. 2005).

The Columbia River estuary provides important migratory and rearing habitat for salmon and steelhead populations, as well as two ESA-listed non-salmonids that are also anadromous, green sturgeon and Pacific eulachon. Since the late 1800s, 68 to 74 percent of the vegetated tidal wetlands of the estuary have been lost to diking, filling, and bank hardening, combined with hydrosystem flow regulation and other modifications (Kukulka and Jay 2003, Bottom et al. 2005, Marcoe and Pilson 2017, Brophy et al. 2019). Disconnection of tidal wetlands and floodplains has eliminated much of the historical rearing habitat for subyearling Chinook and chum salmon and reduced the production of wetland macrodetritus that supports salmonid food webs (Simenstad et al. 1990, Maier and Simenstad 2009), both in shallow water and for larger juveniles migrating in the mainstem (PNNL and NMFS 2020).

Restoration actions in the estuary have improved access and connectivity to some floodplain habitat. From 2007 through 2019, restoration sponsors implemented 64 projects, including dike and levee breaching or lowering, tide-gate removal, and tide-gate upgrades that reconnected over 6,100 acres of historical tidal floodplain habitat to the mainstem and another 2,000 acres of floodplain lakes (Karnezis 2019, BPA et al. 2020). This represents a more than a 2.5 percent net increase in a connectivity index for habitats that are used extensively by subyearling salmon (Johnson et al. 2018, PNNL and NMFS 2020). Although yearling migrants are less likely to enter and rear in these areas, the large amounts of prey (particularly chironomid insects) exported from restored wetlands to the mainstem are actively consumed by both yearling and subyearling smolts. The resulting growth by these fish likely contributes to survival at ocean entry (PNNL and NMFS 2020). In addition to this extensive reconnection effort, about 2,500 acres of currently functioning floodplain habitat have been acquired for conservation. However, much of the historical floodplain remains sequestered behind levees, and riparian conditions along the mainstem and in secondary and side channels are highly degraded by urban, industrial, and agricultural development.

Habitat quality and the food web in the estuary are also degraded because of past and continuing releases of toxic contaminants (Fresh et al. 2005, LCREP 2007) from both estuarine and upstream sources. Historically, levels of contaminants in the Columbia River were low, except for some metals and naturally occurring substances (Fresh et al. 2005). Today, the levels in the estuary are much higher, as it receives contaminants from more than 1,000 sources that discharge into a river and numerous sources of runoff (Fuhrer et al. 1996). With Portland and other cities on its banks, the Columbia River below Bonneville Dam is the most urbanized section of the river. Sediments in the river at Portland are contaminated with various toxic compounds, including metals, PAHs, PCBs, chlorinated pesticides, and dioxin (ODEQ 2008).

Contaminants have been detected in aquatic insects, resident fish species, salmonids, river mammals, and osprey, and they are widespread throughout the estuarine food web (Furher et al. 1996, Tetra Tech 1996, LCREP 2007). Additionally, many contaminants are specifically designed to kill insects and plants, reducing the availability of insect prey or modifying the surrounding vegetation and habitats. Changes in vegetative habitat can shift the composition of biological communities; create favorable conditions for invasive, pollution-tolerant plants and animals; and further shift the food web from macrodetrital to microdetrital sources. Overall, more work is needed on contaminant uptake and impacts on salmon of different populations and life-history types.

In addition, the environmental baseline includes the impacts from dredging to maintain the FNC for commercial vessel traffic and shallow water (shoreline, slough, side channel, and wetland) dredging to maintain marinas for government (e.g., Coast Guard), commercial, and recreational vessels. Modification of the Columbia River for commercial navigation began in 1878, when the Corps began deepening the river to 20 feet–within the range of depths preferred by juvenile rearing and migrating salmonids–then deepening it to 30 feet in 1912, and 35 feet in 1935. Since 1964, the FNC is maintained at 40+ feet in depth. Under the proposed action considered in NMFS (2012), the USACE is periodically dredging nine other secondary and side channels: West Channel in Baker Bay, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek, Wahkiakum Ferry Channel, Westport Slough, Old Mouth of the Cowlitz

River, and Upstream Entrance to Oregon Slough. All are degraded by periodic sediment removal, degraded water quality, and the construction, maintenance, and use of moorage facilities. As a result of these and other human activities, the lower river does not provide many areas of rearing habitats in an undisturbed state.

The hydrology of the lower Columbia River also is significantly altered from historical conditions, shifting the natural cues that salmonids rely on for spawning and outmigration behavior. Water management in the Columbia River System and other water storage projects have reduced flows below Bonneville Dam during April through July; these reductions range from average of 7 kcfs in March to 171 kcfs in June. Flow management for hydropower has increased flows during the winter months. The seasonal mainstem temperature regime also has been altered—factors include increased temperatures in tributaries throughout the basin due to flow management, water withdrawals, loss of riparian shading, point source discharges from cities and industry, and climate change. These combine with the thermal inertia of the mainstem reservoirs so that temperatures exceed 70°F during August and early September (Figure 5), affecting the later summer-run as well as early fall-run adults. Elevated temperatures have the potential to reduce the survival and productivity of adult salmon via direct lethality, migration delays, depletion of energy stores through heightened respiration, deformation of eggs and decreased viability of gametes, and increased incidence of disease (McCullough et al. 2001).

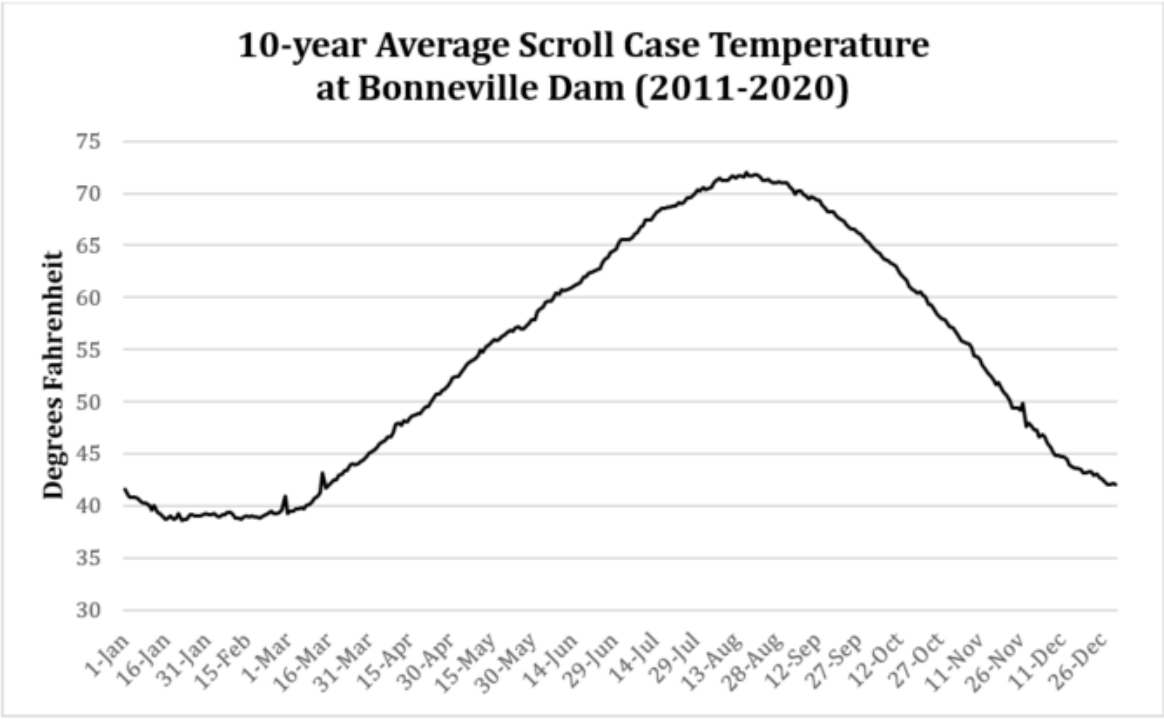


Figure 5. 10-year average temperatures in the scroll case at Bonneville Dam, 2011-2020. Source: Columbia River DART, Columbia Basin Research, University of Washington. River Environment Graphics & Text. Available from http://www.cbr.washington.edu/dart/query/river_graph_text. Accessed April 1, 2021.

The river acquires sediment as it moves downstream. Total sediment load consists of the material that travels in suspension (suspended sediment) and that which rolls and bounces along the bottom (bedload) (Simenstad et al. 1992). Suspended sediment load is mostly silt and clay, particles that can be transported by all but the lowest flows. Major freshets also can transport fine sand, which is otherwise carried downstream as bedload. Because of the exponential relationship between sediment transport and river flow, even a small reduction in peak flow during the freshet can cause a large decrease in sediment transport. Sherwood et al. (1990) calculated an average annual total suspended load for the period 1868 to 1934 (before the construction of the Federal hydrosystem) of 14.9 metric tons (MT) per year. This decreased to an estimated 7.6 MT per year in 1958 to 1981. The percent fine sand decreased from more than 50 percent before 1900 to about 33 percent for 1958 to 1981. Thus, while the model used by Sherwood et al. (1990) reduced the total input of fine sediment to the lower river by about a third between the two time periods, it reduced the input of sand (the dominant size class retained in the estuary) by a factor of three. Most of the change was attributed to flow regulation, due to the reduced intensity of the spring freshet. Although the consequences of reduced sand transport to habitat in the action area are unknown, the magnitude of the decrease indicates that there may have been a substantial effect on habitat-forming processes including those in shoreline rearing areas used by juvenile salmonids, spawning and incubation areas used by eulachon, and foraging areas used by sub-adult and adult green sturgeon.

Juvenile salmonids are vulnerable to predation by birds, fish, and marine mammals, and sea lions also prey on returning adults. A Columbia basin-wide assessment (Roby et al. 2021) of avian predation indicates that the most significant impacts on smolt survival are on steelhead and occur in the Columbia River below Bonneville Dam. Actions to reduce avian predation rates are ongoing, but this factor continues to affect juvenile survival and safe passage and refuge in rearing areas and migration corridors for salmonid ESUs and DPSs. Predation by Caspian terns (*Hydropogne caspia*) on East Sand Island is especially high for juvenile steelhead (more than 10 percent of each cohort of PIT-tagged fish passing Bonneville Dam; Chapter 1 in Roby et al. 2021). Predation on LCR Chinook salmon by double-crested cormorants (*Phalacrocorax auritis*) is also very high—up to 7 percent for the small numbers of birds that now nest on East Sand Island and even higher numbers for the colony that has moved to the Astoria-Megler Bridge (Chapter 4 in Roby et al. 2021). Rearing areas with diverse topography, including shoreline vegetation and overhanging banks, are therefore important for the functioning of rearing areas within the action area.

The native northern pikeminnow (*Ptychocheilus oregonensis*) is a significant predator of juvenile salmonids in the Columbia and Snake Rivers followed by non-native smallmouth bass and walleye (reviewed in Friesen and Ward 1999; ISAB 2011, 2015). Before the start of the sport reward fishery in the Northern Pikeminnow Management Program in 1990, this species was estimated to eat about 8 percent of the 200 million juvenile salmonids that migrated downstream in the Columbia River each year. Williams et al. (2017) compared current estimates of northern pikeminnow predation rates on juvenile salmonids to before the start of the program and estimated a median annual reduction of 30 percent. The lower Columbia River has been the highest producing zone for the pikeminnow sport reward fishery for all but one season since system-wide implementation began in 1991 (Williams et al. 2018, Winther et al. 2019). The Oregon and Washington Departments of Fish and Wildlife, which manage the non-native fish

predators smallmouth bass and walleye, have removed size and bag limits for these species in their sport fishing regulations in an effort to reduce predation pressure on juvenile salmonids. Removing more of these individuals, in addition to pikeminnow, reduces predation on juvenile salmonids and the functioning of rearing and migration areas within the action area.

Predation of adult salmonids by pinnipeds has been a concern due to the general increase in sea lion populations along the West Coast and the numbers observed in the tailrace of Bonneville Dam. The Endangered Salmon Predation Prevention Act, signed into law in December, 2018, reduced restrictions on control efforts (by superseding the criteria that sea lions be individually identifiable and having a significant negative impact before lethal removal) and allowed the removal of Steller as well as California sea lions in the Columbia River and its tributaries. A permit issued by NMFS in 2020 allows three states and six tribes to kill as many as 540 California sea lions and 176 Steller sea lions between Portland and McNary Dam. According to the Oregon Department of Fish and Wildlife, the number of California sea lions feeding in the tailrace at Bonneville Dam declined from a high of 104 animals in 2003 to a low of 19 in 2019 (ODFW 2021). This indicates that control efforts are improving the survival of adult salmonids and sub-adult and adult green sturgeon and the functioning of the adult migration corridor in the action area.

The baseline also includes the future effects of Federal actions that have proceeded subsequent to section 7 consultation. During the last five years, NMFS has engaged in several Section 7 consultations on Federal projects adversely affecting ESA-listed fish and their habitats in and near the action area. These include vicinities (Multnomah County, Oregon; Clark County, Washington) adjacent to or within the action area (WCR-2019-11648, WCR-2018-10138, WCR-2017-7450, WCR-2017-6622, WCR-2016-5516), including the effects of actions addressed in programmatic consultations (the SLOPES IV programmatic consultation; NMFS number WCR-2011-05585). In general, those actions caused temporary, construction-related effects (increased noise and turbidity), and longer term effects like increasing overwater coverage. Conditions of the baseline hinder the quality of downstream migration and reduce benthic production of forage items.

All of the actions processed under the SLOPES IV programmatic consultation also include minimization measures to reduce or avoid both short- and long-term effects in the environment. These include requiring grated and translucent materials to allow light penetration, pile caps to prevent piscivorous bird perching, and limits on square footage of new overwater coverage. Actions implemented under SLOPES IV continue to have some effects that can reduce fitness[5] in a small number of individuals, and have contemporaneous minimization measures to reduce the level of habitat degradation at large. Overall effects of these SLOPES IV actions incrementally contribute to the condition of habitat in the action area under the environmental baseline and the effects of existing structures (e.g. increased shading, reduction in prey, increased predation, and possible minor migration delays).

The condition of habitat within the action area described above includes habitat features used by green sturgeon and eulachon (water quality, water quantity, depth, sediment condition, and prey quality and quantity) is described below as the condition of the PBFs of designated critical

[5] For this analysis, we define fitness as the ability to survive to reproductive age, find a mate, and produce offspring.

habitat. Information specific to green sturgeon and eulachon habitat is described below, as the condition of the PBFs of designated critical habitat.

Conditions within the Four Side Channels

In the BA, the USACE provides physical and chemical information on sediment conditions in the four side channels that it proposes to dredge (Table 6). The percent fines was relatively low in Oregon Slough (less than 9.0 percent) and relatively high in Elochoman Slough, the inner part of the Lake River dredge prism, and the inner shoal at Tongue Point.

Table 6. Physical characteristics of sediments in the four side channels considered in this opinion (USACE 2021).

	Tongue Point	**Elochoman Slough**	**Lake River**	**Oregon Slough**
Sampling date	Nov. 2019	Aug. 2015	Nov. 2018	Sept. 2020
% Silt/clay	3.6% at Outer shoal 53.% at Inner shoal	50.0	<41.0	<9.0

Contaminant testing indicated that 2 of 93 Dredged Material Management Units at Tongue Point contained diethyl phthalate at concentrations that exceeded the screening level for unconfined in-water disposal (Section 1.3). These sediments were further tested in bioassays and determined suitable for in-water disposal (USEPA 2021). No exceedances of screening levels were reported for sediments from Elochoman Slough or Lake River; results were not available for sediments from Oregon Slough at the time the BA was completed.

Beyond these physical and chemical parameters, little information is available on the current condition of fish habitat in these side channels. All four are used to access local marinas and therefore are subject to repeated human disturbance in the form of boat traffic. Boating results in discharges of pollutants and the physical disruption of wetland, riparian and benthic communities and ecosystems through the actions of a boat hull, propeller, anchor, or wake (USEPA 1993, Carrasquero 2001, Kahler et al. 2000, Mosisch and Arthington 1998). Sediment resuspension, water pollution, disturbance of fish and wildlife, destruction of aquatic plants, and shoreline erosion are the major effects pathways of concern (Asplund 2000). However, the benthic environment in these side channels has not been dredged for 30 years at Tongue Point, 40 years at Lake River, and almost 60 years in the proposed dredging prism within Oregon Slough. We expect that, in the absence of dredging, these sites have developed robust benthic communities that provide abundant prey for juvenile salmonids, and in the case of Tongue Point, green sturgeon. The channel at Elochoman Slough was dredged by Wahkiakum Port District No. 1 in 2019 (Section 1.3).

Condition of Critical Habitat for Salmonids within the Action Area.

Currently, a lack of habitat opportunity and reduced habitat quality limit the viability of salmon and steelhead in the Columbia River estuary. The amount and accessibility of in-channel and off-channel habitat have been reduced by the conversion of aquatic habitat for agricultural, urban, and industrial uses; hydroregulation and flood control; and channelization. The degraded habitat conditions in the estuary affect the abundance, productivity, spatial structure, and diversity of

ESA-listed salmon and steelhead and have led both the Oregon and Washington Management Unit recovery plans to list to estuarine habitat issues as one of six general categories of threats that limit the viability of LCR Chinook and coho salmon and steelhead and CR chum salmon. Both Management Unit plans cite water quantity and flow timing, impaired sediment and sand routing, altered channel structure, and loss or degradation of peripheral and transitional habitats in the Columbia River estuary as primary limiting factors for juveniles from all three lower river salmon ESUs and the LCR steelhead DPS (NMFS 2013).

The condition of the physical and biological features essential for conservation discussed above and summarized here in Table 7. Across the action area, widespread development and other land use activities have disrupted watershed processes (e.g., erosion and sediment transport, storage and routing of water, plant growth and successional processes, input of nutrients and thermal energy, nutrient cycling in the aquatic food web, etc.), reduced water quality, and diminished habitat quantity, quality, and complexity. Past and current land use or water management activities in subbasins that drain to the lower Columbia River have adversely affected the quality and quantity of riparian conditions, floodplain function, sediment conditions, and water quality and quantity; as a result, the important watershed processes and functions that once created healthy ecosystems for salmon and steelhead production have been weakened. Conditions in the action area have been substantially affected, and improvements may be needed before these areas function at a level that supports recovery.

Table 7. Physical and biological features (PBFs) of designated critical habitat for Columbia River basin salmon and steelhead.

Physical and Biological Feature (PBF)	Components of the PBF	Principal Factors Affecting Condition of the PBF
Freshwater spawning sites	n/a	Does not occur within the action area
Freshwater rearing sites	Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage, and natural cover.	Loss of vegetated and tidal wetland connectivity (diking, filling, bank hardening) have reduced the quantity and quality of freshwater rearing sites in the lower Columbia River estuary and the production and export of prey and organic detritus to the mainstem food web. Toxics accumulations (urban and rural development, forest and agricultural practices) have reduced water quality in freshwater rearing sites. Disruption of benthic prey communities in slough and side channel habitats (dredging, marina development and operations).

Physical and Biological Feature (PBF)	Components of the PBF	Principal Factors Affecting Condition of the PBF
Freshwater migration corridors	Free of obstruction and excessive predation, adequate water quality and quantity, and natural cover.	Alteration of the seasonal flow regime in the lower Columbia River with elevated fall and winter and reduced spring flows (hydrosystem development and operation). Reservoir releases are managed to seasonal flow objectives for juvenile fish survival given the amount of runoff expected in a given year, resulting in a small negative effect on water quantity in average- to high-flow years and a moderate negative effect in lower flow years. Alteration of the seasonal mainstem temperature regime in the lower Columbia River due to thermal inertia associated with the hydrosystem reservoirs. Temperatures are generally cooler in the spring and warmer in late summer and fall than in the predevelopment condition. This has negatively affected the functioning of water quality in the juvenile and adult migration corridors for the latest migrating subyearling smolts and the summer and earliest migrating adult fall-run Chinook salmon and summer-run steelhead populations (Appendix). Water quality in the mainstem migration corridor is not negatively modified for other adult run types (spring-run salmon and winter-run steelhead). Toxics accumulations (urban and rural development, forest and agricultural practices) have reduced water quality in freshwater rearing sites. Increased mortality on juvenile migrants due to avian predation, especially in the vicinity of East Sand Island and the Astoria-Megler Bridge. Increased mortality on adult migrants due to pinniped predation.
Estuarine areas	Free of obstruction and excessive predation with water quality, quantity, and salinity, natural cover, juvenile and adult forage.	Same as freshwater migration corridors.
Nearshore marine areas	Free of obstruction and excessive predation with water quality, quantity, and forage.	Same as freshwater migration corridors and estuarine areas.

Condition of Critical Habitat for Green Sturgeon within the Action Area

NMFS designated critical habitat for southern DPS green sturgeon from the mouth of the Columbia River to RM 46, an estuarine area. The essential features of this PBF are food resources, migratory corridors, appropriate water and sediment quality, and appropriate flow and depth to support the growth of sub-adult and adult (sexually mature) green sturgeon. We summarize the current status of these essential features is as follows:

- Prey species for green sturgeon within bays and estuaries primarily consist of benthic invertebrates and fishes, including crangonid shrimp, burrowing thalassinidean shrimp (particularly the burrowing ghost shrimp), amphipods, isopods, bivalves, annelid worms, crabs, sand lances, and anchovies (Dumbauld et al. 2008, 74 FR 52300). The types of invertebrate and fish prey favored by green sturgeon is likely to be present in the lower 46 miles of the Columbia River, but whether the abundance is adequate for the sub-adult and adult fish that are present during summer is unknown.
- Although water temperature in the lower Columbia River is affected by the existence and operation of the Federal hydrosystem's dams and storage reservoirs, temperatures in the lower 46 miles are also strongly affected by tidal exchange with the ocean. NMFS (2018a) lists the alteration of water temperatures due to climate change as a "very high" threat in coastal bays and estuaries.
- Suitable water and sediment quality requires low levels of contaminants that otherwise may disrupt the growth and survival of the sub-adult and adult life stages (74 FR 52300). Contaminants due to oil and chemical spills are a "high" threat in coastal bays and estuaries (NMFS 2018a).
- Migratory pathways must allow safe and timely passage. Ship strike, including dredge vessels and barges, is a potential source of degraded passage conditions in the Columbia River estuary.
- Sub-adult and adult green sturgeon require a diversity of depths in estuarine areas for shelter, foraging, and migration. This includes shallow depths used for feeding such as the side channel habitats in the Columbia River estuary.
- Sediment quality necessary for normal behavior, growth, and viability of all green sturgeon life stages includes sediments free of elevated levels of contaminants, such as PAHs and pesticides (74 FR 52300). The USACE's pre-dredging sediment analysis for Tongue Point detected diethyl phthalates at concentrations requiring further testing in 2 of the 93 Dredge Material Management Units (Section 1.3). The same testing of sediment samples from the dredge prism in Elochoman Slough indicated that the material was adequate for unconfined, in-water disposal. The remainder of the action area that is within designated critical habitat for green sturgeon is the flow lane of the mainstem Columbia River below RM 46. Sediment quality is likely to vary throughout this reach.

Condition of Critical Habitat for Eulachon within the Action Area

NMFS designated critical habitat for southern DPS eulachon in the lower Columbia River up to Bonneville Dam and in some tidally influenced areas including the lower reaches of the Elochoman River. The environmental baseline for the PBFs for eulachon critical habitat is reflected in the effects on the physical and biological features needed for conservation discussed above (e.g., mainstem flows, water quality, and predation) and summarized in Table 8.

Table 8. Physical and biological features (PBFs) of designated critical habitat for the southern DPS eulachon.

Physical and Biological Feature (PBF)	Components of the PBF	Principal Factors Affecting Condition of the PBF
Freshwater spawning and incubation sites	Water flow, quality, and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles.	Less fine sediment and sand available to replenish habitat along the margins of the river, at least as far downstream as the Willamette River confluence (hydrosystem development and operations). Altered mainstem flow regime, generally increasing winter flows (November through March), when eulachon are present, and reducing peak spring flows (May and June) (water management). Altered mainstem water temperatures (generally increasing minimum winter temperatures, during spawning season, and decreasing spring temperatures) (hydrosystem development and operations; climate change). Alteration of mainstem spawning and incubation habitat by dredging (navigation). Increased levels of toxic contaminants (land use, industrial development). Increased levels of nutrients and fecal bacteria, lower dissolved oxygen in shoreline areas near leaking septic systems (rural residential and urban development). Risk of injury or mortality for adults that pass Bonneville Dam (most likely through the navigation lock) and fallback downstream [Jan-Mar] (hydrosystem development and operations). Increased exposure of eggs and larvae to total dissolved gas for greater than 35 miles downstream of Bonneville Dam for late migrants that are still in the mainstem when spring spill operations begin on April 10 (hydrosystem development and operations).
Freshwater and estuarine migration corridors	Free of obstruction and with water flow, quality, and temperature conditions that support larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted.	Risk of injury or mortality for adults that pass Bonneville Dam (most likely through the navigation lock) and fallback downstream [Jan-Mar] (hydrosystem development and operations). Loss of a large proportion of the estuarine floodplain (agricultural, rural residential, urban, and industrial development). Recent floodplain reconnection projects are expected to support the production of eulachon prey (phytoplankton) in the lower river by improving the flux of organic material and nutrients (habitat restoration).

2.3.1.1 Summary of Habitat Conditions and Designated Critical Habitat in the Action Area

Under the environmental baseline, the fish from the component populations of each salmonid ESU and DPS that move through and use the action area will encounter habitat conditions degraded by a modified flow regime, reduced water quality from substantial chemical pollution, loss of functioning floodplains and secondary channels, and loss of vegetated riparian areas and associated shoreline cover. The significance of this degradation is reflected in the limiting factors described in recovery plans: insufficient access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing space, pollution, and increased predation. We do not know of habitat conditions in the action area that limit the likelihood of survival and recovery for green sturgeon. Habitat conditions for eulachon are affected by hydrosystem operations and dredging and disposal activities that affect the quantity and quality of substrate for egg and larval development.

Likewise, the environmental baseline does not fully support the conservation role of designated critical habitat for the listed species. The PBFs within the action area that are essential for the conservation of salmon and steelhead include freshwater rearing sites, freshwater migration corridors, and estuarine rearing areas. Despite the degraded conditions, conservation value is high because migration is an obligate role for the habitat to maintain adult access to spawning areas, and juveniles to maintain access to the ocean to complete their life history demands. The Action Agencies and other Federal and non-Federal entities have taken actions in the last two decades to improve the functioning of some of these PBFs. Projects that have protected or restored riparian areas and breached or lowered dikes and levees in the estuary have improved the functioning of rearing sites and the juvenile migration corridor. However, habitat conditions as a whole remain highly modified and the factors described above continue to have negative effects on these PBFs. The estuarine PBF of critical habitat for green sturgeon within the action area is negatively affected by ship traffic and sediment contaminants, and the abundances of preferred prey are unknown. Similarly, the loss of sand due to the existence and operation of the hydrosystem and dredging of the navigation channel and potentially, some side channels, has negatively affected the PBF of substrate in freshwater spawning and incubation sites for eulachon.

2.3.2. Species in the Action Area

All 13 species of ESA-listed Columbia basin salmon and steelhead, and all of their component populations, migrate through the action area. Subyearling Chinook salmon from the Lower Columbia River and Upper Willamette River ESUs and Columbia River chum rear along the shoreline for weeks or months and are exposed to impaired habitat conditions within the action area for much of the juvenile life stage. The larger side channels like the ones that the Corps proposes to dredge for this project, are likely to be important to these fish for foraging and resting where there is no adjacent floodplain wetland, or the wetland is not inundated (e.g., during periods of low tides or low mainstem flow; Roegner et al. 2021).

Large yearling Chinook, coho, and sockeye salmon and steelhead from the interior Columbia basin move through the mainstem relatively quickly on their way to the ocean. However, yearling Chinook from lower river genetic stocks use side channels between islands and the

Oregon and Washington shorelines (Johnson et al. 2015, Sather et al. 2016). Juvenile ESA-listed species also have a wide horizontal and vertical distribution in the Columbia River related to size and life stage. Juvenile salmonids occupy the width of the river, from the surface to average depths of 35 feet (Carter et al. 2009). The likely ESUs and DPSs of Columbia basin salmonids that are likely to be present during the 1 August through 15 December IWWW are shown in the Appendix.

Upstream migrating adult salmonids, especially summer-, fall-, and winter-run fish, migrate along the shoreline or in the channel during the period when the USACE proposes to dredge side channels and release the excavated material in the flow lane (Appendix).

Sub-adult and adult southern DPS green sturgeon migrate seasonally along the West Coast, congregating in bays and estuaries, including the lower Columbia River, during the summer and fall. Individual green sturgeon exhibit diel movements, using deeper water during the day and moving to shallower water during the night to feed (Moser and Lindley 2007). Little is known about green sturgeon diet in estuaries or in the coastal ocean. A very limited sample of green sturgeon stomachs in the Columbia River found mostly crangonid shrimp and some thalassinid shrimp (Dumbauld et al. 2008). The presence of these prey species suggests the sampled green sturgeon fed in the saline and brackish water reaches in the lower Columbia River estuary. However, ODFW (2020) reports occasional incidental catches green sturgeon in commercial gillnets above RM 46 during summer and even young-of-year fish in its own gillnet sampling for sturgeon during the fall. Many of these, and four young-of-year fish captured during the state's gillnet sampling for white sturgeon, are from the unlisted northern DPS (Schreier and Stevens 2020).

Eulachon also migrate through the action area, both as adults and larvae. Adult migrations can occur as early as November or as late as June. Peak spawning typically occurs between January and March, but can occur in December. Eggs are fertilized and drift downstream, adhering to sand and small gravels, and hatch in 3 to 8 weeks depending on water temperatures. Larvae are transported downstream and after rearing in the estuary for an unknown amount of time, move to the ocean (NMFS 2017c).

Because all of the ESA-listed species considered in this opinion must migrate through the action area, all are exposed to the degraded baseline conditions. Salmonids that spend months rearing in the action area (subyearling LCR and UWR Chinook and CR chum salmon) are exposed for a significant portion of their life cycle. These conditions may negatively affect the condition of individuals that also will be exposed to the effects of the proposed action, and may influence the nature and degree of their response.

2.4. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved

in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The effects of the action include the effects on habitat that fish will experience and respond to, and effects on the fish themselves. The effects on habitat include: (1) reduced safe passage conditions in migration and rearing areas for salmonids, estuarine areas for green sturgeon, and migration and spawning and incubation areas for eulachon because of entrainment risk, (2) water quality reductions in rearing and migration areas for salmonids contemporaneous with the dredging and disposal activities, but abating within hours post-work, and (3) prey reductions in juvenile salmonid rearing areas and estuarine areas for green sturgeon that persist for uncertain periods of time (weeks to months, and potentially years) post-dredging.

2.4.1 Entrainment

In this analysis, entrainment refers both to the uptake of aquatic organisms by dredge equipment and the transport of organisms by the downward motion of sediments during in-water disposal. Both mechanical and hydraulic dredges commonly entrain slow-moving and sessile benthic epifauna along with the burrowing infauna that are removed with the sediments.

Critical Habitat

Safe passage conditions are a feature of designated critical habitat where the role of the habitat is to serve migration. Here the action area serves a migration role for all 15 ESA-listed species. Entrainment risk is a consequence both from the dredging and the placement of dredge materials. Mechanical dredges can entrain organisms by capturing them in the clamshell or backhoe bucket. Hydraulic dredges can entrain organisms by suction as sediment and water are pumped into the draghead or cutterhead. Both types of dredge reduce safe passage. The release of dredged sediments from the bottom of a barge or placement pipe can also entrain organisms by catching them in currents created as the discharge descends through the water column. A barge releases a substantial amount of sediment into the flow lane at one time, compared to a pipeline that continuously releases smaller amounts of material while the dredge is operating. Thus, the risk of entrainment in the flow lane is higher for material released from a barge than from a pipeline.

The timing of dredge and disposal activities affects the project's influence on migration values for a given species. If equipment is dredging or depositing dredged materials when fish are migrating to or from the ocean, then safe passage in that habitat will be diminished for that species. And safe passage conditions in the migration corridor may be diminished for one life stage of a species, but not another. Based on the 1 August to 15 December IWWW and the life history timing in the action area for each species (Appendix), we anticipate the safe passage element will be negatively affected each year that dredging occurs over the 25-year duration of the proposed action for the following PBFs:

- LCR Chinook salmon—juvenile and adult migration corridors, rearing areas
- UCR spring-run Chinook salmon—juvenile migration corridor, rearing areas
- UWR Chinook salmon—juvenile migration corridor
- SR spring/summer Chinook salmon—juvenile and adult migration corridors
- SR fall Chinook salmon—juvenile and adult migration corridors

- CR chum salmon—adult migration corridor, rearing areas
- LCR coho salmon—juvenile and adult migration corridors
- SR sockeye salmon—juvenile migration corridor
- MCR steelhead—juvenile migration corridor
- UCR steelhead—juvenile migration corridor
- UWR steelhead—juvenile migration corridor
- SRB steelhead—juvenile migration corridor
- SDPS green sturgeon—sub-adult and adult migration corridors (to over-summering habitat)

Safe passage in the adult migration corridor will also be negatively affected for SDPS eulachon. In addition, the functioning of migratory access to spawning and incubation sites will be disrupted if eulachon would otherwise spawn in one or more of the four side channels during the IWWW (e.g., if the USACE is dredging during early December).

Exposure and Response of Salmonids to Entrainment

In order to be entrained, highly mobile organisms such as adult and yearling salmonids must be directly in the path of a bucket or backhoe or within the suction area for a hydraulic cutter or draghead. This exposure will occur in a small area at any given time, compared with the distribution of fishes across the available habitat. Further, mechanical dredges move slowly during dredging operations, with the barge staying in one location for up to several hours, while the bucket or backhoe is repeatedly deployed within that area. Studies confirm the entrainment of fish and other organisms by hydraulic dredges (Armstrong et al. 1981; Boyd 1976; Dutta and Sookachoff 1975; R2 Resource Consultants 1999). Although there is evidence of fish surviving entrainment (Armstrong et al. 1981), entrainment is often fatal. This is not surprising, especially for larger organisms that are likely to be impacted by the cutterhead and/or pump impellers, before being dumped along with the dredged material into a hopper or onto a disposal area. Hopper dredges operate for prolonged periods, generating continuous fields of suction forces around and under the dragheads while they are pulled along the substrate at relatively high speed as compared to other dredge methods. Entrainment of fish and other mobile organisms by a hopper dredge is believed to occur most often when the dragheads are out of firm contact with the channel bottom (Reine and Clarke 1998). Typical operations require the initial run-up of the pumps before the dragheads contact the bottom, and the pumps are operated with the dragheads raised from the bottom at the end of a run to clear the dragarms. Other situations that may cause the loss of firm contact with the bottom include increases in depth that exceed the draghead's ability to remain flat against the bottom, along with wave action that may periodically pull the draghead away from the bottom. The potential for entrainment also increases with increased dredge size and flow (suction) rates.

Hydraulic pipeline dredges also entrain fish, especially smaller fish that are less able to swim against the powerful currents near the cutterhead, which is often unshrouded. Several studies confirmed entrainment of juvenile salmon by hydraulic pipeline dredging in the Fraser River (Boyd 1976; Dutta and Sookachoff 1975).

We expect that most of the large fish that are in the vicinity of a dredge at the start of operations are likely to swim away to avoid the noise and activity. Therefore, we consider it highly unlikely

that any of the adults and very few of the yearling salmonids considered in this opinion would be entrained by the dredges. The risk of entrainment, and injury or death, is higher for the small subyearlings because it is influenced by the swimming stamina and size of the individual fish (Boysen and Hoover 2009). Small, subyearling Chinook and chum salmon from lower river spawning areas (i.e., populations of LCR and UWR Chinook salmon and CR chum salmon) will be present during the IWWW, with some individuals rearing in or moving through each side channel during excavation. We are unable to estimate the numbers of these fish that will be injured or killed through this pathway, but assume that the magnitude of exposure to and the likelihood of entrainment is a function of the expected days of operation and the frequency of dredging, combined with the volume of material to be dredged (Table 2). Therefore, we anticipate that entrainment will reduce the fitness (likelihood of surviving to adulthood, mating, and producing offspring) of some individuals of each of the salmonid species over the 25-year period of dredging activities.

Excavated sediments that are approved for in-water disposal would be released in the flow lane between RM 3 and 145 at a depth below 20 feet.[6] As dredged material is released from the bottom of a barge, it falls through the water column and mixes with the ambient water to create a plume (USACE 2005). When the diluted material hits the bottom, it spreads out until its energy is expended and then slowly settles out under the influences of gravity and local currents. A 6-inch fish could be dragged downward with the plume, but would most likely be displaced laterally, parallel to the bottom, as the plume reached the boundary layer. Disposal from a pipeline dredge would be less forceful, but continuous while the dredge is operating. River flow (and tidal flushing in the flow lane near the Tongue Point site) are likely to alleviate exposure to the discharged material (Wilber and Clark 2001). Consequently, the likelihood that a juvenile or adult salmon would be harmed or killed by entrainment during flow lane disposal is low.

Based on migration timing and the 1 August through 15 December IWWW, summer- and fall-run adult salmonids and subyearling juveniles could encounter downward falling sediment plumes during flow lane disposal. We estimate the magnitude of exposure and the likelihood of entrainment for these fish by the expected days of operation and the frequency of dredging, combined with the volume of material to be dredged and then released in the flow lane (Table 2). Therefore, we anticipate that flow lane disposal will reduce the fitness of exposed individuals over the 25-year period of dredging activities.

Exposure and Response of Green Sturgeon to Entrainment

Green sturgeon are likely to be in the lower reaches of the Columbia River estuary during April or May through October. Hansel et al. (2017) reported that numbers detected on acoustic arrays were highest in August and September. This indicates that some adults and sub-adults could be in the vicinity of dredging and flow lane disposal activities at Tongue Point and Elochoman Slough, which are within or close to the saline zone of the lower river.

The sub-adult and adult green sturgeon that gather in non-natal Pacific Northwest estuaries range between 2.5 and 8.5 feet in length (Moser et al. 2016). Although highly mobile and known to make vertical migrations in the water column, these fish exhibit behaviors that increase their risk

[6] The USACE would dispose of any sediments that are not approved for in-water disposal (i.e., due to contaminant concentrations that exceed screening levels) in upland areas.

of entrainment. As benthic feeders they are most often found on or near the bottom, while foraging or moving within river and estuarine systems. In Grays Harbor and Willapa Bay, adults and sub-adults were captured in the deepest available habitats, but made forays over the mud flats to feed (O. Langness, Washington Department of Fisheries, Vancouver, WA, unpublished data; cited in Moser et al. 2016).

Although the entrainment of sub-adult and adult sturgeon by suction dredging is relatively rare,[7] it has been documented in projects on the east coast. During hydraulic dredging in Delaware River Ship Channel, a 5.7-foot long Atlantic sturgeon was fatally entrained in 2014, and a 3-foot long short nose sturgeon was fatally entrained in 2017 (NMFS 2017d). A 4-foot long Atlantic sturgeon was also fatally entrained in a hopper dredge operating in the Charleston Entrance Channel in April 2016 (USACE 2016, as cited in NMFS 2018b). Five Atlantic sturgeon were entrained and killed during the first two years of dredging in Savannah Harbor, Georgia, despite pre-trawling the dredging area and capturing and releasing 17 Atlantic sturgeon. NMFS hypothesized that these sturgeon were exposed to entrainment because the project included sustained intense dredging within a relatively small area. Sturgeon also may have been attracted to the newly-dredged area if it stirred up benthic organisms and provided good foraging habitat. These conditions could pertain to dredging in the side channels, especially because maintenance has been deferred for a numbers of years and benthic organisms such as burrowing shrimp and clams may be present.

Green sturgeon are most likely to be in the lower Columbia River and exposed to dredging activities during the first months of the IWWW, August and September. Similar to salmonids, we are unable to estimate the number of green sturgeon that will be entrained and injured or killed. We estimate the magnitude of exposure and the likelihood of adverse response of green sturgeon to entrainment during dredging by the volume of material to be dredged at each site, the expected days of operation per dredging event, and the frequency of dredging (Table 2). The risk is very low for the Oregon Slough and Lake River project areas because of their distance from the mouth of the river. Therefore, we anticipate that a few green sturgeon will experience fitness level consequences during each dredging event over the 25-year action.

We expect that low numbers of sub-adult and adult green sturgeon will be affected by the disposal of sediments in the flow lane. These fish remain on or close to the bottom and over 25 years of operations, some individuals could be under a barge at the time of release. Flow lane disposal from a pipeline dredge will result in continuous exposure while the dredge is operating (Wilber and Clark 2001), but river flow (and tidal flushing near the Tongue Point site) is likely to alleviate exposure to discharged sediment. Exposure is also limited by the IWWW; based on migration timing for sub-adults and adults in Pacific Northwest estuaries, exposure to disposal activities would be very low after September.

Thus, the risk that sub-adult or adult green sturgeon would be injured or killed due to entrainment during disposal is low. We estimate the magnitude of exposure and the likelihood of adverse response of green sturgeon to entrainment during sediment disposal by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the volume of material to be released in the flow lane (Table 2). Assuming that flow lane disposal

[7] See, for example, Stanford et al. (2009).

would take place near each dredged side channel, the risk of entrainment is very low for material dredged from the Oregon Slough and Lake River project areas because of their distance from the mouth of the river. Therefore, we anticipate that very few if any green sturgeon would experience reduced fitness due to flow lane disposal over the 25-year period of the proposed action.

Exposure and Response of Eulachon to Entrainment

Adult eulachon begin to enter the Columbia River during December, so that the earliest migrants (before December 15th) could encounter both the dredging equipment and the sediment plumes created during flow lane disposal. If early migrants begin spawning, incubating eggs will also be affected, with the highest risk in Elochoman Slough and Lake River, which are near major spawning areas.

We expect that low numbers of adult eulachon and their eggs would be entrained and killed by the proposed dredging and flow lane disposal activities. The magnitude of exposure and the likelihood of an adverse response to entrainment during dredging are represented by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the amount of material to be dredged (Table 2). For entrainment into sediment plumes during disposal we estimate the magnitude of exposure and the likelihood of adverse response by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the volume of material to be dredged and then released in the flow lane. These are conservative estimates of exposure and of the risk of injury or mortality, because only the earliest migrants and spawners would be present during the IWWW. Therefore, we anticipate reduced fitness to a few individuals that may overlap with dredging footprints over the 25-year action.

2.4.2. Degraded Water Quality

Critical Habitat

Water quality is a feature of critical habitat supporting migration for all juvenile and adult fish considered in this opinion; rearing for LCR and UWR Chinook salmon, CR chum salmon, LCR coho salmon, and LCR steelhead; and over-summering habitat for sub-adult and adult green sturgeon. Water quality is likely to be moderately degraded during dredging and disposal activities. Degradation will take the form of temporary increases in suspended sediments (measured as turbidity) and at least in the case of Tongue Point, the mobilization of small amounts of the contaminant diethyl phthalate into the water column. Where the material within the dredge prism is high in silt and clay (e.g., 53 percent for the inner shoal at Tongue Point, 50 percent at Elochoman Slough, and 41 percent at Lake River; Table 6), dredging may mobilize organic material and temporarily reduce dissolved oxygen levels in the water column. The amount of sediment that will be suspended in the water column, as well as the duration and extent of a turbidity plume will depend on the composition of the sediments, the method of dredging, and the movement of the water (including tidal forces). The finer the sediment, the longer those particles will remain suspended. The faster the current, the greater distance the turbidity plume will extend from the activity, although at lower suspended sediment concentrations.

We are unable to estimate the concentrations of suspended sediment that dredging the side channels may generate, or the length of time different concentrations are likely to persist. The amount of suspended sediment will also depend on the type of dredge used. Both mechanical and hydraulic dredges may be used in the side channels depending upon availability and cost (USACE 2021). Using a hydraulic dredge would reduce the potential for large turbidity plumes within the side channels because the mobilized sediments are sucked into the dredge. Conversely, the clamshell and backhoe buckets used during mechanical dredging would mobilize sediments across the full depth of the water column as the equipment is pulled through the water. The turbidity plumes from dredging and in-water disposal of sands (e.g., the outer shoal at Tongue Point and the Lake River dredge prism; Table 6) are expected to be both localized and short-lived (hours) compared to the finer-grained sediments mobilized at the other project sites, which would stay suspended for longer periods of time (i.e., more hours).

The USACE will periodically analyze bottom sediments in these side channels for contaminants over the 25-year term of the proposed action. If dredged sediments are contaminated, such as the diethyl phthalate detected in two of the 93 Dredged Material Management Units sampled at Tongue Point in November 2019 (USACE 2021), these compounds will be mobilized into the water column during dredging. The affected sediments from Tongue Point have undergone bioassay testing and are suitable for in-water disposal per the USACE's Sediment Evaluation Framework (USEPA 2021).

Mobilization of anaerobic sediments into the water column may cause an oxygen demand that decreases dissolved oxygen (DO) levels (Hicks et al. 1991, Morton 1977). However, the dispersal of excavated material in the flow lane is not likely to decrease dissolved oxygen concentrations in the mainstem.

Based on their presence in the action area during the IWWW, the influence of these reductions in water quality varies for the 15 species. There will be small, temporary reductions in the water quality component of the migration corridor PBF within the dredging prisms and at the flow lane disposal sites, for up to 900 feet downstream (and 900 feet upstream in areas with tidal influence) for brief periods each year over the 25-year duration of the proposed action for the following PBFs:

- LCR Chinook salmon—juvenile and adult migration corridors
- UCR spring-run Chinook salmon—juvenile migration
- UWR Chinook salmon—juvenile migration corridor
- SR spring/summer Chinook salmon—juvenile and adult migration corridors
- SR fall Chinook salmon—juvenile and adult migration corridors
- CR chum salmon—adult migration corridor
- LCR coho salmon—juvenile and adult migration corridors
- SR sockeye salmon—juvenile migration corridor
- MCR steelhead—juvenile migration corridor
- UCR steelhead—juvenile migration corridor
- UWR steelhead—juvenile migration corridor
- SR steelhead—juvenile migration corridor

- SDPS green sturgeon—sub-adult and adult migration corridors (to over-summering habitat)
- SDPS eulachon—adult migration, spawning and incubation sites

In addition, water quality in rearing areas will be temporarily diminished each year during the IWWW for LCR and UWR Chinook and CR chum salmon. Although there is significant uncertainty regarding the extent and magnitude of the negative effects, the short-term nature of the exposure indicates that the functioning of the water quality component of rearing sites will not be substantially affected.

Exposure and Response of Salmonids to Degraded Water Quality

Water quality reductions due to dredging and disposal activities will occur when summer- and fall-migrating adult salmon (LCR Chinook [fall- and late-fall run populations], SR spring/summer Chinook [summer-run populations], SR fall Chinook, CR chum, and LCR coho) and subyearling LCR and UWR Chinook and CR chum salmon are present (Appendix). Some individuals from each of these ESUs will be present during dredging and disposal activities and thus exposed to altered water quality. Water temperatures during August and early September, the early part of the IWWW, are some of the warmest in the lower Columbia River, often exceeding 70°F in recent years. Thus, some individuals are likely to experience thermal stress contemporaneous with the effects of the proposed action.

The USACE will limit exposure to increased levels of suspended sediments by implementing turbidity monitoring, and pausing dredging activities when levels exceed background by the amounts specified in the proposed action (see Table 3). As a result, we expect that exposures to elevated sediment concentrations will be brief and will elicit only low-level responses such as avoidance of the turbidity plume, and temporary minor physiological responses such as gill flaring (coughing), temporarily reduced feeding rates and success, and moderate levels of stress. Therefore, we do not anticipate fitness consequences to adult summer and fall migrants.

Juvenile salmonids are more sensitive to suspended sediment than adults, and warm water increases their sensitivity. Their metabolic demand for oxygen increases with the need to perform repeated coughing, but warm water holds less dissolved oxygen (Muck 2010). Under these circumstances (e.g., during dredging activities in August and September), even small increases in oxygen demand (e.g., for stress responses and avoidance of the turbidity plume), can result in reduced foraging capability; reduced growth and resistance to disease; physical abrasion; clogging of gills; and interference with orientation in homing and migration (Kjelland et al. 2015).

Where dredging has been deferred and the fine sediment proportion is high (e.g., the inner shoal at Tongue Point and at Lake River), organic carbon is likely to have accumulated. The resuspension of these types of sediments within a semi-enclosed side channel can decrease dissolved oxygen in the water column due to the need for oxygen to decompose the organic material (Kjelland et al. 2015). Avoidance reactions, observed when dissolved oxygen levels drop below 8.0 mg/l (WDOE 2002), could drive small juveniles rearing in these areas from preferred foraging areas, exposing them to increased risk of predation. Hostetter et al. (2012) found that the susceptibility of steelhead to Caspian tern predation increased significantly during

periods of decreased water clarity (increased turbidity), along with other factors. Thus, small numbers of LCR and UWR Chinook salmon and CR chum salmon that are rearing in these channels are likely to experience reduced fitness, especially if the exposure is contemporaneous with elevated temperatures, due to degraded water quality.

Carlson et al. (2001) used hydroacoustics to document the behavioral responses of salmonids to dredging activities in the mainstem Columbia River (e.g., the flow lane). The responses of out-migrating smolts (likely fall Chinook and coho salmon) included moving inshore when they encountered dredging operations and moving offshore when they encountered the discharge plume. These fish assumed their former distributions within a short time, indicating that they could avoid areas where suspended sediment concentrations were above background. Thus, we expect that larger juvenile salmonids moving downstream in the flow lane during the IWWW will be able to avoid areas of reduced water quality and will not experience reduced fitness.

We do not expect adverse decreases in dissolved oxygen at the flow lane disposal sites where the material will be quickly dispersed and diluted.

Although we expect that most of the sediments that would be dredged will be free of contaminants, diethyl phthalates have been detected in two of 93 Dredged Material Management Units at Tongue Point. Adults and juveniles that are present in at least that part of the action area during the IWWW would be exposed to mobilized material for very brief periods before it moved downstream and became diluted in the water column. We do not expect that any of these individuals will experience decreased fitness.

We estimate the magnitude of exposure and the likelihood of adverse response of juvenile and adult salmonids to degraded water quality by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the volume of material to be released in the flow lane (Table 2).

Exposure and Response of Green sturgeon to Degraded Water Quality

Green sturgeon are relatively tolerant of elevated suspended sediment concentrations. They are typically found in turbid conditions, and forage by stirring up sediments to access benthic prey such as burrowing shrimp. Wilkens et al. (2015) demonstrated that closely related Atlantic sturgeon experienced no significant effects from three days of continuous exposure to suspended sediment concentrations of up 500 mg/L. Their tolerance of relatively high levels of suspended sediment suggests that this exposure would not affect the fitness of sub-adult or adult fish during the proposed dredging and disposal activities.

Green sturgeon in the Tongue Point side channel are likely to be exposed to low concentrations of diethyl phthalate during dredging of 2 of the 93 Dredge Material Management Units at that site. We expect the exposure of green sturgeon to be so brief, before that material moves downstream and becomes diluted in the water column, that it will not affect individual fitness.

Green sturgeon could also be affected by contaminants that have been taken up by benthic prey, especially if the act of dredging makes these organisms more available. The long life span and late age at maturity of green sturgeon make them vulnerable to chronic and acute effects of

bioaccumulation. A fish contaminant survey of the Columbia River basin between 1996 and 1998 found white sturgeon to have the highest contaminant concentrations of all the species tested, including various salmonids, two sucker species, walleye, pacific lamprey and eulachon (USEPA 1999). Because of their extensive marine migratory phase, green sturgeon are less exposed to concentrated anthropogenic contaminants than white sturgeon, but the potential for exposure increases when green sturgeon enter freshwater during summer (COSEWIC 2004). We expect that the proposed dredging, especially in the Tongue Point and Elochoman Slough side channels, closer to the ocean, would expose small numbers of individuals to low concentrations of contaminants, with very minor effects on fitness.

Some sub-adult and adult green sturgeon could briefly be exposed to waters within the side channels with reduced DO during dredging activities. The effects of this exposure are uncertain, but could include reduced swimming and foraging and avoidance of the area. However, the number of exposed individuals is likely to be low, and they are unlikely to experience reduced fitness given their relatively large size and mobility.

Dredging has been deferred at the proposed sites for a number of years, and especially where the fine sediment proportion is high (the inner shoal at Tongue Point and Elochoman Slough), anaerobic sediments may have accumulated. We expect exposure to low dissolved oxygen concentrations to be very brief and the effects on sub-adult and adult green sturgeon would most likely be temporary avoidance of the affected area with no detectable effects on the fitness of an exposed individual.

We estimate the magnitude of exposure and the likelihood of adverse response of sub-adult and adult green sturgeon to degraded water quality by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the volume of material to be released in the flow lane (Table 2).

Exposure and Response of Eulachon to Degraded Water Quality

Many eulachon exposed to dredging-related suspended sediments would most likely be moving past the dredging sites during their upstream migration. The duration of their exposure to turbidity above background levels would be measured in minutes or a few hours. However, adults migrating to spawning areas in the Elochoman River are likely to experience longer exposures. Because eulachon are known to spawn, and larvae survive, in naturally turbid glacial rivers in Alaska (NMFS 2017c). Thus, we expect exposure to elevated suspended sediments to elicit only low-level behavioral effects in adults such as avoidance of the sediment plume, and temporary minor physiological effects such as gill flaring (coughing), temporarily reduced feeding rates and success, and moderate levels of stress. We anticipate little to no consequence to individual fitness of adults and their eggs.

If dredged sediments are contaminated (e.g., the diethyl phthalates in two of the 93 Dredge Material Management Units at Tongue Point), these compounds would be mobilized into the water column during dredging and disposal. Eulachon and any eggs present during December, at the start of the spawning run, could then be exposed to contaminants. However, exposure would be very brief before that material moved downstream and became diluted in the water column.

Effects on the condition of adults and eggs in the side channels or the flow lane disposal sites are expected to be minor, with no consequences to fitness.

Some adults and eulachon eggs could be exposed to waters within the side channels with reduced dissolved oxygen during dredging activities. The effects of this exposure are uncertain, but could include reduced swimming and foraging of adults and possible avoidance of the area. Eulachon will not be present during summer, when warm temperatures exacerbate dissolved oxygen conditions. In addition, the number of exposed individuals is likely to be low. Some early spawners could lay eggs in areas that will be exposed to reduced dissolved oxygen conditions during dredging, but those eggs are likely to be lost due to disruption of the benthos in any case. Therefore, we anticipate minimal consequences of reduced dissolved oxygen concentrations to the fitness of individuals.

The planktonic prey of adult eulachon could be affected by degraded water quality, but the degree of effect is unknown. We anticipate that eulachon will forage in other areas, away from the degraded water quality with little effect on individual fitness.

In summary, we expect that low numbers of adult eulachon and their eggs would be exposed to degraded water quality during the proposed dredging and flow lane disposal activities. We estimate the magnitude of exposure and the likelihood of an adverse response during dredging by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the amount of material to be dredged (Table 2). For exposure to degraded water quality during disposal we estimate the magnitude of exposure and the likelihood of adverse response by the expected days of operation at each site per dredging event and the frequency of dredging, combined with the volume of material to be dredged and then released in the flow lane (Table 2). These are conservative estimates of exposure and of the risk of injury or mortality, because only the earliest migrants and spawners would be present during the IWWW.

2.4.3 Altered Benthic Habitat and Reduced Foraging Opportunity

Critical Habitat

Prey is a biological feature of the juvenile salmonid migration corridor and rearing habitat PBFs. We have preliminary information on the benthic community in the secondary channel behind Woodland Islands before dredged material placement and at two nearby reference sites (Sather 2020). The Woodland Islands samples were dominated by amphipods and nematodes and the reference sites by insects (mostly chironomids), annelid worms, and bivalves. The amphipods that were abundant in these channels are an important salmonid prey item, but are relatively rare in the floodplain wetlands (Kidd et al. 2019, PNNL and NMFS 2020). Thus, removal of sediment from the dredge prisms for this project is likely to affect the availability of prey for juvenile salmonids. This is especially likely in the Tongue Point, Lake River, and Oregon Slough channels, which have not been dredged in many years, so the benthic communities have been able to develop. Elochoman Slough was dredged in 2019 and the current status of the prey community in that channel is unknown.

Dredging and in-water disposal of sediments both alter benthic habitat by removing or smothering infaunal and epifaunal organisms. In doing so, these activities simplify the character

of the substrate and alter benthic community structure. The effect that repeated dredging has on prey availability will depend on the frequency of disturbance and the recovery time of the benthos. McCabe et al. (1998) sampled in the mainstem ferry channel between Puget Island and the main navigation channel in the lower Columbia River, and at two nearby shoreline reference sites after a single dredging event. Unlike the areas to be dredged in the proposed action, none of these locations were semi-enclosed side channels, and the habitat in each was mostly sand. The most common benthic species were the bivalve, *Corbicula*, the amphipod, *Corophium*, and dipteran fly larvae. Sampling in the months both before and after dredging indicated no significant effects on community structure; benthic invertebrates recolonized the area very quickly. Jones and Stokes (1998) thought that recolonization of a semi-enclosed channel leading to a shipping terminal in Elliot Bay, Puget Sound, would depend on interactions between sediment parameters, timing of exposure, chance arrival of recruiting fauna, sediment/organic-matter flux to the benthos, and habitat modification caused by the colonizing species themselves (e.g., sediment stabilization, adult-larval interactions, etc.). They stated that the complexity of these factors and the small number of previous studies on recolonization made it impossible to accurately predict community development patterns in their study area. Based on a few studies from other locations, they expected that relatively stable communities would become established after a minimum of 1 to 3 years.

Given the lack of information specific to recolonization of the benthos in a side channel and the uncertainties described by Jones and Stokes (1998), the time over which a benthic community that supports foraging by juvenile salmonids would recolonize is highly uncertain. We expect that the Tongue Point channel, which the USACE proposes to dredge every year, will remain in a state of reduced function (i.e., reduced prey resources) over the entire 25-year period of the proposed action and beyond. The Oregon Slough channel, which would be dredged an average of one year out of five (potentially two years in a row, but no more than five times over the 25-year term of the proposed action), would be more likely to recover, but then become degraded again for unknown periods of time. The substrate and community in this side channel are likely to shift back toward that which was present before dredging, but there is high uncertainty regarding whether they will recover sufficiently to serve as a juvenile salmonid rearing area before the next maintenance dredging occurs. The USACE (2021) proposes to dredge Elochoman Slough and Lake River no more frequently than once every three years to allow the benthic community to recolonize and provide forage for juvenile salmonids. As a result, we conservatively assume that both the rearing and migration PBFs for salmonid critical habitat would experience moderate reductions in food availability for some months or years in the Tongue Point and Oregon Slough side channel prisms, and small reductions in availability at Elochoman Slough and Lake River. These moderate to small reductions will slightly diminish the functioning of critical habitat for all 13 ESUs and DPSs of Columbia basin salmonids.

Prey is also a feature of the green sturgeon estuarine areas PBF. We expect that the periodic removal of sediment and benthic organisms will reduce prey in the Tongue Point, and to a lesser extent, Elochoman Slough side channel dredging prism, is needed by sub-adult and adult green sturgeon for foraging, growth, and development, by a small amount.

In addition, we expect small reductions in substrate suitable for egg deposition by eulachon in spawning and rearing areas due to the periodic removal of sediment within each side channel prism.

Exposure and Response of Salmonids to Altered Benthic Habitat and Reduced Foraging Opportunity

The four side channels the USACE proposes to dredge are likely to provide rearing habitat for small subyearling LCR and UWR Chinook salmon and CR chum salmon. Roegner et al. (2021) measured physical habitat opportunity for juveniles entering floodplain wetlands, noting that the floodplain may not be accessible during low tides (at the lower end of the estuary) and low mainstem flows. This indicates that these side channels are likely to provide important habitat when floodplain wetlands are not inundated.

Annual cohorts of juvenile salmonids will rely on these locations for rearing over the 25-year term of the proposed action and beyond, but during that period will encounter prey communities that have been diminished by the proposed action. Some juveniles will be forced to move to different habitats to find prey, increasing the energetic cost of foraging and the risk of exposure to predators. Dredging also has the potential to increase inter- and intraspecific competition for prey resources and for shallow areas for refuge and resting because alternate habitats are likely to be occupied. Grant et al. (1998) found that the territory size and territorial behavior of juvenile Atlantic salmon was a function of prey availability, with territory size increasing at lower prey abundances. When juvenile salmonids are excluded from or avoid an area and move into adjacent areas, competition and territorial behavior may mean that even more juveniles experience reduced access to prey resources with implications for reduced growth and fitness.

In this case, where dredging will occur multiple times at each location over the 25-year term of the proposed action, this will affect several cohorts of each population, especially for LCR and UWR Chinook and CR chum salmon. Reductions in the fitness of individual juveniles from each cohort are expected to repeat each time a side channel is dredged. We expect this to affect subyearlings, as described above, but also yearling fish from lower Columbia and interior ESUs and DPSs that migrate downstream in the spring. These fish are known to feed primarily on chironomids that originate in floodplain wetlands and corophiid amphipods from shoreline habitats such as secondary and side channels (PNNL and NMFS 2020). Thus, we expect moderate reductions in the fitness of individual subyearling LCR and UWR Chinook and CR chum salmon, and small reductions in the fitness of individual yearling fish from interior ESUs and DPSs, with the degree of effect depending on the frequency of dredging and the time it takes the prey community to recover.

The number of individuals of each species of salmonid and the degree to which their health, condition, growth, or survival will be affected by altered benthic habitat and reduced foraging opportunity is highly uncertain. For the purpose of this analysis, we assume that these risks are proportional to the area that will be dredged, combined with the frequency of dredging, at each project site (Table 2). We anticipate that disruption of benthic communities will reduce the fitness of some individuals of each of the salmonid species over the 25-year period of dredging activities.

We do not expect the ability of juvenile salmonids to forage for prey to be affected by flow lane disposal. The flow lane is an area of strong currents, with relatively coarse-grained sediments and frequent hydraulic disturbance. This suggests that the physical environment is not suitable for the development of salmonid prey communities.

Exposure and Response of Green Sturgeon to Altered Benthic Habitat and Reduced Foraging Opportunity

Green sturgeon typically feed in shallow water on benthic invertebrates such as crustaceans (burrowing shrimp are a major component of their diet) and mollusks (Moyle et al. 1992, Moser et al. 2016). They forage by stirring up sediment to access these prey. We expect the proposed annual maintenance dredging at Tongue Point to reduce or eliminate the benthic infaunal community that has developed in the 30 years since that site was last dredged, and to maintain the benthic community in a degraded state. The loss of this prey resource could cause impacts such as reduced growth and condition in individual sub-adult and adult green sturgeon that would otherwise use this area for foraging, although the number of individuals and the degree to which condition or growth would be affected is highly uncertain. The USACE (2021) proposes to dredge the Elochoman Slough side channel no more frequently than once in every three years, up to five times over the term of the proposed action. Elochoman Slough was dredged relatively recently, in 2019, and the benthic community at this site is likely to have recovered to some degree. For each site, we estimate that the risks of reduced condition, growth, or survival are proportional to the area that will be dredged, combined with the frequency of dredging at each site (Table 2). We anticipate that disruption of the benthic community will reduce the fitness of some sub-adult and adult green sturgeon over the 25-year period of dredging activities.

There is even more uncertainty about whether green sturgeon are likely to forage in the deeper parts of the mainstem channel where flow lane disposal will take place. Although sturgeon forage in relatively deep water during their coastal migrations, they seem to feed over shallower areas in Willapa Bay, even in the intertidal (Dumbauld et al. 2008, Moser and Lindley 2007). We estimate that the level of disturbance will be proportional to the area of sediment that will be dredged, combined with the frequency of dredging at each project site. We do not expect that this will cause any individuals to experience decreased fitness.

Exposure and Response of Eulachon to Altered Benthic Habitat

We do not expect the planktonic communities preyed upon by eulachon to be affected by disturbance of the benthic environment. However, spawning success could be affected if dredging removes large amounts of the materials (especially sand) needed for egg adhesion and incubation (NMFS 2017c), or if suspended sediment that settles out after dredging contains contaminants. In the final recovery plan for this DPS, NMFS (2017c) rated dredging in the mainstem a low threat and dredging in spawning tributaries a moderate threat to recovery. Of the four side channels considered in this opinion, Elochoman Slough is connected to the Elochoman River and Lake River is just upstream of the Lewis River confluence, spawning areas that could be affected by suspended sediments that settle out during dredging. However, the material from this site that was tested in 2018 was determined suitable for unconfined aquatic exposure and disposal. The other spawning tributaries are farther from the four side channels and are unlikely to be affected by the proposed sediment removal activities. We therefore anticipate that dredging will cause reductions in the fitness of some individual adults and their eggs, estimated by the

area that will be dredged, combined with the frequency of dredging, at each project site (Table 2).

2.5. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4). Over the 25-year period of the proposed action, we could expect that some of the climate effects described in the baseline, such as warming water temperatures or increasing variability of volume (low flows, high flows) will become more pronounced. These effects could increase food web disruptions, migration success, or other stresses on any or all of the listed species that rely on the action area. In modeling the response of spring- and summer-run Chinook salmon populations from the interior to warming freshwater and ocean conditions, Crozier et al. (2021) hypothesized that dramatic increases in smolt survival will be needed to overcome the negative impacts of climate change on population viability.

Also, state or private activities in the vicinity of the project locations (e.g., recreational boating, fishing, or other water-based recreation) are expected to increase and be a source of cumulative effects in the action area. Additionally, future state and private activities in upstream areas (particularly intensifying land use, and changes in tree cover) are expected to cause habitat and water quality changes that are expressed as cumulative effects. Our analysis considers how future activities in the Columbia River basin are likely to influence habitat conditions in the action area and cumulative effects caused by specific future activities in the vicinity of the project locations.

Approximately six million people live in the Columbia River basin, concentrated largely in urban centers. The effect of that population is expressed as changes to physical habitat and loadings of pollutants contributed to the Columbia River. These changes were caused by residential, commercial, industrial, agricultural, and other land uses for economic development, and are described in the Environmental Baseline (Section 2.4). The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. As such, these effects accrue within this action area, though many are generated from actions that occur upstream. As human population grows, the range of effects described here are likely to intensify.

Resource-based industries (e.g., agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused many long-lasting environmental changes that harmed ESA-

listed species and their critical habitats, such as basin-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (e.g., temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduced their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue to have a depressive effect on aquatic habitat quality in the Columbia River basin and within the action area. Additionally, as human population grows, other non-Federal uses of the river are likely to increase and intensify, such as recreational boating and fishing, and nonpoint stormwater inputs from upland areas. As a result, recovery of aquatic habitat is likely to be slow in most areas, and contemporaneous cumulative effects from basin-wide activities are likely to have a slightly negative impact on population abundance trends and the quality of critical habitat PBFs into the future.

2.6. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.6.1 Salmonids and their Designated Critical Habitat

With the exception of UCR spring-run Chinook salmon and SR sockeye salmon, which are already considered endangered, each species of salmon and steelhead considered in this opinion is at risk of becoming endangered in the foreseeable future. These species are ESA-listed due to a combination of low abundance and productivity, reduced spatial structure, and decreased genetic (and in some cases, life history) diversity. Several species have lost parts of their historical population structure due to human activities, and the remaining populations face limiting factors in existing habitats. Recent adult returns have been substantially below averages for many populations/MPGs. This downturn is associated with a series of marine heatwaves and their lingering effects, which likely contributes to substantially lower ocean survival rates of juvenile salmon and steelhead. We expect that abundance could further decrease, and extinction

risk increase for many ESUs and DPSs due to factors associated with climate change. These include changes in ocean survival; rates of juvenile growth and development; disease resistance; and run timing, spawn timing, etc.

Under the environmental baseline, the fish from the component populations of each ESU and DPS that move through and use the action area will encounter habitat conditions degraded by a modified flow regime; reduced water quality (chemical contamination and elevated summer and fall temperatures); loss of functioning floodplains; and loss of vegetated riparian areas and associated shoreline cover, both in the mainstem and in secondary and side channels; and high predation rates. The USACE routinely dredges sections of the mainstem navigation channel and periodically dredges shoals in nine other secondary and side channel areas. As a result, juvenile LCR and UWR Chinook and CR chum salmon encounter few undisturbed rearing areas in the lower river and less prey is produced that can be used by larger juveniles from the interior as them move through the mainstem. The significance of this degradation is reflected in the limiting factors described in NMFS' recovery plans: insufficient access to floodplain and secondary channels, degraded habitat, loss of rearing space, pollution, and increased predation. These concerns highlight the importance of minimizing entrainment and water quality degradation and protecting any currently functioning rearing and migration habitat.

The proposed action will create additional repeated physical disturbances in the water column during the IWWW, every year at Tongue Point, and in an average of 1 year out of 5 in the other three side channels, over the 25-year term of the proposed action. Entrainment is likely to kill or injure small numbers of subyearling LCR and UWR Chinook and CR chum salmon, sub-adult and adult green sturgeon attracted to the disruption of sediment and the potential suspension of benthic prey, and adult eulachon and their eggs. Water quality will be reduced within the side channels for short periods of time during dredging, but we expect only minor effects on the condition of a few salmonids, green sturgeon, and eulachon and no mortality for any of these species.

Established benthic prey communities will be disrupted, thereby reducing prey availability for subyearling Chinook and chum salmon that rear within these side channels and for larger yearling fish that consume these prey as they migrate in the mainstem. These disruptions are likely to affect the health, growth, and survival of small numbers of subyearling LCR and UWR Chinook and CR chum salmon from multiple populations each year. These affected subyearlings experience increased energetic costs from having to locate alternate prey as well as competing with juveniles that already occupy nearby areas, and experience increased exposure to predators while swimming between feeding areas. Added to the other nine secondary and side channels that the USACE already dredges (NMFS 2012), the disruption of the benthos in these four channels will further limit the availability of this type of juvenile rearing and foraging habitat. These concerns apply to fish rearing in side channel and shoreline areas or moving off the floodplain as described in Roegner et al. (2021). Reduced access to rearing habitat is identified as a limiting factor in the recovery plans for LCR and UWR Chinook salmon (Table 5).

In the context of the status of designated critical habitat and the baseline conditions of the PBF elements that occur within the action area, the functioning of critical habitat for migration and rearing is moderately reduced in the action area under the environmental baseline. The proposed

action will temporarily diminish safe migration and water quality, and prey within migration corridors and rearing areas over its 25-year term and may have longer effects in the case of reduced prey availability. These additional disruptions will continue to limit opportunities for the functioning of the PBFs within the side channels to improve over time.

In summary, we find that the effects of the proposed action are not likely to diminish the conservation value of adult migration corridors for any of the 13 species of salmonid. However, the conservation value of juvenile migration corridors is likely to be diminished for LCR Chinook, UCR spring-run Chinook, UWR Chinook, SR spring/summer Chinook, SR fall Chinook, LCR coho, SR sockeye, UCR steelhead, SRB steelhead, MCR steelhead and UWR steelhead. And the conservation value of rearing areas in the side channels is likely to be diminished for LCR Chinook, UWR Chinook, and CR chum salmon. However, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to appreciably diminish the value of designated critical habitat for the conservation roles of migration or rearing. Accordingly, it is NMFS' opinion that the proposed action is not likely to result in the destruction or adverse modification of the value of the action area to provide migration and rearing sufficient for the conservation of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer Chinook salmon, UWR Chinook salmon, SR fall Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UCR steelhead, SRB steelhead, MCR steelhead, or UWR steelhead.

The habitat disruptions to safe passage, water quality, and prey will be experienced by individual fish of most of the listed salmonid species as juveniles or adults, affecting some populations each year over the 25-year term of the proposed action (annual dredging at Tongue Point), and some less frequently (an average of 1 in every 5 years at Elochoman Slough, Lake River, and Oregon Slough). We expect effects on adults to be limited to relatively small changes in behavior to avoid the dredging and disposal activities and the resulting sediment plumes. However, even during periods of elevated temperatures during late summer and early fall, we do not expect exposure to effects of the proposed action to lead to the injury or mortality of adult migrants.

Juvenile salmonids from all 13 ESUs and DPSs are more likely to have adverse responses to the reduction in availability of benthic prey such as chironomids and amphipods after excavation in the side channels, with an uncertain period before recolonization and the re-establishment of a productive benthic community. We expect that this latter effect, added to bank protection measures that support agriculture and urban development by cutting off the floodplain, plus dredging in nine other side channels in the lower Columbia River (NMFS 2012), further reduce the availability of preferred prey for rearing and migrating fish. These conditions will be maintained by repeated dredging over the 25-year term of the proposed action, causing the displacement of small numbers of juveniles in each side channel, increasing energetic costs and increasing their exposure to predators as they look for alternate sources of prey.

However, even when we consider the current status of the threatened and endangered species and the degraded environmental baseline within the action area, the proposed action's effect in terms of reducing population abundances is likely to be very small, and spread across multiple populations for any of the 13 species. This reduction itself (even annually in the case of dredging at Tongue Point and an average of once every five years in the other three side channels), for 25

years is not expected to affect the abundance, productivity, spatial structure, or diversity of any of the component populations of the ESA-listed species.

The last element in the integration of effects includes a consideration of the cumulative effects anticipated in the action area. When considering the cumulative effects of non-Federal actions, recovery of aquatic habitat from the degraded baseline conditions is likely to be slow in most of the action area, and cumulative effects (from continued or increasing use of the action area) are likely to have a negative impact on habitat conditions, which in turn may cause negative pressure on population abundance trends in the future. We expect the proposed action to have periodic negative effects on rearing conditions for salmonids in the four side channels and that small numbers of juvenile subyearling LCR Chinook salmon and CR chum salmon will be killed by entrainment. However, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer Chinook salmon, UWR Chinook salmon, SR fall Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UCR steelhead, SRB steelhead, MCR steelhead, or UWR steelhead.

2.6.2 Southern DPS of Green Sturgeon and Designated Critical Habitat

The essential PBF of southern green sturgeon critical habitat that would be affected by the proposed action is limited to estuarine areas. The attributes of these sites that would be affected by the proposed action are food resources and water quality. By periodic disruption of the benthos, the proposed action would maintain reduced prey availability in the side channels and potentially in the flow lane, and would cause episodic and temporary reductions in water quality. Based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term changes in the quality or function of the affected PBF. Therefore, it is NMFS' opinion that the proposed action is not likely to alter habitat features in a manner that undermine the conservation role of habitat in the action area.

The abundance of this DPS is estimated at 2,106 spawning adults, but no data are currently available to establish any trends in population growth or decline. The extinction risk for the DPS is driven by the fact that it consists of a single population that spawns in a limited portion of the Sacramento River basin that has been degraded by land use activities and water diversions. The environmental baseline in the lower Columbia River also has been degraded, in this case by the effects of nearby streambank and shoreline development for urbanization and industry, maritime activities, agriculture, forestry, water diversions, and road building and maintenance.

Dredging-related work in the four side channels will overlap with the later portion of the seasonal presence of adult and sub-adult green sturgeon. We expect that, over the next 25 years, a low but undetermined number of these fish will be fatally entrained during hydraulic dredging and may also be killed by the disposal of dredged sediments in the flow lane. Low numbers of individuals may also be exposed to contaminants and/or water with reduced dissolved oxygen concentrations, but no injury or mortality is expected from these brief exposures. Reduced prey

availability in the side channels and potentially along the bottom at the in-water disposal areas may also cause minor impacts on growth in some individuals.

The planned dredging occurs outside of the DPS's spawning habitat in the Sacramento River and will not cause or worsen any of the factors that are believed to limiting the recovery of this species. Although dredging and in-water disposal act to maintain reduced prey availability, especially in the side channels where green sturgeon may congregate and forage during daylight hours, that effect is expected to be very minor. Based on the best available information, the effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to affect viability at the population level. Therefore, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of southern DPS green sturgeon.

2.6.3 Southern DPS of Eulachon

The essential PBFs of southern eulachon critical habitat that would be affected by the proposed action are freshwater and estuarine migration corridors. Dredging and disposal activities will temporarily obstruct or decrease safe passage within, and will temporarily reduce water quality within and downstream of each side channel dredging prism and at the flow lane disposal sites. Based on the best available information, the effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term changes in the quality or function of the affected PBFs. Therefore, it is NMFS' opinion that the proposed action is not likely to impair any physical or biological feature of habitat to the degree that the action area will not support the conservation role for which it was designated for southern DPS eulachon.

The abundance of the southern DPS of eulachon is at very low levels throughout its range, including the population segment in the lower Columbia River. There was an abrupt decline in the numbers of eulachon returning to the Columbia River in the early 1990s. These improved briefly in the early 2000s, and then returned to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013 to 2015 return years, recent poor ocean conditions and the concern that these conditions will persist into the future, suggest that populations may continue to decline.

Under the environmental baseline, conditions at the proposed dredging and disposal sites has been degraded by the effects of nearby streambank and shoreline development and by maritime activities. The baseline has also been degraded by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance. Over the next 25 years, low numbers of early migrating adult eulachon and their eggs may be entrained and killed by dredging and may briefly be exposed to elevated levels of suspended sediment and turbidity, contaminants, and reduced dissolved oxygen that are mobilized during dredging and in-water disposal. No injury or mortality is expected in adults from the brief exposures to changes in water quality. We do not expect the planktonic communities preyed upon by eulachon to be affected by either dredging within the side channels or disposal in the flow lane, except through effects on water quality as described above.

The planned dredging and disposal would not worsen any of the factors that are believed to limit the recovery of this species. Based on the best available information, the effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to affect viability at the population level. Therefore, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to reduce abundance in a manner that would appreciably reduce the productivity, spatial structure, or diversity of the southern DPS eulachon. Therefore, even when considered as an addition to the baseline conditions, and together with the cumulative effects, the proposed action is not likely to appreciably reduce the likelihood of both the survival and recovery of southern DPS Pacific eulachon.

2.7. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer Chinook salmon, UWR Chinook salmon, SR fall Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, UCR steelhead, SRB steelhead, MCR steelhead, UWR steelhead, southern DPS green sturgeon, or southern DPS Pacific eulachon, or destroy or adversely modify their designated critical habitats.

2.8. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.8.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Incidental take in the form of injury or death due to entrainment during dredging and disposal; incidental take in the form of harm from water quality impairments; and incidental take in the form of harm from reduced prey availability.

Due to the repeating nature of the proposed action, the highly variable number of individual fish present at any given time, and difficulties in the ability to observe injury or mortality of fish, which may sink out of site, be consumed by predatory species, or have delayed death outside of the action area. we cannot determine the number of ESA-listed fish that will be killed, injured or otherwise adversely affected. In such circumstances we use a habitat-based surrogate to account for the amount of take, which is called an "extent" of take. The extent of take is causally related to the harm that occurs, and is an observable measure for monitoring, compliance, and re-initiation purposes. These surrogates function as effective reinitiation triggers because they are clear, measurable limits that can be readily monitored for any exceedances, so reinitiation could be triggered at any time during the dredging.

Injury or death from entrainment: the volume of dredged material, the number of days of operation, and frequency of dredging are the best available surrogates for the extent of take of salmonids, green sturgeon, and eulachon from entrainment. This is because entrainment is positively correlated with the volume of material removed and increases with the length and frequency of the operation.

Harm from water quality reductions: The total volume of material to be dredged, the number of days of operation, and the frequency of dredging are the best available surrogates for the extent of take of salmonids, green sturgeon, and eulachon from exposure to elevated levels of suspended sediments and contaminants or low dissolved oxygen. These reductions in water quality would increase with the volume of material removed, and the number of fish exposed would be correlated with the number of days and frequency of dredging.

Harm from reduced prey availability: The total area of material to be dredged and the frequency of dredging are the best available surrogates for the extent of take of salmonids and green sturgeon from reduced prey availability because the lost benthic prey would be positively correlated with these parameters.

Presenting these measurements of take by the areas where they will occur, the extent of take for this action is defined as:

1. Tongue Point
    a. Injury or death of salmonids, green sturgeon, or eulachon by entrainment while dredging up to 800,000 CY per dredging event each year. Each of these dredging events will take up to 137 days and will occur between 1 August and 15 December.
    b. Harm of salmonids, green sturgeon, or eulachon by exposure to degraded water quality while dredging up to 800,000 CY per dredging event each year. Each of these dredging events will take up to 137 days and will occur between 1 August and 15 December.
    c. Harm of salmonids or green sturgeon from reduced availability of benthic prey from dredging up to 75 acres per dredging event each year. Each of these dredging events will take up to 137 days and will occur annually between 1 August and 15 December.

2. Elochoman Slough

a. Injury or death of salmonids, green sturgeon, or eulachon by entrainment while dredging up to 25,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 14 days and will occur between 1 August and 15 December.

b. Harm of salmonids, green sturgeon, or eulachon by exposure to degraded water quality while dredging up to 25,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 14 days and will occur between 1 August and 15 December.

c. Harm of salmonids or green sturgeon from reduced availability of benthic prey from dredging up to 5 acres per dredging event, to occur during no more than 5 times over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 14 days and will occur between 1 August and 15 December.

3. Lake River

a. Injury or death of salmonids, green sturgeon, or eulachon by entrainment while dredging up to 34,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 15 days and will occur between 1 August and 15 December.

b. Harm of salmonids, green sturgeon, or eulachon by exposure to degraded water quality while dredging up to 34,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 15 days and will occur between 1 August and 15 December.

c. Harm of salmonids or green sturgeon from reduced availability of benthic prey from dredging up to 5 acres per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action and no more frequently than once every three years. Each of these dredging events will take up to 15 days and will occur between 1 August and 15 December.

4. Oregon Slough

a. Injury or death of salmonids, green sturgeon, or eulachon by entrainment while dredging up to 600,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action. Each of these dredging events will take up to 137 days and will occur between 1 August and 15 December.

b. Harm of salmonids, green sturgeon, or eulachon by exposure to degraded water quality while dredging up to 600,000 CY per dredging event, to occur during no more than 5 years over the 25-year term of the proposed action. Each of these dredging events will take up to 137 days and will occur between 1 August and 15 December.

c. Harm of salmonids or green sturgeon from reduced availability of benthic prey from dredging up to 50 acres per dredging event, to occur during no more than 5

years over the 25-year term of the proposed action. Each of these dredging events will take up to 105 days and will occur between 1 August and 15 December.

Dredging operations that are outside of the IWWW will increase the likelihood of more listed individuals being exposed to entrainment and reduced water quality. The volume and area to be dredged, the frequency of dredging, the number of days of dredging per event, and dredging outside of the IWWW are each thresholds for reinitiating consultation. Exceeding any of these indicators for extent of take will trigger the reinitiation provisions of this opinion.

2.8.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPM) are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02). The USACE shall require any permittee or contractor performing the work described in this document to:

1. Minimize entrainment during dredging and in-water disposal;
2. Minimize harm from degradation of water quality;
3. Complete an annual monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USACE and its contractors must comply with them in order to implement the RPMs (50 CFR 402.14). The USACE has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement RPM 1, minimize entrainment during dredging and in-water disposal:
    a. Apply these terms and conditions to its own actions when carrying out FNC O&M work, and to the actions of any contractors hired by the USACE for that purpose.
    b. Complete all dredging and in-water disposal during the IWWW of 1 August through 15 December.

c. Require dredge operators to use best available technologies to ensure that dredging and disposal activities are confined to areas within the current official boundaries of the Federal channels and in-water disposal sites.
d. Require dredge operators to limit the dredge prism and the volume of removed sediment to the minimum area necessary to achieve project goals.
e. Require mechanical dredge operators to ensure that the clamshell or backhoe bucket is lowered to the bottom as slowly as feasible to allow ESA-listed fish to escape.
f. Require operators to keep dragheads or cutterheads at, or buried in the substrate when suction dredge pumps are working, and no more than 3.0 feet above the substrate for the minimum time needed to clean or purge the dragheads.
g. Require hydraulic dredge operators to minimize pump operations when dragheads or cutterheads are above the substrate.
h. Discharge material from a pipeline dredge at depths at least 20.0 feet below the surface of the water.

2. The following terms and conditions implement RPM 2, minimize effects on water quality:
a. Apply these terms and conditions to its own actions when carrying out FNC O&M work, and to the actions of any contractor hired by the USACE for that purpose.
b. Require dredge operators to comply with the current ODEQ or WDOE water quality monitoring plan(s) issued for the site.
c. Require dredge operators to monitor turbidity and comply with the following:
i. A properly and regularly calibrated turbidimeter is recommended, but visual turbidity gauging is acceptable.
ii. Locations of turbidity samples or observations must be identified and described in the USACE's water quality monitoring plans. At a minimum, monitoring must take place at the following distance, and within any visible plumes:
1. Dredging and in-water (flow lane) disposal activities - Up-current (background) and 900 feet down current from the point of discharge (bucket, backhoe, hopper, or pipeline), and no more than 150 feet laterally from the vessel.
2. If a meter is used, the USACE must identify a depth between 10 and 20 feet, or at mid-depth in water less than 20 feet in depth, to collect all sample readings.
iii. Monitoring must occur when dredging and disposal is being conducted and must meet the following requirements:
1. Active dredging–once a day during a flood tide and once a day during an ebb tide.
2. In-water disposal–once a day during a flood tide and once during an ebb tide.
3. Background turbidity NTU or observation, location tidal stage, and time must be recorded before monitoring down-current.
iv. The USACE and any dredging contractors, shall ensure turbidity in the side channels remains at background levels 900 feet downstream from the

point of disturbance during dredging operations by adhering to the measure to monitor turbidity and respond to exceedances as proposed in the project description. This shall include monitoring and compliance reporting of turbidity levels observed during dredging operations as required by the States of Oregon and Washington's CWA section 401 certifications.

d. Require dredge operators to monitor dissolved oxygen concentrations and comply with the following:
   i. Sample dissolved oxygen at the mid-point of the water column, 300 feet down current from the dredge and in the turbidity plume if visible.
   ii. Collect samples during daylight hours during active dredging at the following frequency: once a day during a flood tide and once a day during an ebb tide.
   iii. Sample dissolved oxygen concentrations with a dissolved oxygen meter that is properly and regularly calibrated according to the owner's manual.
   iv. Dredging shall not begin if dissolved oxygen concentrations at the dredge site are less than 6.5 mg/l.
   v. If the level of dissolved oxygen measured is below 8 mg/l, the monitoring frequency must increase to every four hours until the level returns above 8 mg/l.
   vi. If the measured level of dissolved oxygen is below 6.5 mg/l, or if distressed or dead fish are observed in or beside the dredge, the activity must be stopped until the level returns to above 6.5 mg/l.
   vii. Restricted visibility: During periods of restricted visibility that could cause an unsafe condition, the Corps may postpone required compliance monitoring until conditions improve if confirmation is made by a third party, such as the Coast Guard Watch Stander or the National Weather Service, that the visibility in the area to be monitored is considered to be restricted and is unsafe to conduct the required monitoring. If monitoring is postponed due to restricted visibility and unsafe conditions, the weather condition, time of determination, and verification route must be recorded. Regular monitoring must resume once the visibility returns to safe levels.

3. The following terms and conditions implement RPM 3, complete an annual monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.
   a. Require dredging operators to maintain and submit dredging logs to verify that all take indicators are monitored and reported. Minimally, logs should include: (1) type of dredging vessel (mechanical, hydraulic pipeline, hopper); (2) vessel position relative to the side channel while dredging, or certification that dredging was within the authorized channel, and the methods used to confirm vessel location; volumes of sediment removed/disposed; (4) extent of turbidity plumes, compliance with the Water Quality Monitoring Plan; and (5) all observed incidents of entrainment of listed species.

b. Establish procedures for the submission of observer and dredge operator logs, and other materials, to the appropriate USACE office, which will draft and submit annual monitoring reports.

c. Establish procedures for reporting take and annual monitoring reports, along with results from any DMMP sediment testing of material from the four side channels, to include any exceedances of turbidity or dissolved oxygen compliance levels and active or passive methods used to re-attain compliance, along with results from any sediment testing of material from the four side channels.

d. Submit email take reports to:
projectsreports.wcr@noaa.gov
Include WCRO-2020-02918 in the subject line.

e. Submit annual monitoring reports for the preceding calendar year by April 1st to NMFS at the following address:
projectreports.wcr@noaa.gov
Attn: WCR-2020-02918

2.9. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the USACE:

1. Regularly require use of floating silt curtains around the in-water dredge area or the use of an environmental bucket for mechanical dredging in the side channels to minimize the dispersion of suspended sediment, thereby reducing the spread of high levels of suspended sediments into adjacent areas.

2. Narrow the conditions under which maintenance dredging is allowed so that benthic habitat can more completely recover between dredge occurrences. For example, dredging would not be allowed without a showing that sediments are accumulating or have accumulated to an extent that they threaten to impair navigation or berthing.

3. Narrow the IWWW to reduce the duration of activities with risk of entrainment and reduced water quality.

4. Consult with NMFS under Section 7(a)(1) to create a mitigation bank to offset impacts associated with the regular exercise of its authority allowing impacts to the nation's waters.

5. Monitor and evaluate the ecological importance of these areas to the viability and recovery of the Columbia River subpopulation of Pacific eulachon to promote the conservation of the species and address uncertainties regarding the effects of dredging in side channels on spawning and incubation in the lower Columbia River.

6. Conduct before and after macro-benthic community structure analysis in the Elochoman Slough and Lake River dredge prisms to determine the benthic community response (taxa, diversity, richness, and abundance) at 1, 3, and 6 months following dredging. Work with NMFS to identify additional opportunities for this type of monitoring for future side channel dredging projects in the lower Columbia River.

Please notify NMFS if the USACE carries out these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.10. Reinitiation of Consultation

This concludes formal consultation for Federal Navigation Channel Operations and Maintenance Dredging: Tongue Point, Clatsop County, Oregon; Elochoman Slough, Wahkiakum County, Washington; Lake River, Clark County, Washington; and Oregon Slough, Multnomah County, Oregon.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on

EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by the USACE and that conducted by NMFS, and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council [PFMC] 2005) and, coastal pelagic species (CPS) (PFMC 1998), Pacific Coast salmon (PFMC 2014); and highly migratory species (PFMC 2007) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce. In this case, NMFS concluded the proposed action would not adversely affect EFH for coastal pelagic species and highly migratory species. Thus, consultation under the MSA is not required for these habitats.

3.1. Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in the Introduction section to the biological opinion. The action area includes areas designated EFH for various life-history stages of two Pacific Coast salmon species: Chinook salmon and coho salmon (PFMC 2014). Habitat areas of particular concern (HAPC) within the action area include estuaries and channel habitat (PFMC 2005, 2014).

Freshwater EFH for Pacific Coast salmon (Chinook and coho) consists of four major components: 1) spawning and incubation, 2) juvenile rearing, 3) juvenile migration corridors, and 4) adult migration corridors and holding habitat, and overall, can include any habitat currently or historically occupied within Washington, Oregon, and Idaho. The important components of Pacific salmon marine EFH are: 1) estuarine rearing, 2) ocean rearing; and 3) juvenile and adult migration. The only marine EFH habitat for salmon found within the action area for this consultation is the estuarine habitat in the lower Columbia River. Estuarine EFH for Chinook and coho salmon found within the action area for this consultation includes juvenile rearing, juvenile migration corridors, and adult migration corridors and holding habitat (PFMC 2014). In addition, estuaries provide protected, nutrient-rich, and biologically productive habitat for groundfish (PFMC 2020).

3.2. Adverse Effects on Essential Fish Habitat

As described in detail in the preceding opinion, the proposed action is expected to affect EFH components in four side channels and in the mainstem Columbia River, including the saltwater portion of the estuary. We conclude that the proposed action will have the following adverse effects on EFH designated for Pacific Coast Salmon:

1. The proposed dredging and disposal activities will temporarily reduce water quality (suspended sediments and the mobilization of contaminants and potentially, low dissolved oxygen).

2. The proposed dredging in the side channels will reduce the quantity and quality of benthic prey communities.

The proposed action will have the following adverse effects on EFH designated for Pacific Coast Groundfish:

1. The proposed dredging and disposal activities will temporarily reduce water quality (suspended sediments and the mobilization of contaminants and potentially, low dissolved oxygen).
2. The proposed dredging activities will affect sediment characteristics in the side channels for uncertain periods of time.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

To minimize the effects of the proposed dredging and disposal activities on Pacific Coast Salmon and Pacific Coast Groundfish EFH, including the estuaries HPAC, the USACE should:

(1) To minimize water quality impacts, limit the dispersion of suspended sediment from a side channel while using a clamshell or backhoe dredge, by regularly requiring use of floating silt curtains around the in-water dredge area or the use of an environmental bucket for mechanical dredging if turbidity levels are exceeded.

(2) To reduce effects on the benthic prey eaten by salmonids and juvenile groundfish such as flatfishes, conduct before and after macro-benthic community structure analysis in areas less than 20-feet deep within the Elochoman Slough and Lake River dredge prisms to determine the benthic community response (taxa, diversity, richness, and abundance) at 1, 3, and 6 months following dredging. Work with NMFS to identify opportunities for this type of monitoring for future side channel dredging projects. Based on findings, adjust the frequency of dredging to accommodate prey recolonization rates.

(3) To reduce effects on the benthic prey community and sediment characteristics, allow maintenance dredging to occur within the 25-year term of the proposed action only on a showing that sediments have accumulated or are accumulating in a manner that threatens to impair navigation or berthing.

(4) Consult with NMFS under Section 7(a)(1) to create a mitigation bank to offset impacts associated with the regular exercise of its authority allowing impacts to the nation's waters.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in Section 3.2, above, approximately 105 acres of designated EFH and HAPC for Pacific Coast salmon and groundfish.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USACE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. Supplemental Consultation

The USACE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the proposed action:

1. Regularly require use of floating silt curtains around the in-water dredge area or the use of an environmental bucket for mechanical dredging in the side channels to minimize the dispersion of suspended sediment, thereby reducing the spread of high levels of suspended sediments into adjacent areas.

2. Narrow the conditions under which maintenance dredging is allowed so that benthic habitat can more completely recover between dredge occurrences. For example, dredging would not be allowed without a showing that sediments are accumulating or have accumulated to an extent that they threaten to impair navigation or berthing.

3. Narrow the IWWW to reduce the duration of activities with risk of entrainment and reduced water quality.

4. Consult with NMFS under Section 7(a)(1) to create a mitigation bank to offset impacts associated with the regular exercise of its authority allowing impacts to the nation's waters.

5. Monitor and evaluate the ecological importance of these areas to the viability and recovery of the Columbia River subpopulation of Pacific eulachon to promote the conservation of the species and address uncertainties regarding the effects of dredging in side channels on spawning and incubation in the lower Columbia River.

6. Conduct before and after macro-benthic community structure analysis in the Elochoman Slough and Lake River dredge prisms to determine the benthic community response (taxa, diversity, richness, and abundance) at 1, 3, and 6 months following dredging. Work with NMFS to identify additional opportunities for this type of monitoring for future side channel dredging projects in the lower Columbia River.

The USACE must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

5.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are the U.S. Army Corps of Engineers and any contractors it uses for dredging and disposal activities, the Oregon Department of Environmental Quality, and the Washington State Department of Ecology. Other interested users could include the Cowlitz Indian Tribe, the Nez Perce Tribe, Ports, recreational and commercial vessel owners, and recreational or commercial fishers. Individual copies of this opinion were provided to the USACE, the Cowlitz Indian Tribe, and the Nez Perce Tribe. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

5.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

5.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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APPENDIX

Table A-1. Presence of ESA-listed fish species in the lower Columbia River by life stage. Work window months are highlighted in orange.

			=present				= relatively abundant								= peak occurrence									
Species	**Life Stage**	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Eulachon																									
Southern DPS	Adult migr. & holding[1, 2]																								
	Adult spawning[2]																								
	Egg incubation[3]																								
	Larvae emigration																								
Green Sturgeon																									
Southern DPS	Sub-adult and adult foraging																								
Salmon: Chinook																									
Lower Columbia	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper Columbia	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper Willamette	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Snake River - Spring/Summer	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Snake River - Fall	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								

			=present				= relatively abundant				= peak occurrence														
Species	**Life Stage**	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Salmon: Chum																									
Columbia River	Adult migr. & holding																								
River	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration[4]																								
Salmon: Coho																									
Lower	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Salmon: Sockeye																									
Snake River	Adult migr. & holding																								
	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Steelhead																									
Lower	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing[5]																								
	Juvenile emigration[6]																								
Middle	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper	Adult migr. & holding																								
Columbia	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								
Upper	Adult migr. & holding																								
Willamette	Adult spawning																								
	Eggs & pre-emergence																								
	Juvenile rearing																								
	Juvenile emigration																								

			=present						= relatively abundant								= peak occurrence							
Species	**Life Stage**	**Jan**		**Feb**		**Mar**		**Apr**		**May**		**Jun**		**Jul**		**Aug**		**Sep**		**Oct**		**Nov**		**Dec**	
Snake River	Adult migr. & holding																							
	Adult spawning																							
	Eggs & pre-emergence																							
	Juvenile rearing																							
	Juvenile emigration																							

[1] Eulachon Status Review Update, 20 January 2010. Available at: http://www.nwr.noaa.gov/Other-Marine-Species/upload/eulachon-review-update.pdf

[2] Personal communication. Conversation between WDFW (Brad James, Olaf Langness, and Steve West), ODFW (Tom Rien), and NMFS (Rob Markle, Bridgette Lohrman) regarding eulachon presence in the Columbia River. June 23, 2009.

[3] Eulachon egg incubation estimated relative to spawning timing and 20 to 40 day incubation period.

[4] Carter, J. A., G. A. McMichael, I. D. Welch, R. A. Harnish, and B. J. Bellgraph. 2009. Seasonal juvenile salmonid presence and migratory behavior in the lower Columbia River. PNNL-18246, Pacific Northwest National Laboratory, Richland, WA. April, 2009.

[5] Sol, S. Y., B. Anulacion, D. P. Lomax, P. Chittaro, P. Moran, G. M. Ylitalo, A. Hanson, C. Corbett, and L. L. Johnson. 2021. Juvenile salmon ecology in tidal freshwater wetlands in the Lower Columbia River Estuary. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-162. doi.org/10.25923/2bfz-ah24

[6] NMFS (National Marine Fisheries Service). 2013. ESA Recovery Plan for Lower Columbia River coho salmon, Lower Columbia River Chinook salmon, Columbia River Chum salmon, and Lower Columbia River steelhead. National Marine Fisheries Service, Northwest Region. June, 2013.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No.:

WCRO-2022-02520

February 16, 2023

Amy Gibbons
Chief, Environmental Resources Branch
Department of the Army
U.S. Army Corps of Engineers, Portland District
PO Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower Columbia River Federal Navigation Channel Dredged Material Transfer Sites (HUC170800060500, 170800030900, 170800030200)

Dear Ms. Gibbons:

This letter responds to the U.S. Army Corps of Engineers' (USACE) September 29, 2022, request for initiation of consultation with the National Marine Fisheries Service (NMFS) pursuant to Section 7 of the Endangered Species Act (ESA) for the subject action. Your request qualified for our expedited review and analysis because it met our screening criteria and contained all required information on, and analysis of, your proposed action and its potential effects to listed species and designated critical habitat.

We note here that you did not request to re-initiate consultation on "Columbia River Navigation Channel Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington" (NWR-2011-02095) based on this proposed action. The proposed action here is a modification to one existing transfer site, and the identification of six new transfer sites, which will temporarily store sediments dredged for the purpose of maintaining the Federal Navigation Channel (FNC) of the Columbia River. We note here that the USACE and NMFS are in Fish and Wildlife Coordination Act consultation on future management of Columbia River dredge sediment, in anticipation of an Environmental Impact Statement (EIS) that will evaluate a 20-year plan for disposal of dredged materials. NMFS will prepare a separate biological opinion on the effects of the 20-year dredge material management plan on ESA listed species once a preferred alternative is identified.

The current consultation's proposed transfer sites will exist contemporaneously with the existing maintenance dredging, and with the future 20-year dredge-disposal plan. The anticipated duration of these transfer sites is 25 years (see BA at page 1). This consultation focuses specifically on the effects of the 7 transfer sites.

Because the proposed action does not modify dredging operations and is regarding transfer sites for temporary placement only, rather than re-initiate NWR 2011-02095 for this proposed action, we recommended that the USACE prepare a BA that focused on 1) any changes in the status of species or critical habitat since 2012 and 2) that examined the effects of the proposed action as additional dredging and flow lane disposal as analyzed in NWR-2011-02095 because the transfer sites proposed will all be located in flow lanes where velocities are high, and in areas that are deeper in all cases than 20 feet and in most cases deeper than 30 feet.

We reviewed the USACE's consultation request and related initiation package. Where relevant, we have adopted the information and analyses you have provided and/or referenced but only after our independent, science-based evaluation confirmed they meet our regulatory and scientific standards. We adopt by reference:

- Biological Assessment (BA) Section 1.2.2.7 (Pre-Consultation Meetings and Correspondence) for Biological Opinion (BiOp) Section 1.2 (Consultation History).
- BA Section 1 (Federal Action Overview), Section 1.2.1 (Authority) and Section 3 (Proposed Action) for BiOp Section 1.3 (Proposed Federal Action).
- BA Section 1.4 (Listed Species and Designated Critical Habitat within the Action Area), Section 2.4 (Condition of Listed Species in the Action Area) and Section 2.5 (Condition of Critical Habitat in the Action Area) for BiOp Section 2.2 (Rangewide Status of the Species and Critical Habitat).
- BA Section 1.1 (Federal Action Location) and Section 1.3 (Action Area) for BiOp Section 2.3 (Action Area)
- BA Section 2 (Environmental Baseline) for BiOp Section 2.4 (Environmental Baseline)
- BA Section 4 (Effects of the Proposed Action) for BiOp Section 2.5 Effects of the Action

Background and Consultation History. BA Section 1.2.2.7 (Pre-Consultation Meetings and Correspondence) on pages 12 and 13 explains how the USACE and NMFS conducted the pre-consultation. Preconsultation between the USACE and NMFS occurred in 2022 including during a portion of the 2022 in-water work window for LCR FNC dredging. The USACE and NMFS agreed that the addition of transfer sites required a formal consultation. On August 29, 2022, the USACE sent NMFS the BA referenced here, and requested formal consultation. The USACE also requested that NMFS complete its Biological Opinion by September 30, 2022 so that transfer sites could be used in 2022. NMFS did not have staff to meet this deadline. The USACE then rescinded their request for formal consultation and requested NMFS technical assistance on use for one year of a single transfer site at river mile 60 that was necessary to complete 2022 FNC dredging. We replied with an email on September 28, 2022 agreeing to the use of this site in 2022. The USACE resubmitted their request for formal consultation on the continued use of the single transfer site, along with the six proposed transfer sites, for a period of 25 years, on September 29, 2022 and we initiated consultation on that date.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California

issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

Proposed Action. The USACE proposes to establish six new transfer sites and modify one existing transfer site. The details of the site selection criteria, construction and use of transfer sites are described in BA Section 3 on pages 32 through 39 with best management practices (BMP) to minimize the effects of transfer sites on ESA listed species on pages 39 through 42. Transfer sites are large (16-28.8 acre) areas in the flow lane adjacent to the FNC where sediment dredged from the channel is stored until a pipeline dredge is available to move it to an upland or shoreline disposal site. Transfer sites are not proposed or analyzed in NWR 2011-02095. The USACE began using a transfer site at RM 43 (Puget Island) in 2013 and a transfer site at river mile 68 (Howard Island) in 2015. In both cases NMFS concurred that they did not alter the effects analysis in NWR 2011-02095 because their effects are essentially the same as the effects dredging and flow lane disposal that are analyzed in the BiOp.

Status of Species and Critical Habitat. We examined the status of each species that would be adversely affected by the proposed action to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. We also examined the condition of critical habitat throughout the designated area and discuss the function of the physical or biological features essential to the conservation of the species that create the conservation value of that habitat. The BA lists the species affected by the proposed action in Table 2 on pages 13 and 14. The BA also summarizes the life history and migration timing of adults and juveniles of each species in Section 2.4 on pages 22 to 31. These summaries include basic life history descriptions for each species including adult and juvenile migration timing relative to the proposed action in water work window and the diets of juveniles migrating through the action area. They also include the most current risk assessment for each species at the time the BA was prepared. We supplement the information in this table with our most up to date summaries of the recovery status and limiting factors for each species in Table 1 below. Readers of NWR 2011-02095 should replace the status of species and critical habitat sections of that document with the following summary of the status of species and critical habitat.

Table 1. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River (LCR) Chinook salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022a; Ford 2022	This ESU comprises 32 independent populations. Relative to baseline VSP levels identified in the recovery plan (Dornbusch 2013), there has been an overall improvement in the status of a number of fall-run populations although most are still far from the recovery plan goals; Spring-run Chinook salmon populations in this ESU are generally unchanged; most of the populations are at a "high" or "very high" risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Overall, we conclude that the viability of the Lower Columbia River Chinook salmon ESU has increased somewhat since 2016, although the ESU remains at "moderate" risk of extinction	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant
Upper Columbia River (UCR) spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NMFS 2022b; Ford 2022	This ESU comprises four independent populations. Current estimates of natural-origin spawner abundance decreased substantially relative to the levels observed in the prior review for all three extant populations. Productivities also continued to be very low, and both abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Salmon Recovery Plan for all three populations. Based on the information available for this review, the Upper Columbia River spring-run Chinook salmon ESU remains at high risk, with viability largely unchanged since 2016. .	□Effects related to hydropower system in the mainstem Columbia River □Degraded freshwater habitat □Degraded estuarine and nearshore marine habitat □Hatchery-related effects □Persistence of non-native (exotic) fish species □Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River (SR) spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NMFS 2022c; Ford 2022	This ESU comprises 28 extant and four extirpated populations. There have been improvements in abundance/productivity in several populations relative to the time of listing, but the majority of populations experienced sharp declines in abundance in the recent five-year period Overall, at this time we conclude that the Snake River spring/ summer-run Chinook salmon ESU continues to be at moderate-to-high risk.	Degraded freshwater habitat Effects related to the hydropower system in the mainstem Columbia River, Altered flows and degraded water quality Harvest-related effects Predation
Upper Willamette River (UWR) Chinook salmon	Threatened 6/28/05	NMFS 2011	NMFS 2016; Ford 2022	This ESU comprises seven populations. Abundance levels for all but Clackamas River DIP remain well below their recovery goals. Overall, there has likely been a declining trend in the viability of the Upper Willamette River Chinook salmon ESU since the last review. The magnitude of this change is not sufficient to suggest a change in risk category, however, so the Upper Willamette River Chinook salmon ESU remains at "moderate" risk of extinction.	Degraded freshwater habitat Degraded water quality Increased disease incidence Altered stream flows Reduced access to spawning and rearing habitats Altered food web due to reduced inputs of microdetritus Predation by native and non-native species, including hatchery fish Competition related to introduced salmon and steelhead Altered population traits due to fisheries and bycatch Degraded floodplain connectivity and function Harvest-related effects Loss of access to historical habitat above Hells Canyon and other Snake River dams Impacts from mainstem Columbia River and Snake River hydropower systems Hatchery-related effects Degraded estuarine and nearshore habitat.
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NMFS 2022d; Ford 2022	This ESU has one extant population The single extant population in the ESU is currently meeting the criteria for a rating of "viable" developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Complex (NMFS 2017b). The Snake River fall-run Chinook salmon ESU therefore is considered to be at a moderate-to-low risk of extinction.	

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Columbia River (CR) chum salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022a; Ford 2022	This species has 17 populations divided into 3 MPGs. 3 populations exceed the recovery goals established in the recovery plan (Dornbusch 2013). The remaining populations have unknown abundances. Abundances for these populations are assumed to be at or near zero. The viability of this ESU is relatively unchanged since the last review (moderate to high risk), and the improvements in some populations do not warrant a change in risk category, especially given the uncertainty regarding climatic effects in the near future.	Degraded estuarine and nearshore marine habitat Degraded freshwater habitat Degraded stream flow as a result of hydropower and water supply operations Reduced water quality Current or potential predation An altered flow regime and Columbia River plume Reduced access to off-channel rearing habitat in the lower Columbia River Reduced productivity resulting from sediment and nutrient-related changes in the estuary Juvenile fish wake strandings Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NMFS 2022a; Ford 2022	Of the 24 populations that make up this ESUOnly six of the 23 populations for which we have data appear to be above their recovery goals. Overall abundance trends for the Lower Columbia River coho salmon ESU are generally negative. Natural spawner and total abundances have decreased in almost all DIPs, and Coastal and Gorge MPG populations are all at low levels, with significant numbers of hatchery-origin coho salmon on the spawning grounds. Improvements in spatial structure and diversity have been slight, and overshadowed by declines in abundance and productivity. For individual populations, the risk of extinction spans the full range, from “low” to “very high.” Overall, the Lower Columbia River coho salmon ESU remains at “moderate” risk, and viability is largely unchanged since 2016.	Degraded estuarine and near-shore marine habitat Fish passage barriers Degraded freshwater habitat: Hatchery-related effects Harvest-related effects An altered flow regime and Columbia River plume Reduced access to off-channel rearing habitat in the lower Columbia River Reduced productivity resulting from sediment and nutrient-related changes in the estuary Juvenile fish wake strandings Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NMFS 2022f; Ford 2022	This single population ESU is at remains at "extremely high risk," although there has been substantial progress on the first phase of the proposed recovery approach—developing a hatchery-based program to amplify and conserve the stock to facilitate reintroductions. Current climate change modeling supports the "extremely high risk" rating with the potential for extirpation in the near future (Crozier et al. 2020). The viability of the Snake River sockeye salmon ESU therefore has likely declined since the time of the prior review, and the extinction risk category remains "high."	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NMFS 2022b; Ford 2022	This DPS comprises four independent populations. The most recent estimates (five year geometric mean) of total and natural-origin spawner abundance have declined since the last report, largely erasing gains observed over the past two decades for all four populations (Figure 12, Table 6). Recent declines are persistent and large enough to result in small, but negative 15-year trends in abundance for all four populations. The overall Upper Columbia River steelhead DPS viability remains largely unchanged from the prior review, and the DPS is at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NMFS 2022a; Ford 2022	This DPS comprises 23 historical populations, 17 winter-run populations and 6 summer-run populations. 10 are nominally at or above the goals set in the recovery plan (Dornbusch 2013); however, it should be noted that many of these abundance estimates do not distinguish between natural- and hatchery- origin spawners. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk.,	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NMFS 2016; Ford 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. Although the recent magnitude of these declines is relatively moderate, continued declines would be a cause for concern. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk. Overall, the Upper Willamette River steelhead DPS is therefore at "moderate-to-high" risk, with a declining viability trend.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NMFS 2022h; Ford 2022	This DPS comprises 17 extant populations. Recent (five-year) returns are declining across all populations, the declines are from relatively high returns in the previous five-to-ten year interval, so the longer-term risk metrics that are meant to buffer against short-period changes in abundance and productivity remain unchanged. The Middle Columbia River steelhead DPS does not currently meet the viability criteria described in the Middle Columbia River steelhead recovery plan.	Degraded freshwater habitat Mainstem Columbia River hydropower-related impacts Degraded estuarine and nearshore marine habitat Hatchery-related effects Harvest-related effects Effects of predation, competition, and disease
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NMFS 2022i; Ford 2022	This DPS comprises 24 populations. Based on the updated viability information available for this review, all five MPGs are not meeting the specific objectives in the draft recovery plan, and the viability of many individual populations remains uncertain. Of particular note, the updated, population-level abundance estimates have made very clear the recent (last five years) sharp declines that are extremely worrisome, were they to continue.	Adverse effects related to the mainstem Columbia River hydropower system Impaired tributary fish passage Degraded freshwater habitat Increased water temperature Harvest-related effects, particularly for B-run steelhead Predation Genetic diversity effects from out-of-population hatchery releases

The BA provides a brief summary of the critical habitat of each listed species in the action area in Section 2.5 on pages 31 and 32. We supplement this information with descriptions of the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 2, below.

Table 2. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

We also supplement the status of species and critical habitat information provided in the BA with the following assessment of the effects of climate change on the species and critical habitat affected by the proposed action. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC, 2022)). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020). Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier, 2011, 2012, 2013, 2014, 2015, 2016, 2017; Crozier and Siegel, 2018; Siegel and Crozier, 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S.

They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification

and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Burke et al., 2013; Holsman et al., 2012). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al., 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al., 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a

complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al., 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon

historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al., 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al., 2019; Munsch et al., 2022).

Action Area. "Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). BA Section 1.1 on pages 2 through 8 describes the location and dimensions of the six proposed new transfer sites and provides google map images of each transfer site. BA Figure 1 is reproduced below to help orient the reader to the several locations that comprise the action area. The transfer sites are discrete locations but BA section 1.3 on page 13 makes it clear that the action area is the continuous FNC and flow lane from river mile 28 to river mile 101.

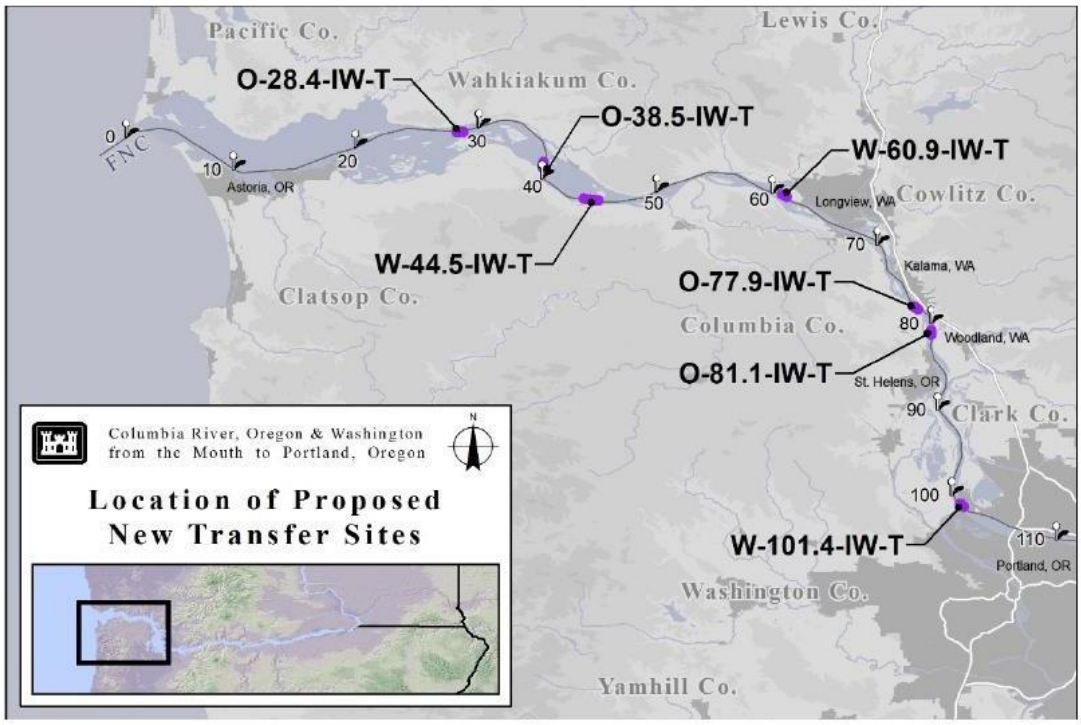


Figure 1. Map of proposed transfer sites (Site W-44.5-IW-T is existing).

Environmental Baseline. The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State

or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The BA provides a very thorough description of the environmental baseline in Section 2 from pages 14 through 22 that establishes the context for all of the stressors in the effects analysis including; vessel and dredging noise, sediment quality, channel bathymetry, water quality, bedload, benthic habitat, primary production, listed species prey, listed species predators, and aquatic vegetation. In Section 2.4 on pages 22 through 31 , the BA combines Status of the Species information described above with information about juvenile rearing and migration times in the action area. In Section 2.5 on pages 31 and 32, the BA lists the critical habitat physical and biological features (PBFs) in the action area for salmon and steelhead. We add here that every population of every species covered by this opinion migrates through and forages in all or part of the action area. Salmon and steelhead migrate through the action area as both adults and juveniles (smolts).

Effects of the Action. Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

The biological assessment provides a detailed discussion and comprehensive assessment and review of the effects of the proposed action and relies on effects that were analyzed in by NMFS in NWR 2011-02095 (see for example BA Section 4 from page 43 to 48). NMFS considers its previous effects analysis to provide an accurate presentation of the pathways of exposure to project effects, and response of species and habitat, to be relevant and valid, and thus it is adopted here (50 CFR 402.14(h)(3)). NMFS has evaluated this section and after our independent, science-based evaluation determined it meets our regulatory and scientific standards.

We supplement the analysis in the BA as follows. The analysis of NWR 2011-02095, which informs the BA for this consultation, quantifies the effects of dredging to salmon, steelhead, eulachon and green sturgeon in terms of the spatial fraction of Columbia River deep water (>20 feet) habitat that is disrupted by dredging. The proposed action adds deep water riverbed surface area to the numerator, making the calculations in NWR 2011-02095 incorrect starting in the 2023 in water work window and going forward. In ***Table 3*** we add the area of the proposed transfer sites to the disturbed benthic surface areas in NWR 2012-02095 Table 36 (page 93) (and Table A2-13 on page A2-11) for salmon and steelhead smolts that utilize deep water habitat.

Table 3. Estimated Lower Columbia Smolt Migratory Corridor (estimated smolt habitat equals the sum of the flowlane used for placement + the flowlane used for transfer sites plus the flowlane not used for placement) from 2023 going forward in time.

River segment (RM_i-RM_{i+1}, miles)	2023 Total transfer site area (acres)	Area of navigation channel that needs dredging to maintain depth (acres)	2011 Area of flow lane deeper than -20 feet contour dused for placement (acres)	Area of navigation channel that does not need dredging to maintain depth (acres)	Area of flow land deeper than -20 feet contour not used for placement (acres)	Total estimated smolt migratory habitat (acres)	2011 Estimated percent habitat potentially affected	2023 Estimated percent habitat potentially affected	Percent change from 2011 Estimate
1 (3-25.2)	0	1,208	138	1,790	23,382	23,521	5.7	5.7	0
2 (25.2-48.2)	92.1	885	358	1,110	8,631	8,989	13.8	14.9	+1.1
3 (48.2-67.2)	24.2	438	330	1,270	4,870	4,200	14.8	15.2	+0.4
4 (67.2-83.8)	54.6	412	248	1,222	4,393	4,641	14.2	15.4	+1.2
5 (83.8-97.8	0	315	193	955	3,158	3,351	15.2.	15.2	0
6 (97.8-105.3)	27.5	42	28	656	2,113	2,141	3.3	4.6	+1.3
7 (105.3-125.3)	0	81	110	910	3,200	3,310	5.8	5.8	0
8 (125.3-136.4)	0	12	27	437	2,123	466	8.4	8.4	0
9 (136.4-145.3)	0	1	0	330	1,220	2,330	0	0	0

The proposed transfer sites add up to 1.3 percent to the area of the Columbia River streambed surface that is affected by dredging and dredge material management. We've thoroughly reviewed the effects analysis in NWR 2011-02095 and can find no instance where that prior analysis, or the BA that references it, would be changed by this small increase in streambed surface disturbance.

Cumulative Effects. "Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. BA Section 4.7 on pages 48 to 40 describe cumulative effects in the action area.

Integration and Synthesis. The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action to the environmental baseline and the cumulative effects, taking into account the status of the species and critical habitat, to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

ESA listed salmon and steelhead listed in Table 1 are at a low level of persistence and moderate risk of extinction. The BA Section 2.4 makes it clear that individuals from all Table 1 species are likely to migrate into or near the action area and some salmon species are likely to rear and forage in the action area for weeks to months. BA Section 2 makes it clear that all fish in the action area will encounter habitat conditions that have been degraded by human activity. BA Section 4.1 shows that the FNC maintenance dredging will result in direct effects to a few juvenile salmon and steelhead such as entrainment in dredge equipment or dredge material disposal plumes and exposure to suspended sediment that will result in injury or death. Since the proposed action allows the USACE to essentially dredge the same material twice, once from the FNC and a second time from the transfer site, it increases the likelihood of exposure to entrainment and suspended sediment. However, following the effects analysis protocol in NWR 2011-02095, we find that this increase in additional exposure is much too small to change the conclusions of NWR 2011-02095, even when combined with any changes to the status of salmon and steelhead species since 2012.

Similarly, the addition of transfer sites may increase the area of Columbia Riverbed disturbed by dredging in any given year but this increase is much too small to alter the critical habitat conclusions in NWR 2011-02095.

Conclusion. After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UCR spring run Chinook salmon, SR spring/summer Chinook salmon, UWR Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, UCR steelhead, LCR steelhead, UWR steelhead, MCR steelhead, or SRB steelhead or destroy or adversely modify their designated critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

Amount or Extent of Take

Dredging and dredge material disposal necessary to complete the proposed maintenance of the Columbia River navigation channel, including dredging or dredge disposal at sites identified in the Mouth of the Columbia River Regional Sediment Management Plan (RSMP), the nine side channels, and in the Portland-Vancouver Anchorage, will occur when ESA listed salmon and steelhead, southern green sturgeon and eulachon will be present. Those actions are reasonably certain to cause incidental take when juvenile salmon, steelhead, or green sturgeon, or juvenile or adult eulachon, are entrained and injured or killed by dredge suction, captured and injured or killed in a mechanical dredge, or when injured or killed by contact with dredged material as it falls through the water column during in-water disposal. Additional incidental take is reasonable liely to occur due to harm caused by adverse alteration of channel substrate and prey resources, and reduced DO, increased turbidity, and other impaired water quality conditions caused by maintenance of the side channels and anchorage.

This incidental take will occur in the Columbia River, between RM -3.0 and 145.0, at disposal sites identified in the RSMP, in the nine side channels, and in the Portland-Vancouver Anchorage. Incidental take within those areas that meets the terms and conditions of this incidental take statement will be exempt from the taking prohibition.

Take caused by the habitat-related effects of this action cannot be accurately quantified as a number of fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales that are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed in their habitat is modified or degraded by the proposed action. In such circumstances, NMFS uses the causal link established between the activity and the likely changes in habitat conditions affecting the listed species to describe the extent of take as a numerical level of habitat disturbance.

Here, the best available indicators for the extent of take are: (1) the area likely to be disturbed each year by active dredging and disposal operations relative to routine (preferred) dredging period, measured as acres; (2) the time that will be required to complete dredging and disposal operations, measured as day of actual active dredging or disposal operations relative to the routine dredging period; and (3) the total number of side channels dredged in a year. Because the amount of take increases with the tie spent dredging and the area disturbed by dredging and disposal, these indicators are proportional to extent of incidental take attributable to this project. The extent of take indicators in the following tables were derived using the salmon, eulachon and green sturgeon impact analyses and additional information received from the USACE regarding their operations (Smith 2012p). Although the USACE' proposed action would have authorized dredging to occur the entire length of the river, year-around, with some timing and area

restrictions; the following extent of take indicators limit the potential effects to ESA-listed species and designated critical habitat to those effects assessed in this opinion.

Table 4. Amount and Extent of Take - Days Dredging and Disposal

River Segment	Annual Operation Duration-Dredging (Days of actual dredging)		Annual Operation Duration-Disposal (Days of actual disposal)	
	Completed During Routine Dates	Completed During Non-Routine Dates	Completed During Routine Dates	Completed During Non-Routine Dates
River Mouth RM-3 to RM +3	52	0	NA*	NA
RM+3 to RM 145	160	30	105	16

*NMFS determined the potential effects to ESA listed fish due to ocean disposal are insignificant.

Table 5. Amount and Extent of Take - Acres

River Segment	Annual Dredging Area (Acres)		Annual Disposal Area (Acres)	
	Completed During Routine Dates	Completed During Non-Routine Dates	Completed During Routine Dates	Completed During Non-Routine Dates
River Mouth RM-3 to RM +3	6,100	0	NA	NA
RM+3 to RM 145	7000	1,400	12,000	1,800

Historically, not all the side channels and Portland-Vancouver Anchorage are dredged each year, allowing habitat to recover. Here the best indicator for the extent of take is the amount of side channel habitat disturbed in a given year. This disturbance is best expressed as, an average of three side channels (including Portland-Vancouver Anchorage) dredged per year in a 5-year period, other than Baker Bay which may be dredged every year.

Exceeding any of these limits will trigger the reinitiation provisions of this opinion.

Effect of the Take

In the accompanying opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

Reasonable and Prudent Measures

“Reasonable and prudent measures” are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02

The following reasonable and prudent measures are necessary and appropriate to minimize take of listed species resulting from implementation of the proposed action. The reasonable and prudent measures will also minimize adverse effects to critical habitat. The USACE shall:

1. Minimize incidental take caused by maintenance of the Columbia River navigation channel by limiting the time and manner of dredging to create and utilize the transfer sites, and dredged material disposal.
2. Ensure completion of a comprehensive monitoring and reporting program to confirm this opinion is meeting its objective of minimizing take from the proposed action.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, USACE must comply with the following terms and conditions. The USACE or any applicant or contractor has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

Section 2.8.4 of NWR 2011-02095 lists 13 terms and conditions to implement RPM 1 and three terms and conditions to implement RPM 2. The addition of 198 acres of transfer sites does not alter these terms and conditions in any way. We re-iterate the terms and conditions here.

1. To implement Reasonable and Prudent Measure #1 (dredging and dredge material disposal), the USACE shall:

a. Apply these terms and conditions to its own actions when carrying out FNC O&M work, to the actions of any contractor hired by the USACE for that purpose, and to the actions of any party licensed by the USACE to dredge sand from the FNC for commercial purposes.

b. Complete all dredging and in-water placement during the following times (the "routine" or "preferred" O&M season):

i. The mouth of the Columbia River at RM -3.0 to the Interstate 5 Bridge at RM 106.5 from June 1 through December 15.

c. Dredging and in-water placement may be completed outside the preferred O&M season as necessary to resolve shoaling conditions that cause, or are likely to cause, significant draft restrictions for commercial vessels if left unmanaged until the next preferred O&M season.

i. Whenever possible, limit dredging outside the preferred O&M season to April 1 through May 31.

ii. No in-water disposal is allowed between December 1 and May 31 Cowlitz River at RM 63 to 70,

iii. When alternative sites are available, there will be no in-water placement near the mouths of the Kalama River at RM 71 to 75, or the Lewis River at RM 85-89 December 1 and May 31.

iv. Testing and calibration of dredge equipment outside the preferred O&M season must occur upstream the Lewis River at RM 89.

d. Prior to any dredging taking place, the USACE must develop and implement a Water Quality Sampling and Monitoring Plan for dredging and disposal that has been reviewed and approved by NMFS. The plan must include the following minimum requirements for turbidity monitoring during periods of active dredging, disposal, and dewatering of upland facilities.

i. A properly and regularly calibrated turbidimeter is recommended, however visual gauging is acceptable

ii. Locations of turbidity samples or observations must be identified and described in the plan. At a minimum, monitoring must take place at the following distance, and within any visible plumes:

1. Dredging and in-water disposal activities (flowlane and beach placement) – Upcurrent (background) and 900 feet down current from the point of discharge (bucket, cutterhead, draghead, or pipeline) and no more than 150 feet laterally from the vessel or shoreline.

2. Other disposal activities (upland) – Upcurrent (background) and 300 feet downcurrent from the discharge point.

3. If a meter is used the USACE must identify a depth between 10 and 20 feet, or at mid-depth if in shallow areas (less than 20 feet in depth), to collect all samples.

iii. Monitoring must occur when dredging and disposal is being conducted and must meet the following requirements;

1. Active Dredging – once a day during a flood tide and once a day during an ebb tide.

2. In-Water Disposal (Flowlane and Beach Placement) – once a day during a flood tide and once a day during an ebb tide during a disposal activity.

3. Background turbidity NTU or observation, location, tidal stage, and time must be recorded prior to monitoring downcurrent

iv. Compliance:

1. Turbidity must be measured or observed and recorded as described above during periods of active dredging, disposal, and dewatering of upland facilities. Results must be compared to the background sample or observation taken during that monitoring event.

2. If an exceedance over the background level (as defined below Table 49) occurs at the second monitoring interval the activity must stop until the

turbidity levels return to background. At that time, activity may resume with the minimum frequency of monitoring while maintaining compliance

Table 6. Turbidity Exceedance and Actions Required

Turbidity Causing Action	Allowable Exceedance Turbidity Level			Action Required at 1st Monitoring Interval	Action Required at 2nd Monitoring Interval
	Turbidimeter		Visual		
	Background <50 NTU	Background > 50 NTU			
Dredging & In-Water Disposal	0 to 5 NTU above background	10% over background	Visible Plume	Modify activity and continue to monitor at ebb or flood tide	Stop activity until levels return to background and continue to monitor at ebb or flood tide
Upland Disposal				Modify activity and continue to monitor every 4 hours	Stop activity until levels return to background and continue to monitor every 4 hours

f. Keep dragheads and cutterheads at or buried in the substrate when suction dredges are working, and no more than 3.0 feet above the substrate for the minimum time necessary to clean or purge the dragheads.

g. Discharge material from a pipeline dredge at depths of 20.0 feet or more below the water surface.

h. Require use of an enclosed-bucket whenever a clamshell dredge or back-hoe will be used to dredge materials that are not approved for in-water disposal due to contaminant concerns.

i. Use the SEF (2009; or the most recent version) to determine the suitability of sediment for in-water disposal or beneficial use.

2. To Implement Reasonable and Prudent Measure #2 (monitoring), the Corps shall:

a. Include in its existing monitoring report (per NWR 2011-02095), sent to NMFS by February 15 each year, data on the volume dredged and locations utilized for placement

b. As previously required, submit the annual monitoring report to: projectreports.wcr@noaa.gov

c. The Corps must attend an annual coordination meeting with NMFS by March 1 each year to discuss the annual report and any actions that can improve conservation under this opinion, or make the maintenance program more efficient or accountable. The Corps is also encouraged to invite representatives from the Oregon Department of Environmental Quality, the Washington Department of Ecology, the Oregon Department of Fish and

Wildlife, the Washington Department of Fish and Wildlife and the U.S. Environmental Protection Agency to attend.

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by the USACE or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) the amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion; or if (4) a new species is listed or critical habitat designated that may be affected by the identified action.

Species and Critical Habitat Not Likely to be Adversely Affected

Eulachon. We concur with the USACE that the proposed action is not likely to adversely affect eulachon because the June 1-December 15 in water work window has minimal overlap with eulachon migration. Adults return migration does include the month of June, and the early part of December causing some overlap with the effects of the proposed action, however we do not expect encountering turbidity associated with use of the transfer sites to impair adult migration to spawning areas. Adults spawn from December through May. Eulachon eggs incubate for 3-4 weeks so most eggs deposited in the Columbia River in May hatch before the middle of June. Eulachon larvae drift downstream in the current. In June the Lower Columbia River current is approximately 1 meter per second so larvae travel the length of the action area in 2 to 3 days. Eggs and larvae drift downstream along with sediment and we do not expect the co-occurrence of the drifting eggs/larvae and sediment from the use of the transfer sites to reduce survival of at this life stage. Effects to eulachon and to the water quality component of critical habitat for eulachon are insignificant.

Green Sturgeon. The BA describes the status of green sturgeon and their occurrence in the action area in Section 2.4.3 on pages 29-31. We concur with the USACE that in the action area, green sturgeon are large, strong swimming fish that can easily avoid or escape the effects of dredging or temporary placement of dredge materials at the transfer sites. There is low likelihood that subadult and adult green sturgeon would be entrained, and green sturgeon do not appear to have negative response to high levels of suspended sediment. Effects to species and the water quality component of critical habitat for green sturgeon are insignificant.

ESSENTIAL FISH HABITAT

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was conducted pursuant to section 305(b) of the MSA, implementing

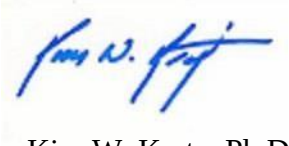
regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

BA Section 6.1 on pages 53-54 provides a complete description and analysis of the effects of the proposed action transfer sites on Pacific Coast Salmon. NWR 2011-02095 provided two EFH conservation recommendations to protect EFH and the addition of transfer sites does not alter these conservation recommendations. We have no additional EFH conservation recommendations at this time.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The biological opinion will be available through NOAA Institutional Repository https://appscloud.fisheries.noaa.gov/suite/sites/eco. A complete record of this consultation is on file at Lacey, Washington.

Please contact Tom Hausmann, in Portland, Oregon, at tom.hausmann@noaa.gov, or 360-231-2315 if you have any questions concerning this consultation, or if you require additional information

Sincerely,



Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Elizabeth Santana, USACE

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Determination of compatibility with provisions in Clatsop, Columbia, and Multnomah County's acknowledged comprehensive plan and land use regulations that relate to water quality

for Columbia River Navigation Channel Operations and Maintenance

(Clean Water Act Section 401 WQC Submittal #43780)

U.S. Army Corps of Engineers

Portland District, Civil Works

1. Contents

1. Contents 2
1. Introduction 1
1.1 Proposed Action 1
Figure 1. Columbia River FNC 2
1.2 Dredged Material Placement 3
Table 1. Specific sites located partially or wholly within the State of Oregon used for upland and/or shoreline placement, or in-water transfer of material dredged from the LCR FNC and associated turning basins RM 3 to RM 106.5: 4
1.3 Duration and Timing 4
1.4 Best Management Practices 5
Table 2. Dredging Best Management Practices (BMPs) and Spill Control Measures Included as Part of the Proposed Maintenance Dredging 5
2. 2. Oregon's Statewide Planning Goals, Clatsop County's Comprehensive Plan, and Local Land Use Regulations 9
2.1 Compatibility with Applicable Clatsop County Comprehensive Plan Provisions 9
2.2 Clatsop County land and water development and use ordinances 19
2.3 Clatsop County Development Standards 22
3. Oregon's Statewide Planning Goals, Columbia County's Comprehensive Plan, and Local Land Use Regulations 36
3.1 Compatibility with Applicable Columbia County Comprehensive Plan Provisions 36
3.2 Columbia County Zoning Ordinance 38
3.3 Columbia County Stormwater & Erosion Control Ordinance 40
4. Oregon's Statewide Planning Goals, Multnomah County's Comprehensive Plan, and Local Land Use Regulations 44
4.1 Compatibility with Applicable Multnomah County Comprehensive Plan Provisions 44
4.2 Chapter 39 – Multnomah County Zoning Code 46
4.3 Chapter 38 – Columbia River Gorge National Scenic Area 49
5. Summary of Findings 50

1. Introduction

The U.S. Army Corps of Engineers, Portland District (Corps) proposes to continue ongoing operations and maintenance (O&M) of federal navigation channels (FNCs) in the Columbia River (CR). Dredging of the CR is necessary to maintain deep-draft navigation in the CR FNC and the auxiliary FNCs so large vessels can safely sail to and from the Pacific Ocean.

The description of provisions in Clatsop, Columbia, and Multnomah County's acknowledged comprehensive plan and land use regulations that relate to water quality, and findings that the project is compatible with those land use factors which relate to water quality, are provided in connection with the Corps' Joint Permit Application for Clean Water Act Section 401 Water Quality Certification (WQC). This WQC would apply to the discharge of dredged material associated with the continued operation and maintenance of the CR FNC and the auxiliary FNCs between River Mile (RM) 3 and 145 in Clatsop, Columbia, and Multnomah Counties, Oregon.

1.1 Proposed Action

The Corps operates and maintains the CR FNCs which includes dredging and dredged material placement to maintain congressionally authorized project dimensions. The intent of the action is to ensure year-round channel access at those dimensions. The authorization does not specify the alignment of the channel or turning basins. When needed, the Corps may coordinate with the U.S. Coast Guard and NOAA to improve navigational safety by changing the alignment to reflect the reality of present-day infrastructure and usage more accurately. All depths are based on Mean Lower Low Water (MLLW) or Columbia River Datum in feet (ft) as appropriate. The Corps proposes to dredge 7 to 9 million cubic yards of material annually.

The Corps is authorized to maintain these federal navigation projects in order to provide safe, reliable channels for the transport of commerce, national security, and recreation. Shoaling occurs in areas where the natural depth of the river is less than the authorized depth of the channel. Dredging is necessary to remove shoals that restrict the movement of vessels. Advanced maintenance dredging is the practice of excavating shoals to a depth and/or width greater than the authorized navigation channel dimensions for the purpose of maintaining the authorized dimensions for a longer period of time between maintenance dredging events. Due to the inaccuracies of dredging, incidental removal of material may occur below the advanced maintenance depth.

The proposed O&M activities currently have a WQC, WQC NWPOP-CLA-F05-001-FR, dated May 19, 2014, as amended on September 3, 2015, August 2, 2019, March 23, 2022, and October 19, 2022. The Corps is not proposing any changes to dredging or dredged material placement locations.

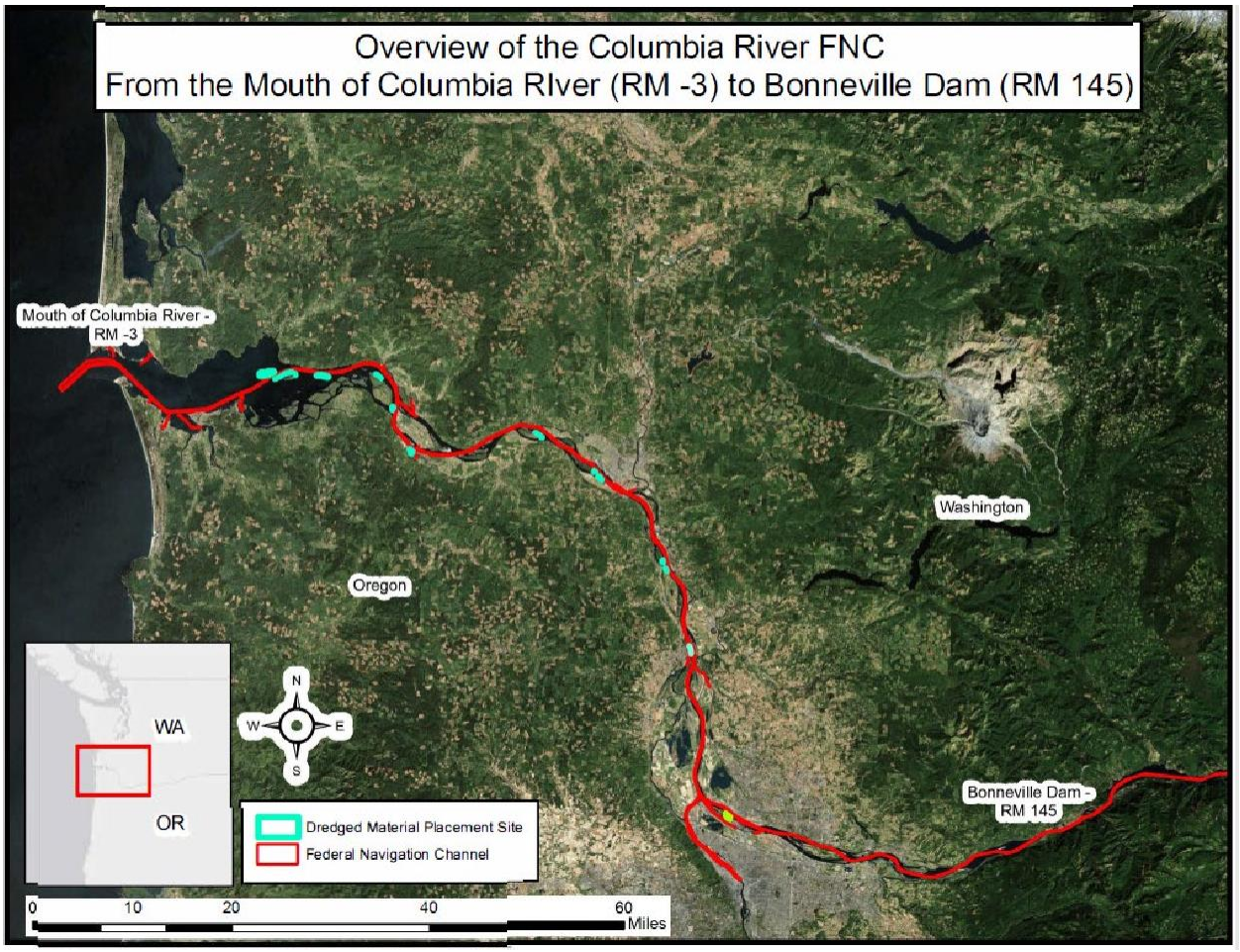


Figure 1. Columbia River FNC

Specific Areas located partially or wholly within the State of Oregon to be maintained by dredging include:

- **Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5).**
  - The authorized channel is generally 600' wide and 43' deep from RM 3 to 105.5 and 35' deep from RM 105.5 to 106.5, with an advanced maintenance depth (AMD) of 5' and overwidth of 100' if necessary.
- **Columbia River FNC; Vancouver, Washington to Bonneville Dam (RM 106.5 to RM 145).**
  - The authorized channel is 300' wide and 27' deep; however, this reach is typically maintained to a depth of 17', with AMD of 2' and variable overwidth up to 100'.
- **Columbia River FNC; side channels.**
  - Skipanon: This channel extends from the Columbia River to the Skipanon RM 2, and is authorized to 30' deep, with a width of 200'. Typically, the Corps maintains this reach to 16' deep, with 2' AMD and variable overwidth.
  - Tongue Point: This channel is authorized to 34' deep and 350' wide, with a length of 1.6 miles, with 2' AMD and variable overwidth.

- Westport Slough: This channel is authorized to 28' deep, and 200' wide, with a length of 3500'. Typically, the USACE maintains this reach to 20' deep with a 2' AMD and variable overwidth. The entrance channel for the ferry is maintained to 9’ deep with 2’ AMD and variable overwidth.
- Oregon Slough: The downstream entrance from the Columbia Channel to Oregon Slough RM 1.5 is part of the deep draft channel authorized to 43' deep. The Oregon Slough side channel RM 1.5 to 3.8 is maintained to 20’ deep by 200’ wide with 2’ AMD and variable overwidth. The upstream entrance side channel is maintained to 10' deep by 300' wide, with a length of 5,800’ with 2’ AMD and variable overwidth.
- Reminder: Although the riverward ends of Baker Bay and Chinook FNCs in the Columbia River are located within the State of Oregon, the Corps will continue the existing practice of following State of Washington 401 compliance when dredging those FNCs.

Portland/Vancouver Anchorage Project

- Anchorage area A: This area is located between RM 102+36.5 and RM 103+3.5, adjacent to the Columbia River FNC. This area is 2000' long by 370' to 550' wide, and is maintained to 43' deep with 2' AMD and variable overwidth.
- Anchorage area B: This area is located between RM 1-03 and RM 103.5, and is approximately 500' outside of the FNC. This will be maintained to a depth of 25' with 2' AMD and variable overwidth.

Material to be dredged at the dredge locations are from the LCR FNC. The proposed dredging and placement sites occur in substrates composed primarily of sand (29% to 99%) and gravel (<1% to >99%); the fines (silt and clay) fraction is less than 1% across all sites.

1.2 Dredged Material Placement

The Corps has five options for dredged material placement: in-water placement in areas of the Columbia River greater than 20 feet deep, upland placement, shoreline (beach nourishment), transfer/rehandle sites, or ocean placement. From RM 3 to 145 (Bonneville Dam), the decision to place material in-water, upland or for beach nourishment, depends on type of dredge used and both the availability and access to the placement site. From RM 3 to 30, the decision to haul material to the ocean site is dependent on type of dredge used and availability of in-water placement sites in the Columbia River. The CR FNC is maintained annually by three hopper dredges and one pipeline dredge. Additionally, clamshell dredges, which remove shoals mechanically using buckets operated by floating cranes on barges, may be used occasionally in the FNC for maintenance. In-water placement of material dredged from federal navigation projects in Oregon and Washington occurs in depths greater than 20 feet within or outside the navigation channel throughout the mainstem Columbia River from RM 3 to RM 145.

Table 1. Specific sites located partially or wholly within the State of Oregon used for upland and/or shoreline placement, or in-water transfer of material dredged from the LCR FNC and associated turning basins RM 3 to RM 106.5:

Site Name	RM	Type	County
Rice Island	W-21.0-UP	Upland & Shoreline	Clatsop (RM 0 – RM 44)
Miller Sands Island	O-23.5-BN	Shoreline	Clatsop
Pillar Rock Island	O-27.2-UP	Upland & Shoreline	Clatsop
Welch Island	O-34.0-UP	Upland	Clatsop
Tenasillahe Island	O-38.3-UP	Upland	Clatsop
James River	O-42.9-UP	Upland	Clatsop
Puget Transfer	W-44.5-IW-T	In-Water Transfer	Columbia (RM 44 - RM 96)
Crims Island	O-57.0-UP	Upland	Columbia
Lord Island	O-63.5-UP	Upland	Columbia
Dibblee Point	O-64.8-UP	Upland	Columbia
Howard Island Transfer	O-69.6-IW-T	In-Water Transfer	Columbia
Sandy Island	O-75.8-UP	Upland	Columbia
Lower Deer Island	O-77.0-UP	Upland	Columbia
O-77.9-IW-T Transfer	O-77.9-IW-T	In-Water Transfer	Columbia
O-81.1-IW-T Transfer	O-81.1-IW-T	In-Water Transfer	Columbia
Sand Island	O-86.2-BN	Shoreline	Columbia
West Hayden Island	O-105.0-UP	Upland	Multnomah (RM 96 – RM 147)

1.3 Duration and Timing

Dredging in the CR FNC between RM 3 and 106.5 may occur at any time of year, although most dredging occurs between 1 June and 15 December. Maintenance dredging of the CR FNC between RM 106.5 and 145 will occur 1 August through 30 September. Side channel dredging will occur 1 August through 15 December. These work windows are in accordance with the most current 2012, 2021 and 2023 Biological Opinions from National Marine Fisheries Service (NMFS).

1.4 Best Management Practices

The best management practices (BMPs) associated with the ongoing Columbia River FNC operations and maintenance program would be included as part of the proposed action. BMPs are implemented to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. Standard methods for handling hazardous materials spills would also be implemented. During any operation and maintenance actions, there would be potential for contaminants to enter the water. If a spill were to occur, the Corps follows a Spill Response Plan, a single consolidated document to meet multiple spill response planning requirements, as identified under the Occupational Safety and Health Administration's Standard, the Resource Conservation and Recovery Act's Contingency Plan, Superfund Amendment and Reauthorization Act, Title III's Emergency Planning and Community Right to Know Act, the Oil Pollution Act, the CWA, and the state, local, regional, and National Contingency Plans for spill response. Implementation of the National Contingency Plans requires a nationwide network of regional response plans, including the Corps' Spill Response Plan. Operations Project Managers, Dredge Incident Commanders, and emergency-system First Responders use this plan as their primary guidance for responding to oil and hazardous substance spill emergencies at the Corps, Portland District.

Table 2 outlines the BMPs and spill control measures that are currently in place for the Columbia River O&M program.

Table 2. Dredging Best Management Practices (BMPs) and Spill Control Measures Included as Part of the Proposed Maintenance Dredging

Dredging BMPs

Measure	Justification	Duration	Ongoing Management
Hopper Dredging			
Drag or cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads. If water is pumped through dragheads to clean the hopper, dragheads will be 20 ft below the surface while dredging between RM 3 and RM 106.5; dragheads will be 9 ft below the surface between RM 106.5 and RM 145, and in shallow-draft side channels.	To minimize potential entrainment of juvenile salmonids	Continuous throughout dredging operations	Maintain unless new information warrants change(s)

Pipeline Dredging			
Maintain dragheads and/or cutterheads buried, or no more than 3 ft elevation of the river bottom when cleaning, for dredging between RM 3 and RM 106.5; within 9 ft between RM 106.5 and RM 145, and in shallow-draft side channels.	To minimize potential entrainment of juvenile salmonids	Continuous throughout dredging operations	Maintain unless new information warrants change(s)
All Dredging			
Dredging of shallow water areas (< 20 ft) will occur during recommended in-water work windows to minimize effects to ESA-listed species.	These shallow water areas are considered migratory habitat for salmonids. Dredging and placement activities could adversely affect food resources or delay migration.	Continuous throughout dredging operations	Maintain unless new information warrants change(s)
Contractor(s) shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into waterways	Protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

Dredged Material Placement BMPs

Measure	Justification	Duration	Ongoing Management
In-River Placement			
Spread out dredged material to prevent mounding	Reduces depth of material to minimize effects to fish and invertebrates	Life of contract or action	Maintain unless new information warrants change(s)
Maintain discharge pipe of pipeline dredge at or below 20 ft depth during placement	Reduce impact of placement, suspended sediment, and turbidity to migrating juvenile salmonids	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Shoreline Placement			
Grade placement site to slope of 10-15%, with no swales, to reduce the possibility of stranding juvenile salmonids	Ungraded slopes can create small pools or flat slopes that can strand juvenile salmon washed ashore by waves	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Ocean Placement			
Place material in accordance with the applicable site management and monitoring plan	Reduce suspended sediments and turbidity in runoff water	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Upland Placement			
Berm upland placement sites (slope at 1.5 to 1 or flatter) to maximize the settlement of fine materials in runoff water	Ungraded slopes can create small pools or flat slopes that can strand juvenile salmon washed ashore by waves	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Only clean dredged material will be placed at upland sites, unless specifically authorized otherwise	Protection of riparian and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Land-based construction equipment that enters within the wetted perimeter of a water body shall be cleaned before use and shall use environmentally acceptable lubricants and other fluids.	Protection of riparian and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Vegetation along the water shall be left in its natural conditions unless removal of such vegetation was authorized in the EIS and required to achieve authorized purposes	Maintain habitat functions/values of riparian and aquatic areas	Continuous throughout operations	Maintain unless new information warrants change(s)

Erosion control measures shall be utilized during upland placement actions to prevent erosion into the Columbia River. Dredged material containment berms with weir systems are measures used to maximize sediment retention within the site.	Minimize potential deleterious effects to water quality and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Construction access routes and barge ramps will be limited to the smallest footprint practicable to minimize potential discharge into areas waterward of OHW or MHHW.	Minimize potential deleterious effects to water quality and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Construction debris (e.g., fuel and oil containers and barrels, misc. litter, etc.) shall be removed by the contractor(s) and no equipment shall be abandoned.	Minimize and ensure safe disposal of hazardous waste, protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
If contamination is suspected, discovered, or occurs during operations, testing of potentially contaminated media must occur. If contaminated soil or groundwater is apparent or revealed through testing, DEQ will be notified.	Minimize and ensure safe disposal of hazardous waste, protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit and DEQ for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
Berms will be constructed, as needed, to prevent material from entering areas below OHW/MHHW	Maintain habitat functions/values of aquatic resources	Continuous throughout operations	Maintain unless new information warrants change(s)
No construction materials shall be abandoned on site at project completion.	Maintain habitat functions/values of riparian and aquatic areas	Life of contract or action	Maintain unless new information warrants change(s)

All Placement			
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

2. 2. Oregon's Statewide Planning Goals, Clatsop County's Comprehensive Plan, and Local Land Use Regulations

Under ORS 197.175, the Statewide Planning Goals in Oregon are to be implemented by local governments through the adoption of comprehensive plans that are compatible with the goals. In turn, the comprehensive plans are to be implemented through adoption and enforcement of land use regulations. Therefore, any proposed activity that is compatible with the acknowledged comprehensive plan and its implementing land use regulations would, by extension, be compatible with Statewide Planning Goals.

In this section the Corps has described those provisions of Clatsop County's acknowledged comprehensive plan and land use regulations that relate to water quality and made affirmative findings that its project is compatible with those land use factors which relate to water quality. The Corps' provision of this applicable land use information ensures that DEQ's WQC decision is compatible with those factors that relate to water quality. FNC dredging and placement site locations used for upland and/or shoreline placement, or in-water transfer of material are listed by county in section 1.2, Table 1 above.

2.1 Compatibility with Applicable Clatsop County Comprehensive Plan Provisions

The Clatsop County Comprehensive Plan contains goals of the county. Those that pertain to water quality or the control and abatement of water pollution in relation to the proposed Project are goals 16 & 17 Estuarine Resources; the sections that are applicable to the proposed action are addressed below.

P20.5 – Dredging and dredged material disposal.

1. Dredging shall be allowed only:

(a) If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable

> *management unit requirements and, (b) If a need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and, (c) If no feasible alternative upland locations exist; and, (d) If adverse impacts are minimized.*

This provision relates to water quality because it concerns the protection of estuarine water resources. The proposed action is compatible because Congress has authorized the Corps to establish and maintain the CR FNCs. Maintaining the CR FNCs will not unreasonably interfere with public trust rights because Project activities would not materially impede or substantially impair the public rights to use the waters for navigation, fishing, commerce, and recreation. Project activities are temporary and will not preclude public use of the river because river users are able to move around the dredge equipment. The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. Alternative dredged material placement sites associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were evaluated in the Final EIS and 2003 Supplemental EIS. The Corps has evaluated practicable and reasonable project alternatives of the proposed action under the CWA Section 404(b)(1) guidelines. Moreover, adverse impacts will be minimized by the use of Best Management Practices as explained above in section 1.4. For these reasons, the proposed action is compatible with provision P20.5 (1).

> *2. Dredging and dredged material disposal shall not disturb more than the minimum area necessary for the project and shall be conducted so as to minimize impacts on wetlands and other estuarine resources. Loss or disruption of fish and wildlife habitat and damage to essential properties of the estuarine resource shall be minimized by careful location, design, and construction of: (a) Facilities requiring dredging, (b) Sites designated to receive dredged material, and (c) Dredging operation staging areas and equipment marshalling yards.*
>
> *Dredged materials shall not be placed in intertidal or tidal marsh habitats or in other areas that local, state, or federal regulatory agencies determine to be unsuitable for dredged material disposal. Exceptions to the requirement concerning disposal in an intertidal or tidal marsh area include use of dredged material as a fill associated with an approved fill project or placement of dredged materials in the sandy intertidal area of a designated beach nourishment site. Land disposal shall enhance or be compatible with the final use of the site area.*

This provision relates to water quality because it concerns the minimization of impacts on wetlands and other estuarine water resources. The proposed action is compatible because as a matter of practice, the Corps only dredges the minimum area necessary to maintain the CR FNCs' dimensions and placement sites are designed to be the smallest acreage needed to accommodate the fill. Dredging and placement activities would occur in areas that have been

previously used for this purpose. Through the careful siting and minimal design, the Corps is minimizing loss or disruption of fish and wildlife habitat and damage to estuarine resource properties. Biological resources within the Columba River system are diverse. There are four primary habitats that encompass the Lower Columbia River system: Estuarine, Riverine, Riparian, and Upland. Each of these habitats carries an intricate level of biologic complexity. The Project operates within each of the habitats to a varying degree. The Corps has already undergone consultation with NMFS and USFWS for the current O&M dredging of FNCs in the Columbia River. The Corps follows established BMPs to minimize adverse impacts to the aquatic and terrestrial environment; the most recent set of both dredging and placement BMPs were detailed in section 1.3 of the NMFS's Biological Opinion: *Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Columbia River Navigation Channel and Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington, NMFS BiOp # 2011/02095 (*NMFS 2012 BiOp) that included an incidental take statement for salmon, steelhead, green sturgeon, and eulachon for inadvertent take occurring during proposed maintenance of the CR FNCs. These baseline activities associated with maintenance dredging of the CR FNCs have not changed; and implementation of these BMPs has been successful in minimizing potential adverse impacts to the aquatic environment. NMFS also issued a Biological Opinion on June 16, 2021 (2021 BiOp) titled Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Operations and Maintenance Dredging of the Federal Navigation Channels at Tongue Point, Clatsop County, Oregon; Elochoman Slough, Wahkiakum County, Washington; Lake River, Clark County, Washington; and Oregon Slough, Multnomah County, Oregon. NMFS issued a Biological Opinion on February 16, 2023 (2023 BiOp) titled Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Lower Columbia River Federal Navigation Channel Dredged Material Transfer Sites (HUC170800060500, 170800030900, 170800030200). The Corps will follow the BMPs outlined in the 2012, 2021 and 2023 BiOps unless or until superseded by a later BiOp. The USFWS concurred with the Corps' determination that the action would have no effect on the following listed species: western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, water howellia, and yellow-billed cuckoo and "may affect, but is not likely to adversely affect" bull trout, marbled murrelet, and Columbian white-tailed deer (Service reference# 13420-2010-I-0165). In 2014, the USFWS issued a BiOp stating that the program may affect and is likely to adversely affect streaked horned lark, but because the Proposed Action maintains breeding habitat and minimizes adverse effects, the action would not jeopardize the continued existence of streaked horned lark or cause adverse modification of critical habitat. The Corps will follow all of the RPMs and Conservation Measures outlined in the current BiOp. For these reasons, the proposed action is compatible with provision P20.5 (2).

> *3. The timing of dredging and dredged material disposal operations shall be coordinated with state and federal resource agencies, local governments, and private interests to protect estuarine aquatic and shoreland resources, minimize interference with recreational and commercial fishing operations, including snag removal from gillnet drifts, and insure proper flushing of sediment and other materials introduced into the water by the project.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. The proposed action is compatible because timing for use of placement sites is intended to protect estuarine aquatic and shoreland resources. For example, the Corps will follow the work windows in the most current 2012, and 2021 and 2023 Biological Opinions from National Marine Fisheries Service (NMFS) for the ongoing O&M activities. The project will not interfere with recreational or commercial fishing operations; river users would need to avoid dredge equipment in the same manner that they avoid other vessels. For these reasons, the proposed action is compatible with provision P20.5 (3).

> *4. The effects of both initial and subsequent maintenance dredging, as well as dredging equipment marshalling and staging, shall be considered prior to approval of new projects or expansion of existing projects. Projects will not be approved unless disposal sites with adequate capacity to meet initial excavation dredging and at least five (5) years of expected maintenance dredging requirements are available.*

This provision could potentially relate to water quality inasmuch as the effects associated with new dredging projects could have additional effects on water quality. However, the Corps is not proposing any new or expanded areas to be dredged. For this reason, the proposed action is compatible with provision P20.5 (4).

> *7. Where a dredged material disposal site is vegetated, disposal should occur on the smallest land area consistent with sound disposal methods (e.g., providing for adequate dewatering of dredged sediments, avoiding degradation of receiving waters). Clearing of land should occur in stages and only as needed. It may, however, be desirable to clear and fill an entire site at one time, if the site will be used for development immediately after dredged material disposal. Reuse of existing disposal sites is preferred to the creation of new sites provided that the dikes surrounding the site are adequate or can be made adequate to contain the dredged materials.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. Placement of dredged fill material will not disturb more than the minimum area necessary for the action. The continued O&M operations have not materially changed, dredging will occur in the same locations as approved in previous compliance and will reuse existing

dredge material placement sites. Alternative dredged material placement sites associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were evaluated in the Final EIS and 2003 Supplemental EIS. The Corps has evaluated practicable and reasonable project alternatives of the proposed action under the CWA Section 404(b)(1) guidelines. No impacts to wetlands are proposed. For these reasons, the proposed action is compatible with provision P20.5 (7).

> *8. Disposal of dredged materials in intertidal areas shall only be allowed at designated beach nourishment sites or to provide fill material for an approved intertidal fill project.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. The Corps will reuse existing dredged material placement sites. Placement of dredged materials will only occur in areas that are currently authorized and designated for use. The Corps has five options for dredged material placement as described in section 1.2 above. The Corps will implement measures to restore and maintain the chemical, physical, and biological integrity of waters of the United States by minimizing discharges and following the guidelines.

For these reasons, the proposed action is compatible with provision P20.5 (8).

> *9. When identifying land dredged material disposal sites, emphasis shall be placed on sites where:*
>
> *(a) The local comprehensive plan land use designation is Development, provided that the disposal does not preclude future development at the site;*
> *(b) The potential for the site's final use will benefit from deposition of dredged materials;*
> *(c) Material may be stockpiled for future use;*
> *(d) Dredged spoils containing organic, chemical, and/or other potentially toxic or polluted materials will be properly contained, presenting minimal health and environmental hazards due to leaching or other redistribution of contaminated materials;*
> *(e) Placement of dredged material will help restore degraded habitat; or where*
> *(f) Wetlands would not be impacted.*
>
> *Important fish and wildlife habitat, or areas with scenic, recreational, archaeological, or historical values that would not benefit from dredged material disposal and sites where the present intensity or type of use is inconsistent with dredged material disposal shall be avoided. The use of agricultural or forest lands for dredged material disposal shall occur only when the project sponsor can demonstrate that the soils can be restored to agricultural or forest productivity after disposal use in completed. In cases where this demonstration cannot be made, an exception to the Agricultural Lands Goal or Forest Lands Goal must be taken and included as an amendment to the Comprehensive Plan*

> *prior to the use of the site for dredged material disposal. The use of shoreland water dependent development sites for dredged material disposal shall occur only when the project sponsor can demonstrate that the dredged material placed on the site will be compatible with current or future water dependent development. Dredged material disposal shall not occur in significant Goal 17 shorelands or wetlands habitats. Engineering factors to be considered in site selection shall include: size and capacity of the site; dredging method; composition of the dredged materials; distance from dredging operation; control of drainage from the site; elevation; and the costs of site acquisition, preparation and revegetation.*

This standard relates to water quality because it concerns the protection of estuarine water resources. The Corps has a nondiscretionary statutory responsibility to continue maintaining FNCs and appurtenant works to achieve authorized dimensions. The Corps will reuse existing placement sites that are currently authorized and designated for use. Alternative dredged material placement sites associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were evaluated in the Final EIS and 2003 Supplemental EIS. The Corps has evaluated practicable and reasonable project alternatives of the proposed action under the CWA Section 404(b)(1) guidelines. No impacts to wetlands are proposed. The Corps implements BMPs to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. Sediment testing has been performed and is described below in section 4.232 (5). For these reasons, the proposed action is compatible with provision P20.5 (9).

> *10. Estuarine in-water disposal sites shall be in areas identified as low in benthic productivity, unless the disposal is to provide fill material for an approved fill project, and where disposal at the site will not have adverse hydraulic effects.*

This provision relates to water quality because it concerns the protection of estuarine water resources. The Corps has five options for dredged material placement: upland placement, in-water (flowlane) placement (in areas of the Columbia River greater than 20 feet deep), transfer/rehandle sites, beach nourishment, or ocean placement. Benthic organisms would be buried or displaced by the in-water discharge. However, the mid-depth habitat created is expected to provide a suitable substrate for re-colonization by organisms from adjacent benthic communities. The dredged material would also have benthic organisms that would be relocated from the dredging areas and may re-establish at the placement site. Beach nourishment sites will leave unfilled intertidal sand areas to allow organisms to recolonize to the maximum extent practicable. Sand will be spread in thin layers to minimize mortality by burial. In-water placement sites are generally located in the flowlane where velocities are high, water is deeper than 20 feet, with naturally unstable or shifting substrate. Lower benthic productivity is expected at these depths. There have been multiple studies to support the conclusion that benthic densities are significantly lower in areas deeper than 20 feet and that benthic primary production consists of shallower, subtidal and intertidal habitats. For example, the study “In-

water restoration between Miller Sands and Pillar Rock Island, Columbia River: Environmental surveys, 1992-93" by Hinton, S.A., G.T. McCabe, Jr., and R.L. Emmett, 1995. Organisms common to areas of unstable substrates are adapted to physically stressful conditions and have life cycles that allow them to withstand the stresses imposed by dredged material placement activities. Dredged material discharged at placement sites that have a naturally unstable or shifting substrate due to wave or current action tends to be more quickly dispersed. Also, the Corps minimizes physical impacts by choosing placement sites with a similar substrate as the dredge material. Impacts to benthic organisms are minimized when sand is placed on a sandy bottom, thus avoiding harmful changes in substrate composition. The Corps will reuse existing placement sites. Therefore, the Corps understands that the project sites will be low in benthic productivity and the project is compatible with provision P20.5 (10).

> *11. Flow lane disposal sites shall only be allowed in development designated areas within or adjacent to a channel where (a) sediments can reasonably be expected to be transported down-stream without excessive shoaling, (b) Interference with recreational and commercial fishing operations will be minimal or can be minimized by applying specific timing restrictions, (c) adverse hydraulic effects will be minimal, (d) adverse effects on estuarine resources will be minimal, and (e) the disposal site depth is between 20 and 65 feet below MLLW.*
>
> This provision relates to water quality because it concerns the protection of estuarine water resources. This provision is intended to ensure that dredged material placement sites are located in particular areas to avoid adverse effects.

Clatsop County Comprehensive Plan Goal 16, Section P30.5 (source: https://www.clatsopcounty.gov/media/29593) states that "the main navigation channel and a flowlane disposal area on each side of the channel (extending either 600 feet or to the 20-foot bathymetric contour, whichever is narrowest) are designated Development. All other areas are Conservation". However, the Clatsop County Webmaps (source: https://delta.co.clatsop.or.us/apps/ClatsopCounty/index.html directed from https://www.clatsopcounty.gov/landuse/page/find-your-zoning-information) show parts of the CR FNCs and in-water placement locations zoned as Aquatic Conservation 2 (AC-2).

The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. Regarding (a) downstream shoaling, analysis for hydraulics, sedimentation, and morphology change consist of areas within the CR, including in-water and beach nourishment placement locations. General shoaling metrics within the river are defined in terms of how and when shoals are formed by seasonal variation in river flow. The relevance of shoaling metrics is based on how and when the shoaling processes affect CR navigation, motivating the need for dredging or the imposition of navigation restrictions. The purpose of the action is to accommodate maintenance dredging of the CR FNCs. The Corps is not proposing any changes to dredging or dredged material placement locations. Any effects associated with the proposed action would be temporary, localized, and minor with respect to

the hydraulics and sediment transport conditions of the Columbia River. CR dredged sand can be remobilized after placement on the riverbed when river currents exceed 0.35 meter/sec (1.1 ft/sec). As river current speed increases beyond 0.35 m/sec, the associated sediment transport rate increases exponentially. In-water placement occurs in locations that will not result in excessive FNC shoaling from remobilized placed sediment. The proposed action would not (b) interfere with recreational or commercial fishing and will follow the work windows in the most current 2012, and 2021 and 2023 Biological Opinions from National Marine Fisheries Service (NMFS) for the ongoing O&M activities, and (c) would not have adverse hydraulic effects (explained above for P20.5(10)) or (d) adverse effects on estuarine resources because the Corps will follow Best Management Practices for the protection of water quality as explained above in section 1.4. Regarding (e), dredged material will continue to be placed in-water in depths 20 feet or greater. These areas are not all located in a development designated area, so the proposed action is compatible to the maximum extent possible with provision P20.5 (11).

> *12. Dredged material disposal at beach nourishment sites shall only be used to offset the erosion and not to create new beach or land areas. Beach nourishment sites shall not be designated in areas where placement or subsequent erosion of the dredged materials would adversely impact tidal marshes or productive intertidal or shallow subtidal areas.*

This provision relates to water quality because it concerns the protection of estuarine water resources. The Corps will reuse existing placement sites to offset erosion and therefore, the proposed action is compatible with provision P20.5 (12).

20.6. Estuarine Construction: Piling and Dolphin Installation, Shoreline Stabilization and Navigational Structures.

The policies in this subsection apply to over-the-water and in-water structures such as docks, bulkheads, moorages, boat ramps, boat houses, jetties, pile dikes, breakwaters and other structures involving installation of piling or placement of riprap in Columbia River Estuary aquatic areas. Also covered under these policies are shoreline stabilization and aquatic area fills. The sections that are applicable to the proposed action are addressed below.

> *2. Navigational structures, such as breakwaters, jetties, groins, and pile dikes are major estuarine alterations with long term biological and physical effects. Proposals for new or enlarged navigational structures, or for removal of existing structures, must demonstrate that expected benefits outweigh potential adverse impacts on estuarine* productivity.
>
> *4. Where structural shoreline stabilization is shown to be necessary, an impact assessment is required and will include consideration of effects on shoreland and aquatic habitats, effects on fishing areas, uses of the adjacent shoreland and aquatic areas, and potential for adverse impacts in adjacent areas due to the project.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. No new or enlarged over-the-water or in-water structures are proposed.

For these reasons, the proposed action is compatible with provision *P20.6 (*2 & 4).

P30.2 Baker Bay – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the aquatic areas of Baker Bay and the Sand Islands. The navigation channels at Baker Bay and Chinook are designated Development. The Corps maintains the Baker Bay and Chinook FNCs. The proposed action is compatible with provision P30.2.

P30.3 Estuary Channels – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the deep-water portions of the estuary from Jetty A (RM 3) to the upper end of Rice Island (RM 22.5). The subarea contains the authorized navigation channel. The boundary of the subarea generally follows the 20-foot bathymetric contour; however, it varies from the contour in the vicinity of cities and other subareas containing deep channels. The description for human use includes navigation improvements, dredging and dredged material disposal. The aquatic designation states that the main navigation channel and a flowlane disposal area on each side of the channel (extending either 600 feet or to the 20-foot bathymetric contour, whichever is narrowest) are designated Development. All other areas are Conservation.

The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. As stated in P20.5 (11), the Corps places dredged material in-water to avoid excessive shoaling, adverse hydraulic effects and adverse effects on estuarine resources, and uses Best Management Practices for the protection of water quality as explained above in section 1.4. The majority but not all of the ongoing FNC dredging and in-water placement areas are located within 600 feet of the FNC in the area designated Development, so the proposed action is compatible to the maximum extent possible with provision P30.3.

P30.4 Estuary Sands – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the dredged material disposal island of Rice Island. The description for human use includes dredged material disposal. The Corps places dredged material at Rice Island. The proposed action is compatible with provision P30.4.

P30.5 River Channels – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the deep-water portions (deeper than 20 feet below MLLW) of the authorized navigation channel and adjacent slopes between Harrington Point (RM 22.5) and the western end of Puget Island. The description for human use includes navigation improvements, dredging and dredged material disposal. The aquatic designation states that the main navigation channel and a flowlane disposal area on each side of the channel (extending either 600 feet or to the 20-foot bathymetric contour, whichever is narrowest) are designated Development. All other areas are Conservation.

The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. As stated in P20.5 (11), the Corps places dredged material in-water to avoid excessive shoaling, adverse hydraulic effects and adverse effects on estuarine resources and uses Best Management Practices for the protection of water quality as explained above in section 1.4. The majority but not all of the ongoing FNC dredging and in-water placement areas are located within 600 feet of the FNC in the area designated Development, so the proposed action is compatible to the maximum extent possible with provision P30.5.

P30.6 Snag Islands – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the dredged material disposal islands of Miller Sands and Jim Crow Sands. The description for human use includes navigation improvements and dredged material disposal. The Corps places dredged material at Miller Sands and Pillar Rock Island, formerly called Jim Crow Sands. The proposed action is compatible with provision P30.6.

P30.8 Upper Marsh Islands – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the dredged material disposal island of Welch Island. The description for human use includes dredged material disposal. The Corps places dredged material at Welch Island. The proposed action is compatible with provision P30.8.

P30.9 Tenasillahe Island – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the dredged material disposal island of Tenasillahe Island. The description for human use includes dredged material disposal. The Corps places dredged material at Tenasillahe Island. The proposed action is compatible with provision P30.9.

P30.15 Tongue Point – The Columbia River Estuary Study Taskforce prepared a regional management plan that included subareas with elements affecting land use. The elements are designed to provide background information. This provision relates to water quality because it concerns the protection of estuarine aquatic resources.

This subarea includes the Tongue Point FNC which is designated Development. The Corps maintains the Tongue Point FNC. The proposed action is compatible with provision P30.15.

2.2 Clatsop County land and water development and use ordinances

The applicable county ordinances are found in S4.200 Columbia River Estuary Shoreland and Aquatic Use and Activity Standards.

The Columbia River estuary shoreland and aquatic area standards are requirements that apply to development uses and activities proposed for the following management designations: Marine Industrial Shorelands Zone (MI); Conservation Shorelands Zone (CS); Natural Shorelands Zone (NS); Aquatic Development Zone (AD); Aquatic Conservation Two Zone (AC-2); Aquatic Conservation One Zone (AC-1); Aquatic Natural Zone (AN); and those areas included in the Shorelands Overlay District (SO). These standards are intended to protect the unique economic, social, and environmental values of the Columbia River Estuary.

County Ordinance 3.660-3.674 Conservation Shorelands Zone (CS)

This ordinance relates to water quality because the purpose of the Conservation Shorelands Zone is to conserve Columbia River Estuary shorelands which provide important resource or ecosystem support functions and to designate areas for long term uses of renewable resources that do not require major alterations of the estuary, except for the purpose of restoration. They are managed for the protection and maintenance of water quality, fish and wildlife habitat, water-dependent uses, economic resources, aesthetic values and recreation. Uses of these shorelands shall be compatible with characteristics and uses of the adjacent estuarine waters. Permitted developments include “dredged material disposal including beach nourishment at sites designated in the Comprehensive Plan”. The Corps places material at Rice Island, Miller Sands, Pillar Rock, Welch Island and Tenasillahe Island which are all designated in the Comprehensive Plan and therefore, the proposed action is compatible with County Ordinance 3.660-3.674.

County Ordinance 3.740-3.756 Aquatic Development (AD) Zone

The purpose of the AD zone is to provide for navigation, and other identified needs for public, commercial, and industrial water-dependent uses, consistent with the level of development or alteration allowed by this zone and the need to minimize damage to the Columbia River estuarine ecosystem. The objective of the AD zone is to ensure optimum utilization of appropriate aquatic areas by providing for intensive development.

Such areas include deepwater areas adjacent to or near the shoreline, navigation channels, turning basins, subtidal areas for in-water disposal of dredged materials, areas of minimal biological significance needed for uses requiring alteration of the estuary not included in Aquatic Conservation-Two Zone, Aquatic Conservation-One Zone, and Aquatic Natural Zone, and areas for which an exception to Statewide Planning Goal 16, Estuarine Resources, has been adopted.

The following uses and activities, and their accessory uses and activities, are permitted in the AD Zone under a Type I procedure, which are actions that involve permitted uses or developments governed by clear and objective review criteria, and are subject to general development zone standards:

1) *Undeveloped low intensity water-dependent recreation.*
2) *Passive restoration measures.*
3) *Navigational aids.*
4) *Vegetative shoreline stabilization.*
5) *Research and educational observation.*
6) *Maintenance and repair of existing structures or facilities, including dikes.*
7) *Temporary dikes for emergency flood protection, subject to state and federal requirements.*
8) *Projects for the protection of habitat, nutrient, fish, wildlife, and aesthetic resources.*
9) *Water-dependent commercial, industrial, and port uses including but not limited to:*

A. *docks, moorages, piers, or wharves*
B. *fuel storage and dispensing facilities*
C. *cargo loading and unloading facilities*
D. *vessel construction, maintenance, or repair facilities*
E. *seafood receiving, processing, and storage*
F. *cargo marshaling, assembly, and storage facilities*
G. *ice making and sales establishments*
H. *integrated manufacturing and shipping facility where a significant portion of the operation is water-dependent*
I. *marine railway facilities*
J. *other water-dependent uses meeting Water-dependent Use criteria.*

10) *Piling and dredging in conjunction with permitted uses 3, and 5 through 9 listed above, pursuant to the applicable standards.*

11) Fill in conjunction with permitted uses 6 through 9 listed above, pursuant to the applicable standards.

12) Communication facilities subject to the standards in S4.700.

Proposed dredging (10) and in-water disposal of dredged materials (11) in conjunction with permitted use (9) is a use and activity consistent with applicable standards established under S4.232 and/or S4.208. This use and activity is required in order to maintain the Congressionally authorized dimensions of the LCR FNC. For this reason, the proposed action is consistent with this enforceable policy.

County Ordinance 3.784–3.792 Aquatic Conservation Two Zone (AC-2)

This ordinance relates to water quality because the purpose of the Aquatic Conservation Two Zone is to conserve areas of the Columbia River Estuary to protect and conserve natural resources. The purpose of the AC-2 zone is to conserve designated areas of the Columbia River estuary for long term uses of renewable resources that do not require major alterations of the estuary, except for the purpose of restoration. The AC-2 zone is managed for the protection and conservation of the natural resources and benefits found in these areas. The AC-2 zone includes areas needed for maintenance and enhancement of biological productivity, recreational resources, aesthetic values, aquaculture, and open water portions of the estuary. The AC-2 zone includes areas of smaller or of less biological importance than those in the Aquatic Natural zone and Aquatic Conservation One zone. Areas that are partially altered and adjacent to existing development of low to moderate intensity which do not possess the resource characteristics of other aquatic areas are also included in this zone.

The statutory responsibility to continue operating and maintaining the CR FNCs to their authorized dimensions is non-discretionary. No material changes are proposed to the ongoing O&M operations. The existing condition and functionality of the LCR would remain the same. Specifically, the action would not preclude long term uses of renewable resources, conservation of natural resources, nor alter the Columbia River estuary from its existing baseline condition. The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. As stated in P20.5 (11), the Corps places dredged material in-water to avoid excessive shoaling, adverse hydraulic effects and adverse effects on estuarine resources and uses Best Management Practices for the protection of water quality as explained above in section 1.4. The majority but not all of the ongoing FNC dredging and in-water placement areas are located within 600 feet of the FNC in the area designated Development. In-water placement that occurs more than 600 feet from the FNC is in the AC-2 zone, which does not include dredged material placement as an approved use. In-water placement restores sediment within the AC-2 zone for the long-term protection and conservation of natural resources.

For this reason, the proposed action is compatible to the maximum extent possible with County Ordinance 3.784–3.792.

2.3 Clatsop County Development Standards

Clatsop County Development Standards are enforceable requirements incorporated into the County's land use regulations.

4.208. Estuarine Construction

Standards in this subsection are applicable to all Piling and Dolphin Installation, Shoreline Stabilization, and Navigational Structures. The standards in this subsection apply to over-the-water and in-water structures such as docks, bulkheads, moorages, boat ramps, boat houses, jetties, pile dikes, breakwaters and other structures involving installation of piling or placement of riprap in Columbia River Estuary aquatic areas.

> *(3) Jetties, groins and breakwaters shall be constructed of clean, erosion-resistant materials from upland sources. In-stream gravels shall not be used, unless part of an approved mining project. Material size shall be appropriate for predicted wave, tide and current conditions.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. No new over-the-water or in-water structures are proposed.

For this reason, the proposed action is compatible with provision *4.208 (3)*.

> *(6) Jetties, groins, breakwaters and piers requiring aquatic fill may be allowed only if all of the following criteria are met:*
> *(A) The proposed use is required for navigation or other water-dependent use requiring an estuarine location, or if specifically allowed in the applicable aquatic zone; and*
> *(B) If a need (i.e. a substantial public benefit) is demonstrated; and*
> *(C) The proposed use does not unreasonably interfere with public trust rights; and*
> *(D) Feasible alternative upland locations do not exist; and*
> *(E) Potential adverse impacts, as identified in the impact assessment, are minimized.*

Applicable responses for this standard is addressed above in 2.1 [P20.5 (1)].

> *(14) Bulkheads installed as a shoreland stabilization and protective measure shall be designed and constructed to minimize adverse physical effects (i.e. erosion, shoaling, reflection of wave energy or interferences with sediment transport in adjacent shoreline areas) resulting from their placement.*

No new over-the-water or in-water structures are proposed.

For this reason, the proposed action is compatible with provision *4.208 (14)*.

4.209. Deep-Water Navigation, Port and Industrial Development.

The standards in this subsection apply to port and industrial development occurring in and over Columbia River estuarine waters, and on adjacent shorelands. This section also applies to navigation projects related to deep-draft maritime activities, such as channel, anchorage and turning basin development or expansion.

> *2. New or expanded facilities for deep-water navigation, port or industrial development requiring aquatic area dredging or filling may be allowed only if all of the following criteria are met:*
>
> *(A) The proposed use is required for navigation or other water-dependent use requiring an estuarine location, or if specifically allowed in the applicable aquatic zone; and*
>
> *(B) If a need (i.e. a substantial public benefit) is demonstrated; and*
>
> *(C) The proposed use does not unreasonably interfere with public trust rights; and*
>
> *(D) Feasible alternative upland locations do not exist; and*
>
> *(E) Potential adverse impacts, as identified in the impact assessment are minimized.*
>
> *3.Deep-water navigation, port or industrial development requiring new piling or dolphin installation, construction of pile-supported structures, or other uses or activities which could alter the estuary may be permitted only if all of the following criteria are met:*
>
> *(A) A need (i.e. a substantial public benefit) is demonstrated; and*
>
> *(B) The proposed use does not unreasonably interfere with public trust rights; and*
>
> *(C) Feasible alternative upland locations do not exist; and*
>
> *(D) Potential adverse impacts, as identified in the impact assessment are minimized.*

No new or expanded over-the-water or in-water structures or facilities are proposed.

For this reason, the proposed action is compatible with provision *4.209*.

S4.230. Bankline and Streambed Alteration.

Standards in this subsection are applicable to an alteration of a stream bank or streambed in the Columbia River Estuary, either within or outside of its normal high-water boundary.

> *(1) Alterations to stream banks or streambeds shall:*
>
> *(A) Maintain stream surface area where feasible; and*
>
> *(B) Make maximum use of natural or existing deep-water channels; and*
>
> *(C) Avoid creation of undesirable hydraulic conditions; and*
>
> *(D) Minimize impacts on estuarine aquatic and shoreland resources.*

This standard relates to water quality because it concerns the protection of estuarine water resources. The Corps has a nondiscretionary statutory responsibility to continue maintaining

FNCs and appurtenant works to achieve authorized dimensions. No changes in river current or hydraulic conditions are expected as the proposed O&M operations will remain the same as currently authorized. Placement of material at the placement sites may influence current patterns and flow. However, the effects would be minimal, temporary, and local. The Corps implements BMPs to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. The proposed action would maintain stream surface area where feasible, make maximum use of natural or existing deep-water channels, avoid creation of undesirable hydraulic conditions, and minimize impacts on estuarine aquatic and shoreland resources.

For these reasons, the proposed action is compatible with provision 4.230 (1).

4.232 : Dredging and Dredged Material Disposal
Standards in this subsection are applicable to all Columbia River estuary estuarine dredging operations and to both estuarine shoreline and aquatic dredged material disposal:

1. *Dredging in estuarine aquatic areas, subject to dredging and dredged material disposal policies and standards, shall be allowed only:*
   (A) If specifically allowed by the applicable aquatic zone and required for one or more of the following uses and activities:

   1) Navigation or navigational access

This development standard relates to water quality because it concerns the protection of estuarine water resources. The proposed action is compatible with S4.232 (1) because it is for purposes of navigation, i.e., is required to maintain the congressionally authorized CR FNCs and is specifically allowed in the Aquatic Development zone.

2. *When dredging is permitted, the dredging shall be the minimum necessary to accomplish the proposed use.*

This development standard relates to water quality because it concerns the protection of water resources by minimizing adverse impacts to aquatic areas. The Corps removes the minimum amount of material necessary from its FNCs as a matter of practice; therefore, the proposed action is compatible with S4.232 (2).

3. *Undesirable erosion, sedimentation, increased flood hazard, and other changes in circulation shall be avoided at the dredging and disposal site and in adjacent areas.*

This standard relates to water quality because its purpose is to reduce shoaling and turbidity in aquatic areas. Any effects associated with the proposed action would be temporary, localized, and minor with respect to the hydraulics and sediment transport conditions of the Columbia River. There would be no direct or indirect impacts on the geologic or hydrologic regime as a

result of the project relative to the current baseline conditions. Changes to existing patterns of erosion, deposition, and flooding would not be expected. For these reasons the proposed action is compatible with 4.232 (3).

4. *The timing of dredging and dredged material disposal operations shall be coordinated with state and federal resource agencies, local governments, and private interests to protect estuarine aquatic and shoreland resources, minimize interference with commercial and recreational fishing, including snag removal from development drifts, and insure proper flushing of sediment and other materials introduced into the water by the project.*

This provision relates to water quality because it concerns the protection of estuarine aquatic resources. The proposed action is compatible because the timing of the proposed dredging and dredged material placement operations is in conjunction with the O&M activities that have previously been coordinated with WDFW, ODFW, and NMFS under the CWA, CZMA, and ESA, as appropriate. For this reason, the proposed action is compatible with 4.232 (4).

5. *Bottom sediments in the dredging area shall be characterized by the applicant in accordance with EPA and DEQ standards. Information that may be required includes, but is not limited to, sediment grain size distribution, organic content, oil and grease, selected heavy metals, pesticides and other organic compounds, and benthic biological studies.*

   The types of sediment tests required would depend on dredging and placement techniques, sediment grain size, available data at the dredging site, and proximity to contaminant sources. Generally, projects involving in-water disposal of fine sediments require a higher level of sediment testing than projects involving disposal of coarse sediments. Projects involving upland disposal may be exempted from the testing requirement, depending on the nature of the sediments and the amount of existing sediment data available. Unavailable burdens on the permit applicant shall be minimized by considering the economic cost of performing the sediment evaluation, the utility of the data to be provided, and the nature and magnitude of any potential environmental effect.

This standard relates to water quality because its purpose is to insure that dredged sediments meet state water quality standards. The Corps performs regular dredged material evaluations in the FNCs to determine whether sediments are suitable for unconfined in-water placement or exposure, according to the requirements of the CWA or the MPRSA, as appropriate. The Corps characterizes sediments present within proposed dredge areas in accordance with national dredged material testing manual protocols (Ocean Testing Manual), Inland Testing Manual, and by using the Sediment Evaluation Framework for the Pacific Northwest (SEF). The Corps, as lead

member of the regional Portland Sediment Evaluation Team (PSET), evaluates the discharge of dredged material through the SEF. WDOE and DEQ are also members of PSET. This framework is based on applicable provisions of CWA Section 404 or MPRSA Section 103. A summary of the most recent results and suitability determinations for locations within Clatsop County is below:

•Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5): A total of 59 stations were sampled within the LCR FNC. All sediment samples consisted of more than 97 percent coarse-grained sediments (gravel and sand) suitable for unconfined, aquatic placement. The total organic carbon (TOC) results for all samples is less than 0.2%.

•Skipanon FNC: Dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%) suitable for unconfined, aquatic placement. TOC in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.

•Tongue Point FNC: The outer shoal dredge prism was 96.4% sand and the inner shoal averaged 46.9% sand, 45.7% silt, and 7.3% clay suitable for unconfined, aquatic placement.

The Corps will continue to sample and evaluate sediment periodically in the future in accordance with the SEF. Dredged material would only be placed in water after the Corps, in coordination with PSET, determines that sediments are suitable for unconfined aquatic placement and unconfined aquatic exposure, in accordance with the SEF. Sediments that are tested and deemed to be unsuitable (that is, not suitable for unconfined in-water placement) would not be placed in water but would instead be placed in upland sites. For these reasons, the proposed action is compatible with 4.232 (5).

6. *Adverse short term adverse effects of dredging and placement of dredged materials such as increased turbidity, release of organic and inorganic materials or toxic substances, depletion of dissolved oxygen, disruption of the food chain, loss of benthic productivity, and disturbance of fish runs and important localized biological communities shall be minimized.*

This standard relates to water quality because its purpose is to insure that dredged sediments and placement of those do not adversely affect water quality where work occurs. The proposed action would result in temporary and localized reduction in water quality during the course of dredging and in-water placement sites, which could suspend sediments in the water column. These impacts would be minor and temporary in nature and would cease shortly after dredging and placement activities are complete. The Corps will continue to utilize the same BMPs as required by WQC No. NWPOP-CLA-F05-001-FR, or subsequent Order, to ensure that direct and indirect impacts are less than significant. Sediments that are disturbed into suspension would be redistributed to areas downstream by natural hydraulic processes after the project is complete. Turbidity would be monitored during dredging operations in accordance with the WQC, the BiOps, and the Corps' BMPs to ensure that turbidity does not increase above acceptable levels. Because the proposed action would adhere to the WQC conditions and

implement BMPs to protect water quality, no significant direct or indirect impacts are anticipated. As previously explained, all materials to be dredged are suitable for unconfined aquatic placement and would not add to the contamination burden of the lower Columbia River nor mobilize hazardous materials in the water column.

Placement of dredged at in-water sites may temporarily disturb aquatic species. Few individual fish that encounter the dredge within the migration corridor will alter their pathway or delay their rate of migration. Adult fish are intent on moving upstream, and a small deviation from the migration path will not significantly change overall distribution or risk of predation. Juvenile salmonids will largely avoid the project activities, as they tend to travel closer to the shoreline. This level of avoidance will be minor and within the normal migration patterns, and thus not likely to increase the risk of predation or otherwise harm these fish. For these reasons, the proposed action is compatible with 4.232 (6).

7. *Impacts on areas adjacent to the dredging site, such as destabilization of fine textured sediments, erosion, accretion, and other undesirable changes in circulation patterns shall be minimized.*

The standard relates to water quality because its purpose is to ensure that dredging activities do not adversely affect water quality where work occurs. The proposed action would result in temporary and localized destabilization of sediments during dredging and in-water placement sites, which could suspend sediments in the water column. These impacts would be minor and temporary in nature and would cease shortly after dredging and placement activities are complete. The Corps disturbs the minimum amount of material necessary from its federal navigation channels and placement sites as a matter of practice. For these reasons, the proposed action is compatible with 4.232 (7).

8. *The effects of both initial and subsequent maintenance dredging, as well as dredging equipment marshaling and staging shall be considered prior to approval of new projects or expansion of existing projects. Projects will not be approved unless disposal sites with adequate capacity to meet initial excavation dredging and at least five years of expected maintenance dredging requirements are available.*

This standard relates to water quality because it concerns the protection of estuarine water resources by minimizing development of new dredged material placement sites. The purpose for this action is to provide continued reliable, safe, and efficient transportation of waterborne commerce and uninterrupted transit for vessels in the CR FNCs. Continued maintenance is warranted based on the significant economic benefits of the Columbia-Snake River Navigation System as well as other commercial and recreational benefits. The Corps has a nondiscretionary statutory responsibility to continue maintaining FNCs and appurtenant works to achieve authorized dimensions. Corps maintenance activities include the dredging of FNCs and the placement of dredged material at Corps-designated sites. There are no material changes proposed as part of the WQC renewal of O&M operations. However, sites that have real estate easements and rights of entry for existing upland placement sites, as well as in-water locations,

are reaching placement capacity. It is expected that the majority of the existing placement sites would reach capacity within 10 dredging seasons. Pursuant to policy, the Corps prepares federal DMMPs to ensure that sufficient capacity exists to accommodate the material it dredges from FNCs. Therefore, the need to update and implement the DMMP is required, as established by the Corps of Engineers policy ER 1105-2-100 (April 22, 2000), which states that all federally maintained navigation projects must demonstrate that dredged material placement sites have the capacity to accommodate maintenance dredging for a minimum of 20 years. The Corps expects to submit a separate WQC application for the DMMP in the next few months. Therefore, the proposed action is compatible with 4.232 (8).

13. *Dredged material disposal shall occur only at designated sites or at new sites which meet the requirements of the Dredged Material Disposal Site Selection Policies.*

This standard relates to water quality because it concerns the protection of estuarine water resources. The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. The Corps places material at Rice Island, Miller Sands, Pillar Rock, Welch Island and Tenasillahe Island which are all designated in the Comprehensive Plan. As stated in P20.5 (11), the Corps places dredged material in-water to avoid excessive shoaling, adverse hydraulic effects and adverse effects on estuarine resources and uses Best Management Practices for the protection of water quality as explained above in section 1.4. The majority but not all of the ongoing FNC dredging and in-water placement areas are located within 600 feet of the FNC in the area designated Development. In-water placement that occurs more than 600 feet from the FNC is in the AC-2 zone, which does not include dredged material placement as an approved use. In-water placement restores sediment within the AC-2 zone for the long-term protection and conservation of natural resources. The Corps implements BMPs to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. For these reasons, the proposed action is compatible to the maximum extent possible with provision 4.232 (13).

14. *Proposals for in-water disposal of dredged materials, including flowlane disposal, beach nourishment, estuarine open-water disposal, ocean disposal, and agitation dredging, shall:*
    a. *Demonstrate the need for the proposed project and that there are no feasible alternative disposal sites or methods that entail less damaging environmental impacts;*
    b. *Demonstrate that the dredged sediments meet state and federal sediment testing requirements and water quality standards (see Dredging Standard 5); and*
    c. *Not be permitted in the vicinity of a public water intake.*

This standard relates to water quality because it concerns the protection of estuarine water resources. The Corps has a nondiscretionary statutory responsibility to continue maintaining FNCs and appurtenant works to achieve authorized dimensions. The Corps proposes to continue ongoing O&M of the FNCs in the CR. The Corps is not proposing any changes to dredging or dredged material placement locations from the current WQC, as amended. Alternative dredged material placement sites associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were evaluated in the Final EIS and 2003 Supplemental EIS. As stated in P20.5 (11), the Corps places dredged material in-water to avoid excessive shoaling, adverse hydraulic effects and adverse effects on estuarine resources. The Corps has evaluated practicable and reasonable project alternatives of the proposed action under the CWA Section 404(b)(1) guidelines. The Corps implements BMPs to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. Sediment testing has been performed and is described above in section 4.232 (5). There are no known public water intakes near the proposed placement sites.

For these reasons, the proposed action is compatible with provision 4.232 (14).

16. *Flowlane disposal, estuarine open water disposal and agitation dredging shall be monitored to assure that estuarine sedimentation is consistent with the resource capabilities and purposes of affected natural and conservation designations. The monitoring program shall be established prior to undertraining disposal. The program shall be designated to both characterize baseline conditions prior to disposal and monitor the effects of the disposal. The primary goals of the monitoring are to determine if the disposal is resulting in measurable adverse impacts and to establish methods to minimize impacts. Monitoring shall include, at minimum, physical measurements such as bathymetric changes and may include biological monitoring. Specific monitoring requirements shall be based on, at minimum, sediment grain size at the dredging and disposal site, presence of contaminants, proximity to sensitive habitats and knowledge of resources and physical characteristics of the disposal site.*

This standard relates to water quality because it requires monitoring to reduce adverse impacts to estuarine water resources. The Corps regularly monitors the FNCs and performs dredging and placement to maintain the channels as is Congressionally authorized. Placement site depths will be surveyed before and after operations. Factors considered when planning for annual maintenance dredging include equipment availability, results of bathymetric surveys, placement site capacity, environmental resource concerns, and funding. The mechanism of dredging and placement is decided based on the severity, type, and location of the shoal. The project will follow all Portland Sediment Evaluation Team (PSET) recommendations for each

dredging event and comply with the Sediment Evaluation Framework for the Pacific Northwest (SEF) (May 2018). The most recent sediment sampling results and suitability determinations are summarized in 4.232(5) above.
For these reasons, the proposed action is compatible with provision 4.232 (16).

17. *Flowlane disposal shall be in Aquatic Development areas identified as low in benthic productivity and use of these areas shall not have adverse hydraulic effects. Use of flowlane disposal areas in the estuary shall be allowed only when no feasible alternative land or ocean disposal sites with less damaging environmental impacts can be identified and the biological and physical impacts of flowlane disposal are demonstrated to be insignificant.*

Applicable responses for these standards are addressed above in P20.5 (10).

18. *Ocean disposal shall be conducted such that:*
    (A) The amount of material deposited at a site is compatible with benthic productivity, other marine resources, and other uses of the area;
    (B) Interference with sport and commercial fishing is minimized;
    (C) Disposal is strictly confined to the sites designated by the U.S. Environmental Protection Agency; and
    (D) The disposal site does not shoal excessively and create dangerous wave and swell conditions.

This provision relates to water quality because it concerns the protection of ocean resources. Material dredged from the Columbia River between RM 3 and RM 30 may be placed in the ocean at the U.S. EPA designated Deep-Water Site. The site has a disposal area of ~4,296 acres with a depth range of 190-300 feet and overall disposal capacity of around 225 MCY shared between the Columbia River navigation project and the Mouth of the Columbia River navigation project. The Deep-Water Site was first used in 2004. Most recently, approximately 1 MCY and 425 KCY of material was placed at the site in 2018 and 2019, respectively. Any new placement related to maintenance of the CR FNC would be coordinated as part of the Annual Use Plan.

For these reasons, the proposed action is compatible with Standard 4.232 (18).

19. *Beach nourishment shall only be conducted at sites identified in the Dredged Material Management Plan. New sites may be added to the Plan by amendment after an exception to Oregon Statewide Planning Goal 16 for the site has been approved. Beach nourishment shall be conducted such that:*
    (A) The beach is not widened beyond its historical profile. The historical profile shall be defined as the widest beach profile that existed prior to June 1986.
    (B) The material placed on the beach consists of sand of equal or greater grain size than the sand existing on the beach.

(C) Placement and subsequent erosion of the materials does not adversely impact tidal marshes or productive intertidal and shallow subtidal areas.
(D) Efforts are made to maintain a stable beach profile.
(E) Dredged material is graded at a uniform slope and contoured to minimize juvenile fish stranding and hazards to beach users.

This standard relates to water quality because it concerns the protection of estuarine water resources. Ongoing O&M Operations will utilize the same beach nourishment sites that are currently authorized by permitting agencies and identified in the Dredged Material Management Plan. Beaches would be widened consistent with their historical profile, material placed on the beach consists of sand of equal or greater grain size than the sand existing on the beach, placement and subsequent erosion of the materials would not adversely impact tidal marshes or productive intertidal and shallow subtidal areas, BMPs would be in place to maintain a stable beach profile, and the dredged material would be graded at a uniform slope and contoured to minimize juvenile fish stranding and hazards to beach users.

For these reasons, the proposed action is compatible with provision 4.232 (19).

20. Except as noted below, land disposal and site preparation shall be conducted such that:
(A) Surface runoff from disposal sites is controlled to protect water quality and prevent sedimentation of adjacent water bodies, wetlands, and drainage ways. Disposal runoff water must enter the receiving waterway through a controlled outfall at a location with adequate circulation and flushing characteristics. Underground springs and aquifers must be identified and protected;

Applicable responses for these standards are addressed above in 3.3 [II.B & III.C.1.a.ii].

(B) Dikes are constructed according to accepted engineering standards and are adequate to support and contain the maximum potential height and volume of dredged materials at the site, and form a sufficiently large containment area to encourage proper ponding and to prevent the return of dredged materials into the waterway or estuary. Containment ponds and outfall weirs shall be designed to maintain adequate standing water at all times to further encourage settling of dredged materials. The dikes shall be constructed within the boundaries of the disposal site and shall be constructed of material obtained from within the site or other approved source. Clean dredged material placed on land disposal sites located directly adjacent to designated beach nourishment sites may be allowed to flow directly into the waterway without conforming to (A) and (B) of this Section, provided that all policies and standards for in-water disposal and beach nourishment are met and the dredged materials are not allowed to enter wetlands or the waterway in areas other than the designated beach nourishment site.

The existing sites will continue to be raised using dikes that meet these criteria.

For this reason, the proposed action is compatible with provision *4.232 (20B)*.

> *21. Land disposal sites which are not intended for dredged material disposal or development use within a two-year period following disposal shall be revegetated as soon as site and weather conditions allow, unless habitat management plans agreed upon by resource management agencies specify that open sand areas should remain at the site. The project sponsor shall notify the City and state and federal permitting and resource management agencies when disposal is completed and shall coordinate revegetation with these agencies. The notification shall be sent to at least the following agencies: the local jurisdiction, U.S. Army Corps of Engineers, Soil Conservation Service, Division of State Lands, Oregon Department of Fish and Wildlife. Revegetation of a disposal site does not preclude future use of the sites for dredged material disposal.*
>
> *The disposal site design shall be reviewed to determine if wetlands or other habitats will form on the site during the period between disposal actions. The disposal permit may be conditioned to allow future disposal actions to fill the created wetlands or habitats.*

This provision relates to water quality because it concerns the minimization of impacts on wetlands and other estuarine water resources. Upland placement sites are typically prepped for placement of dredged material by removing shrubby vegetation and grading the site to accommodate weir placements and/or settling ponds. Once the dredged materials have been placed, the area is graded to an appropriate slope for beach nourishment operations and leveled for upland placement. The material being placed is xeric in nature and does not lend itself to support re-vegetation efforts. Equipment and construction debris will be removed prior to vacating the placement site. Placement of dredged fill material will not disturb more than the minimum area necessary for the project and shall minimize impacts on wetlands and other estuarine resources. The Corps will follow all BMPs as addressed above in P20.5 (2).

For these reasons, the proposed action is compatible with Standard 4.232 (21) to the maximum extent possible.

> *22. The final height and slope after each use of a land dredged material disposal site shall be such that:*
> *(A) The site does not enlarge itself by sloughing and erosion into adjacent areas;*
> *(B) Loss of materials from the site during storms and freshets is minimized; and*
> *(C) Interference with the view from nearby residences, scenic points, and parks does not occur.*

Applicable responses for these standards are addressed above in P20.5 (10).

4.235. Filling of Aquatic Areas and Non-Tidal Wetlands

This subsection applies to the placement of fill material in tidal wetlands and waters of the Columbia River Estuary. These standards also apply to fill in non-tidal wetlands in shoreline designations that are identified as "significant" wetlands under Statewide Planning Goal 17.

1) *Fill in estuarine aquatic areas may be permitted only if all of the following criteria are met:*
    a. *If required for navigation or for other water-dependent uses requiring an estuarine location, or if specifically allowed under the applicable aquatic zone;*
    b. *If a need (i.e. a substantial public benefit) is demonstrated;*
    c. *The proposed fill does not unreasonably interfere with public trust rights;*
    d. *Feasible alternative upland locations do not exist; and*
    e. *Adverse impacts, as identified in the impact assessment, are minimized.*

Applicable responses for these standards are addressed above in P20.5 (1).

2) *The fill shall cover no more than the minimum necessary to accomplish the proposed use.*

Applicable responses for this standard are addressed above in P20.5 (2).

3) *Aquatic areas shall not be used for disposal of solid waste.*

This standard relates to water quality for the protection of water resources. No solid waste would be disposed of at the placement sites. The sediments which the Corps dredges from the CR FNCs are regulated under the CWA and MPRSA, as appropriate, and are not considered solid waste themselves. Therefore, the proposed action is compatible with this standard.

4.239 Fish and Wildlife Habitat

This subsection applies to uses and activities with potential adverse impacts on fish or wildlife habitat in Columbia River Estuary aquatic and shoreline areas.

(1) *Projects affecting endangered, threatened, or sensitive species habitat, as identified by the US Fish and Wildlife Service or Oregon Department of Fish and Wildlife, shall be designed to minimize potential adverse impacts. This shall be accomplished by one or more of the following:*
    a) *Soliciting and incorporating agency recommendations into local permit reviews;*
    b) *Dedicating and setting aside undeveloped on-site areas for habitat;*
    c) *Providing on or off-site compensation for lost or degraded habitat;*

d) Retaining key habitat features (for example: roosting trees, riparian vegetation, feeding areas).

(2) In-water construction activity in aquatic areas shall follow the recommendation of state and federal fisheries agencies with respect to project timing to avoid unnecessary impacts on migratory fish.

(3) Uses and activities with the potential for adversely affecting fish and wildlife habitat may be approved only if the following impact mitigation actions are incorporated into the permit where feasible. These impact mitigation actions are listed from highest to lowest priority:

a) Avoiding the impact altogether by not taking a certain action or parts of an action;

b) Minimizing impacts by limiting the degree or magnitude of an action and its implementation;

c) Rectifying the impact by repairing, rehabilitating, restoring the affected environment (this may include removing wetland fills, rehabilitation of a resource use and/or extracting site when its economic life is terminated, etc.);

d) Reducing or eliminating the impact over time by preservation and maintenance operations.

(4) Projects involving subtidal or intertidal aquatic area fill or intertidal aquatic dredging with the potential for adversely affecting aquatic habitat must provide compensatory mitigation, consistent with Mitigation and Restoration Standards (subsection S4.218).

This provision relates to water quality because it concerns the protection of estuarine water resources. The Corps has consulted with the US Fish and Wildlife Service (USFWS) on the maintenance of the Columbia River navigation projects between the Mouth of the Columbia River and Bonneville Dam, addressing effects to several ESA-listed species as described in P20.5 (2) above.

For these reasons, the proposed action is compatible with Standard 4.239.

S4.242. Water Quality Maintenance.

The standards in this subsection are intended to help protect and enhance the quality of water in the Columbia River Estuary. Impacts on water quality in aquatic areas and in tide gated sloughs in shoreland areas are covered.

(3) The potential adverse impacts on water quality from dredging, fill, in-water dredged material disposal, in-water log storage, water intake or withdrawal, and slip or marina development will be assessed during permit review. Parameters to be addressed include:

(A) Turbidity

(B) Dissolved oxygen

(C) Biochemical oxygen demand

(D) Contaminated sediments

(E) Salinity
(F) Water temperature
(G) Flushing
(4) New or expanded

This provision relates to water quality because it concerns potential adverse impacts to water quality in aquatic areas from dredge/fill activities.

Direct and indirect water quality effects:

In water placement would have minor short-term adverse effects to water quality indicators and negligible adverse indirect effects to water quality indicators. Turbidity would increase slightly during in-water placement, but medium to fine-grain sized dredged material would be placed upon medium- to fine-grain size sand, and combined disturbance would have brief turbidity that would settle out shortly after placement. Water temperature and dissolved oxygen levels would not change from existing conditions appreciably because placement of dredged sand (suitable for unconfined in-water placement) within in-water placement sites would not introduce dissolved organics or nutrient loaded material into deep water areas. Negligible long-term indirect effects to turbidity would occur from long-term dispersion of sediment in the vicinity of the site. These effects would not differ from background levels of existing conditions for water quality indicators at the site vicinity.

Shoreline placement would have minor short-term adverse effects to water quality indicators and negligible adverse indirect effects to water quality indicators. Turbidity would increase during shoreline placement until perimeter of shoreline placement area is established. Practicable avoidance and minimization measures for water quality described in section 1.4 would effectively minimize the effects of placement and construction at the shoreline site. Water temperature and dissolved oxygen levels would not change from existing conditions appreciably because placement of dredged sand at shoreline sites would not introduce dissolved organics or nutrient loaded material into nearshore areas. Negligible long-term indirect effects to turbidity would occur from long-term dispersion of sediment in the vicinity of the site. These effects would not differ from background levels of existing conditions for water quality indicators at the site vicinity.

Transfer placement would have minor short-term adverse effects to water quality indicators and negligible adverse indirect effects to water quality indicators. Turbidity would increase slightly during site preparation (dredging of material to attain sufficient depth), during in-water placement, and during site restoration of pre-construction contours. Turbidity plumes would settle out quickly because material dredged and placed at transfer sites would be composed of medium- to fine-grain sized sand. Water temperature and dissolved oxygen levels would not be appreciably affected by placement of dredged sand at and through transfer sites because it would not introduce dissolved organic or nutrient loaded material into water within the site vicinity. Negligible long-term indirect effects to turbidity would occur from long-term dispersion of sediment in the vicinity of the site. These effects would not differ from background levels of existing conditions for water quality indicators at the site vicinity.

Cumulative water quality effects:

Negligible short- and medium-term and minor long-term additive cumulative effects would occur at a regional scale when compared to past, present, and reasonably foreseeable future effects. Dredging, placement and construction would have negligible additive adverse cumulative effects to water quality indicators because they would contribute localized minimal amounts of turbidity in the vicinity of dredging, placement, and construction. Depletion of placement capacity that retains sediment in the system would lead to minor indirect adverse cumulative effects at the regional level through erosional loss of aquatic ecosystem features at areas where there would be no replacement of sediment at eroded features.

For these reasons, the proposed action is compatible with Standard 4.242.

3. Oregon's Statewide Planning Goals, Columbia County's Comprehensive Plan, and Local Land Use Regulations

In this section the Corps has described those provisions of Columbia County's acknowledged comprehensive plan and land use regulations that relate to water quality and made affirmative findings that its project is compatible with those land use factors which relate to water quality. The Corps' provision of this applicable land use information ensures that DEQ's WQC decision is compatible with those factors that relate to water quality.

Columbia County does not have any land use regulations that apply to work or development within the waterway. However, the Zoning Ordinance, Comprehensive Plan, and the Stormwater & Erosion Control Ordinance may be applicable for grading activities and discharges of fill placed on land depending on the location and size of land disturbance. FNC dredging and placement site locations used for upland and/or shoreline placement, or in-water transfer of material are listed by county in section 1.2, Table 1 above.

3.1 Compatibility with Applicable Columbia County Comprehensive Plan Provisions

The Columbia County Comprehensive Plan contains goals of the county. Those that pertain to water quality or the control and abatement of water pollution in relation to the proposed Project are located in Article VI – Special Districts, Overlay Districts and Special Provisions. The sections that are applicable to the proposed action are addressed below.

VIII.H - Fish and Wildlife Habitat.

This subsection applies to uses and activities with potential adverse impacts on fish or wildlife habitat in Columbia County

9. Prohibit diversion or impoundment of stream courses, which adversely impact fish and wildlife habitat.

This provision relates to water quality because it concerns the protection of estuarine water resources. Dredging and placement activities will not divert or impound stream courses. Placement sites will be constructed with a slope of 10-15%, with no swales, to reduce the possibility of stranding juvenile salmonids consistent with the BMPs stated in Table 2 above. For these reasons, the proposed action is compatible with this standard.

15. *Protect significant streams, lakes and wetlands from the adverse affects of development and other land use practices.*

Applicable responses for this standard is addressed above in 2.1 [P20.5 (2)].

IX.F Natural Areas

This subsection applies to the protection of remaining ecologically significant natural features in Columbia County.

1. *Protect ecologically significant natural features and areas by restricting land use activities which may degrade their unique characteristics and direct incompatible land uses away from such areas.*

This standard relates to water quality because the purpose is to conserve areas of the Columbia River and to protect and conserve natural resources. The effects associated with new dredging projects could have additional effects on ecologically significant natural features. However, the Corps is not proposing new areas to be dredged or new areas for dredge material placement. Intermittent dredging and placement activities are compatible with the resource capabilities of the proposed placement areas because the resources of the area will be able to assimilate the site's use, activity, and their affects. In addition, affected sites will continue to function in a manner which protects ecologically significant natural features, natural biological productivity, recreation, and aesthetic values. Therefore, the proposed action is compatible with this standard.

X.A. Water Resources

This subsection seeks to the protect and maintain the quality of water resources in Columbia County.

2. *Protect areas significant for the recharge of groundwater resources such as wetlands and riparian areas.*

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)].

9. Maintain rivers and streams in their natural state to the maximum extent practicable through sound land and water management practices. Consideration shall be given to natural, scenic, historic, economic, cultural, and recreational qualities of the rivers and adjacent lands.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (1), P20.5 (2), P20.5 (3)] and 2.3 [4.232 (8)].

13. Apply erosion and sediment reduction practices along riparian areas to assist in maintaining water quality.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 2.3 [4.232 (3)].

14. Protect marshes, swamps, and other wetlands from filling, draining, or other alterations which would destroy or reduce their biological value.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)], and below in 3.2 [1173] and 3.2 [1184.C].

23. Protect water quality by applying Riparian Corridor and Wetland Overlay Zones which discourage development in sensitive areas that affect the water resource.

Responses to applicable water quality provisions in the Riparian Corridor and Wetland Overlay Zones are addressed in sections 3.2 [1173] and 3.2 [1184.C] below.

3.2 Columbia County Zoning Ordinance

The applicable county ordinances are found in S1170 Riparian Corridors, Wetlands, Water Quality, and Fish and Wildlife Habitat Protection Overlay Zone

The following activities are prohibited within a riparian corridor boundary, except as provided for in Sub-sections 1175 and 1176 of the Columbia County Zoning Ordinance:

1173 Activities Prohibited within the Riparian Corridor Boundary

A. The alteration of a riparian corridor by grading, placement of fill material, and/or impervious surfaces, including paved or gravel parking areas, or paths, and/or the construction of buildings or other structures which require a building permit under the State of Oregon Uniform Building Code, as amended.
B. The removal of riparian trees or vegetation.

This provision relates to water quality because it concerns the protection of estuarine water resources. Upland placement sites are typically prepped for placement of dredged material by removing shrubby vegetation and grading the site to accommodate weir placements and/or settling ponds. Once the dredged materials have been placed, the area is graded to an appropriate slope for beach nourishment operations and leveled for upland placement. Although USACE will not, in the absence of Congressional direction, apply for any local building permit, consistent with sub-section 1175 A.2 of the Columbia County Zoning Ordinance (Permitted Uses and Activities), vegetation will only be removed if it is necessary to complete O&M operations. Vegetation along the water shall be left in its natural condition to the maximum extent practicable. Placement of dredged fill material will not disturb more than the minimum area necessary for the project and shall minimize impacts on estuarine resources to the maximum extent practicable as addressed above in 2.1 [P20.5 (2)].

For these reasons, the proposed action is compatible with Standard S1173.

1184.C Activities Prohibited within the Wetland Riparian Corridor Boundary

A. *The alteration of a wetland riparian corridor by grading, the placement of fill material, and/or impervious surfaces, including paved or gravel parking areas, or paths, and/or the construction of buildings or other structures which require a building permit under the State of Oregon Uniform Building Code, as amended.*
B. *The removal of riparian trees or vegetation.*

This provision relates to water quality because it concerns the protection of wetland and riparian water resources. Upland placement sites are typically prepped for placement of dredged material by removing shrubby vegetation and grading the site to accommodate weir placements and/or settling ponds. Once the dredged materials have been placed, the area is graded to an appropriate slope for beach nourishment operations and leveled for upland placement. Although USACE will not, in the absence of Congressional direction, apply for any local building permit, consistent with sections 1184.E.1.b., 1184.E.2.b, and 1184.G.1 of the Columbia County Zoning Ordinance (Exceptions of prohibited activities), vegetation will only be removed if it is necessary to complete O&M operations. Vegetation along the water shall be left in its natural conditions unless removal of such vegetation is necessary to complete O&M operations. Placement of dredged fill material will not disturb more than the minimum area necessary for the project and shall minimize impacts on other estuarine resources to the maximum extent possible as addressed above in 2.1 [P20.5 (2)]. No impacts to wetlands are proposed.

For these reasons, the proposed action is compatible to the extent possible with Standard S1184C.

1185 Natural Area Overlay

> *The Natural Area Overlay zone applies to all public land areas that are identified as being significant Natural Areas in the Oregon State Registry of National Heritage Resources, Natural Areas owned by The Nature Conservancy, and to areas which are identified as being significant Natural Areas in the Comprehensive Plan. The Oregon State Registry of National Heritage Resources is attached to the Comprehensive Plan in the Technical Appendix, Part XVI, Article IX.*

This standard relates to water quality for the protection of ecologically significant natural features and areas in Columbia County by restricting land use activities which may degrade the land's unique characteristics. Consistent with section 1188.A (Natural Area Overlay, Permitted Uses), the proposed beach nourishment and upland placement sites would have ecological beneficial uses and will not result in permanent disturbance or destruction of the sensitive, fragile, or otherwise unique characteristics of natural areas. The proposed action could result in temporary and localized soil disturbance at upland and shoreline placement sites, which could result in erosion that can adversely affect water quality, plant, animal, and aquatic life. The Corps disturbs the minimum amount of material necessary from its federal navigation channels and placement sites as a matter of practice. All reasonable Best Management Practices (BMPs) would be employed to control erosion, encourage settling, and reduce turbidity levels from upland placement locations to the maximum extent practicable. Potential affected sites would continue to function in a manner which conserves the long-term ecological significance, natural biological productivity, recreation, and aesthetic values.

For these reasons, the proposed action is compatible with provision 1185.

3.3 Columbia County Stormwater & Erosion Control Ordinance

The purpose of this ordinance is to: Prevent water quality degradation of the county's water resources; Prevent damage to property from increased runoff rates and volumes; Protect the quality of waters for drinking water supply, contact recreation, fisheries, irrigation, and other beneficial uses; Establish sound developmental policies which protect and preserve the county's water and land resources; Protect county roads and rights-of-way from damage due to inadequately controlled runoff and erosion; Protect the health, safety, and welfare of the inhabitants of the county; Maintain existing instream flows; and Preserve and enhance the aesthetic quality of the county's water resources. The sections that are applicable to the proposed action are addressed below.

II. General Requirements

B. Drainage leaving a site

1. Runoff discharges from a site shall occur at their natural location and elevation, unless runoff is conveyed in a constructed system, approved by the county.

2. Surface runoff exiting a parcel shall be discharged with adequate energy dissipators within the development site to prevent downstream damage.

The standard relates to water quality because its purpose is to ensure that grading and soil disturbance activities do not adversely affect water quality where work occurs. No expansion of impervious surface is proposed. Baseline activities associated with continued maintenance dredging and use of upland and shoreline placement sites have not appreciably changed. Implementation of the BMPs described in Section 1.4 above have been successful in minimizing potential adverse impacts to the aquatic environment. Dredged material containment berms with weir systems are measures used to maximize sediment retention within the site. All reasonable Best Management Practices (BMPs) would be employed to encourage settling, infiltration, and reduce turbidity levels from the upland and shoreline placement locations to the maximum extent practicable. Measures employed will be inspected and maintained daily to ensure their proper function. Runoff discharges from placement sites will occur at their natural location, mimic pre-project flow conditions, and will be discharged into waters such that no downstream damage will occur.

For these reasons, the proposed action is compatible with provision II.B.

D. Fills in flood storage areas

In order to control flooding of downstream properties, all wetland fills and fills of low areas where runoff is naturally stored during 100-year storms, must be mitigated by creation of an equivalent amount of runoff storage within 1000 feet of the filled site.

This provision relates to water quality because it concerns the protection of wetland and estuarine resources. Runoff discharges from placement sites will occur at their natural location, mimic pre-project flow conditions, and will be discharged into waters such that no downstream damage will occur. No impacts to wetlands are proposed. Impacts to floodplains associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were evaluated in the Final EIS and 2003 Supplemental EIS. The project, including disposal, is anticipated to have minimal effect on the floodplain or flood levels. The proposed action does not fill within flood levees. The proposed action maintains existing FNCs, rather than creating new channels or increasing channel capacity; therefore, the action would not change the likelihood or rate of floodplain development in any way. Removal of accumulated sediments from the FNCs could decrease the potential for flooding locally. Placement of dredged material in the Columbia River would not raise flood elevations because the volumes placed are negligible compared to the bedload of the Columbia River and because the placement does introduce new material in the stream; in-water placement only moves material within the same river system.

For these reasons, the proposed action is compatible with provision II.D.

III. Standards Specific to Activities

C. Grading Permits

Grading permits that involve disturbing more than 2000 square feet of land or activities disturbing more than 1000 square feet of land on sites with known and apparent erosion problems.

1. Erosion Control

a. Required Measures

ii. Where slopes exceed 5%, a Sediment Fence (ECM-Section 3.3.2) shall be installed at the base of the disturbed area or dirt stockpiles.

The standard relates to water quality because its purpose is to ensure that grading and soil disturbance activities do not adversely affect water quality where work occurs. Although USACE will not, in the absence of Congressional direction, apply for any local grading permit, the proposed action is compatible because implementation of the BMPs described in Section 1.4 above, have been successful in minimizing potential adverse impacts to the aquatic environment. The proposed action would result in temporary and localized soil disturbance and destabilization at upland and shoreline placement sites, which could result in erosion that can adversely affect water quality, plant, animal, and aquatic. The Corps disturbs the minimum amount of material necessary from its federal navigation channels and placement sites as a matter of practice. All reasonable BMPs would be employed to control erosion, encourage settling, and reduce turbidity levels from upland placement locations to the maximum extent practicable. Measures employed will be inspected and maintained daily to ensure their proper function. Runoff discharges from placement sites will occur at their natural location, mimic pre-project flow conditions, and will be discharged into waters such that no downstream damage will occur.

For these reasons, the proposed action is compatible with provision III.C.1.a.ii.

iii. As an alternative to a sediment fence, vegetated and undisturbed buffers at the base of the slope on the subject property can be utilized. Slopes above the buffer cannot exceed 10% and the buffer width must be at least equal to the uphill-disturbed area draining to it.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

iv. During wet weather, October 1-April 30, a 6-mil plastic sheet cover (ECM-Section 3.3.9) or a minimum 2" of straw mulch cover shall be required on stockpiles where sediment is eroding and leaving the subject property or entering a water resource.

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

v. Ground cover shall be reestablished prior to removing the erosion control measures described above (ECM-Section 3.3.6).

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

G. Drainage Modifications

Drainage modifications involving the construction of storm pipes, culverts, channels, embankments, or other flow-altering structures in any stream, stormwater facility, or wetland

1. Erosion Control

a. Required Measures

i. During wet weather, October 1-April 30, a 6-mil plastic sheet cover (ECM-Section 3.3.9) or a minimum 2" of straw mulch cover shall be required on areas of exposed earth where sediment is eroding and entering a water resource.

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

ii. Ground cover shall be reestablished prior to removing erosion control measures (ECM-Section 3.3.6).

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

b. Erosion Control Plan

i. A Final Erosion Control Plan is required if more than 2000 square feet, or 1000 square feet on sites with known and apparent erosion problems, will be disturbed by the drainage modification.

ii. The plan shall be prepared by an Engineer.

iii. The plan shall specify use of the erosion control measures outlined above, plus additional measures as may be necessary to prevent sediment from entering a water resource.

iv. The plan shall be completed in the format specified in Section IV.

v. Construction on the site shall not begin until the plan is approved by the county.

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2), (P20.5 (3)] and 3.3 [III.C.1.a.ii].

4. Oregon's Statewide Planning Goals, Multnomah County's Comprehensive Plan, and Local Land Use Regulations

In this section the Corps has described those provisions of Multnomah County's acknowledged comprehensive plan and land use regulations that relate to water quality and made affirmative findings that its project is compatible with those land use factors which relate to water quality. The Corps' provision of this applicable land use information ensures that DEQ's WQC decision is compatible with those factors that relate to water quality. FNC dredging and placement site locations used for upland and/or shoreline placement, or in-water transfer of material are listed by county in section 1.2, Table 1 above.

4.1 Compatibility with Applicable Multnomah County Comprehensive Plan Provisions

The Multnomah County Comprehensive Plan contains goals of the county. Those that pertain to water quality or the control and abatement of water pollution in relation to the proposed Project are Goals 5 (Natural Resources, Scenic and Historic Areas, and Open Spaces) and 6 (Air, Water, and Land Resources Quality). These goals and their associated administrative rules call for cities and counties to inventory significant natural resources and create and implement programs to protect them from impacts associated with land use and development. The sections that are applicable to the proposed action are addressed below.

General Policies and Strategies (County-wide)

5.2 - Protect natural areas from incompatible development and specifically limit those uses which would significantly damage the natural area values of the site.

Applicable responses for this standard are addressed above in 3.1 [IX.F.1] and 3.2 [1185]

5.6 - Protect vegetated riparian corridors in order to maintain their water quality functions including the following:

1. *Providing shade to maintain or reduce stream temperatures to meet state water quality standards;*
2. *Supporting wildlife in the stream corridors;*
3. *Minimizing erosion, nutrient, and pollutant loading into water;*
4. *Maintaining natural hydrology; and*
5. *Stabilizing slopes to prevent landslides that contribute to sedimentation of water.*

Applicable responses for these standards are addressed above in 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

5.11 - Protect water quality of streams by controlling runoff that flows into them.

Applicable responses for this standard are addressed above in 3.3 [II.B & III.C.1.a.ii].

5.12 - Limit visible and measurable erosion from development in substantial compliance with the water quality standards of Title 3 of the Metro Urban Growth Management Functional Plan.

Applicable responses for this standard are addressed above in 2.3 [S4.232 (3) & S4.232 (7)].

5.14 - Stormwater drainage for new development and redevelopment shall prioritize water quality and natural stream hydrology in order to manage stormwater runoff in accordance with the following:

1. The run-off from the site shall not adversely affect the water quality in adjacent streams, ponds, or lakes, or alter the drainage on adjoining lands, or cause damage to adjacent property or wildlife habitat.

Applicable responses for this standard are addressed above in 3.3 [II.B].

2. Stormwater infiltration and discharge standards shall be designed to protect watershed health by requiring onsite detention and/or infiltration in order to mimic pre-development hydraulic conditions so that post-development runoff rates and volumes do not exceed pre-development conditions.

Applicable responses for this standard are addressed above in 3.3 [II.B & II.D].

3. Apply Low Impact Development Approaches (LIDA) in order to conserve existing resources, minimize disturbance, minimize soil compaction, minimize imperviousness, and direct runoff from impervious areas onto pervious areas.

Applicable responses for this standard are addressed above in 3.3 [II.B & II.D].

4. Protect and maintain natural stream hydrology (or flow), with an emphasis on reducing hydromodification impacts such as stream incision and widening.

Applicable responses for these standards are addressed above in P20.5 (10).

Wild and Scenic Waterways

5.16 – Protect all state or federal designated scenic waterways from incompatible development and prevent the establishment of conflicting uses within scenic waterways.

The Columbia River is not a designated Wild and Scenic waterway.

5.27 – Protect significant native fish and wildlife habitat and wildlife corridors and specifically limit conflicting uses within these habitats and sensitive big game winter habitat areas.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)].

4.2 Chapter 39 – Multnomah County Zoning Code

39.5045 Watercourse Relocation and Alteration

(A) No relocation, encroachment or alteration of a watercourse shall be permitted unless a detailed hydraulic analysis, certified by a State of Oregon Registered Professional Engineer, is provided which demonstrates that:

(1) The flood carrying capacity for the altered or relocated portion of the watercourse will be maintained;

(2) The area subject to inundation by the base flood discharge will not be increased;

(3) The alteration or relocation will cause no measurable increase in base flood levels.

Applicable responses for these standards are addressed above in 2.1 [P20.5 (10)].

39.5090 Geologic Hazards Permit Standards

(E) Fills shall not encroach on any water body unless an Oregon licensed Professional Engineer certifies in writing that the altered portion of the waterbody will continue to provide equal or greater flood carrying capacity for a storm of 10-year design frequency.

Applicable responses for these standards are addressed above in 2.1 [P20.5 (10)].

(F) Fill generated by dredging may be deposited on Sauvie Island only to assist in flood control or to improve a farm's soils or productivity, except that it may not be deposited in any SEC overlay, WRG overlay, or designated wetland.

Applicable responses for these standards are addressed above in 4.1 [5.53].

(H) Stripping of vegetation, ground disturbing activities, or other soil disturbance shall be done in a manner which will minimize soil erosion, stabilize the soil as quickly as practicable, and expose the smallest practical area at any one time during construction.

Applicable responses for these standards are addressed above in sections 3.2 [1173] and 3.2 [1184.C].

(I) Development Plans shall minimize cut or fill operations and ensure conformity with topography so as to create the least erosion potential and adequately accommodate the volume and velocity of surface runoff.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B & III.C.1.a.ii].

(J) Temporary vegetation and/or mulching shall be used to protect exposed critical areas during development.

Applicable responses for this standard *are addressed above* in 2.1 [P20.5 (2) & P20.5 (3)] and 3.3 [III.C.1.a.ii].

(K) Whenever feasible, natural vegetation shall be retained, protected, and supplemented;

(1) A 100-foot undisturbed buffer of natural vegetation shall be retained from the top of the bank of a stream, or from the ordinary high watermark (line of vegetation) of a water body, or within 100-feet of a wetland;

(2) The buffer required in subsection (K)(1) may only be disturbed upon the approval of a mitigation plan which utilizes erosion, sediment, and stormwater control measures designed to perform as effectively as those prescribed in the most recent edition of the City of Portland Erosion and Sediment Control Manual and the City of Portland Stormwater Management Manual and which is consistent with attaining equivalent surface water quality standards as those established for the Tualatin River drainage basin in OAR 340-041-0345(4).

Applicable responses for these standards are addressed above in sections 3.2 [1173] and 3.2 [1184.C].

(L) Permanent plantings and any required structural erosion control and drainage measures shall be installed as soon as practical.

Applicable responses for these standards are addressed above in sections 2.1 [P20.5 (2)] and 3.3 [III.C.1.a.ii].

(M) Provisions shall be made to effectively accommodate increased runoff caused by altered soil and surface conditions during and after development. The rate of surface water runoff shall be structurally retarded where necessary.

Applicable responses for this standard are addressed above in 3.3 [II.B & II.D].

(N) Sediment in the runoff water shall be trapped by use of debris basins, silt traps, or other measures until the disturbed area is stabilized.

Applicable responses for this standard are addressed above in 3.3 [II.B].

(O) Provisions shall be made to prevent surface water from damaging the cut face of excavations or the sloping surface of fills by installation of temporary or permanent drainage across or above such areas, or by other suitable stabilization measures such as mulching or seeding.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B, II.D & III.C.1.a.ii].

(P) All drainage measures shall be designed to prevent erosion and adequately carry existing and potential surface runoff to suitable drainageways such as storm drains, natural water bodies, drainage swales, or an approved drywell system.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B, II.D & III.C.1.a.ii].

(Q) Where drainage swales are used to divert surface waters, they shall be vegetated or protected as required to minimize potential erosion.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B, II.D & III.C.1.a.ii].

(R) Erosion and sediment control measures must be utilized such that no visible or measurable erosion or sediment shall exit the site, enter the public right-of-way or be deposited into any water body or storm drainage.

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B, II.D & III.C.1.a.ii].

(S) Disposed spoil material or stockpiled topsoil shall be prevented from eroding into water bodies by applying mulch or other protective covering; or by location at a sufficient distance from water bodies; or by other sediment reduction measures;

Applicable responses for this standard are addressed above in 2.1 [P20.5 (2)] and 3.3 [II.B & III.C.1.a.ii].

(T) Such non-erosion pollution associated with construction such as pesticides, fertilizers, petrochemicals, solid wastes, construction chemicals, or wastewaters shall be prevented from leaving the construction site through proper handling, disposal, continuous site monitoring and clean-up activities.

This standard relates to water quality for the protection of water resources. The sediments which the Corps dredges from the CR FNCs are regulated under the CWA and MPRSA, as appropriate, and are not considered solid waste themselves. During any operation and maintenance actions, there would be potential for contaminants to enter the water. BMPs would be implemented to prevent petrochemicals, solid wastes, construction chemicals, or wastewaters from leaving the proposed dredging and placement sites. The proposed action does not involve the release of pesticides or fertilizers. Standard methods for handling hazardous materials spills are addressed in section 1.4 above. Therefore, the proposed action is compatible this standard.

(V) Ground disturbing activities within a water body shall use instream best management practices designed to perform as prescribed in the City of Portland Erosion and Sediment Control Manual and the City of Portland Stormwater Management Manual.

Applicable responses for this standard are addressed above in P20.5 (2).

4.3 Chapter 38 – Columbia River Gorge National Scenic Area

The purposes of the Columbia River Gorge National Scenic Area Districts are to protect and provide for the enhancement of the scenic, cultural, recreational, and natural resources of the Columbia River Gorge, and to protect and support the economy of the Columbia River Gorge by encouraging growth to occur in existing urban areas and by allowing future eco-nomic development in a manner that protects and enhances the scenic, cultural, recreational, and natural resources of the Gorge.

This standard relates to water quality for the protection of ecologically significant natural features and areas in Columbia River Gorge National Scenic Area by restricting land use activities which may degrade the land's unique characteristics. The statutory responsibility to continue operating and maintaining the CR FNCs to their authorized dimensions is non-discretionary. No material changes are proposed to the ongoing O&M operations. O&M operations would continue in the same manner and for the same purpose and use. The existing baseline condition and functionality of the LCR would remain the same. Further, General Policies and Guidelines for the Management Plan of the Scenic Area include Savings Policies that ensure certain uses are exempted from management or regulation under the Scenic Area Act. For example, water transportation activities on the Columbia River or its tributaries are exempt from regulation under the Management Plan or land use ordinances adopted by counties or the Gorge Commission. And the term "activities" includes those facilities necessary for navigation, including the federal navigation channels and facilities which accommodate material dredged from the channels. Further, the operation, maintenance, and improvement of

navigation facilities at Bonneville Dam (except for the offsite disposal of excavation material) are exempt from regulation under the Management Plan or land use ordinances.

For these reasons, the proposed action is compatible with Chapter 8 – Columbia River Gorge National Scenic Area.

5. Summary of Findings

As described above, the Corps has determined that the proposed action is compatible with those provisions in Clatsop, Columbia, and Multnomah County's comprehensive plans, land use regulations, and development standards that relate to water quality. Therefore, DEQ's decision to issue a WQC under CWA Section 401 for the proposed action will be compatible with relevant portions of the acknowledged comprehensive plan and local land use regulations.

CONTINUING LCR FLOWLANE CONVERSATION

Develop responses to these complex questions together over a series of meetings.

Goal/Agenda 31 Jan: to build some foundation in order to answer these questions.

1. Corps' approach to flowlane/thalweg placement and effects to river sediment fate and transport (lead: Rod Moritz, Coastal & Hydraulic Engineer)
2. Results from our approach to GIS mapping of County Plan criteria for flowlane placement. Quantify channel maintenance flowlane placement volume. (lead: Jessica Stokke, Project Manager)

These pieces will help inform discussion to be continued at next meeting.

QUESTIONS 1 - 5

1. What are the quantifiable adverse effects to Corps operations if in-river DMD were to adhere to the state enforceable policy regarding flowlane disposal, restricting this practice to within the FNC plus a 600-ft area on either side?
2. What would be the comparative effects to river sediment fate and transport of either: a) adhering to the state definition of flowlane disposal; or b) practicing DMD consistent with the Corps-preferred definition of the flowlane?
3. How much flowlane disposal is currently used now for FNC maintenance, and how much is proposed to occur under the new 20-year DMMP?
4. How would the Corps propose to construct a “Thalweg-Based” definition of the flowlane that would be able to be spatially confined and stable within a regulatory context (i.e., that would not be subject to frequent unrecorded and unevaluated change)?
5. What administrative or procedural steps would the Corps be willing to take in support of a proposal to amend the current definition of flowlane disposal, as codified in the Clatsop County Comprehensive Plan? What information or other resources would the Corps be able to provide to support such a proposal, with special emphasis on effects to biological resources, sediment transport and accumulation, habitat disturbance, and river users?

US Army Corps of Engineers

Portland District's Approach for Inwater Placement of LCR Dredged Sediment Evolved during 1990s to 2012

1998 LCR DMMP (Flowlane): Flowlane placement was done throughout the federal navigation channel (FNC) where depths ranged between 35 and 65 feet, typically below 45 feet. The location of flowlane sites varied, depending on the condition of the FNC each year. 50% of LCR dredging was placed in Flowlane sites. At the same time, river morphology outside FNC was changing and becoming unstable.

Post 2010-12: Flowlane placement method was no longer sustainable. Most deep areas within or adjacent to the FNC were filling up and their continued re-use as placement sites was feeding dredged sediment directly back into the FNC where it would immediately contribute to channel shoaling.

Current Practice (Thalweg): Portland District now manages dredged sediment placement to emulate the natural river processes. Conduct LCR dredged sediment placement within the river thalweg. The thalweg is the "action area", where the river is moving the most sediment during the year.

Portland District's view is that river thalweg is within the 20 ft depth contour, contiguous along the FNC. Distribute dredged sediment within the river thalweg to not harm living resources, not adversely affect other uses of the river, sustain the thalweg, and not rapidly return to the FNC. Success requires constant adaptation as the river continuously relocates the dredged sediment placed inwater each year. We cannot rely on a pre-determined fixed set of inwater placement sites. We carefully target suitable placement sites & coordinate placement within candidate sites to avoid conflicts with other uses.

Thalweg Placement: Requires that we have the flexibility to use different inwater placement sites each year, as the river dynamics dictate. The river's sediment supply is finite and we need to manage it as such. Our manta is to work with the natural system that affects sedimentation and to "do no harm".

Portland District is managing LCR & MCR dredged material in alignment with Oregon Statewide Planning Goals (OCMP Coastal Goals), by:

- Providing immediate and direct benefit for estuary processes (16)
- Providing indirect benefit for coastal shorelands (17)
- Providing indirect benefit for beaches and dunes (18).

US Army Corps of Engineers

OCMP Coastal Statewide Planning Goals, Clatsop County Land Use Zoning, and USACE Thalweg Placement Strategy

GOAL 16: Protect the long-term values, diversity, and benefits of estuaries and associated wetlands and provide for appropriate restoration and development. The goal relies on a classification system that specifies the level of development allowed in each estuary. All local governments with authority over an estuary must prepare and adopt a management plan and land use regulations according to the following four classifications.

1. **Deep-draft development for estuaries with maintained jetties and channels more than 22 feet deep;**
2. **Shallow-draft development for estuaries with maintained jetties and channels up to 22 feet deep;**
3. **Conservation for estuaries without a maintained jetty or channel within or adjacent to an urban area with altered shorelines;**
4. **Natural for estuaries without a maintained jetty or channel not adjacent to an urban area and with little development.**

Within the LCRE, USACE currently limits its placement of dredged sediment to areas located within the main flow-way of the river (thalweg) where water depth is greater than 20 ft and less than 65 ft. USACE thalweg-based dredged material placement sustains the morphology of the LCRE without adversely affecting its living resources; progressing to MCR.

Goal 17: Requires shorelands that are "especially suited for water dependent uses" be protected for such uses, and that local zoning regulations prevent the establishment of uses which would preempt the availability of such lands for water dependent development.

USACE management of river sediment dredged within the LCRE and MCR does not degrade the riverbed morphology, substrate, nor adversely affect water dependent uses of the estuary. USACE placement of dredged sediment within the thalweg of the LCRE emulates the process of morphology evolution that naturally occurs within the thalweg. Thalweg-based dredged material placement sustains river morphology and shorelands that are essential for water dependent uses, while maintaining the viability of the LCR FNC.

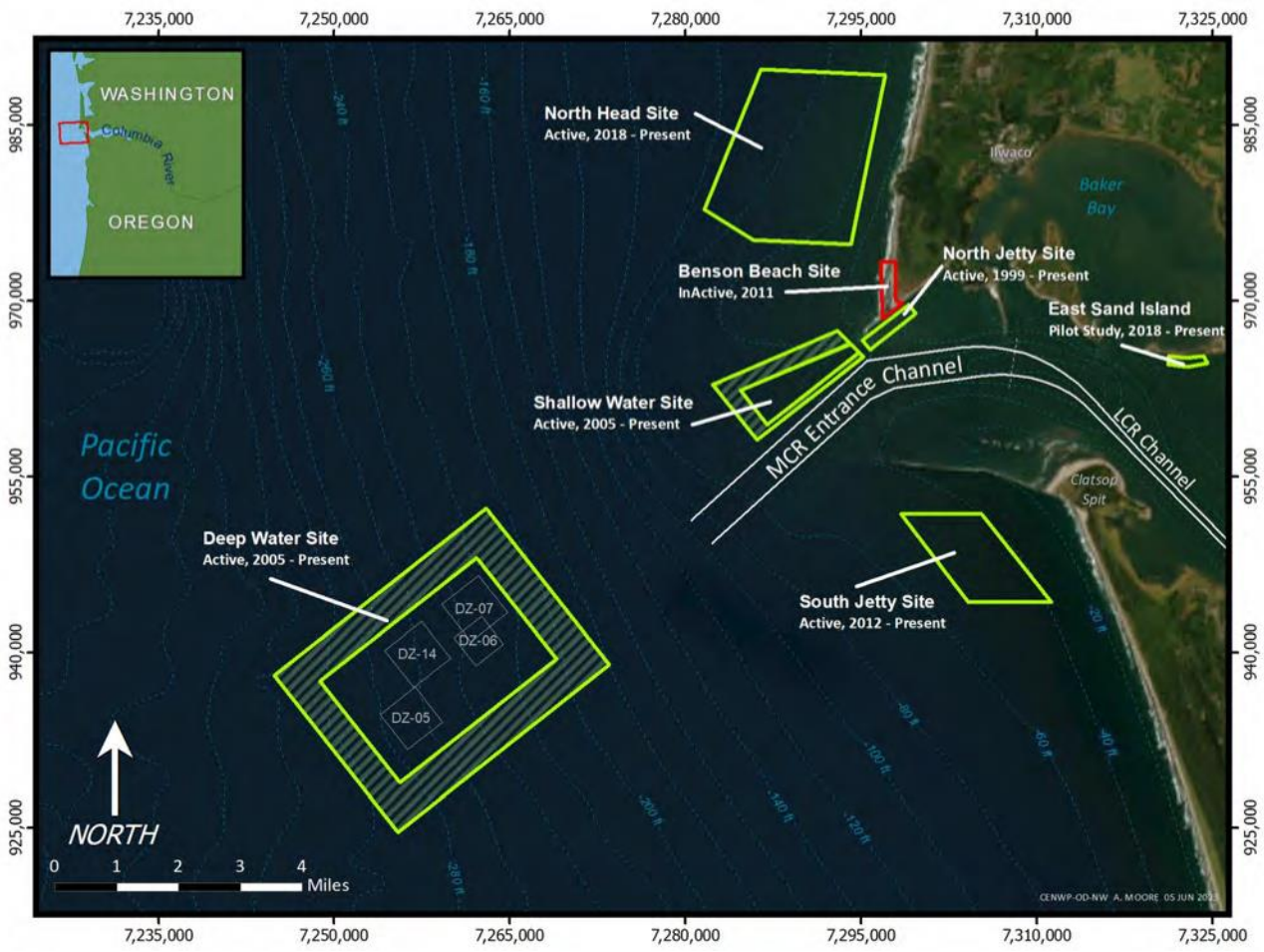
Goal 18: Prohibits development on the most sensitive and hazardous landforms in the beach and dune environment, including beaches, active foredunes and other dune areas subject to severe erosion or flooding. This requirement has been instrumental in preventing inappropriate development on these critical landforms.

USACE management of dredged river sediments within LCRE and MCR sustains the sandy morphology of the coastal margin along Clatsop Plains and Long Beach Peninsula. River sediment dredged from the LCRE FNC is managed to emulate the natural downstream movement of river sediment to the estuary's ocean entrance, where much of the sediment is then transported to coastal margin adjacent to the mouth of the Columbia River feeding the coastal sediment budget.

REGIONAL SEDIMENT MANAGEMENT

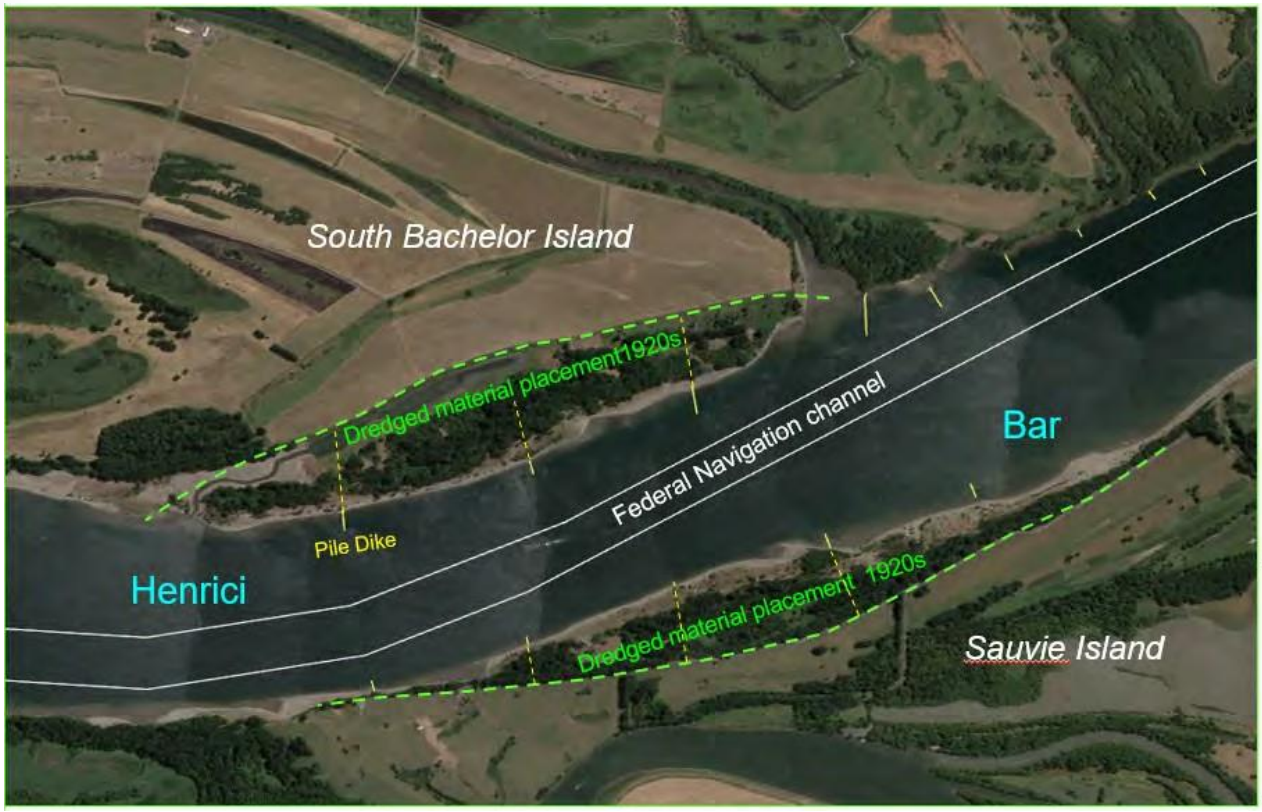
- Corps-wide systems approach using best management practices for more efficient and effective use of sediments in **coastal**, estuarine, and inland environments for healthier and more resilient systems.

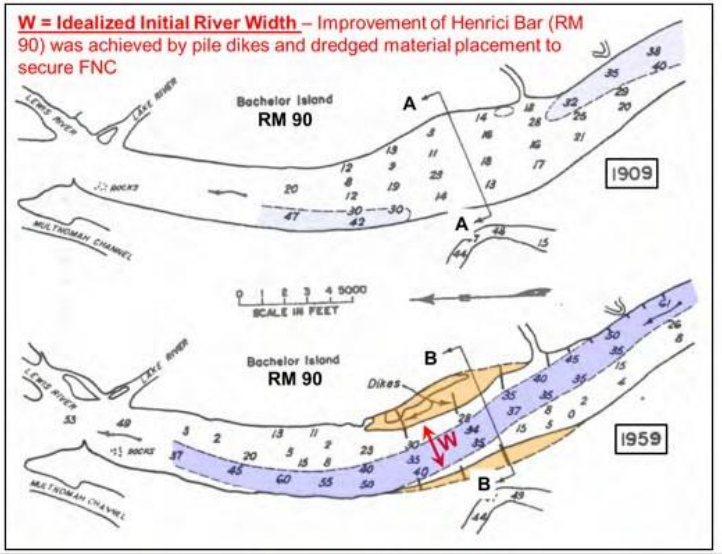
- Corps within Columbia River:
  - Shoals and dredging
  - In-river, upland, shoreline, nearshore placement and ocean disposal
  - Jetty, pile dike infrastructure
  - Other beneficial uses

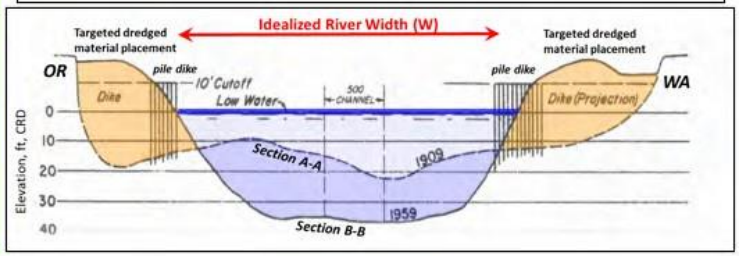


ENGINEERING WITH NATURE

– Corps-wide initiative is the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits through collaboration. Columbia River example:







BENEFICIAL USES OF DREDGED MATERIAL

- Corps-wide Chief of Engineer's national goal to beneficially use 70% or more dredged material by 2030.

- Corps within Columbia River:
  - Fish and wildlife habitat development (ex: salmon, streaked horned larks)
  - Recreation
  - Commercial

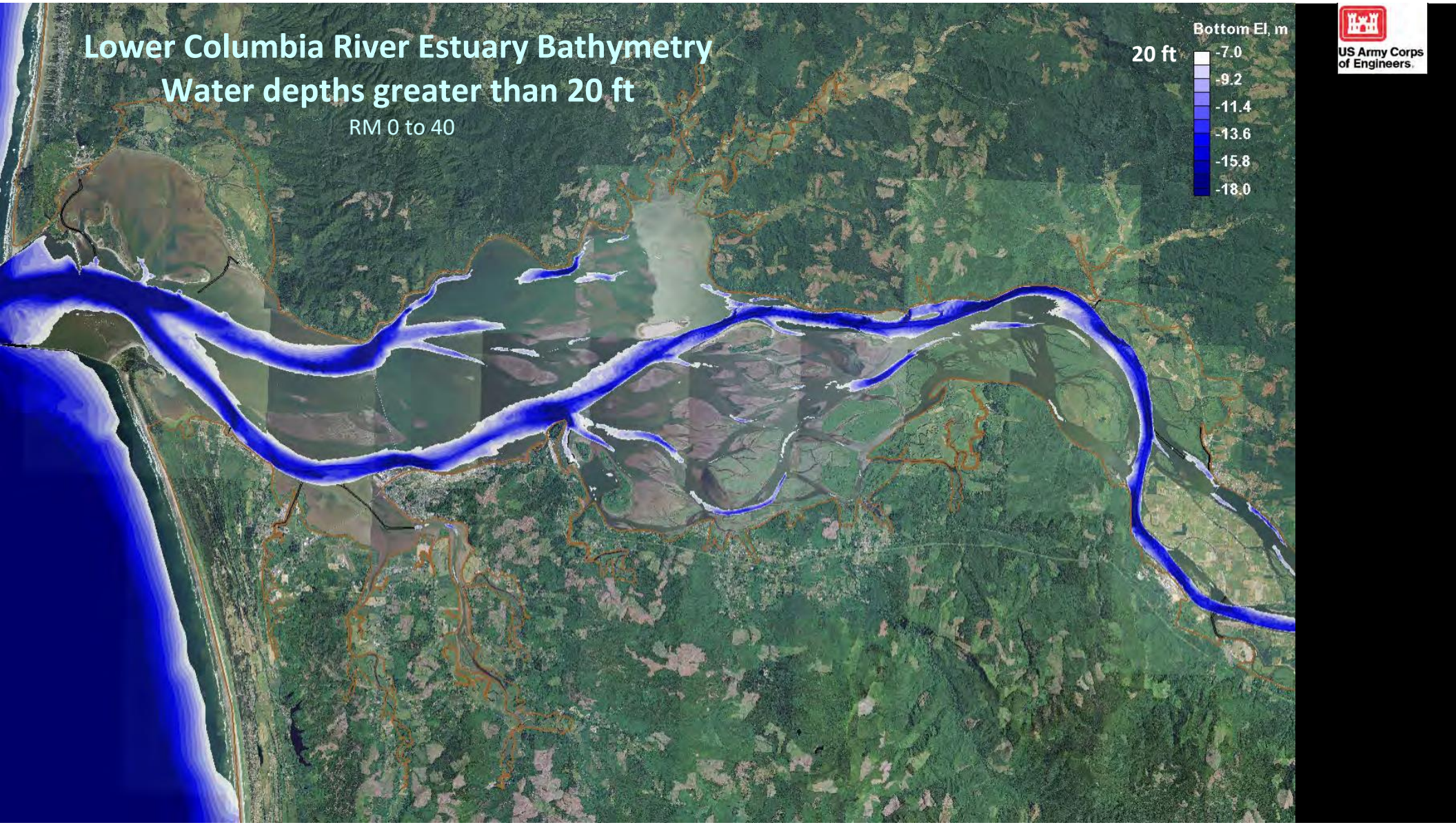
General Hydraulic Conditions in LCRE
Thalweg Extent for depth > 20 ft
Currents for Sand Movement
(areas far beyond the FNC are active)

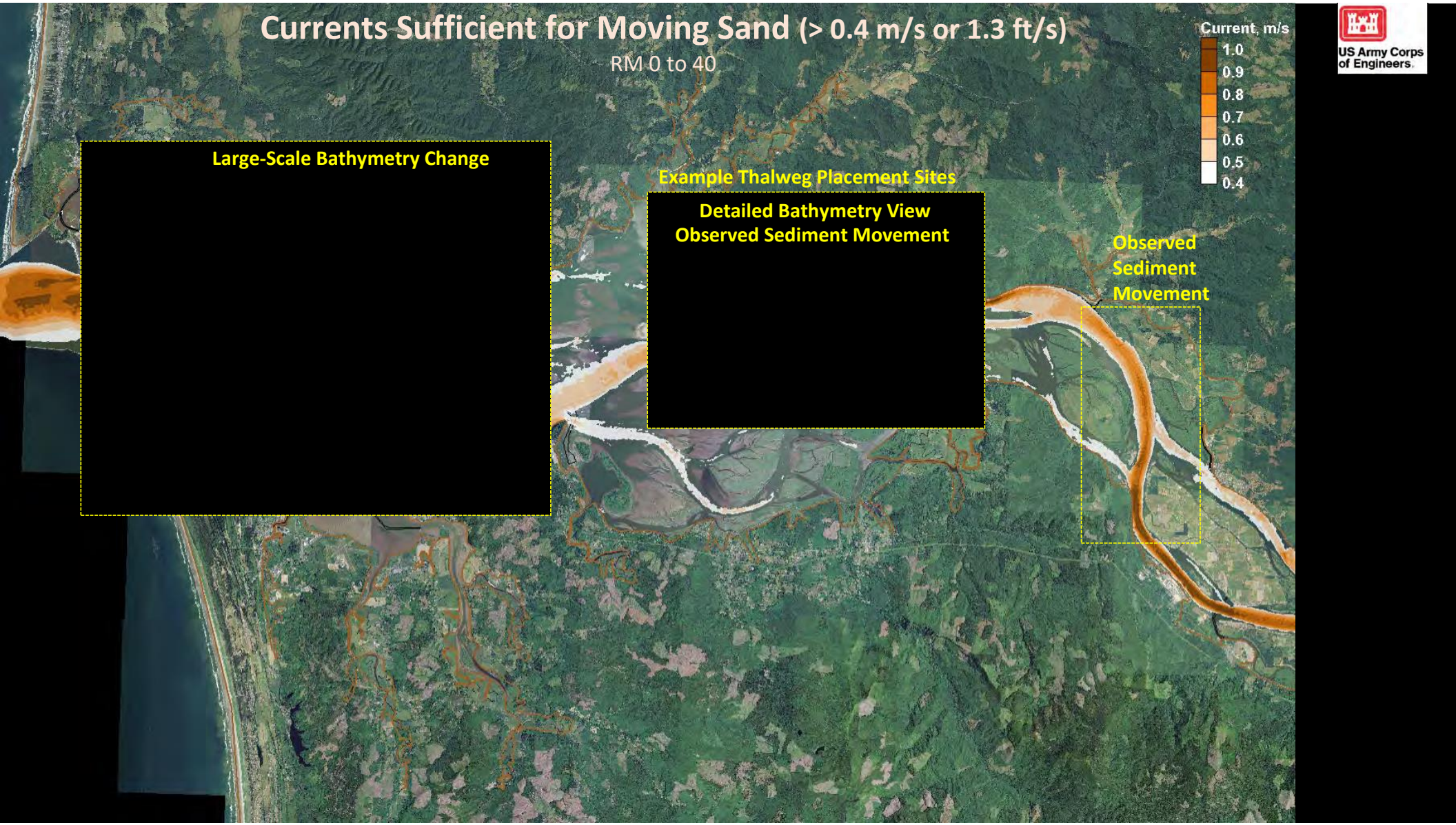
Large Scale Morphology Change
Lower Estuary = RM 0 to 18
(sediment is moving all over the place)

Examples of Thalweg Placement Sites
RM 26 to 29 (in active zone)

Detailed View of LCR Bathymetry
RM 22 to 29 (types of FNC shoaling)

Sediment Movement at Placement Sites
RM 26 to 40 (observed transport)

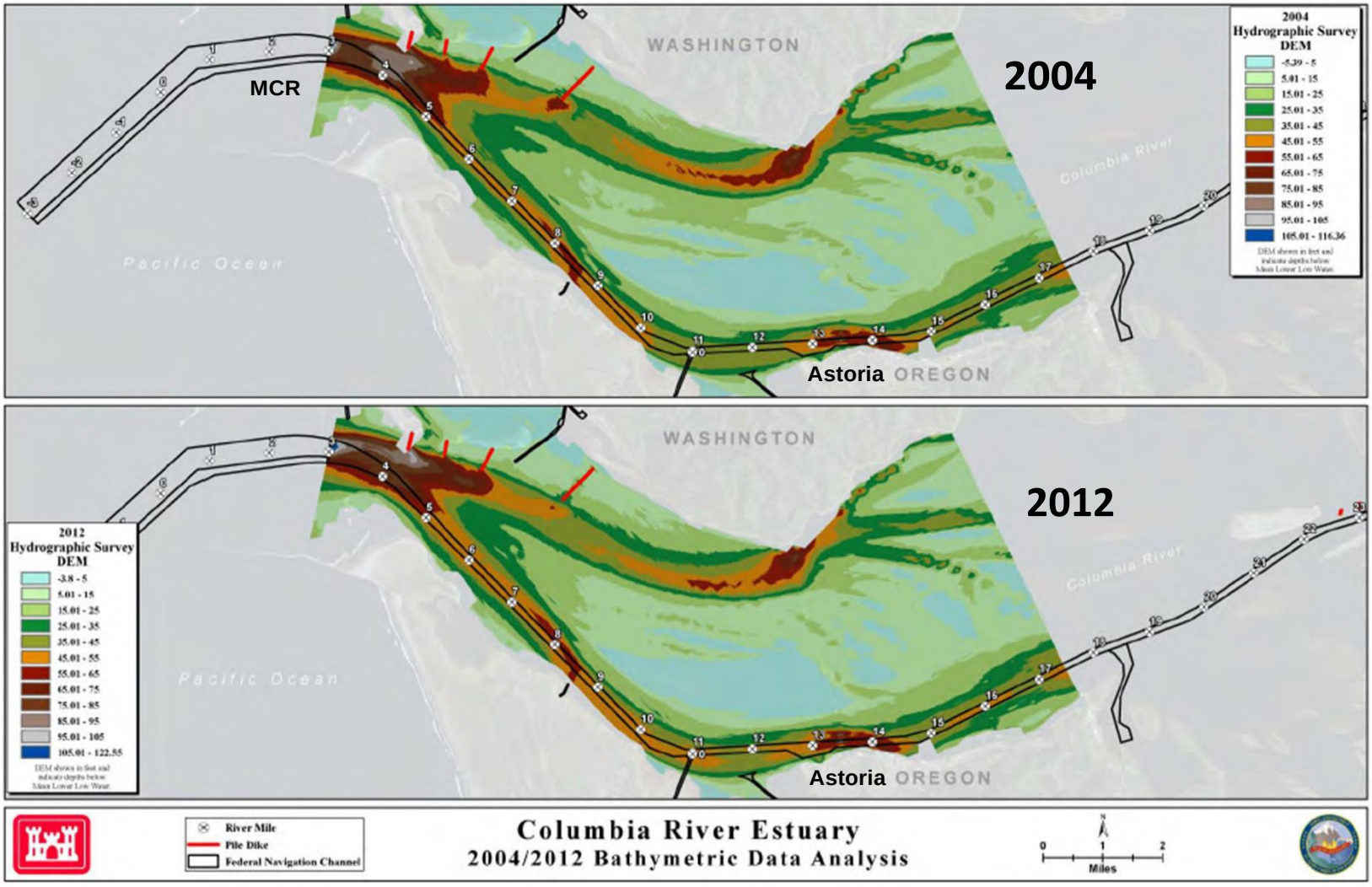

Lower Columbia River Estuary Bathymetry
Water depths greater than 20 ft
RM 0 to 40
20 ft
Bottom El, m
-7.0
-9.2
-11.4
-13.6
-15.8
-18.0
US Army Corps of Engineers


Currents Sufficient for Moving Sand (> 0.4 m/s or 1.3 ft/s)
RM 0 to 40
Current, m/s
1.0
0.9
0.8
0.7
0.6
0.5
0.4
US Army Corps of Engineers
Large-Scale Bathymetry Change
Example Thalweg Placement Sites
Detailed Bathymetry View
Observed Sediment Movement
Observed Sediment Movement

Large Scale Morphology Change
within the Lower Columbia River Estuary
RM 0 to 18 2004-

2012

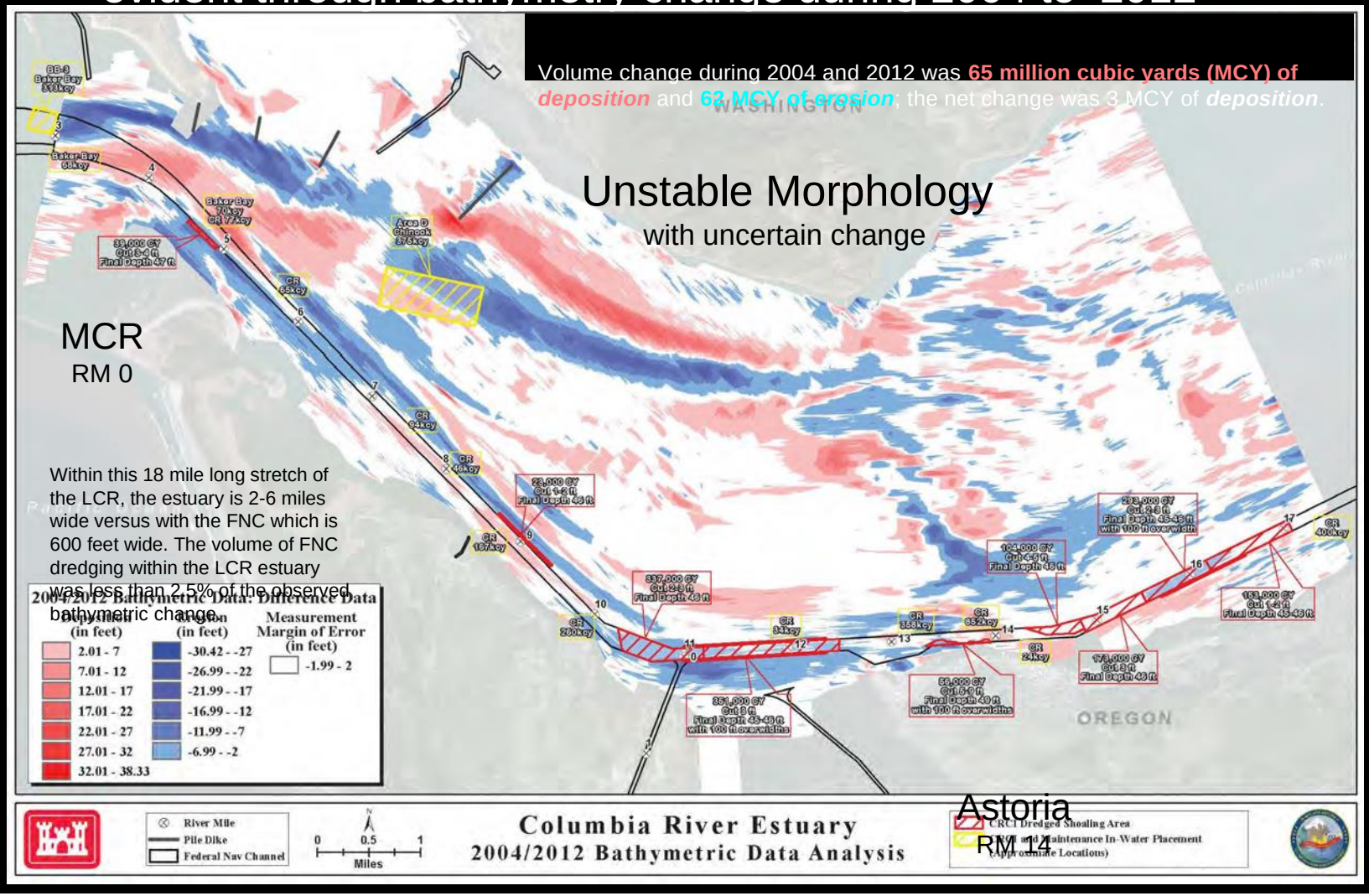
Figure 1: Top graphic is 2004 (CRCI Pre-Construction) and bottom graphic is 2012 (CRCI Post-Construction) Bathymetry



Active Sediment Redistribution within the LCR Estuary

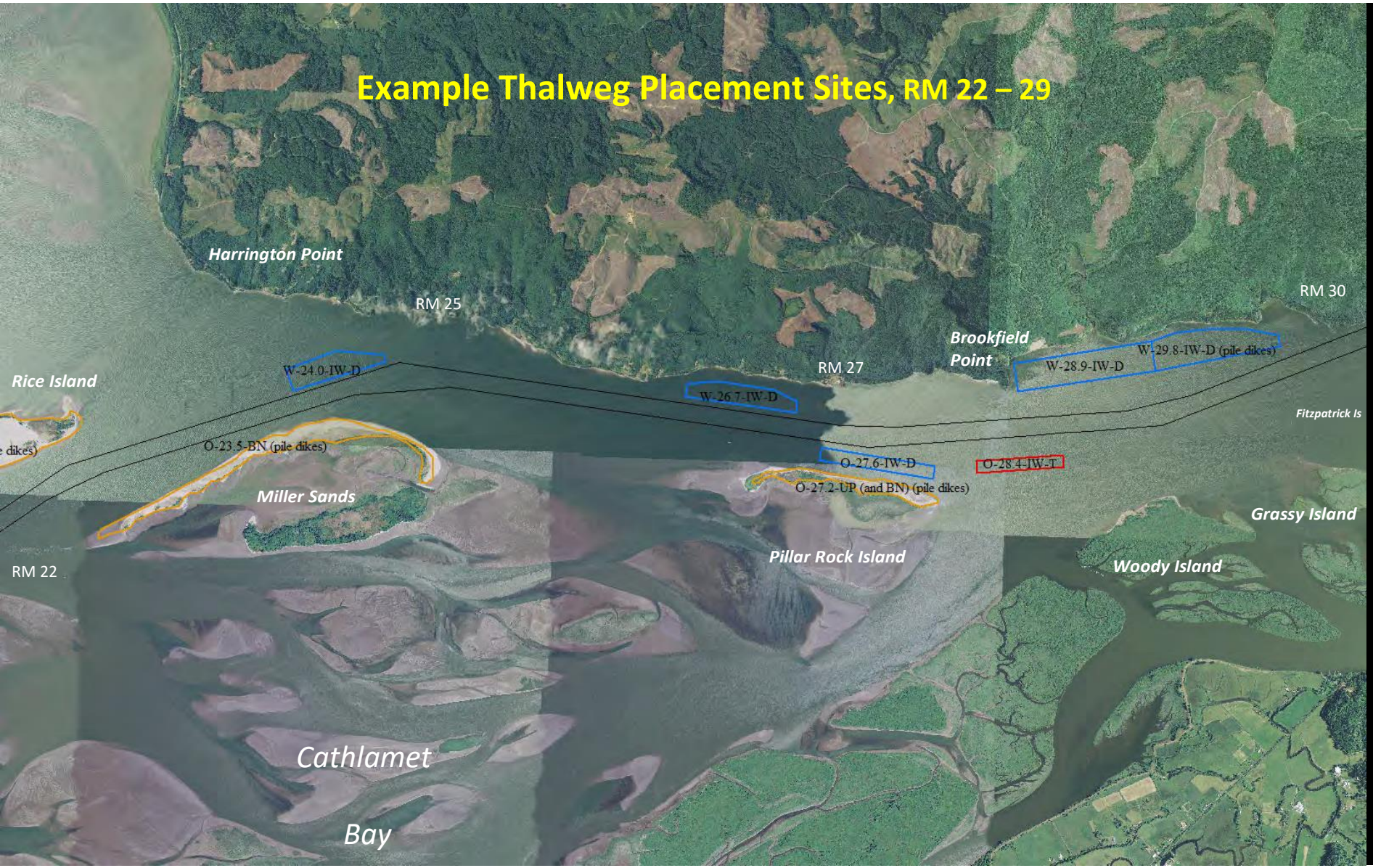
evident through bathymetry change during 2004 to 2012

Erosion >10 ft
Deposition >10 ft



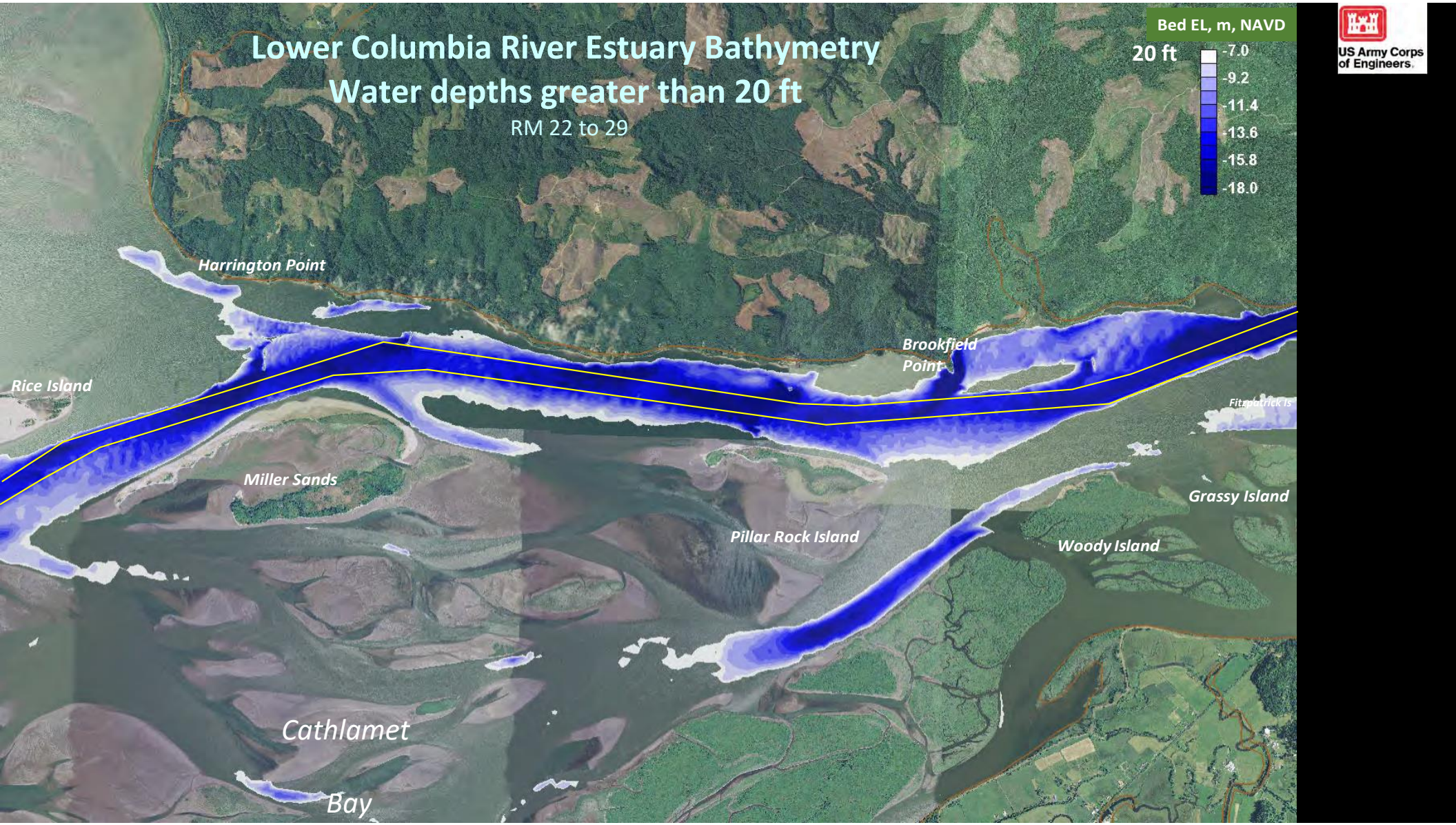
LCR FNC
= 600 ft wide
(-43 ft)

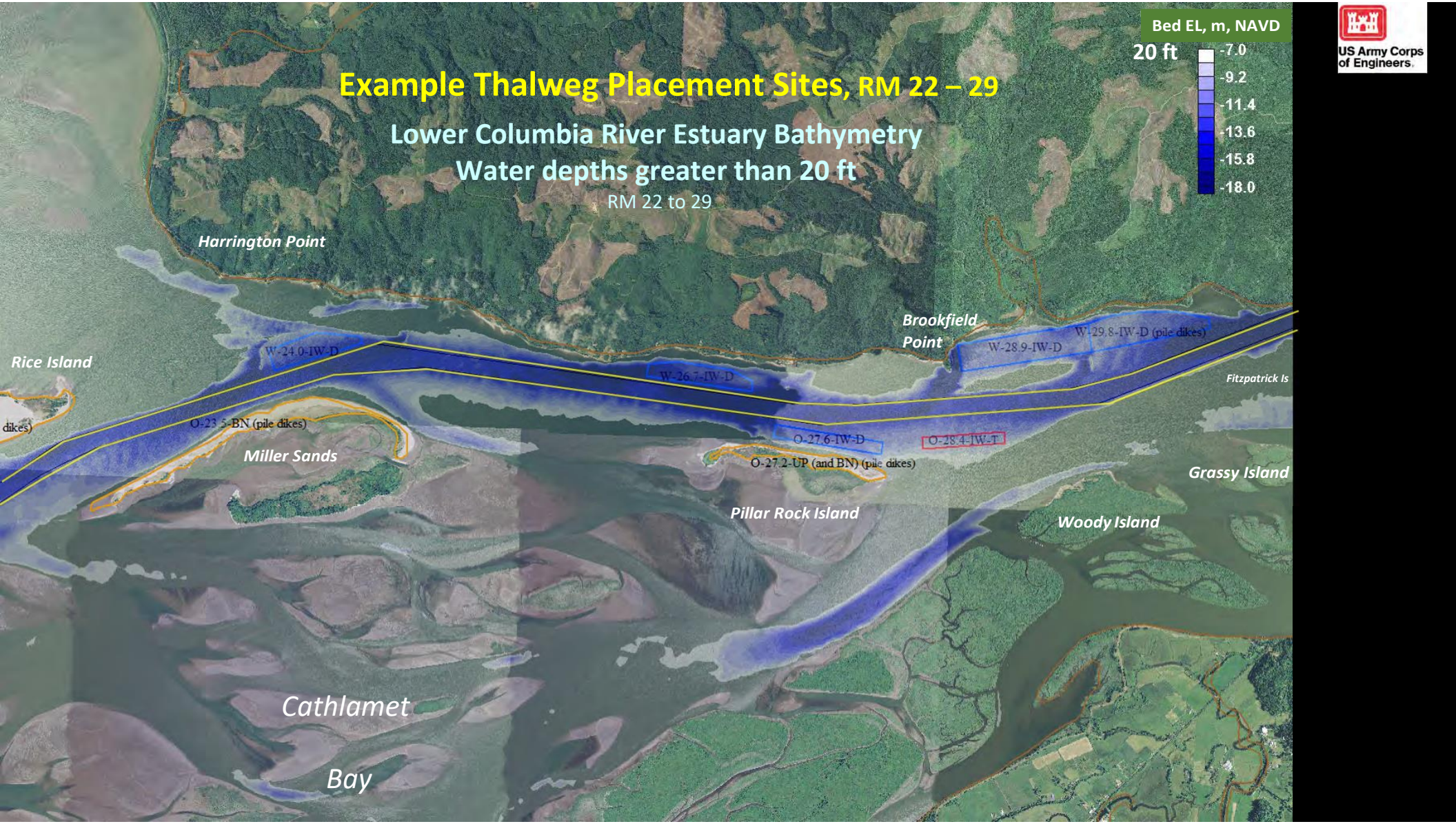
Example Thalweg Placement Sites, RM 22 – 29

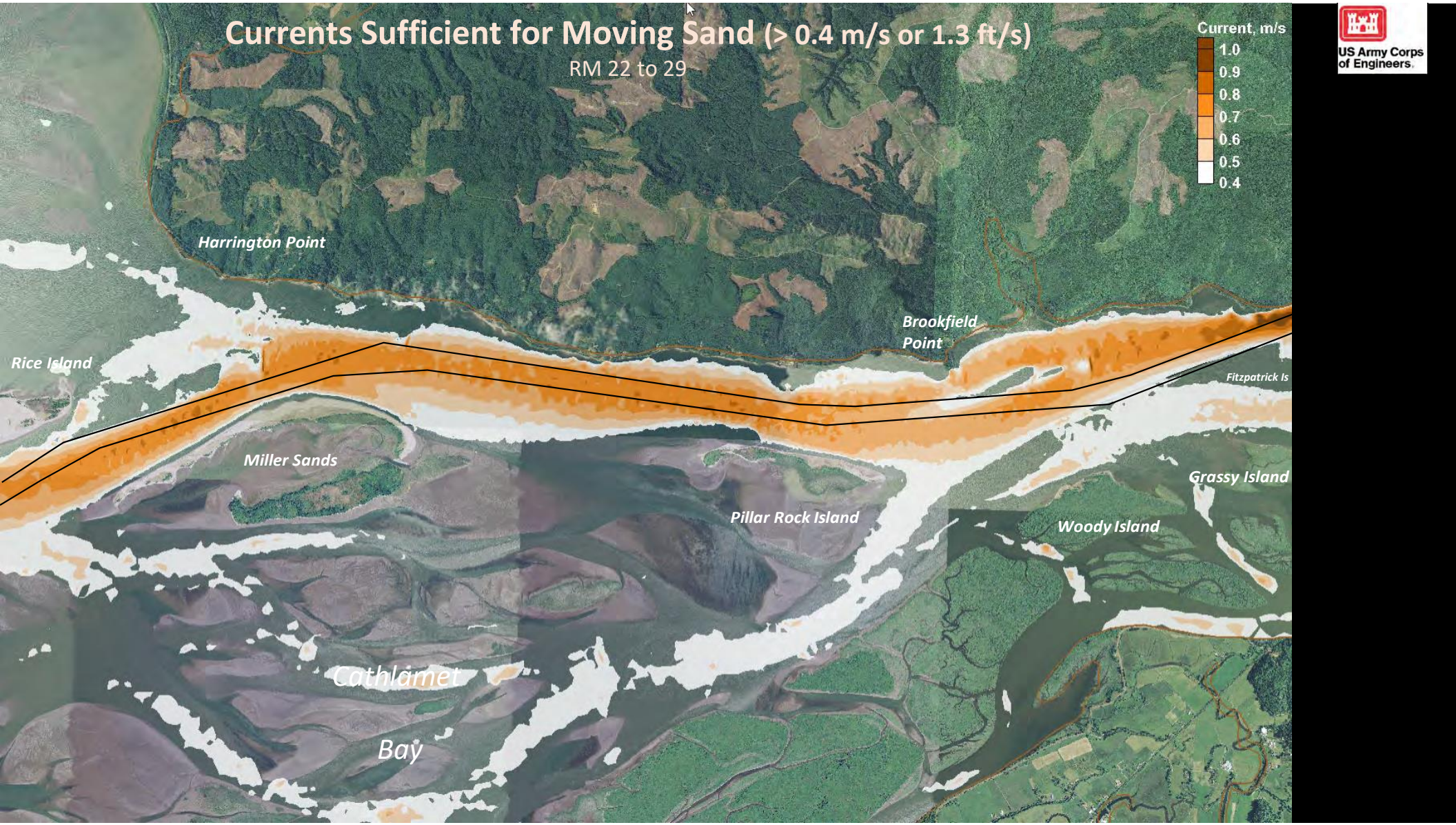


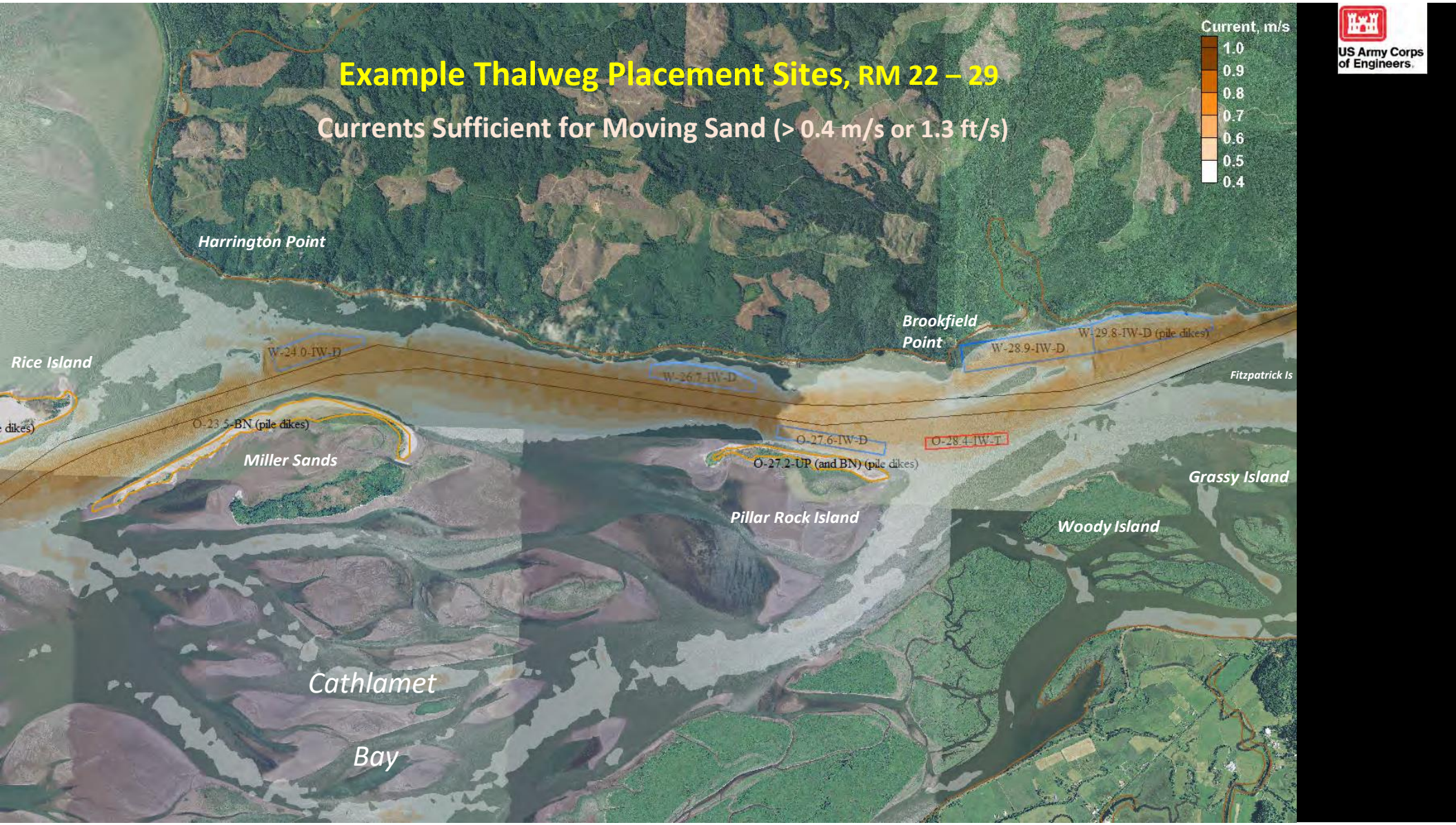
US Army Corps of Engineers

LCR FNC
= 600 ft wide
(-43 ft)


Lower Columbia River Estuary Bathymetry
Water depths greater than 20 ft
RM 22 to 29
Bed EL, m, NAVD
20 ft
-7.0
-9.2
-11.4
-13.6
-15.8
-18.0
US Army Corps of Engineers
Harrington Point
Brookfield Point
Rice Island
Fitzpatrick Is
Miller Sands
Grassy Island
Pillar Rock Island
Woody Island
Cathlamet
Bay


Example Thalweg Placement Sites, RM 22 – 29
Lower Columbia River Estuary Bathymetry
Water depths greater than 20 ft
RM 22 to 29
Bed EL, m, NAVD
20 ft
-7.0
-9.2
-11.4
-13.6
-15.8
-18.0
US Army Corps of Engineers
Harrington Point
Brookfield Point
Rice Island
W-24.0-IW-D
W-26.7-IW-D
W-28.9-IW-D
W-29.8-IW-D (pile dikes)
Fitzpatrick Is
O-23.5-BN (pile dikes)
Miller Sands
O-27.6-IW-D
O-28.4-IW-T
O-27.2-UP (and BN) (pile dikes)
Grassy Island
Pillar Rock Island
Woody Island
Cathlamet
Bay


Currents Sufficient for Moving Sand (> 0.4 m/s or 1.3 ft/s)
RM 22 to 29
Current, m/s
1.0
0.9
0.8
0.7
0.6
0.5
0.4
US Army Corps of Engineers
Harrington Point
Brookfield Point
Rice Island
Fitzpatrick Is
Miller Sands
Grassy Island
Pillar Rock Island
Woody Island
Cathlamet Bay


Example Thalweg Placement Sites, RM 22 – 29
Currents Sufficient for Moving Sand (> 0.4 m/s or 1.3 ft/s)
Current, m/s
1.0
0.9
0.8
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US Army Corps of Engineers
Harrington Point
Brookfield Point
Rice Island
W-24.0-IW-D
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W-28.9-IW-D
W-29.8-IW-D (pile dikes)
Fitzpatrick Is
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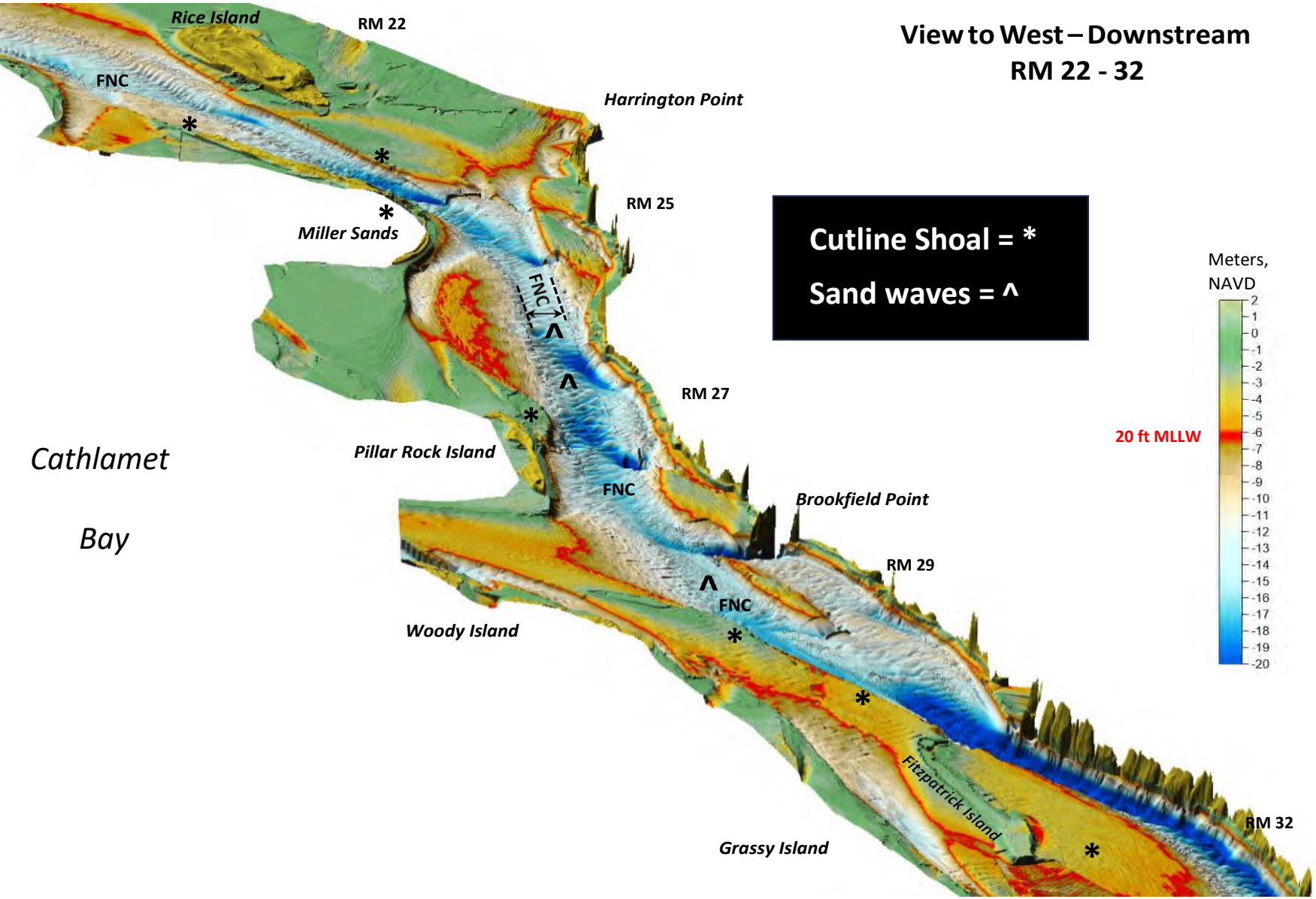
Miller Sands
O-27.6-IW-D
O-28.4-IW-T
O-27.2-UP (and BN) (pile dikes)
Grassy Island
Pillar Rock Island
Woody Island
Cathlamet
Bay



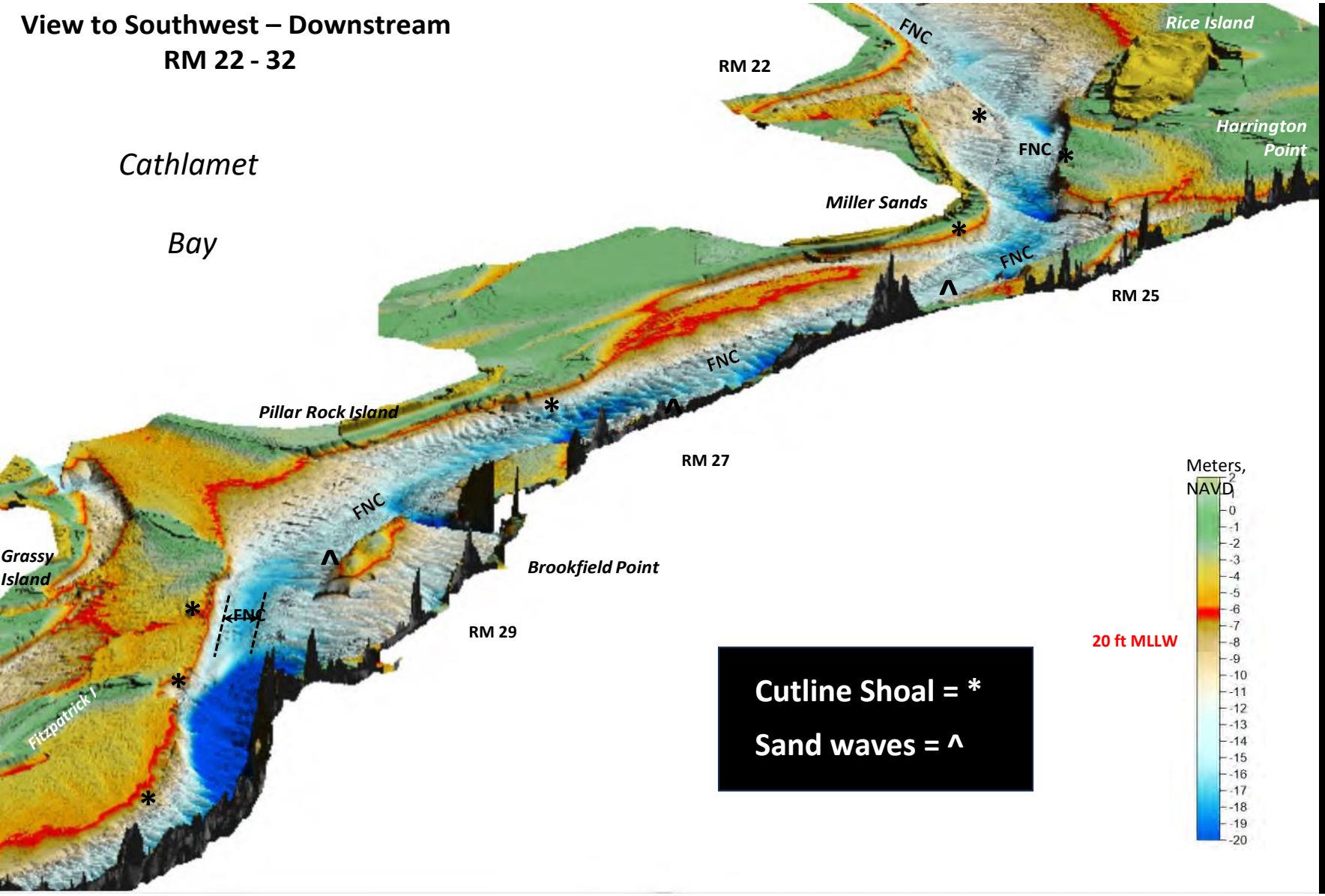
View to West – Downstream
RM 22 - 32

US Army Corps of Engineers

Detailed View of LCR Bathymetry
RM 22 to 29

(types of FNC shoaling)

View to Southwest – Downstream
RM 22 - 32



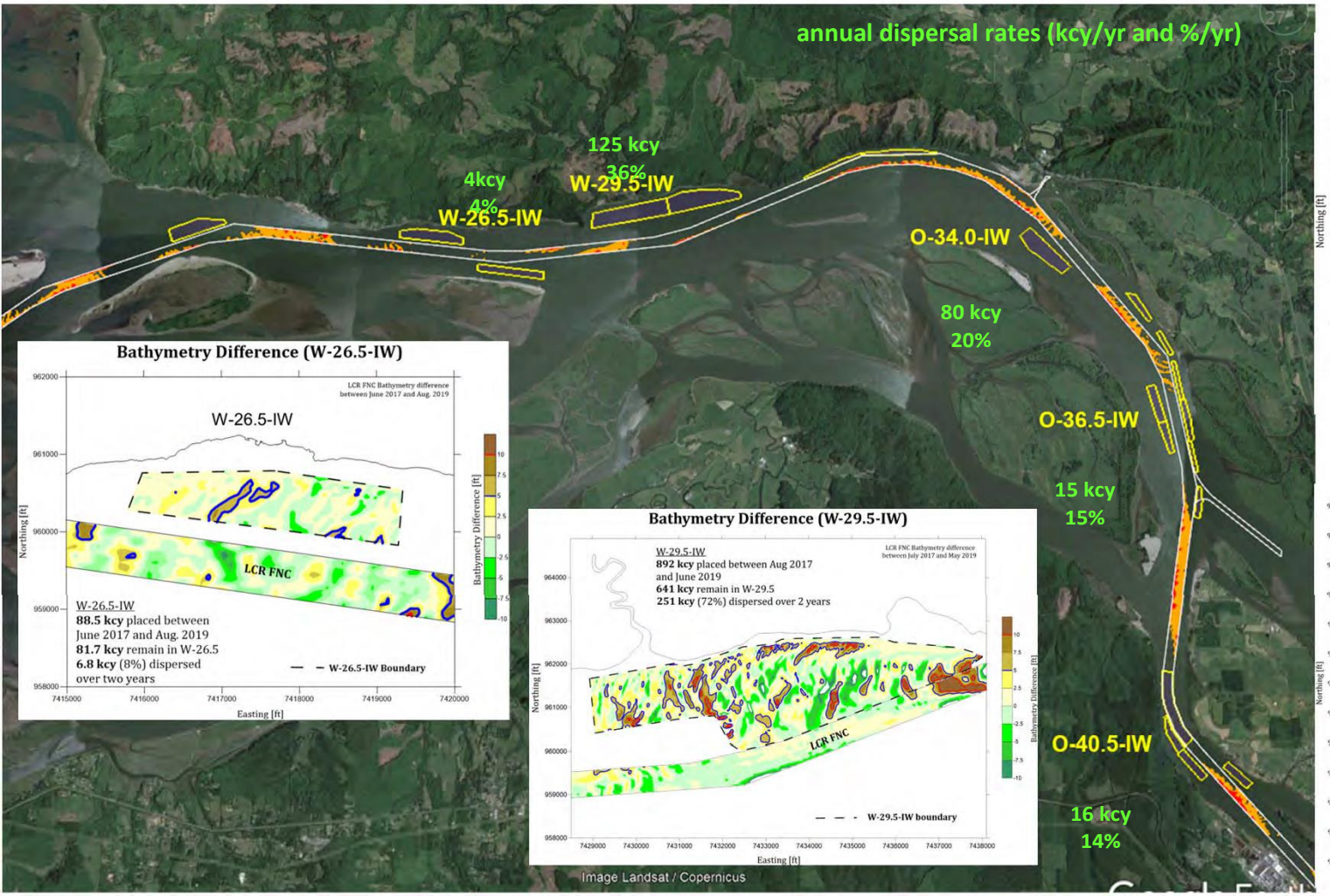
US Army Corps of Engineers

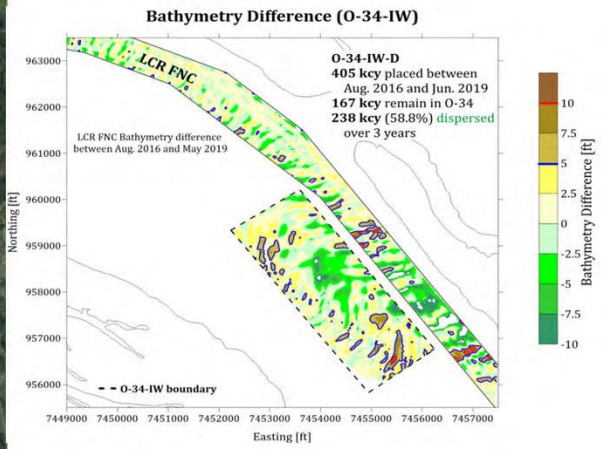
Detailed View of LCR Bathymetry
RM 22 to 29

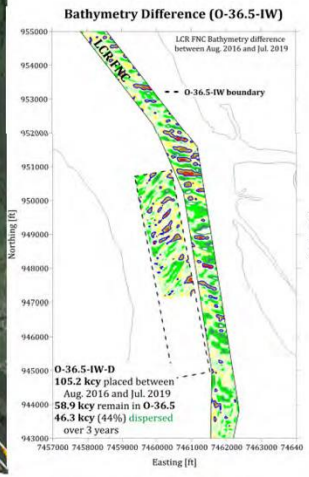
(types of FNC shoaling)

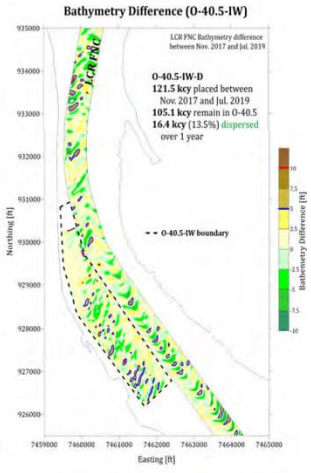
Examples of Bathymetric Differencing to Evaluate Sediment Transport at In-Water Placement Sites

US Army Corps of Engineers









1/31/2024

Consequences of an Imbalanced Sediment Budget

Sediment Supply Deficit
with Respect to
River Transport Capacity

What happens when: Transport capacity > Sediment Supply ?

Columbia River Regulation has altered the HYDROLOGY and SEDIMENT BUDGET of the lower river

(post-regulation = 1974)

Mainstem FLOW:

Annual peak for LCR Seasonal Flow (June Freshet) has been reduced from 500 kcfs to 300 kcfs.

Minimum Seasonal Flow (SEP-OCT) increased from 50 kcfs to 80 kcfs.

LCR SEDIMENT BUDGET:

Reduced by Reservoir impoundment upstream of Bonneville Dam - RM 147 (Sediment supply).

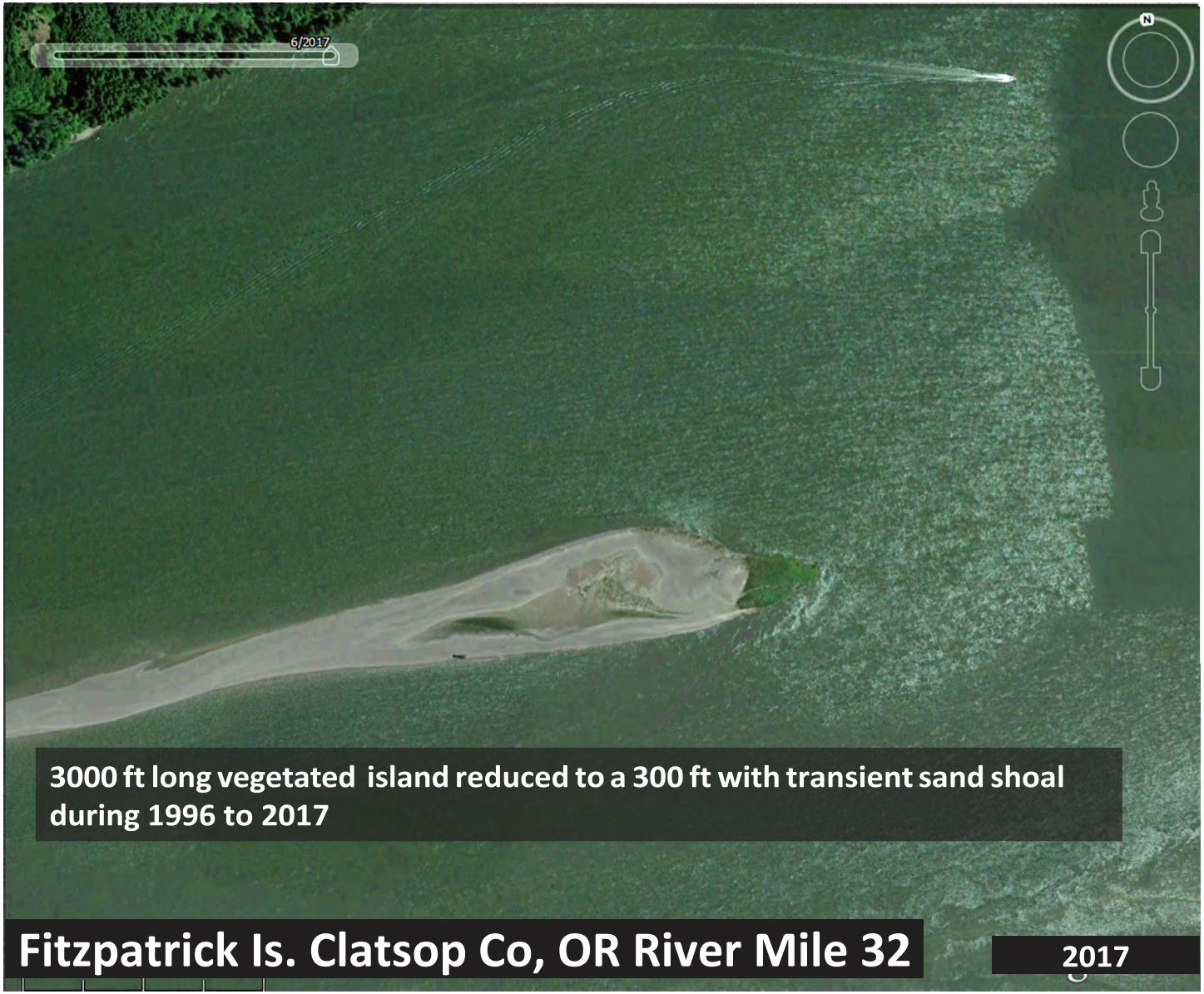
Altered by transport capacity of the river below Bonneville Dam (Flow alteration).

- **Pre-regulation sediment transport = 5 to 15 million cy/year.**
- **Post-regulation sediment transport = 2 to 6 million cy/year, due to flow reduction.**

LCR STAGE:

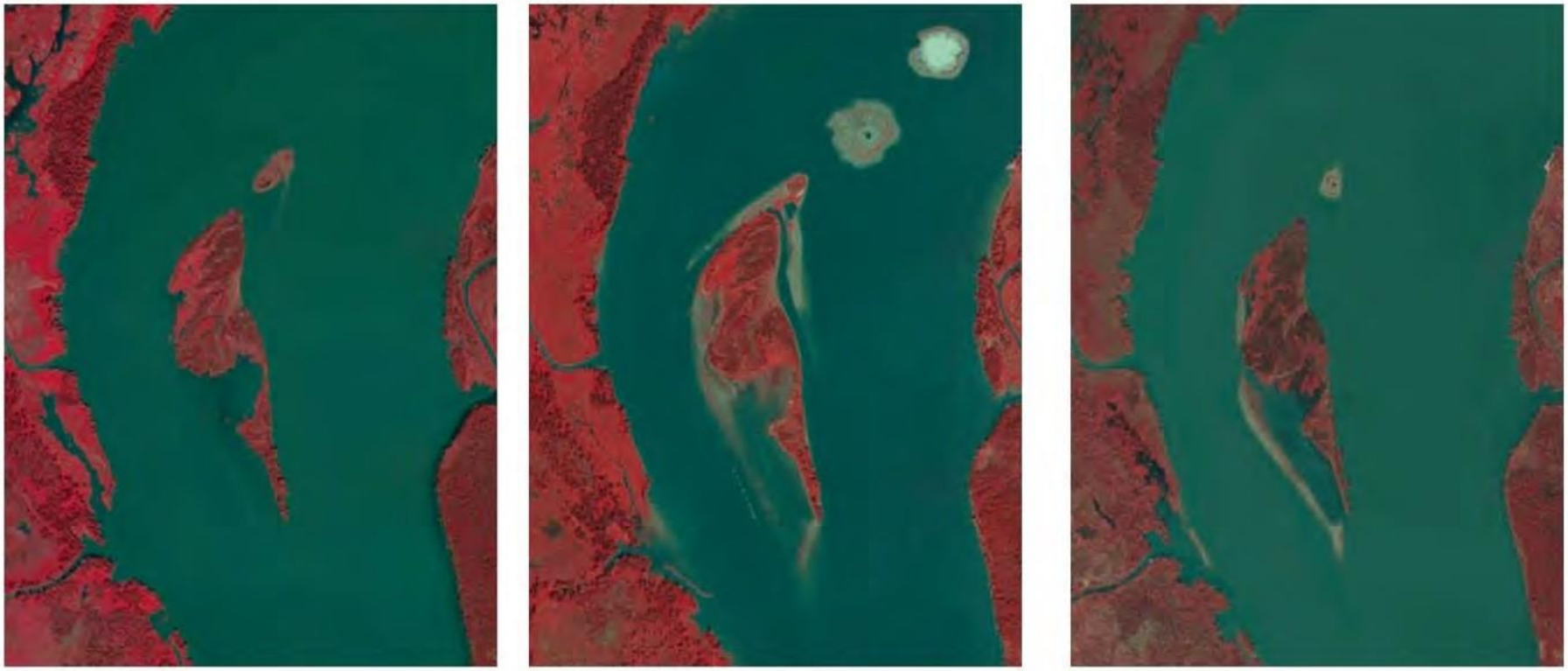
Peak Season Stage during Freshet reduced due to reduced river flow (annual peak: 21 to 16 ft NAVD at RM 95)**.**

Minimum Seasonal stage increased due to increased minimum flow.


6/2017
N
3000 ft long vegetated island reduced to a 300 ft with transient sand shoal during 1996 to 2017
Fitzpatrick Is. Clatsop Co, OR River Mile 32
2017

STRATEGIC IN-WATER PLACEMENT

Example of Strategically Placing Material to Disperse and Redeposit Sediment



Note: From left to right, images show an island before dredged material placement, material that has been placed in locations upstream of the island, and material that has eroded over time and redeposited downstream on the backside of the island.

CHALLENGE: MAPPING COUNTY PLAN CRITERIA

Collectively, we don't know:

1. which areas meet all County Plan criteria = available for flowlane placement
2. the flowlane placement capacity (maximum annual volume of dredged material)

County Plan or CREST DMMP does not assess. Corps has not previously assessed.

Clatsop County Plan 20.5(11) Flow lane disposal sites shall:

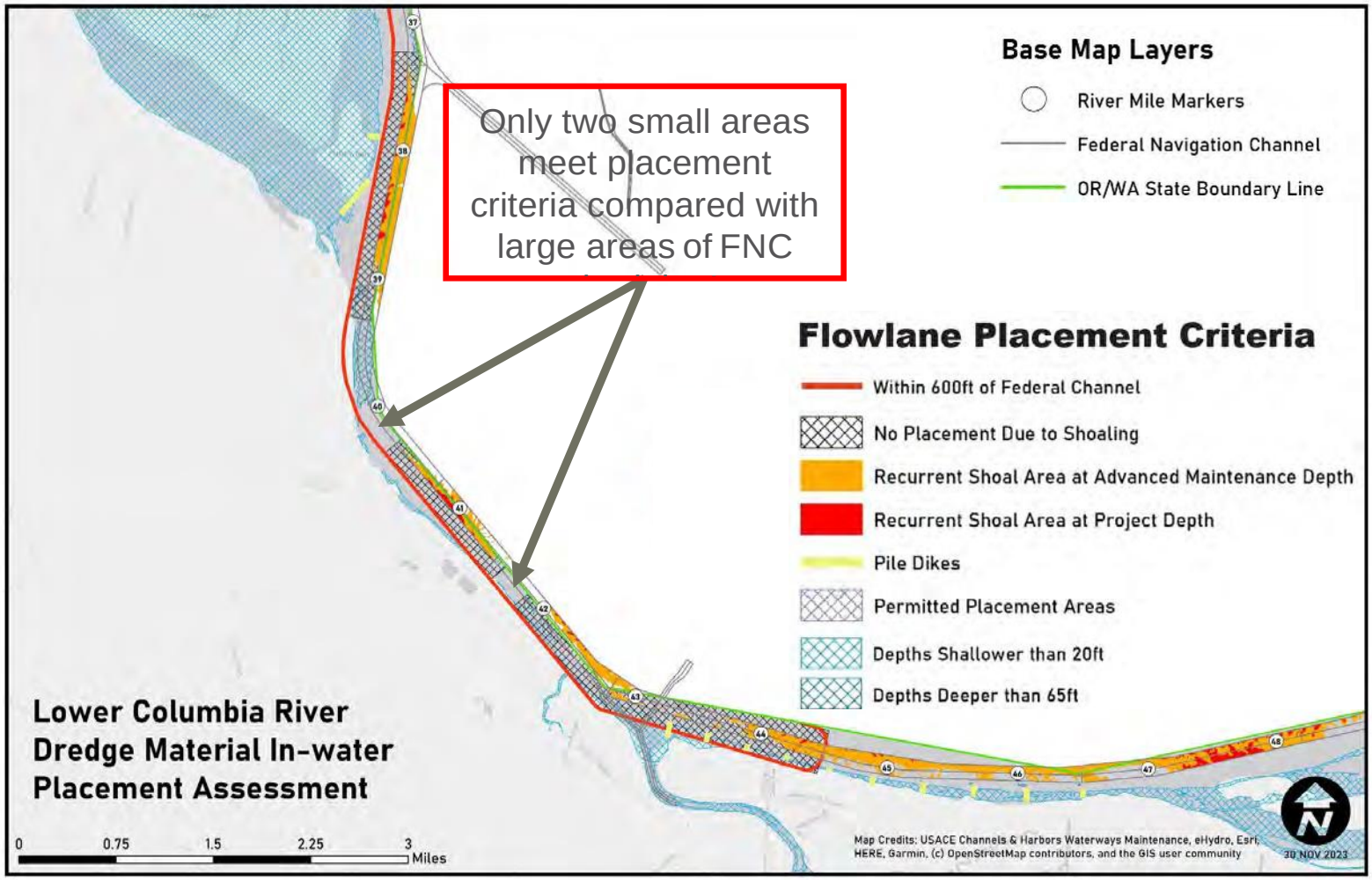
- *only be allowed in development designated areas [within 600 ft of the FNC] where*
- *(a) sediments can reasonably be expected to be transported down-stream without excessive shoaling,*
- *(b) Interference with recreational and commercial fishing operations will be minimal or can be minimized by applying specific timing restrictions,*
- *(c) adverse hydraulic effects will be minimal,*
- *(d) adverse effects on estuarine resources will be minimal, and*
- *(e) the disposal site depth is between 20 and 65 feet below MLLW.*

CORPS' GIS ASSESSMENT

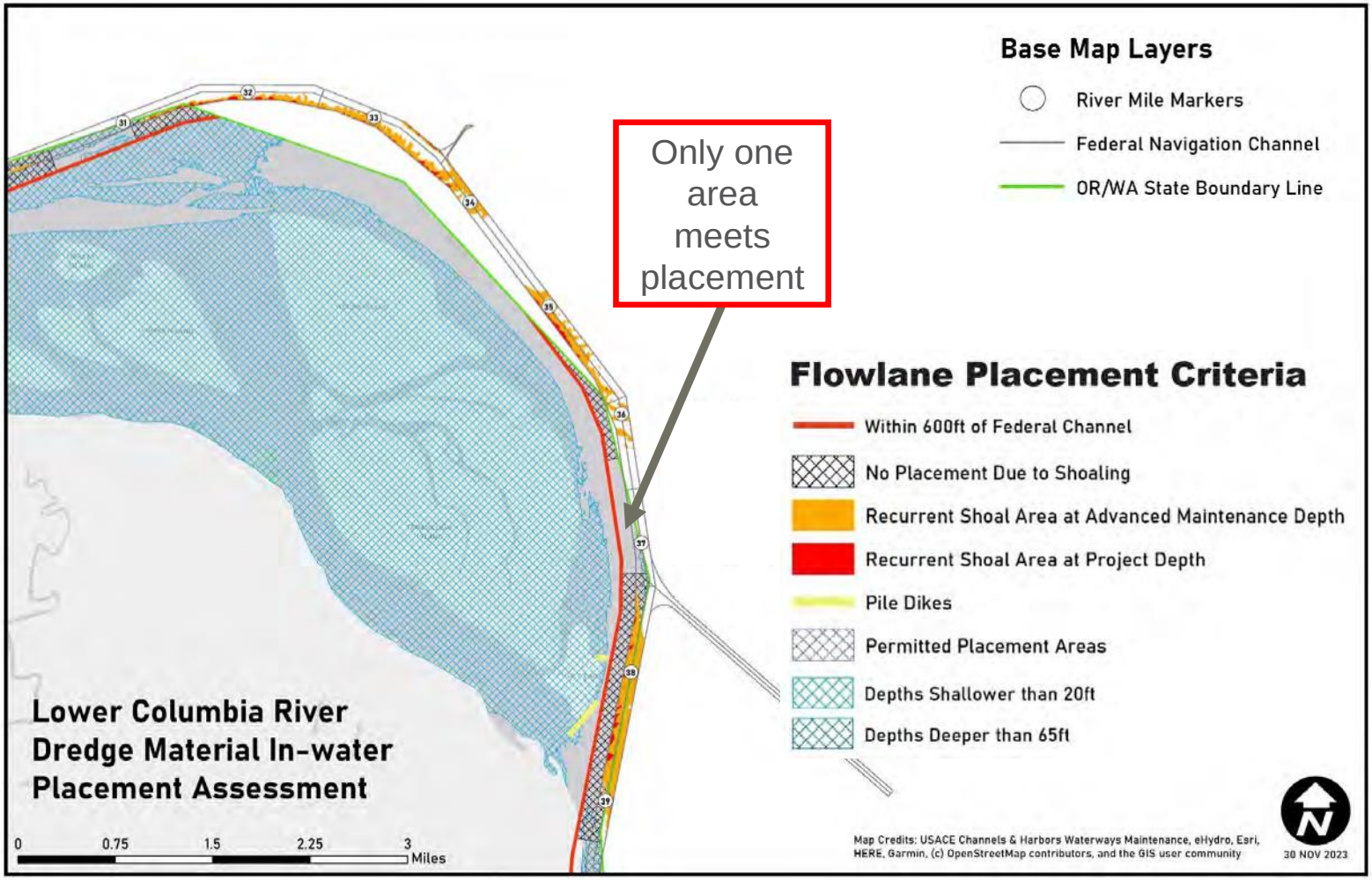
GIS analysis screened out areas within 600 ft of FNC (Clatsop County AD zone) that are not available for Corps placement based on other criteria as follows:

1. County & Corps criteria: No placement where it will result in excessive shoaling. Corps defined it to prohibit placement:
   - on shoals within the federal channel
   - on the adjacent source of shoal material which would increase the rate of shoaling in the federal channel
   - on shoals within U.S. Coast Guard Designated Anchorages
   - in areas already being used by others (such as Port of Astoria) for placement
2. County & Corps criteria: No placement shallower than 20 feet.
3. County further restricts: No placement deeper than 65 feet.

MAP 1 OF 5


Only two small areas meet placement criteria compared with large areas of FNC
Base Map Layers
River Mile Markers
Federal Navigation Channel
OR/WA State Boundary Line
Flowlane Placement Criteria
Within 600ft of Federal Channel
No Placement Due to Shoaling
Recurrent Shoal Area at Advanced Maintenance Depth
Recurrent Shoal Area at Project Depth
Pile Dikes
Permitted Placement Areas
Depths Shallower than 20ft
Depths Deeper than 65ft
Lower Columbia River
Dredge Material In-water
Placement Assessment
0 0.75 1.5 2.25 3 Miles
Map Credits: USACE Channels & Harbors Waterways Maintenance, eHydro, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
30 NOV 2023

MAP 2 OF 5


Only one area meets placement
Base Map Layers
River Mile Markers
Federal Navigation Channel
OR/WA State Boundary Line
Flowlane Placement Criteria
Within 600ft of Federal Channel
No Placement Due to Shoaling
Recurrent Shoal Area at Advanced Maintenance Depth
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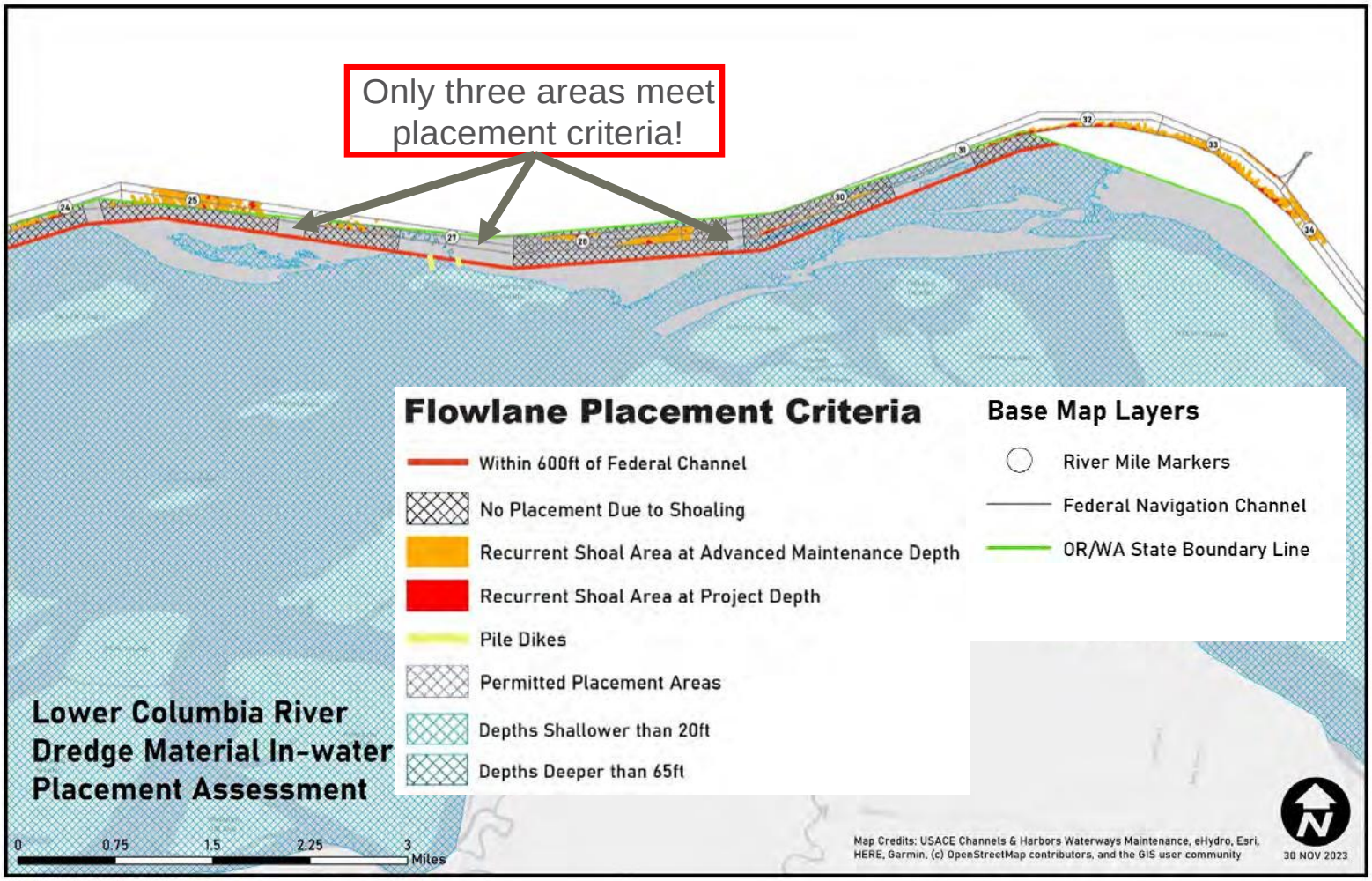
30 NOV 2023

MAP 3 OF 5


Only three areas meet placement criteria!
Flowlane Placement Criteria
Within 600ft of Federal Channel
No Placement Due to Shoaling
Recurrent Shoal Area at Advanced Maintenance Depth
Recurrent Shoal Area at Project Depth
Pile Dikes
Permitted Placement Areas
Depths Shallower than 20ft
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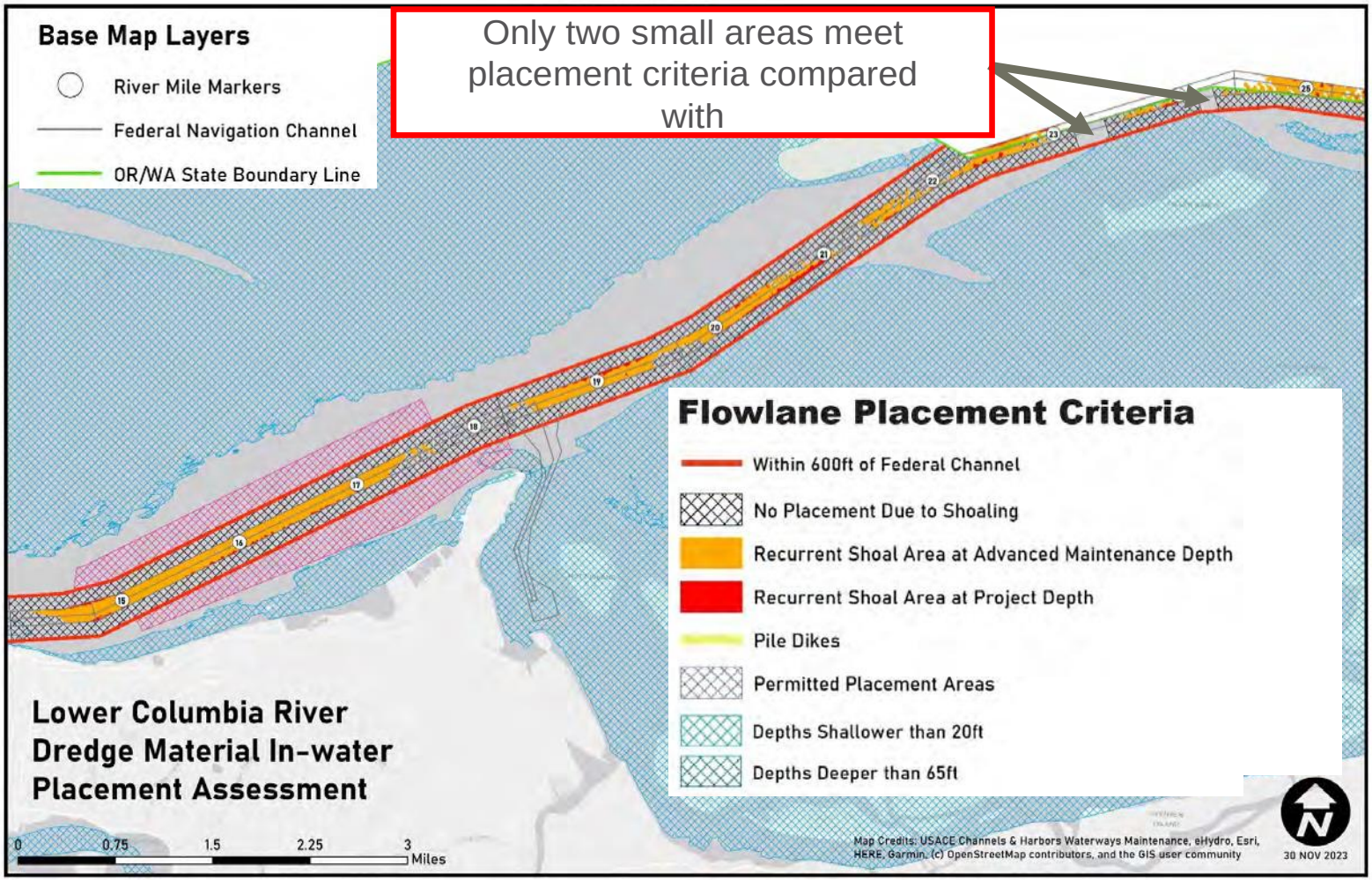
Map Credits: USACE Channels & Harbors Waterways Maintenance, eHydro, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
30 NOV 2023

MAP 4 OF 5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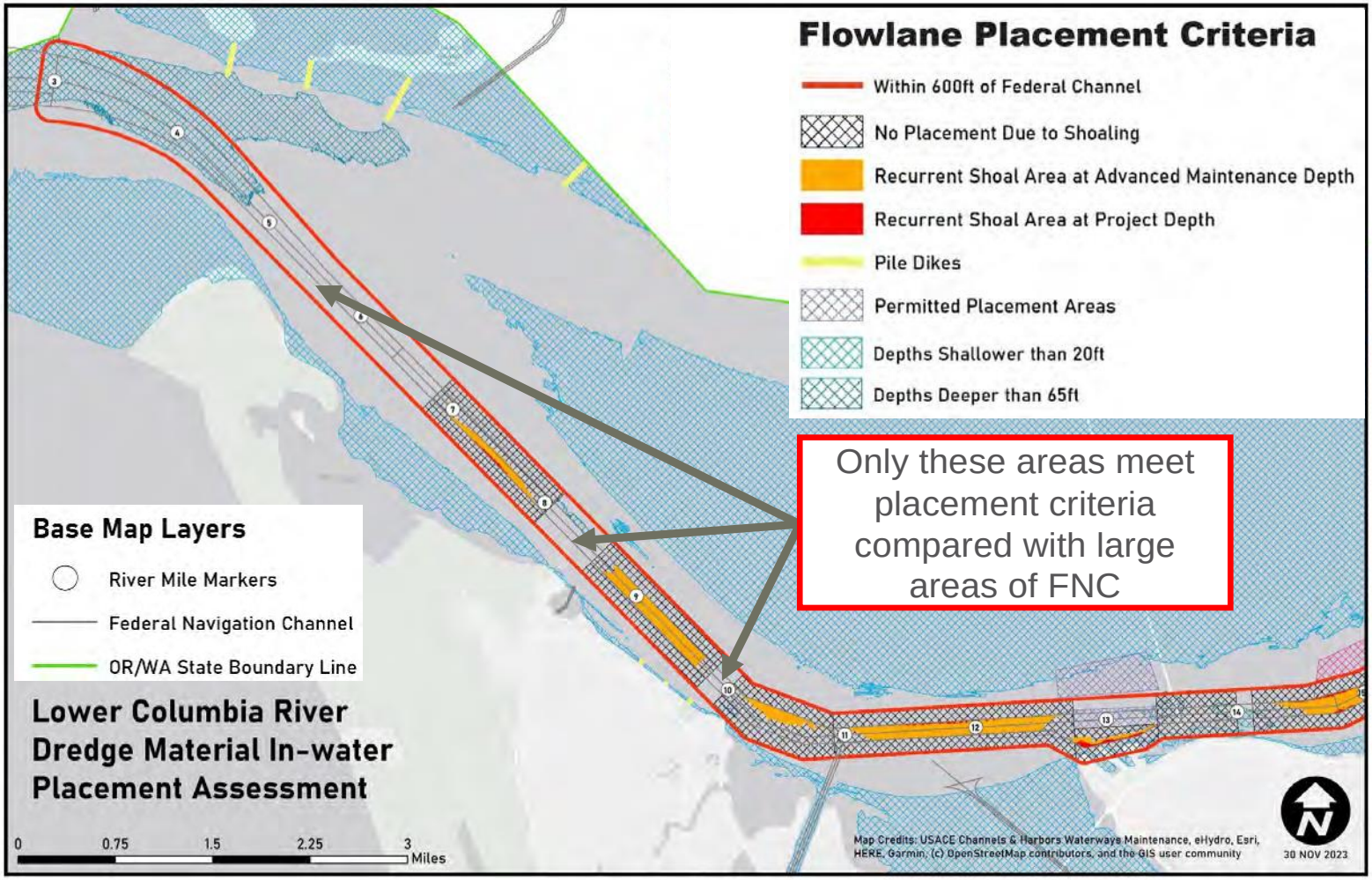
30 NOV 2023

MAP 5 OF 5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30 NOV 2023

CORPS' GIS ASSESSMENT

Findings:

1. GIS shows very limited area within AD zone that meets all County Plan criteria.
2. Likely some areas screened out by GIS shoaling criteria can accept limited placement volume with additional hydraulic engineering input. *Example: deep area on an outside bend where velocity is directed away from FNC.*
3. Likely some areas not screened out by GIS shoaling criteria would be screened out with additional hydraulic engineering input. *Example: very small area in high energy location between two FNC shoals.*
4. GIS shows most available area within 600 feet of FNC between RM 4.8 to 6.8. Limited capacity for dredged material because excessive concentration of sediment in one location would violate County Plan criteria (and Corps criteria) to minimize adverse hydraulic effects.

CHALLENGE: FLOWLANE PLACEMENT VOLUME

Flowlane placement volume for FNC maintenance varies each year for many reasons.

1. Multiple FNC dredging sources:
   - Lower Columbia River deep draft channel (20+ shoal areas)
   - Baker Bay, Chinook, Skipanon, Tongue Point, Skamokawa Creek, Elochoman Slough, Wahkiakum Ferry and Westport Slough channels
2. Corps' placement options include flowlane, shoreline and upland sites, and ocean disposal. In-water transfer sites used for temporary storage. Placement area & volume for each dredge event depends on dredge location & volume, and dredge equipment availability, capabilities & constraints.
3. Flowlane placement event areas & volumes based on surveys and river dynamics. Not broken down by state or county. Total RM 3 to 40 = 2 million CY/year average.

1.4 Best Management Practices

The best management practices (BMPs) associated with the ongoing Columbia River FNC operations and maintenance program would be included as part of the proposed action. BMPs are implemented to minimize impacts on water quality, aquatic species, federal Endangered Species Act (ESA)-listed fish, and sediments during dredging, transportation, and placement of materials. Standard methods for handling hazardous materials spills would also be implemented. During any operation and maintenance actions, there would be potential for contaminants to enter the water. If a spill were to occur, the Corps follows a Spill Response Plan, a single consolidated document to meet multiple spill response planning requirements, as identified under the Occupational Safety and Health Administration's Standard, the Resource Conservation and Recovery Act's Contingency Plan, Superfund Amendment and Reauthorization Act, Title III's Emergency Planning and Community Right to Know Act, the Oil Pollution Act, the CWA, and the state, local, regional, and National Contingency Plans for spill response. Implementation of the National Contingency Plans requires a nationwide network of regional response plans, including the Corps' Spill Response Plan. Operations Project Managers, Dredge Incident Commanders, and emergency-system First Responders use this plan as their primary guidance for responding to oil and hazardous substance spill emergencies at the Corps, Portland District.

Table 2 outlines the BMPs and spill control measures that are currently in place for the Columbia River O&M program.

Table 2. Dredging Best Management Practices (BMPs) and Spill Control Measures Included as Part of the Proposed Maintenance Dredging

Dredging BMPs

Measure	Justification	Duration	Ongoing Management
Hopper Dredging			
Drag or cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads. If water is pumped through dragheads to clean the hopper, dragheads will be 20 ft below the surface while dredging between RM 3 and RM 106.5; dragheads will be 9 ft below the surface between RM 106.5 and RM 145, and in shallow-draft side channels.	To minimize potential entrainment of juvenile salmonids	Continuous throughout dredging operations	Maintain unless new information warrants change(s)

Pipeline Dredging			
Maintain dragheads and/or cutterheads buried, or no more than 3 ft elevation of the river bottom when cleaning, for dredging between RM 3 and RM 106.5; within 9 ft between RM 106.5 and RM 145, and in shallow-draft side channels.	To minimize potential entrainment of juvenile salmonids	Continuous throughout dredging operations	Maintain unless new information warrants change(s)
All Dredging			
Dredging of shallow water areas (< 20 ft) will occur during recommended in-water work windows to minimize effects to ESA-listed species.	These shallow water areas are considered migratory habitat for salmonids. Dredging and placement activities could adversely affect food resources or delay migration.	Continuous throughout dredging operations	Maintain unless new information warrants change(s)
Contractor(s) shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into waterways	Protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

Dredged Material Placement BMPs

Measure	Justification	Duration	Ongoing Management
In-River Placement			
Spread out dredged material to prevent mounding	Reduces depth of material to minimize effects to fish and invertebrates	Life of contract or action	Maintain unless new information warrants change(s)
Maintain discharge pipe of pipeline dredge at or below 20 ft depth during placement	Reduce impact of placement, suspended sediment, and turbidity to migrating juvenile salmonids	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Shoreline Placement			
Grade placement site to slope of 10-15%, with no swales, to reduce the possibility of stranding juvenile salmonids	Ungraded slopes can create small pools or flat slopes that can strand juvenile salmon washed ashore by waves	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Ocean Placement			
Place material in accordance with the applicable site management and monitoring plan	Reduce suspended sediments and turbidity in runoff water	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Upland Placement			
Berm upland placement sites (slope at 1.5 to 1 or flatter) to maximize the settlement of fine materials in runoff water	Ungraded slopes can create small pools or flat slopes that can strand juvenile salmon washed ashore by waves	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Only clean dredged material will be placed at upland sites, unless specifically authorized otherwise	Protection of riparian and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Land-based construction equipment that enters within the wetted perimeter of a water body shall be cleaned before use and shall use environmentally acceptable lubricants and other fluids.	Protection of riparian and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Vegetation along the water shall be left in its natural conditions unless removal of such vegetation was authorized in the EIS and required to achieve authorized purposes	Maintain habitat functions/values of riparian and aquatic areas	Continuous throughout operations	Maintain unless new information warrants change(s)

Erosion control measures shall be utilized during upland placement actions to prevent erosion into the Columbia River. Dredged material containment berms with weir systems are measures used to maximize sediment retention within the site.	Minimize potential deleterious effects to water quality and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Construction access routes and barge ramps will be limited to the smallest footprint practicable to minimize potential discharge into areas waterward of OHW or MHHW.	Minimize potential deleterious effects to water quality and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
Construction debris (e.g., fuel and oil containers and barrels, misc. litter, etc.) shall be removed by the contractor(s) and no equipment shall be abandoned.	Minimize and ensure safe disposal of hazardous waste, protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
If contamination is suspected, discovered, or occurs during operations, testing of potentially contaminated media must occur. If contaminated soil or groundwater is apparent or revealed through testing, DEQ will be notified.	Minimize and ensure safe disposal of hazardous waste, protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit and DEQ for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
Berms will be constructed, as needed, to prevent material from entering areas below OHW/MHHW	Maintain habitat functions/values of aquatic resources	Continuous throughout operations	Maintain unless new information warrants change(s)
No construction materials shall be abandoned on site at project completion.	Maintain habitat functions/values of riparian and aquatic areas	Life of contract or action	Maintain unless new information warrants change(s)

All Placement			
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the U.S. Coast Guard Unit for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

2. 2. Oregon's Statewide Planning Goals, Clatsop County's Comprehensive Plan, and Local Land Use Regulations

Under ORS 197.175, the Statewide Planning Goals in Oregon are to be implemented by local governments through the adoption of comprehensive plans that are compatible with the goals. In turn, the comprehensive plans are to be implemented through adoption and enforcement of land use regulations. Therefore, any proposed activity that is compatible with the acknowledged comprehensive plan and its implementing land use regulations would, by extension, be compatible with Statewide Planning Goals.

In this section the Corps has described those provisions of Clatsop County's acknowledged comprehensive plan and land use regulations that relate to water quality and made affirmative findings that its project is compatible with those land use factors which relate to water quality. The Corps' provision of this applicable land use information ensures that DEQ's WQC decision is compatible with those factors that relate to water quality. FNC dredging and placement site locations used for upland and/or shoreline placement, or in-water transfer of material are listed by county in section 1.2, Table 1 above.

2.1 Compatibility with Applicable Clatsop County Comprehensive Plan Provisions

The Clatsop County Comprehensive Plan contains goals of the county. Those that pertain to water quality or the control and abatement of water pollution in relation to the proposed Project are goals 16 & 17 Estuarine Resources; the sections that are applicable to the proposed action are addressed below.

P20.5 – Dredging and dredged material disposal.

1. Dredging shall be allowed only:

(a) If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, PORTLAND DISTRICT
PO BOX 2946
PORTLAND, OR 97208-2946

July 28, 2023

SUBJECT: Request for Clean Water Act Section 401 Water Quality Certification for the Columbia River Navigation Channel Operations and Maintenance Project

Jeffrey Brittain
Oregon Department of Environmental Quality
700 NE Multnomah St, Suite 600
Portland, OR 97232-4101
401applications@deq.state.or.us

Dear Jeffrey Brittain:

The U.S. Army Corps of Engineers, Portland District (Corps) is requesting the Oregon Department of Environmental Quality (DEQ) to issue a new ten-year Clean Water Act (CWA) Section 401 Water Quality Certification (WQC) for the Columbia River Navigation Channel Operations and Maintenance Project.

In order to maintain necessary navigational depths, the U.S. Army Corps of Engineers (Corps) proposes to continue ongoing operations and maintenance (O&M) of federal navigation channels (FNCs) in the Columbia River (CR) from RM 3 to RM 145. These projects are authorized by Congress to specified dimensions. The intent of the authorization is to ensure year-round channel access at those dimensions. The authorization does not specify the alignment of the channel or turning basins. When needed, the Corps may coordinate with the U.S. Coast Guard and NOAA to improve navigational safety by changing the alignment to more accurately reflect the reality of present-day infrastructure and usage. These O&M activities are currently authorized under Water Quality Certification (WQC) NWPOP-CLA-F05-001-FR, dated May 19, 2014, as amended on September 3, 2015, August 2, 2019, March 23, 2022, and October 19, 2022. All depths in this WQC application are based on Mean Lower Low Water (MLLW) or Columbia River Datum in feet (ft) as appropriate. The Corps proposes to dredge 7 to 9 million cubic yards of material annually.

The Corps has five options for dredged material placement: in-water placement in areas of the Columbia River greater than 20 feet deep, upland placement, shoreline (beach nourishment), transfer/rehandle sites, or ocean placement. From RM 3 to 145 (Bonneville Dam), the decision to place material in-water, upland or for beach nourishment, depends on type of dredge used and both the availability and access to the placement site. From RM 3 to 30, the decision to haul material to the ocean site is dependent on type of dredge used and availability of in-water placement sites in the Columbia River. Dredging and dredged material placement locations have not changed since the most recent WQC, as amended.

The Corps requests one WQC for ten years. This certification request is consistent with the requirements under 40 CFR Part 121. A pre-filing meeting request (40 CFR 121.4) was submitted using DEQ's online system (YourDEQ) on December 8, 2022. The Corps has verified that the contents of this certification request with its enclosures meets the requirements provided in 40 CFR 121.5.

The Corps' regulation governing timing on requests for 401 WQC for Corps' dredging projects provides that the time period is generally two months, 33 CFR 336.1(b)(8)(iii). In accordance with Corps' regulations and 40 CFR 121.6, the Corps has established a reasonable period of time to act on this certification request of 6 months from the date of this request, which will be January 22, 2024. This reasonable period of time was selected because this is an operations and maintenance action requiring no more than standard coordination, is similar to ongoing actions, and a stormwater management review is not required. Any request from DEQ to extend the reasonable period of time should be made in writing to the Corps.

If DEQ requires any additional information regarding this request, please contact Darren Bradford of my staff by email at Darren.L.Bradford@usace.army.mil or phone at 503-808-4663. Thank you for your assistance.

Sincerely,

Amy Gibbons
Chief, Environmental Resources Branch

Enclosure
Page

Joint Permit Application

This is a joint application, and must be sent to all agencies (Corps, DSL, and DEQ). Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Date Stamp

U.S. Army Corps of Engineers Portland District	Oregon Department of State Lands	Oregon Department of Environmental Quality
Action ID Number	Number	

(1) TYPE OF PERMIT(S) IF KNOWN (check all that apply)

Corps: Individual ☐ Nationwide No.: _____ Regional General Permit _____ Other (specify): _____

DSL: Individual ☐ GP Trans ☐ GP Min Wet ☐ GP Maint Dredge ☐ GP Ocean Energy ☐ No Permit ☐ Waiver ☐

(2) APPLICANT AND LANDOWNER CONTACT INFORMATION

	Applicant	Property Owner (if different)	Authorized Agent (if applicable) ☐ Consultant ☐ Contractor
Name (Required) Business Name Mailing Address 1 Mailing Address 2 City, State, Zip	Amy Gibbons USACE, Portland District Attn: Elizabeth Santana PO Box 2946 Portland, OR 97204		Darren Bradford
Business Phone Cell Phone Fax Email	503-808-4389 Amy.C.Gibbons@usace.army.mil		503-808-4663 Darren.L.Bradford@usace.army.mil

(3) PROJECT INFORMATION

A. Provide the project location.

Project Name			Latitude & Longitude*	
Columbia River Navigation Channel Operations and Maintenance Project			Multiple (See Attachment A)	
Project Address / Location	**City (nearest)**			**Counties**
Multiple (See Attachment A)	Warrenton, OR to Cascade Locks, OR			Clatsop, Columbia, Multnomah
Township	**Range**	**Section**	**Quarter / Quarter**	**Tax Lot**
(See Attachment A)				

Brief Directions to the Site:
(See Attachment A)

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

☐ River / Stream ☐ Non-Tidal Wetland ☐ Lake / Reservoir / Pond

☐ Estuary or Tidal Wetland ☐ Other ☐ Pacific Ocean

Waterbody or Wetland Name**	River Mile	6th Field HUC Name	6th Field HUC (12 digits)
Columbia River	3 to 145 + side channels		(See Attachment A)

* In decimal format (e.g., 44.9399, -123.0283)
** If there is no official name for the wetland or waterbody, create a unique name (such as “Wetland 1” or “Tributary A”).

C. Indicate the project category. (Check all that apply.)		
☐ Commercial Development	☐ Industrial Development	☐ Residential Development
☐ Institutional Development	☐ Agricultural	☐ Recreational
☐ Transportation	☐ Restoration	☐ Bridge
☐ Dredging	☐ Utility lines	☐ Survey or Sampling
☐ In- or Over-Water Structure	☐ Maintenance	☐ Other:

(4) PROJECT DESCRIPTION

A. Summarize the overall project including work in areas both in and outside of waters or wetlands.

In order to maintain necessary navigational depths, the U.S. Army Corps of Engineers (Corps) proposes to continue ongoing operations and maintenance (O&M) of federal navigation channels (FNCs) in the Columbia River (CR) from RM 3 to RM 145. These projects are authorized by Congress to specified dimensions. The intent of the authorization is to ensure year-round channel access at those dimensions. The authorization does not specify the alignment of the channel or turning basins. When needed, the Corps may coordinate with the U.S. Coast Guard and NOAA to improve navigational safety by changing the alignment to more accurately reflect the reality of present-day infrastructure and usage. These O&M activities are currently authorized under Water Quality Certification (WQC) NWPOP-CLA-F05-001-FR, dated May 19, 2014, as amended on September 3, 2015, August 2, 2019, March 23, 2022, and October 19, 2022.

The Corps requests one WQC for ten years. All depths in this WQC application are based on Mean Lower Low Water (MLLW) or Columbia River Datum in feet (ft) as appropriate. The Corps proposes to dredge 7 to 9 million cubic yards of material annually.

The Corps has five options for dredged material placement: in-water placement in areas of the Columbia River greater than 20 feet deep, upland placement, shoreline (beach nourishment), transfer/rehandle sites, or ocean placement. From RM 3 to 145 (Bonneville Dam), the decision to place material in-water, upland or for beach nourishment, depends on type of dredge used and both the availability and access to the placement site. From RM 3 to 30, the decision to haul material to the ocean site is dependent on type of dredge used and availability of in-water placement sites in the Columbia River. Dredging and dredged material placement locations have not changed since the most recent WQC, as amended.

B. Describe work within waters and wetlands.

The Corps is authorized to maintain these federal navigation projects in order to provide safe, reliable channels for the transport of commerce, national security, and recreation. Shoaling occurs in areas where the natural depth of the river is less than the authorized depth of the channel. Dredging is necessary to remove shoals that restrict the movement of vessels. Advanced maintenance dredging is the practice of excavating shoals to a depth and/or width greater than the authorized navigation channel dimensions for the purpose of maintaining the authorized dimensions for a longer period of time between maintenance dredging events. Due to the inaccuracies of dredging, incidental removal of material may occur below the advanced maintenance depth.

Specific Areas located partially or wholly within the State of Oregon to be maintained by dredging include:

- **Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5).**
- The authorized channel is generally 600' wide and 43' deep from RM 3 to 105.5 and 35’ deep from RM 105.5 to 106.5, with an advanced maintenance depth (AMD) of 5' and overwidth of 100' if necessary.
- **Columbia River FNC; Vancouver, Washington to Bonneville Dam (RM 106.5 to RM 145).**
- The authorized channel is 300' wide and 27' deep; however, this reach is typically maintained to a depth of 17', with AMD of 2' and variable overwidth up to 100’.
- **Columbia River FNC; side channels.**
  - Skipanon: This channel extends from the Columbia River to the Skipanon RM 2, and is authorized to 30' deep, with a width of 200'. Typically, the Corps maintains this reach to 16' deep, with 2' AMD and variable overwidth.
  - Tongue Point: This channel is authorized to 34' deep and 350' wide, with a length of 1.6 miles, with 2' AMD and variable overwidth.
  - Westport Slough: This channel is authorized to 28' deep, and 200' wide, with a length of 3500'. Typically, the USACE maintains this reach to 20' deep with a 2' AMD and variable overwidth. The entrance channel for the ferry is maintained to 9’ deep with 2’ AMD and variable overwidth.
  - Oregon Slough: The downstream entrance from the Columbia Channel to Oregon Slough RM 1.5 is part of the deep draft channel authorized to 43' deep. The Oregon Slough side channel RM 1.5 to 3.8 is maintained to 20’ deep by 200’ wide with 2’ AMD and variable overwidth. The upstream entrance side channel is maintained to 10' deep by 300' wide, with a length of 5,800’ with 2’ AMD and variable overwidth.

- Reminder: Although the riverward ends of Baker Bay and Chinook FNCs in the Columbia River are located within the State of Oregon, the Corps will continue the existing practice of following State of Washington 401 compliance when dredging those FNCs.

- **Portland/Vancouver Anchorage Project**
  - Anchorage area A: This area is located between RM 102+36.5 and RM 103+3.5, adjacent to the Columbia River FNC. This area is 2000' long by 370' to 550' wide, and is maintained to 43' deep with 2' AMD and variable overwidth.
  - Anchorage area B: This area is located between RM 1-03 and RM 103.5, and is approximately 500' outside of the FNC. This will be maintained to a depth of 25' with 2' AMD and variable overwidth.

C. Construction Methods. Describe how the removal and/or fill activities will be accomplished to minimize impacts to waters and wetlands.

Several different types of shoaling occur within the CR channels. The most common shoals occurring in the mainstem CR are continuous cutline shoals and sandwave (continuous or isolated) formations. Cutline shoals are defined by bedload material that is moving in from the side slopes (parallel edges) of the channel, typically longer than 1,000 feet in length (upstream to downstream); cutline shoaling is more continuous than sand waves and usually forms slowly and steadily. These kinds of shoals are more common in the lower river. Sand wave shoals are where bedload material forms peaks and troughs along the channel, around 15 feet in height and 200 feet long (upstream to downstream); sand-wave shoaling is more intermittent, and forms more dynamically compared to cutline shoaling. Usually only the peaks of the sand waves encroach into the authorized channel or advanced maintenance depth and require dredging. These kinds of shoals are typically found in the upper reaches of the river. A third kind of shoal, low-energy accretionary depositional shoals (shoals formed by settling of sediment out of the water column due to low water movement through the area) are typically fund in the lower energy side channels.

Maintenance of the CR channels is conducted via hydraulic or mechanical dredges. Hydraulic dredges consist of hopper or pipeline. Mechanical dredges consist of clamshell or backhoe. Both types of dredging actions will occur within the Columbia River system.

Hopper dredges currently dredge about 4.7 MCY of material annually from the mainstem FNC (RM 3 to RM 145). Hopper dredges are highly mobile and maneuverable, making them the preferred choice for limited sandwave shoals within the FNC and large-volume continuous cutline shoals located in the tidally influenced environment from RM 3 - 30. The Corps hopper dredges are capable of placing dredged sediment only at in-water sites (including the ocean); the Corps may contract out hopper dredges for upland/shoreline placement.

Pipeline dredges are used for large continuous cutline shoals and continuous sandwave shoals. Pipelines are typically mobilized to a reach and continuous dredging is performed until the shoal is cleared; due to the reduced mobility of the pipeline, these dredges are preferred for large shoals. Pipeline dredges are capable of placing dredged sediment at in-water, upland, and beach nourishment sites. Currently, about 2.5 MCY annually is dredged from the mainstem FNC using a pipeline dredge.

Clamshell dredging is performed using a bucket operated from a crane mounted on a barge (or from the shore). Backhoe dredging is performed using a bucket operated on the end of a backhoe arm. Sediment from either the clamshell or backhoe dredge is placed on a barge for transport to disposal the placement site. Depending on the barge used, dredged sediment can be placed at in-water, upland, beach nourishment, and ocean sites. Clamshells are used mainly for side channel projects, since they are able to dredge areas where pipelines and hopper dredges are not able to access, like shallow areas and narrow channels. Backhoe dredges can be used in space restricted areas, shallow channels, and are used to remove rock, hard-packed materials, and fine-grained sediments.

In-River placement: Hopper dredges collect material in the hopper of the vessel until it fills to capacity. When filled, the vessel moves to an in-river site. As the dredge is moving, the hopper doors open and the material is discharged at varying rates depending upon how far the hopper doors are opened. The dredge releases the material gradually while moving to avoid mounding. In-water discharge from pipeline dredges differs from hoppers in that with a pipeline dredge, material is continuously discharged during dredging operations, whereas hoppers must stop dredging when full and move to another location to discharge material. Pipeline dredge placement of material at in-water sites is done using a down-pipe with a diffuser plate at the end. This downpipe extends 20 feet below the water surface to minimize or avoid impacts to migrating juvenile salmonids.

Upland Placement: Upland placement is primarily accomplished using a pipeline dredge but can also be accomplished with clamshell or hopper dredges. Pipeline and hopper dredges pump dredged material as sand and water slurry directly into a diked, upland site near the dredging area. Some clearing of shoreline vegetation, grading and fill material may be required to provide access for the slurry and return water pipelines and to offload shore equipment from the landing barge, but this would be minimized to the extent practicable. Containment berms are typically created around the perimeter of the placement area to prevent runoff. These berms are created by pushing existing material from the center of the upland placement area out to the perimeter. As the site is filled, sand may be continually pushed to the perimeter

to raise the containment berm. Once placement is complete, the final berm will be roughly 2 feet higher than the main placement area. The fill area at placement sites is also typically terraced to allow for incremental increases in elevation. During placement, the dredge material slurry pipeline is positioned to place material at the farthest landward area first, then moved over the course of placement to achieve a relatively uniform layer of dredged material over the full area enclosed by the berm. Primary and secondary ponds may be constructed within the containment area to facilitate longer retention of fine sediments prior to reaching a spillway weir. Weir systems are typically installed and removed with each placement event. Discharge of water from the final settling pond back into the river is controlled by the use of weirs. The return water discharge pipe will be submerged at least -20 foot depth. Clamshell-dredged material deposited onto a barge can be off-loaded at a transfer point to be taken to an upland site. Some upland placement sites are within the 100-year floodplain.

Shoreline, also called Beach Nourishment: Shoreline placement is primarily accomplished by a pipeline dredge. It involves pumping dredged material through a floating discharge pipe to an existing shoreline. The dredge first pumps a landing on the shoreline to establish a point from which further material placement occurs. Dredged material is pumped in a slurry of 20% sand and 80% water. As the sand exits the shore pipe, the sand settles out on the shoreline while the water returns to the river. Settling rates of Columbia River sands are very quick and turbidity from these operations is minimal. After sufficient sand has settled out and begins to increase in height, it is moved by bulldozers to match the elevation of the existing shoreline at approximately the high-water line. During beach nourishment, a temporary sand berm is constructed to retain sand on the beach during pump-out. The berms are built gradually by earth-moving equipment as pump-out continues and are created from existing beach sand, pumped sand, or both. A typical shoreline placement operation lasts from 5 to 15 days and the width of the shoreline created is approximately 100 to 150 feet. The process continues by adding to the shore pipe and proceeding longitudinally along the shoreline. The length of shoreline replaced is dependent on the quantity of material to be dredged from the shoal in the channel. After placement, the slope of the shoreline is groomed to a steepness of 10 to 15 percent to prevent the possibility of creating areas where juvenile fish could be stranded from vessel wakes on the new shoreline. Placement of material for beach nourishment will always occur at the sand/water interface, not in open water. Beach nourishment sites are within the 100-year floodplain.

In-water transfer: In some cases, dredged material may be temporarily placed in-water nearby to clear shoaling quickly and then transferred/rehandled by another dredge to a final placement site, usually upland. Near those upland sites, a dredge creates a temporary sump which is a deeper area of the river bottom outside of the main channel for temporary in-water storage of dredged material before it is transferred into the final upland site. Each transfer site is operated in a cycle. First, a self-propelled hopper dredge collects materials from LCR FNC shoals in the hopper of the vessel until it is full, then moves to the transfer site to discharge the material by releasing material gradually from the bottom of the dredge while moving to avoid mounding and then repeats until the shoals are removed and the transfer site is full. A pipeline dredge then removes the material collected within the transfer site, plus some existing underlying river-bottom material, and pumps it continuously through a discharge pipe to the final destination placement site. Finally, a hopper dredge would refill the transfer site storage basin using material dredged from the LCR FNC, leaving the site in about the same condition that it began in prior to any activity. This cycle is scheduled within a single dredge season. The cycle may occur more than once within a dredge season or there may be years between cycles.

Factors considered when planning for annual maintenance dredging include: equipment availability, results of bathymetric surveys, placement site capacity, environmental resource concerns, and funding. The mechanism of dredging and placement is decided based on the severity, type, and location of the shoal. The project will follow all Portland Sediment Evaluation Team (PSET) recommendations for each dredging event and comply with the Sediment Evaluation Framework for the Pacific Northwest (SEF) (May 2018). All dredging and placement for the CR channels follow established Best Management Practices (BMPs) (See Attachment B).

(4) PROJECT DESCRIPTION (continued)

D. Describe source of fill material and disposal locations if known.

Dredged Material Placement: Prior to any dredged material placement, all areas proposed to be dredged will be reviewed by the Portland Sediment Evaluation Team (PSET) to characterize sediment and determine suitability of sediment for in-water or upland placement. All material placed in-water will be determined to be suitable for this use.

In-water placement of material dredged from federal navigation projects in Oregon and Washington occurs in depths greater than 20 feet within or outside the navigation channel throughout the mainstem Columbia River from RM 3 to RM 145. Placement areas vary depending on survey depths each year. As deeper areas are filled with dredged material, new deep areas are formed elsewhere as a result of natural river processes.

Specific sites located partially or wholly within the State of Oregon used for upland and/or shoreline placement, or in-water transfer of material dredged from the LCR FNC and associated turning basins RM 3 to RM 106.5:

Site Name	RM	Type
Rice Island	W-21.0-UP	Upland & Shoreline
Miller Sands Island	O-23.5-BN	Shoreline
Pillar Rock Island	O-27.2-UP	Upland & Shoreline
Welch Island	O-34.0-UP	Upland
Tenasillahe Island	O-38.3-UP	Upland
James River	O-42.9-UP	Upland
Puget Transfer	W-44.5-IW-T	In-Water Transfer
Crims Island	O-57.0-UP	Upland
Lord Island	O-63.5-UP	Upland
Dibblee Point	O-64.8-UP	Upland
Howard Island Transfer	O-69.6-IW-T	In-Water Transfer
Sandy Island	O-75.8-UP	Upland
Lower Deer Island	O-77.0-UP	Upland
O-77.9-IW-T Transfer	O-77.9-IW-T	In-Water Transfer
O-81.1-IW-T Transfer	O-81.1-IW-T	In-Water Transfer
Sand Island	O-86.2-BN	Shoreline
West Hayden Island	O-105.0-UP	Upland

E. Construction timeline.

What is the estimated project start date? Ongoing/Recurring O&M

What is the estimated project completion date? N/A

Is any of the work underway or already complete? If yes, please describe. **Yes**

F. Removal Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name *	Removal Dimensions					Time Removal is to remain**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq.ft. or ac.)	Volume (c.y.)		
Columbia River RM 3 to 145, Skipanon FNC, Tongue Point FNC, Westport Slough FNC, Oregon Slough FNC	~150 miles	Varies	Varies	See Project Description 4.B	Annual average of ~7-9 MCY from RM 3 to 145; variable for side channels	Intermittent; maintenance dredging is recurring action	Shoaled sediment (primarily Sand and gravel)

G. Total Removal Volumes and Dimensions			
Total Removal to Wetlands and Other Waters	**Length (ft.)**	**Area (sq. ft or ac.)**	**Volume (c.y.)**
Total Removal to Wetlands			
Total Removal Below Ordinary High Water			~7-9 MCY/year
Total Removal Below Highest Measured Tide			
Total Removal Below High Tide Line			
Total Removal Below Mean High Water Tidal Elevation			

H. Fill Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name*	Fill Dimensions					Time Fill is to remain**	Material***
	Length (ft.)	Width (ft.)	Depth (ft.)	Area (sq. ft. or ac.)	Volume (c.y.)		
Columbia River RM 3 to 145 (in-water placement areas and transfer sites)	~150 miles	Varies	Varies	See Project Description 4.B	Annual average of ~7-9 MCY from RM 3 to 145; variable for side channels	Intermittent; in-water placement areas are erosive and transfer sites are temporary fill	Dredged material (see Removal section)

(4) PROJECT DESCRIPTION (CONTINUED)

I. Total Fill Volumes and Dimensions

Total Fill to Wetlands and Other Waters	Length (ft.)	Area (sq. ft or ac.)	Volume (c.y.)
Total Fill to Wetlands			
Total Fill Below Ordinary High Water			~7-9 MCY/year
Total Fill Below Highest Measured Tide			
Total Fill Below High Tide Line			
Total Fill Below Mean High Water Tidal Elevation			

*If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").
**Indicate whether the proposed area of removal or fill is permanent or, if you are proposing temporary impacts, specify the days, months or years the fill or removal is to remain.
*** Example: soil, gravel, wood, concrete, pilings, rock etc.

(5) PROJECT PURPOSE AND NEED

Provide a statement of the purpose and need for the overall project.

Dredging of the Columbia River is necessary to maintain deep-draft navigation in the CR FNC and the auxiliary FNCs so large vessels can safely sail to and from the Pacific Ocean. The CR FNC is important to local, regional, national, and global economies. The Columbia River is the largest wheat export channel for the United States. Approximately 100,000 jobs are indirectly or directly tied to the Columbia River maritime commerce, generating $1.8 billion of personal wealth. In order to ensure the continuity of safe passage through this system, a total of 7-9 MCY of material may need to be dredged annually and placed in upland or in-water dredged material placement sites.

(6) DESCRIPTION OF RESOURCES IN PROJECT AREA

A. Describe the existing physical, chemical, and biological characteristics of each wetland or waterbody. Reference the wetland and waters delineation report if one is available. Include the list of items provided in the instructions.

Channel and bank conditions

Channels and banks of the Columbia River are deeply incised river valleys, where banks are typically vegetated and consist of basalt, silt, and clay deposit. The river thalweg is primarily comprised of fine and medium grained sand. The Columbia River has been highly modified since the 1890s. Pre-1890s, the shore edge of the Columbia River was dynamic; there were sections of the Columbia River where sand dominate the morphology and other parts where silt/hardpan dominated. Present topography is a result of both the excavation of a portion of the deposited gravels by the Columbia River, and of the subsequent post-glacial sea level rise of about 300 ft. The lower Columbia River valley flooded during the sea level rise causing extensive deposition of silt and clay materials in a low energy estuarine-lacustrine environment. These deposits form the majority of the bank materials that are found in the current Columbia River lowlands. Present river geometry is controlled by these erosion-resistant silt and clay materials (Dodge, 1971). Current thalweg depths are typically around 50 ft deep with deeper spots occurring along outside bends.

The most common sediment movement along the riverbed in the mainstem Columbia River consists of cutline shoals or sand wave formations. Cutline shoals are defined by bed load material moving toward deeper areas from the side slopes of the channel; this type of sediment movement is more continuous at steady rates and is more common in the lower river. Sand waves occur where bed load material forms peaks and troughs like ripples along the river bottom; this type of sediment movement is more intermittent and dynamic. Sand waves are typically larger in deeper water and smaller in shallower water and are most commonly found in the upper reaches of the river. Low-energy accretionary depositional shoals (formed by sediment settling out of the water column due to low water movement) are typically found in the Columbia River side channels. The natural riverbanks consist of a 10-foot-to-20-foot deep layer of clay-silt, overlying much deeper sand deposits. Sandy beaches occur only where dredged material has been placed along the shore. There has been little change in the river's location in the last 100 years. However, river bathymetry has drastically changed since the turn of the twentieth century. Navigation development has deepened the channel in all reaches, and riverine and entrance channels have been narrowed. Dredge material disposal has been used to create shoreline and in-water fills that have also narrowed the river and created small side channels. The systems of pile dikes are in place to prevent erosion of shoreline and upland placement sites. The riverbed side slopes remain generally flat, with slightly steeper slopes near shorelines that are protected by pile dikes.

Chemical

The LCR was evaluated in two studies (Tetra Tech 1995, 1996). The studies concluded that the river is classified as “marginally healthy” base on levels of dissolved oxygen, toxins, and habitat conditions. The Oregon Department of Environmental Quality lists placed it on the CWA 303(d) list for the following parameters: RM 0 to 35.2 for water temperature; fecal coliform; DDE 4,4; dioxin (2,3,7,8-TCDD); polychlorinated biphenyls (PCBs); and arsenic; from RM 35.2 to 98 for arsenic, dichlorodiphenyl trichlorethane (DDT), PCBs, and temperature; and from RM 98 to 142 for temperature; arsenic, DDT, PCBs, and polycyclic aromatic hydrocarbons (PAHs). Hazardous materials, such as fuels, oils, and lubricants are likely to be present on the dredge or in other equipment during construction; however, the Corps and its contractors do not store any hazardous waste in reportable quantities on dredge vessels and BMPs are used to avoid, minimize, control, and contain spills, consistent with state and federal laws (Attachment B). Should a spill occur, the Corps will follow Spill Response Plan, a single consolidated document to meet multiple spill response planning requirements, as identified under the Occupational Safety and Health Administration’s Standard; the Resource Conservation and Recovery Act (RCRA) Contingency Plan; Superfund Amendment and Reauthorization Act; Title III’s Emergency Planning and Community Right To Know Act; Oil Pollution Act; CWA; and state, area, regional, and National Contingency Plans (NCPs) for spill response. Implementation of the NCP requires a nationwide network of regional response plans, including the Corps’ Spill Response by Portland District. Operation project managers, dredge incident commanders, and emergency system first responders will use this plan as their primary guidance for responding to oil and hazardous substance spill emergencies in the Portland District.

Sediment Characterization

Sediments from the FNCs are evaluated to determine if they are suitable for in-water placement according to the requirements of the CWA and Marine Protection Reserve and Sanctuaries Act (MPRSA). The Corps began collection sediment quality data from its projects in the 1970s. These data are available at https://www.nwp.usace.army.mil/Missions/Environmental-Stewardship/DMM.

The Corps Portland District uses the most recent 2018 version of the Sediment Evaluation Framework (SEF) for the Pacific Northwest to ensure that civil works projects and the projects permitted by the Regulatory Program comply with the CWA and MPRSA. The SEF aids federal and state agencies in Washington, Oregon, and Idaho in evaluating the suitability of dredged material for unconfined, aquatic placement in inland waters and disposal in ocean waters. It is periodically updated to incorporate the latest technical and scientific advances and incorporate changes in regional policy.

The most recent dredged material suitability determinations are included as Attachment C and summarized below. Sediments will continue to be routinely sampled and evaluated in the future in accordance with the SEF. Sediment that is suitable for unconfined aquatic placement is also suitable for placement upland and along shorelines and other beneficial uses.

•Lower Columbia River FNC; deep draft channel and associated turning basins (RM 3 to RM 106.5): A total of 59 stations were sampled within the LCR FNC. All sediment samples consisted of more than 97 percent coarse-grained sediments (gravel and sand) suitable for unconfined, aquatic placement. The total organic carbon (TOC) results for all samples is less than 0.2%.

•Columbia River FNC; Vancouver, Washington to Bonneville Dam (RM 106.5 to RM 145): Coarse sands and gravels (>98%) with low TOC content (<0.2%) suitable for unconfined, aquatic placement.

•Skipanon FNC: Dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%) suitable for unconfined, aquatic placement. TOC in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.

•Tongue Point FNC: The outer shoal dredge prism was 96.4% sand and the inner shoal averaged 46.9% sand, 45.7% silt, and 7.3% clay suitable for unconfined, aquatic placement.

•Westport Slough FNC: Material is composed of an average of 83.1% sand and 15.2% fines suitable for unconfined, aquatic placement. The TOC content is 0.698%.

•Oregon Slough FNC downstream entrance from the Columbia Channel to Oregon Slough RM 1.5: Composite samples consisted of 73 to 82% sand and 18 to 27% fines with trace gravel (<0.4%) suitable for unconfined, aquatic placement. The TOC ranged from 0.62 to 1.27%. Total solids ranged from 60.7 to 63.8%.

•Oregon Slough FNC RM 1.5 to 3.8: Samples were composed predominately of sand (91.4% to 94.2%) with little gravel (2.8% to 8.2%), trace silt (0.6% to 4.5%), and trace clay (0.3% to 0.4%). Subsurface samples were composed predominately of sand (67% to 95.7%) with little gravel (0.5% to 6.6%), some silt (0.8% to 26.3%), and trace clay (0.1% to 6.2%). All material is suitable for unconfined, aquatic placement.

•Oregon Slough FNC upstream entrance: Sediment was composed of 96.8% sand, 2.0% fines, and 0.3% gravel at one sample location and 78.6% sand and 21.3% fines at the other sample location. All material is suitable for unconfined, aquatic placement.

•In-water Transfer sites: Substrates are composed primarily of sand (29% to 99%) and gravel(<1% to >99%); the fines (silt and clay) fraction is less than 1%. All material is suitable for unconfined, aquatic placement.

a. Statewide Narrative Criteria – The proposed action does not include new waste, discharges of waste, log handling, sand and gravel mining operations, road building activities, new tastes or odor, or toxic materials. The proposed action will not promote the development of fungi or other growths, nor formation of sludge deposits, nor floating solids, nor radioisotopes.

b. Bacteria – The proposed action does not include sewage, animal waste, or other pollution that would contribute to bacterial growth.

c. Biocriteria – The proposed action may result in temporary reduction of quality of benthic habitat in dredge locations; however, these areas are expected to recover within 1 to 3 years after the dredging event, and therefore, would not significantly degrade Waters of the State.

d. Dissolved Oxygen (DO) – DO is monitored during all side channel dredging per the current Biological Opinion. Dredging may not occur if DO is less than 6.5 mg/L. More frequent monitoring is required if the DO is below 8 Mg/L.

e. Nuisance Phytoplankton Growth – The proposed action is not expected to increase phytoplankton growth because activities are occurring in open, flowing waters.

f. pH – The proposed action would not modify the pH of Waters of the State.

g. Temperature – The proposed action would not modify the temperature of Waters of the State.

h. Total Dissolved Gas – The proposed action will not affect total dissolved gases in Waters of the State because no spill events or other activities or substances contributing to an increase in dissolved gases are associated with the proposed action.

i. Total Dissolved Solids (TDS) – The proposed action is not anticipated to contribute to TDS in Waters of the State because the proposed action does not include activities normally contributing such as agricultural runoff, residential runoff, or point source discharges.

j. Toxic Substances – No toxic substances are associated with the proposed action.

k. Turbidity – Turbidity is monitored during all dredging per the existing WQC. Dredging must stop if exceedance over background level occurs at second monitoring interval; dredging continues once turbidity levels return to background level.

l. Basin-Specific Criteria – Refer to previous responses.

m. Antidegradation – The proposed action does not include pollution and would not degrade water quality. The receiving waters are exposed to the same sources of contamination as the dredge areas; therefore, there is no potential for the activities to degrade Waters of the State. The sediments are suitable for aquatic placement and exposure per the 2018 SEF.

Type and condition of riparian vegetation

Estuarine vegetation habitat within the Lower Columbia River is typically comprised of fringing intertidal marshes and intertidal island marshes. From RM 11 to RM 35, over 14,000 acres of land adjacent to the river are diked, primarily for agricultural resources. West Sand Island, Rice, Miller Sands, Pillar Rock, and Tenasillahe Islands are sandy islands, either created as a result of natural shoaling processes, or intentionally developed via placement of dredged material. Active dredged material placement sites typically do not support established plant communities, due to lack of nutrients and xeric nature of the dredged material. West Sand Island retains probably the largest and best remaining native sand dune plant community. High tide lines that perimeter upland dredged material placement sites are more likely to support vegetative communities due to nutrient and debris deposited within this zone. Established estuarine riparian habitats commonly found are stands of cottonwoods and alders.

Riverine vegetation habitat upstream of RM 35 consists of fragmented, reduced riparian habitat. Approximately 162,000 acres of land have been converted for agricultural and industrial purposes. Unless modified or developed, a narrow band of vegetation lines the banks of the Columbia River. Cottonwood and Oregon ash stands are likely to populate areas that have yet been developed or altered for use. There are a number of refuges and wildlife management areas located within the Columbia River basin. These areas provide established natural and man-made wetland and riparian forest habitat for a variety of wildlife species.

Fish and wildlife (type, abundance, period of use, significance of site)

Biological resources within the Columba River system are diverse. There is a wide range of aquatic, terrestrial, and avian species that utilize one or more types of habitat found within the project area. There are four primary habitats that encompass the Lower Columbia River system: Estuarine, Riverine, Riparian, and Upland. Each of these habitats carries an intricate level of biologic complexity. CR O&M project operates within each of the habitats to a varying degree. NMFS issued a Biological Opinion on 11 July 2012 (2012 BiOp) titled Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Columbia River Navigation Channel and Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington (HUCs 1708000605, 1708000307, 1708000108). NMFS No. 2011/02095. Northwest Region, Seattle, Washington, and a Biological Opinion on June 16, 2021 (2021 BiOp) titled Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Operations and Maintenance Dredging of the Federal Navigation Channels at Tongue Point, Clatsop County, Oregon; Elochoman Slough, Wahkiakum County, Washington; Lake River, Clark County, Washington; and Oregon Slough, Multnomah County, Oregon. The 2012 and 2021 BiOps concluded that the action would not jeopardize the continued existence of ESA listed species, including salmon, steelhead, green sturgeon, and eulachon, or cause adverse modifications to their critical habitats, because the Corps will follow Reasonable and Prudent Measures (RPMs) for timing of work, water quality sampling and monitoring, and operational constraints. The USFWS concurred with the Corps' determination that the action would have no effect on the following listed species: western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, water howellia, and yellow-billed cuckoo and "may affect, but is not likely to adversely affect" bull trout, marbled murrelet, and Columbian white-tailed deer (Service reference# 13420-2010-I-0165). In 2014, the USFWS issued a BiOp stating that the program may affect and is likely to adversely affect streaked horned lark, but because the Proposed Action maintains breeding habitat and minimizes adverse effects, the action would not jeopardize the continued existence of streaked horned lark or cause adverse modification of critical habitat. The Corps will follow all of the RPMs and Conservation Measures outlined in the current BiOp.

B. Describe the existing navigation, fishing and recreational use of the waterbody or wetland.

Navigation: In support of the regional and national economy, the Corps maintains the Columbia River FNC to provide reliable navigation. The Columbia River is the gateway for global imports and exports from the Columbia-Snake River navigation system. The Columbia River is the primary gateway on the West Coast for the export of wheat, wood products, and bulk minerals. In 2018, the deep-draft navigation channel supported an annual $23 billion import/export industry, transporting approximately 56 million tons of goods. More than 12,000 commercial vessels and 100,000 recreational/charter vessels navigate through the deep-draft navigation channel each year. According to the Pacific Northwest Waterways Association, more than 40,000 jobs along the lower Columbia River are directly dependent on seaport activity.

Fishing: Columbia River support treaty, non-treaty commercial, and recreational fisheries. These fisheries are highly regulated by state, federal, and tribal entities. A wide range of fish and aquatic species are harvested from the Columbia River. There are 13 ESA-listed Evolutionary Significant Unit (ESU) salmon that migrate into the Columbia River system. Additionally, five other ESA-listed fish species use the Columbia River system in some capacity. Overall, there are over 120 species of fish and aquatic species that are harvested from this region. The Columbia River supports a $410 million dollar fishery industry (salmon, crab, groundfish, etc.). (USFWS, 2006) (http://www.fws.gov/gorgefish/carson/reports/MA%20Fact%20Sheet%203_3_06.pdf)

Recreation: The Columbia River is unparalleled in terms of access to recreational activities. Recreational use of the Columbia River occurs year-round; river-based tourism and recreational activities are the driving economic force for a lot of the towns situated along the Columbia River. Fishing, hunting, swimming, water sports, and sightseeing are among the most popular activities to engage in with the Columbia River. Many attempts have been undertaken by various agencies to quantify the recreational opportunity spectrum for the Columbia River. Given the wide range of recreational opportunities and large geographic range the Columbia River encompasses, it is difficult to fully encapsulate the extrinsic and intrinsic value of recreation for this region.

(7) PROJECT SPECIFIC CRITERIA AND ALTERNATIVES ANALYSIS

Describe project-specific criteria necessary to achieve the project purpose. Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterbody or wetland.*

Dredging and dredged material placement locations have not changed since the most recent WQC, as amended. Alternative dredged material placement sites associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance were described in the Final EIS and 2003 Supplemental EIS.

The project will follow all Portland Sediment Evaluation Team (PSET) recommendations for each dredging event and comply with the Sediment Evaluation Framework for the Pacific Northwest (SEF) (May 2018).

(8) ADDITIONAL INFORMATION

Are there state or federally listed species on the project site?	**Yes**	**No**	**Unknown**
Is the project site within designated or proposed critical habitat?	**Yes**	**No**	**Unknown**
Is the project site within a national Wild and Scenic River ?	**Yes**	**No**	**Unknown**
Is the project site within a State Scenic Waterway?	**Yes**	**No**	**Unknown**
Is the project site within the 100-year floodplain?	**Yes**	**No**	**Unknown**

If yes to any above, explain in Block 6 and describe measures to minimize adverse effects to those resources in Block 7.

Is the project site within the Territorial Sea Plan (TSP) Area?	**Yes**	**No**	**Unknown**

If yes, attach TSP review as a separate document for DSL.

Is the project site within a designated Marine Reserve?	**Yes**	**No**	**Unknown**

If yes, certain additional DSL restrictions will apply.

Will the overall project involve ground disturbance of one acre or more? **If yes, you may need a 1200-C permit from the Oregon Department of Environmental Quality (DEQ).**	**Yes**	**No**	**Unknown**
Is the fill or dredged material a carrier of contaminants from on-site or off-site spills?	**Yes**	**No**	**Unknown**
Has the fill or dredged material been physically and/or chemically tested? **If yes, explain in Block 6 and provide references to any physical/chemical testing report(s).**	**Yes**	**No**	**Unknown**
Has a cultural resource (archaeological and/or built environment) survey been performed on the project area?	**Yes**	**No**	**Unknown**
Do you have any additional archaeological or built environment documentation, or correspondence from tribes or the State Historic Preservation Office? **If yes, provide a copy of the survey and/or documentation of correspondence with this application to the Corps only. Do not describe any resources in this document. Do not provide the survey or documentation to DSL.**	**Yes**	**No**	**Unknown**

* Not required by the Corps for a complete application, but is necessary for individual permits before a permit decision can be rendered.

Is the project part of a DEQ Cleanup Site? No☐ Yes☐ Permit number _____

DEQ contact._

Will the project result in new impervious surfaces or the redevelopment of existing surfaces? Yes ☐ No ☐

If yes, the applicant must submit a post-construction stormwater management plan as part of this application to DEQ's 401 WQC program for review and approval, see https://www.oregon.gov/deq/FilterDocs/401wqcertPostCon.pdf

Identify any other federal agency that is funding, authorizing or implementing the project.

Agency Name	Contact Name	Phone Number	Most Recent Date of Contact

List other certificates or approvals/denials required or received from other federal, state or local agencies for work described in this application.

Agency	Certificate / approval / denial description	Date Applied
Department of Land Conservation and Development	Consistency Determination Concurrence previously received for ongoing actions, varies by FNC	
National Marine Fisheries Service	Existing Biological Opinions 2012 and 2021	

Other DSL and/or Corps Actions Associated with this Site (Check all that apply.)

☐ Work proposed on or over lands owned by or leased from the Corps (may require authorization pursuant to 33 USC 408). These could include the federal navigation channel, structures, levees, real estate, dikes, dams, and other Corps projects.

State owned waterway — DSL Waterway Lease #:

Other Corps or DSL Permits — Corps # — DSL #

☐ Violation for Unauthorized Activity — Corps # — DSL #

Wetland and Waters Delineation — Corps # — DSL #

Submit the entire delineation report to the Corps; submit only the concurrence letter (if complete) and approved maps to DSL. If not previously submitted to DSL, send under a separate cover letter

(9) IMPACTS, RESTORATION/REHABILITATION, AND COMPENSATORY MITIGATION

A. Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct, and indirect impacts.

Placement of dredge materials will be localized and minor with respect to the hydraulics and sediment transport conditions of the Columbia River. Therefore, changes to erosion and deposition is not expected. The project may result in temporary and localized reduction in water quality during the course of dredging and in-water placement, which would suspend sediments in the water column. These impacts would cease after O&M operations are complete.

The Corps will continue to follow the same monitoring, reporting and other BMPs as required by WQC No. NWPOP-CLA-F05-001-FR to ensure that direct and indirect impacts are less than significant. Sediments from the placement areas and from areas adjacent to the dredge footprint will be redistributed to downstream areas by natural hydraulic processes after dredging events are completed. The project will follow all Portland Sediment Evaluation Team (PSET) recommendations for each dredging event and comply with the Sediment Evaluation Framework for the Pacific Northwest (SEF) (May 2018).

Dredging in the FNC between RM 3 and 106.5 may occur at any time of year, although most dredging occurs between 1 June and 15 December. Maintenance dredging of the FNC between RM 106.5 and 145 will occur 1 August through 30 September. Side channel dredging will occur 1 August through 15 December. These work windows are in accordance with the most current 2012 and 2021 Biological Opinions from National Marine Fisheries Service (NMFS). O&M activities may have adverse and beneficial effects on ESA-listed species and their habitats. Few individual fish that encounter the dredging operations will alter their pathway or delay their rate of migration. Juvenile salmonids will largely avoid the dredging and adult fish are intent on moving upstream. Therefore, the project will not significantly change the overall distribution of fish or risk of predation. Salmonid smolts within a couple feet of a hydraulic cutterhead could become entrained, but most would be able to avoid the entrainment. Subyearling salmonids are less able to escape entrainment and are subject to a wider zone of potential entrainment due to less swimming stamina and speed. The number of subyearling salmonids that will be killed from entrainment cannot be quantified, but the numbers are expected to be low based on BMPs that reduce the chance of fish migrating through the project area during the in-water work window. For all designated salmonid and steel head critical habitats, the project would cause temporary disturbance to the migratory corridor, degradation of water clarity as fine

sediments and organic matter are resuspended, and a temporary reduction in quantity of food organisms and benthic productivity. Therefore, effects on critical habitat will be temporary, low magnitude, and not significantly alter critical habitat within the project area.

A wildlife/wetland mitigation plan for offsetting anticipated impacts to agricultural, wetland, and riparian environments associated with the implementation of the Columbia River Channel Improvement Plan (CRCIP) and subsequent operations and maintenance was described in the Final EIS and 2003 Supplemental EIS. The final mitigation plan numbers were reported in the 2008 Columbia River Channel Improvement Project Supplemental Evaluation. The ongoing operations and maintenance of the Columbia River and side channels, including placement actions, will not result in any additional impacts outside the scope of what has already been mitigated. Thus, no further mitigation is proposed.

B. For temporary removal or fill or disturbance of vegetation in waterbodies, wetlands or riparian (i.e., streamside) areas, discuss how the site will be restored after construction to include the timeline for restoration.

Upland placement sites are typically prepped for placement of dredged material by removing shrubby vegetation and grading the site to accommodate weir placements and/or settling ponds. Once the dredged materials have been placed, the area is graded to an appropriate slope for beach nourishment operations and leveled for upland placement. Placement of dredged material on estuary islands may be contoured to reduce line-of-sight from land to water which may be effective in precluding double-crested cormorants or Caspian terns from nesting. The material being placed is xeric in nature and does not lend itself to support re-vegetation efforts. Equipment and construction debris will be removed prior to vacating the placement site.

Compensatory Mitigation

C. Proposed mitigation approach. Check all that apply:

Permittee responsible Onsite Mitigation	Permittee responsible Offsite Mitigation	Mitigation Bank In-Lieu Fee Program	Payment In-Lieu (Not approved for use with Corps permits)
☐	☐	☐	☐

D. Provide a brief description of proposed mitigation approach and the rationale for choosing that approach. If you believe mitigation should not be required, explain why.

N/A

Mitigation Bank / In-Lieu Fee Information:

Name of mitigation bank or in-lieu fee project:

Type and amount of credits to be purchased: N/A

If you are proposing permittee-responsible mitigation, have you prepared a compensatory mitigation plan?

☐ Yes. Submit the plan with this application and complete the remainder of this section.

☐ No. A mitigation plan will need to be submitted (for DSL, this plan is required for a complete application).

Mitigation Location Information (Fill out only if permittee-responsible mitigation is proposed)

Mitigation Site Name/Legal Description	Mitigation Site Address	Tax Lot #
County	**City**	**Latitude & Longitude (in DD.DDDD format)**

Township	Range	Section	Quarter/Quarter

(10) ADJACENT PROPERTY OWNERS FOR PROJECT AND MITIGATION SITE		
☐ **Pre-printed mailing labels of adjacent property owners attached separately (if more than 30).**	**Project Site Adjacent Property Owners**	**Mitigation Site Adjacent Property Owners**
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**		
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**		
Contact Name **Address 1** **Address 2** **City, ST ZIP Code**		

(11) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT (TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)

I have reviewed the project described in this application and have determined that:

- ☐ This project is not regulated by the comprehensive plan and land use regulations
- ☐ This project is consistent with the comprehensive plan and land use regulations
- ☐ This project is consistent with the comprehensive plan and land use regulations with the following:
  - ☐ Conditional Use Approval
  - ☐ Development Permit
  - ☐ Other Permit (explain in comment section below)
- ☐ This project is not currently consistent with the comprehensive plan and land use regulations. To be consistent requires:
  - ☐ Plan Amendment
  - ☐ Zone Change
  - ☐ Other Approval or Review (explain in comment section below)

An application or variance request has ☐ has not ☐ been filed for the approvals required above.

Local planning official name (print)	Title	City / County

Signature	Date

Comments:

(12) COASTAL ZONE CERTIFICATION

If the proposed activity described in your permit application is within the Oregon Coastal Zone, the following certification is required before your application can be processed. The signed statement will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program and consistency reviews of federally permitted projects, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050 or click here.

CERTIFICATION STATEMENT

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Print /Type Applicant Name	Title

Applicant Signature	Date

(13) SIGNATURES

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or DSL staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish supplemental information in support of this permit application. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that payment of the required state processing fee does not guarantee permit issuance.

To be considered complete, the fee must accompany the application to DSL. The fee is not required for submittal of an application to the Corps.

Fee Amount Enclosed	$

Applicant Signature (required) must match the name in Block 2	
Print Name Amy Gibbons	Title Chief, Environmental Resources Branch
Signature GIBBONS.AMY.COLLEEN.1381427567 Digitally signed by GIBBONS.AMY.COLLEEN.1381427567 Date: 2023.07.28 12:11:41 -07'00'	Date 28 July 2023
Authorized Agent Signature	
Print Name Darren Bradford	Title Natural Resource Specialist
Signature BRADFORD.DARREN.LEE.1618666871 Digitally signed by BRADFORD.DARREN.LEE.1618666871 Date: 2023.07.28 11:48:35 -07'00'	Date 20 July 2023

Landowner Signature(s)*	
Landowner of the Project Site (if different from applicant)	
Print Name	Title
Signature	Date
Landowner of the Mitigation Site (if different from applicant)	
Print Name	Title
Signature	Date

Department of State Lands, Property Manager (to be completed by DSL)

If the project is located on state-owned submerged and submersible lands, DSL staff will obtain a signature from the Land Management Division of DSL. A signature by DSL for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for a removal-fill permit. A signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied and a separate proprietary authorization may be required.

Print Name	Title
Signature	Date

* Not required by the Corps.

(14) ATTACHMENTS

- ☐ Drawings
  - ☐ Location map with roads identified
  - ☐ U.S.G.S topographic map
  - ☐ Tax lot map
  - ☐ Site plan(s)
  - ☐ Plan view and cross section drawing(s)
  - ☐ Recent aerial photo
  - ☐ Project photos
  - ☐ Erosion and Pollution Control Plan(s), if applicable
  - ☐ DSL / Corps Wetland Concurrence letter and map, if approved and applicable
- ☐ Pre-printed labels for adjacent property owners (Required if more than 30)
- ☐ Incumbency Certificate if applicant is a partnership or corporation
- ☐ Restoration plan or rehabilitation plan for temporary impacts
- ☐ Mitigation plan
- ☐ Wetland functional assessments, if applicable
  - ☐ Cover Page
  - ☐ Score Sheets
  - ☐ ORWAP OR, F, T, & S forms
  - ☐ ORWAP Reports
  - ☐ Assessment Maps
  - ☐ ORWAP Reports: Soils, Topo, Assessment area, Contributing area
- ☐ Stream Functional Assessments, if applicable
  - ☐ Cover Page
  - ☐ Score Sheets
  - ☐ SFAM PA, PAA, & EAA forms
  - ☐ SFAM Report
  - ☐ Assessment Maps
    - ☐ Aerial Photo Site Map and Topo Site Map (Both maps should document the PA, PAA, & EAA)
- ☐ Compensatory Mitigation (CM) Eligibility & Accounting Worksheet
  - ☐ Matching Quickguide sheet(s)
  - ☐ CM Eligibility & Accounting sheet
- ☐ Alternatives analysis
- ☐ Biological assessment (if requested by the Corps project manager during pre-application coordination)
- ☐ Stormwater management plan (may be required by the Corps or DEQ)
- ☐ Other
  - ☐ Please describe:

For U.S. Army Corps of Engineers send application to:

USACE Portland District
ATTN: CENWP-ODG-P
PO Box 2946
Portland, OR 97208-2946
Phone: 503-808-4373
portlandpermits@usace.army.mil

Counties:
Baker, Benton, Clackamas, Clatsop, Columbia, Gilliam, Grant, Hood River, Jefferson, Lincoln, Linn, Malheur, Marion, Morrow, Multnomah, Polk, Sherman, Tillamook, Umatilla, Union, Wallowa, Wasco, Washington, Wheeler, Yamhill

U.S. Army Corps of Engineers
ATTN: CENWP-ODG-E
211 E. 7th AVE, Suite 105
Eugene, OR 97401-2722
Phone: 541-465-6868
portlandpermits@usace.army.mil

Counties:
Coos, Crook, Curry, Deschutes, Douglas, Jackson, Josephine, Harney, Klamath, Lake, Lane

For Department of State Lands send application to:

West of the Cascades:
Department of State Lands
775 Summer Street NE, Ste 100
Salem, OR 97301-1279
Phone: 503-986-5200
https://www.oregon.gov/dsl/WW/Documents/uploadinstructions_removalfill.pdf

East of the Cascades:
Department of State Lands
951 SW Simpson Ave, Ste 104
Bend, OR 97702
Phone: 541-388-6112
https://www.oregon.gov/dsl/WW/Documents/uploadinstructions_removalfill.pdf

For Department of Environmental Quality:

Submit all application materials electronically through *Your DEQ Online*.

For questions related to *Your DEQ Online*, please visit the *Your DEQ Online* help page, email YourDEQOnline@deq.state.or.us, or call 503-229-6184

INSTRUCTIONS FOR PREPARING THE JOINT APPLICATION

This is a joint application and must be sent to all agencies (Corps, DSL, and DEQ), who administer separate permit or certification processes. For questions regarding these instructions or the form, contact the Corps, DSL and/or DEQ or refer to the following online resources:

- DSL's Removal-Fill Guide; or,
- The Corps Regulatory website: http://www.nwp.usace.army.mil/Missions/Regulatory.aspx
- DEQ's 401 Water Quality Certification website: https://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401-Certification.aspx

General Instructions and Tips

- Provide the information in the appropriate blocks of the application form. If you need more space, provide a summary in the space provided and attach additional detail as an appendix to the application. Each appendix or attachment must reference which application block number it pertains to.
- Not all items on the application form will apply to all projects.
- Electronic submittal of applications and supporting material is preferred by the Corps. Both electronic and hard copies must be in 8 ½ x 11-inch sized format and reproducible in black and white. Currently DSL does not accept electronic submittals. DSL will accept color figures and 11 X 17. Use either all double sided or all single sided paper. Do not use staples or dividers. NOTE: If the electronic submittal of application and associated documents is 10 megabytes or more, check with each agency for how best to submit the document to that agency.
- **FEES:** Fees for water quality certification apply. Nationwide projects approved by DEQ will incur a fee of $985. Others will be evaluated on a case-by-case basis: https://www.oregon.gov/deq/wq/wqpermits/Pages/Section-401-Fees.aspx.

For complex projects or for those that may have more than minimal impacts, additional information may be necessary to complete the evaluation and make a permit decision. Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Section 1. Type of Permit(s) if Known

If known, indicate the type of permit/authorization applying for.

Section 2. Applicant and Landowner Contact Information

Applicant: The applicant is the responsible party. If the applicant is an agency, business entity or other organization, indicate the name of the organization and a person that has the authority to sign the application. If applicant is a partnership or corporation, the applicant name must match the Incumbency Certificate, and the business name as listed on OR Secretary of State business registry. Applicant must not be "doing business as" or has an "assumed business name." In such cases the applicant must be an individual.

Applicant Contact Name: If the applicant is a business, provide the contact name for an individual representing the business.

Authorized Agent: An authorized agent is someone who has permission from the applicant to represent their interests and supply information to the agencies. An agent can be a consultant, an attorney, builder, contractor, or any other person or organization. An authorized agent is optional.

Landowner: Provide landowner information if different from the applicant. DSL requires the landowner's signature, unless the project qualifies as a linear project, e.g. road, pipeline, utility.

Section 3. Project Information

A. Provide location information. Latitude and longitude must be reported in decimal format and can be found by zooming in to your respective project location and reading off the coordinates displayed on the bottom many maps, such as Google Earth.

B. Provide information on wetlands and waterbodies within the project area. Indicate the category of activities that make up your project. For projects with multiple locations, provide latitude and longitude for each location. For linear projects, provide the latitude and longitude for the start and end points.

Section 4. Project Description

A. Overall Description: Provide a description of the overall project, including:

- All associated work with the project both outside and within waters or wetlands.
- Total ground disturbance for all associated work (i.e., area and volume of ground disturbance).
- Total area of impervious surfaces created or modified by the project, if applicable.

B. Work within Waters and Wetlands: Provide a description of the proposed work within waters and wetlands, including:

- Each removal or fill activity proposed in waters or wetlands, as well as any construction or maintenance of in-water or over-water structures.
- The number and dimensions of in-water or over-water structures (i.e., pilings, floating docks) proposed within waters or wetlands.

C. Construction Methods: Describe how the removal and/or fill activities will be accomplished, including the following:

- Construction methods, equipment to be used, access and staging areas, etc.
- Measures you will use during construction to minimize impacts to the waterbody or wetland. Examples may include isolating work areas, controlling construction access, site specific erosion and sediment control methods, site specific best management practices, and using specialized equipment or materials. Attach work area isolation and/or erosion and pollution control plans, if applicable.

D. Fill Material and Disposal: Provide a description of fill material and procedure for disposal of removed material, including:

- The source(s) of fill materials (if known).
- Locations for disposal area(s) for dredged material, if applicable. If dredged material is to be discharged on an upland site, identify the site and the steps to be taken (if necessary) to prevent runoff from the dredged material back into jurisdictional waters. If using an upland disposal area that is not a Department of Environmental Quality (DEQ)-regulated landfill, a Solid Waste Letter of Authorization or a Beneficial Use Determination from DEQ may be required.

E. Construction Timing: Provide the proposed start and completion dates for the project. Describe project work that is already complete, if applicable.

F. – I. Summary of Removal and Fill Activities: Summarize the dimensions, volume and type/composition of material being placed or removed in each waterbody or wetland. Describe each impact on a separate row. For instance, if two culverts are being removed from Clear Creek, use two rows. Add extra rows if needed or include an attachment.

The DSL and the Corps use different elevations for determining whether an activity in tidal waters is regulated by the State's Removal-Fill law, the Clean Water Act, and/or the Rivers and Harbors Act. DSL regulates activities below the highest measured tide. The Clean Water Act applies below the high tide line. The Rivers and Harbors Act applies below the mean high water.

If jurisdictional limits are not the same for each agency, prepare a table for each agency stating impacts within that agency's jurisdiction.

Section 5. Project Purpose and Need
Explain the purpose and need for the project. Also include a brief description of any related activities needed to accomplish the project objectives.

The following items are required by DSL, as applicable:
- If the removal-fill would satisfy a public need and the applicant is a public body, include any pertinent findings regarding public need and benefit.
- If the project involves fill in the estuary for a non-water dependent use, explain how the project is for public use and/or satisfies a public need.
- If the project is located within a marine reserve or marine protected area, explain how the project is needed to study, monitor, evaluate, enforce or protect the designated area.

Section 6. Description of Resources in Project Area
Territorial Sea: For activities in the Territorial Sea (mean lower low water seaward 3 nautical miles), provide a separate evaluation of the resources and effects determination.

For each wetland, include:
- Whether the wetland is freshwater or tidal, and the Cowardin class and Hydrogeomorphic (HGM) class.
- Source of hydrology and direction of flow (if any).
- Dominant plant species by layer (herb, shrub, tree).
- Assessment of the hydrologic, water quality, fish habitat, aquatic habitat, and ecosystem support functions and values of the wetland(s) to be permanently impacted. The assessment should be attached as a separate Excel document.
    - DSL requires the use of ORWAP for wetland impacts over 0.2 acre and any wetland that is an Aquatic Resource of Special Concern (ARSC), unless the impacts are to Agate Desert Vernal Pools (VPs). See Appendix B of the Removal Fill Guide for a list of ARSCs. The Vernal Pool Assessment Method is required for all VPs. For impacts to wetlands less than 0.2 acre that are not ARSCs or VPs Best Professional Judgment (BPJ) may be used.
- Identify any Aquatic Resources of Special Concern (ARSC) in or near the project area. ARSCs include alkali wetlands, bogs, cold water habitat, fens, hot springs, interdunal wetlands, kelp beds, mature forested wetlands, native eelgrass beds, off-channel habitats (alcoves and side channels), ultramafic soil wetlands, vernal pools (including Willamette Valley, Medford area, Modoc basalt, and Columbia Plateau vernal pools), wet prairies, or wooded tidal wetlands. See Appendix B of the Removal Fill Guide for a list of ARSCs.
- Include relevant summary information from the wetland delineation report if available. Provide a copy of the wetland delineation report to **the Corps,** if not previously provided to the Corps. If a delineation report has not been previously submitted to DSL, then submit to DSL under a separate cover.
- Describe existing uses, including fish and wildlife use (type, abundance, period of use, and significance of site).
- Next major downstream waterbody name.

For rivers, streams, other waterbodies, lakes and ponds, include a description of, as applicable:
- Streamflow regime (e.g., perennial year-round flow, intermittent seasonal flow, ephemeral event-driven flow). If flow is ephemeral, provide streamflow assessment data sheet or other information that supports your determination.
- Field indicators used to identify the Ordinary High Water Mark (OHWM).
- Channel and bank conditions.

- Type and condition of riparian (streamside) vegetation.
- Channel morphology (structure and shape).
- Stream substrate.
- Assessment of the hydrologic, geomorphic, biologic and water quality functions and values of waters to be permanently impacted.
    - DSL requires use of the Stream Function Assessment Methodology (SFAM) for wadable non-tidal streams. SFAM should be attached as a separate Excel document. For impacts to non-wadable or tidal streams, BPJ can be used. Sections 2.2 through 2.3 of the SFAM User Manual give guidance for the functions and values to be addressed for all streams, even if SFAM does not apply.
- Identify any Aquatic Resources of Special Concern (ARSC) in or near the project area. ARSCs include alkali wetlands, bogs, cold water habitat, fens, hot springs, interdunal wetlands, kelp beds, mature forested wetlands, native eelgrass beds, off-channel habitats (alcoves and side channels), ultramafic soil wetlands, vernal pools (including Willamette Valley, Medford area, Modoc basalt, and Columbia Plateau vernal pools), wet prairies, or wooded tidal wetlands.
- Fish and wildlife use (type, abundance, period of use, and significance of site).
- Water quality impairments, including waterways adjacent to impacted wetlands and waterway to be impacted and next major downstream waterbody

Section 7. Project Specific Criteria and Alternatives Analysis
Provide an explanation describing how impacts to waters and wetlands are being avoided and minimized on the project site. For DSL, the alternatives analysis must include:
- Project-specific criteria that are needed to accomplish the stated project purpose.
- A range of alternative sites and designs that were considered with less impact.
- An evaluation of each alternative site and design against the project criteria and a reason for why the alternative was not chosen.
- If the project involves fill in an estuary for a non-water dependent use, a description of alternative non-estuarine sites must be included.

The level of rigor required in this analysis should be commensurate with the level of impact proposed. Please note that additional information regarding alternatives may be necessary for Corps Individual Permits to comply with the Clean Water Act Section 404(b)(1) Guidelines. Please check with your local Corps contact early in the planning process to determine what level of analysis is required. An alternative analysis is not required for a complete application by the Corps; however, it may be required before a permit decision can be rendered.

Section 8. Additional Information
Any additional information you provide helps the reviewer(s) understand your project and the other approvals or reviews that may be required.

Section 9. Impacts, Restoration/Rehabilitation, and Compensatory Mitigation
A. Description of Impacts: Clearly identify the permanent, temporary, direct and indirect impacts. Provide a written analysis of potential changes the project may make to the hydrologic characteristics of the affected wetlands or waterbodies, and an explanation of measures taken to avoid or minimize any adverse effects of those changes, such as: impeding, restricting or increasing flows; relocating or redirecting flow; and potential flooding or erosion downstream of the project. Provide a table summarizing permanent and temporary impacts by HGM and Cowardin Classifications.

B. Site Restoration/Rehabilitation: For temporary disturbance of soils and/or vegetation in waterbodies, wetlands or riparian (streamside) areas, discuss how you will restore the site after construction. This may include the following:

- ☐ Grading plans to restore pre-existing elevations.
- ☐ Planting plans and species list (native species only) to replace vegetation in riparian or wetland areas.
- ☐ Maintenance and monitoring plans to document restoration to wetland condition and/or vegetation establishment.
- ☐ Associated erosion control for site stabilization.

C.-D. Compensatory Mitigation. Describe your proposed compensatory mitigation approach or explain why you believe compensatory mitigation is not required. If proposing permittee-responsible mitigation for permanent impacts to jurisdictional waters, see OAR 141-085-0705 and 33 CFR 332.4(c) for plan requirements. The Oregon Explorer Aquatic Mitigation topic page and map viewers may be a helpful resource.

For activities involving discharges of dredged or fill material into waters of the United States, the Corps requires the application to include a statement describing how impacts to waters of the United States are to be avoided and minimized. The application must also include either a statement describing how impacts to waters of the United States are to be compensated for or a statement explaining why compensatory mitigation should not be required for the proposed impacts.

Section 10. Adjacent Property Owners for Project and Mitigation Site(s)
Names and addresses for properties that are adjacent to the project site and permittee responsible mitigation site (if applicable), are required. "Adjacent" means those properties that share or touch upon a common property line or are across the street or stream. If more than 30, attach pre-printed labels. A list of property owners may be obtained by contacting the county tax assessor's office.

Section 11. City/County Planning Department Land Use Affidavit
This section is required to demonstrate land use compatibility for removal fill permits and water quality certifications. Provide this form to your local planning official for them to complete and sign.

Section 12. Coastal Zone Certification
Your signature for this statement is **required** for projects within the coastal zone (generally, west of the summit of the Coast Range).

Section 13. Signatures
The application **must** be signed by the responsible party as identified in section 1. DSL also requires the landowner's signature. Linear Facilities (e.g. road, pipeline, utility) do not require landowner signature for the impact sites; signatures are required for mitigation sites.

Section 14: Attachments
Project Drawings. A complete application must include a location map, site plan, and plan view and cross-section drawings. DSL also requires a recent aerial photo. All drawings should be clear, legible, and to scale. For the Corps, drawings must be on 8.5 x 11-inch paper and must be in black and white or clearly reproducible in black and white. DSL will accept color and 11 x 17, but all figures must be clear when reproduced in black and white. While illustrations need not be professionally prepared, they should be clear, accurate, and contain all necessary information, as follows:

Location maps (with project boundaries, including staging and construction access, scale bar and north arrow on all):
- ☐ Location map with roads identified
- ☐ U.S.G.S. Topographic map
- ☐ Tax lot map

Site plan(s), including:
- ☐ Entire project site and activity areas, which includes staging and construction access areas
- ☐ Existing and proposed contours
- ☐ Stormwater outfalls and other related features
- ☐ Location of Ordinary High Water Mark, wetland boundaries, and other jurisdictional boundaries. Clearly identify temporary, permanent, direct and indirect impact areas within waterbodies and wetlands
- ☐ Scale bar, legend, and north arrow
- ☐ Location of staging areas and construction access
- ☐ Location of cross section(s), as applicable
- ☐ Location of mitigation area, if applicable

Cross section drawing(s), including:
- ☐ Existing and proposed elevations
- ☐ Clearly identify temporary, permanent, direct and indirect impact areas within waterbodies and wetlands
- ☐ Ordinary High Water Mark, wetland boundaries, and other jurisdictional boundaries
- ☐ Scale bar (horizontal and vertical scale)

Recent Aerial Photo
- ☐ 1:200 resolution, or, if not available for your site, highest resolution possible

DSL Wetland Concurrence (map and letter only for DSL; the Corps requires the full wetland/waters delineation report if not already submitted)

Mitigation documents including:
- ☐ Functional assessment results for each impacted resource and mitigation area
  - Results should include: Cover sheet, Score Sheet, assessment area maps
- ☐ Eligibility and Accounting Worksheet
  - Matching "Quickguide" sheet(s)
  - Compensatory Mitigation (CM) Eligibility & Accounting sheet

Do NOT submit the following items to DSL (unless specifically requested by DSL for your project):
- ☐ Wetland delineation report
- ☐ Biological assessment
- ☐ Cultural/archeological reports
- ☐ Stormwater calculations
- ☐ Geotechnical reports
- ☐ Marketing reports
- ☐ Contract agreements
- ☐ Applications for other agencies such as local land use applications
- ☐ Contractor/construction specifications
- ☐ Other extraneous drawings and information

Columbia River Navigation Channel O&M_Project Location Information (Upland and Shoreline Placement Sites)

Site Name	RM	Placement Type	Property Owner	City (Nearest)	County	Latitude, Longitude	Township	Range	Section	Tax Lot	Adjacent Landowners	HUC
Rice Island	W-21.0-UP	Upland & Shoreline	ODSL and WDNR (state line thru site)	Astoria	Clatsop	46.251159, -123.704421	9N	8W	20	908000000200	Island surrounded by water	170800060500
Miller Sands Island	O-23.5-BN	Shoreline	ODSL	Astoria	Clatsop	46.245104, -123.653279	9N	8W	21, 22, 27		Island	170800060500
Pillar Rock Island	O-27.2-UP	Upland & Shoreline	ODSL	Brownsmead	Clatsop	46.251044, -123.584509	9N	7W	19, 20	907000000600	Island	170800060500
Welch Island	O-34.0-UP	Upland	ODSL	Westport	Clatsop	46.253755, -123.466113	9N	6W	18, 19, 20	906000000300	USA Int: PO Box 3737, Portland, OR 97208-3737	170800030900
Tenasillahe Island	O-38.3-UP	Upland	ODSL	Clifton	Clatsop	46.20786, -123.433726	8N	6W	4	806000003800		170800030802
James River	O-42.9-UP	Upland	Georgia Pacific Consumer Products	Westport	Clatsop	46.145078, -123.390561	8N	6W	26	806260000100		170800030802
Crims Island	O-57.0-UP	Upland	ODSL	Mayger	Columbia	46.175631, -123.122564	8N	4W	13, 14, 15	8413-00-00100	USFWS: 911 11th Ave. NE Portland, OR 97231	170800030900
Lord Island	O-63.5-UP	Upland	ODSL	Rainier	Columbia	46.132253, -123.020727	8N	3W	34, 35, 36	8300-00-00300	Columbia County: 230 Strand St, St Helens, OR 97051	170800030900
Dibblee Point	O-64.8-UP	Upland	ODSL	Rainier	Columbia	46.119306, -123.005135	7N	3W	1	7301-00-00100, 7207-00-00100	Columbia County: 230 Strand St, St Helens, OR 97051 U.S. Gypsum: P.O. BOX 6721, DEPT 179 CHICAGO, IL 60680	170800030404
Crims Island	O-75.8-UP	Upland	ODSL	Kalama	Columbia	46.008238, -122.862907	6N	1W	19	6118-00-00101	Columbia Tidelands LLC: 1151 Fairview Ave N, Ste 101, Seattle, WA	170800030900
Lower Deer Island	O-77.0-UP	Upland	ODSL	Deer Island	Columbia	45.984463, -122.848044	6N	1W	19	6119-00-00200	Columbia Land Trust: 850 Officers' Row, Vancouver, WA Sarbanand Enterprisces LLC: 2619 Road 192, Delano, CA 93215	170800030401
Sand Island	O-86.2-BN	Shoreline	ODSL	St. Helens	Columbia	45.556830, -122.200217	5N	1W	34	5134-00-00300	City of St Helens: 265 Strand St., St. Helens, OR 97051	170800010804
West Hayden Island	O-105.0-UP	Upland	Port of Portland	Portland	Multnomah	45.625177, -122.703871	2N	1E	33	R323351	Portland General Electric Company	170800030200

Dredging BMPs

Measure	Justification	Duration	Ongoing Management
Hopper and Pipeline Dredging			
Drag or cutterheads will be buried in the substrate and will not exceed an elevation of 3 feet off the bottom for when cleaning the hopper or reverse purging dragheads or clearing pipeline. If water is pumped through dragheads to clean the hopper or cutterhead to clear the pipeline, dragheads or cutterhead will be 20 ft below the surface while dredging between RM 3 and RM 106.5 and 9 ft below the surface between RM 106.5 and RM 145 and in shallow-draft side channels.	To minimize potential entrainment of juvenile salmonids	Continuous throughout dredging operations	Maintain unless new information warrants change(s)
All Dredging			
Contractor(s) shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into waterways	Protection of aquatic resources	Life of contract or action	Any unintentional in-water release will be immediately reported to the National Spill Response Center, U.S. Coast Guard, and other federal and state agencies for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the National Spill Response Center, U.S. Coast Guard, and other federal and state agencies for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

Dredged Material Placement BMPs

Measure	Justification	Duration	Ongoing Management
In-Water Placement			
Spread out dredged material to prevent mounding	Reduces depth of material to minimize effects to fish and invertebrates	Life of contract or action	Maintain unless new information warrants change(s)
Maintain discharge pipe of pipeline dredge at or below 20 ft depth during placement	Reduce impact of placement, suspended sediment, and turbidity to migrating juvenile salmonids	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Shoreline Placement			
Grade placement site to slope of 10-15%, with no swales, to reduce the possibility of stranding juvenile salmonids	Ungraded slopes can create small pools or flat slopes that can strand juvenile salmon washed ashore by waves	Continuous throughout placement operations	Maintain unless new information warrants change(s)
Upland Placement			
Construct dredge material containment berms with weir systems to maximize the settlement of fine materials in runoff water	Maintain habitat functions/values of aquatic resources	Continuous throughout operations	Maintain unless new information warrants change(s)
Construction access routes and barge ramps will be limited to the smallest footprint practicable to minimize potential discharge into areas waterward of OHW or MHHW.	Minimize potential deleterious effects to water quality and aquatic resources	Life of contract or action	Maintain unless new information warrants change(s)
All Placement			
Contractor(s), where possible, will use or propose for use materials considered environmentally friendly in that waste from such materials is not regulated as hazardous or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Minimize and ensure safe disposal of hazardous waste	Life of contract or action	Any unintentional in-water release will be immediately reported to the National Spill Response Center, U.S. Coast Guard, and other federal and state agencies for appropriate response. If material is released, it shall be immediately cleaned up/removed and the affected area shall be restored to a condition approximating adjacent undisturbed areas. Contaminated soils shall be excavated and removed.

EPA-Region 10 5 July 2017
Office of Environmental Review & Assessment (Sediment Management Unit)

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-OD-NW, Stokke)

Subject: Portland Sediment Evaluation Team (PSET) Level 2 dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging of the Lower Columbia River (LCR) deep-draft Federal Navigation Channel (FNC) in the Columbia River from River Mile (RM) 3 to 106.5 in Oregon and Washington.

Introduction: Per the *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic placement. The PSET reviewed the Corps' 21 April 2017 "Sediment Quality Evaluation Report: Lower Columbia River Federal Navigation Channel (River Miles 3 to 106.5)" (SQER), prepared by Corps' Sediment Quality Team (SQT)[2]. Sediment physical testing results are summarized in the SQER; the analytical results were compared to the physical screening levels published in the 2016 SEF.

Suitability Summary:

Surface Sediments:	☑ Suitable	☐ Unsuitable
Post-Dredge Surface (PDS):	☑ Suitable	☐ Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☑ James Holm (Corps, Lead)	☑ Bridgette Lohrman (EPA, Co-Lead)	
☑ James McMillan (Corps)	☑ Pete Anderson (ODEQ)	☑ Laura Inouye (Ecology)
☑ Tom Hausmann (NMFS)	☐ Jeremy Buck (USFWS)	

Table 1. PSET Review Timeline

Sampling and analysis plan (SAP) received	9 March 2016
SAP consistency determination	9 March 2016[3]
Sampling date(s)	22-31 March 2016
SQER received by PSET	24 April 2017
Suitability determination memorandum issued	5 July 2017
Management area ranking	Very Low (deep-draft federal navigation channel)
Recency of data*	10 years from sampling date (expires March 2026)

* If site conditions or the proposed project change, or if new information related contaminants of concerns are discovered, additional project coordination with PSET may be required to determine the validity of this SDM.

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2016. *Sediment Evaluation Framework for the Pacific Northwest*. Published July 2016, by the U.S. Army Corps of Engineers, Northwestern Division, 172 pp + Appendices.

[2] U.S. Army Corps of Engineers – Portland District. 2017. *Sediment Quality Evaluation Report – Lower Columbia River Federal Navigation Channel (RMs 3 to 106.5)*. Prepared by the Portland District Sediment Quality Team, 21 April 2017. 89 pp.

[3] Portland Sediment Evaluation Team (PSET). 2016. *PSET - SAP Approval for the LCR FNC and RSM Dredging.* Email issued 9 March 2016, by PSET. 2 pp.

Federal Regulatory Authorities:

- ☑ Section 10, Rivers and Harbors Act
- ☑ Section 404, Clean Water Act (CWA)
- ☑ Section 401, CWA
- ☑ Section 7, Endangered Species Act
- ☑ Section 305 of the Magnuson-Stevens Act
- ☑ Fish and Wildlife Coordination Act
- ☑ Section 103, Marine Protection, Research and Sanctuaries Act
- ☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 summarizes the O&M dredging program details for the LCR FNC project. Dredging is needed to provide reliable commercial and recreational navigation.

Table 2. Project Details

Waterbody / river miles (RMs)	Columbia River / +3.0 to +106.5
Dredged volume	~6.7 million cubic yards annually
Deep-draft channel dimensions	600 ft. wide + 100 ft. over-dredge width, 103 miles long
Max. proposed dredging depth	-48 ft. (43 ft. + 5 ft. advanced maintenance depth, MLLW/CRD)
Dredging method	Pipeline, Hopper Dredge
Dredged material transport	Pipeline, Hopper Dredge
Placement locations	Ocean, in-river, shoreline, upland
Dredging dates	Typically April through October

Sampling and Analysis Description: The Corps' sampling and analytical program for the LCR FNC is summarized in Table 3. Dredge prism surface grab (power grab sampler) samples were collected from 22 through 31 March 2016. Sample station locations are shown in Figures 2 through 6 of the SQER.

Table 3. LCR FNC Sampling and Analysis Description

Sampling Description		
Sample collection methods		Power grab sampler
Dredged material management unit (DMMU)		N/A
Averaged DMMU volume (cy)		On average, each sample represents ~114,000 cy
Subsamples (SS)/DMMU		
DP	Depth range (ft. MLLW/CRD)	-22.6 to -74.5
	Composite (Y/N)	N
	SS archive (Y/N) Composite archive (Y/N)	N N
PDS	Not Proposed	--
Sediment Physical and Chemical Analysis (no. analyses/decision unit)		
Decision unit (DMMU ID)		59 discrete stations
Station ID(s)		CR-2 to CR-299
ASTM Dredge Analyses		--
Grain size		1
Bulk Density		1
Total volatile solids		--
Total organic carbon		1
Sulfides		--
Ammonia		--
Metals		--

Semi volatile organic compounds (polynuclear aromatic hydrocarbons, chlorinated hydrocarbons, phthalates, phenols, misc. extractables)	--
Pesticides	--
Polychlorinated biphenyls (Aroclors)	--
Butyltins	--
Total petroleum hydrocarbons	--
Dioxins/furans	--
Biological Testing Description	
Bioassays planned (Y/N)	N

Deviations from the SAP: Five (5) deviations from the PSET-approved SAP occurred.

1. The Corps simplified the sample ID by removing the date of collection from the sample ID and relied on the station ID because each station was discretely analyzed.
2. No fine-grained sediments were visually observed in the FNC grab samples. Therefore, no chemical analyses were necessary.
3. The Corps sampled 59 stations within the LCR FNC, 4 more than proposed in the PSET-approved SAP.
4. To achieve cost efficiencies, the Corps proposed the LCR FNC survey in conjunction with a larger regional sediment management survey. This combined survey effort and unpredictable shoaling resulted in only 44% (26) of samples representing dredge prism material and 56% (33) of the stations were below the advanced maintenance depth of – 48 feet. For 6.7 MCY of dredging, a minimum of 22 stations are needed in very low ranked project (300,000 CY per DMMU) per the 2016 SEF. The 26 samples the Corps collected within the dredge prism meets the sampling density for a very low ranked project.
5. Even though approximately half of the stations were below maintenance depth (-48', AMD included), the majority of dredged material in the FNC consists of coarse-grained bedload material instead of fine-grained suspended sediment load. Bedload material typically form the sand waves that shoal (each typically less than 50,000 CY) within the FNC and trigger localized dredging. Sand waves move downstream as bedload sediment erodes from the upstream face, deposits in the downstream trough and is then buried by additional material eroded from the upstream face. This movement occurs in a layer only a few sand grains thick. Through this mechanism, all the individual grains in a sand wave are exposed to flow, eroded, transported, deposited, buried, and then eventually exposed again as the sand wave migrates downstream. The height of sand waves is dependent on higher river flows (spring freshets) that shapes the bedload material into taller sand waves. The suspended sediment load stays suspended by high flows and does not interact with the bedload materials that form sand waves. Therefore, even the bedload sediments sampled below -48' have the potential to form sandwave shoals that require dredging and are represented of dredged materials in LCR FNC.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. The analytical results from the SQER were compared to the 2016 SEF SLs.

Table 4. LCR FNC Sediment Analytical Summary

Sediment Physical Results	
DMMU ID and Sample ID(s):	59 discrete sampling stations
Sample type (dredge prism, adv. main. depth)	dredge prism + advanced maintenance depth*
Grain size, minimum % gravel and sand / maximum % silt and clay	>97 / 2.6
Bulk density, range (g/cm^3)	1.27 to 2.15
Total organic carbon, range (%)	0.1 to 0.29
* 33 of the 59 stations (56%) were sampled below the maximum depth of -48' due the location of the regional sediment management transects every ~two river miles. This broader survey effort dictated where LCR FNC stations were placed.	

There have been no substantive changes in the complex hydrologic (riverine, tidal) regimes of the lower Columbia River, hydropower operations within the Columbia River Basin, or the LCR federal navigation channel since the completion of the Columbia River Channel Improvement Project that deepened the LCR FNC to -43+5 feet in 2010. The grain size, bulk density, and total organic carbon results from the March 2016 sampling event are representative of the bedload sediments within the LCR FNC regardless of the sampling surface elevation relative to the project depth. The 2016 physical results confirm the LCR FNC sediments are very similar to previous testing results (2008).

Dredge Prism: The LCR deep-draft FNC is assigned a "very low" rank because the project is dominated by coarse sands, low total organic carbon content (<0.5%), and strong river and tidal currents. Per the Section 3.5.3 of the 2016 SEF, chemical testing is not required. Therefore, the LCR deep-draft FNC dredge prism material is suitable for unconfined, aquatic placement per the SEF guidance through March 2026.

Post-Dredge Surface: The dredge prism materials were determined to be suitable and the LCR deep-draft FNC is assigned a "very low" rank. As such, the PSET assumes that the LCR deep-draft FNC post-dredge surface is suitable for unconfined, aquatic exposure per the SEF guidance through March 2026.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET Co-Lead) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Stokke, Jessica B CIV USARMY CENWP (USA)

From: Lohrman, Bridgette <lohrman.bridgette@epa.gov>
Sent: Friday, July 8, 2022 2:28 PM
To: Stokke, Jessica B CIV USARMY CENWP (USA)
Cc: Holm, James A CIV USARMY CENWP (USA); Yballe, Dominic P CIV USARMY CENWP (USA); Pete Anderson; Inouye, Laura (ECY); Jeremy_Buck@fws.gov; Tom Hausmann - NOAA Federal (tom.hausmann@noaa.gov)
Subject: [Non-DoD Source] PSET - LCR FNC Transfer Sites - suitability
Attachments: 20220707 LCR DM Transfer Sites Lvl 1_Plates.pdf

Hello Jessica,

This email correspondence constitutes the Portland Sediment Evaluation Team's (PSET's) determination regarding the June 2022 No Test request for the U.S. Army Corps of Engineers – Portland District (Corps) transfer sites for the Lower Columbia River (LCR) deep-draft federal navigation channel (FNC). The LCR FNC is located in the Columbia River from river mile (RM 3 to 106.5) along the boundary between the states of Oregon and Washington. This determination was made in accordance with the May 2018 Sediment Evaluation Framework for the Pacific Northwest (SEF) and after reviewing the Corps 28 June 2022 "MEMORANDUM FOR THE RECORD – Re: SEF Level 1 No-Test Request for the Lower Columbia River Federal Navigation Project – In-Water Dredged Material Transfer Sites" (Level 1 memo), prepared by the Corps' Sediment Quality Team. The scope of the PSET's sediment evaluation includes placement of previously determined suitable LCR FNC dredged material in the aquatic transfer sites and the subsequent dredging for shoreline or upland placement, including minimal over-dredging of the transfer sites when removing LCR FNC sediments. This email documents the PSET's decision to not require sediment testing per Subpart G of the Clean Water Act section 404(b)(1) guidelines (see 40 CFR 230.60-230.61).

PROJECT DESCRIPTION: The Corps dredges 6 to 8 million cubic yards of sand from the LCR FNC each year. The eight LCR FNC transfer sites are in-water holding areas for temporary storage of suitable dredged materials. The Corps proposes to modify one existing site and add seven new sites. Transfer sites are necessary when shoaling forms beyond the reach of the pipeline DREDGE Oregon that is used to place sediments along shorelines or in upland sites. Dredged materials would typically be placed by a hopper dredge. Transfer sites are located in water deeper than 20 feet and in locations which have been previously used by the Corps for placement of dredged material. The Corps anticipates placing and removing the material into/from these eight sites annually.

SOURCES OF CONTAMINATION: In 2017, the PSET evaluated potential sources of contamination for the LCR FNC sediments and issued a suitability determination memo (SDM) stating the dredged materials are suitable for unconfined aquatic placement without chemical testing. The PSET confirmed a "very low" management area ranking for these sediments.

Once the material is within the transfer sites, the potential for contamination is very low given the 8 sites are subject to high river flows which transport large bed loads of material. Based on the Corps' LCR FNC sediment sampling in 2017, an analysis of stations in close proximity to the transfer sites indicates that any material that may be transported into the transfer sites by the riverine processes is predominately sand and gravel (>95%) with less than 5% fines. Thus, the potential for the sediments to be carriers of contamination is very low. Also, the 8 transfer sites are not in close proximity to known land-based sources of contamination that could cause contamination while the sediments are "stored" at the transfer sites.

MANAGEMENT AREA RANK: The PSET assigns a "very low" management area ranking to these 8 transfer sites due to the previous review of the LCR FNC, and no reason to believe that the project sediments have chemicals of concerns at concentrations above SEF SLs.

REGULATORY REQUIREMENTS FOR SEDIMENT EVALUATION: In accordance with the CWA section 404(b)(1) guidelines (40 CFR 230.60), when provided information indicates the material is sufficiently removed from sources of contamination, with reasonable assurances that the dredged material is not a carrier of contaminants, then testing is unnecessary. Project sediments are most likely not a carrier of contaminants because they are composed primarily of sand, gravel, or other naturally occurring inert material and if dredged materials are found in areas of high current or wave energy. Less than 5% of the material is fine-grained sediment.

NO TEST DETERMINATION: Based on the information provided, the PSET has determined that the transfer sites project areas do not require additional sediment physical or chemical evaluation per the CWA section 404(b)(1) guidelines. If the project changes or if additional information is available, then this "no test" determination must be re-evaluated, and sediment testing may be required. The PSET has assigned a "very low" site management area ranking to this project with this analysis being valid until March 2026, which aligns with the recency of the data collected by the Corps for the LCR FNC in 2016. If there are project changes or new information regarding sources of contamination are available, PSET would re-evaluate the suitability determination.

REVIEWING PSET AGENCIES: U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Oregon Department of Environmental Quality, Washington Department of Ecology, U.S. Fish and Wildlife Service, National Marine Fisheries Service.

CONTACT: If you have questions regarding this PSET determination, please email or call me.

Take care,
-Bridgette
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EPA-Region 10 Water Division, Wetlands and Oceans Section 08 May 2023

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Downstream Deep Draft Federal Navigation Channel (entrance to mile 1.5) in Portland, Multnomah County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (USACE) operations and maintenance (O&M) dredging for the Oregon Slough Downstream (OSD) Deep Draft Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 102 to 104 (project mile entrance to 1.5).

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the OSD deep draft FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the April 2023 "*Sediment Characterization: Oregon Slough Downstream Deep-Draft Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon*" (SQER)[2] prepared by ANAMAR for the USACE's Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs[3].

Suitability Summary:

Dredge Prism (DP) Sediments:	☒Suitable	☐Unsuitable
Post-Dredge Surface (PDS):	☒Suitable	☐Unsuitable

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers (USACE) – Portland District. 2023. *Sediment Characterization: Oregon Slough Downstream Deep-Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon*. Prepared by ANAMAR, April 2023. 25 pp with Maps, Tables, and Appendices.

[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

Reviewers: The PSET agencies include the USACE, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒ James Holm (USACE, Lead)
☒ Bridgette Lohrman (EPA, Co-Lead)
☒ Pete Anderson (ODEQ)
☒ Laura Inouye (Ecology)
☒ Dominic Yballe (USACE)
☒ Tom Hausmann (NMFS)
☒ Jeremy Buck (USFWS)
☒ Samantha Lynch (USACE)

PSET/SEF Conditions:

☒ Data Recency Expiration – Based on a "**Low**" rank, the data recency for sediments in the Oregon Slough Downstream Deep Draft Federal Navigation Channel expires in **November 2029**.

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP) submitted to PSET	30 August 2022
SAP revisions requested by PSET	31 August 2022
Revised SAP submitted to PSET	31 August 2022
Revised SAP revisions requested by PSET	7 September 2022
Final SAP[4] submitted to PSET	13 September 2022
Final SAP approved by PSET[5]	19 September 2022
Sampling date(s)	14 November 2022
Draft SQER submitted to PSET	4 April 2023
Draft SQER edits requested by PSET	18 April 2023
Final SQER submitted to PSET	25 April 2023
Suitability Determination Memorandum (SDM) issued by PSET	08 May 2023
Management area ranking	Low
Recency of data	November 2029 (7 years)

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

[4] USACE – Portland District. 2022. *Oregon Slough Downstream Deep-Draft Channel, Columbia River Mile 102.5, Multnomah County, Oregon, Sediment Sampling and Analyses Plan.* Prepared by SQT, 13 September 2022. 16 pp with Attachments.

[5] Portland Sediment Evaluation Team (PSET). 2022. *PSET - Oregon Slough SAP Approval.* Email issued by B. Lohrman (EPA) for PSET, 19 September 2022. 2 pp with Attachment.

Project Description: Table 2 provides a summary of the dredging project details for the OSD deep draft FNC. Maintenance dredging is needed to provide navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 102 to 104
Total proposed dredging volume (cy)	~100,000 to 250,000
Max. proposed dredging depth (includes overdepth allowance)	-48 feet CRD (43+5 ft overdredge)
Dredging area (acres, approx.)	~125
Dredge dimensions	Triangular turning basin: ~1,000 ft. wide by 3,000 ft long; Deep draft channel: 400 ft wide by 1.5 miles
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	August 1 through December 15
Dredged material mgmt. units (DMMUs)	3

Sampling and Analysis Description: The USACE sampling and analytical program for the OSD deep draft FNC is summarized in Table 3. Actual grab sample station locations are shown in SQER Table 1 and Map 1 (SDM Figure 1).

Deviations from the SAP: One lab deviation from the PSET-approved SAP was identified in SQER Section 4.3.5, regarding the SVOCs.

In all three composite samples, bis(2-ethylhexyl) phthalate was L-qualified (QC recovery was off scale high and the concentration exceeded the linear range) and V-qualified (detected in the sample and blank). Benzoic acid was HP-qualified (the time between prep and analysis was outside the method specified hold time) and V-qualified. Di-n-butyl phthalate and phenol were V-qualified. Therefore, the USACE had frozen archive samples analyzed at ARI for bis(2-ethylhexyl) phthalate and benzoic acid. The ARI results were below SEF SLs for both analytes.

Table 3. Sampling and Analysis Description

Sample collection method		Standard Ponar		
DMMU IDs (location)		OSDS-1 (triangular turning basin)	OSDS-2 (mile 0+05 to 0+48)	OSDS-3 (mile 0+48 to 1+26)
DMMU Rank		Low		
Station/Sample ID		OSDS-1A, OSDS-1B, OSDS-1C, OSDS-1D	OSDS-2A, OSDS-2B, OSDS-2C, OSDS-2D	OSDS-3A, OSDS-3B, OSDS-3C, OSDS-3D
Composite Sample ID		1122-OSDS-1-COMP	1122-OSDS-2-COMP	1122-OSDS-3-COMP
DMMU volume (cy)		~100,000 to 250,000		
Dredge Prism	Mudline range (ft CRD)	-40.8 to -45.7	-36.2 to -45.5	-31.8 to -41.6
	Composite (Y/N)	Y	Y	Y
	Subsample /DMMU	4	4	4
	Subsample Archive (Y/N)	Y	Y	Y
PDS Layer	Depth range (ft CRD)	N/A	N/A	N/A
	Composite (Y/N)			
	Subsample /PDS			
	Subsample Archive (Y/N)			
Sediment Physical and Chemical Analysis (No. DP samples / No. PDS samples analyzed)				
Grain size		1/-	1/-	1/-
Total organic carbon		1/-	1/-	1/-
Total solids		1/-	1/-	1/-
Ammonia		1/-	1/-	1/-
Total sulfides		1/-	1/-	1/-
Metals, freshwater		1/-	1/-	1/-
PAHs		1/-	1/-	1/-
SVOCs (phthalates, phenols, misc. extractables)		1/-	1/-	1/-
Pesticides		1/-	1/-	1/-
PCBs (Total Aroclors)		1/-	1/-	1/-
Butyltins		1/-	1/-	1/-
TPH (diesel [dx], residual [rx] range)		1/-	1/-	1/-
Dioxin/Furans		-/-	-/-	-/-
Biological Analysis (No. DP samples / No. PDS samples analyzed)				
Freshwater Bioassays		-/-	-/-	-/-

Results and Discussion: Analytical results for the USACE sampling event are summarized in Table 4. The chemical analytical results were compared to the 2018 SEF freshwater SLs and to ODEQ's fish based freshwater SLV (22 ug/kg) to evaluate PCBs (total Aroclors). There were no exceedances of ODEQ's fish-based, freshwater bioaccumulative SLV (22 ug/kg) for total PCB Aroclors because all samples were between 5.75 and 8.81 ug/kg.

All analytes were detected below SEF freshwater SLs or were non-detections (U) with method reporting limits (MRLs) below SLs. The composite samples consisted of 73 to 82% sand and 18 to 27% fines with trace gravel (<0.4%). The total organic carbon (TOC) ranged from 0.62 to 1.27%. Total solids ranged from 60.7 to 63.8%.

Site Ranking: Based on the results, the PSET confirms a "low" rank to the Oregon Slough Downstream deep draft sediments.

PSET Suitability Determination:
Dredge Prism – Chemical concentrations in OSD dredge prisms are below the SEF freshwater SLs and ODEQ SLV as discussed above. As such, the **OSD deep draft FNC dredged prism material** is **suitable for unconfined, aquatic disposal** per the 2018 SEF guidance without additional testing.

Post-Dredge Surface – Based on a "Low" rank and multiple rounds of suitable sediments, the post-dredge surfaces are expected to be of similar quality to the dredge prisms. As such, the **OSD deep draft FNC post-dredge surfaces** are **suitable for unconfined, aquatic exposure** per the 2018 SEF guidance without additional testing.

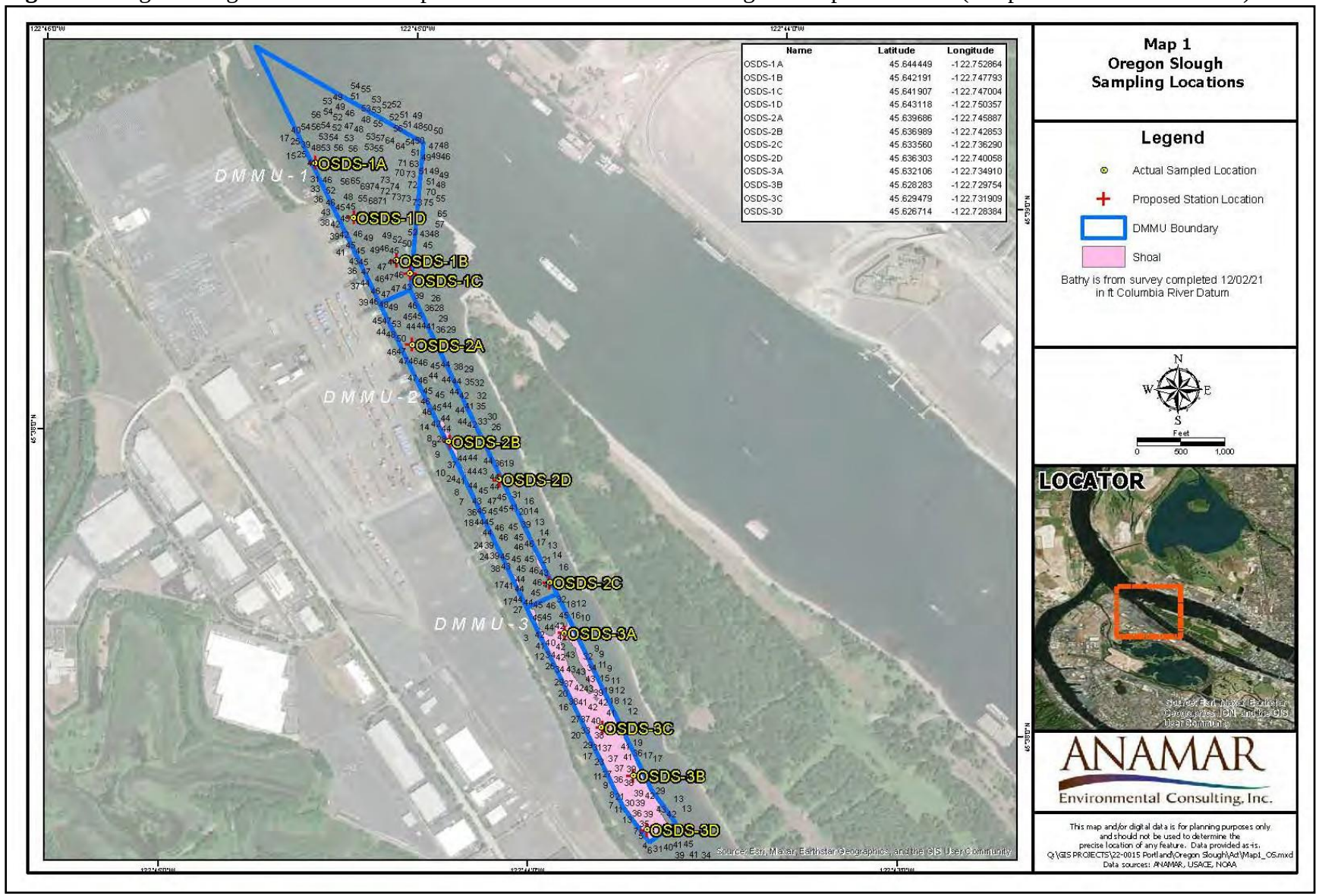
Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, USACE) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 4. Project Sediment Analytical Summary – Dredge Prism (sampled November 2022)

Sediment Physical and Chemical Results				
Composite Sample ID: Parameter	1122-OSDS-1-COMP	1122-OSDS-2-COMP	1122-OSDS-3-COMP	SEF SL1, freshwater (SLV†)
Grain size: gravel, sand, silt + clay (%)	0.4, 81.4, 18.2	0.2, 72.8, 26.9	0.1, 81.8, 18.0	--
Total Solids (%)	60.7	61.9	63.8	--
Total Organic Carbon (%)	1.27	0.98	0.62	--
Ammonia (mg/kg)	72.8	78.8	51.5	230
Total Sulfides (mg/kg)	0.54 U	0.68 U	0.37 U	39
Metals (mg/kg)	Non-detect, Detect <SLs U, J, V	Non-detect, Detect <SLs U, J, V	Non-detect, Detect <SLs U, J, V	Varies
Total PAHs (ug/kg)	31.7 J	27.8 J	17.6 J	17,000
SVOCs (ug/kg) (phenols, phthalates, misc. extractables)	Non-detect, Detect <SLs U, J, V, C+	Non-detect, Detect <SLs U, J, V, C+	Non-detect, Detect <SLs U, J, V, C+	Varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
2,4'+4,4'-DDD	1.65 HP, U	1.62 HP, U	1.57 HP, U	310
2,4'+4,4'-DDE	1.05 J	0.60 J, P	1.57 HP, U	21
2,4'+4,4'-DDT	1.65 HP, U	1.62 HP, U	1.57 HP, U	100
PCBs, Total Aroclors (ug/kg)	5.75 C	8.81 C	7.23 C	110 (22†)
Butyltins (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
TPH (dx/rx) (ug/kg)	25 U / 15.8 J	25 U / 21.7 J	25 U / 25 U	340 / 3,600

U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (MDL in parenthesis); J = Estimated value between MDL and MRL; V = analyte detected is sample and blank; HP = time between prep and analysis was outside the method holding time; P = difference between GC column results greater than method requirement - higher result reported; C = associated calibration QC is outside the established QC criteria for accuracy; C+ = associated calibration QC is outside the established QC criteria for accuracy - no hit in sample - data not affected and acceptable to report; † = ODEQ (2007) freshwater fish-based bioaccumulation screening level value.

Figure 1. Oregon Slough Downstream deep draft FNC DMMUs and actual grab sample locations (sampled 14 November 2022).



EPA-Region 10 Water Division, Wetlands and Oceans Section 17 April 2019

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Vancouver to The Dalles Federal Navigation Channel

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Vancouver to The Dalles Federal Navigation Channel (VTD FNC) in the Columbia River from river mile (RM) 106 to 192.5.

Introduction: Per the *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic disposal. The PSET reviewed the Corps' 20 March 2019 "Sediment Quality Evaluation Report: Vancouver to The Dalles Federal Navigation Channel" (SQER)[2], prepared by Corps' Sediment Quality Team (SQT). Sediment testing consisted of physical analysis of sediments to confirm very low rank. If the sediment testing did not confirm a "very low rank", additional testing would be pursued.

Suitability Summary:

Surface Sediments:	☒Suitable	☐Unsuitable
Post-Dredge Surface (PDS):	☒Suitable	☐Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒James Holm (Corps, Lead) ☒ Bridgette Lohrman (EPA, Co-Lead)
☒Pete Anderson (ODEQ) ☒Laura Inouye (Ecology) ☒ Dominic Yballe (Corps)
☒Tom Hausmann (NMFS) ☒ Jeremy Buck (USFWS)

PSET/SEF Condition:

☒ Data Recency Expiration – The data recency of this SDM expires for the VTD FNC in January 2029.

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 278 pp with Appendices.

[2] U.S. Army Corps of Engineers – Portland District. 2019. Sediment Quality Evaluation Report – Vancouver to the Dalles Federal Navigation Channel. Prepared by the Portland District Sediment Quality Team, 20 March 2019. 22 pp

Table 1. PSET Review Timeline

Sampling and analysis plan (SAP) received	18 December 2018
SAP Approval	27 December 2018[3]
Sampling date(s)	10 January 2019
SQER received by PSET	25 March 2019
Suitability Determination Memo issued	17 April 2019
Management area ranking	Very Low
Recency of data*	January 2029 (10 years)

* If site conditions or the proposed project change, or if new information related contaminants of concerns are discovered, additional project coordination with PSET may be required to determine the validity of this SDM.

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 summarizes the O&M dredging program details for the VTD FNC project. Dredging is needed to provide reliable commercial and recreational navigation.

Table 2. Project Details

Waterbody / river miles (RMs)	Columbia River (106-192.5)
Dredged volume (cy)	~406,960 (2019 volume for RM 106-136; dredged annually)
Channel dimensions	300 ft wide by 84.5 miles long
Dredge area	~1,090 acres
Max. proposed dredging depth + advanced maintenance depth	-27 ft Columbia River Datum (CRD) (authorized); Maintained to -19 ft CRD (-17+2)
Dredging method	Hopper dredge
Dredged material transport	Hopper dredge
Disposal locations	In-water placement in off-channel areas
Dredging dates	Typically June through December
Dredged material management units (DMMUs): No. of stations	DMMU 1: 4 grabs, 1 composite sample DMMU 2: 5 grabs, 1 composite sample DMMU 3: 2 grabs, 1 composite sample

Sampling and Analysis Description: The Corps' sampling and analytical program for the VTD FNC is summarized in Table 3. Actual sample station locations are shown in SQER Table 3 and Figures 2, 3, and 4.

[3] Portland Sediment Evaluation Team (PSET). 2018. [E-mail correspondence] PSET – SAP Approval for LCR FNC and RSM Dredging. *Bridgette Lohrman*. 27 December 2018. 2 pages.

Table 3. Project Sampling and Analysis Description

Sampling Description				
Sample collection methods		Double van Veen grab sampler		
DMMU ID		VTD-01	VTD-02	VTD-03
Proposed DMMU volume (cy)		~122,467	~258,049	~26,444
Subsamples per DMMU		4	5	2
Dredge Prism	Depth range (ft. CRD)	-5.8 to -21.7	-13.4 to -20.5	-13.8 to -18.7
	Composite (Y/N)	Y	Y	Y
	SS archive (Y/N)	N	N	N
	Composite archive (Y/N)	N	N	N
PDS		Not proposed		
Sediment Analytical Parameters (No. Analyses by DMMU)				
Grain Size		1 (triplicate analysis)	1	1
Total Solids		1	1	1
Total Organic Carbon		1	1	1

Deviations from the SAP: There were two minor deviations from the sampling and analysis plan. These minor deviations do not affect the sediment suitability.

- Samples were collected using a double van Veen grab sampler provided by the contractor instead of the Grey-O'hara box corer.
- Five of the 11 stations were deeper than the proposed dredge prism (-19 ft. CRD) as listed in SQER Table 3; however, at least two samples in each DMMU are representative of the dredge prism. Surficial sediments within the VTD FNC are consistently dominated by coarse-grain particles.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. Sediment testing consisted of physical analysis of sediments to confirm a very low rank (minimum 80% sand, less than 0.5% total organic carbon (TOC)). As expected, the sampling results confirmed a "very low rank", therefore, analytical chemistry testing was not triggered.

Table 4. Sediment Analytical Summary

Sediment Physical and Conventional Results – Dredge Prism			
Sample ID:	011019VTD-COMP01	011019VTD-COMP02	011019VTD-COMP03
DMMU ID: Parameter	DMMU 1 (triplicate analysis)	DMMU 2	DMMU 3
Total Organic Carbon (%)	0.04	0.16	0.03
Total Solids (%)	85.3 85.4 76.7	73.2	74.2
Gravel (%)	17.7 17.4 20.8	0.1	0.2
Sand (%)	81.2 81.2 76.7	98.0	99.6
Fines (%), silt + clays	1.1 1.4 2.5	1.9	0.1

PSET Suitability Determination:

Dredge Prism

The VTD FNC maintains a “very low” management area rank because the project sediments are still dominated by coarse sands and gravels (>98%) with low total organic carbon content (<0.2%) in strong river and tidal currents. The **VTD FNC dredge prism material** is **suitable** for **unconfined, aquatic disposal** without further testing per the 2018 SEF guidance.

Post-Dredge Surface

Based on a “very low” management area rank and confirmed coarse grain size with low total organic carbon for the dredge prism, chemical testing of the post-dredge surface sediments is not required. The **VTD FNC post-dredge surface** is **suitable** for **unconfined, aquatic exposure** without further testing per the 2018 SEF guidance.

Contact: This memorandum was prepared by Bridgette Lohrman (EPA, PSET Co-Lead), James Holm (USACE, PSET Lead) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

EPA-Region 10 Water Division, Wetlands and Oceans Section 17 March 2021

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Groth), Skipanon River Federal Navigation Channel (Mile 0.0 to 2.0), near Warrenton, Clatsop County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Skipanon River (SKIP) Federal Navigation Channel (FNC) at river mile (RM) 10.7 of the Columbia River.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the SKIP FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the February 2021 "*Sediment Characterization: Skipanon Channel Federal Navigation Project, Skipanon River Miles 0.0 to 2.0, Clatsop County, Oregon*" (SQER)[2], prepared by ANAMAR for the Corps' Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the marine benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for marine fish to evaluate PCBs[3].

Suitability Summary:
Dredge Prism (DP) Sediments:
☒Suitable ☐Unsuitable
Post-Dredge Surface (PDS):
☒Suitable ☒Unsuitable (DMMU SKIP-04-Z, -17 to -19 ft MLLW)

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒ James Holm (Corps, Lead) ☒ Bridgette Lohrman (EPA, Co-Lead)
☒ Pete Anderson (ODEQ) ☒ Laura Inouye (Ecology) ☒ Dominic Yballe (Corps)
☒ Tom Hausmann (NMFS) ☒ Jeremy Buck (USFWS)

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.
[2] U.S. Army Corps of Engineers – Portland District. 2021. *Sediment Characterization: Skipanon Channel Federal Navigation Project, Skipanon River Miles 0.0 to 2.0, Clatsop County, Oregon*. Prepared by ANAMAR, February 2021. 23 pp with Maps, Tables, and Appendices.
[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

PSET/SEF Conditions:

☒ Data Recency Expiration:

- Based on a "**Moderate**" rank, the data recency for **DMMUs 2, 3, 4, and 5** in the **Skipanon FNC** expires in **September 2025**.
- Based on a "**Low**" rank, the data recency for **DMMUs 1 and 6789** in the **Skipanon FNC** expires in **September 2027**.

☒ **Biological testing** per the 2018 SEF is required for the **post-dredge surface in DMMU 4** to assess the suitability of these sediments for unconfined, aquatic exposure. If biological testing is not performed or if biological tests fail, then the following is required:

- **Upland disposal** of post-dredge surface sediments (-17 to -19 feet MLLW) from **DMMU 4** with full characterization of underlying sediments and/or placement of 12 inches of sand; or
- **Post-dredge surface management** in **DMMU 4** in coordination with PSET. Post-dredge surface management may include one or more of the following:
  - Under dredging to -15 feet MLLW or shallower;
  - Post-dredge sampling for pesticides;
  - Placement of 12 inches of sand; and/or
  - Monitored natural recovery.

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP)[4] submitted to PSET	24 August 2020
SAP approved by PSET[5]	4 September 2020
Sampling date(s)	8 and 9 September 2020
Draft SQER submitted to PSET	11 December 2020
SQER revisions requested by PSET	14, 16 December 2020
Core correction discussion	23 December 2020
SQER revisions requested by PSET	6 January 2021
Corps submits re-analysis results	9 February 2021
Final SQER submitted to PSET	25 February 2021
Suitability Determination Memorandum (SDM) issued by PSET	17 March 2021
Management area ranking	Moderate – DMMUs 2-5 Low – DMMUs 1 & 6789*
Recency of data	DMMUs 2-5 – September 2025 DMMUs 1 & 6789* – September 2027

* - Naming convention for DMMU "6789" represents DMMUs 6 through 9 sampled in 2014.

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act

☒ Section 404, Clean Water Act (CWA)

☒ Section 401, CWA

[4] U.S. Army Corps of Engineers. 2020. *Skipanon Channel Federal Navigation Project, Skipanon River, Miles 0.0 to 2.0, Clatsop County, Oregon, Sediment Sampling and Analysis Plan.* Prepared by Corps SQT, 24 August 2020. 21 pp with Attachments.

[5] Portland Sediment Evaluation Team (PSET). 2020. [E-mail correspondence] *PSET – Skipanon FNC SAP Approval*. Bridgette Lohrman, EPA, sent 4 September 2021. 3 pp.

☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the SKIP FNC. Maintenance dredging is needed to provide reliable navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Skipanon River / 0.0 to 2.0 (Enters the Columbia River at RM 10.7)
Total proposed dredging volume (cy)	~160,000 (range: 65,000 to 355,000)
Max. proposed dredging depth (includes overdepth allowance)	-17 feet MLLW (-16 + 1 ft)
Dredge dimensions	Channel: 2.0 miles long by 200 feet wide with a turning basin from RM 1.5 to 1.8 that is 220 to 480 feet wide
Dredging method	Pipeline, clamshell, or hopper
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMUs) / stations	6 / 2 per DMMU

Sampling and Analysis Description: The Corps' sampling and analytical program for the SKIP FNC is summarized in Table 3. Actual sample station locations are shown in the SQER Table 1 and Map 1 (SDM Figure 1) with full delineation of all DMMUs in Figures 3 and 4 of SAP.

Deviations from the SAP: Deviations from the PSET-approved SAP are listed in SQER section 3.1 and noted in SQER Tables 1 (core summary). Deviations included the following:

1. Core station VC-04 for DMMU SKIP-02 was relocated to avoid rocks (potentially rip rap) that caused shallow refusal. The Corps was only able to penetrate to -18 feet MLLW, one foot short of the full Z-layer interval (-17 to -19 ft MLLW).
2. Seven cores (VC-06 to VC-12) were over-penetrated by 1 to 4 feet to improve retention of the soft silty surface layer and minimize sample loss from the bottom of the core sampler. Consolidated sediments at depth prevented sample loss. The over-penetrated section of the core was discarded after completing the linear core compaction correction. See SQER section 2.2.2 (Vibracore Sampling Methods) and SQER Exhibit 2-3.
3. Low percent core recovery (<75%) occurred on multiple core attempts at core stations VC-02, VC-04, VC-05, VC-06, VC-07, VC-08, VC-09, VC-11, and VC-12 as shown in SQER Table 1. The field team processed the core with highest recovery.

Table 3. Sampling and Analysis Description

Sample collection method		Vibracore					
DMMU ID		SKIP-01	SKIP-02	SKIP-03	SKIP-04	SKIP-05	SKIP-6789
Project mile		1+50 to 2+00	1+40 to 1+50	1+37 to 1+40	1+32 to 1+37	1+30 to 1+32	0+00 to 1+30
DMMMU volume (CY)		~50,000	~20,000	~17,000	~22,000	~14,000	~37,000
DMMU rank		Low	Moderate	Moderate	Moderate	Moderate	Low
DP composite sample ID (mudline to -17 ft MLLW)		SKIP-01-COMP	SKIP-02-COMP	SKIP-03-COMP	SKIP-04-COMP	SKIP-05-COMP	SKIP-6789-COMP
PDS composite sample ID (-17 to -19 ft MLLW)		SKIP-01-COMP-Z	SKIP-02-COMP-Z	SKIP-03-COMP-Z	SKIP-04-COMP-Z	SKIP-05-COMP-Z	SKIP-6789-COMP-Z
Dredge Prism	Depth range (ft MLLW)	-6.4, -7.2 to -17	-7.4, -8.5 to -17	-12.3, -13.0 to -17	-12.0, -12.6 to -17	-12.1, -15.3 to -17	-14.6, -15.0 to -17
	Composite (Y/N)	Y	Y	Y	Y	Y	Y
	Subsamples /DMMU	2	2	2	2	2	2
	Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
PDS Layer	Depth range (ft MLLW)	-17 to -19	-17 to -19, -17 to -18^	-17 to -19	-17 to -19	-17 to -19	-17 to -19
	Composite (Y/N)	Y	Y	Y	Y	Y	Y
	Subsample /PDS-layer	2	2	2	2	2	2
	Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
Sediment Physical and Chemical Analysis per DMMU (No. DP/ No. PDS)							
Grain size		1/1	1/1	1/1	1/1	1/1	1/1
Total organic carbon		1/1	1/1	1/1	1/1	1/1	1/1
Total solids		1/1	1/1	1/1	1/1	1/1	1/1
Ammonia		1/1	1/1	1/1	1/1	1/1	1/1
Total sulfides		1/1	1/1	1/1	1/1	1/1	1/1
Metals, marine		1/1	1/1	1/1	1/1	1/1	1/1
PAHs		1/1	1/1	1/1	1/1	1/1	1/1
SVOCs (chlorinated hydrocarbons, phthalates, phenols, misc. extractables)		1/1	1/1	1/1	1/1	1/1	1/1
Pesticides		1/1	1/1	1/1	1/1	1/1	1/1
PCBs (Total Aroclors)		1/1	1/1	1/1	1/1	1/1	1/1
Tributyltin		1/1	1/1	1/1	1/1	1/1	1/1
Dioxin/Furans		-/-	-/-	-/-	-/-	-/-	-/-

^ = refusal meet, 1-ft Z-layer sample collected

Results and Discussion: Dredge prism analytical results for the Corps' sampling event are summarized in Table 4. Post-dredge surface analytical results for the Corps' sampling event are summarized in Table 5. The chemical analytical results from the SQER were compared to the 2018 SEF marine SLs and to ODEQ's SLV for marine fish (47 ug/kg) to evaluate PCBs.

The dredge prism sediments are predominantly silt (77-86%) with some clay (12-20%) and minor amounts of sand and gravels (<3%). Total organic carbon (TOC) in the dredge prism sediments ranged from 2.14 to 2.79%. Total solids in the dredge prism sediments ranged from 35 to 42%.

In all dredge prism composite samples, no parameters had detections, estimated concentrations (J) or non-detections (U) with elevated detections or reporting limits above SEF marine SLs or the ODEQ SLV for PCB Aroclors.

The post-dredge surface sediments are predominantly silt (56-79%) with clay (15-42%) and lesser amounts of sand and gravels (2 to 29%). Total organic carbon (TOC) in the post-dredge surface sediments ranged from 1.66 to 3.13%. Total solids in the dredge prism sediments ranged from 44 to 52%.

In the post-dredge surface composite sample for DMMU 4 (SKIP-04-COMP-Z), 4,4'-DDD was detected at a concentration of 48.2 ug/kg which exceeds the SEF marine SL of 16 ug/kg. In the 2014 dredged material evaluation, 4,4'-DDD was also detected at a concentration of 19 ug/kg in the post-dredge surface layer of DMMU 4. Based on the continued presence of elevated DDD concentrations, the post-dredge surface is not suitable for unconfined aquatic exposure without further testing. If testing is not conducted or fails, management of the post-dredge surface in DMMU 4 is required. The Corps may choose upland disposal of the post-dredge surface sediments and conduct post-dredge sampling for pesticides to inform placement of a 12-inch sand layer. The Corps shall prepare a dredging and disposal quality control plan for the project and coordinate with PSET for implementation prior to dredging DMMU 4.

N-nitrosodiphenylamine was detected in 3 PDS samples (1Z, 3Z, and 4Z). However, the concentration only minimally exceeded the SEF marine SL (28 ug/kg) in the 1Z (29 ug/kg) and 4Z (30 ug/kg) samples. The sample 3Z concentration of 17 ug/kg is below the SEF SL. To confirm the concentration in the post-dredge surface of DMMU 1, the Corps re-analyzed the initial composite sample twice and an archived jar of the composite sample. All three re-analyses were non-detections for n-nitrosodiphenylamine with a sufficiently low MRL (5.0 ug/kg) below the SEF SL. There is "no reason to believe" that n-nitrosodiphenylamine is present in the post-dredge surface sediments in DMMU 1 at concentrations exceeding the SEF SL.

No other parameters had detections, estimated concentrations (J) or non-detections (U) with elevated detections limits above SEF marine SLs or ODEQ SLV for PCB Aroclors.

PSET Suitability Determination:
Dredge Prism – Chemical concentrations in all dredge prism samples were below the SEF marine SLs and ODEQ SLV as discussed above. As such, the **Skipanon FNC dredged prism**

material is **suitable for unconfined, aquatic disposal** per the 2018 SEF guidance without additional testing.

Post-Dredge Surface – Chemical concentrations in five of the six post-dredge surface samples were below the SEF marine SLs and ODEQ SLV as discussed above. As such, the **Skipanon FNC post-dredge surfaces**, **excluding DMMU 4**, are **suitable for unconfined, aquatic exposure** per the 2018 SEF guidance without additional testing.

The post-dredge surface (-17 to -19 ft MLLW) in DMMU 4 has elevated n-nitrosodiphenylamine and 4,4'-DDD above SEF marine SLs. Therefore, the **DMMU 4 post-dredge surface** is **not suitable** for **unconfined, aquatic exposure** without biological testing per the 2018 SEF. If additional testing is not completed or fails, management of the post-dredge surface is required in coordination with the PSET.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 4. Project Sediment Analytical Summary – Dredge Prism

Dredge Prism Sediment Physical and Chemical Results							
Decision unit/Sample ID: **Parameter**	Mile 1+50 to 2+00 / **SKIP-01-COMP**	Mile 1+40 to 1+50 / **SKIP-02-COMP**	Mile 1+37 to 1+40 / **SKIP-03-COMP**	Mile 1+32 to 1+37 / **SKIP-04-COMP**	Mile 1+30 to 1+32 / **SKIP-05-COMP**	Mile 0+00 to 1+30 / **SKIP-6789-COMP**	**SEF SL1 marine (SLV)**
Grain size: gravel, sand, silt, clay (%)	0.3, 1.5, 86.0, 12.5	0.3, 2.3, 84.8, 12.9	0.3, 2.0, 82.4, 15.5	0.3, 1.6, 79.8, 18.6	0.3, 2.2, 79.2, 18.7	0.5, 3.1, 76.9, 19.8	--
Total Solids (%)	39.41	42.42	35.09	39.59	38.8	40.01	--
Total Organic Carbon (%)	2.76	2.14	2.79	2.5	2.53	2.22	--
Ammonia (mg/kg)	344	281	278	300	255	205	--
Total Sulfides (mg/kg)	2,940	2,710	2,720	2,610	2,030	2,080	--
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
LPAHs (ug/kg)	13 J	32 J	7.7 J	22 J	8.6 J	20 U	5,200
HPAHs (ug/kg)	248 J	329 J	129 J	200 J	152 J	89 J	12,000
SVOCs (ug/kg) (phenols, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
N-nitrosodiphenylamine	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	28
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4'-DDD	4.20	2.86	2.69	4.00	3.91	2.12 J	16
4,4'-DDE	2.99	2.22	3.31	1.75	1.81	1.43	9
4,4'-DDT	0.99 U	1.0 U	1.0 U	1.0 U	1.02 U	1.0 U	12
PCBs, Total Aroclors (ug/kg)	27.8 J	16.7	17.9	20.5	12.9 J	11.2 J	130 (47†)
Tributyltin (ug/kg)	1.5 J	1.8 J	1.6 J	1.8 J	0.83 J	0.85 J	73

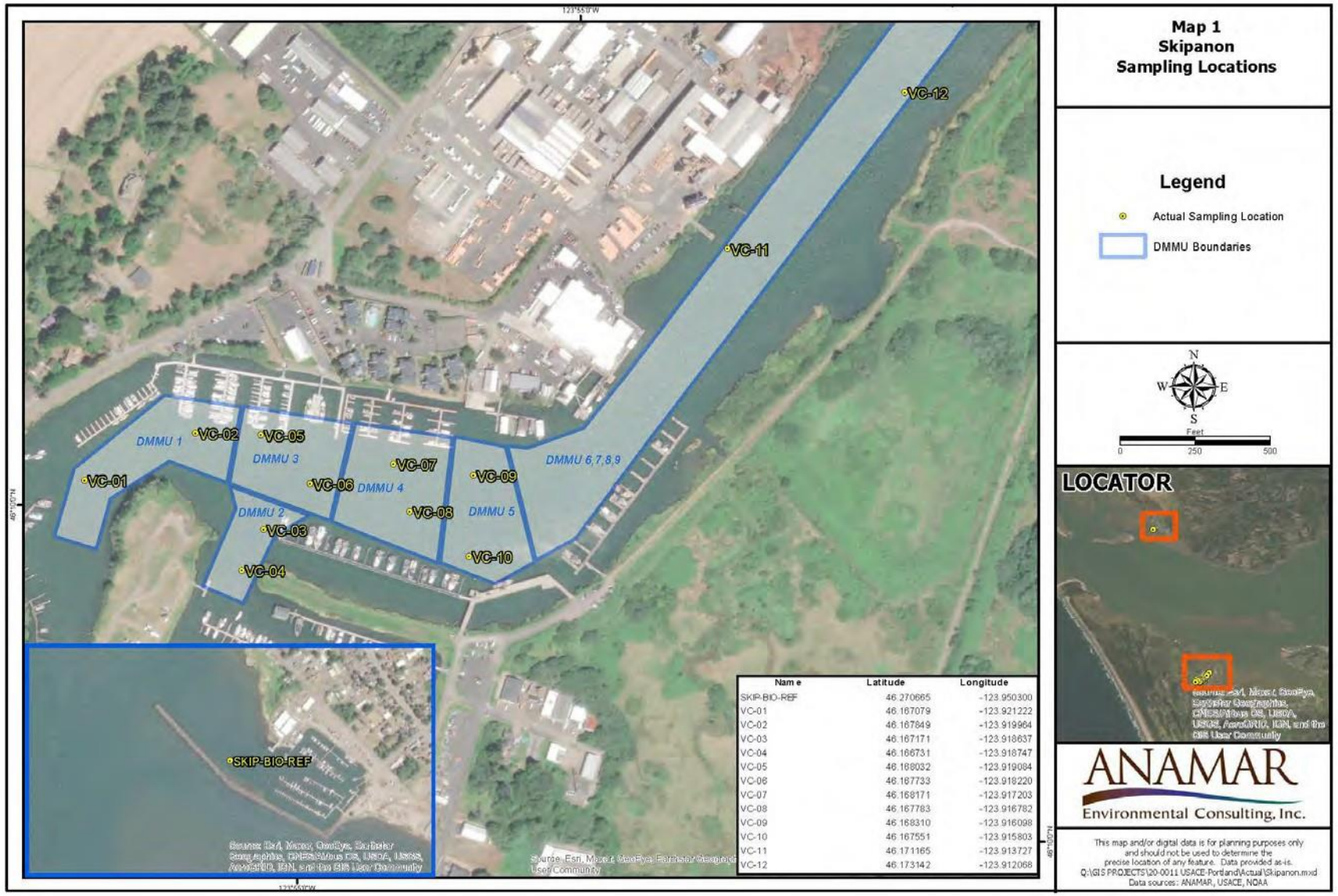
BOLD = Detection exceeds SEF marine screening level (SL); U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; J = Estimated value between MDL and MRL; † = ODEQ (2007) Marine fish-based bioaccumulation screening level value.

Table 5. Project Sediment Analytical Summary – Post-Dredge Surface

Post-Dredge Surface Sediment Physical and Chemical Results							
Decision unit/Sample ID: **Parameter**	Mile 1+50 to 2+00 / **SKIP-01-COMP-Z**	Mile 1+40 to 1+50 / **SKIP-02-COMP-Z**	Mile 1+37 to 1+40 / **SKIP-03-COMP-Z**	Mile 1+32 to 1+37 / **SKIP-04-COMP-Z**	Mile 1+30 to 1+32 / **SKIP-05-COMP-Z**	Mile 0+00 to 1+30 / **SKIP-6789-COMP-Z**	**SEF SL1 marine (SLV)**
Grain size: gravel, sand, silt, clay (%)	0.3, 1.3, 57.0, 41.8	0.7, 28.0, 56.3, 15.0	0.9, 1.3, 79.1, 19.2	0.3, 1.4, 74.8, 24.0	0.3, 3.3, 78.0, 18.7	0.3, 2.9, 77.0, 20.0	--
Total Solids (%)	48.05	52.33	45.12	44.96	44.35	44.17	--
Total Organic Carbon (%)	3.13	1.66	2.62	2.73	2.36	2.22	--
Ammonia (mg/kg)	707	257	463	630	457	409	--
Total Sulfides (mg/kg)	1,150	1,660	2,830	2,080	2,060	1,930	--
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
LPAHs (ug/kg)	151 J	159 J	102 J	107 J	16 J	9.5 J	5,200
HPAHs (ug/kg)	1,271 J	485 J	532 J	700 J	258 J	147 J	12,000
SVOCs (ug/kg) (phenols, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
N-nitrosodiphenylamine Re-analysis in triplicate	**29** 5.0 U	5.0 U	17	**30**	5.0 U	5.0 U	28
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4'-DDD	15.8	3.32	15.3	**48.2**	11.6	2.32 J	16
4,4'-DDE	2.11	1.64	3.38	3.37	2.71	1.73	9
4,4'-DDT	1.0 U	1.0 U	1.0 U	0.99 U	1.0 U	0.99 U	12
PCBs, Total Aroclors (ug/kg)	23.8	24.8	33.3 J	28.9 J	37.1 J	11.3 J	130 (47†)
Tributyltin (ug/kg)	3.8 U	1.2 J	1.2 J	0.49 J	0.78 J	0.76 J	73

BOLD = Detection exceeds SEF marine screening level (SL); U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; J = Estimated value between MDL and MRL; † = ODEQ (2007) Marine fish-based bioaccumulation screening level value.

Figure 1. Skipanon River Federal Navigation Channel, actual sample locations and DMMUs (sampled 8-9 September 2020).



EPA-Region 10 Water Division, Wetlands and Oceans Section 11 January 2021

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Cathlamet Bay (Tongue Point) Federal Navigation Channel (Station 0+00 to 1+24), near Astoria, Clatsop County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2B dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Cathlamet Bay (CBY) Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 18.5.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this Level 2B suitability determination memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the CBY FNC dredged material from DMMUs CBY-54-B and CBY-67-A for unconfined, aquatic disposal. The PSET reviewed the December 2020 "*Sediment Characterization and Bioassays of Cathlamet Bay Federal Side Channel (Tongue Point), Lower Columbia River, Clatsop County, Oregon*" (2B SQER)[2], prepared by ANAMAR for the Corps' Sediment Quality Team (SQT). Sediment chemical and bioassay testing results are summarized in the 2B SQER; chemical analytical results were compared to the marine benthic toxicity screening levels (SLs) published in the 2018 SEF; bioassay results were compared to the SEF interpretive criteria for dispersive sites (SEF Table 7-1). The PSET also used Oregon DEQ's sediment screening level value (SLV) for marine fish to evaluate PCBs[3].

Suitability Summary:

Dredge Prism (DP) Sediments:

☒ Suitable (DMMUs CBY 54-B and 67-A)

☐ Unsuitable

Post-Dredge Surface (PDS):

Previously determined suitable.

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒ James Holm (Corps, Lead) ☒ Bridgette Lohrman (EPA, Co-Lead)

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers – Portland District (Corps). 2020. *Sediment Characterization and Bioassays of the Cathlamet Bay Federal Side Channel (Tongue Point), Lower Columbia River, Clatsop County, Oregon*. Prepared by ANAMAR, December 2020. 24 pp with Maps, Tables, and Appendices.

[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

☒ Pete Anderson (ODEQ) ☒ Laura Inouye (Ecology) ☒ Dominic Yballe (Corps)
☒ Tom Hausmann (NMFS) ☒ Jeremy Buck (USFWS)

PSET/SEF Condition:

☒ Data Recency Expiration: Based on a "**Moderate**" rank, the data recency for **DMMUs 54-B** and **67-A** in **Shoal B** of the Cathlamet Bay Federal Navigation Channel expires concurrent with the rest of Shoal B in **November 2024**.

Table 1. Review Timeline – CBY FNC

LEVEL 2A	
Draft Sampling and analysis plan (SAP) submitted to PSET	1 October 2019
SAP revisions requested by PSET	2 October 2019
Revised Draft SAP submitted	8 October 2019
Revised SAP revisions requested by PSET	11 October 2019
Final SAP submitted	15 October 2019
Final SAP approved by PSET	31 October 2019
Sampling date(s)	11 to 19 November 2019
Draft SQER submitted to PSET	10 March 2020
SQER revisions requested by PSET	11 March 2020
Final SQER submitted to PSET	22 April 2020
Level 2A SDM issued by PSET	31 July 2020
LEVEL 2B	
Draft Supplement SAP (SSAP) submitted to PSET	20 August 2020
SSAP comments given during PSET call	26 August 2020
Revised SSAP[4] submitted to PSET	1 September 2020
SSAP approved by PSET[5]	2 September 2020
Sampling date(s)	10 September 2020
Level 2B SQER submitted to PSET	8 December 2020
Level 2B SDM issued by PSET	11 January 2021
Management area ranking	Shoal A – Very Low Shoal B – Moderate
Recency of data	Shoal A – November 2029 (10 years) Shoal B – November 2024 (5 years)

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☒ Section 103, Marine Protection, Research and Sanctuaries Act

[4] Corps. 2020. *Supplemental Sediment Sampling and Analysis Plan (SSAP) for the Cathlamet Bay Federal Navigation Side Channel.* Prepared by Corps SQT, 1 September 2020. 6 pp.

[5] Portland Sediment Evaluation Team (PSET). 2020. [E-mail correspondence] *PSET – Cathlamet Bay – Bioassay SAP Approval*. Bridgette Lohrman, EPA, sent 2 September 2020. 3 pp with attachment.

☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the Corps' dredging project details for the CBY FNC. Maintenance dredging is needed to provide navigation access. The CBY turning basin (Station 1+24 to 1+40) will not be dredged, was not characterized in the Level 2A or 2B SQER and is not evaluated in this 2B SDM.

Table 2. Project Details – CBY FNC

Waterbody/river mile (RM)	Columbia River, 18.5
Total proposed dredging volume (cy)	~585,000 (Shoal A = ~80,000, Shoal B = ~465,000, Shoal B side slopes = ~40,000)
Max. proposed dredging depth (includes overdepth allowance)	-36 feet MLLW (34 + 2 ft overdredge)
Dredging area (acres, approx.)	~120
Dredge dimensions	~2,200 ft. wide narrowing to 350 ft. wide for ~3,000 ft., then 350 ft. wide for 1 mi. (turning basin excluded)
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMUs)	Level 2A: 94 + 16 side slope stations Level 2B: 2 (CBY-54-B, CBY-67-A)

Sampling and Analysis Description: The Corps' Level 2B sampling and analytical program for DMMUs CBY-54-B and CBY-67-A and the reference site sediments are summarized in Table 3. Actual sample station locations are shown in the 2B SQER Table 1 and Map 1 (Level 2B SDM Figure 1).

Deviations from the SSAP: One deviation from the PSET-approved SSAP was necessary. The reference site was relocated from outside the Chinook Channel breakwater to within the breakwater to collect reference sediments with grain size similar to the Cathlamet Bay FNC test sediments.

Table 3. Sampling and Analysis Description – Level 2B, CBY FNC

Sampling Description				
Sample collection method		Vibracore		PONAR
Shoal ID		B	B	Reference Site
DMMU ID		CBY-54-B	CBY-67-A	N/A
DMMU Rank		Moderate	Moderate	N/A
Proposed DMMU volume (cy)		~5,000	~5,000	N/A
Sample ID (planned interval, ft MLLW)		200910-CBY-54-B-BIO-COMP (-32 to -36)	200910-CBY-67-A-BIO-COMP (mudline to -32)	200910-CBY-REF-COMP (mudline)
Dredge Prism	Depth range (ft MLLW)	-32 to -36	Mudline (-27.1) to -32	Mudline at -6
	Composite (Y/N)	Y	Y	N
	Subsamples /DMMU	2	2	1
	Subsample Archive (Y/N)	Y	Y	N
PDS Layer	Depth range (ft MLLW)	N/A	N/A	N/A
	Composite (Y/N)			
	Subsample /PDS-layer			
	Subsample Archive (Y/N)			
Sediment Physical, Chemical and Biological Analyses per DMMU (No. DP/ No. PDS)				
Grain size		1/--	1/--	1/--
Total organic carbon		1/--	1/--	1/--
Total solids		1/--	1/--	1/--
Ammonia		1/--	1/--	1/--
Total sulfides		1/--	1/--	1/--
Metals, marine		1/--	1/--	1/--
PAHs		1/--	1/--	1/--
SVOCs (chlorinated hydrocarbons, phthalates, phenols, misc. extractables)		1/--	1/--	1/--
Pesticides		1/--	1/--	1/--
PCBs (Total Aroclors)		1/--	1/--	1/--
Tributyltin		1/--	1/--	1/--
Bioassays, marine		3/--	3/--	3/--

Results and Discussion: Analytical results for the Corps' Level 2B sampling event are summarized in Table 4. The chemical analytical results were compared to the 2018 SEF marine SLs and to ODEQ's SLV for marine fish to evaluate PCBs (47 ug/kg). The marine bioassay results were compared to the 2018 SEF performance standards and interpretive criteria for dispersive disposal sites as shown in Tables 5, 6, 7, and 8.

The initial November 2019 concentrations of diethyl phthalate detected in DMMUs CBY-54-B (254 ug/kg) and CBY-67-A (223 ug/kg) were not replicated in the Level 2B test sediments (19 ug/kg J, 15 ug/kg J). No other parameters had detections, estimated concentrations (J) or non-detections (U) with elevated detections limits above SEF marine SLs or ODEQ SLV for PCBs.

Table 4. DMMUs CBY-54-B and CBY-67-A and Reference Site Analytical Summary

Sediment Physical and Chemical Results				
Decision unit/Sample ID: Parameter	200910-CBY-54-B-BIO-COMP	200910-CBY-67-A-BIO-COMP	200910-CBY-REF-COMP	SEF SL1 marine (SLV)
Grain size: gravel, sand, silt, clay (%)	0.7, 8.9, 80.8, 9.8	0.3, 31.5, 59.7, 8.7	0.3, 19, 61.7, 19	--
Total Solids (%)	47.5	58.7	61.3	--
Total Organic Carbon (%)	2.12	1.54	1.18	--
Ammonia (mg/kg)	5.27	187	46.1	--
Total Sulfides (mg/kg)	599	646	514	--
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Detect <SLs J	varies
PAHs (ug/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
LPAHs (ug/kg)	103 J	65 J	307 J	5,200
HPAHs (ug/kg)	331 J	314 J	1,149 J	12,000
SVOCs (ug/kg) (phenols, phthalates, chlorinated hydrocarbons, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	varies
4,4'-DDD	1.4	0.52 J	0.87 J	16
4,4'-DDE	0.84 J	0.42 J	0.85 J	9
4,4'-DDT	1.0 U	1.0 U	0.50 U	12
PCBs, Total Aroclors (ug/kg)	10.2 J	1.2 J	6.6 J	130 (47†)
Tributyltin (ug/kg)	7.0	0.83 J	3.8 U	73

U = Non-detection at the method reporting limit (MRL) or method detection limit (MDL), MRL reported; J = Estimated value between MDL and MRL; † = ODEQ (2007) Marine fish-based bioaccumulation screening level value for PCBs.

Table 5. DMMUs CBY-54-B and CBY-67-A Bioassay Summary

Treatment	1-Hit Rule			2-Hit Rule		
	Amphipod	Polychaete	Larval	Amphipod	Polychaete	Larval
200910-CBY-54-B-BIO-Comp	Pass	Pass	Pass	Pass	Pass	Pass
200910-CBY-67-A-BIO-Comp	Pass	Pass	Pass	Pass	Pass	Pass

Table 6. 10-day Amphipod Mortality Comparison for *Eohaustorius estuarius*

Treatment	Mean Mortality (%)	Statistically Different than Reference? (P=0.05)	Mortality Comparison to Control M_T-M_C (%)	Mortality Comparison to Reference M_T-M_R (%)	Fails 2-Hit?[1]	Fails 1-Hit?[2]
Control	2					
200910-CBY-REF-Comp	18					
200910-CBY-54-B-BIO-Comp	5	No	3	-13	No	No
200910-CBY-67-A-BIO-Comp	10	No	8	-8	No	No

[1]2-Hit Rule: Statistical Significance and M_T-M_C >20%; [2]1-Hit Rule: Statistical Significance and M_T-M_C >20% and M_T-M_R >10% (dispersive); M_T = Treatment Mortality; M_R = Reference Mortality; M_C = Control Mortality

Table 7. 20-day Polychaete Mortality and Growth Comparison for *Neanthes arenaceodentata*

Treatment	MIG (mg/ind/day) AFDW	Statistically Less than Reference? (p=0.05)	MIG Relative to Control MIG_T/MIG_C	MIG Relative to Reference MIG_T/MIG_R	Fails 2-Hit?[1]	Fails 1-Hit?[2]
Control	0.552					
200910-CBY-REF-Comp	0.445					
200910-CBY-54-B-BIO-Comp	0.543	No	0.98	1.22	No	No
200910-CBY-67-A-BIO-Comp	0.623	No	1.13	1.40	No	No

[1]2-Hit Rule: Statistical Significance and MIG_T/MIG_C <0.80; [2]1-Hit Rule: Statistical Significance and MIG_T/MIG_C <0.80 and MIG_T/MIG_R <0.70; MIG_T = Treatment Mean Individual Growth; MIG_R = Reference Mean Individual Growth; MIG_C = Control Mean Individual Growth

Table 8. Larval Development Comparison for *Mytilus galloprovincialis*

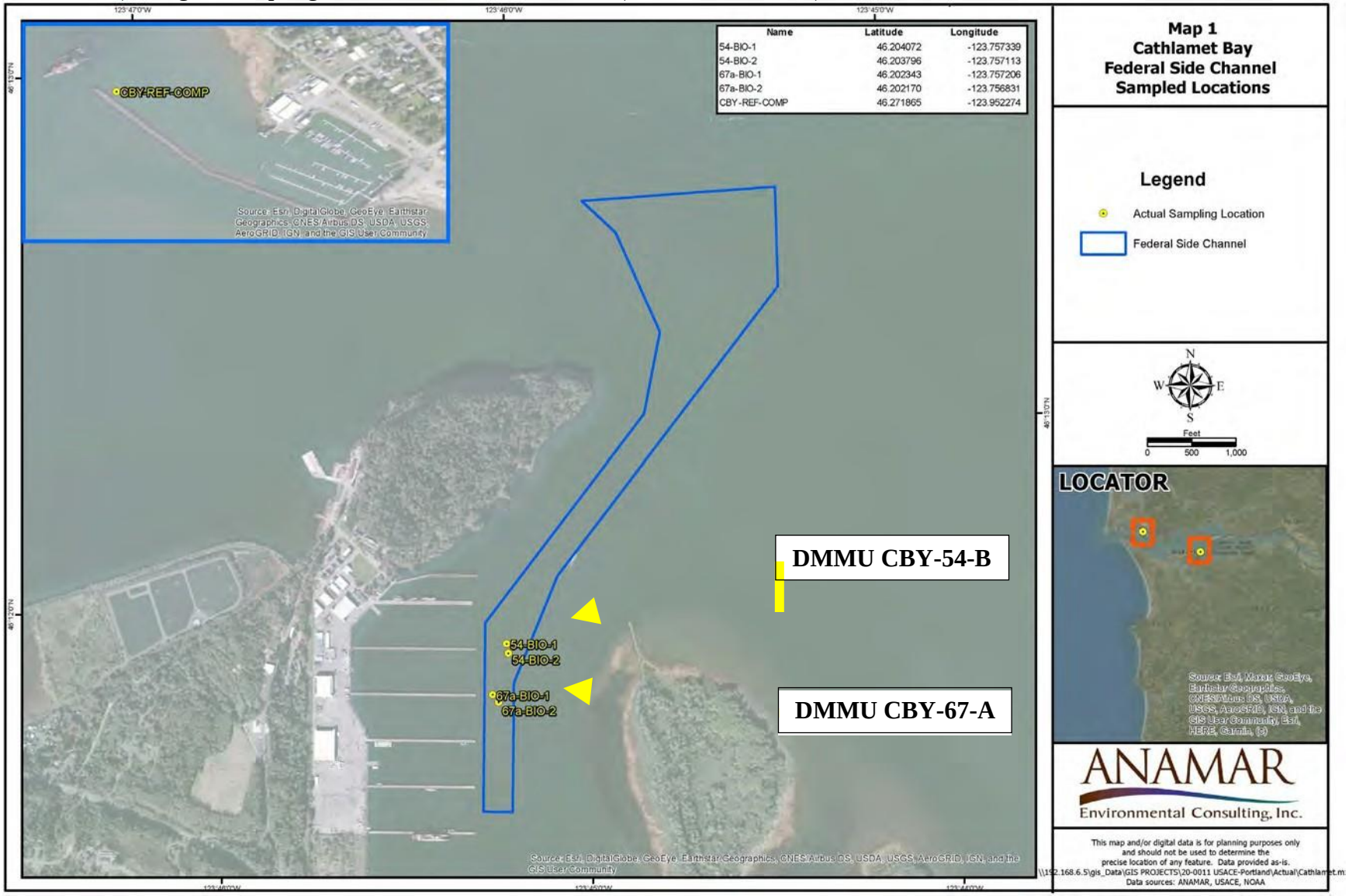
Treatment	Mean Number Normal	Statistically Less than Reference? (p=0.10)	Normal Survival to Seawater Control N_T/N_C	N_R/N_C - N_T/N_C	Fails 2-Hit?[1]	Fails 1-Hit?[2]
Seawater Control	244.6					
Sediment Control	252.0					
200910-CBY-REF-Comp	252.6					
200910-CBY-54-B-BIO-Comp	235.0	Yes	0.96	0.07	No	No
200910-CBY-67-A-BIO-Comp	226.0	Yes	0.92	0.11	No	No

[1]2-Hit Rule: Statistical Significance and (N_T/N_C) <0.80; [2]1-Hit Rule: Statistical Significance and (N_T/N_C) <0.80 and N_R/N_C - N_T/N_C > 0.15; N_T =Treatment Mean Number Normal; N_R =Reference Mean Number Normal; N_C =Control Mean Number Normal

PSET Suitability Determination:
Based on both 1-hit and 2-hit rules for dispersive disposal site criteria, both DMMU CBY-54-B and DMMU CBY-67-A pass all marine bioassay tests. Therefore, **dredged materials** from **DMMUs CBY-54-B** and **CBY-67-A** are **suitable for unconfined, aquatic disposal** per the 2018 SEF.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Figure 1. Cathlamet Bay Federal Navigation Channel, actual core sampling stations for DMMUs CBY-54-B and CBY-67-A (near Astoria, OR) and grab sampling stations for the reference site (near Chinook, WA).



CENWP-EC-HR March 5, 2014

Memorandum for: Portland District, Waterways Maintenance, (CENWP-OD-NW, Stokke)

Subject: Portland Sediment Evaluation Team (PSET) Level 2 dredged material suitability determination for maintenance dredging at the Wahkiakum Ferry and Westport Slough side channel projects.

Reviewers: The PSET includes the U.S. Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). The reviewers for this project included James McMillan and James Holm (Corps), Laura Inouye (Ecology), Jeff Lockwood (NMFS), Jeremy Buck (USFWS), Pete Anderson (ODEQ), and Jonathan Freedman and Bridgette Lohrman (EPA).

The PSET reviewed the Portland District (District) Sediment Quality Team's February 3, 2014 "Wahkiakum Ferry Channel Realignment – Westport Slough Dredging Project, Sediment Quality Evaluation Report" (SQER). This technical memorandum documents the consensus of the reviewing agencies regarding the suitability of sediments at the Wahkiakum Ferry and Westport Slough side channels for unconfined, aquatic placement. Sediment quality data collected from these side channel projects was evaluated using guidance found in the 2009 *Sediment Evaluation Framework for the Pacific Northwest* (SEF).

Applicable Authorities Governing the Project: Congressional authorization under the Rivers and Harbors Act of 1937; sections 401 and 404 of the Clean Water Act; section 7 of the Endangered Species Act; section 305 of the Magnuson-Stevens Act; et al.

Project Description: The Lower Columbia River (LCR) deep draft navigation channel bisects the Wahkiakum Ferry channel into two side channel projects: the Westport Slough side channel (Oregon) and Wahkiakum Ferry side channel (Washington). These side channel projects are located at Columbia River mile (RM) 43.5. Side channel project figures appear in the SQER.

Wahkiakum Ferry Side Channel. The existing Wahkiakum Ferry side channel project is currently maintained for ferry traffic only, and provides for a channel 9 ft. deep, 200 ft. wide, and 1,900 ft. long, with a 100-ft. over-width on each side of the channel. The Corps performs advanced maintenance dredging on the project to -11 ft. Columbia River Datum (CRD); the project was last dredged in 2010 and the sediment was placed in the Columbia River flow lane. The Corps proposes to widen and realign the Puget Island segment of the ferry channel; the channel centerline would be shifted upstream and the channel will be widened from 200 to 300 ft. and shifted upstream. The downstream channel boundary would shift upstream approximately 70 ft. while the upstream channel boundary would shift upstream approximately 170 ft. The 100-ft. over-width will shift upstream as well. The Wahkiakum Ferry side channel depth would remain the same (-11 ft. CRD). The new area to be dredged is approximately 300 ft. by 400 ft., and the

total volume of sediment to be dredged is estimated between 22,000 and 33,000 cubic yards (CY).

Westport Slough Side Channel. The Westport Slough side channel project was authorized by Congress for a channel 28 ft. deep, 200 ft. wide, and 1,600 ft. long, with a 100-ft. over-width on each side of the channel. A single user may ultimately need the channel maintained to -22 ft. CRD, but funding has not been available for the Corps to maintain the channel to that depth. However, the Corps currently maintains the Westport Slough side channel to -11 ft. CRD for the ferry. The project was last maintained to -11 ft. CRD in 2010 and the sediment was placed in the Columbia River flow lane. The area to be dredged (to -11 ft. CRD) is approximately 200 ft. by 500 ft., and the total volume to be dredged is estimated between 30,000 and 40,000 CY. The estimated volume of sediment to be dredged for the -22 ft. CRD project would be 75,000 to 100,000 CY.

Dredging Methods: Both side channel projects will be dredged with a clamshell dredge.

Dredged Material Transport and Placement: A tug and bottom dumping scow are typically used to transport the dredged material. Dredged material will be placed near the Wahkiakum Ferry channel in the Columbia River flow lane.

Site History and Management Area Ranking: Based on prior sediment characterization, sediment grades from coarse-grained material in the LCR federal navigation channel to fine-grained material in the Westport Slough side channel. The Wahkiakum Ferry side channel is composed of coarse-grained material. There are no known sources of contamination in the project area or immediately upstream of the ferry. Georgia Pacific (formerly James River paper mill) is located at Wauna, Clatsop County, Oregon, approximately 2 miles downstream. Sediments in both side channel projects have been characterized multiple times. Sediment concentrations of metals, semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) have never exceeded the SEF freshwater benthic toxicity screening levels (SLs). Based on the previous testing, SVOC analysis was not included in the CoC list for this round of testing.

Management Area Ranking: The PSET has assigned a “very low” management area ranking to the Wahkiakum Ferry side channel. The Wahkiakum Ferry side channel sediments must be re-characterized 10 years from the sampling date, by September 2023. A “low” management area ranking is assigned to the Westport Slough side channel project. The Westport Slough side channel sediments must be re-characterized 7 years from the sampling date, by September 2020.

Sampling and Analysis Description: The Wahkiakum Ferry federal project was sampled on September 26, 2013; samples were collected with a petite ponar grab sampler. Sample stations appear in Figures 3 and 4 of the SQER; the grab sample log form appears in Attachment A of the SQER. The laboratory chain of custody form appears in Attachment B of the SQER.

Wahkiakum Ferry Side Channel. Three dredge prism subsamples were collected at the Wahkiakum Ferry dredged material management unit (DMMU) to form one composite sample (092613CRWF-COMP-1). Although metals were not originally proposed for analysis, the District instructed the contract laboratory to analyze the Wahkiakum Ferry composite sample for total solids, total organic carbon, grain size, and metals.

Westport Slough Side Channel. The Westport Slough side channel was split into two DMMUs that were defined by depth. Sample 092613CRWS-COMP-1 was composited from four grabs to characterize material above -11 ft. CRD (the typical maintenance depth). Sample 092613CRWS-COMP-2 was composited from four grabs to characterize material from -11 ft. to -22 ft. CRD (the depth that would be required for ocean-going barges that could potentially use the channel in the future). The District instructed the contract laboratory to analyze the Westport Slough composite samples for total solids, total organic carbon (TOC), grain size, metals, pesticides, PCBs, and total petroleum hydrocarbons.

Results: Sediment chemical results appear in Table 2 of the SQER. The District compared bulk sediment concentrations to the 2006 SEF freshwater SLs.

Wahkiakum Ferry Side Channel. The Wahkiakum Ferry shoal is composed of 96.2% sand and 3.5% fines (silt + clay); the TOC content of the shoal material is 0.768%. Antimony, mercury, and silver were not detected in sample 092613CRWF-COMP-1. Concentrations of detected metals were below the respective SLs.

Westport Slough Side Channel. The Westport Slough material is composed of an average of 83.1% sand and 15.2% fines; the TOC content is 0.698%. Antimony, mercury, and silver were not detected in either of the composite samples (092613CRWS-COMP-1, 092613CRWS-COMP-2). Concentrations of detected metals were below the respective SLs in both samples. Pesticides and PCBs were not detected in either sample. Diesel-range organics ranged from 7.8 to 35 mg/kg. Lube oil was only detected in the deep composite sample (092613CRWS-COMP-2; -11 to -22 ft. CRD) at 130 mg/kg; it was not detected in 092613CRWS-COMP-1.

Suitability Determination: The PSET's suitability determination is based on comparison of the District's sediment quality data to the 2006 SEF freshwater SLs.

Wahkiakum Ferry Side Channel. Material in the current and realigned Wahkiakum Ferry side channel configurations is suitable for unconfined, aquatic placement. The PSET assumes that the quality of sediments exposed after dredging will be similar to the dredge prism material.

Westport Slough Side Channel. Material in the Westport Slough side channel project is suitable for unconfined, aquatic placement. Materials from the mudline to -11 ft. CRD and from -11 ft. to -22 ft. CRD may be placed in the Columbia River flow lane. The PSET assumes that the quality of sediments exposed after dredging will be similar to the dredge prism material.

Contact: This memorandum was prepared by James McMillan, and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to James McMillan (Lead – Portland Sediment Evaluation Team) at (503) 808-4376 or e-mail to: james.m.mcmillan@usace.army.mil.

References:

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2009. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2009, by the U.S. Army Corps of Engineers, Northwestern Division, 128 p. plus Appendices.

U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2006. Interim Final *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2009, by the U.S. Army Corps of Engineers, Northwestern Division, 194 p. plus Appendices.

U. S. Army Corps of Engineers. 2014. Wahkiakum Ferry Channel Realignment – Westport Slough Dredging Project, Sediment Quality Evaluation Report. February 3, 2014; *prepared by* Portland District – Sediment Quality Team; 12 p. plus figures and attachments.

EPA-Region 10 Water Division, Wetlands and Oceans Section 08 September 2021

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Downstream Shallow Draft Federal Navigation Channel (miles 1.5 to 3.8) in Portland, Multnomah County, Oregon.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (USACE) operations and maintenance (O&M) dredging for the Oregon Slough Downstream (OSD) Shallow Draft Federal Navigation Channel (FNC) in the Columbia River at river mile (RM) 101.4 to 104.6 (project mile 1.5 to 3.8).

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the OSD shallow draft FNC dredged material for unconfined, aquatic disposal and suitability of the post-dredge surface for unconfined, aquatic exposure. The PSET reviewed the December 2020 "*Sediment Characterization: Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon*" (2020 SQER)[2] and the August 2021 "*Supplemental Sediment Characterization: Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon*" (2021 SQER)[3], prepared by ANAMAR for the USACE's Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs and dioxins and furans[4].

Suitability Summary:

Dredge Prism (DP) Sediments:	☒Suitable	☐Unsuitable
Post-Dredge Surface (PDS):	☒Suitable	☐Unsuitable

Reviewers: The PSET agencies include the USACE, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers (USACE) – Portland District. 2020. *Sediment Characterization Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon*. Prepared by ANAMAR, December 2020. 25 pp with Maps, Tables, and Appendices.

[3] USACE – Portland District. 2021. *Supplemental Sediment Characterization Oregon Slough Downstream Shallow Draft Channel (Miles 1.5 to 3.8), Multnomah County, Oregon*. Prepared by ANAMAR, August 2021. 27 pp with Maps, Tables, and Appendices

[4] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

☒ James Holm (USACE, Lead) ☒ Bridgette Lohrman (EPA, Co-Lead)
☒ Pete Anderson (ODEQ) ☒ Laura Inouye (Ecology)
☒ Dominic Yballe (USACE) ☒ Tom Hausmann (NMFS)
☒ Jeremy Buck (USFWS)

PSET/SEF Conditions:

☒ Data Recency Expiration – Based on a "Low" rank, the data recency for sediments in the Oregon Slough Downstream Shallow Draft Federal Navigation Channel expires in May 2028.

Table 1. Review Timeline

Draft Sampling and analysis plan (SAP) submitted to PSET	1 September 2020
SAP revisions requested by PSET	4 September 2020
Revised SAP[5] submitted	5 September 2020
Revised SAP approved by PSET[6]	10 September 2020
Sampling date(s)	11-13 September 2020
Draft SQER submitted to PSET	11 December 2020
Sonic drill sampling concept submitted to PSET	19 January 2021
Supplemental SAP submitted to PSET[7]	29 January 2021
Supplemental SAP approved by PSET[8]	25 February 2021
Sonic drill sampling date(s)	10-12 May 2021
Supplemental SQER submitted to PSET	24 August 2021
Suitability Determination Memorandum (SDM) issued by PSET	08 September 2021
Management area ranking	Low
Recency of data	May 2028 (7 years)

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the OSD shallow draft FNC. Maintenance dredging is needed to provide navigation access.

[5] USACE – Portland District. 2020. *Oregon Slough Downstream Shallow Draft Channel (mile 1.5 to 3.8) Multnomah County, Oregon, Sediment Sampling and Analysis Plan (v2.1).* Prepared by SQT, 5 September 2020. 29 pp with Attachment.
[6] Portland Sediment Evaluation Team (PSET). 2020. *Oregon Slough Downstream FNC – SAP Approval.* Email issued by B. Lohrman (EPA) for PSET, 10 September 2020. 3 pp with Attachment.
[7] USACE – Portland District. 2021. *Supplemental Sampling and Analysis Plan (SSAP) for Level 2A and contingency sediment characterization and sampling with a sonic drill at the Oregon Slough Downstream, Shallow Draft Federal Navigation Channel.* Prepared by SQT, 29 January 2021. 6 pp.
[8] PSET. 2021. *PSET - Oregon Slough Downstream FNC (SSAP Approval).* Email issued by B. Lohrman (EPA) for PSET, 25 February 2021. 2 pp with Attachment.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 101.4 to 104.6
Total proposed dredging volume (cy)	~425,000
Max. proposed dredging depth (includes overdepth allowance)	-22 feet CRD (20+2 ft overdredge)
Dredging area (acres, approx.)	~55
Dredge dimensions	~200 ft. wide for 2.3 miles
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	August 1 through December 15
Dredged material mgmt. units (DMMUs)	11

Sampling and Analysis Description: The USACE sampling and analytical program for the OSD FNC is summarized in Table 3. Actual grab sample station locations are shown in the 2020 SQER Table 1A and Map 1 (SDM Figure 1). Based on the inability to collect deeper-dredge prism material, a SSAP was prepared, approved by PSET, and implemented by the USACE. The USACE' significantly modified their sampling approach by using a sonic core sample to penetrate deeper through the dredge prism and into the post-dredge surface. The PSET agreed to the USACE' approach of considering the grab samples to represent the top 4-feet of dredge prism material because of the likelihood of those materials being more recently deposited coarse Columbia River sand. Actual sonic core sample station locations are shown in the 2021 SQER Table 1C and Map 1 (SDM Figure 2). The conceptual DMMU layout is shown in Figure 2 of the PSET-approved SSAP (SDM Figure 3).

Deviations from the SAP: Deviations from the PSET-approved SAP are identified in the 2020 SQER sections 2.1.1, 2.2.2, and 2.2.3 and are noted in SQER Tables 1A (grab sample summary) and 1B (core sample summary).

1. Core sampling with a standard vibracore sample and core catcher was not possible due to the presence of unconsolidated, coarse sand and gravel in the upper 6 to 9 feet of the dredge prism. Coarse sediments resulted in core refusals above project depth (-24 ft CRD) or core recoveries of 0 to 16%. After many coring attempts across the project and coordinating with Ecology staff from the field, the USACE switched to a standard Ponar grab sampler to characterize the surface layer DMMUs (OSD-01, OSD-02, OSD-03, OSD-06, OSD-09 and OSD-11) of the project.
2. Due to the coarse character of the surface sediments, the reference site for the contingency bioassays was relocated from Elk Rock Island in the Willamette River (~RM 16) to sandy sediments along Sauvie Island in the Columbia River (~RM 100).

Deviations from the SSAP: Deviations from the PSET-approved SSAP are listed in the 2021 SQER Table 1C for stations OSD-06D, OSD-06E, OSD-09D, and OSD-09E. The deviations included the inability to collect surface material from DMMUs 6 and 9 because the mudline elevation encountered in the field during sampling was deeper than what was encountered in 2020. This deviation did not result in a lack of data collection because the 2020 sampling collected sediment from the shallower depths.

Table 3. Sampling and Analysis Description

Sample collection method		Standard Ponar (†) or Sonic Drill (‡)					
DP sample IDs / DMMU IDs (DP interval in ft CRD)		OSD-01† (mudline to -22 ft)	OSD-02† (mudline to -22 ft)	OSD-03† (mudline to -14 ft) OSD-04r‡ (-14 to -18 ft) OSD-05r‡ (-18 to -22 ft)	OSD-06† (mudline to -14 ft) OSD-07r‡ (-14 to -18 ft) OSD-08r‡ (-18 to -22 ft)	OSD-09† (mudline to -18 ft) OSD-10r‡ (-18 to -22 ft)	OSD-11† (mudline to -22 ft)
PDS sample IDs (-22 to -24 ft CRD)		OSD-01Z‡	OSD-02Z‡	OSD-03Z‡	OSD-06Z‡	OSD-09Z‡	OSD-11Z‡
DMMU volume (CY)		~45,000	~45,000	~35,000 to ~40,000	~35,000 to ~40,000	~40,000	~25,000
Dredge Prism	Mudline range (ft CRD)	-15.5 to -17.3†	-14.5 to -18.3†	-11.0 to -12.5†	-7.8 to -9.8†	-10.9 to -14.4†	-19.1 to -21.4†
	Composite (Y/N)	Y	Y	Y	Y	Y	Y
	Subsample /DMMU	3	3	3 / 2r	3 / 2r	3 / 2r	3
	Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
PDS Layer	Depth range (ft CRD)	-22 to -24‡	-22 to -24‡	-22 to -24‡	-22 to -24‡	-22 to -24‡	-22 to -24‡
	Composite (Y/N)	Y	Y	Y	Y	Y	Y
	Subsample /PDS-layer	2r	2r	2r	2r	2r	2r
	Subsample Archive (Y/N)	Y	Y	Y	Y	Y	Y
Sediment Physical and Chemical Analysis (No. DP samples / No. PDS samples analyzed)							
Grain size		1/1	1/1	3/1	3/1	2/1	1/1
Total organic carbon		1/1	1/1	3/1	3/1	2/1	1/1
Total solids		1/1	1/1	3/1	3/1	2/1	1/1
Ammonia		1/1	1/1	3/1	3/1	2/1	1/1
Total sulfides		1/1^	1/1^	3/1^	3/1^	2/1^	1/1^
Metals, freshwater		1/1	1/1	3/1	3/1	2/1	1/1
PAHs		1/1	1/1	3/1	3/1	2/1	1/1
SVOCs (phthalates, phenols, misc. extractables)		1/1	1/1	3/1	3/1	2/1	1/1
Pesticides		1/1	1/1	3/1	3/1	2/1	1/1
PCBs (Total Aroclors)		1/1	1/1	3/1	3/1	2/1	1/1
Butyltins		1/1	1/1	3/1	3/1	2/1	1/1
TPH (diesel [dx] and residual [rx] range)		1/1	1/1	3/1	3/1	2/1	1/1
Dioxin/Furans		1/1	1/1	3/1	3/1	2/1	1/1
Contingency Biological Analysis – dredge prism only, three DMMUs maximum							
Freshwater Bioassays		1*	1*	3*	3*	2*	1*

† = Ponar grab samples; ‡ = sonic drill core samples; ^ = sulfides analysis removed by USACE since no biological test are needed on the PDS; * = contingency bioassays not required based on sediment chemistry.

Total sulfides were removed from analysis by the USACE on the six Z-layer composite samples because biological tests are not necessary on the post-dredge surface and the overlying DMMUs were analyzed for sulfides. Only one of the 11 overlying DMMUs detected elevated sulfides (39.1 mg/kg, DMMU OSD-5r) above the SEF freshwater SL (39 mg/kg).

Results and Discussion: Analytical results for the USACE sampling event are summarized in Tables 5a (dredge prism) and 5b (post-dredge surface). The chemical analytical results from both SQERs were compared to the 2018 SEF freshwater SLs and to ODEQ's freshwater fish-based SLV (22 ug/kg) to evaluate PCBs (total aroclors) and SLV (5.6 ng/kg) for dioxins and furans.

Total sulfides in DMMU OSD-05r (39.1 mg/kg) was the only DMMU or post-dredge surface sample with an analyte detected above an SEF SL (39 mg/kg). All other analytes were detected below SEF freshwater SLs or were non-detections (U) with method reporting limits (MRLs) below SLs. Sulfides are generally used to inform bioassay testing for potential non-treatment effects. When total sulfides are the sole parameter detected above an SEF SL, the PSET may determine sediments are suitable for unconfined, aquatic disposal and exposure.

Except for DMMU OSD-05r, all dredge prism samples (Table 5a) consisted of at least 91% sand with a total organic carbon (TOC) of 0.1% or less. DMMU OSD-05r was 67% sand, 26% silt, and 6% clay with a TOC of 0.3%.

Except for samples OSD-03Z and OSD-09Z, all post-dredge surface samples (Table 5b) consisted of at least 80% sand with a TOC of less than 0.19%. OSD-03Z consisted of 38% sand, 51% silt, and 11% clay with a TOC of 0.89%. OSD-09Z consisted of 3% gravel, 72% sand, 22% silt, and 3% clay with a TOC of 0.9%. DMMU OSD-05r is directly on top of OSD-3Z layer.

There were no exceedances of ODEQ's bioaccumulative SLV for PCBs because all samples were non-detections (U) with an MRL (4.0 ug/kg) below the SLV (22 ug/kg). There were no exceedances of ODEQ's bioaccumulative SLV for dioxins and furans because all samples had 2,3,7,8 TCDD TEQ results below the SLV (5.6 ng/kg).

No other parameters had detections, estimated concentrations (J) or non-detections (U) with elevated MRLs above an SEF freshwater SLs or an ODEQ SLVs.

Site Ranking: The sampling design was based upon a "moderate" rank due to the lack of dredging and agency concerns about CoCs at depth. Based on the dredge prism and post-dredge surface results and similar physical characteristics to surrounding projects, the PSET has assigned a "low" rank to the OSD shallow-draft sediments.

PSET Suitability Determination:
Dredge Prism – Chemical concentrations in OSD dredge prisms are below the SEF freshwater SLs and ODEQ SLVs as discussed above. As such, the **OSD shallow draft FNC dredged prism material** is **suitable for unconfined, aquatic disposal** per the 2018 SEF guidance without additional testing.

Post-Dredge Surface – Chemical concentrations in OSD post-dredge surface samples are below the SEF freshwater SLs and ODEQ SLVs as discussed above. As such, the **OSD shallow draft FNC post-dredge surfaces** are **suitable for unconfined, aquatic exposure** per the 2018 SEF guidance without additional testing.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, USACE) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Table 5a. Project Sediment Analytical Summary – Dredge Prism (sampled September 2020 and May 2021)

Sediment Physical and Chemical Results							
Sample Location (sample year)	Surface (2020)	Subsurface (2021)					**SEF SL1, freshwater (SLV†)**
DMMU ID / Sample ID: Parameter	OSD-01, OSD-02, OSD-03, OSD-06, OSD-09, OSD-11	OSD-04r	OSD-05r	OSD-07r	OSD-08r	OSD-10r	
Grain size: gravel, sand, silt, clay (%)	Range: 2.8 to 8.2, 91.4 to 94.2, 0.6 to 4.5, 0.3 to 0.4	1.0, 95.7, 3.5, 0.3	0.5, 67.0, 26.3, 6.2	3.1, 95.1, 1.7, 0.1	1.5, 95.3, 3.0, 0.2	6.6, 92.7, 0.8, 0.1	--
Total Solids (%)	Range: 76.1 to 88.2	79.0	74.55	80.62	84.30	79.78	--
Total Organic Carbon (%)	Range: 0.04 to 0.1	0.05	0.30	0.06	0.05	0.05	--
Ammonia (mg/kg)	Range: 0.45 U to 0.52 U	22.0	52.5	8.58	7.01	3.19	230
Total Sulfides (mg/kg)	Range: 1.13 U to 1.26 U	Range: 1.16 U to 1.26 U	Range: 1.21 U to **39.1**	Range: 1.21 U to 1.24 U	Range: 1.23 U to 1.25 U	Range: 1.17 U to 1.20 U	39
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Detect <SLs J	Non-detect, Detect <SLs U, J	Detect <SLs J	Non-detect, Detect <SLs U, J	Varies
Total PAHs (ug/kg)	Range: 4.8 J to 39.8 U Non-detect, Detect <SL	39.9 U	62.7	39.9 U	40.0 U	40.0 U	17,000
SVOCs (ug/kg) (phenols, phthalates, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
4,4'-DDD	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	310
4,4'-DDE							21
4,4'-DDT							100
PCBs, Total Aroclors (ug/kg)	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	110 (22†)
Butyltins (ug/kg)	3.69 U to 5.73 U Non-detect <SLs U	3.84 U to 5.74 U Non-detect <SLs U	3.83 U to 5.74 U Non-detect <SLs U	3.83 U to 5.73 U Non-detect <SLs U	3.86 U to 5.78 U Non-detect <SLs U	3.86 U to 5.78 U Non-detect <SLs U	Varies
TPH (dx/rx) (ug/kg)	Range: 5.55 U to 6.9 / 11.1 U to 37.8	6.05 U / 12.1 U	6.47 U / 17.3	6.10 U / 12.2 U	5.94 U / 11.9 U	6.08 U / 12.2 U	340 / 3,600
Dioxins/Furans, 2,3,7,8 TCDD TEQ (ng/kg) ND=0 / ND = ½ EDL	Range: 0.0056 to 0.0268 / 0.0666 to 0.1030	0.0183 / 0.1620	0.0118 / 0.1470	0.0593 / 0.1840	0.0240 / 0.1920	0.0154 / 0.1620	(5.6†)

BOLD = Detection exceeds SEF freshwater screening level; U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (MDL in parenthesis); J = Estimated value between MDL and MRL; † = ODEQ (2007) freshwater fish-based bioaccumulation screening level value.

Table 5b. Project Sediment Analytical Summary – Post-Dredge Surface (sampled May 2021)

Sediment Physical and Chemical Results							
PDS Sample ID: Parameter	OSD-01Z	OSD-02Z	OSD-03Z	OSD-06Z	OSD-09Z	OSD-11Z	**SEF SL1, freshwater (SLV†)**
Grain size: gravel, sand, silt, clay (%)	0.4, 95.6, 4.0, 0.1	0.5, 92.5, 7.0, 0.1	0.3, 38.1, 50.8, 10.6	1.0, 86.6, 11.0, 1.5	3.2, 71.9, 21.8, 3.1	2.4, 80.0, 16.1, 1.5	--
Total Solids (%)	76.1	75.4	68.7	82.0	74.5	74.7	--
Total Organic Carbon (%)	0.06	0.06	0.89	0.08	0.90	0.19	--
Ammonia (mg/kg)	28.4	20.6	169	31.5	29.5	18.6	230
Total Sulfides (mg/kg)	--	--	--	--	--	--	39
Metals (mg/kg)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Detect <SLs J	Detect <SLs J	Detect <SLs J	Detect <SLs J	Varies
Total PAHs (ug/kg)	40.0 U	39.9 U	39.9 U	20.4	66.6 J	39.8 U	17,000
SVOCs (ug/kg) (phenols, phthalates, misc. extractables)	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Non-detect, Detect <SLs U, J	Varies
Pesticides (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Varies
4,4'-DDD	1.0 U	1.0 U	1.0 U	1.0 U	1.15 J	1.0 U	310
4,4'-DDE					0.36 J		21
4,4'-DDT					1.0 U		100
PCBs, Total Aroclors (ug/kg)	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	4.0 U	110 (22†)
Butyltins (ug/kg)	Non-detect <SLs U	Non-detect <SLs U	Non-detect <SLs U	Non-detect, Detect <SLs U	Non-detect, Detect <SLs U	Non-detect <SLs U	Varies
TPH (dx/rx) (ug/kg)	6.71 U / 13.4 U	6.68 U / 13.4 U	11.9 / 40.5	6.09 U / 12.2 U	6.92 U / 20.8	6.82 U / 13.6 U	340 / 3,600
Dioxins/Furans, 2,3,7,8 TCDD TEQ (ng/kg) ND=0 / ND = ½ EDL	0.0304 / 0.1790	0.0124 / 0.1240	0.0289 / 0.1510	0.0304 / 0.1980	2.68 / 2.78	0.0216 / 0.1850	(5.6†)

BOLD = Detection exceeds SEF freshwater screening level; U = Non-detection (ND) at the method reporting limit (MRL) or method detection limit (MDL), MRL reported (MDL in parenthesis); J = Estimated value between MDL and MRL; † = ODEQ (2007) freshwater fish-based bioaccumulation screening level value.

Figure 1. Oregon Slough Downstream shallow draft Federal Navigation Channel, actual grab sample locations (sampled 11-13 September 2020).

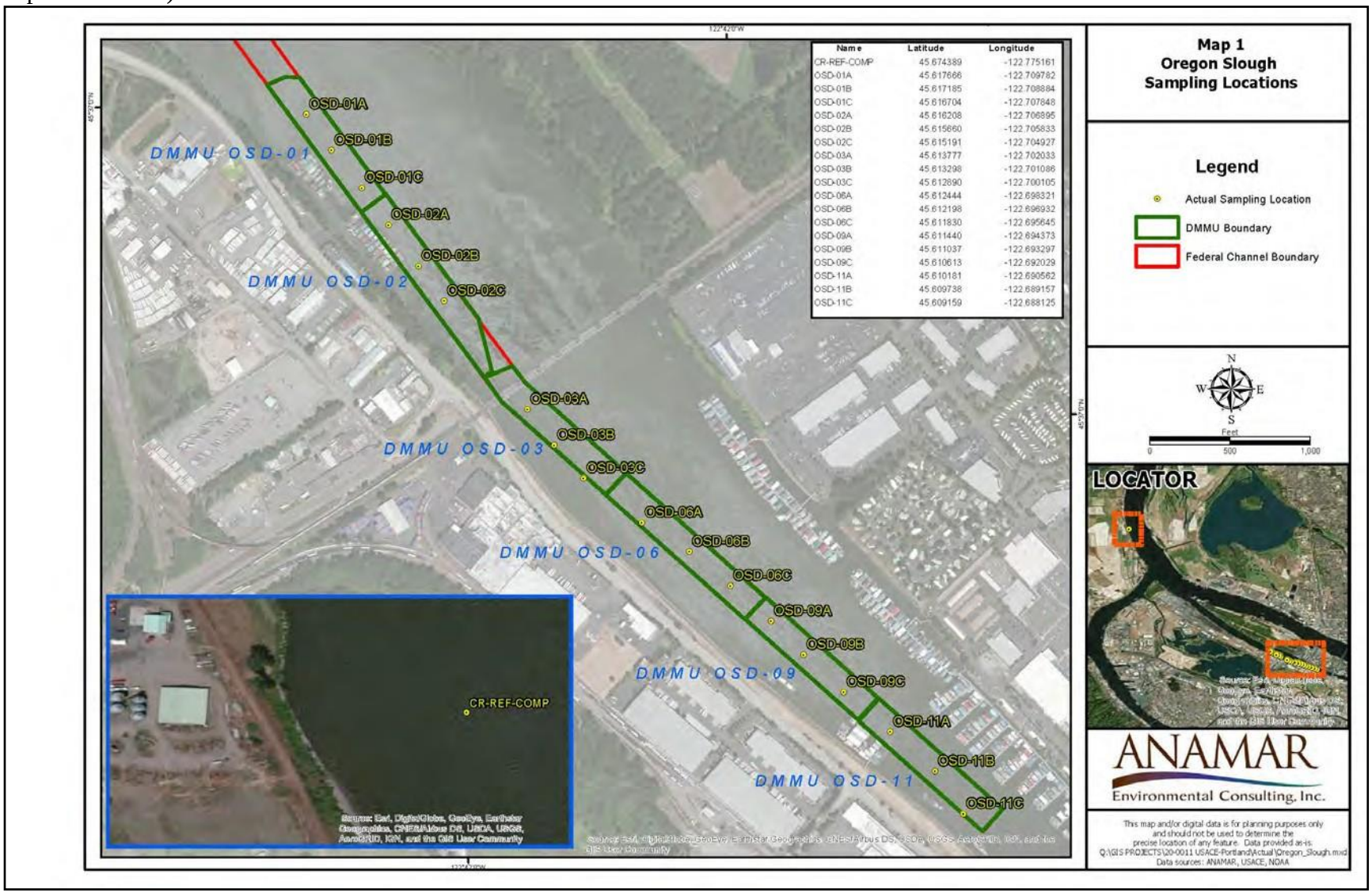


Figure 2. Oregon Slough Downstream shallow draft Federal Navigation Channel, actual sonic drill sample locations (sampled 10-12 May 2021).

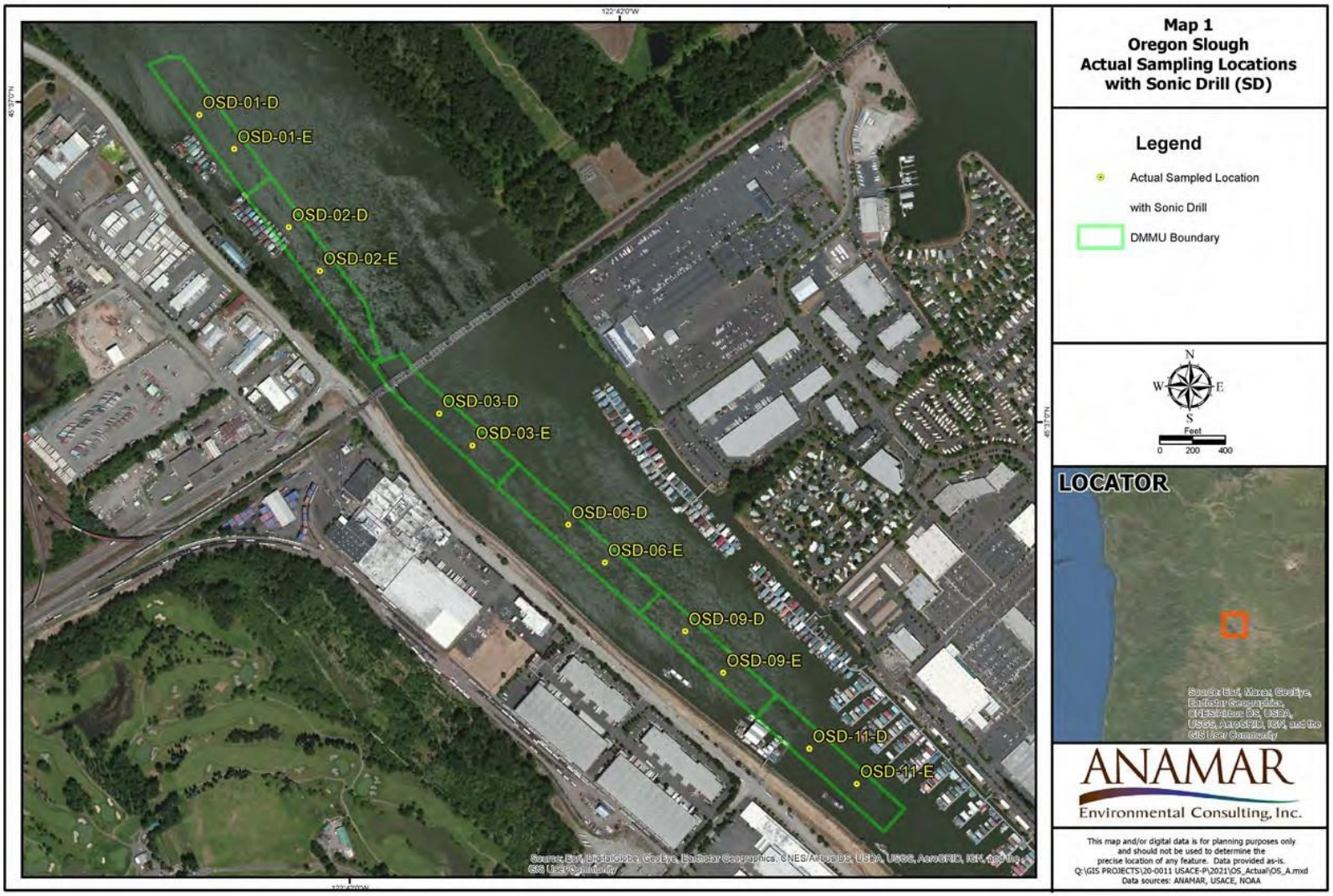
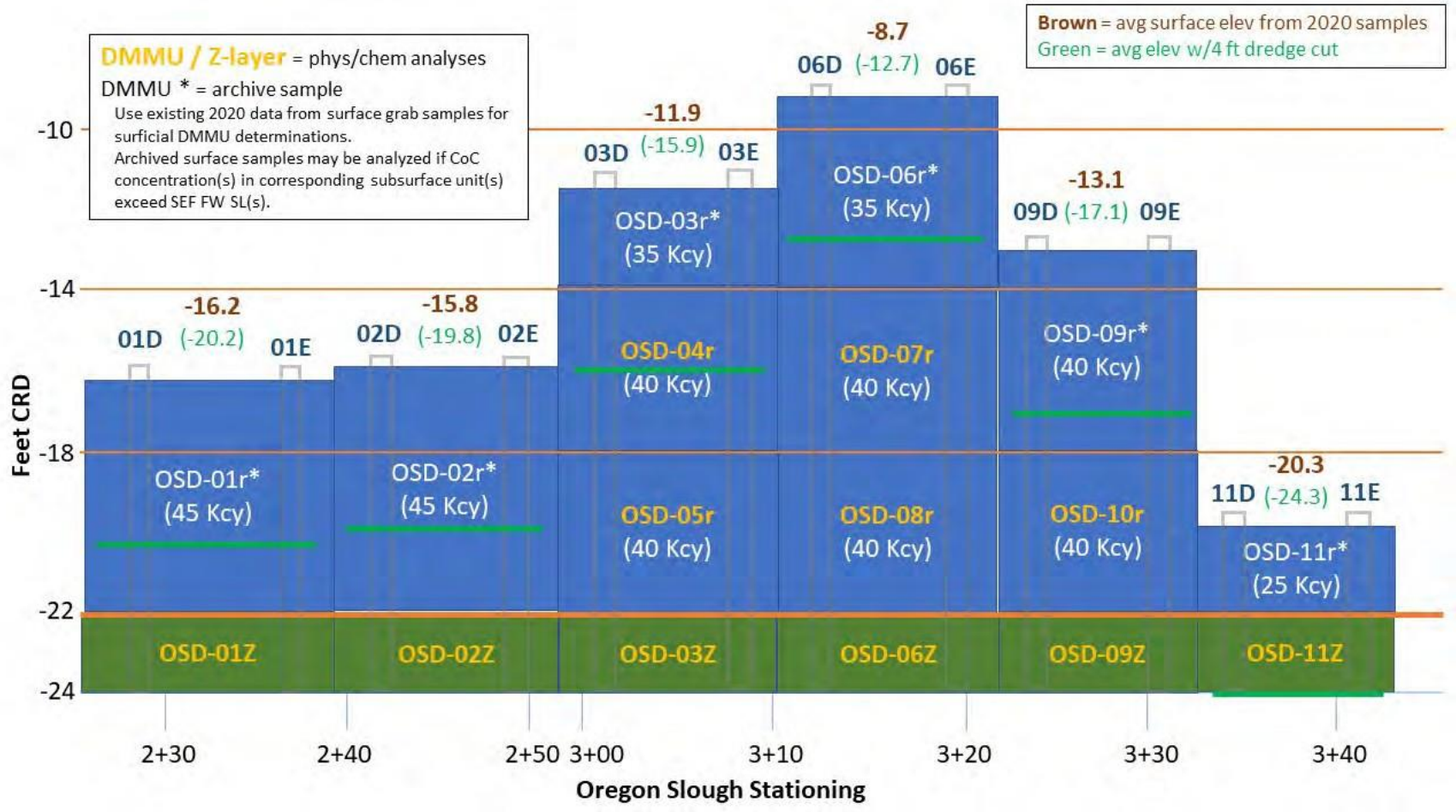


Figure 3. Oregon Slough Downstream shallow draft conceptual DMMU and Z-layer diagram (USACE SSAP, 2021).



EPA-Region 10 Water Division, Wetlands and Oceans Section 1 August 2019

Memorandum for: U.S. Army Corps of Engineers – Portland District, Operations Division, Channels and Harbors, Waterways Maintenance Section (CENWP-ODN-W, Stokke), Oregon Slough Federal Navigation Side Channel, Upstream Entrance.

Subject: Portland Sediment Evaluation Team (PSET) Level 2A dredged material suitability determination for the U.S. Army Corps of Engineers - Portland District's (Corps) operations and maintenance (O&M) dredging for the Oregon Slough Federal Navigation Side Channel, Upstream Entrance (OSU FNC) in the Columbia River at river mile (RM) 108.

Introduction: Per the May 2018 *Sediment Evaluation Framework for the Pacific Northwest* (SEF)[1], this suitability memorandum (SDM) documents the consensus of the PSET agencies regarding the suitability of the dredged material for unconfined, aquatic disposal. The PSET reviewed the Corps' 18 July 2019 "*Oregon Slough Upstream Federal Navigation Side Channel, Sediment Quality Evaluation Report*" (SQER)[2], prepared by Corps' Sediment Quality Team (SQT). Sediment chemical testing results are summarized in the SQER; chemical analytical results were compared to the freshwater benthic toxicity screening levels (SEF SLs) published in the 2018 SEF. The PSET also used Oregon DEQ's sediment screening level value (SLV) for freshwater fish to evaluate PCBs[3].

Suitability Summary:

Surface Sediments:	☒ Suitable	☐ Unsuitable
Post-Dredge Surface (PDS):	☒ Suitable	☐ Unsuitable

Reviewers: The PSET agencies include the Corps, U.S. Environmental Protection Agency – Region 10 (EPA), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife (USFWS), Washington Department of Ecology (Ecology), and Oregon Department of Environmental Quality (ODEQ). Table 1 lists the PSET's review timeline for this project. Reviewers included:

☒ James Holm (Corps, Lead)	☒ Bridgette Lohrman (EPA, Co-Lead)	
☒ Pete Anderson (ODEQ)	☒ Laura Inouye (Ecology)	☒ Dominic Yballe (Corps)
☒ Tom Hausmann (NMFS)	☒ Jeremy Buck (USFWS)	

PSET/SEF Conditions:

☒ Data Recency Expiration – The data recency of this SDM for the OSU FNC expires in April 2026.

[1] U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, Washington Department of Ecology, Washington Department of Natural Resources, Oregon Department of Environmental Quality, Idaho Department of Environmental Quality, National Marine Fisheries Service, and U.S. Fish and Wildlife Service. 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Published May 2018, by the U.S. Army Corps of Engineers, Northwestern Division, 183 pp with Appendices.

[2] U.S. Army Corps of Engineers – Portland District. 2019. *Oregon Slough Upstream Federal Navigation Side Channel; Multnomah County, Oregon; Columbia River (River Mile 108); Sediment Quality Evaluation Report*. Prepared by the Corps SQT, 18 July 2019. 14 pp plus Attachments.

[3] Oregon Department of Environmental Quality. 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Updated April 3, 2007 by ODEQ Environmental Cleanup Program, 18 pp with Appendices.

Table 1. Review Timeline

Sampling and analysis plan (SAP) submitted to PSET	12 February 2019
SAP revisions requested by PSET (verbal)	13 February 2019
Revised SAP submitted	22 February 2019
Final SAP[4] submitted	11 March 2019
Final SAP approved by PSET	26 March 2019[5]
Sampling date(s)	5 April 2019
Draft SQER submitted to PSET	18 July 2019
Final SQER	18 July 2019
Suitability Determination Memorandum (SDM) issued by PSET	01 August 2019
Management area ranking	Low
Recency of data*	April 2026 (7 years)

Federal Regulatory Authorities:

☒ Section 10, Rivers and Harbors Act
☒ Section 404, Clean Water Act (CWA)
☒ Section 401, CWA
☒ Section 7, Endangered Species Act
☒ Section 305 of the Magnuson-Stevens Act
☒ Fish and Wildlife Coordination Act
☐ Section 103, Marine Protection, Research and Sanctuaries Act
☐ Comprehensive Environmental Response, Compensation, and Liability Act

Project Description: Table 2 provides a summary of the dredging project details for the OSU FNC. Maintenance dredging is needed to provide navigation access.

Table 2. Project Details

Waterbody/river mile (RM)	Columbia River, 108
Total proposed dredging volume (cy)	~133,000
Max. proposed dredging depth (includes overdepth allowance)	-12 ft. CRD
Dredging area (acres, approx.)	~40
Dredge dimensions	300 ft. wide by 5,800 ft. long
Dredging method	Pipeline, clamshell or hopper dredge
Dredged material transport	Barge, hopper, or pipeline
Proposed disposal location(s)	Columbia River flowlane
Proposed dredging date(s)	Typically August through December
Dredged material mgmt. units (DMMU)	2 (3-station composite samples)

[4] US Army Corps of Engineers. 2019. *Oregon Slough Federal Navigation Channel – Upstream Entrance (Columbia River, River Miles 108-109); Multnomah County, Oregon; Sediment Sampling and Analysis Plan*. Prepared by Corps SQT 11 March 2019. 14 pp with Attachments.
[5] Portland Sediment Evaluation Team (PSET). 2019. [E-mail correspondence] *PSET – Oregon Slough Federal Project (SAP Approval)*. Bridgette Lohrman, EPA, sent 26 March 2019. 2 pp.

Sampling and Analysis Description: The Corps' sampling and analytical program for the OSU FNC is summarized in Table 3. Actual sample station locations are shown in the SQER Table 3 and Figure 1, and SDM Figure 1.

Table 3. Sampling and Analysis Description

Sample collection method		Standard PONAR Grab		
DMMU ID		OSU-01	OSU-02	BOTH
DMMU Rank		Low	Low	Low
DP sample ID		040519-OSU-01-COMP	040519-OSU-02-COMP	040519-OSU-COMP-TIN
PDS sample ID		NA	NA	NA
Proposed DMMU volume (cy)		70,000	63,000	133,000
Dredge Prism	Depth range (ft CRD)	-6.42 to -6.81	-4.75 to -8.23	-4.75 to -8.23
	Composite (Y/N)	Y	Y	Y
	Subsamples (SS)/DMMU	3	3	6
	SS Archive (Y/N)	Y	Y	Y
PDS Layer	Depth range (ft CRD)	N/A		
	Composite (Y/N)			
	SS/PDS-layer			
	SS Archive (Y/N)			
Sediment Physical and Chemical Analysis (No. DP/ No. PDS)				
Grain size		1/-	1/-	-/-
Total organic carbon		1/-	1/-	-/-
Total solids		1/-	1/-	-/-
Total volatile solids		1/-	1/-	-/-
Metals, freshwater		1/-	1/-	-/-
Total PAHs		1/-	1/-	-/-
SVOCs (phthalates, phenols, misc. extractables)		1/-	1/-	-/-
Pesticides		1/-	1/-	-/-
PCBs (Total Aroclors)		1/-	1/-	-/-
Butyltins		-/-	-/-	1/-
Total petroleum hydrocarbons (dx, rx)		1/-	1/-	-/-

Deviations from the SAP: There were no deviations from the PSET-approved SAP.

Results and Discussion: Analytical results for the Corps' sampling event are summarized in Table 4. The chemical analytical results from the SQER were compared to the 2018 SEF freshwater SLs and ODEQ's SLV for freshwater fish to evaluate PCBs. There were no detections or non-detection exceedances (U) of freshwater SEF SLs or applicable ODEQ SLV.

Table 4. Project Sediment Analytical summary

Decision unit (Sample ID): Parameters	040519-OSU-01-COMP	040519-OSU-02-COMP	040519-OSU-COMP-TIN	SEF freshwater SL1
Grain size (%)				
Gravel	1.0	0.0	--	--
Sand	96.8	78.6	--	--
Silt and clay	2.0	21.3	--	--
Total organic carbon (%)	0.03	0.47	--	--
Total solids (%)	99.97	71.8	--	--
Metals (mg/kg)	<SLs J, U	<SLs J, U	--	Varies
Total PAHs (ug/kg)	93.9 J	39.7 U	--	17,000
SVOCs (ug/kg) (phthalates, phenols, misc. extractables)	<SLs J, U	<SLs U	--	Varies
Pesticides (ug/kg)				
DDDs	0.99 U	0.98 U	--	310
DDEs	0.99 U	0.98 U	--	21
DDTs	0.99 U	0.98 U	--	100
Other pesticides	<SLs U	<SLs U	--	Varies
Total Aroclors – PCBs (ug/kg)	4.0 U	3.9 U	--	110 (22†)
Butyltins (ug/kg)				
Monobutyltin	--	--	3.85 U	540
Dibutyltin	--	--	5.45 U	910
Tributyltin	--	--	3.64 U	47
Tetrabutyltin	--	--	4.71 U	97
Total Petroleum Hydrocarbons (mg/kg)				
Diesel range	6.1 U	27.7	--	340
Residual range	12.2 U	55.7	--	3,600

U = Non-detection at the method reporting limit (MRL) or method detection limit (MDL), MRL reported;
J = Estimated value between MDL and MRL; † = ODEQ (2007) freshwater fish-based SLV

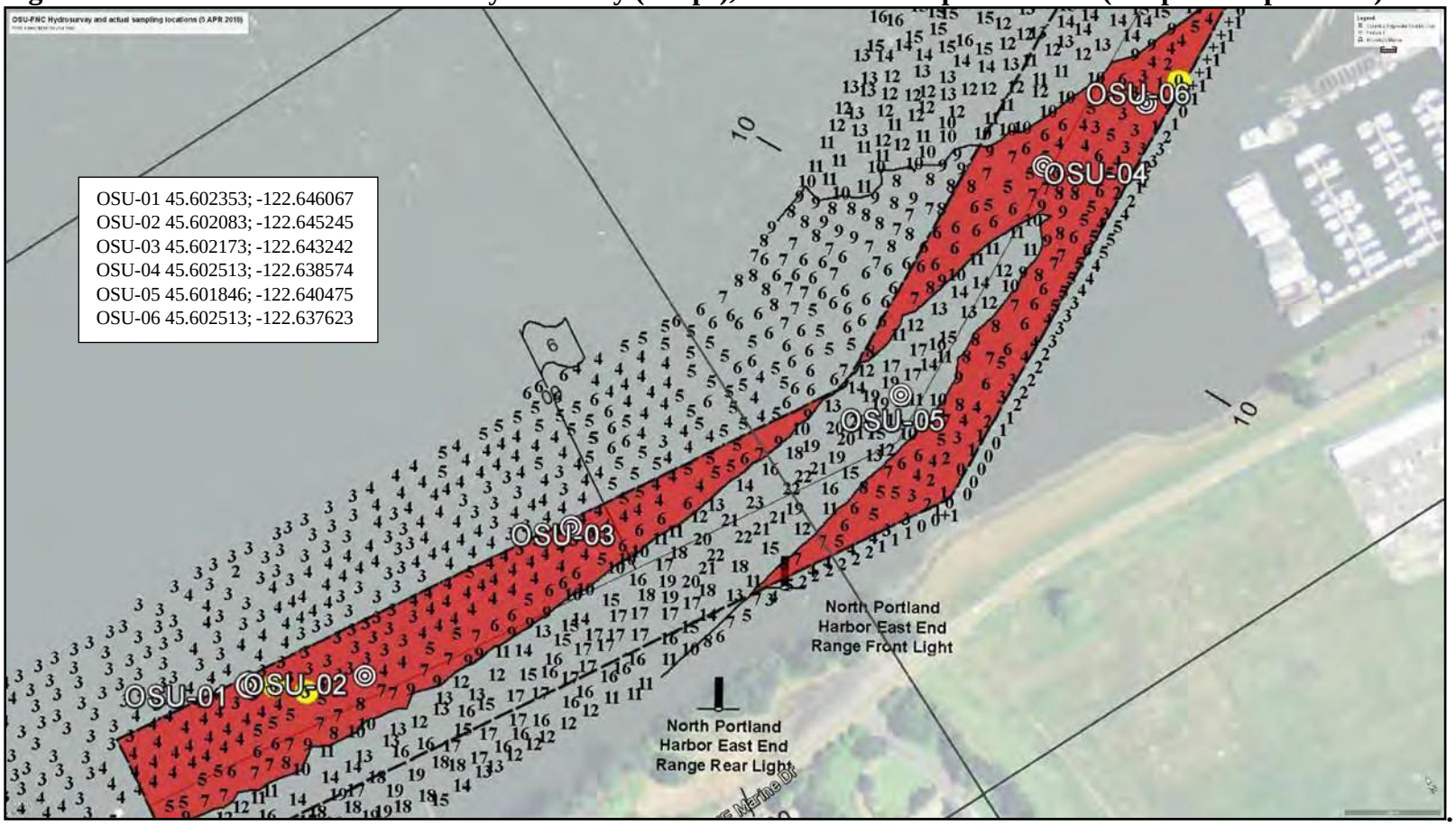
PSET Suitability Determination:

Dredge Prism – Chemical concentrations in both dredge prism composite samples were below the SEF freshwater SLs as discussed above. As such, the **OSU FNC dredged prism material** is **suitable for unconfined, aquatic disposal** per the 2018 SEF guidance.

Post-Dredge Surface – The dredge prism materials were determined to be suitable and the Oregon Slough Upstream Entrance has a "low" management area rank. As such, the PSET assumes that the **OSU FNC post-dredge surface** is **suitable for unconfined, aquatic exposure** per the 2018 SEF guidance.

Contact: This memorandum was prepared by Bridgette Lohrman (PSET co-lead) and James Holm (PSET Lead, Corps) and reviewed by the participating PSET agencies, identified above. Questions regarding this memorandum should be directed to Bridgette Lohrman at (503) 326-4006 or e-mail to: lohrman.bridgette@epa.gov.

Figure 1. OSU FNC – December 2018 hydrosurvey (Corps), 2019 actual sample locations (sampled 5 April 2019)



Water Quality Sampling and Monitoring Plan

For Federally authorized Columbia River Navigation Channel (RM 3 to 145),
Columbia River Side Channels and Portland-Vancouver Anchorages

This plan is prepared in accordance with the following environmental clearances:

A) 401 Water Quality Certificates:

Columbia River (RM 3 to 145) & Side Channels
State of Oregon Department of Environmental Quality, application for certificate renewal
State of Washington Department of Ecology, certificate dated September 10, 2020, as amended

B) Biological Opinions:

Mouth of the Columbia River, Columbia River & Side Channels (except as listed separately)
National Marine Fisheries Service, consultation number 2011/02095 dated July 11, 2012

Tongue Point, Elochoman Slough, Lake River and Oregon Slough Side Channels
National Marine Fisheries Service, consultation number WCRO-2020-02918 dated June 16, 2021

The work procedures described herein have been coordinated with the States of Oregon and Washington and the National Marine Fisheries Service to ensure compliance with all applicable Water Quality Certificates and Biological Opinions. All requirements of the state Water Quality Certificates and Biological Opinions apply.

If there is a discrepancy between this Sampling Plan and the Water Quality Certificates or Biological Opinions, the more restrictive requirement applies.

Sampling Procedures

1. **Instrument Sampling and Visual Observations**. It is expected that instrument samples for turbidity and dissolved oxygen will be taken from a water quality monitoring boat. All sample measurements by instrument will be taken at a water depth of 15 feet (± 2 feet) or the midpoint of the water column (± 2 feet) if the water depth is less than 20 feet. It is expected that visual turbidity observations for dredging activities will be observed from the dredge and turbidity observations for in-water placement will be observed from the hopper dredge or tugboat or end scow, as applicable. Visual observations shall include notation of whether the water is clear (no visible turbidity) or cloudy (yes visible turbidity) at the observation point.

2. **Background Sampling**. Background samples/observations must be taken immediately prior to conducting each compliance test. Background samples/observations will be taken up current of dredging and placement operations, within the authorized navigation channel if possible, and well outside the influence of the dredging operation. Obtaining a sample/observation outside the influence of the dredging or placement operation is critical to ensuring valid compliance tests, and is the primary consideration when selecting a location. Background sampling does not apply to dissolved oxygen compliance.

3. **Dredging Compliance Sampling**. Compliance samples/observations must be taken during daylight hours, during active dredging, and in the turbidity plume if visible. Sampling/observation frequencies, locations, and types are listed below by Federal channel.

Turbidity

Dredge Area	Frequency of Testing	Compliance Test Location	Type of Sample
Columbia River Navigation Channel RM 3 to 145	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Visual
State of Washington Side Channels: Baker Bay, Chinook, Skamokawa Creek, Elochoman Slough, Wahkiakum Ferry Channel, Old Mouth Cowlitz, Lake River	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Visual
State of Oregon Side Channels: Hammond Boat Basin, Skipanon, Tongue Point, Westport Slough, Oregon Slough RM 1.5-3.8, Upstream Entrance to Oregon Slough	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Instrument (Turbidimeter)
State of Oregon: Portland-Vancouver Anchorages	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Instrument (Turbidimeter)

Dissolved Oxygen

Dredge Area	Frequency of Testing	Compliance Test Location	Type of Sample
Columbia River Navigation Channel RM 3 to 145	Not required		
All Side Channels and Portland-Vancouver Anchorages	Prior to start of project, then twice/day (ebb & flood)	300 feet downcurrent from point of discharge and no more than 150 feet lateral	Instrument (Dissolved Oxygen meter)

4. **Placement Compliance Sampling**. Compliance samples must be taken during daylight hours, during active placement and/or placement site dewatering, and in the turbidity plume if possible. Sampling frequencies, locations, and types are organized below by operation.

Turbidity

Operation	Frequency of Testing	Compliance Test Location	Type of Sample
In-Water Placement	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Visual
Shoreline Placement	twice/day (ebb & flood)	900 feet downcurrent from point of discharge and no more than 150 feet lateral	Visual
Upland Placement return water outfall	every 4 hours	300 feet downcurrent from point of discharge	Visual

Notes:

1. Upcurrent & downcurrent locations for selecting sampling points are determined by surface currents, not by tidal state.

2. Tidal state will be reported as the tide at the sample location as determined by the automatic tide gauge on the dredge, or by a published tide program specific to the area being tested.

3. Daylight hours are determined by the published times for sunrise and sunset. These will be noted on the water quality monitoring report.

4. Monitoring will generally be conducted mid-way through the dredging cycle or placement event, or after a sufficient amount of time has elapsed to ensure that the turbidity plume has had sufficient time to reach the compliance sampling location. This would generally be several minutes after a cycle or event commences.

5. Water quality monitoring will not be done under any unsafe conditions as determined by the boat operator, captain or other individual. A monitoring interval may be omitted during unsafe conditions for the monitoring boat. As long as monitoring can be done during the tide cycle, third party verification will not be made. However, if conditions do not improve by the end of the tide cycle and monitoring cannot be done on the tide cycle as required, a third party verification will be required. Should the boat operator or dredge captain determine that conditions are unsafe for the monitoring boat; this must be verified via an independent third party such as the Coast Guard Watch Stander, National Weather Service, Columbia River Pilots, Columbia River Bar Pilots, or other credible third party. This verification must be done in writing by preparing a written record of the telephone conversation (worksheet attached). This third party verification must be obtained prior to the end of the tide cycle.

6. A positive means of determining relative position of the monitoring boat to the dredge, such as an electronic distance measurer (range finder) will be kept on the monitoring boat and used to periodically check positioning.

7. The testing depth will be automatically logged by the YSI instrument and reported on the Water Quality Monitoring Report.

8. Coordinates will be automatically logged by the YSI instrument for all test locations by a differential GPS unit (using the Coast Guard beacon or a WASS-enabled GPS unit). This coordinate data will be reported in NAD 83 (State Plane Oregon North) on the Water Quality Monitoring Report.

9. The instrument will be lowered to the testing depth (background and compliance); the reading will be taken shortly after reaching the testing depth. The only exception is if the readings are rapidly going up, which indicates that the instrument display has not had time to increment up to the correct reading. The reading will not be recorded until the display number has stabilized.

Equipment (for non-visual monitoring)

1. Instrumentation. The YSI Meter will be used, with the following features (or equivalent):

    a. Turbidity Probe, Model 6136
    b. Dissolved Oxygen Probe, Model 6562 or 6150
    c. Logger 650 MDS
    d. Sonde: Multiparameter 6600 EDS-M or 6820
    e. Temperature and Depth Probe 6560

2. Calibrations:

    a. The turbidity probe will be calibrated once a week, or more if data is suspect. A two-point calibration method will be used and calibrations will be in accordance with the manufacturer's instructions.
    b. The YSI data logger clock will be checked against the dredge clock (or tug if a scow is used for disposal) daily.
    c. The Dissolved Oxygen probe and all other instrument features will be calibrated in accordance with the manufacturer's recommendations.
    d. The results of the calibrations (including measurement value against a standard) will be recorded in the Daily Water Quality Monitoring Report.

3. Instrument Parameters. The YSI instrument will be set to take discrete readings every 0.5 seconds.

4. Downrigger System. The YSI instrument will be mounted on an automatically operated downrigger with a 15-pound minimum weight. Downrigger stops will be installed at the testing depth so it can be rapidly reached quickly while the boat is in position for testing. A manual downrigger will be stored on each monitoring boat in a readily accessible location. This manual downrigger will be used in the event that the automatic downrigger malfunctions. All necessary mounting hardware for the manual downrigger will be installed on the boat so that the manual downrigger can be quickly put in place.

5. The Operations Manual Supplied by YSI. A copy of this manual will be kept with all instruments.

6. Instrument Accuracy. For the YSI meter specified, the manufacturer's stated accuracies are as follows:

    a. Turbidity: $\pm$ 2 NTU or 5% of the reading, whichever is greater.
    b. Dissolved Oxygen: $\pm$ 0.2 mg/l or 2% of the reading (in the range of 0 to 20 mg/l), whichever is greater.

    All measurements should be considered to be a range of values based on the stated accuracy. For example, a measurement of 8 NTU would be considered to be a range of 6 NTU to 10 NTU.

    Turbidity will be reported to the nearest 1 NTU. Conventional rounding will be used. For example 0.5 or greater, should be rounded to 1 when reporting whole numbers.

    Dissolved oxygen will be reported to the nearest 0.1 mg/l. Conventional rounding will be used.

Compliance

1. Turbidity

Turbidity must be measured/observed and recorded as described above. All samples/observations must be recorded. Results must be compared to the background sample/observation taken during that monitoring event.

For visual observations: the observation of the turbidity plume at the compliance location is considered an exceedance.

For instrument sampling: Determination of compliance must take into account the accuracy of the instrument (compliance range calculation examples attached). Turbidity is considered to be in exceedance when the lower range value of the compliance measurement (considering instrument accuracy) is greater than the upper range value of the sum of the background measurement and acceptable compliance range (defined in table below).

Turbidity is considered to have returned to background when the lower range value of the compliance measurement is at or below the upper range value of the background measurement.

If an exceedance is measured, a re-test will be taken immediately. If the value of the re-test is also an exceedance, the exceedance is confirmed for that monitoring interval and action must be taken according to the table below. If the re-test value is within acceptable levels, the initial exceedance is not confirmed so there is no exceedance for that monitoring interval.

If a confirmed exceedance occurs at two consecutive monitoring intervals, the activity must stop until the turbidity levels return to background (as confirmed by another sample or observation). At that time, activity may resume with the minimum frequency of monitoring while maintaining compliance.

Turbidity Level		Action Required at 1st Monitoring Interval	Action Required at 2nd Monitoring Interval
Background <50 NTU	Background ≥ 50 NTU		
0 to 5 NTU above background	10% or less over background	Continue to monitor at next interval	Continue to monitor at next interval
Greater than 5 NTU above background	Greater than 10% over background	Modify activity and continue to monitor at next interval	Stop activity until levels return to background and then continue to monitor at next interval

During re-sampling/observations to determine when levels return to background, a new background sample/observation for turbidity will be obtained if it appears that conditions have changed such that the background sample/observation may be invalid, or if up to two hours have passed. If a new background sample/observation is obtained, the reason therefore must be clearly annotated on the water quality monitoring report.

2. Dissolved Oxygen

Dissolved oxygen must be measured and recorded as described above. All samples must be recorded. If the concentration measured is below 8 mg/l, a re-test will be taken immediately. If the value of the re-test is also measured below 8 mg/l, the reduced level is confirmed and action must be taken according to the table below.

If a confirmed level (test and re-test) below 6.5 mg/l is measured (or if distressed or dead fish are observed in or beside the dredge), the activity must stop until the dissolved oxygen level returns above 6.5 mg/l (as measured by another sample). At that time, activity may resume with monitoring at the appropriate frequency interval based on the level of dissolved oxygen measured. Dredging may not begin if dissolved oxygen concentration at the dredge site is less than 6.5mg/l.

Dissolved Oxygen Level	Action Required
8 mg/l or greater	Continue to monitor at next interval
6.5 mg/l up to 8 mg/l	Increase monitoring frequency to every 4 hours during daylight hours and active dredging
Less than 6.5 mg/l	Stop activity until levels return to above 6.5 mg/l and then continue to monitor at appropriate interval based on level of dissolved oxygen measured

Activity Modifications and Stopping Activity

Dredging

1. Hopper Dredging Activity:
    a. Modification of the hopper dredging activity means that the dredge cannot pass back over the point where the exceedance occurred while completing the dredging load. Dredging may continue while moving away from the area, but no dredging can occur in the area where the exceedance was observed (or measured and confirmed) until the water quality parameter(s) have returned to acceptable levels. The mate's screen will be marked with the position of the dredge when the exceedance was measured to ensure that the dredge does not pass back over this point while filling the hopper. This may necessitate frequent moves or additional transit time, especially during clean-up operations.
    b. Stopping the hopper dredging activity could be any of the following actions:
        i. Stop dredging and transit to the disposal site.
        ii. Stop dredging and move to a different dredging location well away from the area where an exceedance was measured.
        iii. Stop dredging and stand by.

    Dredging may not resume at the same dredging location where the exceedance occurred until an additional observation (or sampling) indicates that the water quality parameter(s) have returned to acceptable levels.

2. Pipeline Dredging Activity: The Corps is not aware of any acceptable "modifications" for pipeline dredging activities. Once an exceedance has been observed or measured and confirmed, all further dredging operations must be stopped until additional sampling indicates that the water quality parameter(s) have returned to acceptable levels.

3. Clamshell Dredging Activity: Currently the Corps is not aware of any acceptable "modifications" for clamshell dredging activities. Because of the stationary nature of a clamshell operation, once an exceedance has been observed or measured and confirmed, all further dredging operations must be stopped until additional observations or sampling indicate that the water quality parameter(s) have returned to acceptable levels.

In-Water Placement

1. Hopper Dredge and Dump Scow Placement: In-water placement by a hopper dredge or dump scow is anticipated to be a short term discrete event. Because of the short term nature of the placement event, the dredge or scow will not be expected to stop placing the current load if an exceedance is observed during placement. However, once an exceedance has been observed, all further placement operations at that placement site must be stopped until an additional observation indicates turbidity has returned to acceptable levels. It is anticipated that turbidity levels will return to background before the next scheduled placement event.

2. Pipeline Dredge Placement: In-water placement by a pipeline dredge is anticipated to be a continuous event. The Corps is not aware of any acceptable "modifications" for pipeline dredge in-water placement operations. Once an exceedance has been observed, placement operations at that site must be stopped until an additional observation indicates that turbidity has returned to acceptable levels.

Shoreline Placement

1. Activity modifications include: adjusting site berms to slow water discharge and any other action intended to further minimize turbidity.

2. If exceedances occur at two consecutive monitoring intervals, placement operations at that site must be stopped until an additional observation indicates turbidity has returned to acceptable levels.

Upland Placement

1. Return water from upland placement site: Activity modifications include: adjusting weirs (boards and outfall discharge ends), adjusting internal site berms to slow water discharge, and any other action intended to further minimize turbidity.

2. If exceedances occur at two consecutive monitoring intervals, all water discharge to the river must be stopped until an additional observation indicates turbidity has returned to acceptable levels. The drainage system for return water to the river must contain a means to shut off the discharge.

Reporting

Daily Water Quality Monitoring Report. There must be a water quality monitoring report completed for each day that there is scheduled activity. If no activity actually occurs during a monitoring interval (for example, the dredge is down for repairs), a report is submitted with an explanation in the Remarks column. Example reporting forms for visual turbidity observations turbidity/dissolved oxygen sampling with an instrument are attached. Electronic copies are provided to the dredge. The following data will be included:

1. Date
2. Published times for sunrise and sunset
3. Test (Background, compliance, confirmation of exceedance (if applicable), return to background)
4. Location (Channel Dredge Area or Placement site name)
5. Contract Name (if applicable)
6. Contract Number (if applicable)
7. Placement Site
8. For instrument sampling: Position in NAD 83 (State Plane Oregon North)
9. For instrument sampling: Depth as logged by the YSI instrument
10. Tidal State (ebb/flood/slack), at the testing location
11. Load Number
12. Time
13. Remarks column will contain any statements necessary to explain the data including the following:
    a. Delays in the testing cycle and the reason therefore (for example if the dredge was down for repairs, or if the dredging cycle was longer than the required testing frequency)
    b. Delays in monitoring due to restricted visibility
    c. Locations where water quality criteria were exceeded, along with actions taken (i.e. was the operation modified or stopped)
    d. Additional samples performed to confirm exceedance or return to background, this must be noted
    e. If operation is modified or stopped as a result of the exceedance, what time the modification or stoppage began, how long it lasted, and what time operations resumed
    f. Best Management Practices used to bring the levels back into compliance
    g. Observation of a visible plume (yes/no) if present when measurement exceeds water quality criteria
14. Results of calibrations

Water Quality Monitoring Report - Visual Observations

Date (mm/dd/yy):		**Contract #:**		**Dredge Name:**		**Sunrise/Sunset (hh:mm):**	
Contract Name:		**Dredge Type:**		**Captain:**			

Load #	Activity (Dredging or Placement)	Tidal State	Time	Channel Name (Dredging)	Channel Station (Dredging)	Placement Area (Placement)	**Background Point** upcurrent and outside the area of influence (dredging or placement) Visible Turbidity (yes/no)	**Compliance Point** 900 feet down current, less than 150 feet laterally from dredging or placement Visible Plume (yes/no)	**Exceedance:** no visible turbidity at Background Point and yes visible turbidity plume at Compliance Point (yes/no)	**Remarks** **If in Exceedance:** **Action Taken, time activity stopped, resumed and duration of stoppage**

Form dated 27-Jun-2014

Water Quality Monitoring Report - Sampling with an Instrument

Date (mm/dd/yy):				Contract #:				Dredge Type:			Clock Validated (hh:mm):				Calibration Date (mm/dd/yy):				Calibration Standard Value:		
Contract Name:								Dredge Name:			Captain:				Sunrise/Sunset (hh:mm):				Calibration Measured Value:		
Test No.	Test Type	Load No.	Tidal State	Channel Name	Dredging RM From	Dredging RM To	Test Time hh:mm:ss	Test Coordinates (NAD83) (x)	Test Coordinates (NAD83) (y)	NTU Meter Display	Adjusted NTU	Depth (ft)	NTU Limit	NTU Compliance	DO (mg/L)	Adjusted DO Compliance	In/Out Of Plume	Stopped (hh:mm)	Resumed (hh:mm)	Duration of Stoppage (hh:mm)	Exceedance Action Taken	Remarks
											-		-	-		-						
											-		-	-		-						
											-		-	-		-					

Unsafe Water Quality Monitoring Conditions Worksheet

Project Information

Date & Time	
Monitoring Vessel	
Location(s) & action(s)	
Tide (ebb and/or flood)	

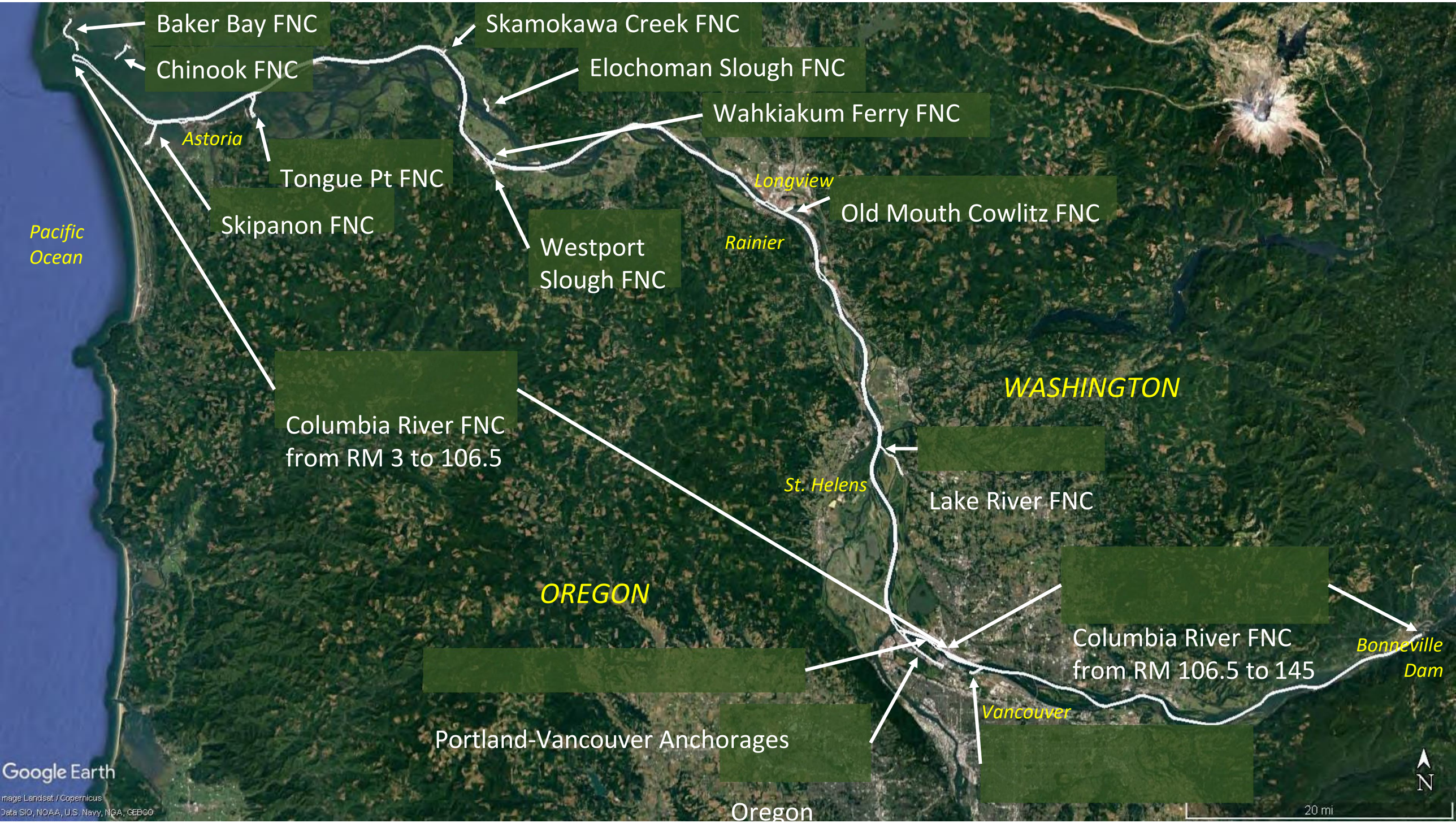
Third Party Contacted (check one)		Contact Info
	MCR Recorded Message	(360) 642-3565
	USCG Watch Stander	(360) 642-2382 or Marine Radio Channel 13
	Columbia River Bar Pilot (Bar to Astoria)	(503) 325-2641 or Marine Radio Channel 13
	Columbia River Pilot (Astoria to Portland)	(503) 289-9922 or Marine Radio Channel 13

Criteria in Question

Visibility (miles)	
Wind (kts, steady and gusts)	
Wave Height (feet)	
Current (kts)	
Precipitation (type)	

Title	Name	Decision (Monitoring is Safe or Unsafe)
Dredge Captain		
Launch Operator		
Third Party		

Notes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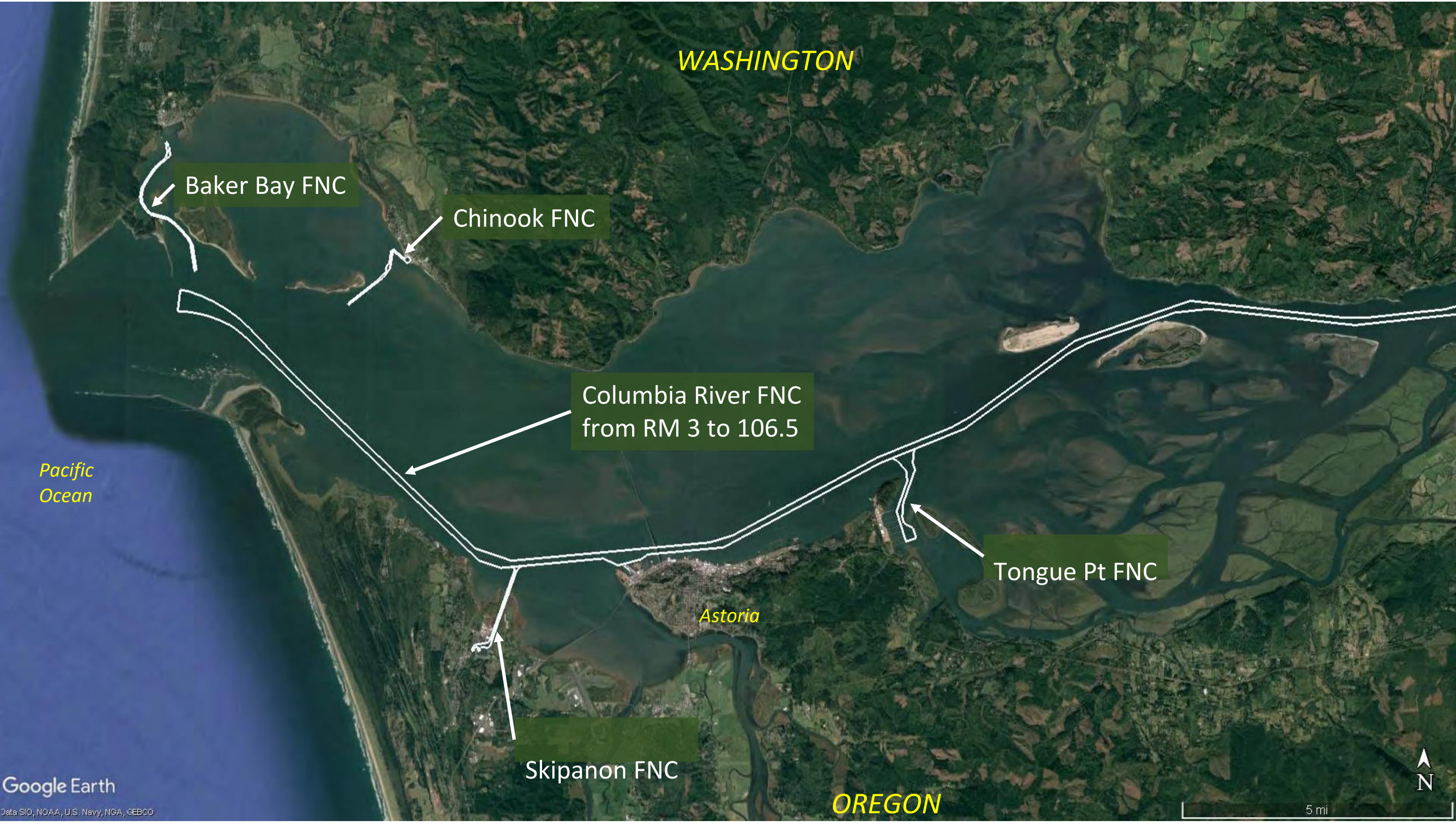
Wahkiakum Ferry FNC
Astoria
Tongue Pt FNC
Longview
Old Mouth Cowlitz FNC
Skipanon FNC
Pacific Ocean
Westport Slough FNC
Rainier
WASHINGTON
Columbia River FNC from RM 3 to 106.5
St. Helens
Lake River FNC
OREGON
Columbia River FNC from RM 106.5 to 145
Bonneville Dam
Vancouver
Portland-Vancouver Anchorages
Google Earth
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Oregon
Portland
20 mi
N

Attachment E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Chinook FNC
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from RM 3 to 106.5
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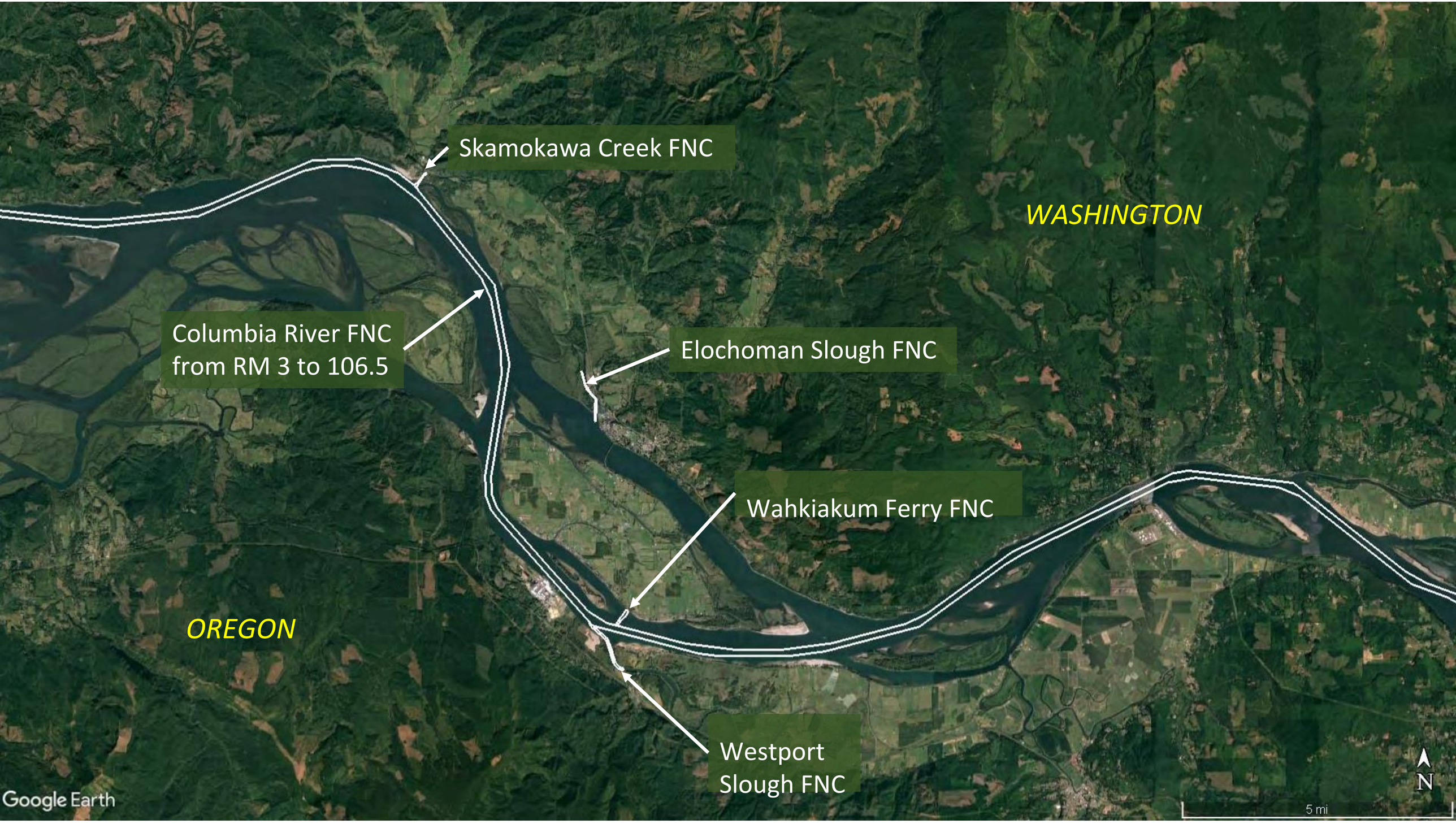
Skamokawa Creek FNC
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Columbia River FNC
from RM 3 to 106.5
Elochoman Slough FNC
Wahkiakum Ferry FNC
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Longview
Old Mouth Cowlitz FNC
Rainier
WASHINGTON
Columbia River FNC
from RM 3 to 106.5
OREGON
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Columbia River FNC
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WASHINGTON
St. Helens
Lake River FNC
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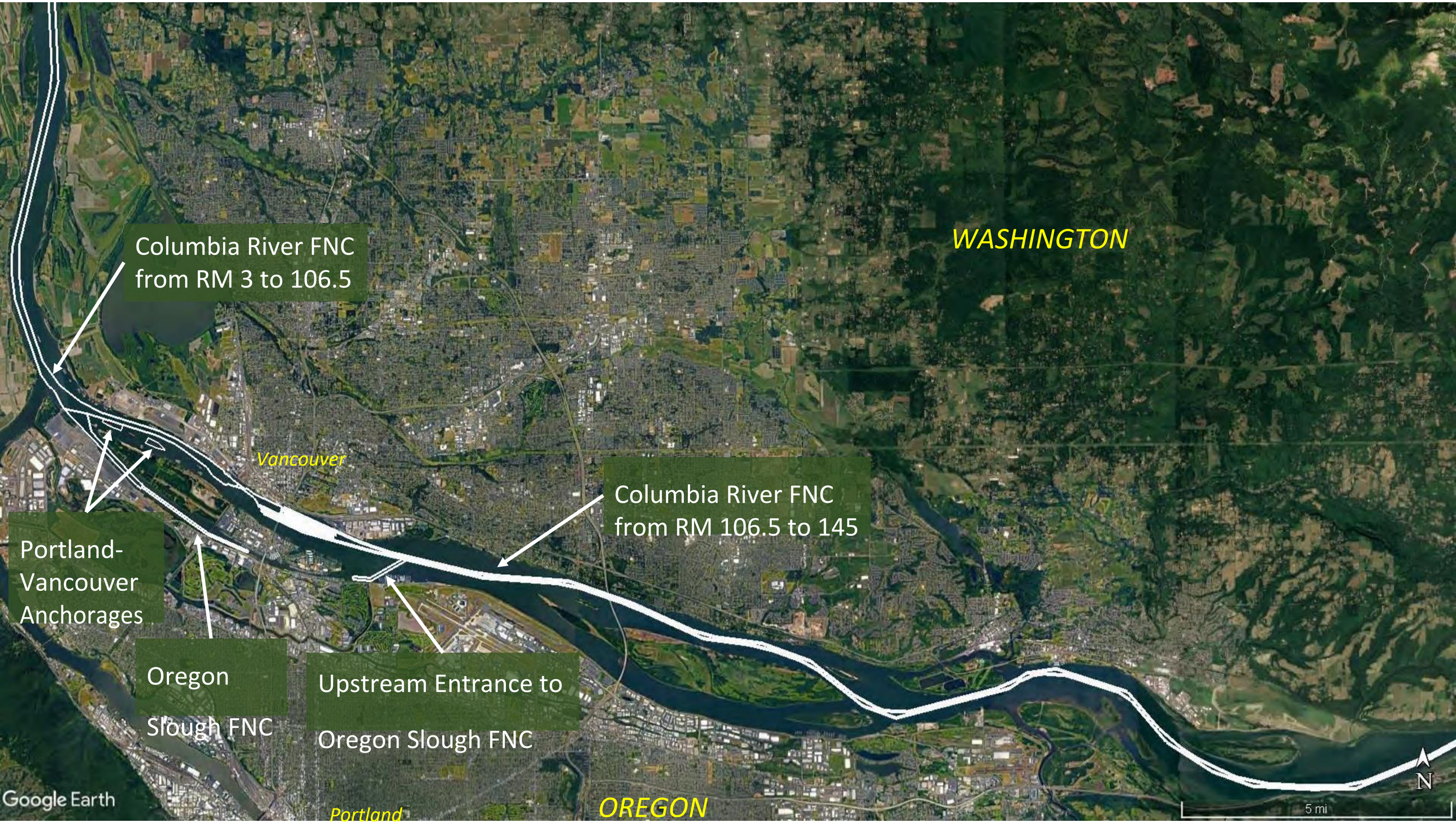
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from RM 3 to 106.5
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Vancouver
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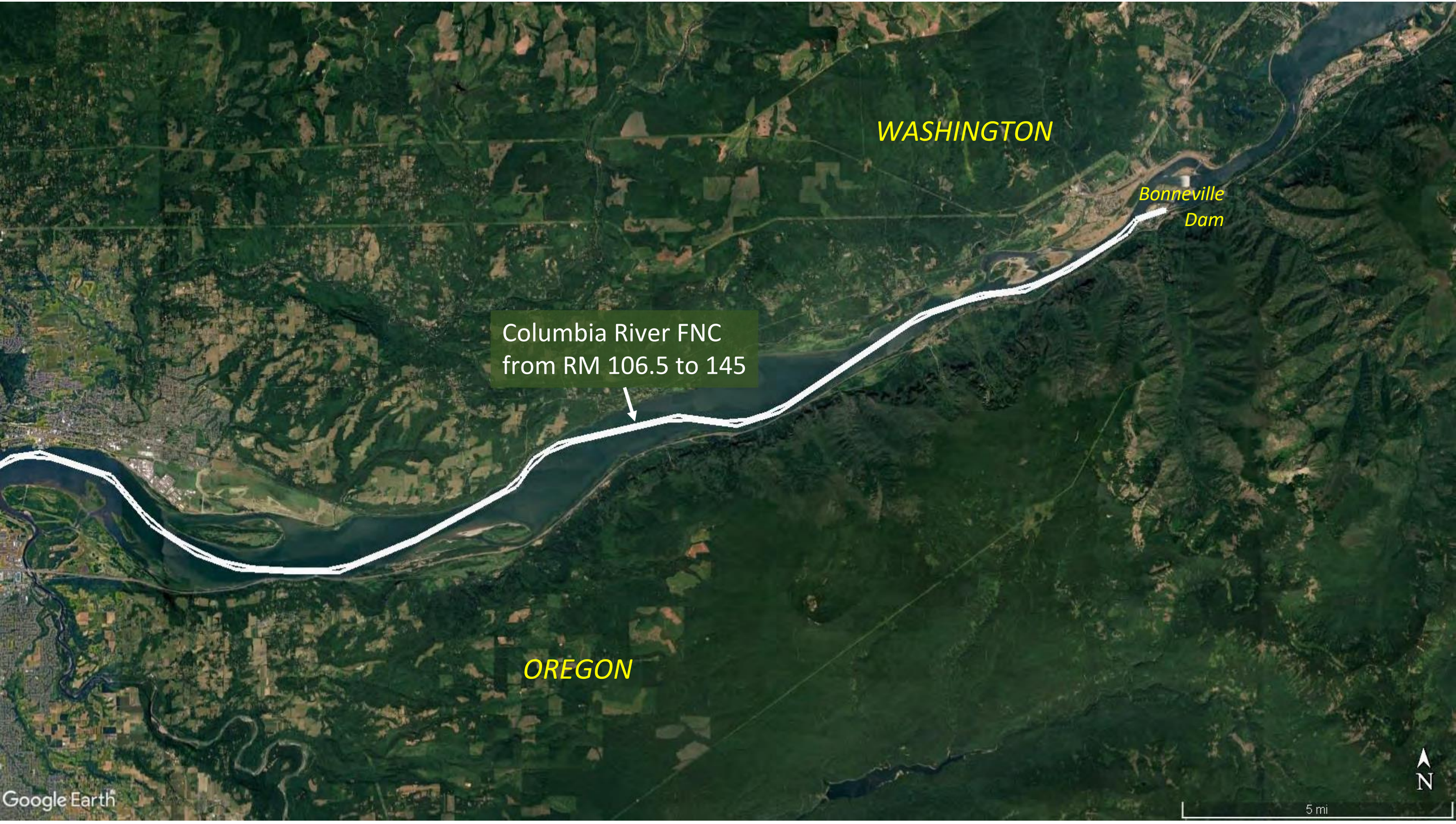
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Bonneville Dam
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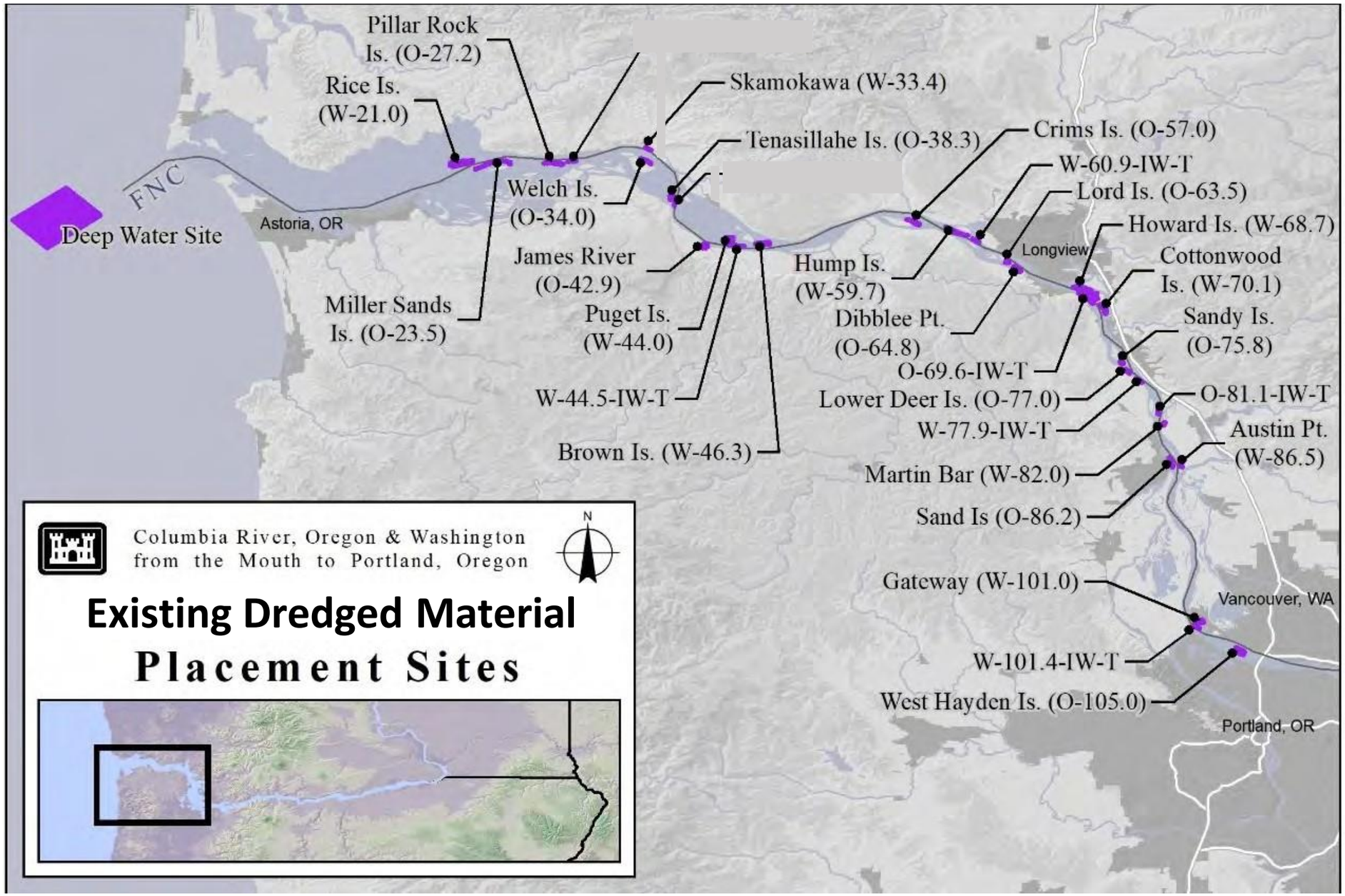

LCR FNC Upland, Shoreline, Transfer, and Ocean Dredged Material Placement Sites. In-water placement of material dredged from federal navigation projects in Oregon and Washington occurs in depths greater than 20 feet within or outside the navigation channel throughout the mainstem Columbia River from RM 3 to RM 145.

BIOLOGICAL ASSESSMENT FOR THE CONTINUED OPERATIONS AND MAINTENANCE DREDGING PROGRAM FOR THE COLUMBIA RIVER FEDERAL NAVIGATION CHANNEL

Upland placement of dredged materials on Rice Island, September 2013

Photos courtesy of USFWS: streaked horned lark, bull trout, Columbian white-tailed deer, marbled murrelet

MARCH 2014

U.S. Army Corps of Engineers
Portland District

Table of Contents

INTRODUCTION **1**

Background and History **1**

Project Authority **2**

Consultation History **3**
Western Yellow-Billed Cuckoo 6

Changes from Previous Action **7**

ACTION AREA **8**

DESCRIPTION OF THE PROPOSED ACTION **12**

Site Preparations **13**

Dissuasion **18**
Cormorants and Terns 18
Larks 19

Dredging And In-Water Placement **20**
Dredged Material Sediment Quality 20

Upland and Shoreline Dredged material placement **21**
Overview 21
Shoreline Placement 21
Upland Placement 23
Five-year Dredged Material Placement Plan 24
Network Scale 31
Individual Placement Site Scale 32

Post-placement Modifications **57**

Monitoring **59**
Terns/Cormorants 59
SHLA/SHLA Habitat 59

Coordination & Consultation **60**

STATUS OF THE SPECIES AND CRITICAL HABITAT **61**

Streaked Horned Larks and Limiting Factors **61**

Critical Habitat **66**

EFFECTS ANALYSIS **68**

Climate Change **69**

Effects of the Action **69**
Site Preparations 70
Dissuasion 71
Dredging and Ocean and In-Water Placement 72
Dredged Material Placement at Upland and Shoreline Sites 72
Post-Placement Modifications 90
Monitoring 91

Effects of the Action on Critical Habitat **91**
Suitability of SHLA Critical Habitat Within Unit 3: Washington Coast and Columbia River Islands 91
Five-Year Dredged Material Placement Plan on Sites that Overlap with Designated Critical Habitat Subunits 92

Effects from Inter-related and Inter-dependant Actions **105**

Cumulative Effects **106**

Summary of Effects **106**

DETERMINATION AND CONCLUSION **109**

REFERENCES AND LITERATURE CITED **110**

LIST OF FIGURES

Figure 1: Modification to the Wahkiakum Ferry Channel 8
Figure 2: Upland and shoreline Dredged Material Placement Network in the Columbia River 11
Figure 3: Trenches on Rice Island (left) and mounding on Miller Sands Island (right) 14
Figure 4: Site preparations and dike building for placement of dredged materials (at Northport) 14
Figure 5: Typical build-out of a barge landing (Rice Island) 15
Figure 6: Grading slope for incoming dredged material pipe 15
Figure 7: Weir and berm structure, in operation on Rice Island 16
Figure 8: Outfall pipes returning water back to river after dredged material has settled out, Rice Island 17
Figure 9: Staging equipment on top of the bank at Sand Island Shoreline Placement Site 17
Figure 10: Active shoreline placement at Sand Island (looking upstream) 22
Figure 11: Active shoreline placement at Sand Island (looking downstream) 22
Figure 12: Active dredged material placement at Martin Bar Upland Site 23
Figure 13: Active discharge of sand and water dredged material slurry at Rice Island Upland Site 24
Figure 14: Transition of Suitable SHLA Nesting Habitat throughout Network, 2014-2018 31
Figure 15: Availability of SHLA Nesting Habitat on Benson Beach, 2014-2018 32
Figure 16: Availability of SHLA Nesting Habitat on West Sand Island, 2014-2018 32
Figure 17: Availability of SHLA Nesting Habitat on Group I Sites, 2014-2018 33
Figure 18: Availability of SHLA Nesting Habitat on Rice Island, 2014-2018 34
Figure 19: Availability of SHLA Nesting Habitat on Miller Sands, 2014-2018 36
Figure 20: Availability of SHLA Nesting Habitat on Pillar Rock Island, 2014-2018 37
Figure 21: Availability of SHLA Nesting Habitat on Group II Sites, 2014-2018 38
Figure 22: Availability of Nesting Habitat at Skamokawa-Vista Park, 2014-2018 38
Figure 23: Availability of SHLA Nesting Habitat on Welch Island, 2014-2018 39
Figure 24: Availability of SHLA Nesting Habitat on Tenasillahe Island, 2014-2018 40
Figure 25: Availability of SHLA Nesting Habitat on James River Site, 2014-2018 41
Figure 26: Availability of SHLA Nesting Habitat on Puget Island Site, 2014-2018 42
Figure 27: Availability of SHLA Nesting Habitat on Brown Island, 2014-2018 43
Figure 28: Availability of SHLA Nesting Habitat on Group III Sites, 2014-2018 44
Figure 29: Availability of SHLA Nesting Habitat on Crims Island, 2014-2018 45
Figure 30: Availability of SHLA Nesting Habitat on Hump Island, 2014-2018 46
Figure 31: Availability of SHLA Nesting Habitat on Lord Island (upstream), 2014-2018 47
Figure 32: Availability of SHLA Nesting Habitat on Dibblee Point, 2014-2018 47

Figure 33: Availability of SHLA Nesting Habitat on Howard Island, 2014-2018 48
Figure 34: Availability of SHLA Nesting Habitat on Cottonwood Island, 2014-2018 49
Figure 35: Availability of SHLA Nesting Habitat at Northport, 2014-2018 49
Figure 36: Availability of SHLA Nesting Habitat on Group IV sites, 2014-2018 50
Figure 37: Availability of SHLA Nesting Habitat on Sandy Island, 2014-2018 51
Figure 38: Availability of SHLA Nesting Habitat on Lower Deer Island, 2014-2018 52
Figure 39: Availability of SHLA Nesting Habitat at Martin Bar, 2014-2018 53
Figure 40: Availability of SHLA Nesting Habitat on Sand Island, 2014-2018 54
Figure 41: Availability of SHLA Nesting Habitat at Austin Point, 2014-2018 54
Figure 42: Availability of SHLA Nesting Habitat on Group V Sites, 2014-2018 55
Figure 43: Availability of SHLA Nesting Habitat at the Fazio Sand & Gravel Site, 2014-2018 55
Figure 44: Availability of SHLA Nesting Habitat at Gateway, 2014-2018 56
Figure 45: Availability of SHLA Nesting Habitat on the West Hayden Island Site, 2014-2018 56
Figure 46: Availability of SHLA Nesting Habitat on the Group VI Sites, 2014-2018 57
Figure 47: Estimate of Current and Historic Ranges of SHLA Image courtesy of Anderson 2011 62
Figure 48: Designated Critical Habitat Subunits of Unit 3 in the Lower Columbia River 67
Figure 49: Potential Range of Breeding Pairs throughout Network, 2014-2018 74
Figure 50: Potential Range of Breeding Pairs in Groups I and VI, 2014-2018 74
Figure 51: Potential Range of Breeding Pairs at Rice Island, 2014-2018 75
Figure 52: Potential Range of Breeding Pairs at Miller Sands Island, 2014-2018 76
Figure 53: Potential Range of Breeding Pairs at Pillar Rock Island, 2014-2018 76
Figure 54: Potential Range of Breeding Pairs at Group II Sites, 2014-2018 77
Figure 55: Potential Range of Breeding pairs at Skamokawa - Vista Park, 2014-2018 78
Figure 56: Potential Range of Breeding Pairs at Welch Island, 2014-2018 78
Figure 57: Potential Range of Breeding Pairs at Tenasillahe Island, 2014-2018 79
Figure 58: Potential Range of Breeding pairs at James River, 2014-2018 79
Figure 59: Potential Range of Breeding Pairs at Puget Island, 2014-2018 80
Figure 60: Potential Range of Breeding Pairs at Brown Island, 2014-2018 81
Figure 61: Potential Range of Breeding Pairs at Group III Sites, 2014-2018 82
Figure 62: Potential Range of Breeding pairs at Crims Island, 2014-2018 82
Figure 63: Potential Range of Breeding Pairs at Hump Island, 2014-2018 83
Figure 64: Potential Range of Breeding Pairs at Lord Island (upstream), 2014-2018 84
Figure 65: Potential Range of Breeding Pairs at Dibblee Point, 2014-2018 84
Figure 66: Potential Range of Breeding Pairs at Howard Island, 2014-2018 85

Figure 67: Potential Range of Breeding Pairs at Cottonwood Island, 2014-2018 85
Figure 68: Potential Range of Breeding Pairs at Northport, 2014-2018 86
Figure 69: Potential Range of Breeding Pairs at Group IV Sites, 2014-2018 87
Figure 70: Potential Range of Breeding Pairs at Sandy Island, 2014-2018 87
Figure 71: Potential Range of Breeding Pairs at Lower Deer Island, 2014-2018 88
Figure 72: Potential Range of Breeding Pairs at Martin Bar, 2014-2018 88
Figure 73: Potential Range of Breeding Pairs at Sand Island, 2014-2018 89
Figure 74: Potential Range of Breeding Pairs at Austin Point, 2014-2018 89
Figure 75: Potential Range of Breeding Pairs at Group V Sites, 2014-2018 90
Figure 76: Availability of SHLA Nesting Habitat within Designated Critical Habitat across the Network including Wallace Island, 2014-2018 94
Figure 77: Availability of SHLA Nesting Habitat on the Rice Island Critical Habitat Subunit, 2014-2018 96
Figure 78: Availability of SHLA Nesting Habitat on the Miller Sands Critical Habitat Subunit, 2014-2018 97
Figure 79: Availability of SHLA Nesting Habitat on the Pillar Rock Island Critical Habitat Subunit, 2014-2018 99
Figure 80: Availability of SHLA Nesting Habitat on the Welch Island Critical Habitat Subunit, 2014-2018 100
Figure 81: Availability of SHLA Nesting Habitat on the Tenasillahe Island Critical Habitat Subunit, 2014-2018 101
Figure 82: Availability of SHLA Nesting Habitat on the Brown Island Critical Habitat Subunit, 2014-2018 102
Figure 83: Availability of SHLA Nesting Habitat on the Wallace Island Critical Habitat Subunit, 2014-2018 103
Figure 84: Availability of SHLA Nesting Habitat on the Crims Island Critical Habitat Subunit, 2014-2018 104
Figure 85: Availability of SHLA Nesting Habitat on the Sandy Island Critical Habitat Subunit, 2014-2018 105
Figure 86: Summary of effects to suitable habitat and potential range of breeding pairs, 2014 – 2018 108
Figure 87: Summary of effects to suitable habitat and potential range of breeding pairs if no placement occurs, 2014-2018 108

LIST OF TABLES

Table 1: USFWS ESA-listed species in the proposed action area. 3
Table 2: Upland and Shoreline Dredged Material Placement Network 10
Table 3: Five-year Dredged Material Placement Plan (2014 – 2018) 26
Table 4: Estimated 2014 Dredged Material Placement Sequence 27
Table 5: Availability of Suitable Streaked Horned Lark Nesting Habitat within the Dredged Material Placement Network (2014-2018) 30
Table 6: Estimated Number of SHLA Breeding Pairs in the Lower Columbia River 64
Table 7: Designated Critical Habitat within Lower Columbia River and Corps' Network 68
Table 8: Availability of Suitable Streaked Horned Lark Nesting Habitat within the Designated Critical Habitat Subunits of the Lower Columbia River (2014-2018) 93

LIST OF APPENDICES

Appendix A. Congressional Authorizations for the Columbia River Dredging Program

Appendix B. Columbia River Dredging Program: Dredging, Placement, and Ocean Disposal Dredged Material Placement Network Description

Appendix C. Six-Year Panel Figures of Dredged Material Placement for the Proposed Action – Suitable Streaked Horned Lark Nesting Habitat, 2014-2018

Appendix D. Six-Year Panel Figures of Dredged Material Placement for the Proposed Action – Designated Critical Habitat for Streaked Horned Lark, 2014-2018

Appendix E. WDFW Streaked Horned Lark 2010 Protocol - Form B

ACRONYMS AND ABBREVIATIONS

ATV	All-terrain vehicle
BA	Biological Assessment
BiOp	Biological Opinion
CFR	Code of Federal Regulations
CH	Critical Habitat
Corps	U.S. Army Corps of Engineers, Portland District
CRCIP	Columbia River Channel Improvement Project
CR FNC	Columbia River Federal Navigation Channel
CWA	Clean Water Act
CY	cubic yards
DMEF	Dredge Material Evaluation Framework, 1998
DPS	Distinct Population Segment
DSL	Department of State Lands
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973, as amended
kCY	Thousand cubic yards
MCR	Mouth of the Columbia River
MHHW	Mean Higher High Water
MPRSA	Marine Protection, Research, and Sanctuaries Act, 1972
NDVI	Normalized Difference Vegetation Index
NMFS	National Marine Fisheries Service
O&M	Operations and Maintenance
ODFW	Oregon Department of Fish and Wildlife
OHV	Off-highway vehicle
OHW	Ordinary High Water
PCE	Primary Constituent Elements
RM	River Mile
SEF	Sediment Evaluation Framework for the Pacific Northwest, 2009
SHLA	streaked horned lark
T&Cs	Terms and Conditions
USGCRP	United States Global Change Research Program
USFWS	U.S. Fish and Wildlife Service
WDFW	Washington Department of Fish and Wildlife

INTRODUCTION

The U.S. Army Corps of Engineers, Portland District (Corps) prepared this Biological Assessment (BA) for the purpose of re-initiating consultation under Section 7 of the Endangered Species Act (ESA) of 1973, as amended. This document evaluates the effects on federally listed species and their designated critical habitats for the Columbia River Federal Navigation Channel (CR FNC), Operations and Maintenance (O&M) Program through 2018. This BA specifically describes the biological effects to streaked horned larks (SHLA) (*Eremophila alpestris strigata*) that may occur from the placement of material dredged from the Columbia River. Dredging the Columbia River maintains the CR FNC from the River Mouth to Bonneville Dam (River Mile (RM) -3.0 to 145), including the Mouth of the Columbia River (MCR) project, nine side channel projects (Baker Bay, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek, Wahkiakum Ferry Channel, Westport Slough, Old Mouth Cowlitz River, and Upstream Entrance to Oregon Slough), and the Portland-Vancouver Anchorages.

Section 7 of the ESA states that Federal agencies shall ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in destruction or adverse modification to designated critical habitat (CH). Therefore, Federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS), depending on the species that may be affected. Section 7 (a)(1) further directs federal agencies to use their existing authorities to further the purposes of the Act, aid in recovering listed species, and to address existing and potential conservation issues with regards to preserving, enhancing, and restoring important habitat types (USFWS 1998).

The proposed action, as described in this BA, entails upgrading the existing placement network and operations to meet current and projected dredged material placement needs for the next five years (2014 through the 2018 dredging season). This BA describes the potential adverse and beneficial effects to SHLA and its critical habitat in the lower Columbia River. The SHLA was listed as threatened and had critical habitat designated under the ESA on 3 October 2013.

BACKGROUND AND HISTORY

In support of the regional and national economy, the Corps operates and maintains the CR FNC to provide reliable navigation throughout the lower river between the Mouth of the Columbia River and Bonneville Dam (RM -3 to 145). The CR FNC includes nine side channels and the Portland/Vancouver anchorages (referred to as auxiliary channels). The Columbia River is the gateway for global imports and exports from the Columbia-Snake River navigation system, where the CR FNC is used by commercial, industrial, agricultural, and recreational interests. The CR FNC is the number one gateway on the West Coast for the export of wheat, wood products, and bulk minerals, totaling 42 million tons in 2010 and $20 billion worth of U.S. products bound for world markets. Approximately 55 million tons of incoming cargo pass through the Columbia River annually, supporting more than 40,000 regional jobs directly linked to the seaport and import/export activities on the river (PNWA 2010).

The deep draft channel from the ocean to Vancouver, WA was originally authorized for full construction in 1878 with a 20-foot minimum depth. Over the years, the depth has increased in order to accommodate larger ocean-going vessels transporting goods into and out of the region. Most recently completed in 2010, the channel from RM 3 to 106.5 was deepened from 40 to 43 feet. The Supplemental Environmental Impact Statement (EIS) for this action identified dredge

placement sites suitable for a period of 20 years (USACE 2003). However, since the channel deepening was completed, some placement sites have reached or are nearing maximum capacity.

The Corps annually dredges shoals from the CR FNC from RM -3 to 3 and RM 3 to 106.5 to maintain the congressionally-authorized depths of 48/55 feet and 43 feet, respectively, to accommodate deep-draft vessels. The Corps also dredges shoals annually from the CR FNC from RM 106.5 to 145 to maintain a depth of 17 feet for current users. The auxiliary channels are dredged annually or less often to their various full authorized depths or as adjusted for current user traffic. Inherent to the dredging is placement of the dredged materials immediately following or simultaneous to active dredging. To maintain the navigation channels in the complex river system, the Corps uses a balance of dredged material placement at in-water, shoreline, and upland (including island) sites, which is referred to as the Columbia River Dredged Material Placement Network (Network). The Network is a complex combination of sites distributed throughout the lower river, and includes federal, state and locally managed lands, and some private lands and shorelines.

As part of the NMFS' 2012 Biological Opinion (BiOp), *Reinitiation of Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Columbia River Navigation Channel Operations and Maintenance, Mouth of the Columbia River to Bonneville Dam, Oregon and Washington (HUCs 1708000605, 1708000307, 1708000108),* the Corps was directed to implement Terms and Conditions (T&Cs) to minimize take of ESA-listed species (namely salmonids) (NMFS 2012). In the NMFS BiOp, the T&Cs include specific mandates for the timing of dredging and placement activities, water quality sampling and monitoring, operational constraints, dissuasion practices for avian species that consume juvenile salmonids, and construction requirements for in-water, upland, and shoreline dredged material placement sites.

PROJECT AUTHORITY

Since 1824, the Corps has been the governmental agency responsible for maintaining navigable waters. The Commerce Clause in the U.S. Constitution and subsequent Supreme Court decisions have established the Federal right and obligation to regulate navigation and commercial activity, and also to make any necessary improvements to the river for this purpose. Congress has strengthened this authority through several Rivers and Harbor Acts, the earliest one enacted in 1872. The Rivers and Harbors Acts gave way to the Water Resources Development Acts in 1973. Subsequently, the Courts have determined the Corps has paramount rights to work in all navigable waters of the U.S. below the ordinary high water mark (mean higher high water in the estuary). Appendix A provides a complete history of Congressional authorizations for the Columbia River dredging program.

Maintenance dredging and in-water placement of dredged sediments to maintain these authorized navigation channels is conducted under the provisions of Sections 102 and 103 of the Marine Protection Reserve and Sanctuaries Act (MPRSA) of 1972, Sections 401 and 404 of the Clean Water Act (CWA) of 1977, and in accordance with Regulations 33 Code of Federal Regulations (CFR) parts 335 through 338 ("Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving Discharge of Dredged or Fill Material into Waters of the U.S. or Ocean Waters" and affiliated procedures, etc).

The Corps does not own or have exclusive use of the dredged material placement sites, and therefore cannot manage or regulate use of the sites prior to or following dredged material placement. Some sites may be leased by the landowner (states of Washington or Oregon, private entities, or Ports) to outside parties for the purpose of extracting the placed dredged materials for

off-site uses. Other sites have public and private users for recreation, agriculture, grazing, storage, or training.

CONSULTATION HISTORY

The Corps has previously consulted with the USFWS on the CR O&M navigation program addressing effects to several ESA-listed species. Table 1 lists current ESA-listed species in the action area that are within the USFWS' jurisdiction.

Table 1: USFWS ESA-listed species in the proposed action area.

Species		Federal Status	Critical Habitat	Protective Regulations
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Designated	75 FR 3424 76 FR 61599
Northern spotted owl	*Strix occidentalis caurina*	Threatened	Designated	77 FR 71875
Short-tailed albatross	*Phoebastria albatrus*	Endangered	(none)	65 FR 46643
Western snowy (coastal) plover	*Charadrius nivosus*	Threatened	Designated	53 FR 45788 77 FR 36727
Streaked horned lark	*Eremophila alpestris strigata*	Threatened	Designated	78 FR 61452 78 FR 61506
Yellow-billed cuckoo	*Coccyzus americanus*	Proposed Threatened	(none)	78 FR 61621 78 FR 78322
Bull trout	*Salvelinus confluentus*	Threatened	Designated	63 FR 31647 75 FR 63897
Oregon silverspot butterfly	*Speyeria zerene hippolyta*	Threatened	Designated	45 FR 44935
Columbian white-tailed deer	*Odocoileus virginianus leucurus*	Endangered	(none)	35 FR 16047 68 FR 43647
Water howellia	*Howellia aquatilis*	Threatened	(none)	59 FR 35860

Several species have been delisted and no longer require ESA consultation, which include the bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), brown pelican (*Pelecanus occidentalis*), and the Aleutian Canada goose (*Branta canadensis leucopareia*). These consultations are incorporated herein, and include:

- On June 14, 1991, the USFWS issued a Biological Opinion which stated the placement of dredged material on Rice Island is *"not likely to jeopardize"* the continued existence of bald eagles (USFWS reference #1-7-91-F-280).
- On July 9, 1991, the Corps determined that the interim disposal site at RM 5.5-6.5 would have *"no effect"* on bald eagle, peregrine falcon, Columbian white-tailed deer, marbled murrelet, and western snowy plover (USFWS reference # 1-7-91-I-398).
- On November 19, 1992, the Corps determined that ocean dredged material disposal sites would have *"no effect"* on marbled murrelet (USFWS reference # 1-7-93-I-57).

- On June 28, 1994, the USFWS concurred the Baker Bay West Channel Maintenance Dredging project *"may affect, not likely to adversely affect"* bald eagle, peregrine falcon, brown pelican, and marbled murrelet (USFWS reference # 1-7-94-I-328).
- On February 19, 1998, the Corps determined the O&M of the Columbia River federal navigation channel from RM 3 to 106.5 would have *"no effect"* on peregrine falcon, Aleutian Canada goose, Oregon silverspot butterfly, water howellia, golden paintbrush, Nelson's checker-mallow, Bradshaw's lomatium, brown pelican, marbled murrelet, and western snowy plover (USFWS reference # 1-7-97-I-127).
- On February 24, 1998, the USFWS concurred that O&M of the Columbia River federal navigation channel from RM 3 to 106.5, *"may affect, not likely adversely affect"* Columbian white-tailed deer and bald eagle (USFWS reference # 1-7-97-I-127).
- On August 14, 1998, the Corps determined that the MCR North Jetty Dredged Material Placement would have *"no effect"* on Aleutian Canada goose, bull trout, bald eagle, peregrine falcon, marbled murrelet, and brown pelican (USFWS reference # 1-3-98-I-0385).
- On December 6, 1999, the USFWS issued a Biological Opinion (1-7-99-F-280, 1-7-99-TA-374, 1-7-98-I-342, 1-7-98-I-138) on the Columbia River Channel Deepening project. The Corps determined that the channel deepening project would have *"no effect"* on Aleutian Canada goose, brown pelican, marbled murrelet, western snowy plover, Oregon silverspot butterfly, Bradshaw's lomatium, golden paintbrush, Nelson's checker-mallow, and water howellia. The USFWS concurred that the action *"may affect, not likely adversely affect"* peregrine falcon. The USFWS determined the channel deepening project *"may affect, likely to adversely affect"* bald eagle and Columbian white-tailed deer. On April 24, 2002, the USFWS concurred the MCR dredging and disposal project *"may affect, not likely adversely affect"* bald eagle, brown pelican, and marbled murrelet (USFWS reference # 02-4212).
- On May 20, 2002, the USFWS issued a Biological and Conference Opinion on the Columbia River Channel Improvement Project (CRCIP), from RM 3-106.5. The Opinion stated the project *"may effect, likely to adversely affect"* proposed Southwestern Washington/Columbia River distinct population segment (DPS) of coastal cutthroat trout, bald eagle, Columbia River DPS of bull trout, and Columbian white-tailed deer. The USFWS provided an updated incidental take statement for Columbian white-tailed deer and bald eagle to the December 6, 1999 Opinion, (USFWS reference #02-4212).
- On September 13, 2004, the USFWS concurred that the MCR jetty rehabilitation project *"may affect, not likely adversely affect"* bald eagle, marbled murrelet, and brown pelican (USFWS reference # 04-3736).
- On December 14, 2004, the Corps determined that continued O&M of the CR navigation channel, from RM -3.0 to 145, would have *"no effect"* on western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, and water howellia. The USFWS concurred that the O&M of the project *"may affect, not likely adversely affect"* bull trout, bald eagle, brown pelican, marbled murrelet, and Columbian white-tailed deer (USFWS reference # 1-7-04-I-0090).
- On December 27, 2004, the USFWS concurred that de-designation and designation of the dredged material disposal sites offshore of the MCR, in Oregon and Washington, *"may affect, not likely adversely affect"* short-tailed albatross, marbled murrelet, and brown pelican (USFWS reference # 1-7-04-I-489).
- On May 23, 2008, the USFWS concurred that the Benson Beach sand berm restoration project *"may affect, not likely adversely affect"* brown pelican and western snowy plover (USFWS reference # 13420-2008-I-0063).

- On September 29, 2010, the Corps determined that O&M of the Columbia River federal navigation channel, from RM -3.0 to 145, will have *"no effect"* to western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, and water howellia. The USFWS concurred that O&M of the project *"may affect, not likely adversely affect"* bull trout, marbled murrelet, and Columbian white-tailed deer (USFWS reference # 13420-2010-I-0165).
- On February 23, 2011, the USFWS concurred that the major rehabilitation of the MCR Jetty System *"may affect, not likely adversely affect"* bull trout, marbled murrelet, and western snowy plover (USFWS reference # 13420-2011-I-0082).
- On January 24, 2012, the USFWS concurred that the minor 2012 updates to the North Jetty dredged material placement site has the same effects as the 2010 consultation (USFWS reference # 13420-2010-I-0165) on the O&M of the Columbia River federal navigation channel. The USFWS concurred that the action *"may affect, not likely adversely affect"* bull trout, marbled murrelet, and Columbian white-tailed deer (USFWS reference # 13420-2010-I-0165).

The Corps' 2010 BA for the Columbia River dredging and dredged material placement program, for which the dredging and placement action and range of effects is very similar to the proposed action described herein, received USFWS concurrence on September 29, 2010, as listed above. Therefore, the potential effects for bull trout, marbled murrelet, and Columbian white-tailed deer ***are consistent with previous determinations*** and the species are not further evaluated in this BA. In addition, the Corps determined the proposed action will have ***"no effect"*** to western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, and water howellia. Therefore, these species are also not further evaluated in this BA.

Beginning in April 2013, the Corps sought active participation from USFWS on ways to avoid and minimize potential adverse effects to SHLA and its habitats. Placement activities can facilitate the creation and/or maintenance of suitable SHLA habitat and the Corps has worked with USFWS and its partners to minimize potentially adverse effects and maximize the beneficial effects of dredged material placement actions throughout the lower Columbia River for SHLA. Specific meetings and phone conversations include the following:

- The Corps met with staff from USFWS and the Center for National Lands Management on 26 April 2013 to discuss the dredging program and processes involved in coordinating dredging and placement at uplands sites.
- In addition, the Corps met with the USFWS on 25 June 2013 to discuss the dredged material placement sites and define the project area to include all placement sites within the Network.
- In August 2013, the Corps participated in a workshop with USFWS personnel from both the Washington and Oregon offices and the ports to discuss ESA coverage, Section 7 consultation, the Corps' proposed action and consequential management needs – specifically the development of Habitat Conservation Plans.
- Staff from the USFWS participated in a site visit to Rice and Miller Sands Islands on 16 September 2013 to observe active dredged material placement by the Dredge OREGON.
- Following this site visit, the Corps and USFWS (both ESA consultation specialists and migratory bird specialists) met on 25 September 2013 to discuss the Corps' actions in the lower Columbia River and potential impacts to Caspian terns and double-crested cormorants in the lower estuary.

- On 19 December 2013, the Corps met with USFWS staff to discuss the proposed action, specifically dissuasion of terns and cormorants and monitoring of streaked horned larks, as well as how to address western yellow-billed cuckoos (discussed below).
- The Corps presented the USFWS with an initial draft of the proposed action on 10 January 2014 and further discussed the proposed action in a follow-up meeting on 21 January 2014.
- The Corps organized a meeting on 3 February 2014 to discuss the proposed monitoring strategy for streaked horned larks, including USFWS staff and regional experts from the Washington Department of Fish and Wildlife, the Center for Natural Lands Management.
- On 26 February 2014, the Corps discussed dissuasion of terns and cormorants, and possible areas of overlap with staff from the USFWS.
- Finally, on 3 March 2014, the Corps initiated formal consultation with USFWS and delivered this biological assessment to the Service for review.

WESTERN YELLOW-BILLED CUCKOO

The USFWS announced the proposed listing of the western distinct population of yellow-billed cuckoos (*Coccyzus americanus occidentalis*) as *threatened* under the ESA on October 3, 2013 (FR 78 61622). This proposal applies to the western yellow-billed cuckoo throughout its entire breeding range. The cuckoo became a candidate for ESA-listing in 2001 and since this time, the USFWS has annually evaluated the species' status and identified threats to its continued existence. The available information concludes that the western yellow-billed cuckoo has declined by several orders of magnitude over the past 100 years, and that the decline is continuing, isolating birds into smaller populations at core breeding areas. The decline of the western yellow-billed cuckoo is primarily the result of habitat loss and degradation. While much of this habitat loss occurred historically, many of the impacts have subsequent ramifications that are on-going and affect the size, extent, connectivity, and quality of riparian vegetation within the range of the cuckoo. The USFWS found that no critical habitat was present in Oregon or Washington and as a result, no critical habitat was proposed for designation in this region.

The western yellow-billed cuckoo is a riparian obligate species, historically found in parts of 12 states west of the Continental Divide, including: Oregon, Washington, Idaho, Montana, Wyoming, Colorado, Nevada, Utah, California, Arizona, New Mexico, and Texas. Approximately 350-500 pairs are estimated to breed north of the Mexican border where habitat requirements include extensive riparian forests dominated by mature, structurally diverse trees and a vegetative understory consisting of shrubs and smaller trees. The last confirmed breeding records in Oregon are from the 1940s and observations of individual birds in 2009, 2010, and 2012 near the Sandy River Delta and its confluence with the Columbia River were the first confirmed sightings west of the Cascade Mountains since 1977. Historically, the western yellow-billed cuckoo was considered rare in the Pacific Northwest and the available data suggests that if yellow-billed cuckoos still breed in Oregon and Washington, the numbers are extremely low with pairs numbering in the single digits.

The USFWS concluded that the curtailment and decline in riparian habitat is primarily the result of long-lasting effects from manmade features that alter watercourse hydrology such that the natural processes that sustain riparian habitats are diminished or non-functional. In addition, the encroachment and establishment of non-native species has further degraded the quality of remaining riparian areas. Climate change was also recognized as a critical issue with potentially wide-ranging effects on the species and its habitat; it was suggested that the effects of climate change will exacerbate habitat loss and degradation, invasive species, and wildlife/drought resulting in smaller patch sizes and more isolated breeding areas. Nesting yellow-billed cuckoos are sensitive to patch size and seldom use riparian areas smaller than 100m x 300m. For this reason, the USFWS concluded that smaller patch sizes and isolated breeding areas may compound juvenile

dispersal and re-occupation of breeding adults. Furthermore, where riparian areas are located in proximity to urban and agricultural areas, the potential for pesticide and herbicide to affect habitat, prey availability, and cuckoos themselves is increasingly high.

Based on the information provided above, it is assumed that very few western yellow-billed cuckoos are present in the region, and if any birds are present they would likely occupy intact and extensive riparian forests found outside of the Network. The placement sites (described in more detail below) are largely composed of open, sandy areas and if riparian vegetation is present, it does not consist of large, extensive riparian forests preferred by the cuckoo (greater than 100 x 300m). For this reason, the proposed placement activities are highly unlikely to affect individual cuckoos or their preferred habitats because these conditions are not present in the action area. As a result, the Corps has determined the proposed action will have **"*no effect*"** to the western yellow-billed cuckoo and therefore the species is not further discussed in this assessment.

CHANGES FROM PREVIOUS ACTION

The Corps is proposing to practice shoreline placement at Pillar Rock Island (RM 27.2), which is currently an upland placement site within the existing Network and is owned by Oregon Department of State Lands. Shoreline placement will facilitate use of the upland placement site, which is currently too narrow for placement to occur. Once the site reaches upland placement capacity, shoreline placement would be conducted periodically to protect the integrity of the upland site.

The Corps is also modifying the Wahkiakum Ferry Channel side channel project (RM 43) that connects the ferry landing on Puget Island to an area of deep water in the Columbia River for the purpose of supporting improvements to the ferry dock and a new, larger ferry. The modification increases channel width from 200 to 300 feet and shifts the channel centerline approximately 120 feet upstream. There is no change to dredging or placement methods or best management practices, and construction and future maintenance volumes associated with the channel widening are within the previously considered range of effects. Figure 1 shows the revised channel alignment and shoaling to be dredged within the existing and new footprints.

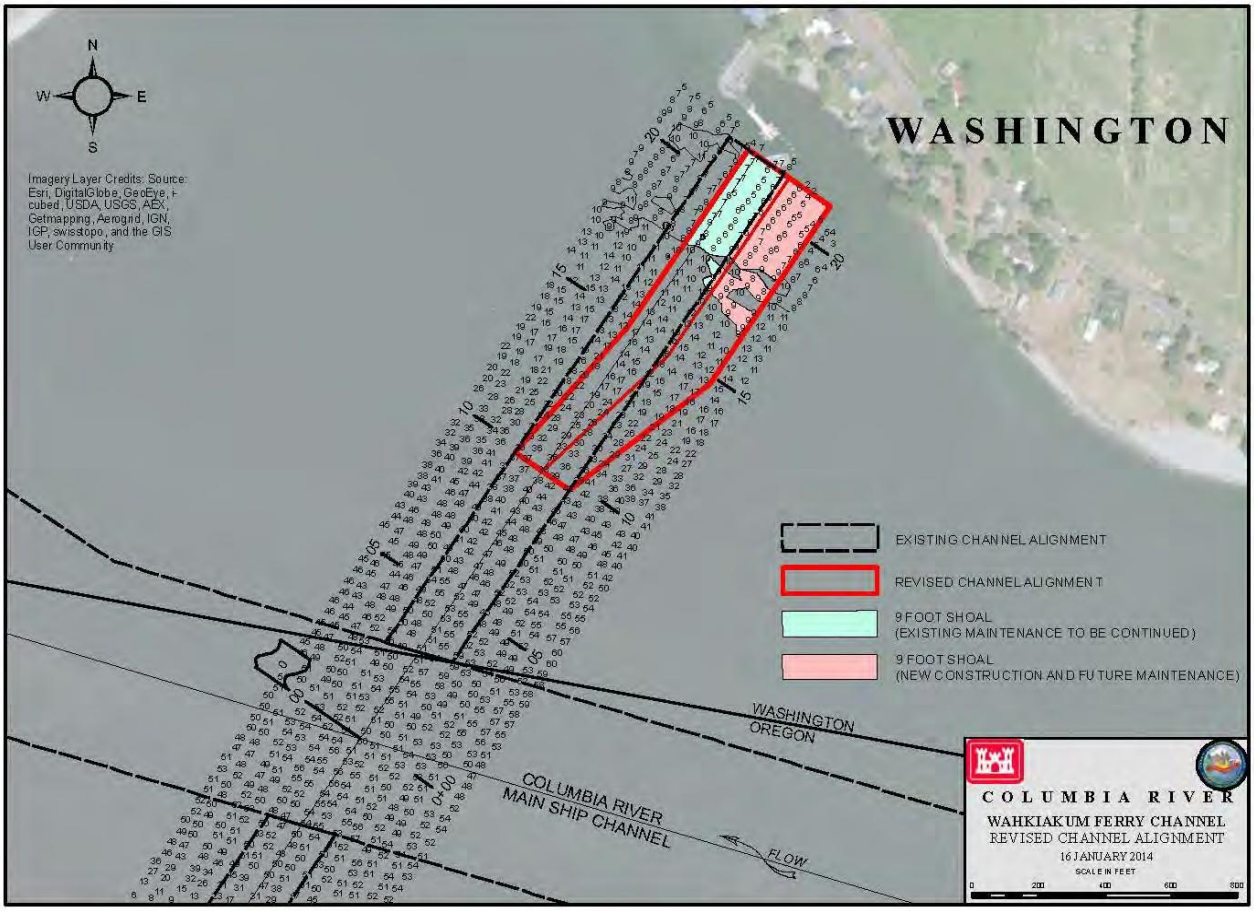

Figure 1: Modification to the Wahkiakum Ferry Channel

As detailed above, the Corps has previously consulted on the range of effects from shoreline placement in the lower Columbia River and dredging the Wahkiakum Ferry Channel and associated in-water placement on bull trout, marbled murrelet, Columbian white-tailed deer, and determined there would be ***"no effect"*** to western snowy plover, northern spotted owl, short-tailed albatross, Oregon silverspot butterfly, and water howellia. As a result of these evaluations, the addition of shoreline placement at Pillar Rock Island and modifications to the Wahkiakum Ferry Channel ***will not result in new or additional effects*** that were not previously considered. For this reason, the effects to these species from shoreline placement at Pillar Rock Island and modifications to the Wahkiakum Ferry Channel will not be evaluated further.

ACTION AREA

The Action Area includes all areas to be affected directly or indirectly by the Federal action and not merely the immediate are involved in the action (50 CFR § 402.02). The Columbia River is the largest river in the Pacific Northwest, starting high in the Rocky Mountains of British Columbia. The river flows northwest before turning south into Washington State and then west toward the Pacific Ocean, forming the border between Oregon and Washington. The river is approximately 1,240 miles in length and, by volume, is the fourth largest river in the United States.

For the purposes of this BA, the Action Area is defined as the Columbia River Federal Navigation Channel from the mouth (RM -3), upstream to Bonneville Dam (RM 145), including the Portland-

Vancouver Anchorages and the nine federally authorized side channel projects in this reach. The side channels include Baker Bay, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek, Wahkiakum Ferry Channel, Westport Slough, Old Mouth Cowlitz River, and Upstream Entrance to Oregon Slough. The lateral extension of the Action Area extends 300 feet shoreward of the mean higher high water (MHHW) or ordinary high water (OHW) line to include direct and indirect effects from dredging and in-water placement of dredged materials in the lower Columbia River. The Action Area also extends 200 feet landward from the boundaries of the upland and shoreline dredged material placement sites.

The upland and shoreline dredged material placement network, as shown in Table 2 and Figure 2 below, includes 25 sites in the Columbia River between RM 3 to 105 and the Benson Beach intertidal site on the Pacific Ocean. Detailed information, figures, and current environmental baseline conditions on the upland and shoreline placement sites is provided in Appendix B. The Action Area includes the ocean disposal sites, which are described in Appendix B.

Table 2: Upland and Shoreline Dredged Material Placement Network

Site	State – River Mile	Site Type
Benson Beach	W-Pacific Ocean	Shoreline (intertidal)
West Sand Island	O-3.1	Upland
Rice Island	O/W-21.0	Upland, Sump
Miller Sands	O-23.5	Shoreline
Pillar Rock Island	O-27.2	Upland, Shoreline
Skamokawa - Vista Park	W-33.4	Upland, Shoreline
Welch Island	O-34.0	Upland
Tenasillahe Island	O-38.3	Upland
James River	O-42.9	Upland
Puget Island	W-44.0	Upland, Sump
Brown Island	W-46.3	Upland
Crims Island	O-57.0	Upland
Hump Island	W-59.7	Upland
Lord Island (Upstream)	O-63.5	Upland
Dibblee Point	O-64.8	Upland
Howard Island	W-68.7	Upland
Cottonwood Island	W-70.1	Upland
Northport	W-71.9	Upland
Sandy Island	O-75.8	Upland
Lower Deer Island	O-77.0	Upland
Martin Bar	W-82.0	Upland
Sand Island	O-86.2	Shoreline
Austin Point	W-86.5	Upland
Fazio Sand & Gravel	W-97.1	Upland, In-water
Gateway	W-101.0	Upland
West Hayden Island	O-105.0	Upland

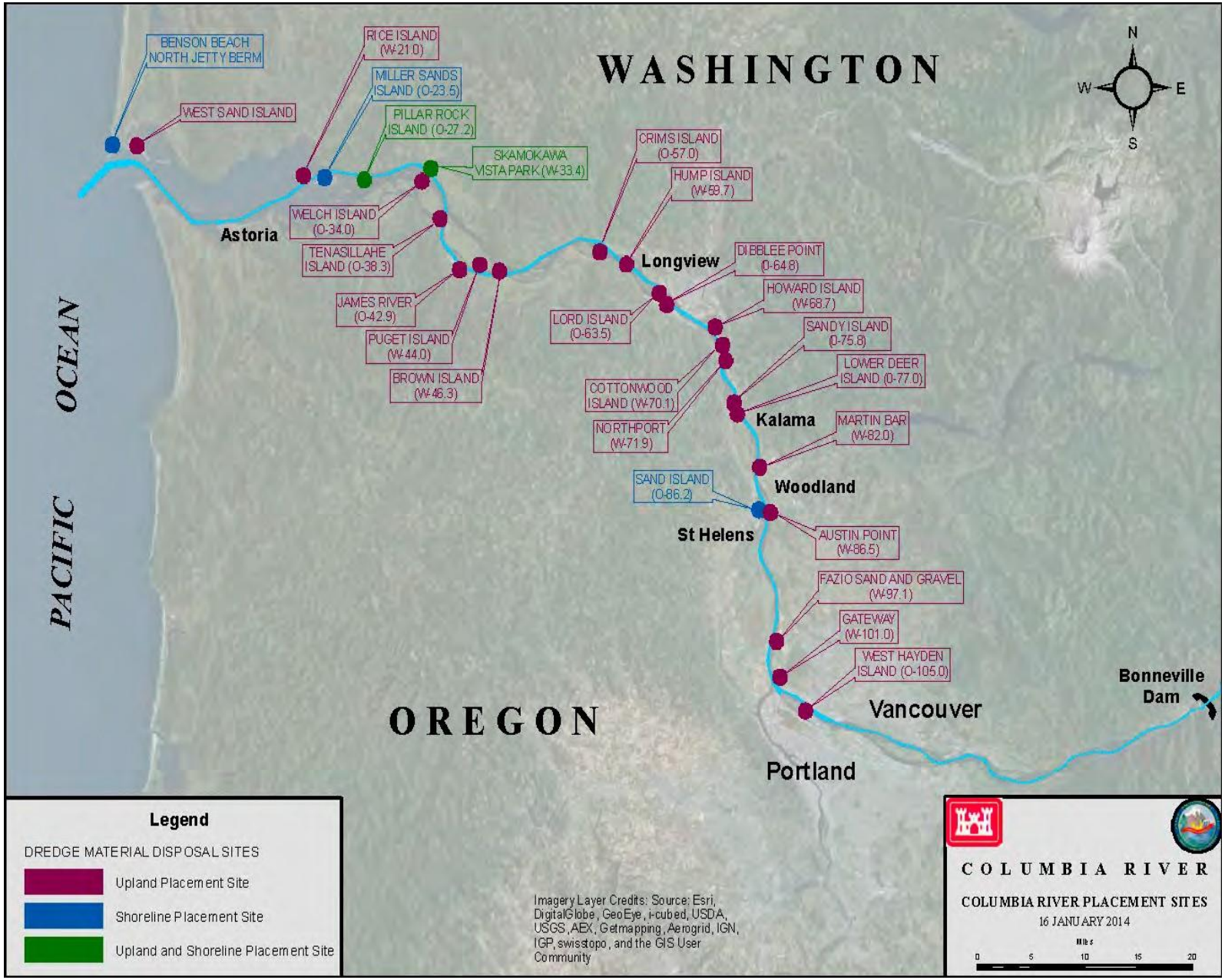

Figure 2: Upland and shoreline Dredged Material Placement Network in the Columbia River

Streaked horned larks are not distributed evenly throughout the Columbia River or across all placement sites, where some sites host a large proportion of the local population (Rice and Brown Islands) and other sites have very few, if any, birds. For the purpose of this document, placement sites were grouped together to describe changes to habitat within specific sections of the river. Six groups were identified as biologically relevant and within operational flexibility for the O&M program, and include the following placement sites:

- Group 1: Benson Beach intertidal site and West Sand Island
- Group 2: Rice, Miller Sands, and Pillar Rock Islands
- Group 3: Skamokawa – Vista Park, Welch and Tenasillahe Islands, James River, Puget and Brown Islands
- Group 4: Crims and Hump Islands, Lord Island (upstream), Dibblee Point, Howard and Cottonwood Islands, and Northport
- Group 5: Sandy and Lower Deer Islands, Martin Bar, Sand Island, and Austin Point
- Group 6: Fazio Sand & Gravel, Gateway, and West Hayden Island

DESCRIPTION OF THE PROPOSED ACTION

The proposed action entails the continued operation and maintenance of the CR FNC and upgrading the existing placement network and operations to meet current and projected dredged material placement needs for the next five years. As part of the proposed management of material placement, the maintenance of the placement network includes pre-placement conservation measures to minimize potential impacts of placement, post-placement redistribution of sediment, and routine dissuasion of colonial nesting birds to preclude nesting on active placement sites in order to minimize adverse effects. Additionally, the placement of dredged materials on previously unsuitable habitat will be beneficial by creating denuded areas, which will transition into suitable breeding habitat for SHLA.

Appendix B provides a general description by which the Portland District Corps conducts dredging and placement activities in the Columbia River. The appendix briefly describes the different types of dredges (hopper, pipeline, clamshell, and backhoe), placement sites (in-water, ocean, upland, and shoreline), and best management practices performed during dredging, as well as site descriptions for the upland and shoreline dredged material placement network.

There are seven individual features of the proposed action discussed at length below, including:

- Pre-placement site preparations and modifications
- Dissuasion of avian species
- Dredging and in-water placement
- Upland and shoreline placement: 5-year placement plan
- Post-placement site modifications
- SHLA monitoring
- Communication and Coordination

All actions will necessarily be specific to each dredged material placement location, but would generally include site preparations prior to placement, avian dissuasion actions (if necessary), followed by active dredged material placement and post-dredged material placement modifications, monitoring, and regular stakeholder meetings.

SITE PREPARATIONS

Prior to placement of dredged sediments, upland and shoreline sites may need preparation and/or modification to facilitate placement and minimize adverse impacts to sensitive species and habitat. There are two phases to site preparations: those that occur prior to the breeding season and those that occur immediately prior to placement of dredged material. In all cases, site preparations begin with delineation of the dredged material placement footprint by a Corps technical channel maintenance representative, dredge manager, and a Corps biologist.

The dredging season typically begins in June after the spring freshet has subsided. This coincides with the breeding season for nesting and migratory songbirds, whereupon nesting begins at upland locations in the early spring in March and April. If vegetation (trees, shrubs, forbs) is present in the dredged material placement footprint and is used for nesting, nestlings and juvenile songbirds could be directly impacted from dredged material placement later in the summer (June through September). To minimize adverse impacts to songbirds in the dredged material placement footprint, vegetation would be mechanically removed via a bulldozer or similar equipment, piled on the site, and if possible, buried in the dikes or berms in the late winter/early spring prior to the onset of the breeding season. Only vegetation within that year's dredged material placement footprint, and any staging/stockpile areas, or access routes would be removed during site preparations.

Depending on the dredged material placement schedule (presented and discussed later), each site will need to be evaluated prior to placement to assess the suitability of the area for SHLA and document the presence/absence of any birds. A protocol will be based on established survey methods or the most recent site information. If upland or shoreline sites have high site use by SHLA, early site preparations would occur in the winter/spring prior to the lark nesting season and may include site grading by earth-moving equipment, and trenching or mounding of sands for dissuasive purposes. As a ground dwelling bird, SHLA prefer open space with a clear view of their surroundings. Mounding or trenching of dredged materials throughout a placement site substantially reduces the line-of-sight available to birds from the ground, resulting in an area that may be less appealing for nesting and foraging than nearby areas which provide better visibility. If a dredged material placement site is scheduled for use in any particular year, making a site unsuitable by trenching or mounding sands could minimize adverse affects associated with dredged material placement during the breeding season.

For example, if Tenasillahe Island is used for dredged material placement in June, site preparations would clear and remove vegetation in February or March before songbirds have an opportunity to initiate nesting in the dredged material placement footprint. Similarly, off-loading, staging, stockpile areas and all access roads used during material placement will be evaluated prior to placement. If these secondary use areas are not contained within the dredged material placement footprint, these areas will be evaluated and prepared in the same manner as the dredged material placement area to minimize adverse effects to SHLA and nesting songbirds.

As a preventative measure to preclude site use by terns and cormorants, sands were mounded and trenched following placement activities in 2011, 2012, and 2013 at Miller Sands Island and Rice Island (see Figure 3). While neither site was regularly monitored following mounding/trenching, it is hypothesized that the reduced visibility decreased site nesting by larks and other birds, including Caspian terns, double-crested cormorants, and American white pelicans. Where mounding or trenching occurs during the five-year implementation plan, a monitoring plan (presented and discussed later) will evaluate the efficacy of these actions in precluding site use and minimizing direct adverse effects to avian species during the nesting season.

Figure 3: Trenches on Rice Island (left) and mounding on Miller Sands Island (right)

It should be noted that it is not the intent of the dredging program to make all dredged material placement sites unsuitable in every year. Rather, only those portions of sites that are suitable in any given year ***and*** are proposed for use during the breeding season will be modified to preclude active SHLA use during the breeding season. Ideally, a shifting mosaic of suitable nesting habitat on a particular site and across the Network would be available for SHLA use while only a portion of some sites are actively prepared for dredged material placement (and therefore unsuitable) in any given year. At sites with high human activity (sand mining/borrow sites, public recreation, agriculture, heavy machines, storage, etc.) where there are no avian species concerns, early site preparations may not be necessary to preclude effects to larks during placement activities because nesting birds are highly unlikely to be present in these areas.

Where site preparations are deemed necessary, earth-moving equipment (bulldozers, tractors, etc.) is used to construct berms and dikes around the perimeter of upland dredged material placement areas to contain the slurry mixture as it is discharged from the incoming dredged material pipe (see Figure 4). In addition, the site is graded to maximize the capacity of the dredged material placement footprint (see) and provide space for the settling ponds.

Figure 4: Site preparations and dike building for placement of dredged materials (at Northport).

If there is not sufficient water depth for the equipment barge to land at an existing shoreline, a landing ramp and access road would be constructed from material on the placement site to gain access to the island (see Figure 5). Some shoreline grading at the landing location may also be

necessary to facilitate equipment access to other portions of the island. Typical site preparations at upland sites include grading a slope for the incoming dredged material pipe (see Figure 6).

Figure 5: Typical build-out of a barge landing (Rice Island)

Figure 6: Grading slope for incoming dredged material pipe

Site preparations may take anywhere from several days to several weeks to complete, depending on the existing condition of the site. If a site has little-to-no vegetation, was used recently where some berms or dikes remain in place, the necessary site preparations would be minimal and could be completed within 1-3 days. Conversely, if a site has substantial vegetation and/or has not been used recently, preparations could take several weeks to clear vegetation, construct dikes and re-grade the area for dredged material placement.

Prior to placement of sediments in the summer/fall, additional site preparations at all sites would include the staging, stockpiling and placement of pipes and valves for sediment discharge. When pipes and other material are not stockpiled on the landing barge, they are stockpiled in the staging area within or near the placement footprint. Unless there are permanent weirs (i.e. Gateway and West Hayden Island) and outfall pipes on site, temporary weirs and outfall pipes are re-used as the dredge moves from site to site (see Figure 7 and Figure 8). At upland sites requiring the installation of temporary weirs and outfall pipes, these actions will occur immediately prior to placement and disassembly would occur immediately after placement.

Figure 7: Weir and berm structure, in operation on Rice Island

The combination of riverine processes, river flows, waves, and tidal effects naturally erodes material from shorelines. As described in Appendix B, beach nourishment is a method of replenishing material that has eroded away from shorelines and is conducted as needed. Beach nourishment or shoreline placement occurs at the sand/water interface, not in open water. Shoreline placement operations differ from beach nourishment operations in that the premise of placement is also used to directly protect a Corps asset. For example, shoreline placement is conducted when the integrity of an upland placement site is compromised by rapidly eroding shorelines. However, for the purposes of this document, shoreline placement and beach nourishment are used interchangeably with regards to placement methodology.

Shoreline sites (listed in Table 2: Upland and Shoreline Dredged Material Placement Network) typically experience substantial erosion between dredged material placement events. Each shoreline site experiences varying rates of erosion and replenishment needs range from annual for areas with high erosion to periodic (every 3 to 5 years) for sites with less erosion. Because shoreline sites are used at higher frequencies for placement and are exposed to erosion, little vegetation typically becomes established between dredged material placement events. However, because SHLA and other ground-dwelling songbirds prefer habitats with minimal vegetation, these areas could provide suitable breeding and foraging habitat in the interim.

Figure 8: Outfall pipes returning water back to river after dredged material has settled out, Rice Island

Furthermore, equipment, vehicles and pipes are staged above the scarp of the existing dredged material placement footprint at shoreline placement sites prior to actual sediment placement (see Figure 9). These staging areas are typically 50 feet by 90 feet (~0.10 acre) and are located as close to the shoreline as safely feasible. During placement inspections, the exact location of the 0.10-acre staging area can be located to avoid or minimize impacts to SHLA. Similar to site preparations at upland sites, early preparations may be necessary in the upland areas at shoreline sites to accommodate the staging area. The remaining activities occur during active placement (discussed later).

Figure 9: Staging equipment on top of the bank at Sand Island Shoreline Placement Site

DISSUASION

It is anticipated that in some instances dissuasion will be necessary to preclude use of the site by larks, Caspian terns (*Hydroprogne caspia*, formerly *Sterna caspia*), and/or double-crested cormorants (*Phalacrocorax auritus*) during the breeding season when it overlaps with dredged material placement (larks) or when required by NMFS 2012 BiOp T&C (Caspian terns and double-crested cormorants). Management activities can be categorized into three actions: hazing; physical barriers or obstructions; and habitat modification to discourage nesting, roosting, and/or foraging behavior. All management actions will comply with local, state, and federal regulations. As necessary, multiple management measures will be used in conjunction to increase the effectiveness of dissuasion in order to minimize adverse effects to birds during placement activities.

CORMORANTS AND TERNS

The Pacific Flyway Council has outlined a management strategy for double-crested cormorants to be implemented at the local, regional, and flyway scale (Pacific Flyway Plan 2012). The localized strategies are relevant and appropriate for implementation with the dredging program in the Columbia River estuary for cormorants, as well as Caspian terns and other piscivorous species. The peak nesting season for these species begins in mid-April and culminates in June, though nestlings may be present through August and September. Hazing will be conducted, where necessary, to prevent terns and cormorants from establishing nest colonies on islands in the Network (as described below). Hazing activities, including the use of frightening devices, decoys, scarecrows, visual and/or auditory deterrents, human disturbance, dogs, lights, and/or water cannons are best used in combination with other methods to ensure lasting effects.

Caspian terns formerly had a nest colony on the west (downstream) portion of Rice Island which was later moved downstream to East Sand Island in 1999 and 2000. Following the move to East Sand Island, dissuasion activities on upland placement sites in the Network are implemented regularly to prevent nesting by terns and cormorants as required by the NMFS 2012 BiOp, specifically T&C 1(k) that states, "monitor upland disposal sites during the nesting season. Discourage any avian predators that are found nesting at an upland disposal site, consistent with the Migratory Bird Act." Dissuasion activities occurred (as necessary) at the placement sites on Rice, Miller Sands, and Pillar Rock Islands, as these are the locations where terns have exhibited nesting behavior in recent years.

Between 2001 and 2003, terns were occasionally observed roosting, loafing, and displaying courtship/breeding behaviors on upland portions of Rice, Miller Sands and Pillar Rock Islands. Dissuasion materials (fencing, flagging, eagle silhouettes) were installed at Miller Sands and Pillar Rock Islands in 2004, 2005, and 2006, effectively discouraging terns from roosting or nesting in these areas. No birds were observed at Rice, Miller Sands, or Pillar Rock Islands in 2007 or 2008, but terns did initiate nesting at Rice Island in 2009, and the eggs were collect using a depredation permit from the USFWS; no further nesting attempts were made in 2009 following egg collection.

In all previous years, dissuasion materials were installed at the former colony site at the west end of Rice Island prior to the beginning of the nesting season to discourage terns from nesting. In 2010, this area became completely vegetated and consequently unsuitable for nesting terns. However, terns were observed in an upland area east of the former colony site in 2010, whereupon stakes and flagging were installed which effectively deterred nesting at Rice Island; no terns were observed at Miller Sands or Pillar Rock Islands in 2010. There was no suitable habitat for tern nesting at Miller Sands or Pillar Rock Island in 2011, 2012, or 2013, and terns were only observed in upland areas at Rice Island, from which they were subsequently hazed.

With regards to the proposed 5-year placement plan, if dissuasion is needed in the dredge placement network, physical barriers could be employed to preclude site use when regular human presence is not feasible. Following successful dissuasion, these materials (nets, ropes, silt fencing, etc.) may be dismantled and reused in other areas as needed. Only non-lethal dissuasion practices will be implemented for adult terns and cormorants. These dissuasion activities could occur and overlap spatially and temporally with SHLA nesting. Currently, Rice Island has habitat conditions which are suitable for tern nesting, but these areas do not overlap spatially with suitable habitat areas for SHLA. Pillar Rock Island has some habitat areas that are marginally suitable for tern nesting, and these areas overlap with the suitable habitat that is available for SHLA.

Where tern nests are discovered before egg-laying has been initiated, nests would be manually brushed over to eliminate the nest. Where tern egg laying has occurred, the Corps has a contract to collect tern eggs under a USFWS Migratory Bird Permit (permit # MB209988-0) from Rice, Miller Sands, and Pillar Rock Islands. Studies have shown that birds disperse to other nearby nesting areas when nests and eggs are repeatedly destroyed and birds are continually harassed early in the breeding season (Pacific Flyway Council 2012).

If birds are present and exhibit nesting or breeding behavior, the person monitoring would haze the birds from the area, destroying nest scrapes, collecting eggs (as permitted), and would follow these actions by immediately installing dissuasive materials. Wooden stakes at least three feet would be installed with flagging secured to the stakes to scare birds from the area. Flagging would be a minimum of two feet in length, and stakes shall be placed 10 feet apart. Polyester roping may be used in conjunction with the flagging to further preclude the habitat available to birds. All survey and monitoring efforts will be standardized to the extent possible to ensure consistency of information and detections. A proposed monitoring plan is presented and described later in this document, and includes monitoring the effectiveness of dissuasion actions on deterring terns and cormorants, as well as precluding site use by SHLA where it is deemed necessary.

LARKS

Recent observations have shown that some areas become suitable for SHLA less than 12 months following dredged material placement if sufficient organic materials are present in the dredged sediments to support vegetation growth (Anderson 2013). Similarly, it is anticipated that areas where dense vegetation currently makes an area unsuitable for larks could become suitable within the breeding season immediately following vegetation removal during site preparations in the spring. These same areas may also be or could become suitable for nesting or roosting by Caspian terns and double-crested cormorants.

To prevent larks from using areas that are prepared in the spring (prior to mid-April) for dredged material placement during the active breeding season (mid-April – mid-August), habitat modifications and/or physical barriers may be used to dissuade larks. Habitat modifications could be implemented to reduce the availability of nesting habitat, as well alter a site's suitability. It is proposed that trenching or mounding, as described above, effectively alters the suitability of a site for birds preferring habitats with minimal vegetation and expansive open habitat. Tree and vegetation removal, altering the density of vegetation, and modifying the topography of a site are all methods that could passively dissuade use of a placement site between dredged material placement events. Both vegetation removal and modifications to site topography would involve mechanical methods (bulldozers). Ropes and flagging may be installed at a site immediately following vegetation removal. Physical barriers and visual deterrents (nets, fencing, ropes, flagging, screens, etc.) can minimize the area available for nesting and roosting, effectively dissuading nesting behavior through passive means.

DREDGING AND IN-WATER PLACEMENT

The CR FNC projects are maintained by regular O&M dredging to provide reliable deep-draft navigation. Each year, the Corps dredges 3-5 million cubic yards (CY) of sediment at the Mouth of the Columbia River to maintain the inlet's 6-mile long deep-draft navigation entrance channel and approximately 6 to 9 million cubic yards of material from the lower Columbia River with placement at in-water, ocean, upland, and shoreline dredged material placement sites. The annual dredging plan is based on up-to-date survey data collected regularly and frequently throughout the year.

Unusually high and sustained spring flows occurred in 2011 and 2012 and it is unknown where "typical" shoaling will occur with the deepened channel from RM 3 to 106.5. In addition, it is also unknown what potential volumes of sediment will need to be removed from the deeper channel and placed in upland or shoreline areas. The proposed action forecasts dredging and placement need based on the best available information.

A general description of dredging and placement activities is described in detail in Appendix B.

DREDGED MATERIAL SEDIMENT QUALITY

Sediments from the federal navigation channels are evaluated to determine if they are acceptable for in-water unconfined placement according to the requirements of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act. The Corps has characterized sediments to be dredged in accordance with the regional and national dredge material testing manual protocols, Ocean Testing Manual, Inland Testing Manual, 2009 Northwest Regional Sediment Evaluation Framework (SEF), and previously under the 1998 Dredge Material Evaluation Framework (DMEF).

Project sediment testing is typically performed on the mainstem Columbia River on a 10-year rotational cycle unless an event occurs that would warrant more frequent sampling. The 10-year rotation allows for the continued, even management of both budget and labor while providing sediment quality information to allow dredging to proceed unobstructed. Projects dredged less frequently, such as the auxiliary side channel projects, are evaluated, sampled, and tested as required by the SEF. A brief description of recent sediment quality sampling results is provided below for the Action Area.

- Mouth of the Columbia River (MCR) FNC (RM -3 to RM 3) – The sediments tested in 2008 at the MCR averaged 98.5% sands and 1.5% fines.
- Columbia River FNC, deep draft channel and associated turning basins (RM 3 to RM 106.5) – The 2008 analyses indicated a mean grain-size of 92% sand. Total organic carbon averaged 0.25%. The Oregon Slough reach of the deep-draft channel was tested in 2005. Mean grain size for all the samples is 0.40 mm, with .037% gravel, 48.15% sand, 41.925% silt, and 9.875% clay.
- Columbia River FNC, Vancouver, Washington to Bonneville Dam (RM 106.5 to RM 145) – The 2009 analyses indicated a mean grain-size of 99.9% sand and gravel.
- Portland/Vancouver Anchorage Project – There is currently no shoaling in the anchorages to test. If shoaling develops, the site will be evaluated under the SEF prior to dredging.
- Columbia River FNC, side channels:
  - Baker Bay (tested in 2009) – Materials are primarily fine-grained that have settled out of the Columbia River.
  - Chinook Channel (tested in 2008) – The material is less than 25% sand, with the outer channel averaging 19.3% sand and 81.0% fine-grained material. The inner channel averaged 1.5% sand and 98.1% fine-grained material.

- Hammond Boat Basin (tested in 1994) – The samples were sandy, clayey, silts. They averaged 10% sand, 18% clay and 72% silt. The median grain size for the samples varied from medium to coarse silt.
- Skipanon (tested in 2003 and 2013) – The post dredge sampling materials from 2013 are predominately fine-grained, with approximately 83.6% fines. The 2003 physical analyses indicated mean values of 23.9% sand and 76.1% silt/clay.
- Skamokawa Creek (tested in 1992) – Sediments are primarily sandy silt with concentrations of silt and clay, up to 22%.
- Wahkiakum Ferry (tested in 2006 and 2013) – This channel is part of the main Columbia River channel and in 2006 it was predominately sand, with 1.2 % fines. Sampling results from 2013 for the channel re-alignment are in preparation and review under the SEF.
- Westport Slough (tested in 2006 and 2013) – The 2006 analysis indicates the material is 66.4% sand and 33.8% silt and clay. Sampling results from 2013 are in preparation and review under the SEF.
- Old Mouth Cowlitz (tested in 2006) – The material is mostly silty sand of 96% fines.
- Upstream Entrance to Oregon Slough (tested in 2005) – Analysis indicate the material ranges from poorly graded sand to silty sand with an average of 94.28 % sand and 5.67 % fines.

The detailed results of the characterizations highlighted above are available upon request. Based on these results, the dredged materials have been determined suitable for unconfined aquatic placement without further testing.

UPLAND AND SHORELINE DREDGED MATERIAL PLACEMENT

OVERVIEW

The Columbia River has not yet stabilized following the completion of channel improvements in 2010, and by necessity, the Network needs to be fully utilized to accommodate the increased volumes of dredged material removed from shoals in the Columbia River. To meet this need, the Corps is proposing to continue placing dredged materials on the existing dredged material placement network, including the addition of shoreline placement at Pillar Rock as described previously. This allows for strategic management of dredged material for conservation and operational purposes. The careful management of the Network will allow for greater flexibility for the CR O&M program, as well as create suitable habitat for larks.

SHORELINE PLACEMENT

Shoreline placement involves pumping dredged material through a floating discharge pipe from the pipeline or hopper dredge (see Figure 10). The material is pumped to an existing shoreline where placement occurs at the sand/water interface (not in open-water). As described in the site preparations, the dredge first pumps a landing area on the shoreline to establish a point from which further material placement occurs. Dredged material is then pumped out in sand and water slurry (about 20% sand) and as it exits the shore pipe, sand settles out along the shoreline while water returns to the river (see Figure 11). A temporary sand berm is constructed to retain sand on the beach during pump-out, otherwise, much of the sand would immediately be lost to the river. Settling rates of Columbia River sands are very quick and turbidity from the operation is minimal.

Figure 10: Active shoreline placement at Sand Island (looking upstream)

Figure 11: Active shoreline placement at Sand Island (looking downstream)

The temporary berms are typically 5 feet high and 12 feet wide at the base. The berms are built gradually by earth-moving equipment as pump-out continues and are created from existing beach sand, pumped sand, or both. After sufficient sand has settled out and begins to increase in height, the settled sand is moved by bulldozers to match the elevation and profile of the existing shoreline at approximately the high water line. This process continues by adding to the shore pipe and proceeding longitudinally along the shoreline.

A typical beach/shoreline placement operation lasts from 5 to 15 days and the typical width of the created shoreline is approximately 100 to 150 ft, but may vary slightly depending on site and river

conditions. The length of shoreline replaced is dependent on the quantity of material to be dredged from the shoal in the channel and the available capacity within the placement footprint. After shoreline placement has completed, the slope of the shoreline is groomed by mechanical equipment (bulldozers) to a steepness of 10% to 15% to prevent the possibility of creating areas where juvenile fish could be stranded from vessel wakes on the new shoreline.

UPLAND PLACEMENT

Upland placement of dredged material is conducted via clamshell, hopper, and pipeline dredges, and earth-moving equipment (bulldozers, backhoes, etc.) to manage sediment placement. Regardless of type of dredge used, the earth-moving equipment may be barged in or driven in, depending on site accessibility. When equipment is barged in, the barge(s) is maneuvered to the shoreline where it is anchored for the duration of the operation. As discussed in site preparation, a wide sand berm is constructed from the barge to the placement site for movement and transfer of equipment.

While the method of discharge is similar to shoreline placement, upland placement requires extension of a pipeline from the dredge to a location in the placement site that is higher in elevation (see Figure 12). To maintain the stability and integrity of the pipeline, it is placed to rest against the berms that were constructed during site preparations. The sand-water slurry flows downhill from the discharge point toward the settling pond and weirs, which are lower in elevation than the discharge pipe (see Figure 13). There may be several discharge points (controlled by a valve) to better manage the incoming dredged material and use multiple settling pond configurations to ensure sufficient time for sediments to settle out before the water returns to the river.

Figure 12: Active dredged material placement at Martin Bar Upland Site

Figure 13: Active discharge of sand and water dredged material slurry at Rice Island Upland Site

If a clamshell dredge places material on a barge for upland placement, the material is off-loaded at a transfer point for placement at an upland site. Hopper and pipeline dredges pump dredged material in sand-and-water slurry directly into the diked, upland site. Discharge of water from upland sites back into the river is controlled by the use of weirs. The landward end of the pipe is moved by a bulldozer at regular intervals to minimize unintentional mounding on the site. In addition, sediment is maneuvered regularly during placement to facilitate flow and drainage of the slurry mixture across the site, maximizing settling and sediment accretion.

FIVE-YEAR DREDGED MATERIAL PLACEMENT PLAN

Recent surveys of the placement sites indicate site capacity varies by site and placement activities may fill a site to capacity. The pipeline dredge will likely be capable of pumping material farther and higher on upland placement sites due to a planned engine overhaul, increasing the Corps' ability to place dredged material on sites that were not previously viable or feasible. Table 3 below provides the estimated placement volumes in thousands of cubic yards (kCY) and estimated acres of each placement in the next five years, from 2014 through 2018.

The estimated volumes and acreages take into consideration the maximum feasible amount of placement based on equipment limitations, anticipated shoaling, site-use logistics based on past and future placements, and anticipated funding. Actual placement volumes and areas may be less due to limited annual funding and shoal development. In total, approximately 17,270,000 CY of dredged material will be placed at 20 of 26 sites over the next five years. Of that total volume, approximately 3,750,000 CY will be placed across four shoreline sites (Miller Sands, Pillar Rock Island, Skamokawa – Vista Park, Sand Island) over the next five years. The six sites not planned for use by the Corps for placement in the next five years (Benson Beach, Dibblee Point, Northport, Sandy Island, Austin Point, and Fazio Sand & Gravel) will remain in the Corps' planning for long-term placement.

Appendix B provides information on site history, existing site conditions, recent placements of dredged materials, and known SHLA use for each site within the Corps' Network. Figures for each site's placement plan over the next five years relative to suitable SHLA nesting conditions are

located in Appendix C. Placements of dredged material and availability of suitable SHLA nesting habitat on each designated critical habitat subunit in the Network are displayed on figures located in Appendix D.

Table 3: Five-year Dredged Material Placement Plan (2014 – 2018)

SITE (acres)	State River Mile	2014		2015		2016		2017		2018	
		kCY	Acres	kCY	Acres	kCY	Acres	kCY	Acres	kCY	Acres
Benson Beach (27)	*W-n/a*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
West Sand Island (83)	O-3.1	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	20	83
Rice Island (264) # +	O/W-21.0	650	53	250	3	*0*	*0*	650	104	600	23
Miller Sands (117) # +	O-23.5	*200	*6	*200	*14	*450	11	*200	*9	*200	*9
Pillar Rock Island (52) # +	O-27.2	*500	*26	*500	*26	*500	26	500	26	500	26
Skamokawa - Vista Park (15)	W-33.4	*0*	*0*	*0*	*0*	*0*	*0*	*200	*15	*0*	*0*
Welch Island (41) # +	O-34.0	*0*	*0*	400	41	*0*	*0*	200	23	*0*	*0*
Tenasillahe Island (41) # +	O-38.3	400	14	*0*	*0*	400	27	*0*	*0*	200	14
James River (53)	O-42.9	*0*	*0*	*0*	*0*	400	53	450	53	*0*	*0*
Puget Island (96)	W-44.0	*0*	*0*	400	96	*0*	*0*	*0*	*0*	1,000	96
Brown Island (102) # +	W-46.3	500	68	*0*	*0*	400	50	*0*	*0*	*0*	*0*
Crims Island (59) # +	O-57.0	*0*	*0*	500	22	*0*	*0*	*0*	*0*	*0*	*0*
Hump Island (65)	W-59.7	300	65	*0*	*0*	250	48	*0*	*0*	*0*	*0*
Lord Island Upstream (24)	O-63.5	*0*	*0*	*0*	*0*	*0*	*0*	200	20	*0*	*0*
Dibblee Point (52)	*O-64.8*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Howard Island (315)	W-68.7	*0*	*0*	400	173	*0*	*0*	400	108	400	34
Cottonwood Island (62)	W-70.1	350	26	*0*	*0*	300	13	*0*	*0*	*0*	*0*
Northport (31) +	*W-71.9*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Sandy Island (32) # +	*O-75.8*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Lower Deer Island (24)	O-77.0	*0*	*0*	400	11	300	12	*0*	*0*	*0*	*0*
Martin Bar (40)	W-82.0	250	23	*0*	*0*	*0*	*0*	*0*	*0*	300	40
Sand Island (28)	O-86.2	*0*	*0*	*400	*14	*0*	*0*	*400	*14	*0*	*0*
Austin Point (30)	*W-86.5*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Fazio Sand & Gravel (17)	*W-97.1*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Gateway (40)	W-101.0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	900	40
W. Hayden Island (116)	O-105.0	*0*	*0*	*0*	*0*	350	84	*0*	*0*	*0*	*0*
Yearly Totals		**3,150**	**281**	**3,450**	**400**	**3,350**	**324**	**3,200**	**372**	**4,120**	**365**
5 Year Total		**17,270**	**1,741**	*Denotes shoreline placement; # denotes designated SHLA critical habitat; *Italics indicate no placement activities*; + denotes recent breeding pairs recorded							

The following narrative summarizes the proposed dredged material placement activities across the Network by year.

Eight (8) sites will be used in 2014, totaling approximately 3,150,000 CY over 281 acres. Approximately 700,000 CY will be shoreline placement at the Miller Sands and Pillar Rock Island sites, combined. Table 4 provides the Corps' estimated sequence and timing of placement during the 2014 dredging season. The placement sequence assumes 25,000 CY will be placed daily, working five to seven days a week, and requiring three days to move between work areas. The sequence for each subsequent dredging year will be estimated during each year's annual coordination meeting with the USFWS.

Table 4: Estimated 2014 Dredged Material Placement Sequence

Site	Volume (CY)	Area (acres)	Timing	Notes
Tenasillahe Island	400,000	14	During SHLA nesting	Need early season site prep to remove vegetation and install SHLA dissuasion
Pillar Rock Island	500,000 (Shoreline)	26	During SHLA nesting	Shoreline placement with 0.10-acre staging site
Hump Island	300,000	65	During SHLA nesting	Need early season site prep to remove vegetation and install SHLA dissuasion
Martin Bar	250,000	23	During SHLA nesting	South parcel only, no SHLA or migratory bird nesting at borrow site
Miller Sands	200,000 (Shoreline)	6	During SHLA nesting	Shoreline placement with 0.10-acre staging site
Rice Island	650,000	53	After SHLA nesting	Site prep on west end to remove vegetation with tern dissuasion
Brown Island	500,000	68	After SHLA nesting	Site prep to remove vegetation, no dissuasion
Cottonwood Island	350,000	26	After SHLA nesting	Site prep to remove vegetation, no dissuasion
2014 TOTAL	3,150,00	281		

In 2015, nine (9) sites will be used, totaling approximately 3,450,000 CY over 400 acres. Approximately 1,100,000 CY will be shoreline placement at the Miller Sands, Pillar Rock Island, and Sand Island sites, combined.

In 2016, nine (9) sites will also be used, totaling approximately 3,350,000 CY over 324 acres. Approximately 950,000 CY will be shoreline placement at the Miller Sands and Pillar Rock Island sites, combined.

In 2017, nine (9) sites will be used, totaling approximately 3,200,000 CY over 372 acres. Approximately 800,000 CY will be shoreline placement at the Miller Sands, Skamokawa-Vista Park, and Sand Island sites, combined.

In 2018, nine (9) sites will be used, totaling approximately 4,120,000 CY over 365 acres. Approximately 200,000 CY will be shoreline placement at the Miller Sands site.

The availability of SHLA breeding habitat during the next five years is affected by specific site characteristics and landscape context, recent site modifications, vegetation succession, other human site uses, and planned site preparation and placement actions. Each placement site is

evaluated annually to assess the amount of habitat available for nesting, the amount of habitat that is unsuitable, and the amount of habitat yet-to-be suitable for nesting in any given year[1]. Finally, SHLA are not likely to completely use a site because they require a buffer of open space between the habitat edge and actual nest sites. This buffer to the river's edge, taller vegetation, or a riparian edge is approximately 25 meters (Anderson 2013).

As described above, site preparations and placement of dredged materials removes or buries all vegetation in the placement footprint. Habitat in the placement footprint is then considered yet-to-be suitable because the area is devoid of all vegetation (>90% bare sand). If left undisturbed, these areas are assumed to transition into suitable SHLA nesting habitat conditions after sufficient time has elapsed for vegetation to become established following placement. Once areas have developed into suitable habitat, it is further assumed they will remain suitable for a given number of years, based on the amount of time it takes for vegetation to grow and exceed 50% cover. It should also be noted that without placement of dredged materials, many areas would transition into unsuitable SHLA nesting habitat and these areas would remain unavailable to SHLAs until habitat conditions change through other disturbance mechanisms. The Corps' placement of dredged materials is therefore a crucial disturbance event for maintaining suitable breeding habitat for SHLA on upland placement sites.

Upland placement events at Rice Island, Skamokawa-Vista Park, James River, Puget Island, Howard Island, and Sand Island typically occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. Therefore, placement events at these sites are not expected to interfere with active SHLA nesting during the breeding season. All other sites are assumed to have placement occur during the breeding season, which may affect SHLAs if they move into the placement footprint and initiate nesting after the Corps has conducted site preparations and dissuasion activities.

It should also be reiterated that habitat conditions on Rice, Miller Sands, and Pillar Rock Islands transition slower than on the other islands farther upstream. It is assumed that vegetation succession takes three growing seasons following placement to transition into suitable nesting habitat, such that the placement area is suitable at the beginning of the fourth year after placement. Since vegetation establishment and growth is reduced in the lower river due to high winds and harsh growing conditions, suitable nesting habitat is assumed to remain viable for a duration of 12 years at Rice, Miller Sands, and Pillar Rock Islands.

For all other sites (Skamokawa – Vista Park upstream to West Hayden Island), it is assumed that vegetation only takes one full growing season to develop into suitable nesting habitat. Placement areas would then be available as suitable nesting habitat at the beginning of the breeding season in second year following placement if no additional disturbance occurs. This suitable habitat is assumed to remain viable for a duration of 6 years (Anderson 2013).

To maintain consistency with recent information and observations about SHLA in the Columbia River, the Corps used Normalized Difference Vegetation Index (NDVI) data that was collected and classified as part of an analysis to identify suitable nesting habitat throughout the lower river for the USFWS (Anderson 2013). The Corps has taken into account additional Corps' placement actions in 2011, 2012, and 2013 to establish the 2014 suitable SHLA nesting habitat baseline across the network. Since this consultation covers five years and baseline conditions for suitable habitat are

[1] Unsuitable areas are assumed to be those areas not affected by the placement of dredged materials, but which are also not suitable for nesting SHLA. This includes areas with dense vegetation (trees, shrubs, grasses, forbs), rocks, wetlands, beach and shorelines that are tidally-influenced daily, etc.

based on NDVI data collected in 2011, some areas may transition beyond suitability if placement activities do not occur to restart vegetation succession that benefits SHLA.

The following narrative and Table 5 details the acreages of currently available suitable SHLA nesting habitat, placements of dredged material, regrading events, and the shifting mosaic of yet-to-be suitable to suitable to unsuitable SHLA nesting habitats on each of the Network sites from 2014 through 2018. Sites without planned placements are included because a few sites provide suitable SHLA nesting habitat during the next five years. Figures for each site's placement plan over the next five years relative to suitable SHLA nesting conditions are located in Appendix C.

Table 5: Availability of Suitable Streaked Horned Lark Nesting Habitat within the Dredged Material Placement Network (2014-2018)

Placement Site	Placement Area		2014											2015											2016											2017											2018										
			Baseline Suitable[1]		Placement (acres)	Suitable Lost[2]		Yet-to-be Suitable		Suitable Remaining		Unsuitable		Baseline Suitable[3]		Placement (acres)	Suitable Lost[2]		Yet-to-be Suitable		Suitable Remaining		Unsuitable		Baseline Conditions[3]		Placement (acres)	Suitable Lost[2]		Yet-to-be Suitable		Suitable Remaining		Unsuitable		Baseline Conditions[3]		Placement (acres)	Suitable Lost[2]		Yet-to-be Suitable		Suitable Remaining		Unsuitable		Baseline Conditions[3]		Placement (acres)	Suitable Lost[2]		Yet-to-be Suitable		Suitable Remaining		Unsuitable	
	Acres	Timing	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Benson Beach	27	*During breeding*	0	0%	0	0	0%	0	0%	0	0%	27	100%	0	0%	0	0	0%	0	0%	0	0%	27	100%	0	0%	0	0	0%	0	0%	0	0%	27	100%	0	0%	0	0	0%	0	0%	0	0%	27	100%	0	0%	0	0	0%	0	0%	0	0%	27	100%
West Sand Island	83	*During breeding*	0	0%	0	0	0%	0	0%	0	0%	83	100%	0	0%	0	0	0%	0	0%	0	0%	83	100%	0	0%	0	0	0%	0	0%	0	0%	83	100%	0	0%	0	0	0%	0	0%	0	0%	83	100%	0	0%	83	0	0%	0	0%	0	0%	83	100%
Group I Total	**110**		**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**110**	**100%**	**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**110**	**100%**	**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**110**	**100%**	**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**110**	**100%**	**0**	**0%**	**83**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**110**	**100%**
Rice Island*	264	*Post-breeding*	150	57%	53	28	19%	0	0%	150	57%	114	43%	122	46%	3	0	0%	76	29%	122	46%	66	25%	122	46%	0	0	0%	79	30%	122	46%	63	24%	122	46%	104	64	52%	79	30%	122	46%	63	24%	134	51%	23	23	17%	107	41%	134	51%	23	9%
Miller Sands*	117	*During breeding*	0	0%	6	0	0%	0	0%	0	0%	117	100%	0	0%	14	0	0%	34	29%	0	0%	83	71%	0	0%	11	0	0%	34	29%	0	0%	83	71%	0	0%	9	0	0%	34	29%	0	0%	83	71%	34	29%	9	0	0%	0	0%	34	29%	83	71%
Pillar Rock Island*	52	*During breeding*	4	8%	26	0	0%	0	0%	4	8%	48	92%	4	8%	26	0	0%	0	0%	4	8%	48	92%	4	8%	26	0	0%	0	0%	4	8%	48	92%	0	0%	26	0	0%	0	0%	0	0%	52	100%	0	0%	26	0	0%	13	25%	0	0%	39	75%
Group II Total	**433**		**154**	**36%**	**85**	**28**	**18%**	**0**	**0%**	**154**	**36%**	**279**	**64%**	**126**	**29%**	**43**	**0**	**0%**	**110**	**25%**	**126**	**29%**	**197**	**45%**	**126**	**29%**	**37**	**0**	**0%**	**113**	**26%**	**126**	**29%**	**194**	**45%**	**122**	**28%**	**139**	**64**	**52%**	**113**	**26%**	**122**	**28%**	**198**	**46%**	**168**	**39%**	**58**	**23**	**14%**	**120**	**28%**	**168**	**39%**	**145**	**33%**
Skamokawa - Vista Park	15	*Post-breeding*	0	0%	0	0	0%	0	0%	0	0%	15	100%	0	0%	0	0	0%	0	0%	0	0%	15	100%	0	0%	0	0	0%	0	0%	0	0%	15	100%	0	0%	15	0	0%	0	0%	0	0%	15	100%	0	0%	0	0	0%	0	0%	0	0%	15	100%
Welch Island*	41	*During breeding*	10	24%	0	0	0%	0	0%	10	24%	31	76%	10	24%	41	10	100%	0	0%	0	0%	41	100%	0	0%	0	0	0%	41	100%	0	0%	0	0%	41	100%	23	23	56%	0	0%	18	44%	23	56%	18	44%	0	0	0%	23	56%	18	44%	0	0%
Tenasillahe Island*	41	*During breeding*	3	7%	14	1	33%	21	51%	2	5%	18	44%	23	56%	0	0	0%	14	34%	23	56%	4	10%	37	90%	27	12	32%	0	0%	10	24%	31	76%	10	24%	0	0	0%	27	66%	10	24%	4	10%	37	90%	14	14	38%	0	0%	23	56%	18	44%
James River	53	*Post-breeding*	0	0%	0	0	0%	0	0%	0	0%	53	100%	0	0%	0	0	0%	0	0%	0	0%	53	100%	0	0%	53	0	0%	0	0%	0	0%	53	100%	0	0%	53	0	0%	0	0%	0	0%	53	100%	0	0%	0	0	0%	0	0%	0	0%	53	100%
Puget Island	96	*Post-breeding*	0	0%	0	0	0%	0	0%	0	0%	96	100%	0	0%	96	0	0%	0	0%	0	0%	96	100%	0	0%	0	0	0%	0	0%	0	0%	96	100%	0	0%	0	0	0%	0	0%	0	0%	96	100%	0	0%	96	0	0%	0	0%	0	0%	96	100%
Brown Island*[4]	102	*Post-breeding*	72	0%	68	51	71%	0	0%	72	71%	30	29%	21	21%	0	0	0%	68	67%	21	21%	13	13%	89	87%	50	50	56%	0	0%	49	48%	53	52%	49	48%	0	0	0%	50	49%	49	48%	3	3%	99	97%	0	0	0%	0	0%	99	97%	3	3%
Group III Total	**348**		**85**	**24%**	**82**	**52**	**61%**	**21**	**6%**	**84**	**24%**	**243**	**70%**	**54**	**16%**	**137**	**10**	**19%**	**82**	**24%**	**44**	**13%**	**222**	**64%**	**126**	**36%**	**130**	**62**	**49%**	**41**	**12%**	**59**	**17%**	**248**	**71%**	**100**	**29%**	**91**	**23**	**23%**	**77**	**22%**	**77**	**22%**	**194**	**56%**	**154**	**44%**	**110**	**14**	**9%**	**23**	**7%**	**140**	**40%**	**185**	**53%**
Crims Island*	59	*During breeding*	25	3%	0	0	0%	0	0%	25	42%	34	58%	25	42%	22	5	20%	0	0%	20	34%	39	66%	20	34%	0	0	0%	22	37%	20	34%	17	29%	42	71%	0	0	0%	0	0%	42	71%	17	29%	42	71%	0	0	0%	0	0%	42	71%	17	29%
Hump Island	65	*During breeding*	0	0%	65	0	0%	0	0%	0	0%	65	100%	0	0%	0	0	0%	65	100%	0	0%	0	0%	65	100%	48	48	74%	0	0%	17	26%	48	74%	17	26%	0	0	0%	48	74%	17	26%	0	0%	65	100%	0	0	0%	0	0%	65	100%	0	0%
Lord Island (upstream)	24	*During breeding*	10	42%	0	0	0%	0	0%	10	42%	14	58%	10	42%	0	0	0%	0	0%	10	42%	14	58%	10	42%	0	0	0%	0	0%	10	42%	14	58%	10	42%	20	10	100%	0	0%	0	0%	24	100%	0	0%	0	0	0%	20	83%	0	0%	4	17%
Dibblee Point	52	*n/a*	0	0%	0	0	0%	0	0%	0	0%	52	100%	0	0%	0	0	0%	0	0%	0	0%	52	100%	0	0%	0	0	0%	0	0%	0	0%	52	100%	0	0%	0	0	0%	0	0%	0	0%	52	100%	0	0%	0	0	0%	0	0%	0	0%	52	100%
Howard Island	315	*Post-breeding*	5	2%	0	0	0%	0	0%	5	2%	310	98%	5	2%	173	5	100%	0	0%	5	2%	310	98%	0	0%	0	0	0%	173	55%	0	0%	142	45%	173	55%	108	0	0%	0	0%	173	55%	142	45%	173	55%	34	0	0%	108	34%	173	55%	34	11%
Cottonwood Island	62	*During breeding*	0	0%	26	0	0%	0	0%	0	0%	62	100%	0	0%	0	0	0%	0	0%	0	0%	62	100%	0	0%	13	0	0%	0	0%	0	0%	62	100%	0	0%	0	0	0%	0	0%	0	0%	62	100%	0	0%	0	0	0%	0	0%	0	0%	62	100%
Northport	31	*n/a*	3	10%	0	0	0%	0	0%	3	10%	28	90%	3	10%	0	0	0%	0	0%	3	10%	28	90%	0	0%	0	0	0%	0	0%	0	0%	31	100%	0	0%	0	0	0%	0	0%	0	0%	31	100%	0	0%	0	0	0%	0	0%	0	0%	31	100%
Group IV Total	**608**		**43**	**7%**	**91**	**0**	**0%**	**0**	**0%**	**43**	**7%**	**565**	**93%**	**43**	**7%**	**195**	**10**	**23%**	**65**	**11%**	**38**	**6%**	**505**	**83%**	**95**	**16%**	**61**	**48**	**51%**	**195**	**32%**	**47**	**8%**	**366**	**60%**	**242**	**40%**	**128**	**10**	**4%**	**48**	**8%**	**232**	**38%**	**328**	**54%**	**280**	**46%**	**34**	**0**	**0%**	**128**	**21%**	**280**	**46%**	**200**	**33%**
Sandy Island*	32	*n/a*	32	0%	0	0	0%	0	0%	32	0%	0	0%	32	100%	0	0	0%	0	0%	32	100%	0	0%	32	100%	0	0	0%	0	0%	32	100%	0	0%	32	100%	0	0	0%	0	0%	32	100%	0	0%	32	100%	0	0	0%	0	0%	32	100%	0	0%
Lower Deer Island	24	*During breeding*	0	0%	0	0	0%	0	0%	0	0%	24	100%	0	0%	11	0	0%	0	0%	0	0%	24	100%	0	0%	12	0	0%	11	46%	0	0%	13	54%	11	46%	0	0	0%	12	50%	11	46%	1	4%	23	96%	0	0	0%	0	0%	23	96%	1	4%
Martin Bar	40	*During breeding*	0	0%	23	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	40	0	0%	0	0%	0	0%	40	100%
Sand Island	28	*Post-breeding*	1	4%	0	0	0%	0	0%	1	4%	27	96%	1	4%	14	0	0%	0	0%	1	4%	27	96%	1	4%	0	0	0%	0	0%	1	4%	27	96%	0	0%	14	0	0%	0	0%	0	0%	28	100%	0	0%	0	0	0%	0	0%	0	0%	28	100%
Austin Point	30	*n/a*	0	0%	0	0	0%	0	0%	0	0%	30	100%	0	0%	0	0	0%	0	0%	0	0%	30	100%	0	0%	0	0	0%	0	0%	0	0%	30	100%	0	0%	0	0	0%	0	0%	0	0%	30	100%	0	0%	0	0	0%	0	0%	0	0%	30	100%
Group V Total	**154**		**33**	**21%**	**23**	**0**	**0%**	**0**	**0%**	**33**	**21%**	**121**	**79%**	**33**	**21%**	**25**	**0**	**0%**	**0**	**0%**	**33**	**21%**	**121**	**79%**	**33**	**21%**	**12**	**0**	**0%**	**11**	**7%**	**33**	**21%**	**110**	**71%**	**43**	**28%**	**14**	**0**	**0%**	**12**	**8%**	**43**	**28%**	**99**	**64%**	**55**	**36%**	**40**	**0**	**0%**	**0**	**0%**	**55**	**36%**	**99**	**64%**
Fazio Sand & Gravel	17	*n/a*	0	0%	0	0	0%	0	0%	0	0%	17	100%	0	0%	0	0	0%	0	0%	0	0%	17	100%	0	0%	0	0	0%	0	0%	0	0%	17	100%	0	0%	0	0	0%	0	0%	0	0%	17	100%	0	0%	0	0	0%	0	0%	0	0%	17	100%
Gateway	40	*During breeding*	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	0	0	0%	0	0%	0	0%	40	100%	0	0%	40	0	0%	0	0%	0	0%	40	100%
West Hayden Island	116	*During breeding*	0	0%	0	0	0%	0	0%	0	0%	116	100%	0	0%	0	0	0%	0	0%	0	0%	116	100%	0	0%	84	0	0%	0	0%	0	0%	116	100%	0	0%	0	0	0%	0	0%	0	0%	116	100%	0	0%	0	0	0%	0	0%	0	0%	116	100%
Group VI Total	**173**		**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**173**	**100%**	**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**173**	**100%**	**0**	**0%**	**84**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**173**	**100%**	**0**	**0%**	**0**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**173**	**100%**	**0**	**0%**	**40**	**0**	**0%**	**0**	**0%**	**0**	**0%**	**173**	**100%**
Total Network Acres	***1826***		***315***	***17%***	***281***	***80***	***4%***	***21***	***1%***	***314***	***17%***	***1491***	***82%***	***256***	***14%***	***400***	***20***	***1%***	***257***	***14%***	***241***	***13%***	***1328***	***73%***	***380***	***21%***	***324***	***110***	***6%***	***360***	***20%***	***265***	***15%***	***1201***	***66%***	***507***	***28%***	***372***	***97***	***5%***	***250***	***14%***	***474***	***26%***	***1102***	***60%***	***657***	***36%***	***365***	***37***	***2%***	***271***	***15%***	***643***	***35%***	***912***	***50%***

* Denotes placement areas/islands designated as critical habitat.

[1] Baseline suitable in 2014 equal the extent of habitat which is suitable for SHLA at the beginning of the breeding season based on the best scientific information available (Anderson 2013). In addition, the area is calculated by subtracting a 25m buffer from the edge of shorelines, unsuitable vegetation (trees, shrubs). While larks are known to forage in these areas, they are not known to nest and breed in these areas.

[2] Suitable habitat loss is defined as those areas where placement or pre-season site-preparation activities affect suitable habitat, thereby making these areas unsuitable during the given breeding season.

[3] Baseline suitable for 2015, 2016, 2017, and 2018 are estimates of suitable habitat at the beginning of the breeding season. These values are assumed to equal the quantity of suitable habitat remaining from the preceding year plus any areas that become suitable from previous placement events. Where placement occurs after the breeding season, any loss of suitable habitat acres are not realized until the beginning of the following breeding season, and thus reflected in the baseline suitable conditions.

[4] 2016 placement on Brown Island will occur during the nesting season, thereby reducing available suitable nesting habitat during the 2016 nesting season

NETWORK SCALE

Figure 14 below summarizes how SHLA nesting habitat changes throughout the Network due to the 5-year placement plan as detailed in Table 5. The entire Network totals 1,826 acres that are categorized as suitable habitat, yet-to-be suitable habitat, or unsuitable habitat based on the assumptions discussed above. The 2011 NDVI habitat data, Corps placement events in 2011, 2012, 2013, and placement events during the 2014 nesting season are included in the baseline information for the analysis. Of the 1,826 acres in the Network, only 315 acres (17% of total upland placement area) are considered suitable SHLA nesting habitat at the time of its listing under the ESA in October 2013.

Following the placements in 2014, the suitable habitat acreage of the Network will initially experience a reduction (-0.3%) of suitable habitat during the 2014 breeding season, for a total of 314 acres available in 2014. Dredged material placement and/or habitat succession results in an initial decrease of 73 acres (-23%) o suitable habitat during the 2015 breeding season as compared to 2014, for a total of 241 acres available in 2015.

Following placement activities in 2015, the acreage of suitable habitat available increases in 2016, 2017, and 2018 across the Network. Dredged material placement and/or habitat succession results in an increase of 24 acres (+10%) of suitable nesting habitat during the 2016 breeding season as compared to 2015, for a total of 265 acres available in 2016. Dredged material placement and/or habitat succession results in an increase of 209 acres (+79%) of suitable habitat during the 2017 breeding season, as compared to 2016, for a total of 474 acres in 2017. Dredged material placement and/or habitat succession results in an increase of 169 acres (+36%) of suitable habitat during the 2018 breeding season, for a total of 643 acres of suitable habitat available across the Network in 2018.

Overall, suitable SHLA nesting habitat will increase by 328 acres (+104%) from 315 acres in 2014 to 643 acres in 2018. Additionally, the acreage of yet-to-be suitable nesting habitat increases by 250 acres, from 21 acres in 2014 to 271 acres in 2018 (+1,190%) across the Network. Unsuitable habitat will decrease by 579 acres from 1,491 to 912 acres, a reduction of -39%. Therefore, at the Network scale, the upland placement of dredged materials is essential for suitable SHLA nesting habitat in the lower Columbia River, which will aid in the recovery of the species.

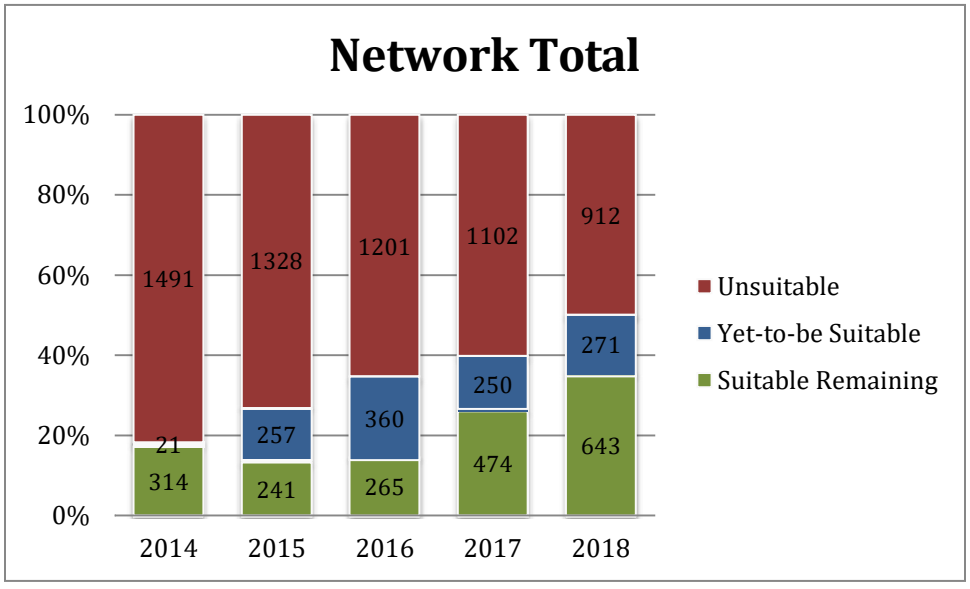

Figure 14: Transition of Suitable SHLA Nesting Habitat throughout Network, 2014-2018

INDIVIDUAL PLACEMENT SITE SCALE

BENSON BEACH (PACIFIC OCEAN)

No placement is planned on the 27-acre Benson Beach intertidal site on the Pacific Ocean during the 5-year placement plan. No suitable SHLA nesting habitat is known or expected to develop over the course of this consultation, as shown in Figure 15 below.

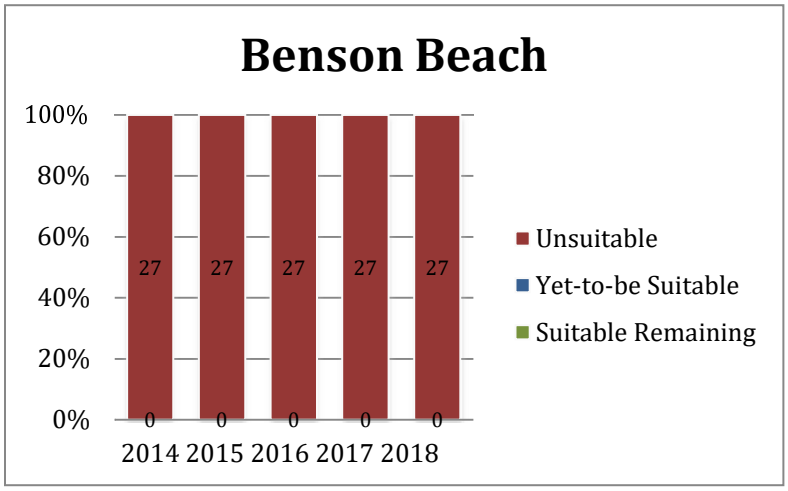

Figure 15: Availability of SHLA Nesting Habitat on Benson Beach, 2014-2018

WEST SAND ISLAND (RM 3.1)

This site is 83 acres and has no suitable SHLA breeding habitat currently available due to extensive site vegetation. Placement would occur during the summer in-water work window. In 2018, or earlier if needed, dredged material will be placed on the entire 83-acre site using a pipeline dredge. This will require early spring removal of existing vegetation and installation of SHLA dissuasion measures. If practicable, following placement the site will be replanted with native vegetation that will not affect the native dune-grass community south of the placement site. No suitable SHLA nesting habitat is available or is expected to develop over the course of this consultation at West Sand Island, as shown in Figure 16.

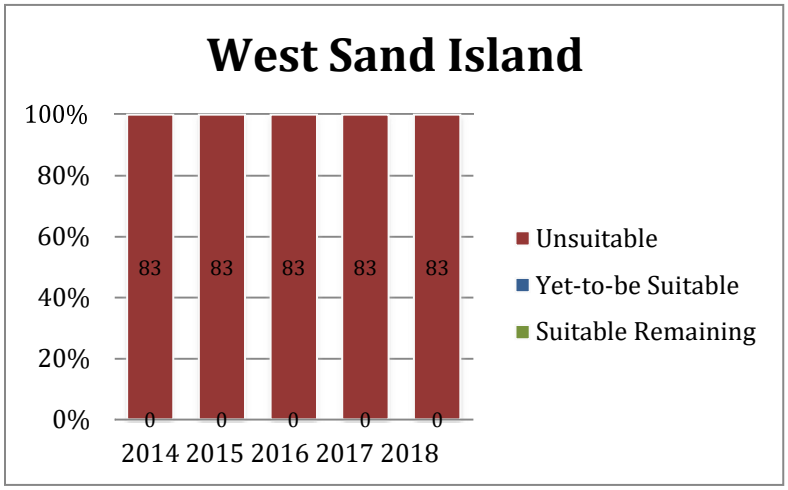

Figure 16: Availability of SHLA Nesting Habitat on West Sand Island, 2014-2018

GROUP I

Group I consists of two placement sites located at the mouth of the Columbia River: the Benson Beach intertidal site on the Pacific Ocean and the West Sand Island upland placement area. No suitable SHLA nesting is currently available within the 110 acres of Group I. The 83-acre placement on West Sand Island in 2018 will not result in a loss of suitable habitat or create suitable habitat because the site is revegetated with native plants. Group I will be unsuitable over the 5-year placement plan. No suitable SHLA nesting habitat is available or is expected to develop over the course of this consultation in Group I, as shown in Figure 17.

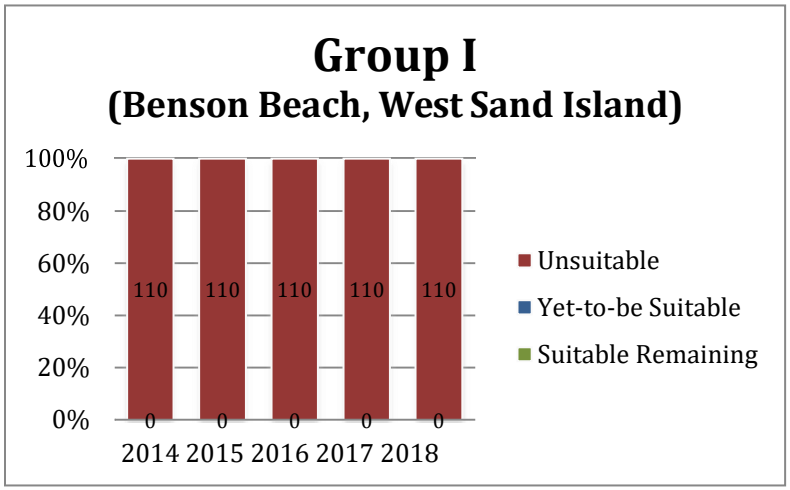

Figure 17: Availability of SHLA Nesting Habitat on Group I Sites, 2014-2018

RICE ISLAND (RM 21.0)

Placement events on the 264-acre Rice Island occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. Therefore, placement actions on Rice Island are not expected to interfere with active SHLA nesting during the year of dredged material placement. Habitat conditions on Rice Island transition slower than on other islands farther upstream and it is assumed that vegetation succession takes three growing seasons following placement to transition into suitable breeding habitat in the fourth year after placement. In addition, because vegetation establishment and subsequent growth on dredged materials is reduced in the estuary, suitable SHLA nesting habitat conditions are assumed to remain viable for 12 years at Rice Island. The total succession cycle from placement to unsuitable is 15 years.

In 2014, the baseline of suitable breeding habitat is 150 acres with the remaining 114 acres of the site as unsuitable. The 2014 placement events will occur after the breeding season has ended and will cover a total of 53 acres of habitat currently classified as a mixture of suitable and unsuitable conditions, where 28 acres of suitable habitat will be covered. The placement events will occur in two locations on the island: (1) on the downstream end of the island which is currently covered by short vegetation, and (2) along a strip of low-ground in the interior portion of the island. In addition to the placement of dredged materials, 23 acres on the upstream end of the island, which was trenched following placement activities in September 2013, will be smoothed out after the 2014 breeding season. This regraded area will develop into suitable breeding habitat in 2018.

Approximately 122 acres will remain in suitable nesting conditions for the beginning of the SHLA breeding season in 2015. The 53-acre area covered by the 2014 placements and the 23-acre trenched/regraded area are expected to be mostly bare sand for the duration of 2015, and this yet-

to-be suitable acreage (76 acres) is assumed to be unavailable for nesting SHLA. All remaining areas (66 acres) are considered unsuitable as breeding habitat in 2015. A small placement event will occur in 2015 in an area that is not currently suitable for SHLA, covering approximately three acres at the upper-most end of the island after the nesting season.

No placement will occur in 2016 at Rice Island, and therefore no suitable breeding habitat will be lost. The areas covered by the 2014 and 2015 placement events (79 acres total) will be yet-to-be suitable habitat, and it is assumed to be unavailable for nesting. It is assumed all areas suitable at the beginning of the 2016 breeding season will remain in suitable condition throughout the breeding season, such that 122 acres are available SHLA nesting habitat and the remaining 63 acres are unsuitable for nesting.

Approximately 122 acres will be available as suitable nesting habitat in the 2017 breeding season. The 76 acres from the 2014 re-grading and placement activities will be in the third year of vegetation succession, but still considered yet-to-be suitable habitat, along with the three acres from the 2015 placement event, resulting in a total of 79 acres of yet-to-be suitable habitat in 2017 nesting season. The placement event in 2017 will cover approximately 104 acres in the center of the island after the breeding season, whereupon 64 acres of suitable habitat would be lost to nesting SHLA in the following breeding season. The 2017 placement event will cover areas where the most SHLA activity has been recorded in the recent years (Anderson 2013). The remaining 63 acres of the site are still expected to be unsuitable nesting habitat.

Approximately 134 acres will be available as suitable nesting habitat in the 2018 breeding season due to the loss of 64 acres of suitable habitat by the placement event in 2017 and the addition of 76 acres from the 2014 placement and regrading areas that were yet-to-be suitable becoming suitable in 2018. The 104-acre placement event in 2017, combined with the 3-acre placement event in 2015 at the upstream tip, will total 107 acres of yet-to-be suitable habitat for the 2018 breeding season. The remaining 23 acres are expected to remain unsuitable. A 2018 placement event will cover approximately 23 acres at the upstream end of the site after the breeding season, resulting in a loss of 23 acres of suitable breeding habitat in subsequent years. These 23 acres had recently transitioned into viable nesting habitat from the 2014 re-grading event. The 23-acre placement event will increase the acreage of yet-to-be suitable habitat following in subsequent years.

Figure 18 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Rice Island.

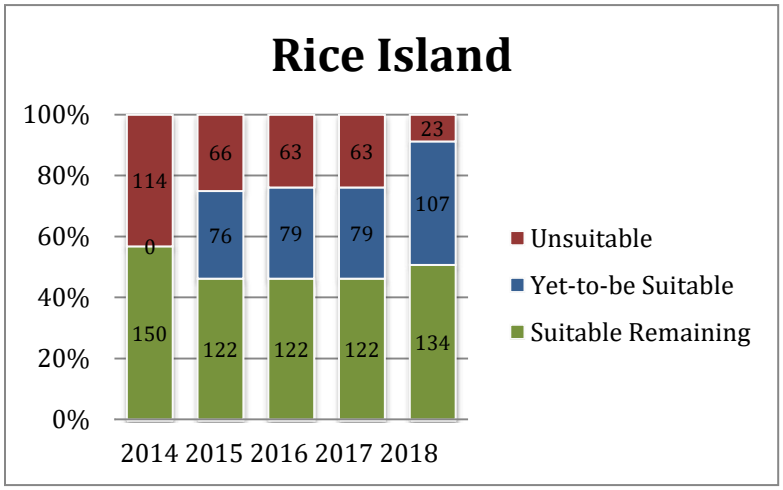

Figure 18: Availability of SHLA Nesting Habitat on Rice Island, 2014-2018

MILLER SANDS (RM 23.5)

Placement events on the 117-acre Miller Sands site occur during the SHLA nesting season. However, this site is only used for shoreline placements and the 0.10-acre upland staging area can be placed to avoid any nesting larks, if any are identified. Therefore, shoreline placement actions on Miller Sands are not expected to interfere with active SHLA nesting. Shoreline placements on Miller Sands are also not expected to typically develop into suitable SHLA nesting habitat because the dredged material is expected to erode away in subsequent years. Habitat conditions on Miller Sands transition slower than on other islands farther upstream and it is assumed that vegetation succession takes three growing seasons following placement to transition into suitable breeding habitat in the four year after upland placement. In addition, because vegetation establishment and subsequent growth on dredged materials are reduced in the estuary, suitable SHLA nesting habitat conditions are assumed to remain viable for 12 years at Miller Sands. The total succession cycle from placement to unsuitable is 15 years.

In 2014, the baseline of suitable breeding habitat is zero (0) acres due to the succession of vegetation on Miller Sands and the entire 117 acres are considered unsuitable for SHLA nesting. In 2014, a six-acre shoreline placement will occur on the upstream tip of the site during the breeding season. In addition to the shoreline placement, 34 acres in the middle of the island will be smoothed during the 2014 breeding season to offset future impacts to suitable habitat in Group II following an extensive placement event at Rice Island in 2017. Regrading in 2014 allows this area to transition into suitable habitat at the beginning of 2018 for the purpose of avoiding substantial impacts to SHLA at the population scale in 2018. This area was previously mounded to dissuade tern and cormorant use.

No suitable SHLA nesting conditions will be present on Miller Sands in 2015. The 34-acre re-graded mound area is expected to be yet-to-be suitable habitat. All remaining areas (83 acres), including the prior shoreline placement, are considered unsuitable as breeding habitat in 2015. A 14-acre shoreline placement will occur on the mid-downstream portion of the site, during the 2015 breeding season.

No suitable SHLA nesting conditions will be present on Miller Sands in 2016. The 34-acre re-graded mound area is expected to be in its second year of yet-to-be suitable habitat. All remaining areas (83 acres), including the prior shoreline placements, are considered unsuitable as breeding habitat in 2016. An 11-acre shoreline placement will occur on two downstream portions of the site, during the 2016 breeding season.

No suitable SHLA nesting conditions will be present on Miller Sands in 2017. The 34-acre re-graded mound area is expected to be in its third year of yet-to-be suitable habitat. All remaining areas (83 acres), including the prior shoreline placements, are considered unsuitable as breeding habitat in 2017. A nine-acre shoreline placement will occur where necessary to repair site erosion, during the 2017 breeding season.

The 34 acres of mounded area that was regarded in 2014 will be available as suitable SHLA nesting habitat in the 2018 breeding season. All remaining areas (83 acres), including the prior shoreline placements, are considered unsuitable as breeding habitat in 2018. A nine-acre shoreline placement will occur where necessary to repair site erosion, during the 2018 breeding season.

Figure 19 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Miller Sands.

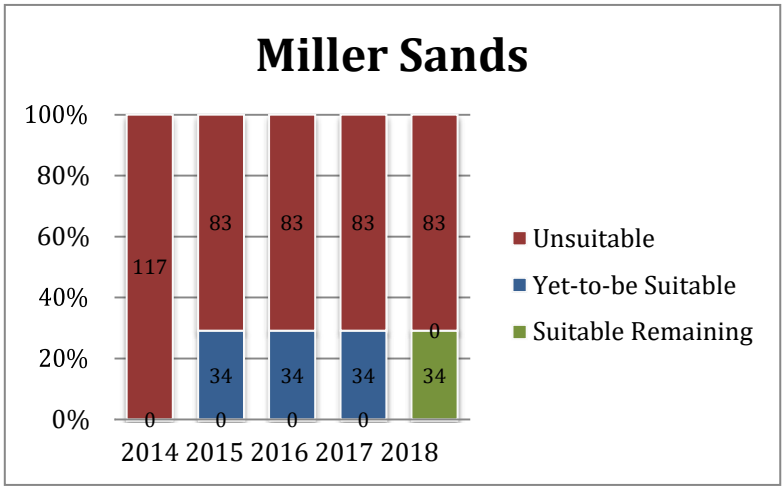

Figure 19: Availability of SHLA Nesting Habitat on Miller Sands, 2014-2018

PILLAR ROCK ISLAND (RM 27.2)

Both shoreline and upland placement events on the 52-acre Pillar Rock Island site occur during the SHLA nesting season. Shoreline placements require a 0.10-acre upland staging area which can be placed to avoid any nesting larks, if any are identified. Therefore, shoreline placement actions on Pillar Rock Island are not expected to interfere with active SHLA nesting. Shoreline placements on Pillar Rock Island are not expected to typically develop into suitable SHLA nesting habitat because the placements are expected to erode away in subsequent years. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Pillar Rock Island transition slower than on other islands farther upstream to and it is assumed that vegetation succession takes three growing seasons following upland placement to transition into suitable breeding habitat in the four year after placement. In addition, because vegetation establishment and subsequent growth on dredged materials are reduced in the estuary, suitable SHLA nesting habitat conditions are assumed to remain viable for 12 years at Pillar Rock Island. The total succession cycle from placement to unsuitable is 15 years.

In 2014, the baseline of suitable SHLA breeding habitat is four acres due to the succession of vegetation and active erosion of Pillar Rock Island. The remaining 48 acres of the site are considered unsuitable for SHLA nesting. In 2014, a 26-acre shoreline placement will occur on the northern portion to rebuild the site. The 2014 shoreline placement event will occur during the breeding season on the shoreline.

In 2015, the baseline of suitable SHLA breeding habitat is four acres. The remaining 48 acres of the site are considered unsuitable for SHLA nesting. In 2015, a 26-acre shoreline placement will occur on the northern portion to rebuild the site. The 2015 shoreline placement event will occur during the breeding season on the shoreline.

In 2016, the baseline of suitable SHLA breeding habitat is four acres. The remaining 48 acres of the site are considered unsuitable for SHLA nesting. In 2016, a 26-acre shoreline placement will occur on the northern portion to rebuild the site. The 2016 shoreline placement event will occur during the breeding season on the shoreline.

No suitable SHLA nesting conditions will be present on Pillar Rock Island in 2017 due to the succession of vegetation since placement last occurred in 2001, 15 years prior. A 26-acre placement will occur during the breeding season in 2017 on Pillar Rock Island. Approximately half

of the acreage will be shoreline placement to maintain the site and the other 13 acres will be placed in uplands that had vegetation removed and SHLA dissuasion techniques installed in the early spring. The entire 52-acre site is considered unsuitable for SHLA nesting in 2017.

No suitable SHLA nesting conditions will be present on Pillar Rock Island in 2018. Approximately 13 acres of yet-to-be suitable habitat is expected from the 2017 upland placement. The remaining 43 acres of the site are considered unsuitable for SHLA nesting in 2018. A 26-acre placement will occur during the breeding season in 2018 on Pillar Rock Island. Approximately half of the acreage will be shoreline placement to maintain the site and the other 13 acres will be placed in uplands that had vegetation removed and SHLA dissuasion techniques installed in the early spring. The 13-acre upland placement in 2018 will not overlap with the 2017 upland placement.

Figure 20 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Pillar Rock Island.

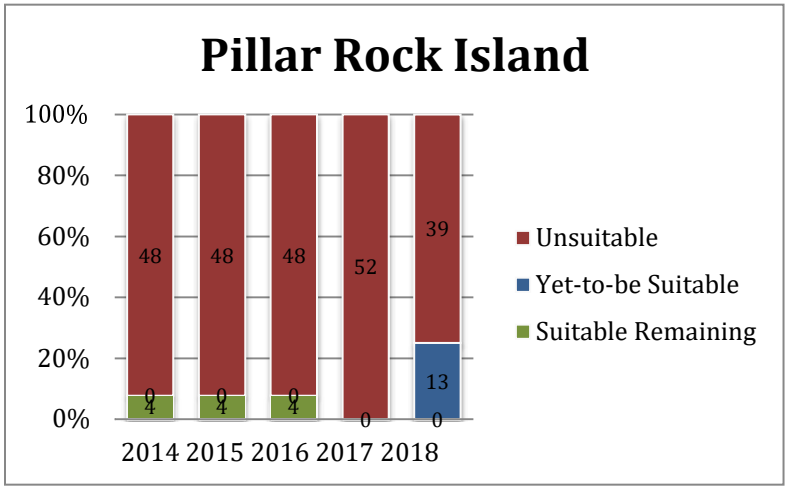

Figure 20: Availability of SHLA Nesting Habitat on Pillar Rock Island, 2014-2018

GROUP II

Group II consists of three placement sites located in the lower Columbia River estuary: Rice Island, Miller Sands, and Pillar Rock Island. Of the 433 acres in Group II, only 154 acres (36% of total upland placement area) are baseline suitable SHLA nesting habitat at the time of its listing under the ESA in October 2013 and all 154 acres are available during the 2014 breeding season. Dredged material placement and/or habitat succession results in a decrease of 28 acres (-18%) of suitable habitat during the 2015 breeding season as compared to 2014, for a total of 126 acres available in 2015. There is no change in the acreage of suitable habitat between 2015 and 2016 breeding seasons. Increased vegetation at Pillar Rock Island results in a decrease of 4 acres (-3%) of suitable nesting habitat during the 2017 breeding season as compared to 2016, for a total of 122 acres available in 2017. Dredged material placement and/or habitat succession results in an increase of 46 acres (+38%) of suitable nesting habitat available during the 2018 breeding season as compared to 2017, for a total of 168 acres available in 2018. Overall, suitable nesting habitat is expected to increase by 14 acres from 154 acres available as baseline habitat during the 2014 breeding season to 168 acres available during the 2018 breeding season (+9%). Additionally, yet-to-be suitable nesting habitat is expected to increase from zero acres in 2014 to 120 acres in 2018. Figure 21 shows the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years in Group II.

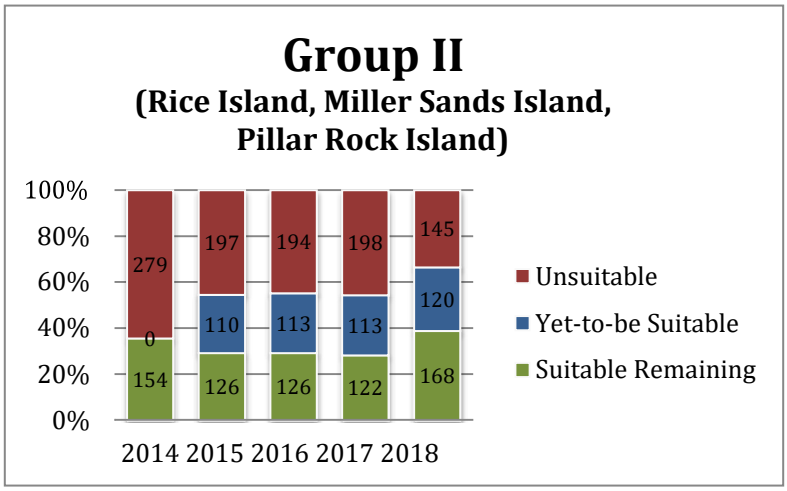

Figure 21: Availability of SHLA Nesting Habitat on Group II Sites, 2014-2018

SKAMOKAWA – VISTA PARK (RM 33.4)

The CNLM estimated that approximately five acres of suitable lark breeding habitat existed on the site in 2011 using NDVI habitat analysis. A placement event in 2012 covered the entire 15 acre upland site, eliminating all habitat identified as suitable in the 2011 analysis. The site was surveyed for larks in 2013 by CNLM, but no individuals were observed. Despite the NDVI analysis results, high levels of human use and regular disturbance from recreation and commercial sand extraction likely preclude SHLA use of the site. Therefore, the Corps assumes that no suitable nesting habitat is currently available for SHLA, and no suitable SHLA nesting habitat is expected to develop over the course of this consultation, as shown in Figure 22.

In 2017, the entire site 15-acre site is planned for placement after the breeding season across the uplands and shoreline. The Corps does not anticipate this area would transition into yet-to-be suitable nesting habitat in 2018 due to high levels of human use at the site and the site is unsuitable in all years. No placements are planned to occur in 2014, 2015, 2016, or 2018.

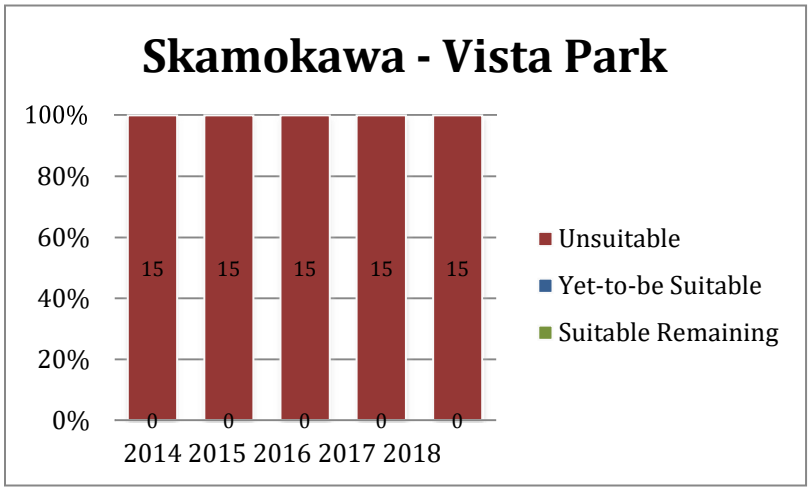

Figure 22: Availability of Nesting Habitat at Skamokawa-Vista Park, 2014-2018

WELCH ISLAND (RM 34.0)

Placement events on the 41-acre Welch Island occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Welch Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Welch Island (Anderson 2013). The total succession cycle from placement to unsuitable is seven years.

In 2014, the baseline of suitable SHLA breeding habitat is 10 acres with the remaining 31 acres of the site as unsuitable habitat. No placements are planned in 2014.

In 2015, the baseline of suitable SHLA breeding habitat is 10 acres. However, the entire 41-acre site will used for upland placement during the breeding season. Therefore, the entire 41-acre site would be unsuitable for SHLA nesting in 2015.

In 2016, no suitable SHLA breeding habitat will be available on the site. The entire 41-acre site is classified as yet-to-be suitable due the 2015 placement event. No placement is planned in 2016.

In 2017, the 41 acres of yet-to-be suitable habitat is expected to transition into suitable SHLA nesting habitat. However, a 23-acre placement is planned during the breeding season on the upstream portion of the site making it unsuitable for nesting. Therefore, the baseline of suitable SHLA nesting habitat is 18 acres in 2017.

In 2018, the baseline of suitable SHLA nesting habitat is 18 acres with the remaining 23 acres as yet-to-be suitable due to the 2017 upland placement. No placement is planned in 2018.

Figure 23 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Welch Island.

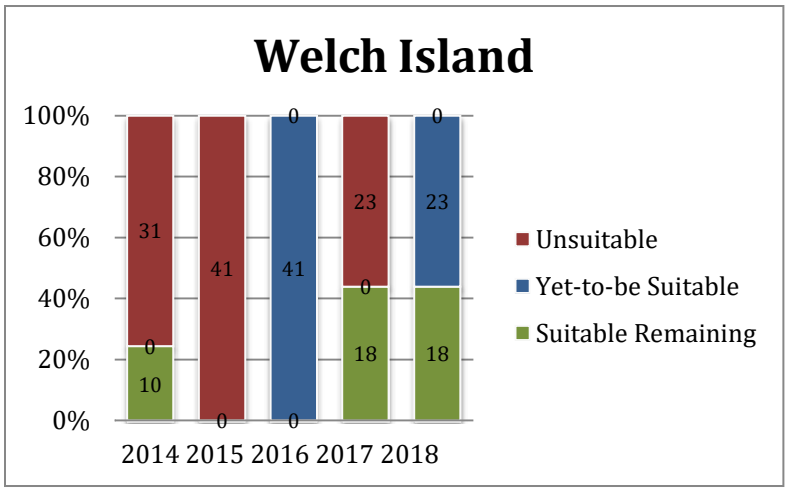

Figure 23: Availability of SHLA Nesting Habitat on Welch Island, 2014-2018

TENASILLAHE ISLAND (RM 38.3)

Placement events on the 41-acre Tenasillahe Island occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement

locations. Habitat conditions on Tenasillahe Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Tenasillahe Island (Anderson 2013). The total succession cycle from placement to unsuitable is seven years.

The baseline of suitable SHLA breeding habitat is two acres at the time of its listing under the ESA in October 2013. In 2014, a 14-acre placement is planned during the breeding season on the downstream third of the site, resulting in a loss of one acre of suitable SHLA nesting habitat. Therefore, the baseline of suitable SHLA breeding habitat in 2014 is two acres. Approximately 21 acres of yet-to-be suitable habitat are anticipated due to placements in 2012 and 2013. Approximately 18 acres on the site is unsuitable for SHLA nesting habitat.

In 2015, the baseline of suitable SHLA breeding habitat is 23 acres because the 21 acres of placement in 2013 have become suitable habitat. The 14-acre placement in 2014 is classified as yet-to-be suitable in 2015 with the remaining four acres as unsuitable. No placement is planned in 2015.

In 2016, a 27-acre placement is planned during the breeding season on the downstream two thirds of the site, resulting in a loss of approximately 12 acres of suitable nesting habitat and 14 acres of yet-to-be suitable habitat. Therefore, there are an estimated 10 acres of suitable SHLA nesting habitat in 2016. The remaining 31 acres are unsuitable.

In 2017, the baseline of suitable SHLA breeding habitat is 10 acres. The 27-acre placement area from 2016 is yet-to-be suitable habitat and the remaining four acres of the site is unsuitable. No placement is planned in 2017.

In 2018, a 14-acre placement is planned during the breeding season on the downstream third of the site, resulting is a loss of 14 acres of suitable SHLA nesting habitat. However, the 27-acre placement event from 2016 will transition into suitability, thereby creating a net gain of 13 acres of suitable habitat. As a result, 23 acres are estimated to be suitable for SHLA nesting in 2018 and the remaining 18 acres are considered unsuitable for nesting.

Figure 24 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Tenasillahe Island.

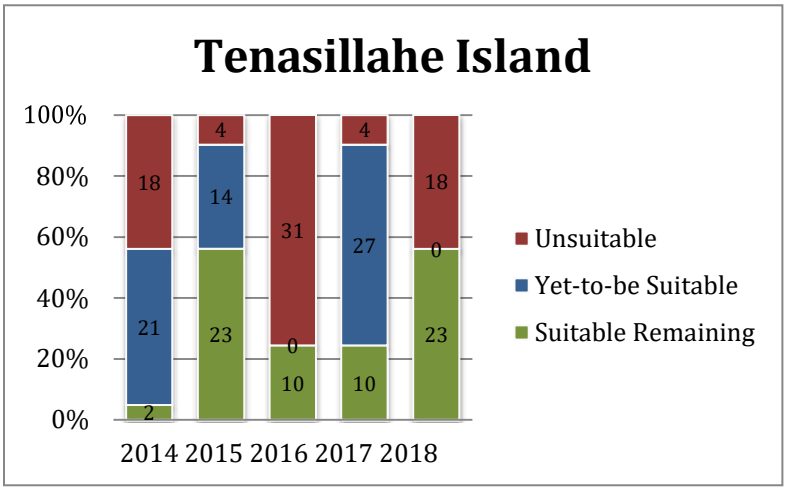

Figure 24: Availability of SHLA Nesting Habitat on Tenasillahe Island, 2014-2018

JAMES RIVER (RM 42.9)

The CNLM estimated that approximately 14 acres of suitable lark breeding habitat existed on the James River site in 2011 using NDVI analysis. James River has not been surveyed due to expected low habitat value. Despite the NDVI analysis, high levels of human use and regular disturbance from recreation and commercial sand extraction likely preclude SHLA use of the site. Therefore, the Corps assumes that no suitable nesting habitat is currently available for SHLA and no suitable SHLA nesting habitat is expected to develop at James River over the course of this consultation.

No placements are planned in 2014 or 2015. The entire 53-acre site is planned for placement after the 2016 and 2017 SHLA breeding seasons, but the Corps assumes this site would not develop into suitable SHLA nesting habitat between 2014 and 2018 due to regular site disturbance, as shown in Figure 25, and the entire site would be unsuitable in all years.

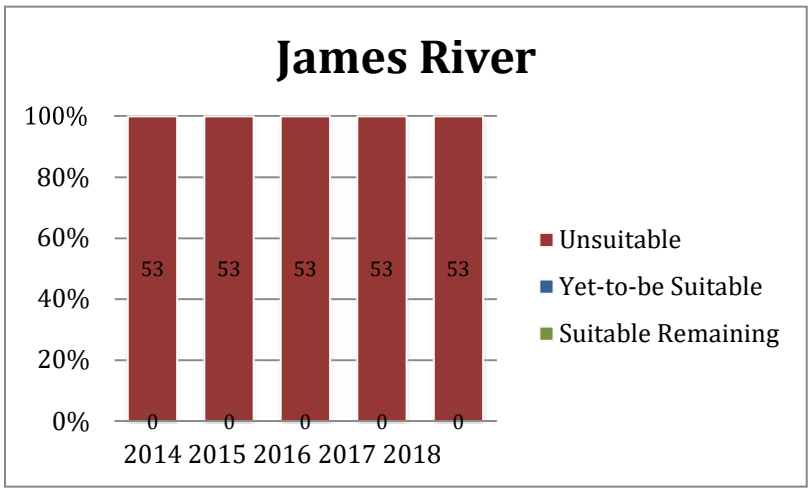

Figure 25: Availability of SHLA Nesting Habitat on James River Site, 2014-2018

PUGET ISLAND (RM 44.0)

Placements on the 96-acre Puget Island site occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. As part of required site maintenance after each placement event, the Corps will establish a healthy vegetative cover by grass seeding, fertilization, and/or irrigation to prevent wind erosion of placed sand onto adjacent agricultural lands. Additionally, trees may be planted along the perimeter of the site for the same purpose. Maintenance mowing and invasive vegetation control measures may be taken. Therefore, no suitable SHLA nesting is expected to develop on Puget Island between 2014 and 2018, as shown in Figure 26, and the site will be unsuitable in all years.

In 2014, no suitable SHLA nesting habitat is available on the site and the 96-acre site is unsuitable habitat. No placement is planned in 2014.

In 2015, no suitable SHLA nesting habitat is available on the site and the 96-acre site is unsuitable habitat. A full 96-acre site placement is planned after the SHLA nesting season in 2015.

In 2016, no suitable SHLA nesting habitat is available on the site due to reseeding the site with grass and the 96-acre site is unsuitable habitat. No placement is planned in 2016.

In 2017, no suitable SHLA nesting habitat is available on the site and the 96-acre site is unsuitable habitat. No placement is planned in 2017.

In 2018, no suitable SHLA nesting habitat is available on the site due to reseeding the site with grass and the 96-acre site is unsuitable habitat. A full 96-acre site placement is planned after the SHLA nesting season in 2018.

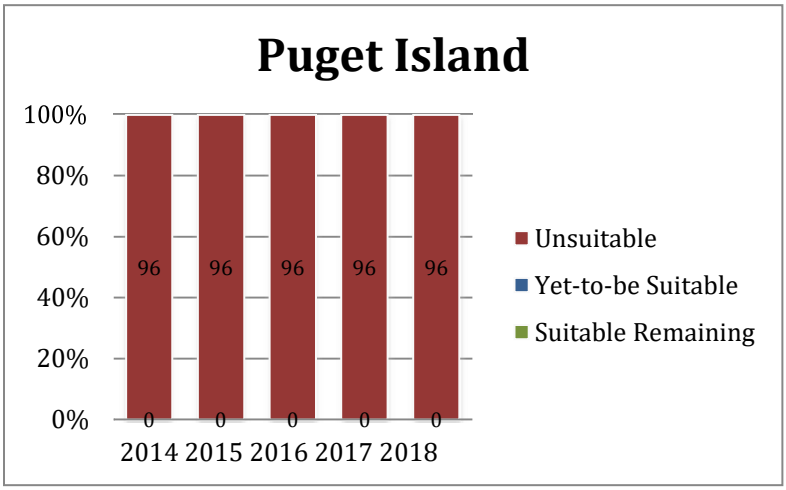

Figure 26: Availability of SHLA Nesting Habitat on Puget Island Site, 2014-2018

BROWN ISLAND (RM 46.3)

Placement events on the 102-acre Brown Island typically occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Placement actions after the breeding season are not expected to interfere with active SHLA nesting during the year of dredged material placement. Habitat conditions on Brown Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Brown Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, the baseline of suitable breeding habitat is 72 acres due to placement activities in 2011. The remaining 30 acres of the site are unsuitable during the nesting season. A 68-acre placement is planned after the nesting season, resulting is a loss of 51 acres of suitable nesting habitat in the following year. The placement will occur adjacent the shoreline and downstream end of the site.

In 2015, the baseline of suitable breeding habitat is 21 acres with approximately 68 acres of yet-to-be suitable habitat and 13 acres of unsuitable habitat. No placement is planned in 2015 on Brown Island.

In 2016, a 50-acre placement on the north side and downstream end of the site will occur during the breeding season, resulting is a loss of 50 acres of suitable nesting habitat. The 68-acre placement event in 2014 will become suitable nesting habitat. Therefore, 49 acres of suitable SHLA nesting habitat will be available during 2016 breeding season. The remaining 53 acres will be unsuitable habitat.

In 2017, the baseline of suitable breeding habitat on Brown Island will be 49 acres. The 50-acre placement event in 2016 will be yet-to-be suitable habitat with three acres of unsuitable habitat. No placement is planned in 2017 on Brown Island.

In 2018, the 50-acre placement event from 2016 will become suitable. Therefore, the baseline of suitable SHLA nesting habitat in 2018 on Brown Island is approximately 99 acres. The remaining three acres will be unsuitable. No placement is planned in 2018 on Brown Island.

Figure 27 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years s on Brown Island.

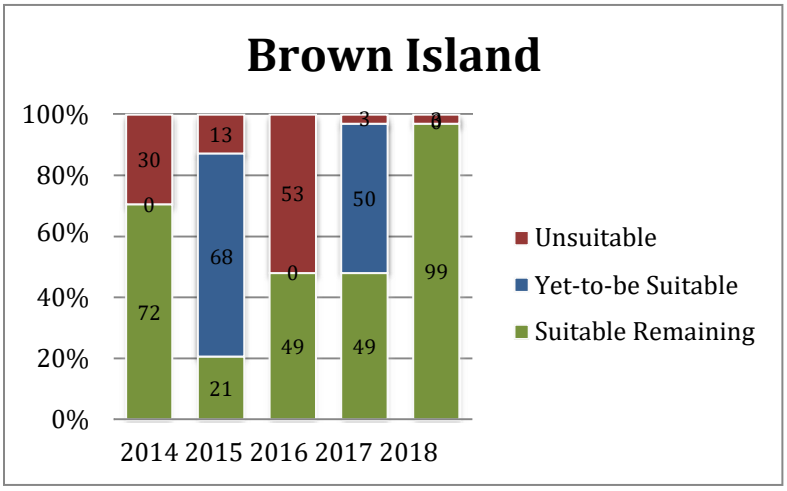

Figure 27: Availability of SHLA Nesting Habitat on Brown Island, 2014-2018

GROUP III

Group III consists of six placement sites located in the lower Columbia River: Skamokawa-Vista Park, Welch Island, Tenasillahe Island, James River, Puget Island, and Brown Island. Of the 348 acres in Group III, only 85 acres (24% of total upland placement area) are baseline suitable SHLA nesting habitat at the time of its listing under the ESA in October 2013. Dredged material placement results in a decrease of one acre (-1%) of suitable habitat during the 2014 breeding season, for a total of 84 acres available in 2014. Dredged material placement and/or habitat succession results in a decrease of 40 acres (-48%) of suitable habitat during the 2015 breeding season as compared to 2014, for a total of 44 acres available in 2015. Dredged material placement and/or habitat succession results in an increase of 15 acres (+34%) of suitable nesting habitat during the 2016 breeding season as compared to 2015, for a total of 59 acres available in 2016. Dredged material placement and/or habitat succession results in an increase of 18 acres (+31%) of suitable nesting habitat during the 2017 breeding season as compared to 2016, for a total of 77 acres available in 2017. Dredged material placement and/or habitat succession results in an increase of 63 acres (+82%) of suitable nesting habitat available during the 2018 breeding season as compared to 2017, for a total of 140 acres available in 2018. Overall, suitable nesting habitat is expected to increase by 55 acres from 85 acres available as baseline habitat during the 2014 breeding season to 140 acres available during the 2018 breeding season (+65%). Additionally, yet-to-be suitable nesting habitat is expected to increase by 2 acres from 21 acres in 2014 to 23 acres in 2018 (+10%). Figure 28 shows the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years Group III.

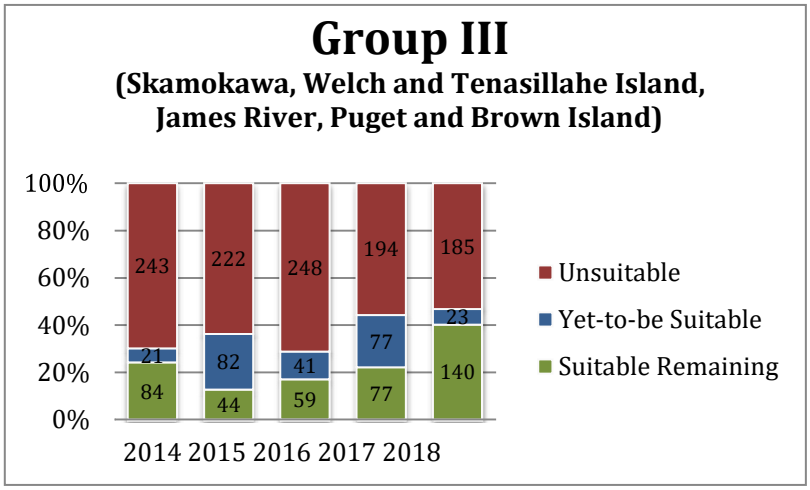

Figure 28: Availability of SHLA Nesting Habitat on Group III Sites, 2014-2018

CRIMS ISLAND (RM 57.0)

Placement events on the 59-acre Crims Island occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Crims Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Crims Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, the baseline of suitable SHLA breeding habitat is 25 acres with the remaining 34 acres of the site as unsuitable habitat. No placements are planned in 2014.

In 2015, a 22-acre placement on the downstream end of the site during the breeding season will result in a loss of five acres of suitable SHLA nesting habitat. Therefore, there will be an estimated 20 acres of suitable SHLA nesting habitat in 2015. The remaining 39 acres will be unsuitable habitat.

In 2016, the baseline of suitable SHLA nesting habitat is 20 acres. The 22-acre placement event in 2015 will be yet-to-be suitable habitat. The remaining 17 acres will be unsuitable habitat. No placement is planned in 2016 on Crims Island.

In 2017, the 22-acre placement event in 2015 will transition to suitable habitat. Therefore, the baseline of suitable SHLA nesting habitat in 2017 will be 42 acres. The remaining 17 acres will be unsuitable habitat. No placement is planned in 2017 on Crims Island.

In 2018, the baseline of suitable SHLA nesting habitat is 42 acres. The remaining 17 acres will be unsuitable habitat. No placement is planned in 2018 on Crims Island.

Figure 29 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Crims Island.

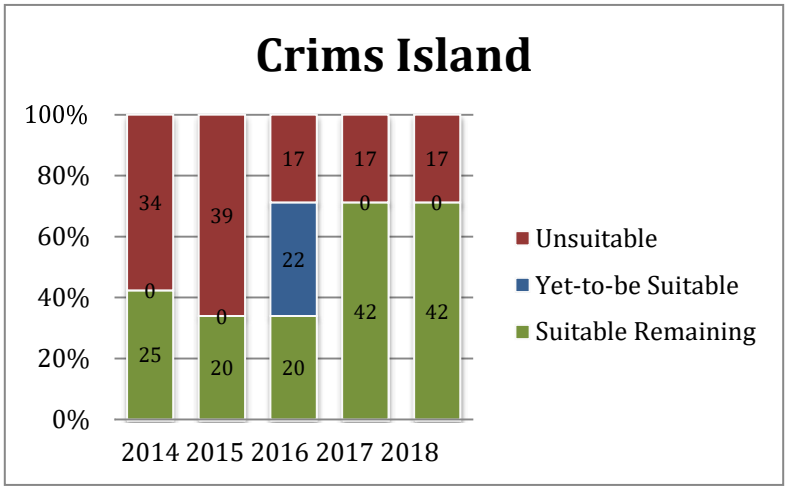

Figure 29: Availability of SHLA Nesting Habitat on Crims Island, 2014-2018

HUMP ISLAND (RM 59.7)

Placement events on the 65-acre Hump Island occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Hump Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Hump Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, no suitable SHLA nesting habitat is available on the site due to extensive vegetation since the last placement prior to 2000. A full-site placement is planned during the nesting season on Hump Island. The 65-acre Hump Island site is unsuitable habitat.

In 2015, no suitable SHLA nesting habitat is available on the site due to the previous year's placement event. The entire 65-acre site is yet-to-be suitable habitat. No placement is planned in 2015 on Hump Island.

In 2016, the 65-acre site would transition into suitable habitat. However, a 48-acre placement in the upper three quarters of the site during the breeding season will prevent 48 acres from becoming suitable. Therefore, there will be an estimated 17 acres of suitable SHLA nesting habitat in 2016. The remaining 48 acres will be unsuitable habitat.

In 2017, the baseline of suitable SHLA nesting habitat is 17 acres. The remaining 48 acres will be yet-to-be suitable habitat from the placement event in 2016. No placement is planned in 2017 on Hump Island.

In 2018, the baseline of suitable SHLA nesting habitat will be 65 acres due to the 48-acre placement in 2016 transitioning to suitable habitat. No placement is planned in 2018 on Hump Island.

Figure 30 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Hump Island.

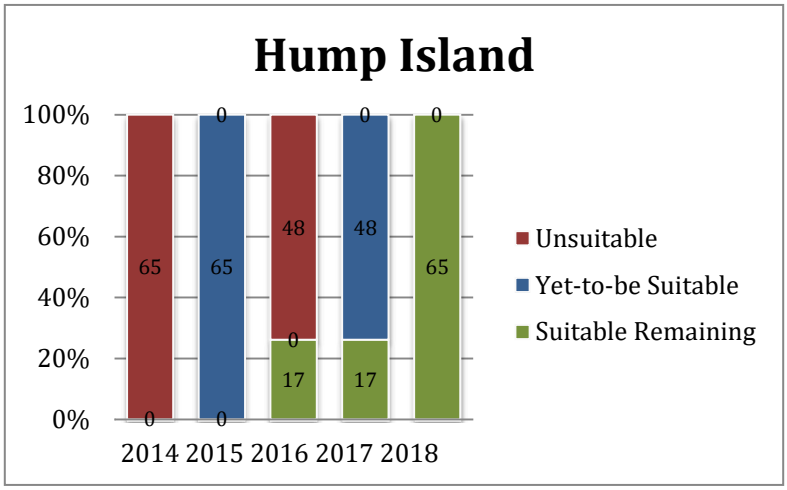

Figure 30: Availability of SHLA Nesting Habitat on Hump Island, 2014-2018

LORD ISLAND – UPSTREAM (RM 63.5)

Placement events on the 24-acre Lord Island Upstream site occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Lord Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Lord Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, the baseline of suitable SHLA breeding habitat is 10 acres with the remaining 14 acres of the site as unsuitable habitat. No placements are planned in 2014.

In 2015, the baseline of suitable SHLA breeding habitat is 10 acres with the remaining 14 acres of the site as unsuitable habitat. No placements are planned in 2015.

In 2016, the baseline of suitable SHLA breeding habitat is 10 acres with the remaining 14 acres of the site as unsuitable habitat. No placements are planned in 2016.

In 2017, no suitable SHLA nesting habitat is available on the site because it will have been seven years since the site was last used in 2009. A 20-acre placement over the majority of the site will occur during the breeding season. The entire 24-acre site will be unsuitable habitat in 2017.

In 2018, no suitable SHLA nesting habitat is available on the site. However, the 20-acre placement from 2017 will be yet-to-be suitable habitat. The remaining four acres of the site will be unsuitable. No placements are planned in 2018.

Figure 31 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on the Lord Island (upstream) site.

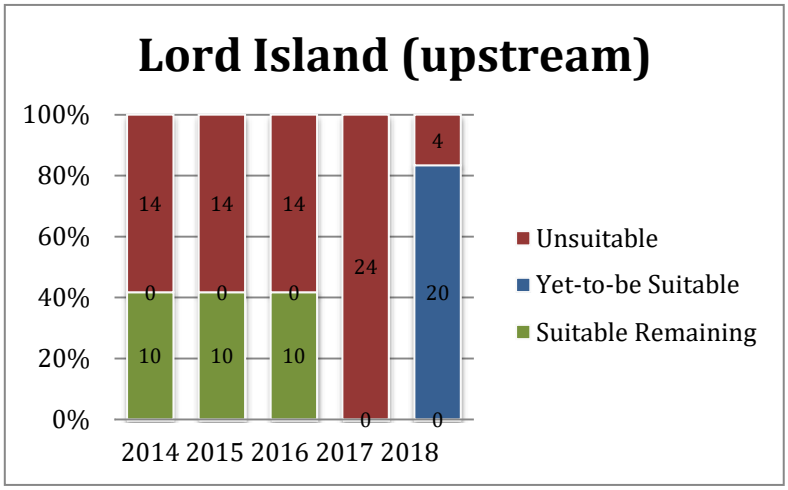

Figure 31: Availability of SHLA Nesting Habitat on Lord Island (upstream), 2014-2018

DIBBLEE POINT (RM 64.8)

No placements are planned on the 52-acre Dibblee Point upland placement site between 2014 and 2018. One acre of suitable habitat was identified as suitable habitat based on NDVI analysis in 2011. In 2013, Dibblee Point was surveyed for larks by CNLM and none were detected. It is assumed that commercial sand removal activities likely exclude SHLA from nesting or occupying the habitat. Therefore, the Corps has determined that even though the NDVI analysis indicates suitable habitat conditions exist, no suitable habitat is available or is expected to develop over the course of this consultation, as shown in Figure 32, and the site is unsuitable in all years.

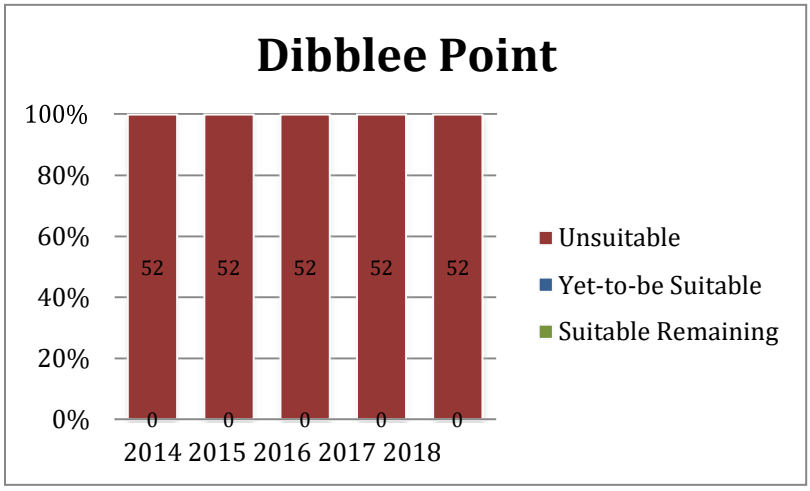

Figure 32: Availability of SHLA Nesting Habitat on Dibblee Point, 2014-2018

HOWARD ISLAND (RM 68.7)

Placements on the 315-acre Howard Island site occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. Therefore, placement actions on Howard Island are not expected to interfere with active SHLA nesting during the year of dredged material placement. Habitat conditions on site assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable

SHLA nesting habitat conditions are assumed to remain viable for six years at Howard Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, the baseline of suitable SHLA breeding habitat is five acres with the remaining 310 acres of the site as unsuitable habitat. No placements are planned in 2014.

In 2015, the baseline of suitable SHLA breeding habitat is five acres with the remaining 310 acres of the site as unsuitable habitat. A 173-acre placement on the upstream half of the site will occur after the SHLA nesting season, resulting is a loss of five acres of suitable SHLA nesting habitat in the following year.

In 2016, no suitable SHLA nesting habitat is available on the site. The 173-acre placement event in 2015 will be yet-to-be suitable habitat in 2016. The remaining 142 acres of the site are unsuitable habitat. No placements are planned in 2016.

In 2017, the baseline of suitable SHLA breeding habitat will be 173 acres due to the 2015 placement event being suitable habitat. The remaining 142 acres of the site are unsuitable habitat. A 108-acre placement on a downstream portion of the site will occur after the SHLA nesting season. No suitable SHLA nesting habitat will be lost to the 108-acre placement.

In 2018, the baseline of suitable SHLA breeding habitat is 173 acres on Howard Island. The 108-acre placement area in 2017 will transition into yet-to-be suitable habitat. The remaining 34 acres of the site will be unsuitable habitat during the nesting season. A 34-acre placement is planned on the downstream tip of the after the SHLA nesting season. No suitable SHLA nesting habitat will be lost to the 34-acre placement.

Figure 33 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Howard Island.

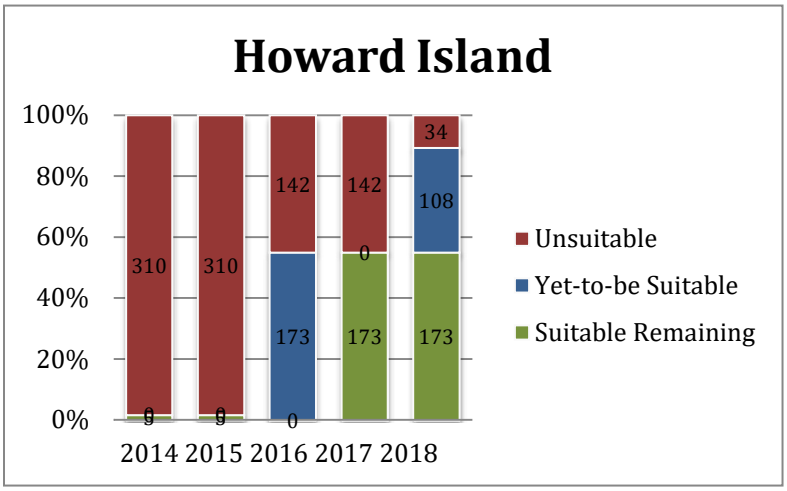

Figure 33: Availability of SHLA Nesting Habitat on Howard Island, 2014-2018

COTTONWOOD ISLAND (RM 70.1)

Placements on the 62-acre Cottonwood Island site occur in the summer, during the SHLA nesting season. Suitable SHLA nesting habitat is not expected to be available on Cottonwood Island because the site is bordered by trees that preclude lark nesting. Cottonwood Island is managed for Columbian white-tailed deer and the removal of trees and shrubs adjacent to the site is unlikely. No suitable SHLA nesting habitat is available or is expected to develop over the course of this consultation at Cottonwood Island, as shown in Figure 34, and the site is unsuitable in all years.

A 26-acre placement is planned on the downstream portion of the site during the 2014 nesting season. A 13-acre placement is planned on the downstream portion of the site during the 2016 nesting season. No placement is planned in 2015, 2017, or 2018. Despite these placements, the entire site is assumed to be unsuitable for nesting all years because the site lacks an open landscape preferred by SHLA.

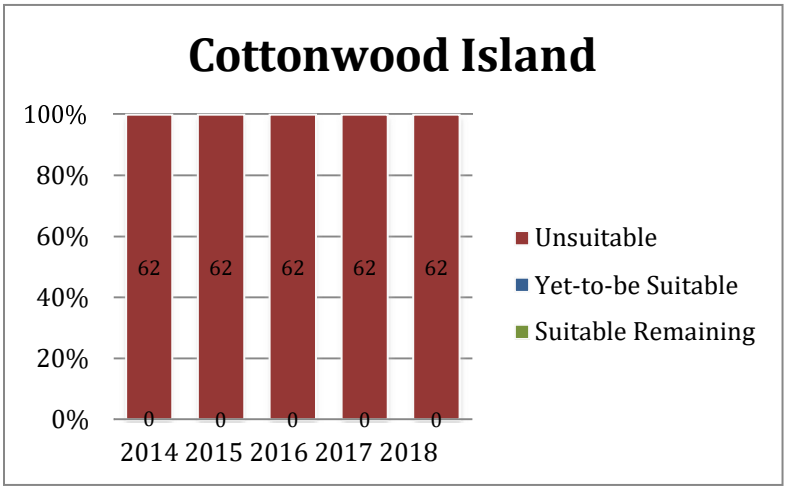

Figure 34: Availability of SHLA Nesting Habitat on Cottonwood Island, 2014-2018

NORTHPORT (RM 71.9)

No placements are planned on the 31-acre Northport upland placement site. Three acres of suitable habitat were identified in the 2011 NDVI habitat analysis. Currently, no borrow activities occur at Northport because three pair of SHLA were detected in 2013 during annual surveys by CNLM (Anderson 2013). However, since dredged materials were last placed in 2008, the site is expected to become unsuitable after the 2015 nesting season due to vegetation succession, as shown in Figure 35.

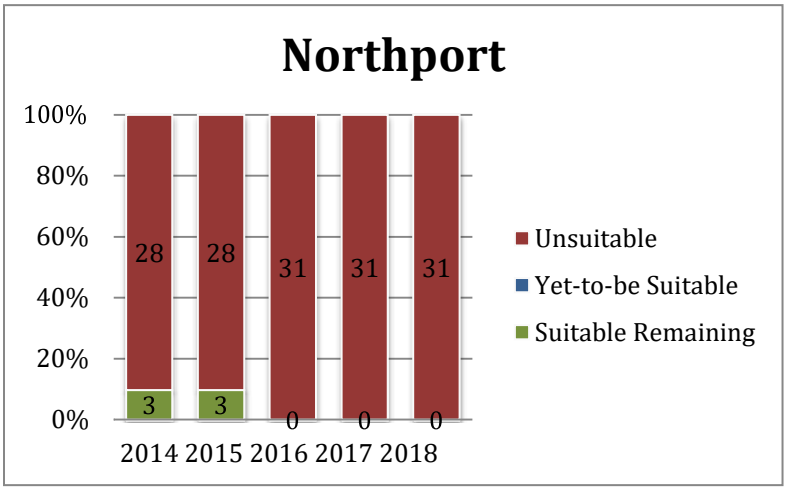

Figure 35: Availability of SHLA Nesting Habitat at Northport, 2014-2018

GROUP IV

Group IV consists of seven placement sites located in the lower Columbia River: Crims Island, Hump Island, Lord Island Upstream, Dibblee Point, Howard Island, Cottonwood Island, and Northport. Of the 608 acres in Group IV, only 43 acres (7% of total upland placement area) are baseline suitable SHLA nesting habitat at the time of its listing under the ESA in October 2013 and all 43 acres are available during the 2014 breeding season. Dredged material placement and/or habitat succession results in a decrease of five acres (-12%) of suitable habitat during the 2015 breeding season as compared to 2014, for a total of 38 acres available in 2015. Dredged material placement and/or habitat succession results in an increase of nine acres (+24%) of suitable nesting habitat during the 2016 breeding season as compared to 2015, for a total of 47 acres available in 2016. Dredged material placement and/or habitat succession results in an increase of 185 acres (+394%) of suitable nesting habitat during the 2017 breeding season as compared to 2016, for a total of 232 acres available in 2017. Dredged material placement and/or habitat succession results in an increase of 48 acres (+21%) of suitable nesting habitat available during the 2018 breeding season as compared to 2017, for a total of 280 acres available in 2018. Overall, suitable nesting habitat is expected to increase by 237 acres from 43 acres available as baseline habitat during the 2014 breeding season to 280 acres available during the 2018 breeding season (+551%). Additionally, yet-to-be suitable nesting habitat is expected to increase from no acres in 2014 to 128 acres in 2018. Figure 36 shows the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years in Group IV.

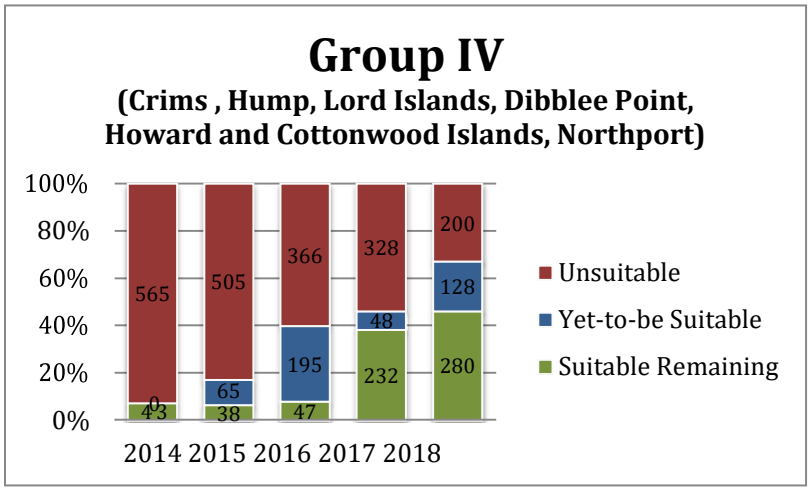

Figure 36: Availability of SHLA Nesting Habitat on Group IV sites, 2014-2018

SANDY ISLAND (RM 75.8)

No placement is planned on the 32-acre Sandy Island upland placement site. Thirty-two (32) acres of suitable SHLA nesting habitat are estimated on site due to a full-site placement in 2011. The site is expected to remain suitable for nesting from 2014 through 2018, as shown in Figure 37. Habitat is expected to become unsuitable after the 2018 nesting season.

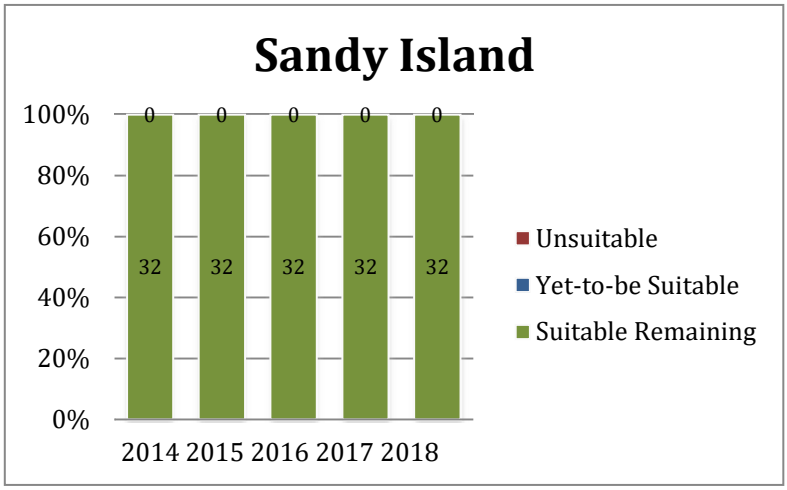

Figure 37: Availability of SHLA Nesting Habitat on Sandy Island, 2014-2018

LOWER DEER ISLAND (RM 77.0)

Placement events on the 24-acre Lower Deer Island site occur in the summer, during the SHLA nesting season. Early season site preparation activities for upland placement will include vegetation removal and dissuasion techniques to preclude SHLA nesting in proposed upland placement locations. Habitat conditions on Lower Deer Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Lower Deer Island. The total succession cycle from placement to unsuitable is seven years.

In 2014, no suitable SHLA nesting habitat is available on the site because the site has not been used since 1995 and it has established vegetation. The entire 24-acre site will be unsuitable habitat. No placement is planned in 2014.

In 2015, no suitable SHLA nesting habitat is available. An 11-acre placement is planned on the downstream portion of the site during the nesting season. The entire 24-acre site will be unsuitable habitat.

In 2016, no suitable SHLA nesting habitat is available. The 11-acre placement on the downstream end from 2015 will be yet-to-be suitable habitat. A 12-acre placement is planned on the upstream portion of the site during the nesting season. The remaining one acre of site will be unsuitable habitat. This one-acre portion is underlain by a natural gas line and fiber optics cable. No additional dredged material placement can occur over these utility lines. A total of 13 acres of unsuitable habitat will be present on Lower Deer Island in 2016.

In 2017, the baseline of suitable SHLA nesting habitat is 11 acres due to the 2015 placement area transitioning into suitable habitat on the downstream portion of the site. The 12-acre upstream placement in 2016 will be yet-to-be suitable habitat. The remaining one acre of the site over the utility lines will be unsuitable.

In 2018, the baseline of suitable SHLA nesting habitat is 23 acres due to the 2016 placement area transitioning into suitable habitat on the upstream portion of the site. The remaining one acre of the site over the utility lines will be unsuitable.

Figure 38 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Lower Deer Island.

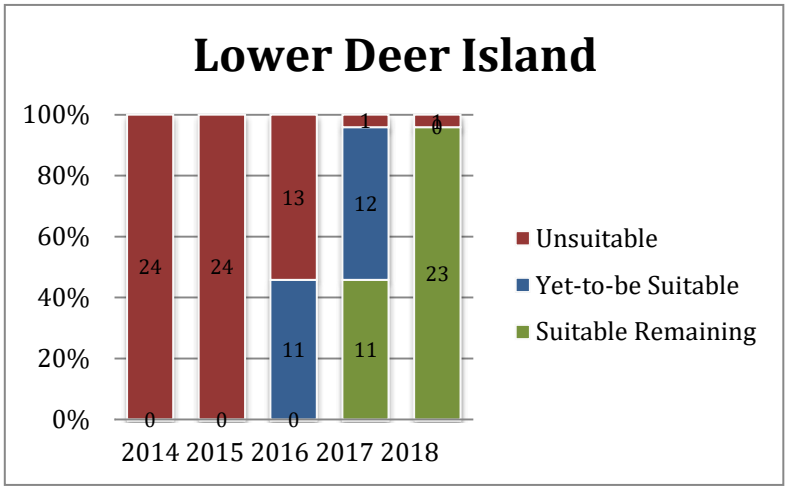

Figure 38: Availability of SHLA Nesting Habitat on Lower Deer Island, 2014-2018

MARTIN BAR (RM 82.0)

Placement events on the 40-acre Martin Bar site occur in the summer, during the SHLA nesting season. The site is composed of a 17-acre North parcel and 23-acre South parcel. The North parcel is leased for agriculture and no suitable SHLA nesting habitat is available. The South parcel is used as a borrow site. The South parcel has exterior berms that preclude SHLA nesting. The CNLM estimated that approximately five acres of suitable lark breeding habitat existed on the site in 2011, and SHLA are not known to use the site, however, Martin Bar has not been recently surveyed for the presence of SHLA. The Corps assumes that suitable SHLA nesting habitat would not be available on the site between 2014 and 2018 because of the high level of human use. As shown in Figure 39, the entire site is assumed to be unsuitable in all years.

A placement is planned in 2014 on the 23-acre South parcel during the SHLA nesting season. However, SHLA are not likely to use the South parcel for nesting due to the existing exterior berms that limit visibility from the 23-acre parcel. The material placed in 2014 on the South parcel is planned for removal in 2014 through 2016 and the exterior berms will remain in place. The entire 40-acre site will be unsuitable habitat. No placement is planned in 2015, 2016, or 2017. The entire 40-acre site is planned for placement during the SHLA nesting season in 2018 and the entire 40-acre site will be unsuitable habitat.

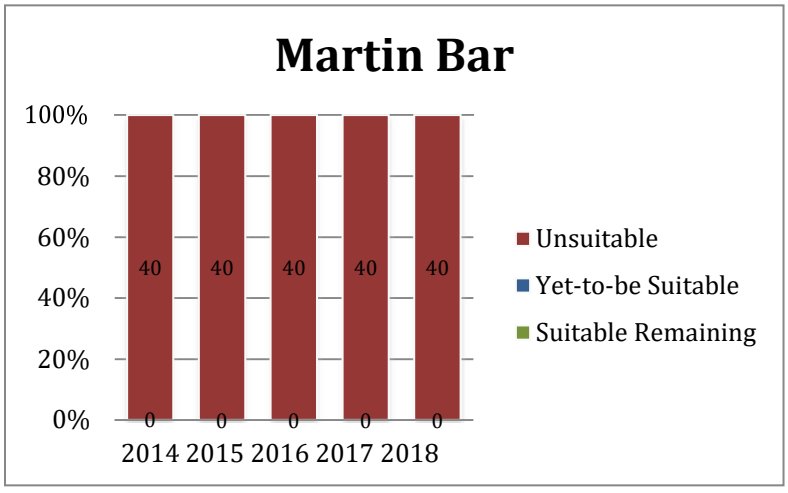

Figure 39: Availability of SHLA Nesting Habitat at Martin Bar, 2014-2018

SAND ISLAND (RM 86.2)

Shoreline placement events on the 28-acre Sand Island occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. Shoreline placements require a 0.10-acre upland staging area can be placed to avoid any nesting larks, if any are identified late in the summer. Therefore, shoreline placement actions on Sand Island are not expected to interfere with active SHLA nesting during the year of dredged material placement. Shoreline placements on Sand Island are not expected to typically develop into suitable SHLA nesting habitat because the placements are expected to erode away in subsequent years. Habitat conditions on Sand Island assume vegetation succession takes one growing season following placement to transition into suitable breeding habitat in the second year after placement. Suitable SHLA nesting habitat conditions are assumed to remain viable for six years on Sand Island. The total succession cycle from placement to unsuitable is seven years. The Sand Island is extensively used for public recreation during the spring, summer, and early fall.

In 2014, the baseline of suitable SHLA nesting habitat is one acre. The remaining 27 acres on the site are unsuitable habitat. No placements are planned in 2014 on the Sand Island site.

In 2015, the baseline of suitable SHLA nesting habitat is one acre. The remaining 27 acres on the site are unsuitable habitat. A 14-acre shoreline placement is planned after the nesting season on the eastern and upstream portion of the site in 2015. No suitable SHLA nesting habitat will be lost to this placement.

In 2016, the baseline of suitable SHLA nesting habitat is one acre. The remaining 27 acres on the site are unsuitable habitat. No placements are planned in 2016 on the Sand Island site.

In 2017, no suitable SHLA nesting habitat is available due to vegetation succession on the upland portions of the site. The entire 28-acre site will be unsuitable habitat. A 14-acre shoreline placement is planned after the nesting season on the eastern and upstream portion of the site in 2017. No suitable SHLA nesting habitat will be lost to this placement.

In 2018, no suitable SHLA nesting habitat is available on the site. The entire 28-acre site will be unsuitable habitat in 2018. No placements are planned in 2018 on the Sand Island site.

Figure 40 displays the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years on Sand Island.

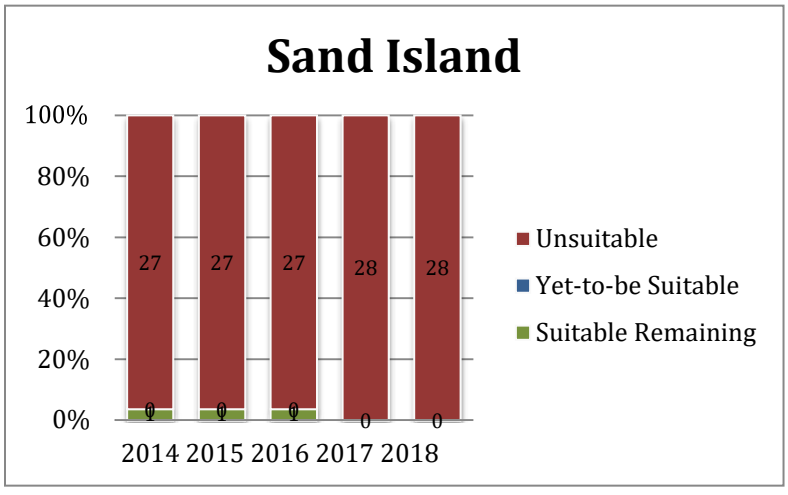

Figure 40: Availability of SHLA Nesting Habitat on Sand Island, 2014-2018

AUSTIN POINT (RM 86.5)

No placements are planned on the 30-acre Austin Point upland placement site. Although larks are not known to historically occupy the site and no formal lark surveys have been conducted recently, several juvenile larks were observed by the Corps in September 2013 prior to placing dredged material across the site. The CNLM estimated that approximately 14 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that no suitable SHLA nesting habitat occurs at Austin Point due to ongoing heavy equipment school site grading activities and therefore assumes no suitable habitat would be available between 2014 and 2018 due to regular site disturbance. As shown in Figure 41, and the entire site is assumed to be unsuitable in all years.

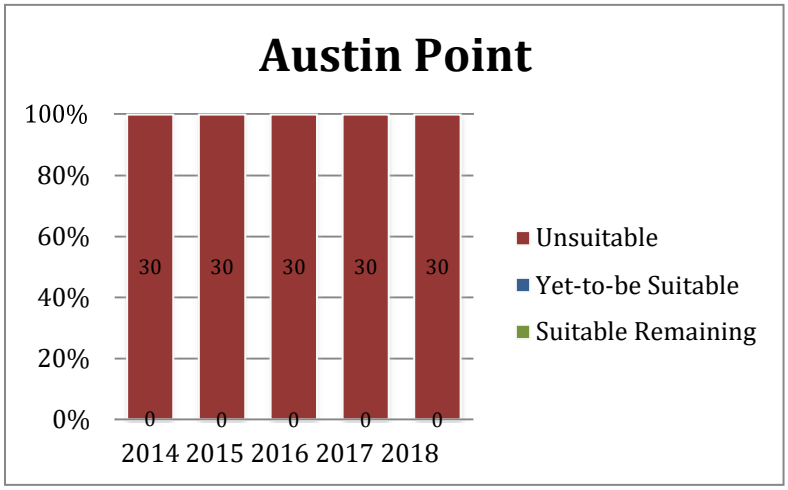

Figure 41: Availability of SHLA Nesting Habitat at Austin Point, 2014-2018

GROUP V

Group V consists of five placement sites located in the lower Columbia River: Sandy Island, Lower Deer Island, Martin Bar, Sand Island, and Austin Point. Of the 154 acres in Group V, only 33 acres (21% of total upland placement area) are baseline suitable SHLA nesting habitat at the time of its listing in October 2013. All 33 acres are suitable nesting habitat during the 2014, 2015, and 2016 breeding seasons. Dredged material placement and/or habitat succession results in an increase of 10 acres (+30%) of suitable nesting habitat during the 2017 breeding season as compared to 2016, for a total of 43 acres available in 2017. Dredged material placement and/or habitat succession results in an increase of 12 acres (+28%) of suitable nesting habitat during the 2018 breeding season as compared to 2017, for a total of 55 acres available in 2018. Overall, suitable nesting habitat is expected to increase by 22 acres from 33 acres of baseline suitable habitat in 2014 to 55 acres available during the 2018 breeding season (+67%). Figure 42 shows the percentage and acreage of suitable, yet-to-be suitable, and unsuitable SHLA nesting habitat over the next five years in Group V.

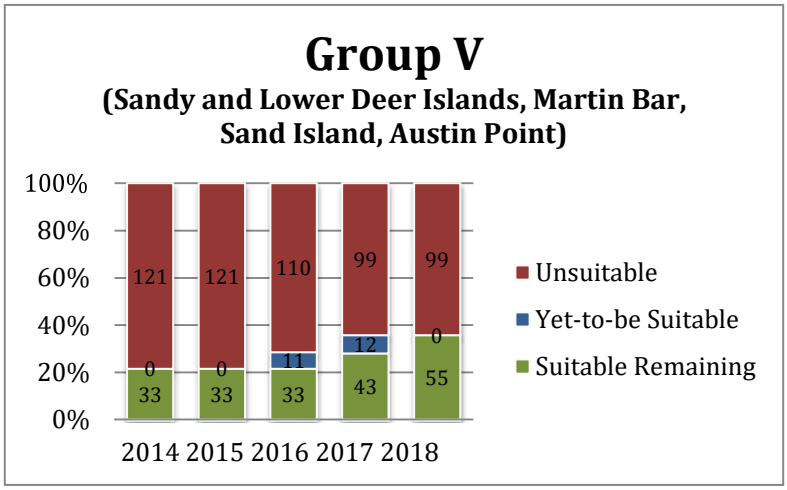

Figure 42: Availability of SHLA Nesting Habitat on Group V Sites, 2014-2018

FAZIO SAND & GRAVEL (RM 97.1)

No placements are planned on the 17-acre Fazio Sand & Gravel upland site. No suitable habitat is known or available in 2014 through 2018 due to ongoing sand and gravel mining and processing activities, as shown in Figure 43, and the entire site is assumed to be unsuitable in all years.

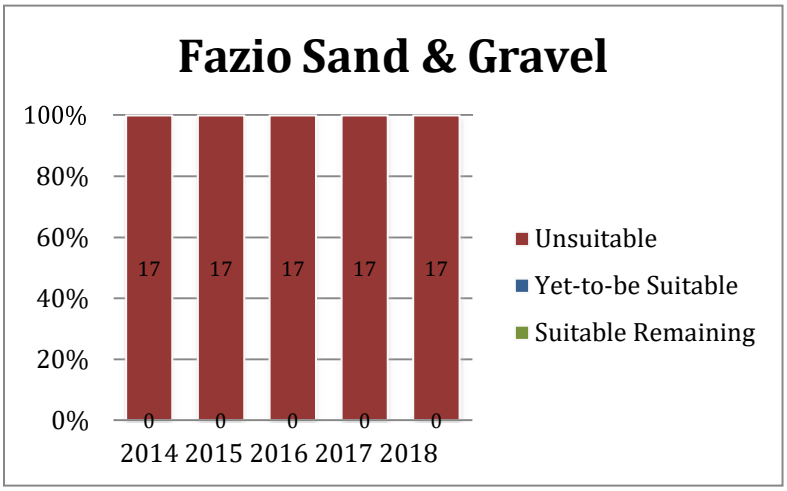

Figure 43: Availability of SHLA Nesting Habitat at the Fazio Sand & Gravel Site, 2014-2018

GATEWAY (RM 101.0)

Placement events on the 40-acre Gateway site occur in the summer, during the SHLA nesting season. The site is actively used for borrow activities and maintained by the Port of Vancouver. It has a 20-foot tall exterior berm along its perimeter and it is separated from the Columbia River by trees. Therefore, suitable SHLA nesting habitat is not expected to occur or develop on the Gateway site as shown in Figure 44.

In 2014 through 2018, no suitable SHLA nesting habitat is available on the site. No placements are planned on the site in 2014, 2015, 2016, or 2017. In 2018, the entire 40-acre site is planned for placement during the nesting season. However, no suitable SHLA nesting habitat is available on the site in 2018. The entire 40-acre site will be unsuitable habitat for nesting in all years.

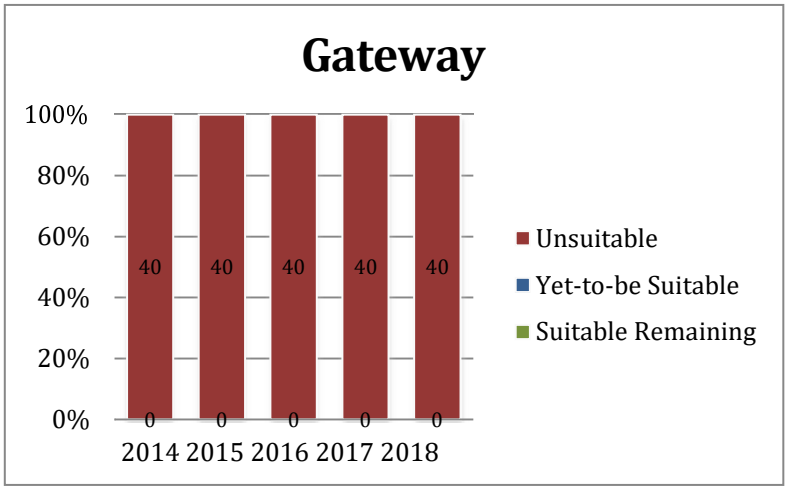

Figure 44: Availability of SHLA Nesting Habitat at Gateway, 2014-2018

WEST HAYDEN ISLAND (RM 105.0)

Placement events on the 116-acre West Hayden Island site occur in the summer, during the SHLA nesting season. The site is actively used by the Port of Portland for placing their dredged materials, storing dredging equipment, and other storage. The site has containment berms, roads, and a mix of trees, shrubs, forbs, grasses, and open ground. The site is separated from the Columbia River by trees. Therefore, suitable SHLA nesting habitat is not expected to occur or develop at West Hayden Island, as shown in Figure 45, and the site is assumed to be unsuitable in all years.

In 2014 through 2018, no suitable SHLA nesting habitat is available on the site. No placements are planned in 2014, 2015, 2017, or 2018. In 2016, an 84-acre placement is planned during the nesting season on the southern portion of the site. However, no suitable SHLA nesting habitat is available on the site in 2016. The entire 116-acre site will be unsuitable habitat for SHLA nesting from 2014 through 2018.

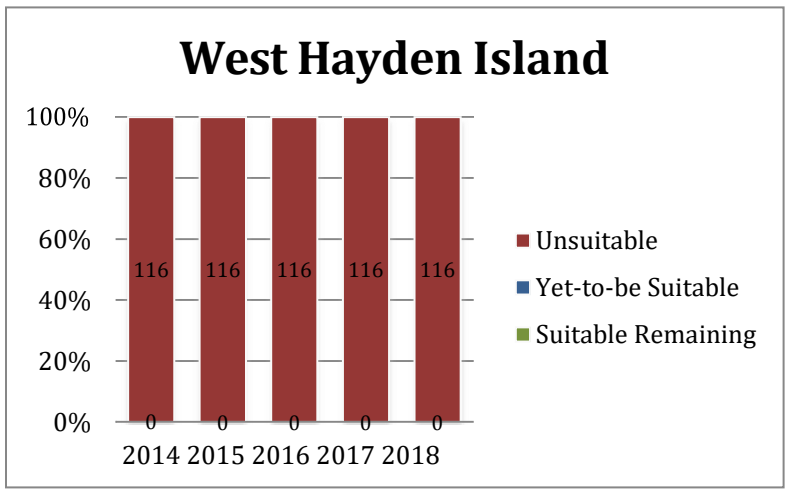

Figure 45: Availability of SHLA Nesting Habitat on the West Hayden Island Site, 2014-2018

GROUP VI

Group VI consists of three placement sites located in the lower Columbia River: Fazio Sand & Gravel, Gateway, and West Hayden Island. No suitable SHLA nesting is currently available within

the 173 acres of Group VI. The placement of dredged materials from 2014 through 2018 within Group VI will not result in a loss of suitable nesting habitat or create suitable nesting habitat because the sites are active borrow sites, have external visual barriers, and are actively disturbed by the landowners. Group VI will be unsuitable for nesting over the 5-year placement plan,as shown in Figure 46.

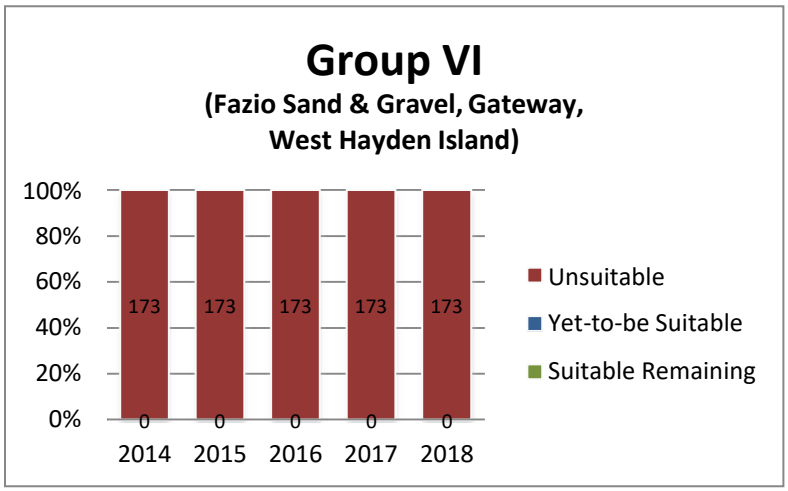

Figure 46: Availability of SHLA Nesting Habitat on the Group VI Sites, 2014-2018

POST-PLACEMENT MODIFICATIONS

Following dredged material placement, all temporary equipment (weirs, outfall pipes, valves, etc.) is removed from a placement site and transferred to the next scheduled location. The site is then graded to a condition to allow development into suitable SHLA habitat if left undisturbed or to dissuade avian species, according to what will most minimize effects. Depending on the remaining capacity within the dredged material placement footprint following placement, the berms may or may not be dismantled. Typically, when a site is not planned for placement the following year, or where sites have limited anthropogenic activity (not active borrow pits and/or public parks) the berms will be disassembled and the sand material distributed across the dredged material placement footprint evenly. The settling pond will be left undisturbed so sparse vegetation is allowed to grow quickly in the organic layer. Sites used annually (in whole or partially), or with regular anthropogenic activity, may be disassembled. However, dissuasion activities may be implemented to prevent active use of the site by larks, terns and/or cormorants (as discussed in Site Preparations).

The Corps does not own the placement sites, and therefore does not manage or regulate use of the sites prior to or following dredged material placement. Some sites may be leased by the landowner (states of Washington or Oregon, private entities, or Ports) to outside parties for the purpose of extracting the dredged material for off-site use. Other sites have public uses. Locations designated as SHLA critical habitat are denoted by # in the lists below.

The following sites are part of the dredged material placement network but are not planned for placement as part of the Columbia River FNC O&M program in the next five years:

- Dibblee Point

- Northport
- Sandy Island #
- Austin Point
- Fazio sand/gravel

The following sites have a high level of human activity and the Corps may not need to implement post-placement dissuasion:

- Skamokawa – Vista Park (county park and port-owned borrow site),
- James River (privately-owned borrow site),
- Dibblee Point (state-owned borrow site) – No planned placement,
- Northport (port-owned borrow site) – No planned placement,
- Martin Bar (port-owned borrow site),
- Sand Island (city park),
- Austin point (port-owned site leased as equipment training school) – No planned placement,
- Fazio Sand and Gravel (privately-owned sand and gravel operation) – No planned placement,
- Gateway (port-owned borrow site), and
- West Hayden Island (actively managed port-owned site with placement by others)

While some sites are currently borrow sites, any site has the potential to become a borrow site if the landowner grants permission to an interested party.

At sites that are not currently borrow sites, but where the Corps plans to return the following year for dredged material placement (on at least a portion of the placement site), the Corps intends to leave the site in a condition that does not attract SHLA. In these instances, dissuasive materials and mounding or trenching may be used to preclude site use by larks, terns and cormorants.

- Pillar Rock #

At West Sand Island, RM 3.1, the Corps will revegetate to the placement area to preclude the establishment of vegetation that could become detrimental to the native dune-grass community south of the placement area.

At sites where the Corps does not plan to repeat placement of dredged material, or repeatedly place dredged material in the same portion of a site, during the five-year dredged material placement plan, the Corps proposes to the leave the site or portions of the site in a condition that could develop into suitable SHLA habitat. These sites include:

- Rice Island #
- Miller Sands #
- Welch Island #
- Tenasillahe Island #
- Brown Island #
- Crims Island #
- Hump Island
- Lord Island (upstream portion)
- Howard Island
- Cottonwood Island
- Lower Deer Island

MONITORING

Part of the proposed action for the five-year dredged material placement plan includes monitoring the actions described above (site preparations, dissuasion, dredging, dredged material placement, and post-dredged material placement site management) across the Network. Monitoring will provide a greater comprehensive understanding of SHLA population distribution and relative abundance within the Network in response to the Corps' proposed action. Data will be collected on the presence/absence of larks throughout the Network, and incidental to this information, observational data will be collected about use of the placement site (breeding, foraging,sheltering). This information will help the Corps verify the effects from management of dredged material placement sites and evaluate the assumptions regarding habitat conditions and use by SHLA. Results will be summarized in an annual report and submitted to the USFWS. The Corps will also be able to use the results of the monitoring to plan long-term use of the Network to provide a shifting mosaic of suitable SHLA nesting habitat.

The Corps is proposing two monitoring efforts: piscivorous birds (terns/cormorants) and SHLA.

TERNS/CORMORANTS

A monitoring protocol has been developed for terns and cormorants on East Sand Island and it has been adapted for use with the dredged material placement network. This protocol has been used at Rice, Miller Sands, and Pillar Rock Islands to detect tern use in dredged material placement areas, subsequently triggering the need for active hazing from the islands during the breeding season (monitoring has not detected tern use to date). As part of the five-year dredged material placement plan, monitoring for terns and cormorants will occur at those islands where hazing should be implemented to preclude tern and cormorant use.

SHLA/SHLA HABITAT

Monitoring efforts for SHLA and SHLA habitat will focus on the sites within the Network. Monitoring for SHLA will document presence/absence, SHLA foraging and nesting, the efficacy of dissuasion efforts, and changes to SHLA habitats. For SHLA habitat, monitoring will document the placement footprint, the amount of suitable habitat modified during placement, the amount of suitable habitat available during the breeding season, and the amount of suitable habitat or yet-to-be suitable habitat remaining after placement. The acreage determinations will be done on a per site (and critical habitat sub-unit) basis, Network wide, and for the critical habitat unit (see Status of Critical Habitat section below).

A specific monitoring plan and methodologies will be developed in coordination with the USFWS and the Corps will begin implementation in 2014. In order to adequately collect data to validate how SHLA are distributed throughout the Network and how they respond to the proposed action, the Corps intends to build upon the existing SHLA data and adopt the Washington Department of Fish and Wildlife (WDFW) survey methodology to evaluate occupancy, abundance, and populations trends of SHLA in the Network.

The WDFW protocol recommends conducting three line-transect surveys during the breeding season between May and early July to confirm presence/absence of SHLA and document abundance and breeding behavior in occupied habitats. There is evidence, however, that this method may over-estimate the number of birds at a site, and some birds may not be detected in some areas where occupation is later confirmed. For example, Anderson did not detect birds at Tenasillahe Island in 2012 or 2013, but nests were discovered by Corps personnel prior to placement in both

years (2013). To increase the detection probability for sites where no surveys have been conducted, or where larks are not known to occur but where suitable habitat exists, the Corps proposes to conduct a fourth survey to confirm absence in areas where suitable habitat occurs.

COORDINATION & CONSULTATION

As part of the proposed action, the Corps requests an annual coordination meeting with the resource agencies (USFWS) and project sponsors to synthesize and discuss results from the prior dredged material placement activities. Regular meetings would guarantee on-going coordination during the five-year implementation schedule, where information about SHLA site use could be evaluated as it relates to the planned dredged material placement activities discussed above. In addition, these meetings would serve as a venue to discuss priorities for the upcoming dredging season and identify any issues needing resolution before dredged material placement commences the following year.

The Corps will initiate scheduling stakeholder meetings with the landowners and resource agencies annually in the winter (January) before site preparations are conducted for the upcoming dredging season, wherein the previous dredging season and monitoring results will be discussed and reviewed. Additional meetings would be scheduled as necessary when unanticipated shoaling necessitates unscheduled critical dredging actions and where these actions may affect SHLA.

STATUS OF THE SPECIES AND CRITICAL HABITAT

STREAKED HORNED LARKS AND LIMITING FACTORS

Horned larks are small ground-dwelling passerines endemic to open grassland habitats. There are 21 subspecies of horned larks found in 15 western states, and specific to the Pacific Northwest, streaked horned larks (SHLA) are considered a genetically distinct evolutionary unit found only in Oregon and Washington (Drovetski et al. 2005). The subspecies was originally proposed for listing by the USFWS on 30 October, 2001, and was formally listed as threatened on 3 October 2013 (FR 78 61452). In addition, to the proposed ESA-listing, SHLA are listed as *Endangered* by the State of Washington, considered *Sensitive* by the Oregon Department of Fish and Wildlife (ODFW), and are Red-listed (extirpated) in British Columbia, Canada (USFWS 2010).

The SHLA subspecies is found in prairie-oak habitats and coastal dune communities west of the Cascade Mountains in Washington and Oregon, where the birds prefer sparsely vegetated areas including sandy islands, wet prairies, oak savannahs and grasslands found at airports, and coastal spits. Prairie-oak habitat is distributed in a linear, north-south gradient in the Pacific Northwest, with the Cascade Mountains serving as a major ecological barrier to the east and the Pacific Ocean to the west. Historically, SHLA were common breeders from southern British Columbia south through the Puget Trough in Washington and into the Willamette and Rogue River Valleys in Oregon (see Figure 47) (Altman 2011, Anderson 2011).

The temporal dynamics of vegetation succession adds an additional layer of complexity to habitat development and maintenance for SHLA. Specific to the Action Area, invasive beach grasses have reduced the overall suitability of available habitat in the Columbia River and along the Washington Coast by altering the erosion/accretion processes that naturally maintain areas of sparse vegetation preferred by SHLA. Conversely, island sites currently used for placement activities may mimic sandy areas that were historically cleared of vegetation during the spring freshet and annual high flow events in the Columbia River basin (Stinson 2005).

The breeding range for SHLA has contracted in response to the loss in quantity and connectivity of native grassland habitats and increased isolation within a narrow band of suitable habitat, as is typical of edge populations (Altman 2011). Streaked horned larks experienced simultaneous north-south contraction between the 1960s and 1990s. The last SHLA in British Columbia, the northern extent of the historical range, was observed at the Vancouver International Airport in 1987; southern extent, the birds were last seen in the Rogue Valley in 1976 (Altman 2011). Currently, populations of SHLA breed in four eco-regions of Oregon and Washington: the Puget Lowlands, sandy areas along the Washington coast, islands in the lower Columbia River, and fallow agricultural fields in the Willamette Valley[2].

The breeding season is initiated with adults arriving on the breeding site in late February/early March. Most nests are constructed in late April or early May, with the first clutch fledging in May/June[3]. Females select the nest location (typically at the base of a bunch grass or forb) and will construct and incubate the nest with little involvement from the male (Stinson 2005). A typical clutch includes three eggs (one egg laid per day), which are incubated for 11 or 12 days. A successful nest will fledge nestlings after 8-10 days, and the altricial young are dependent on the parent birds until they become independent at 21-27 days. Adults and juveniles vacate breeding sites in late August, bound for over-wintering sites farther south.

[2] There is some overlap in habitat along coastal Washington, near Willapa National Wildlife Refuge.

[3] The earliest recorded clutch was observed on 15 March (Stinson 2005).

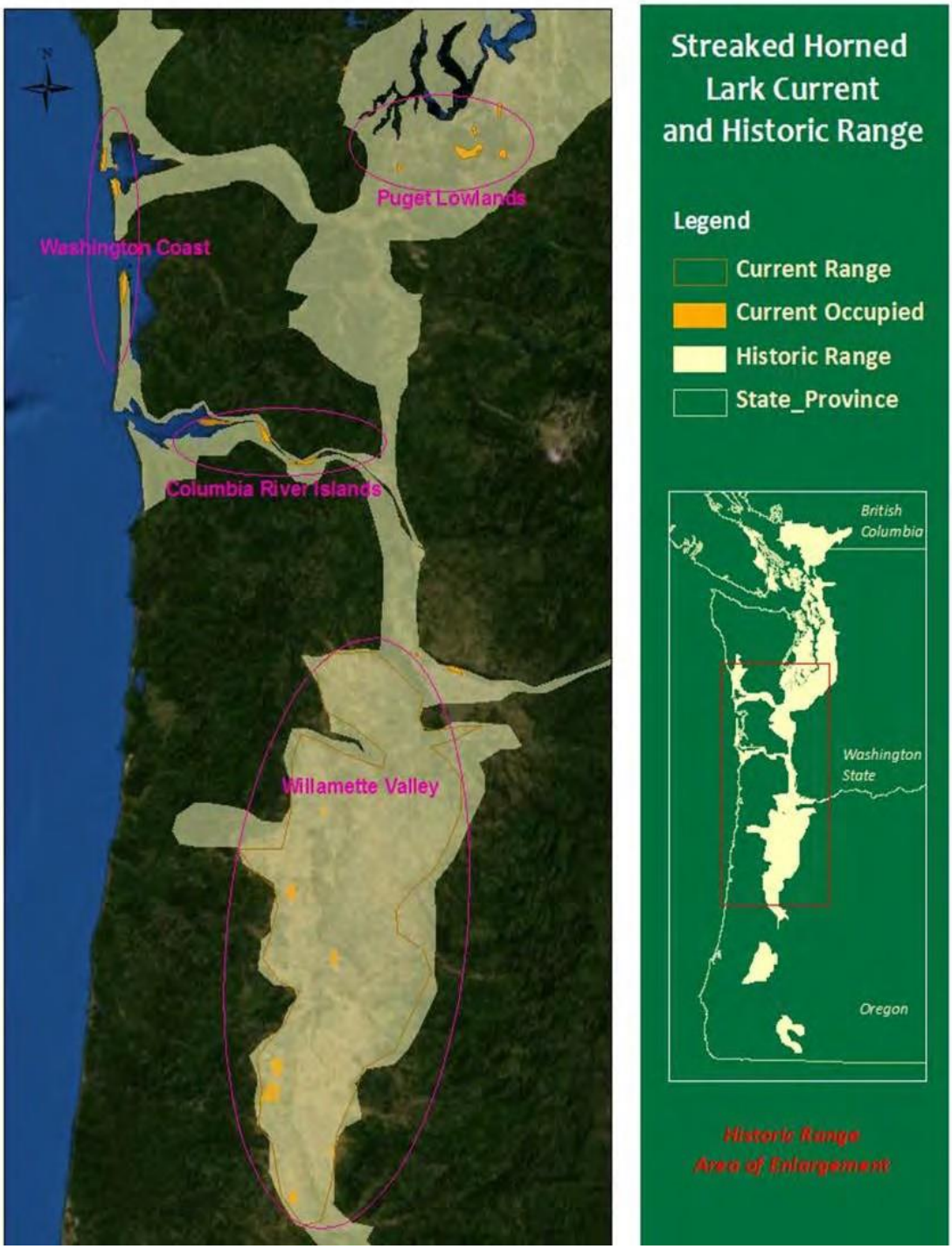

Figure 47: Estimate of Current and Historic Ranges of SHLA Image courtesy of Anderson 2011.

Breeding territories are established after adults form pair bonds in the spring. Average territories range in size between 1.5 to 2.5 acres, with an average of approximately 1.9 acres per breeding pair (Altman 1999, USFWS 2014). Nests are most often (89%) constructed on the north side of

perennial forbs in shallow depressions 2 to 3 inches deep (Beason and Franks 1974, Pearson and Hopey 2005, Stinson 2005). If the first nest fails or is abandoned, adults will likely re-initiate a second clutch within 2 days after failure in May or June. If timing allows after the re-nesting attempt, or if the first nestlings fledge successfully, a second (or third) clutch is initiated approximately 1 week following juvenile independence, with the second nest fledging in late July or August (Beason and Franks 1974, Stinson 2005, USFWS 2010 and 2013). Research by Pearson and Hopey showed three peaks in clutch initiation dates in the Action Area, where nesting is started earlier in the Columbia River and last longer into the summer than at sites in the Puget Lowlands in Washington (2005).

Recent population surveys estimate the overall population of SHLA to total approximately 1,170 – 1,600 individuals (Altman 2011, Anderson 2011). Point-count data in 1996 and 2008 indicate populations in the Willamette Valley are largely stable, but the regional population is estimated to be declining by 40% per year in the Puget Lowlands, the Washington coast, and the lower Columbia River (Pearson et al. 2008, Altman 2011, Camfield et al. 2011). The range-wide population is estimated to be declining by 40% per year as a result of low fecundity and low adult survival (Pearson et al. 2008). Model results from Pearson et al., Schapaugh, and Camfield et al. showed adult survival explains a high proportion of the variation in range-wide population growth rates, followed by juvenile survival and fecundity, suggesting adult survival has a significant impact on population growth (2008, 2009, and 2011, respectively). These findings suggest SHLA populations are demographically limited, rather than limited by the availability of suitable habitat conditions.

Direct threats to individuals include predation, natural and anthropogenic factors including low reproductive success, low genetic variation (which leads to inbreeding depression), reduced disease resistance and adaptability to stochastic events, and human disturbance (Stinson 2005, USFWS 2010)[4]. Human disturbance can cause abandonment, which may indirectly increase the predation of eggs or chicks while the nest is left exposed and vulnerable after adults are flushed. As populations continue to decline and become increasingly fragmented, genetic diversity and variability is reduced ultimately leading to reduced adaptability and a high risk of local extirpation and additional range contraction.

The available data estimates there are approximately 120-140 adults (upwards of 60-70 breeding pairs) throughout the Action Area (Altman 2011, Anderson 2013). Of the dredged material placement sites described in Appendix B and surveyed for presence/absence, nine have known breeding pairs of SHLA: Rice, Miller Sands, Pillar Rock, Welch, Tenasillahe, Brown, Wallace, Crims and Sandy Islands. Rice and Brown Island both support a substantial proportion of SHLA, where each island is estimated to sustain over 20 pairs of breeding adults (Anderson 2013). Table 6 shows the number of breeding pairs estimated between 2011 and 2013 (Anderson 2013)[5]. It should be noted that because not all potentially available sites were surveyed by a systematic method, the number of pairs estimated between 2011 and 2013 does not reflect total SHLA abundance throughout the lower Columbia River, but rather the abundance at those sites surveyed during the course of the investigation.

[4] While brown-headed cowbirds (*Molothrus ater*) have been observed at all known breeding sites, no parasitism has been observed to date (Stinson 2005).

[5] Breeding pairs were estimated by doubling the number of singing males detected during any one visit; there is some indication that survey methods used to detect SHLA may over-estimate the number of birds occupying each site and some birds may go undetected between site visits. For a complete description of survey methods and results, please refer to Anderson 2013.

Table 6: Estimated Number of SHLA Breeding Pairs in the Lower Columbia River

Site	2011	2012	2013
Rice Island	13	14	22
Miller Sands Island	4	2	5
Pillar Rock Island	4	3	2
Welch Island	0	1	0
Tenasillahe Island	2	2	0
Brown Island	14	18	23
Wallace Island (not in Corps Network)	0	1	0
Crims Island	7	4	2
Northport	-	-	3
Sandy Island	2	1	4
Total	***46***	***46***	***61***

Nesting success within the Action Area is estimated to be approximately 33%, where predation and abandonment are the most frequent causes of nest failure, each contributing equally to failure (40%, each) (Pearson and Hopey 2005, Stinson 2005). While predation is a substantial source of failure, Pearson et al. (2012) showed that nest exclosures commonly used with precocial young (shorebirds and ducks) have no effect on nest success of altricial SHLA. The lower rate of predation associated with nest exclosures was offset by an increased rate of abandonment and predation of adults by raptors.

Streaked horned larks exhibit high site fidelity to (successful) breeding areas, as documented by mark-recapture/re-sight studies where birds return to the same areas year after year to nest semi-colonially. There is no published data documenting intra- or inter-annual movement between nesting sites during the breeding season in the lower Columbia River. Observations have shown a high density of nests in one location with large expanses of nearby unoccupied nesting habitat (Pearson and Altman 2005, Stinson 2005). Over-wintering site fidelity is low and the birds disperse throughout the region to locate suitable foraging habitats, the distribution and availability of which may change from year to year. As a result, while wintering sites are extremely important to the conservation of the species, they are functionally difficult to manage and protect.

While threats to SHLA are not known to be increasing, the existing threats continue to exert unnaturally high pressures on small populations which have low genetic diversity, low growth rates, and congregate in a few over-wintering populations. Few of the existing breeding and wintering habitats are protected, and none are managed exclusively for SHLA (Pearson and Altman 2005). The islands in the lower Columbia River may serve as a geographic link between occupied regions to the north in the Puget Lowlands, to the west along the Washington coast, and to the south in the Willamette Valley. Streaked horned larks are semi-migratory and over-winter in the lower Columbia River and throughout the Willamette Valley. It is estimated that 60% to 70% of the regional population over-winters in the Willamette Valley and the remaining 30% to 40% are distributed largely between islands in the lower river and along the Washington coast (Pearson and Altman 2005, Stinson 2005).

Dynamic ecosystem processes and the management of accretion and erosion are critical to maintaining breeding and wintering habitats along the Columbia River. As described above, many of the islands in the lower Columbia River are state-owned and leased for the placement of dredged

material, and the placement of dredged material directly impacts the inter-annual availability of SHLA nesting habitat. Dredged material placement has the potential to maintain existing habitat and create or expand new sites for nesting and foraging. However, these activities ought to be spatially and temporally coordinated to minimize the adverse impacts to SHLA and their breeding habitats. In 2005, Pearson and Altman observed placement activities burying a nest, causing nest failure. However, placement events in recent years (2012 and 2013) were conducted in a manner that avoided burying active nests by isolating the nests from the placement footprint.

Various studies have evaluated habitat characteristics to identify suitable sites for foraging and nesting SHLA. These studies have demonstrated that suitability is predominantly a function of ground substrate, the composition of vegetation and the adjacency or visibility to open water areas (Pearson and Hopey 2005, Anderson 2013). Recent information suggests the percent of bare sand at a particular site can be used as a proxy for identifying suitable habitat conditions for breeding SHLA. In a recent analysis of habitat conditions in the lower river, Anderson showed that areas comprised of 50% to 90% bare sand were indicative of those habitats used most frequently by SHLA for nesting (2013). In this analysis, larks did not nest in areas with no vegetation (>90%) and did not frequent areas with covered by more than 50% vegetation. Furthermore, SHLA preferentially select nest sites at the base of perennial forbs and bunch grasses (as opposed to annual grass and forbs) and sites with low horizontal density and a high percentage of bare ground are preferred foraging areas (Stinson 2005).

Larks are known to use areas outside of what is widely considered “suitable” and while some birds utilize areas where placement of dredged material recently occurred, this BA assumes nesting would be restricted to those areas where the percent cover of vegetation and bare sand meet the suitable conditions (50% to 90% bare sand). In addition, for the purpose of this BA, habitat conditions on the placement sites are divided into three categories based on the best available science: (1) suitable, where habitat consists of 50% to 90% bare sand with some vegetation; (2) yet-to-be suitable, where vegetation has not yet established across the site and there is >90% bare sand; and (3) unsuitable, where vegetation exceeds 50% cover and the area is too dense for SHLAs. In addition, because larks are known to use areas with clear visibility of the surrounding landscape, suitable habitat is also assumed to be 25 meters from a forested edge or the shoreline. This buffer excludes areas where vegetation likely becomes too dense for SHLAs and areas affected by tides and therefore unsuitable for nesting.

The amount of time needed for vegetation succession varies throughout the lower Columbia River. Current research shows that to take longer for vegetation to establish on Rice, Miller Sands, and Pillar Rock Islands, presumably as a result of high winds and harsher climatic conditions (Anderson 2013). For this reason, it is assumed that vegetation takes three growing seasons to become established on these islands, and habitat is suitable for SHLA nesting at the beginning of the fourth breeding season following placement. For all other islands (between Skamokawa–Vista Park at RM 33.4 and West Hayden Island at RM 105), it is assumed that vegetation transitions more quickly and vegetation becomes established after one full growing season. In these areas, it is assumed that placement sites transition into suitable habitat at the beginning of the breeding season in the second year following placement.

In some instance, vegetation has been observed growing in placement areas within one year of placement, likely as a result of organic materials in the dredged sediments supporting establishment of quick-growing plants (Anderson 2013). While vegetation establishment and succession occurs at different rates throughout the Network, a habitat analysis by Anderson showed that once areas become suitable, they remain suitable for approximately 6-7 years (2013), provided the areas do not experience other disturbances during this time. Where vegetation is transforming suitable nesting habitats into densely vegetation areas, controlled burns and

mechanical or chemical treatments (tilling, mowing, and herbicide application) can be used to restore and maintain suitable foraging habitat (Pearson and Altman 2005, Anderson 2011). It has been proposed that the strategic placement of dredged materials, in combination with herbicide application, can effectively control invasive species to maintain preferred habitats for SHLA and create additional habitats where naturally erosive processes have eliminated other island habitats (Anderson 2011).

CRITICAL HABITAT

The USFWS designated a total of 4,629 acres range wide in Oregon and Washington as critical habitat for streaked horned larks (78 FR 61506). All areas designated as critical habitat constitute areas currently occupied at the time of listing and contain the primary constituent elements (PCEs) to support the life-history needs of the species. The designated areas contain the physical and biological features essential to the conservation of the species, having a minimum of 16% bare ground with sparse, low-stature vegetation comprised primarily of grasses and forbs less than 13 inches in height. In addition, these features are found in flat areas (zero to five percent slope). These areas are 300 acres in size or within a landscape context that provides visual access to open areas, such as open water or fields. These areas provide suitable foraging and nesting habitats.

The USFWS identified a number of activities that may affect the physical and biological features essential to the conservation of SHLA across its range such that special management considerations or protections may be required. Threats include (1) the loss of habitat; (2) control of non-native, invasive species; (3) development; (4) construction and maintenance of roads and utility corridors; and (5) habitat modifications brought on by successive vegetation growth from lack of regular disturbance, both small and large scale. The effects of specific activities on the quality and quantity of essential features vary between areas within the critical habitat designation, particularly where sites are large (greater than 300 acres).

The USFWS identified two units of critical habitat for SHLA, which can be further divided into 16 sub-units, one unit (Unit 3) encompassing 13 subunits along the Washington coast and lower Columbia River and another unit (Unit 4) encompassing 3 subunits in the Willamette Valley. Units 1 and 2 were not designated for SHLA. The relevant subunits for this analysis include those in Unit 3 along the Washington Coast and Columbia River, totaling 2,899 acres, where 2,209 acres are State-owned lands, 564 acres are under Federal ownership, and the remaining 126 acres are privately owned.

The four Washington coastal subunits total 2,235 acres and include:

- Damon Point (subunit 3-A), 480 acres (not part of the Corps' Network)
- Midway Beach (subunit 3-B), 611 acres (not part of the Corps' Network)
- Shoalwater Spit (subunit 3-C), 479 acres (not part of the Corps' Network)
- Leadbetter Point (subunit 3-D), 665 acres (not part of the Corps' Network)

The nine subunits in the lower Columbia River are state-owned, small islands adjacent to open water and landscapes preferred by SHLA. It should be noted that only a portion of each Corps placement site overlaps with designated critical habitat on the island. Within any Corps placement site, only a portion of the site is likely to be suitable and used by SHLA in any year. The designated subunits of critical habitat do not shift over time because they are fixed geographic units. However, the availability of suitable nesting habitat within each placement site and each subunit shifts over time as new materials are deposited, vegetation is established, and older placement sites become too heavily vegetated for nesting by SHLA. The total acreage of designated critical habitat for SHLA throughout the lower Columbia River is 665 acres, including:

- Rice Island (subunit 3-E), 224 acres
- Miller Sands (subunit 3-F), 123 acres
- Pillar Rock/Jim Crow (subunit 3-G), 44 acres
- Welch Island (subunit 3-H), 43 acres
- Tenasillahe Island (subunit 3-I), 23 acres
- Whites/Brown Island (subunit 3-J), 98 acres
- Wallace Island (subunit 3-K), 13 acres (not part of the Corps' Network)
- Crims Island (subunit 3-L), 60 acres
- Sandy Island (subunit 3-M), 37 acres

Of these, all but Wallace Island overlap dredged material placement sites within the Corps' dredged material placement Network. Figure 48 shows the designated critical habitat subunits within Unit 3 for the lower Columbia River.

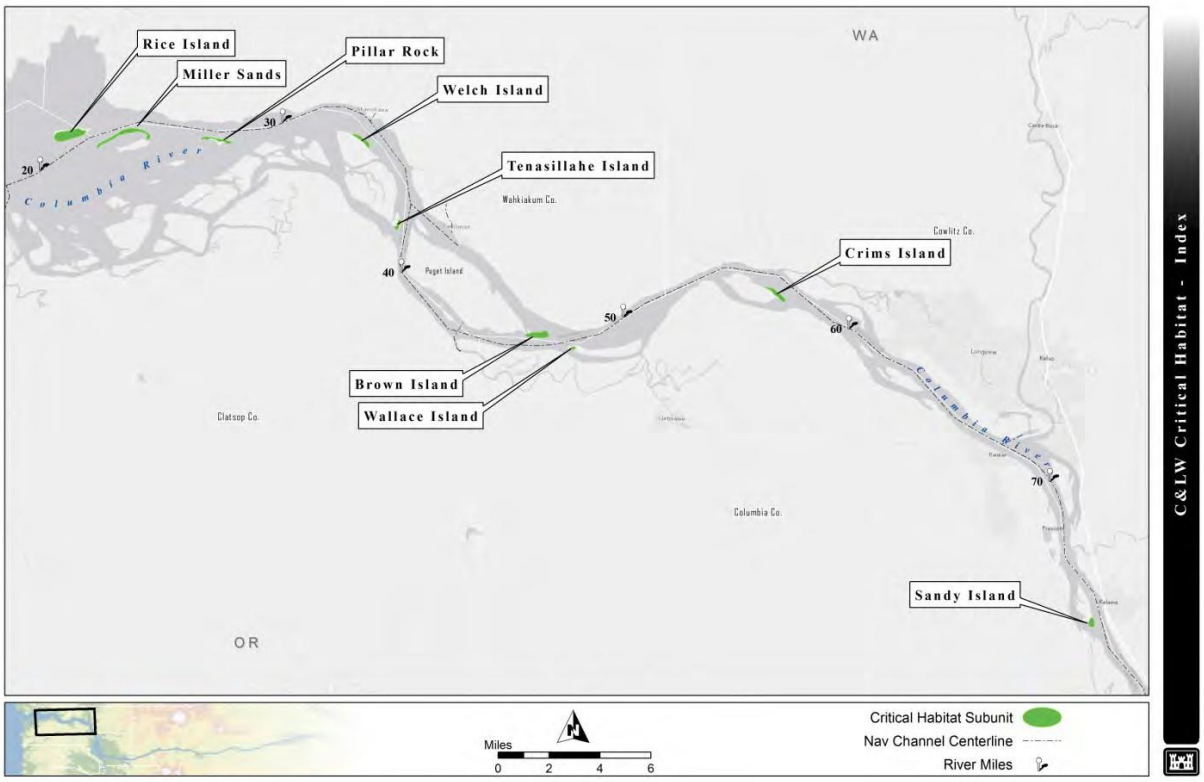

Figure 48: Designated Critical Habitat Subunits of Unit 3 in the Lower Columbia River

The main threats to SHLA critical habitat in the Columbia River subunits are natural vegetation succession, invasive vegetation, direct impacts associated with dredged material placement during the breeding season, and foraging habitat for over-wintering birds (USFWS, 2013).

Table 7 details the acreages of designated SHLA critical habitat, overlap with each placement site, and how much of that critical habitat subunit is currently suitable SHLA nesting habitat. Suitable nesting habitat for SHLA typically contains all the PCEs of SHLA designated critical habitat. However, designated SHLA critical habitat is not always suitable for nesting because of natural

vegetative succession both within and adjacent to specific subunits. Wallace Island (*) is not in the Corps' placement network.

Table 7: Designated Critical Habitat within Lower Columbia River and Corps' Network

Subunit	Subunit (acres)	Placement Site (acres)	Designated Critical Habitat (CH) Within Site (acres)	Currently Suitable SHLA Nesting Habitat Within CH (acres)
Rice Island (RM 21.0)	224	264	219	150
Miller Sands Island (23.5)	123	117	88	0
Pillar Rock Island (27.2)	44	52	41	4
Welch Island (RM 34.0)	43	41	37	10
Tenasillahe Island (RM 38.3)	23	41	23	2
Brown Island (RM 46.1)	98	102	97	72
Wallace Island (RM 47)*	13	n/a	n/a	3
Crims Island (RM 57.0)	60	59	53	25
Sandy Island (RM 75.8)	37	32	32	32
TOTAL (acres)	**665**	**708**	**590**	**298 (45% of 665)**

EFFECTS ANALYSIS

The effects of the proposed action are described with respect to the proximity, duration and frequency of the action, and resulting disturbance to species, modifications to habitat, and habitat creation. Some islands have known occupation by SHLA while others have no reported (historical) use by larks. Because habitat suitability is directly linked to vegetation succession, some areas with dense vegetation are not used by larks and have not been used by larks for several years. Placement will vary throughout the Action Area, as some sites will be used annually whereas others will be used once or intermittently during the 5-year plan. The effects to the species and critical habitat will be both localized to entire placement sites, or portions of the placement sites, as well as distributed throughout the placement network. There are eight islands designated as critical habitat in the Network, but only seven islands are in the 5-year Plan: Rice, Miller Sands, Pillar Rock, Welch, Tenasillahe, Brown, and Crims islands. No placement is planned on Sandy Island in the next five years.

Included in the discussion below is the effect of the action on specific stages of the SHLA lifecycle (adults, juveniles, nestlings, eggs) and whether the effects may affect the overall population size and distribution of larks in the Columbia River estuary. Because the Columbia River islands may serve as an increasingly important geographic link between occupied regions to the north (Puget Lowlands), the west (coastal areas), and areas to the south (Willamette Valley), it has been recommended to avoid disturbing nesting areas in the Columbia River between April 15 and August 15 (Anderson 2011). To minimize impacts to breeding birds and nesting areas, certain actions are timed to coincide outside of the breeding. However, some placement activities will occur within this timeframe, and the effects of these actions are described below.

The duration and frequency of dredged material placement has also been evaluated for its effect on SHLA and its habitat. There are immediate, short-term adverse effects to individuals and SHLA

habitat from the proposed actions. However, long-term, beneficial effects to SHLA habitat are anticipated from the strategic management of placement within the Network. To the extent practicable, the timing of certain components of the proposed action will minimize disturbance to the birds. Maintenance of the navigation channel requires annual dredging and some effects will be sustained for the life of individuals, which might have lasting effects to population growth rate and recovery of the Columbia River population. However, the long-term beneficial effects to suitable SHLA nesting habitat are expected to outweigh short-term adverse effects to individuals and habitat.

CLIMATE CHANGE

It is likely that climate change will play an increasingly important role in future years in determining the abundance of ESA-listed species and the conservation value of designated critical habitats by exacerbating long-term problems related to temperature, stream flow, habitat access, predation, and marine productivity (CIG 2004, ISAB 2007). According to the U.S. Global Change Research Program (USGRP), the average regional air temperatures have increased by an average of 1.5°F over the last century (up to 4°F in some areas), with warming trends expected to continue into the next century (2009).

Precipitation trends during the next century are less certain than those for temperature, but increased precipitation is likely to occur during October through March and less during summer, with more winter precipitation falling as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff resulting in lower stream flows and warmer water temperatures in late spring, summer, and fall (ISAB 2007, USGCRP 2009). These changes will not be spatially homogeneous across the entire Columbia River basin. Areas with elevations high enough to maintain temperatures well below freezing for most of the winter and early spring would be less affected. Low-lying areas that historically have received scant precipitation during the winter and contribute little to total stream flow and are likely to be more affected. The ISAB recommends planning now for future climate conditions by implementing protective tributary, mainstem, and estuarine habitat measures; as well as protective hydropower mitigation measures (2007).

Climate change may result in an expansion of prairie-oak habitats northward; however, SHLA population dynamics are declining for a multitude of reasons and not just habitat loss. Until these factors are addressed and regional populations can serve as a source population as opposed to a population sink, habitat expansion as a result from climate change is not likely to provide relief to the current declines in SHLA abundance (Altman 2011).

The effects of climate change in the Action Area could lead to a change in the timing of precipitation, the extent of snowpack, and rain-on-snow events. These changes in weather patterns could influence seasonal river flows, subsequently influencing the presence of size of shoaling in the lower Columbia River, thereby influencing the timing of dredging and placement of materials. However, the proposed placement plan described above is a short-term project, lasting five years in duration. It is assumed that any effects climate change might have across the action area during this timeframe would be negligible and effects to SHLAs or their habitats would be immeasurable.

EFFECTS OF THE ACTION

While a number of measures will be taken to minimize and avoid impacts to birds and their habitats, some direct, indirect, and cumulative effects are expected to occur. Additionally, the upland placement of dredged material will create and sustain suitable SHLA nesting habitat over

time. The sections below evaluate the effects of the components of the proposed action, as described above, on the species and its critical habitat, as well as the interrelated and interdependent activities.

SITE PREPARATIONS

The timing of site preparations will occur in the winter and early spring months outside of the breeding season to minimize future direct impacts to nesting birds. During this time period, over-wintering adults may be present on placement sites and these individuals are expected to move out of the area of active site preparation. Site preparation, including the construction of landing ramps, shoreline grading, physical demarcation of the footprint (flagging, berm building, etc.), vegetation removal that is necessary to facilitate dredged material placement could disturb birds and disrupt foraging. These actions could directly injure or harm individuals, however this is likely discountable because birds will likely flush and avoid the activity.

Repeated flushing events during the winter and before the breeding season could lead to a decrease in overall fitness of individuals, where energy is expended or foraging is interrupted to flee from people and equipment. Over-winter foraging success is directly linked to building or maintaining body fat in preparation of migration and the upcoming breeding season. Research has suggested that birds which winter in higher quality wintering habitat are more likely to survive annual migration and have higher reproductive success during the breeding season (Sillett and Holmes 2002). Flushing during site preparations could stress birds and force individuals to expend increased levels of energy to seek safety and shelter.

The physical movement or displacement of sand, vegetation, and other habitat features would fundamentally alter site characteristics and habitat suitability (either making it more or less suitable, depending on the preparations specific to the placement plan). Vegetation removed during site preparations will be buried or made unavailable to nesting birds. If the habitat was suitable for nesting, it is likely that this habitat would no longer be suitable following site preparations. During the winter and early spring, vegetation likely provides a buffer against severe weather and predators. The removal of this vegetation is expected to result in wide open expanses of exposed sand, forcing individuals to seek shelter on unused portions of the placement sites with suitable habitat conditions.

The process of removing vegetation using vehicles and earth-moving equipment will disturb the soil surface, mixing layers of the soil and exposing seeds and insects that were previously buried and inaccessible to foraging songbirds. There may be a short-term benefit to larks immediately following vegetation removal. Seeds would likely be knocked off branches and insects would be exposed when leaf litter is moved during vegetation clearing. This additional foraging material would be valuable during the winter season when forage and prey items are scarce. While there may be a short-term benefit, increased exposure resulting from vegetation removal could also lead to increased predation. However, most recorded predation events occur to juveniles during the nesting season. Streaked horned larks present on the placement sites in the winter/spring are expected to be fully mobile and able to escape most predators. While the lack of vegetation cleared during site preparations would expose SHLA to increased predation, predators would also be likewise exposed and it is expected that healthy adult larks (not injured or sick) would be able to escape predators.

Overall, the number of individuals directly affected by site preparations is expected to be low and should not result in any direct mortality.

DISSUASION

Similar to the effects from site preparations, repeated dissuasion and hazing could also impact SHLA. Dissuasion actions that coincide with site preparations are intended to minimize site use by larks, and other migratory birds where active dredged material placement will occur during the breeding season. The Corps implements early-season (February-March) dissuasion to reduce the potential for more severe impacts to SHLA later in the nesting season. All dissuasion practices are intended to discourage nesting, roosting, and/or foraging behaviors, with the ultimate intent to avoid, minimize, and reduce impacts to adults, juveniles, and/or nestlings during the breeding season. No active dissuasion of SHLA will occur during the breeding season (15 April through 15 August). While some uncertainty remains regarding the effectiveness of early season dissuasion, the Corps is confident that dissuasion efforts would be effective at precluding site use by SHLA based on discussion with species experts in the region. Further, despite dissuasion efforts, some birds may be undeterred from nesting; therefore these individuals may be adversely affected directly through the placement of sediment in their nesting territories, eliminating those areas for nesting in the short term and possibly resulting in mortality to eggs and/or chicks.

As a requirement of the NMFS 2012 BiOp, T&C 1(k), if avian predators (piscivorous birds) are identified in the action area, hazing actions would be implemented to intentionally flush birds and discourage nesting on upland placement sites. If nesting activity is observed on placement sites, the Corps will actively discourage these behaviors, including egg collection. Alternatives to intentional hazing and dissuasion actions include the use of physical barriers (nets and fencing, flagging, etc.) and habitat modifications (vegetation removal, trenching, mounding, etc.) to minimize the extent and suitability of habitat available for foraging and nesting. These activities will include human presence and may involve the use of vehicles. As a result, these activities may result in a range of effects to SHLAs, depending on the timing, location and intensity of hazing and dissuasion. This includes flushing adults and/or young, increased exposure of individuals to weather and predation, nest abandonment and/or destruction, and possible mortality of eggs or young. If these actions occur with substantial frequency and/or duration, dissuasion of avian predators could result in direct effects to SHLA survival.

Currently, dissuasion of piscivorous birds only occurs at Rice, Miller Sands and Pillar Rock islands, which are potential habitat for Caspian terns. In these areas, habitat is modified , silt fences are constructed and terns are hazed from the island to prevent occupation and nesting (Stinson 2005). These actions accelerate the development of dense vegetation, reducing the availability of bare ground and precluding the use of these areas as nesting and foraging habitat for terns or SHLA. Similarly, hazing actions directed at terns can have adverse effects to larks, when active dissuasion occurs in suitable SHLA nesting habitat. Currently, only Pillar Rock Island contains potential tern habitat that overlaps with suitable nesting habitat for SHLA. Terns have not attempted to nest in these areas to date and dissuasion of terns has not occurred. If tern dissuasion is necessary in suitable SHLA nesting habitat in the future, there could be direct and indirect effects to SHLA and its nesting habitat.

Dissuasion to avian predators and SHLA is not expected to result in direct mortality of adults, rather, dissuasion and hazing activities are expected to directly affect or alter adult behavior. Direct effects include flushing of adults, flushing adults from nests, increased exposure of eggs/young to environmental conditions, increased risk of nest predation, accident injury to eggs/young, nest abandonment, and nest failure from activity in nesting habitats. Indirect effects include the loss of suitable nesting habitat that could result in decreased nest success. Indirect effects resulting from dissuasion include modifications to habitat that preclude the use ofsuitable nesting habitat, thereby

indirectly affecting individuals. However, habitat availability is not assumed to be a limiting factor in the action area (Pearson et al. 2008, Schapaugh 2009, and Camfield et al. 2011).

DREDGING AND OCEAN AND IN-WATER PLACEMENT

All dredging and in-water work is expected to have no effects to SHLA or their critical habitat. In-water dredged material placement has no effect to terrestrial species and therefore, it will not be evaluated in this analysis. Furthermore, it has been determined that all dredged material is suitable for unconfined, in-water placement without further characterization.

DREDGED MATERIAL PLACEMENT AT UPLAND AND SHORELINE SITES

Efforts have been made in recent years to identify active nests in the placement Network and avoid these areas. As previously stated, site preparations and dissuasion activities should minimize direct effects to adult SHLAs, as these actions occur outside of the breeding season and any reductions to the suitability of placement sites for nesting will occur before the onset of the breeding season. Dredged material placement activities generally include access, equipment staging and set-up, site grading, placement of weirs and outfall pipes using earth-moving equipment, berm construction and discharge of the sand-water slurry into the placement footprint. Based on the results of sediment quality testing described above, no effects to SHLA or their habitat are expected as a result of the quality of the dredged sediments placed on upland or shoreline sites. Following placement of dredged materials, all equipment is removed from the site.

Due to a lack of data supporting the effectiveness of site preparations and dissuasion to preclude site use, SHLA may nest in the placement footprint despite these efforts. Placement sites used during the breeding season will be evaluated for any active nesting by a biologist prior to placement occurring. Adult SHLAs may experience direct effects from the placement of dredged materials if they occupy the site for foraging or nesting. While adult SHLA may be disturbed during placement, they would likely flush from the area , which could result in nest abandonment, increased predation, decreased foraging opportunities, and increased energetic expenditures. Past placement activities have resulted in placement of dredged materials on active SHLA nests. In the event that nests are in the placement footprint, sediment placement will result in the direct mortality and burial of eggs, and nestlings; adults are expected to flush from the area and avoid burial and direct mortality.

Individuals in areas adjacent to the placement footprint (but outside of the placement boundary) are expected to experience similar effects to actions in the placement footprint, including flushing adults and/or young, increased exposure of individuals to weather and predation, nest abandonment and/or destruction. In addition, juveniles and young-of-the-year birds that move into the dredged material placement footprint are expected to have sufficient flight capabilities to flush from the area upon initiation of active material placement or other disturbances.

Indirect effects to SHLA are expected to result from modifications to habitat and an associated loss of nesting and foraging areas following the placement of dredged materials, wherein the net effects are realized later in time. Based on the expected changes to the availability of suitable nesting habitat throughout the Network over the 5-year placement plan, SHLA will experience increases and decreases in the availability of suitable habitat in some years, which may impact territory size for breeding pairs and dispersal of juveniles.

ESTIMATED BREEDING PAIRS IN SUITABLE SHLA NESTING HABITAT

As described in the above sections, the breeding population of SHLA in the Columbia River is estimated to contain approximately 120-140 adults, or 60-70 breeding pairs. Additionally, territories are assumed to range between 1.5 and 2.5 acres per breeding pair (USFWS 2014). For this analysis, all areas identified as suitable are assumed to be available for nesting and the potential number of breeding pairs an area is able to support is based on the estimated number of suitable habitat acres and the given range of breeding territories, where:

$$Number\ of\ breeding\ pairs = \frac{Available\ suitable\ nesting\ habitat\ (X\ acres)}{Territory\ size\ (2.5\ acres)}$$

and

$$Number\ of\ breeding\ pairs = \frac{Available\ suitable\ nesting\ habitat\ (X\ acres)}{Territory\ size\ (1.5\ acres)}$$

NETWORK SCALE

Based on recent 2011 through 2013 surveys, the numbers of SHLA breeding pairs observed in the Network were 46, 46, and 61 pairs, respectively (Table 6). Based on the currently available suitable nesting habitat for SHLA and the assumptions about the possible number of breeding pairs habitat can support, the Network can support between 122 and 205 SHLA breeding pairs. This estimate is two to three times the observed number of pairs in recent years. This also assumes the population has a 1:1 sex ratio of males to females, across 315 acres of suitable habitat. This range is supported by population models which suggest SHLAs are not limited by the availability of suitable habitat, but rather by population demographics (adult and juvenile survival, nest success) (Pearson et al. 2008, Schapaugh 2009, Camfield et al. 2011). When the total extent of suitable habitat across the Network is lowest in 2015 (261 acres), the habitat could still support 93 to 157 SHLA pairs throughout the Columbia River, which is 55% more than what is estimated to occupy the lower river under current conditions (60 to 70 pairs). Over time, as suitable habitat conditions increase throughout the Network, it is assumed that the number of breeding pairs will also increase to a maximum range of breeding pairs between 253 and 426 across 643 acres of suitable habitat throughout the Network in 2018 (see Figure 49).

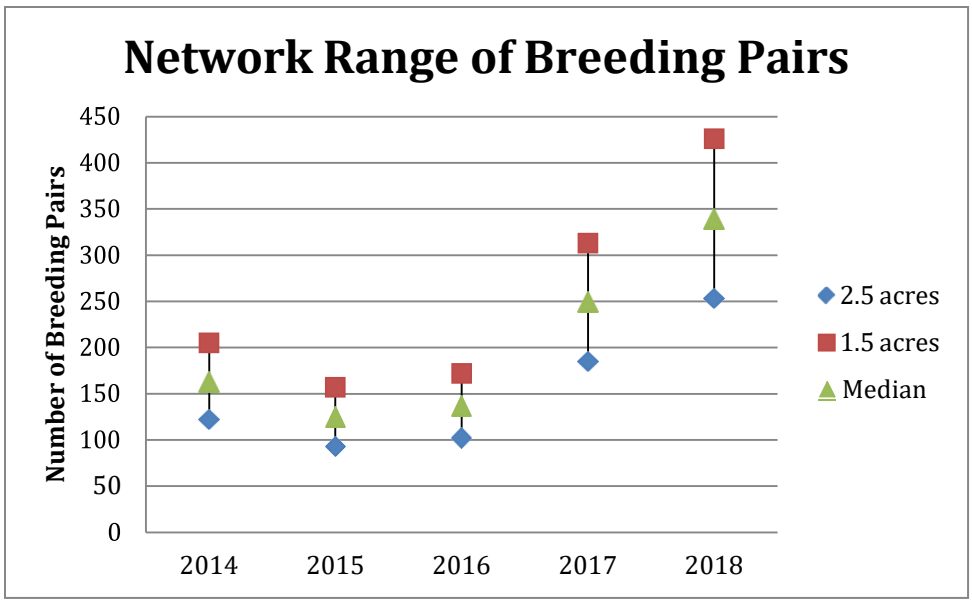

Figure 49: Potential Range of Breeding Pairs throughout Network, 2014-2018

GROUPS I AND VI

The analysis of impacts to breeding SHLA and effective territory size discussed below refers to Groups I through VI described earlier in this document. No breeding SHLA have been observed at any of the placement sites in Group I (Benson Beach and West Sand Island, the Group farthest downstream) or Group VI (Fazio Sand & Gravel, Gateway, and West Hayden Island, the Group farthest upstream). These sites do not contain suitable nesting habitat as identified by the NDVI data from 2011, as all sites in these groups have established vegetation or a high level of anthropogenic disturbances associated with sand and gravel removal or a lack of recent placement of dredged materials to re-start vegetation succession. For these reasons, it is assumed that no suitable habitat will develop on these placement sites for the duration of this consultation, and therefore no SHLA are assumed to breed and nest in these areas (see Figure 50).

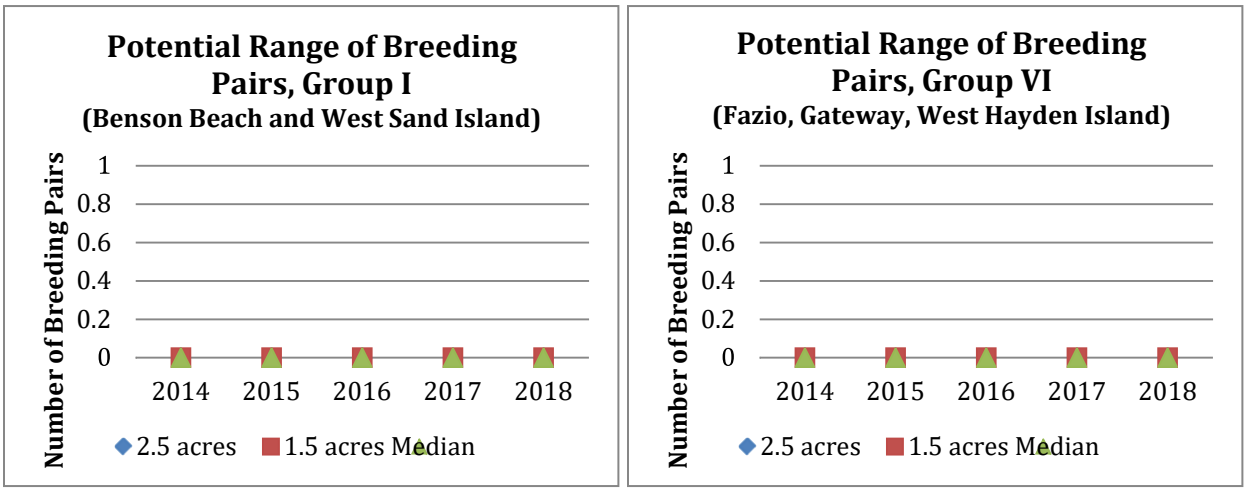

Figure 50: Potential Range of Breeding Pairs in Groups I and VI, 2014-2018

RICE ISLAND (RM 21.0)

Most of the SHLA observed in Group II were observed at Rice Island, where Anderson (2013) observed 22 singing males in 2013 (and assumed a singing male equals one breeding pair). Based on the analysis of habitat availability described above, 150 acres of suitable habitat are present under current conditions at Rice Island, which could support 60 to 100 breeding pairs of SHLA. Even though placement events are proposed for Rice Island in 2014 and 2017 covering upwards of 20% to 50% of the available suitable habitat, the minimum extent of available nesting habitat in any year is 122 acres. This area is expected to support between 48 and 81 breeding pairs (see Figure 51), which is a 118% increase over the actual number of observed breeding pairs at Rice Island.

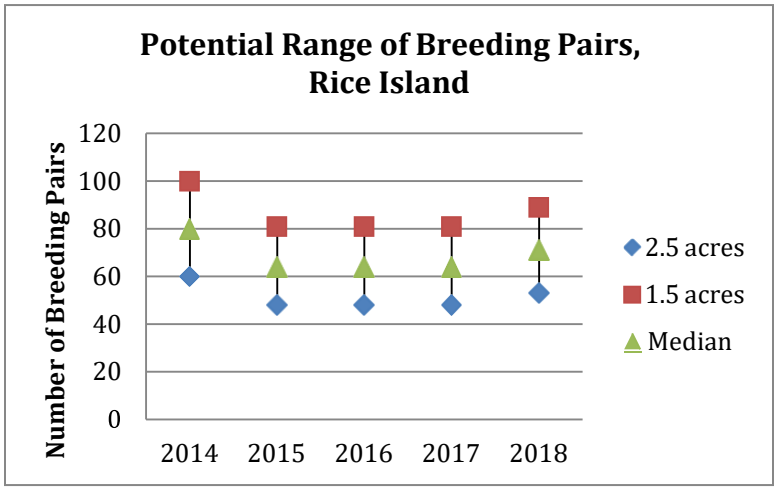

Figure 51: Potential Range of Breeding Pairs at Rice Island, 2014-2018

MILLER SANDS (RM 23.5)

Anderson observed five pairs (singing males) at Miller Sands Island in past years, but the upland habitat areas were mounded during past placement events in 2011, 2012 and 2013. It is unknown if SHLA nest successfully in these mounded areas and the Corps conservatively assumes that nesting might be precluded in the mounded areas. In an effort to maximize the availability of future nesting habitat in Group II when habitat conditions are lowest at Rice Island and Pillar Rock Islands, the mounds will be smoothed in 2014 to encourage vegetation establishment and development into suitable habitat in future years. It is anticipated that no breeding SHLA will be supported at Miller Sands Island in 2014, 2015, 2016, and 2017. It is assumed that SHLA will move to nearby Rice or Pillar Rock Islands for nesting in these years while vegetation is developing at Miller Sands Island. In 2018, it is assumed that vegetation will have transitioned into suitable habitat conditions and approximately 34 acres of suitable habitat will be available which could support between 13 and 22 breeding pairs of SHLA (see Figure 52).

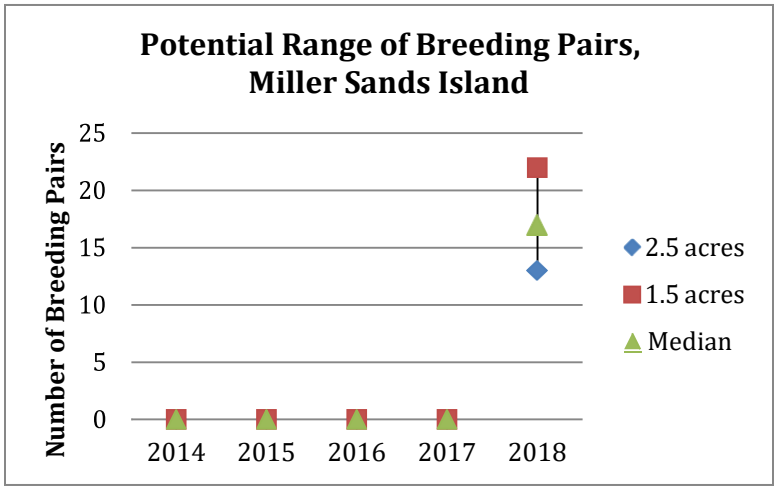

Figure 52: Potential Range of Breeding Pairs at Miller Sands Island, 2014-2018

PILLAR ROCK ISLAND (RM 27.2)

Only four acres are currently available as suitable habitat at Pillar Rock Island, and two pairs (singing males) are estimated to occupy this placement site. The island is significantly eroded, and shoreline placement is required to rebuild the site footprint before upland placement can occur to re-start vegetation succession. The Corps will begin shoreline placement immediately in 2014 so that suitable SHLA habitat can form as quickly as possible. All placement events at Pillar Rock Island between 2014 and 2016 will be shoreline events, so no suitable habitat will be lost to placement. As a result, habitat conditions are not expected to change between 2014 and 2016, and the available habitat is expected to support up to two breeding pairs of SHLA. However, the Corps assumes habitat conditions will become too vegetated in 2017 to support suitable nesting habitat, and therefore habitat conditions will not support any breeding pairs (see Figure 53) in 2017 or 2018.

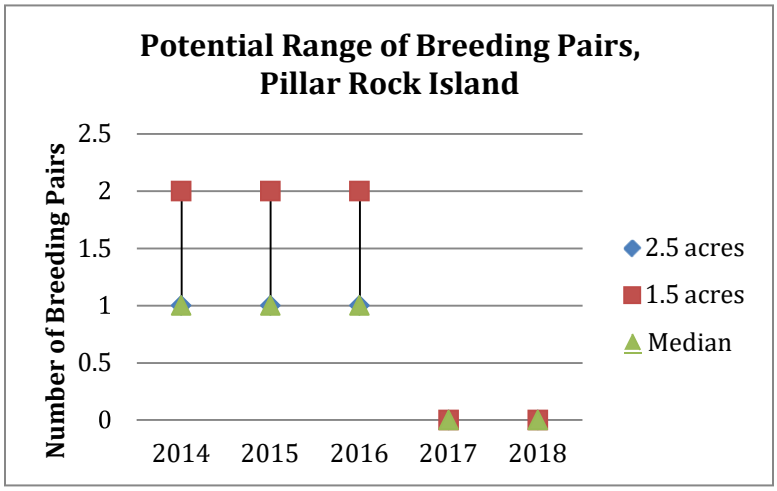

Figure 53: Potential Range of Breeding Pairs at Pillar Rock Island, 2014-2018

Upland placement events will occur at Pillar Rock Island in 2017 and 2018 where each will cover half of the upland portions of the island, re-starting vegetation succession for future years. In 2017,

it is assumed that the suitable habitat currently available will become too vegetated and no remnant suitable habitat will be available to support breeding SHLA and the only available suitable habitat within Group II will be at Rice Island. It is assumed that breeding SHLA will disperse to Rice Island in 2017, and Rice and Miller Sands Island in 2018 where habitat is available after upland placements at Pillar Rock Island.

GROUP II

The extent of suitable habitat across Group II (Rice, Miller Sands, and Pillar Rock Islands) is expected to increase by nine percent over the 5-year placement plan from 154 acres to a total of 168 acres in 2018. Following this increase in the availability of suitable habitat, it is assumed that the number of breeding pairs this habitat could support would also increase. Recent observations have estimated that Group II supports approximately 29 pairs of SHLA across the three sites (Anderson 2013). However, suitable habitat will decrease from 154 acres in 2014 to a low of 122 acres in 2017, a decrease of approximately 21%. Based on the assumptions about territory size, current conditions in Group II could potentially support a breeding population between 61 and 102 breeding pairs of SHLA in 2014. This estimate demonstrates the population has not reached saturation for population density and more suitable nesting habitat is available than breeding pairs are present to fill the available nesting habitat.

As the suitable habitat in Group II decreases to a low of 122 acres in 2017, the maximum density of breeding pairs is assumed to decrease to a range between by 48 and 81 breeding pairs, which is still 66% more than what is currently estimated to occupy Group II (see Figure 54). The range of breeding SHLA Group II could support is expected to increase to between 66 and 111 breeding pairs in 2018, when the available suitable habitat is at its maximum of 168 acres across Group II.

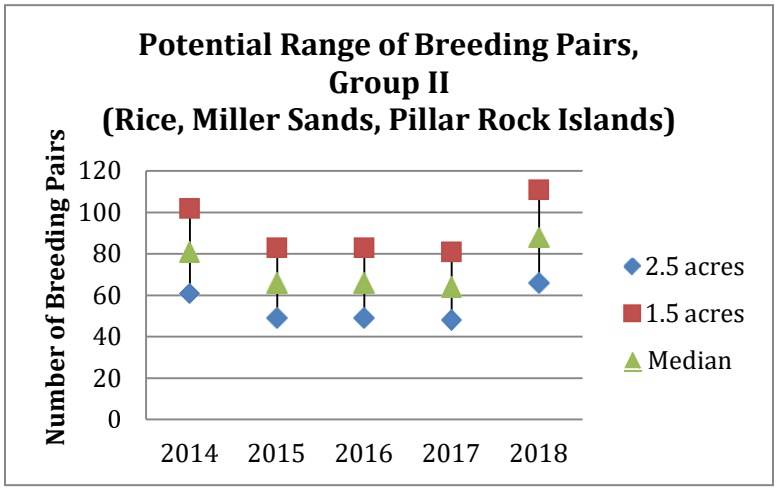

Figure 54: Potential Range of Breeding Pairs at Group II Sites, 2014-2018

SKAMOKAWA – VISTA PARK (RM 33.4)

As described above, the Corps assumes there is currently no suitable nesting habitat for breeding SHLA at Skamokawa – Vista Park and suitable nesting habitat would not develop during the course of this consultation due to the high level of human use and regular disturbance. It is therefore assumed that no SHLA would be present during the nesting season because no suitable habitat would support breeding activities (see Figure 55). No SHLA have been detected at this active borrow site.

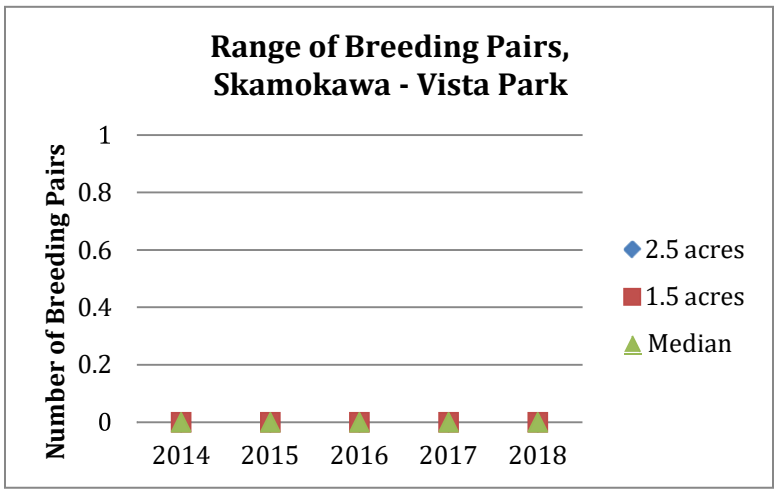

Figure 55: Potential Range of Breeding pairs at Skamokawa - Vista Park, 2014-2018

WELCH ISLAND (RM 34.0)

During the past three years of surveys, Welch Island only supported 1 breeding pair of SHLA in 2012 (Anderson 2013). Currently, there are 10 acres of suitable habitat at Welch Island, which could support upwards of 4 to 6 breeding pairs based on the assumptions about territory size and habitat conditions. The 2015 placement event will cover the entire placement site, eliminating all suitable nesting habitat in 2015 and 2016 (see Figure 56). No nesting habitat will be available until habitat transitions into suitable conditions in 2017, at which point 18 acres will be available for nesting and between 7 and 12 breeding pairs of SHLA could nest at Welch Island through 2018.

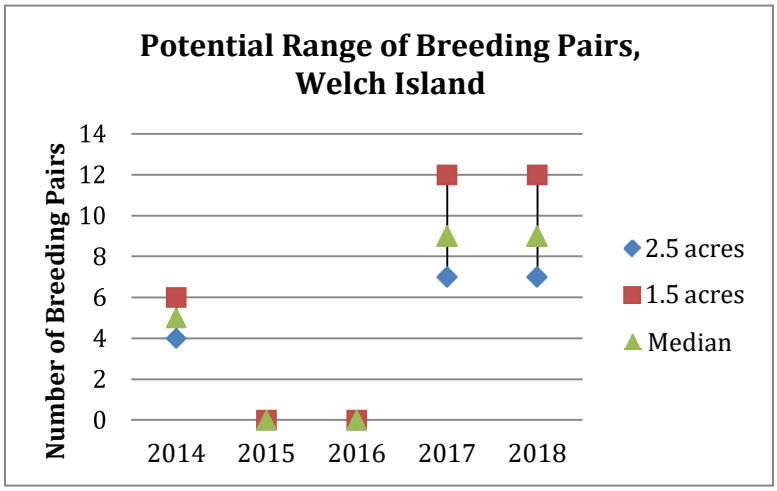

Figure 56: Potential Range of Breeding Pairs at Welch Island, 2014-2018

TENASILLAHE ISLAND (RM 38.3)

In the past three years, Tenasillahe Island has recently supported up to two breeding pairs of SHLA. No pairs were observed by Anderson during routine surveys in 2013, but the Corps detected a nesting pair prior to placement activities in 2013 and the nest was avoided during active placement (nest success is unknown). Current conditions at Tenasillahe Island estimate two acres of suitable nesting habitat are available at the beginning of the 2014 breeding season, which could support up

to one breeding pair in 2014. As habitat transitions into suitable condition in 2015, upwards of nine to 15 breeding pairs could nest at Tenasillahe Island (see Figure 57). The placement event in 2016 covers some suitable habitat, reducing the area available for nesting pairs to 10 acres, which could potentially support four to six breeding pairs in 2016 and 2017. Following the 2016 placement event, vegetation is estimated to transition into suitable condition and 23 acres of suitable habitat could support nine to 15 breeding pairs of SHLA in 2018.

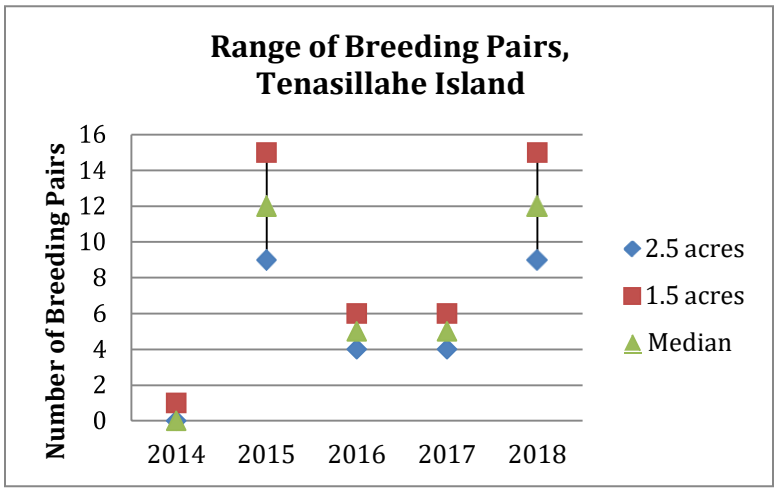

Figure 57: Potential Range of Breeding Pairs at Tenasillahe Island, 2014-2018

JAMES RIVER (RM 42.9)

James River has not been surveyed for potential SHLA occupation. The Corps estimates that there is currently no suitable nesting habitat for SHLA at James River. In addition, the Corps assumes that no suitable nesting habitat would develop during the course of this consultation due to the high level of human use and regular disturbance from sand extraction activities. It is therefore assumed that no SHLA would be present during the nesting season because no suitable habitat would support breeding activities (see Figure 58).

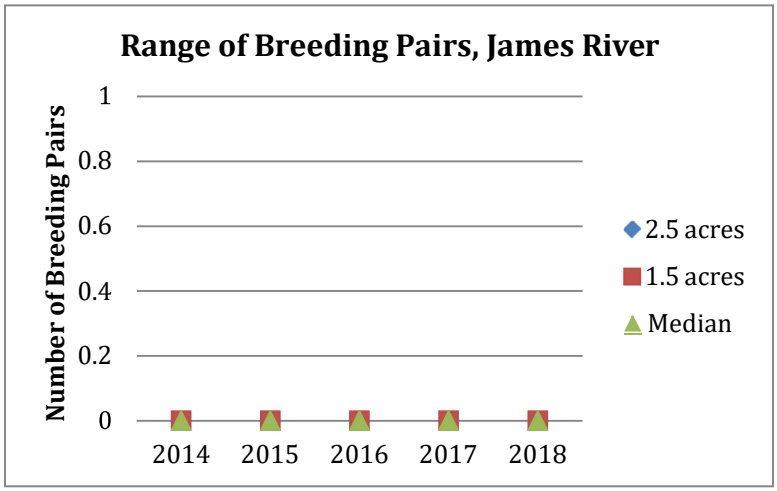

Figure 58: Potential Range of Breeding pairs at James River, 2014-2018

PUGET ISLAND (RM 44.0)

Similar to James River, Puget Island has not been surveyed for SHLA occupation, but it is assumed that SHLA are not present on site based on current agricultural land use activities associated with the area. Immediately following placement events at Puget Island in 2015 and 2018, the Corps will re-seed the entire site to promote a healthy vegetative cover to prevent wind erosion of placed sand onto adjacent agricultural lands. The landowner (independent of Corps action) may pasture cattle on site between placement events. It is assumed that habitat conditions would transition too quickly for suitable habitat to be maintained at Puget Island, in addition to the elevated levels of local disturbance from site maintenance and cattle. Furthermore, the Corps may plant trees and shrubs around the boundary of the site to reduce wind erosion of sediment following placement, precluding open habitat conditions favored by SHLA. For these reasons, no breeding SHLA are expected to occur at Puget Island throughout the 5-year placement plan (see Figure 59).

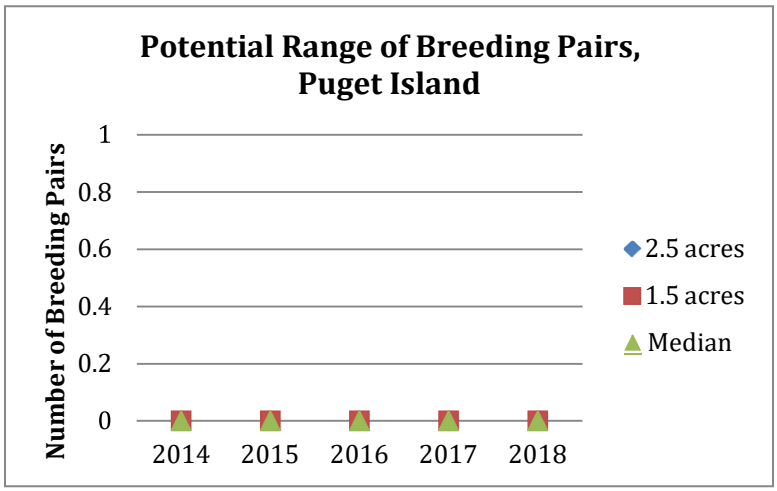

Figure 59: Potential Range of Breeding Pairs at Puget Island, 2014-2018

BROWN ISLAND (RM 46.3)

The majority of SHLA recently observed in Group III have been at Brown Island. In 2012 and 2013, 18 and 23 breeding pairs were observed on Brown Island, respectively, following post-breeding placement in 2011 over approximately 45 acres. Given that entire placement site is 102 acres with 45 acres unsuitable due to the 2011 placement, the Corps estimated that 27 acres were suitable in 2012, which is supported by aerial photography from that same year. Approximately 18 breeding pairs utilized the 27 acres of habitat in 2012, resulting in a territory size of approximately 1.5 acres in 2012. In 2013, 27 acres outside of the 2011 placement area were still suitable and the Corps assumes the entire 45-acre placement site from 2011 was suitable for nesting activities, providing 72 acres of suitable nesting habitat. With 72 acres potentially suitable for nesting, the 23 SHLA pairs observed by Anderson in 2013 may have nesting territories of two acres. This baseline is not expected to change in 2014.

Suitable habitat at Brown Island in 2015 is expected to decrease 70% from baseline conditions (72 acres to 21 acres following dredged material placement). This reduction in suitable nesting habitat may adversely impact nesting SHLA such that the remaining suitable habitat could only support 8 to 14 breeding pairs, which is 0 to 15 fewer pairs than nested in breeding years 2011 – 2013 and at least 50% fewer pairs than the estimated population (28 to 48 pairs in 2014) based on the availability of suitable habitat (see Figure 60).

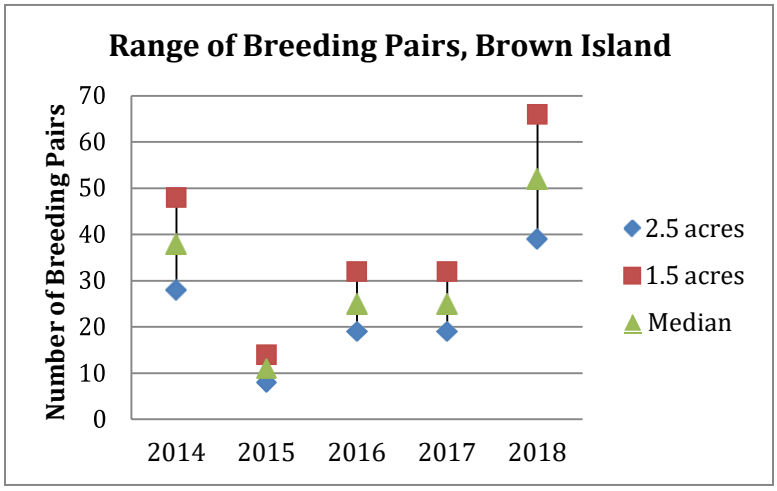

Figure 60: Potential Range of Breeding Pairs at Brown Island, 2014-2018

As mentioned in the discussion about Group III below, the Corps anticipates that SHLA would disperse to adjacent placement sites in 2015 when sufficient acres of suitable habitat are not available at Brown Island to support 20+ pairs of breeding birds. A sufficient quantity of suitable habitat will be available throughout Group III (primarily at Tenasillahe Island) to provide suitable nesting conditions for SHLA in any given year. Following the placement event in 2014, it is assumed that 49 acres of suitable habitat would be available in 2016 and 2017, and Brown Island could potentially support upwards of 19 to 32 breeding pairs. In 2018, following the placement activities in 2016, it is estimated that 99 acres of habitat will be suitable and this quantity of suitable nesting habitat could support 39 to 66 breeding pairs.

Group III

The extent of suitable habitat across Group III (Skamokawa-Vista Park, Welch and Tenasillahe Islands, James River, Puget and Brown Islands) is currently 85 acres and it is expected to increase by 65% to a total of 140 acres by 2018. Group III supports the second highest localized population of SHLA in the lower Columbia River, where 23 pairs were estimated to occupy Brown Island in 2013. The Corps discovered an active nest in 2012 and active nesting behavior in 2013 (nest not located) at Tenasillahe Island, during dredged material placement activities, but the fate of these nests is uncertain. Current conditions in Group III could support a breeding population between 32 and 55 breeding pairs in 2014, similarly demonstrating that more habitat is available than breeding birds are present to occupy nesting territories.

As shown is Figure 61, the availability of suitable habitat in Group III is lowest in 2015, and the estimated number of SHLA that could be supported is expected to range between 17 and 29 breeding pairs, which coincides with the current estimate of breeding pairs in this Group (23 birds in 2013, per Anderson 2013). As the amount of suitable habitat increases across Group III in 2016, 2017 and 2018, and it is estimated that the number of breeding pairs also increases, such that 55 to 93 pairs could potentially occupy nesting habitat across a broader range of placement sites within the Group III sites by 2018.

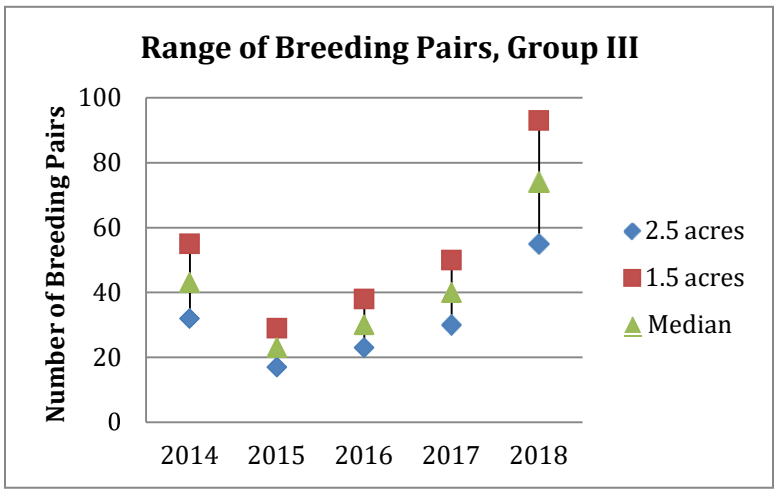

Figure 61: Potential Range of Breeding Pairs at Group III Sites, 2014-2018

CRIMS ISLAND (RM 57.0)

As shown in Figure 62, there are 25 acres of suitable habitat at Crims Island, which could support between 10 and 16 breeding pairs, assuming territories range between 1.5 and 2.5 acres. Surveys in 2011 detected seven breeding pairs of SHLA at Crims Island, and surveys in 2012 detected four pairs of birds (Anderson 2013). The number of breeding pairs declined between 2011 and 2013, even though suitable habitat conditions are assumed to have remained constant during this time. While only two pairs were detected in 2013, additional birds of unknown sex (perhaps females or additional paired males) were documented; this information suggests the number of birds was underestimated as a function of inadequacies in the survey protocol.

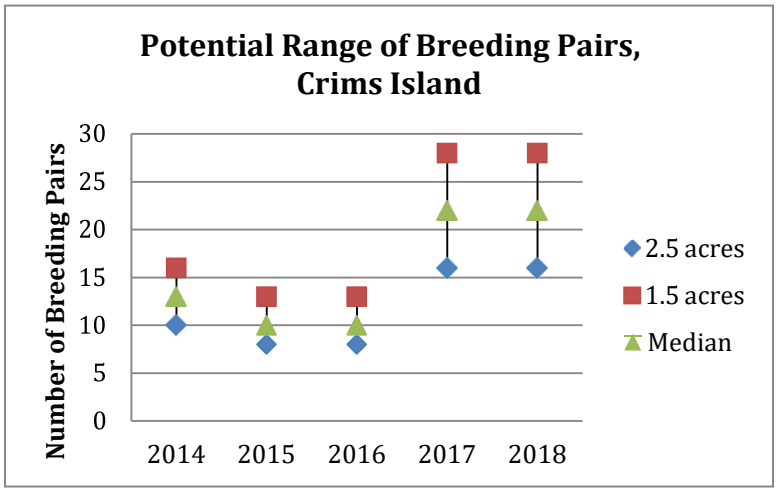

Figure 62: Potential Range of Breeding pairs at Crims Island, 2014-2018

A placement event in 2015 on Crims Island will cover five acres of suitable habitat, reducing the total habitat available for nesting SHLA to 20 acres in 2015 and 2016. However, 20 acres of suitable habitat are expected to support upwards of eight and 13 breeding pairs, which is more than the highest number of detections (7 pairs) in 2011. If some birds from Brown Island disperse onto Crims Island for nesting in 2015, it is assumed that sufficient habitat will be available to support some of these birds in both 2015 and 2016. As the 2015 placement event transitions into suitable

conditions in 2017, the entire island will be suitable for nesting in 2017 and 2018, totaling 42 acres, and it is assumed this area could potentially support 16 to 28 breeding pairs of SHLA.

HUMP ISLAND (RM 59.7)

Hump Island has not been surveyed for SHLA and it is unknown if suitable habitat conditions exist; the Corps assumes no suitable habitat conditions are present on the island due to the presence of extensive vegetation via aerial photographs and therefore no nesting habitat exists for breeding SHLA (see Hump Island Figure in Appendix C). Placement over the entire 65-acre site is planned to occur in 2014, and a portion of this area would develop into suitable nesting habitat conditions in 2016 due to a second placement covering 48 acres in 2015. In 2016, approximately 17 acres are assumed to be suitable, which could support six to 11 breeding pairs in 2016 and 2017 (see Figure 63). The additional habitat from the 2015 placement event is expected transition into suitable habitat conditions in 2018, and the entire placement is expected to be suitable and could potentially support upwards of 26 to 43 breeding pairs of SHLA.

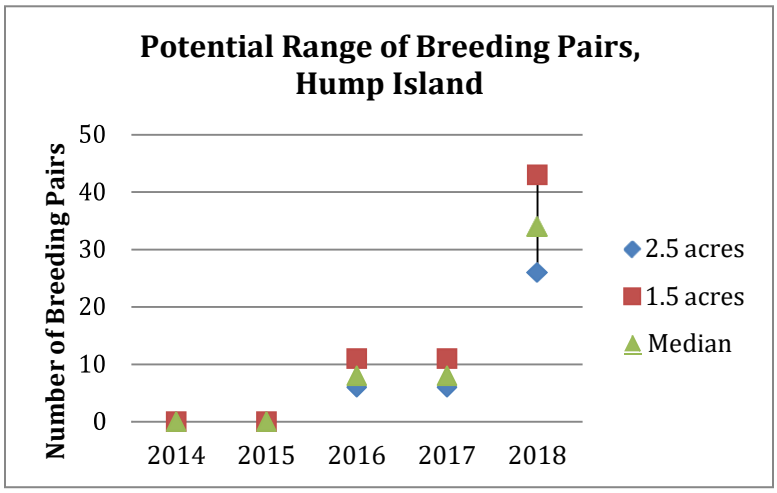

Figure 63: Potential Range of Breeding Pairs at Hump Island, 2014-2018

LORD ISLAND – UPSTREAM (RM 63.5)

Like Hump Island, Lord Island Upstream has not been surveyed from SHLA. However, unlike Hump Island, the Corps assumes that 10 acres of suitable habitat exist on the island, based on NDVI data, which could support four to six breeding pairs of SHLA. It is assumed that habitat conditions will remain constant through the 2016 nesting season. In 2017, the Corps plans to place dredged materials over 20 acres of the site, covering the 10 acres of suitable habitat. This placement event will eliminate all suitable nesting conditions at Lord Island in 2017 and 2018 (see Figure 64). If any breeding SHLA occupy this area between 2014 and 2016 when suitable conditions exist, it is assumed birds could disperse to adjacent sites (Hump Island and Howard Island) where suitable habitat conditions support nesting in 2017 and 2018.

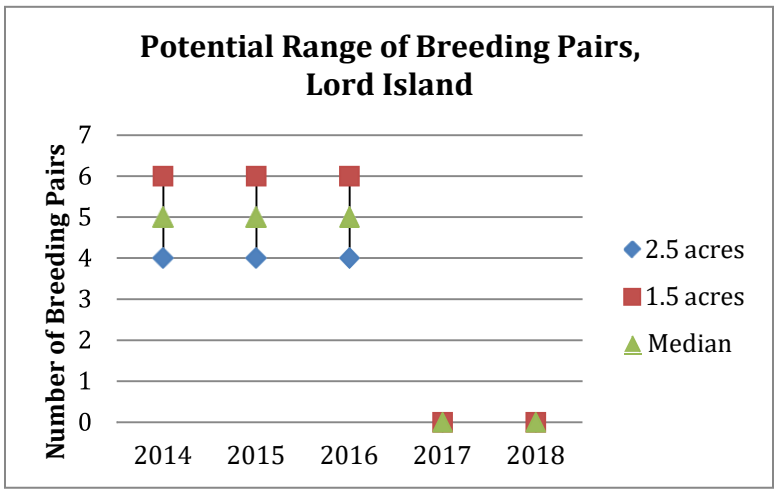

Figure 64: Potential Range of Breeding Pairs at Lord Island (upstream), 2014-2018

DIBBLEE POINT (RM 64.8)

Dibblee Point was surveyed for SHLA in 2013 and even though approximately one acre of suitable habitat was estimate per the 2011 NDVI data, no SHLA were detected. This placement site is an active borrow location where dredged materials are regularly removed for commercial purposes. It is assumed that the high anthropogenic use of this area precludes SHLA occupation of the site and no nesting habitat will be available over the course of this consultation. No placement events are planned for Dibblee Point during the 5-year placement plan described above and no SHLA would be affected at this location because none are assumed to be present (see Figure 65).

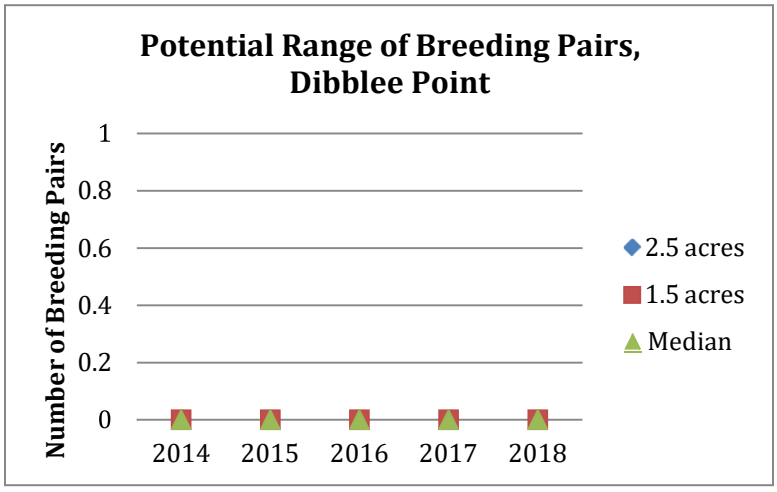

Figure 65: Potential Range of Breeding Pairs at Dibblee Point, 2014-2018

HOWARD ISLAND (RM 68.7)

Howard Island was not surveyed for SHLA in 2013, as much of the island is heavily vegetated. Of the 315 acres that make up the placement site, approximately five acres are currently suitable, based on NDVI data. If SHLA occupy Howard Island, it is assumed the current habitat conditions could support two to three breeding pairs (see Figure 66). In 2015, a 173-acre placement event will cover a portion of the island after the breeding season has ended and it is assumed that no suitable habitat conditions will be present on the island at the beginning of the breeding season in 2016,

supporting no SHLA will nest on Howard Island. This placement event is then expected to rotate into suitable habitat at the onset of the 2017 breeding season, where 173 acres of suitable habitat could support 69 to 115 breeding pairs of SHLA if territory sizes range between 1.5 and 2.5 acres. Suitable habitat conditions are assumed to remain constant in 2017 and 2018, and therefore the number of breeding pairs that could be supported on the island would also remain constant.

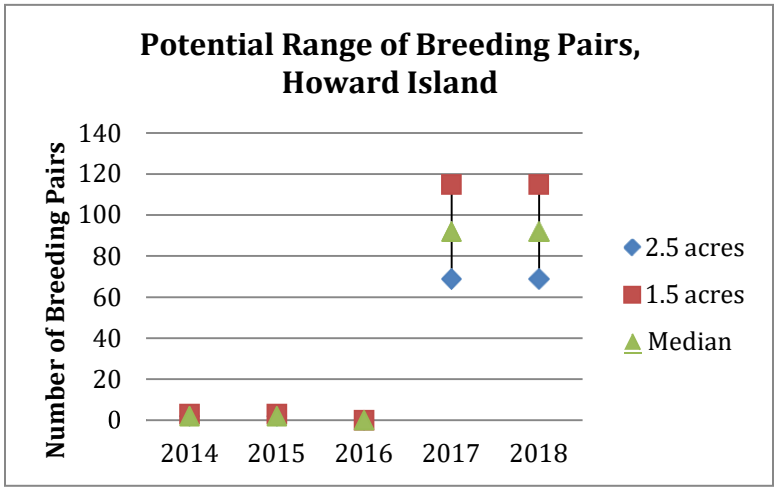

Figure 66: Potential Range of Breeding Pairs at Howard Island, 2014-2018

COTTONWOOD ISLAND (RM 70.1)

No SHLA have been observed at Cottonwood Island in recent years. The Corps does not anticipate that suitable habitat for breeding SHLA would develop at Cottonwood Island during the course of this consultation due to extensive vegetation surrounding the site that precludes an open view of the river and surrounding landscape. Therefore, no SHLA breeding pairs would be present during the nesting season because no suitable nesting habitat is available (see Figure 67).

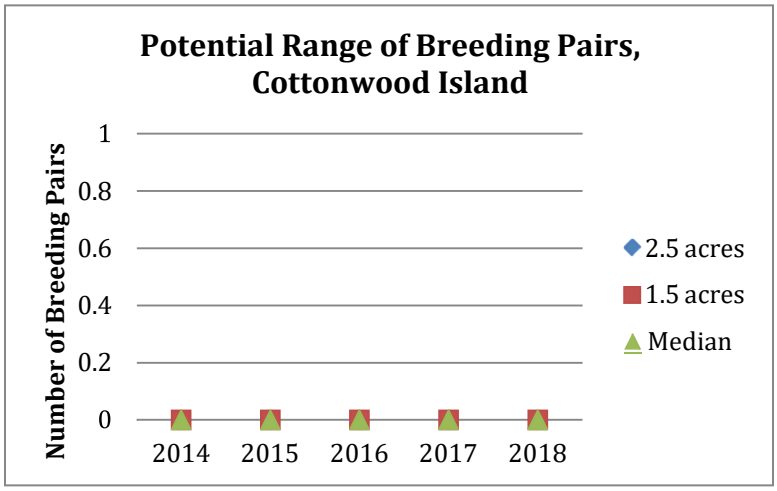

Figure 67: Potential Range of Breeding Pairs at Cottonwood Island, 2014-2018

NORTHPORT (RM 71.9)

Northport is designated as a borrow site, however commercial sand extraction has not occurred in recent years. Three pairs of SHLA were detected during annual surveys in 2013 (Anderson 2013). The NDVI baseline data estimates three acres of suitable habitat conditions were present at the site, which could support one to two breeding pairs under the assumption that territory sizes range between 1.5 and 2.5 acres. If three pairs nested at Northport in 2013, territory sizes would have been lower (1 to 1.5 acres) based on the estimated three acres of suitable habitat conditions present. Breeding behavior (singing males and female presence) was observed at Northport, and the presence of young-of-the-year juveniles indicate SHLA were nesting successfully at Northport.

Habitat conditions at Northport are expected to remain similar to current conditions until 2016, when habitat is expected to become too vegetated (greater than 50% cover) and conditions are no longer suitable for nesting by SHLA (see Figure 68). No placement of dredged materials by the Corps is planned to re-start vegetation succession at Northport during the five-year placement plan. If SHLA continue to occupy Northport and are present in 2016, it is assumed that birds would disperse to favorable nesting conditions on Howard Island in Group IV or Sandy Island in Group V, where suitable habitat is available in 2016 and 2017.

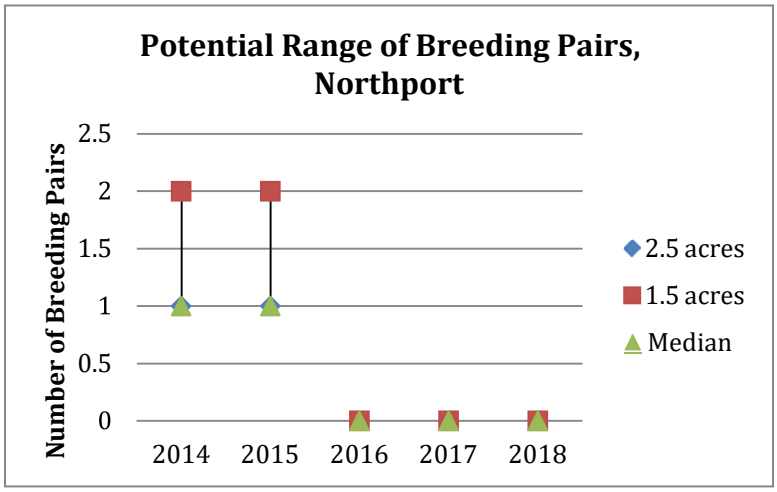

Figure 68: Potential Range of Breeding Pairs at Northport, 2014-2018

GROUP IV

Group IV (Crims, Hump, and Lord Islands, Dibblee Point, Howard and Cottonwood Islands, and Northport) have had comparatively low numbers of observed SHLA breeding pairs in recent years (Anderson 2013). Surveys only detected larks on Crims Island and Northport, where current suitable habitat conditions could potentially support upwards of 17 to 27 breeding pairs. Across the Group, suitable habitat is expected to increase from 43 acres in 2014 to 280 acres in 2018, following a substantial placement event at Howard Island in 2016. This increase in suitable habitat conditions could potentially support 111 to 186 breeding pairs of SHLA by 2018 (see Figure 69).

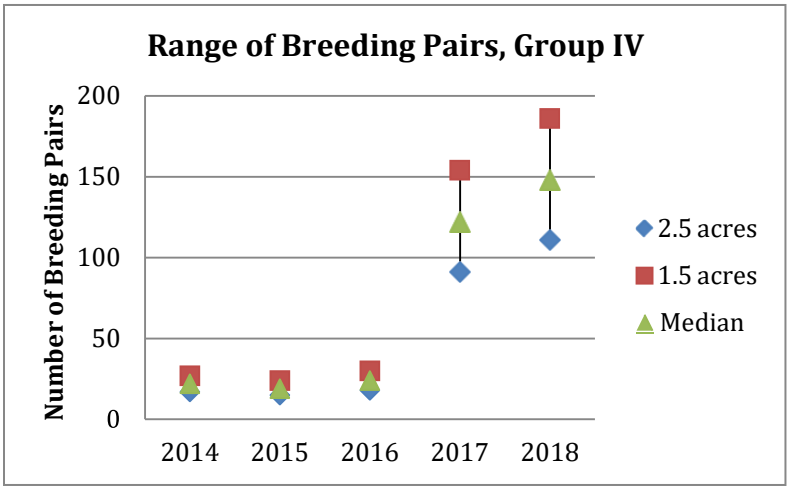

Figure 69: Potential Range of Breeding Pairs at Group IV Sites, 2014-2018

SANDY ISLAND (RM 75.8)

All 32 acres of the Sandy Island placement site is currently classified as suitable nesting habitat. In 2013, Anderson observed four pairs of SHLA in 2013, one pair in 2012, and two pairs in 2011 (2013). No placement events are planned during the 5-year placement plan and the entire island is expected to remain in suitable condition, potentially supporting a constant localized population of SHLA (see Figure 70). Suitable habitat is not expected to transition beyond suitable conditions (greater than 50% vegetation cover) until after 2018. Based on the assumptions regarding the range of territory size, Sandy Island could support between 12 and 21 breeding pairs in all years, providing sufficient space for the recently observed birds, and any offspring that return to their natal site for breeding.

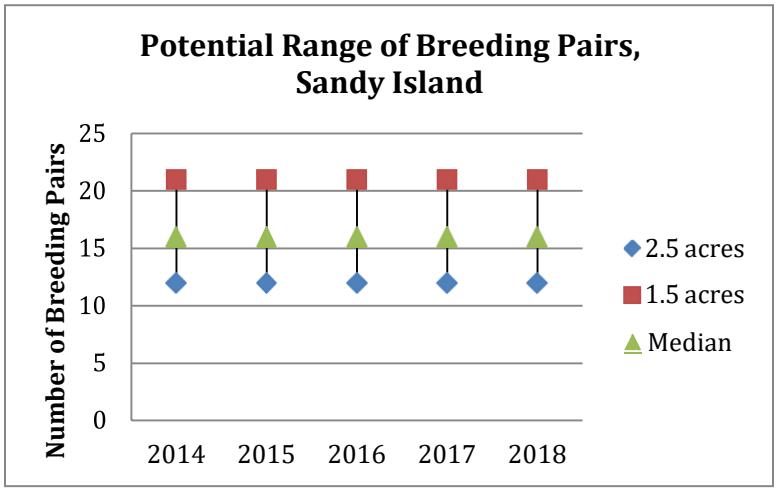

Figure 70: Potential Range of Breeding Pairs at Sandy Island, 2014-2018

LOWER DEER ISLAND (RM 77.0)

No SHLA have been observed at Lower Deer Island in recent years, and no suitable nesting habitat is currently available in the placement area. The 11-acre placement event in 2015 is assumed to trigger vegetation succession and suitable nesting habitat conditions will be present on the downstream portion of the island at the beginning of the second breeding season (2017). The 11

acres of then suitable habitat is expected to support between four and seven breeding pairs in 2017 (see Figure 71). Similarly, a 12-acre placement event on the upstream half of the site in 2016 will initiate vegetation succession that will transition into suitable nesting habitat in 2018. In 2018, 23 acres of suitable habitat could then support between nine and 15 breeding pairs of SHLA.

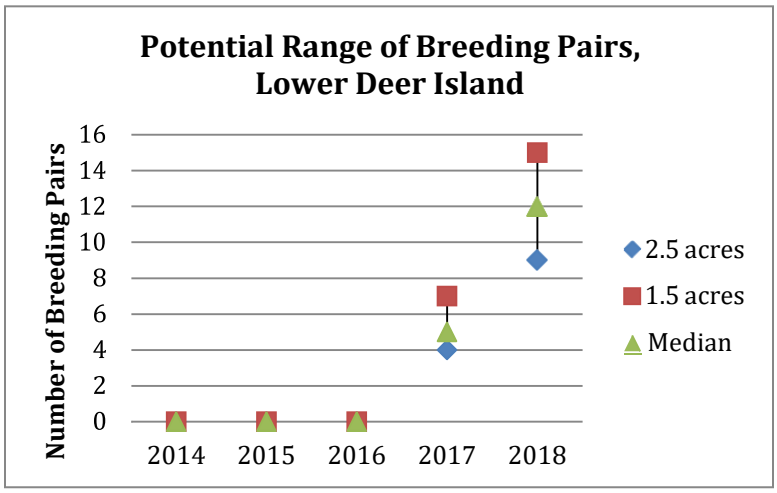

Figure 71: Potential Range of Breeding Pairs at Lower Deer Island, 2014-2018

MARTIN BAR (RM 82.0)

The Corps estimates that there is currently no suitable nesting habitat for breeding SHLA at Martin Bar and assumes that suitable nesting habitat would not develop during the course of this consultation due to the high level of human use and regular disturbance. It is therefore assumed that no SHLA would be present during the nesting season because no suitable habitat would support breeding activities (see Figure 72).

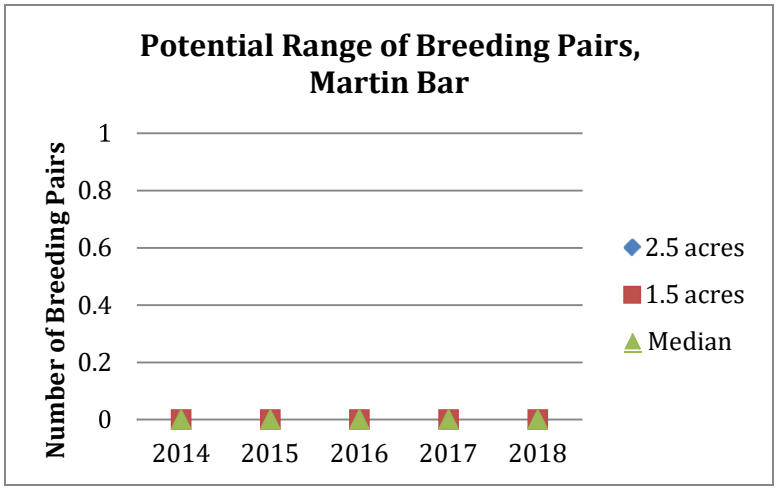

Figure 72: Potential Range of Breeding Pairs at Martin Bar, 2014-2018

SAND ISLAND (RM 86.2)

Currently, there is one acre of suitable nesting habitat at Sand Island according to the 2011 NDVI habitat analysis, but no SHLA have been observed on this placement site. The amount of suitable

habitat under baseline conditions is assumed to be too small to support breeding of SHLA. The placement events in 2015 and 2017 are shoreline placement events that will not affect the availability of suitable nesting habitat in upland areas, providing no habitat for breeding SHLA. As a result, no SHLA are assumed to be present at the site for the duration of the consultation because no suitable habitat occurs at the site (see Figure 73).

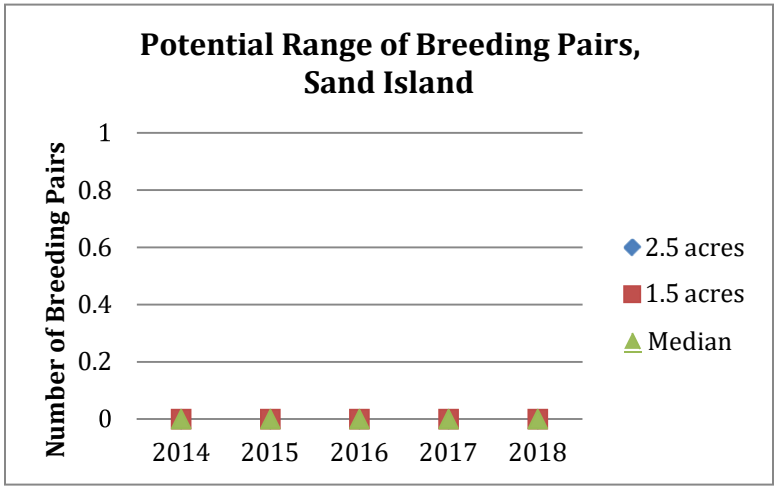

Figure 73: Potential Range of Breeding Pairs at Sand Island, 2014-2018

AUSTIN POINT (RM 86.5)

Similar to other sites that include commercial sand removal activities, the Corps does not anticipate that suitable habitat for breeding SHLA would develop at Austin Point during the course of this consultation. Due to the high level of human use and regular disturbance and it is therefore assumed that no SHLA would be present during the nesting season because no suitable habitat would be available (see Figure 74).

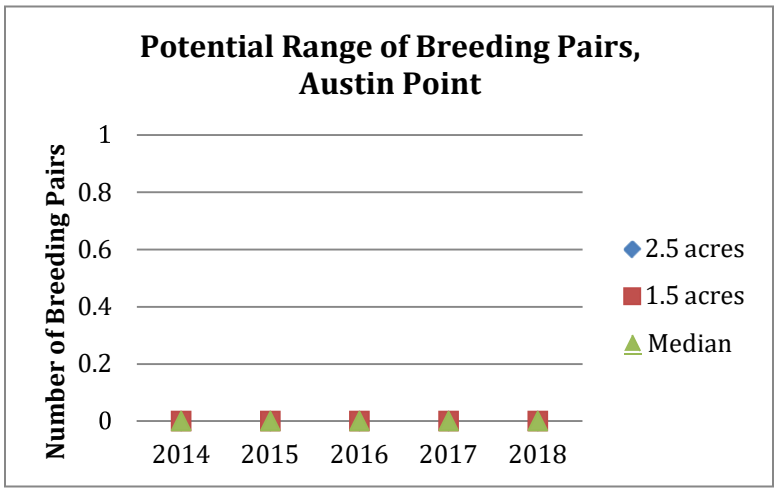

Figure 74: Potential Range of Breeding Pairs at Austin Point, 2014-2018

GROUP V

Group V (Sandy and Lower Deer Islands, Martin Bar, Sand Island and Austin Point) has also had relatively low numbers of observed SHLA breeding pairs in recent years (Anderson 2013). Only surveys at Sandy Island have detected nesting SHLA, where four pairs were observed in 2013. However, it should be noted that non-breeding larks were observed by Corps personnel during a pre-placement site survey at Austin Point in 2013. It is unknown if larks nested at Austin Point in 2013, or if these birds were juveniles dispersing from adjacent islands/sites after the breeding season ended.

Under current conditions, suitable nesting habitat in Group V only occurs at Sandy and Sand Islands, where 32 acres are suitable at Sandy Island and one acre is suitable as Sand Island. Together, the 33 acres of habitat could support between 12 and 21 breeding SHLA, which is at least 200% more pairs than the four observed pairs in recent years. Habitat conditions across Group V are expected to remain constant through 2017. Lower Deer Island will become suitable and the one acre at Sand Island is expected to succeed beyond suitable conditions and become unsuitable to nesting SHLA. In 2017, a total of 43 acres could support 16 to 28 breeding pairs, and in 2018, the extent of suitable nesting habitat is expected to further increase to 55 acres, which could support 21 to 36 breeding pairs of SHLA (see Figure 75).

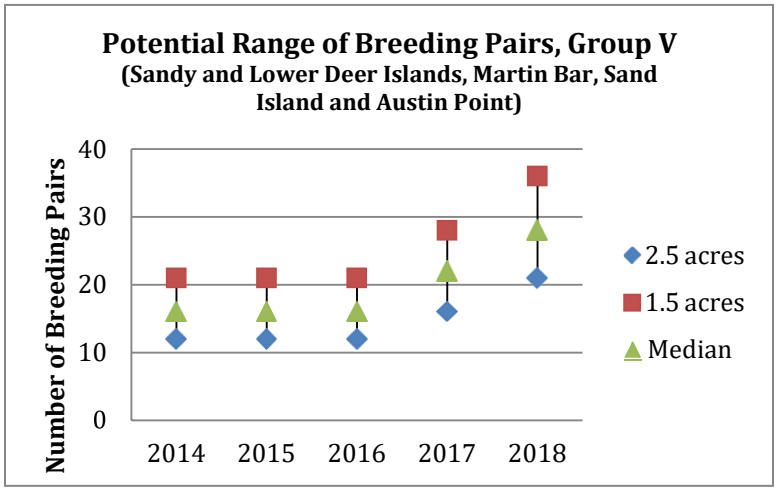

Figure 75: Potential Range of Breeding Pairs at Group V Sites, 2014-2018

POST-PLACEMENT MODIFICATIONS

As discussed above, all temporary equipment (weirs, outfall pipes, valves, etc.) is removed from a placement site following placement of dredged materials. In addition, any habitat modifications (grading, trenching, mounding) that is prescribed will be implemented immediately following placement of materials. The Corps anticipates direct effects to SHLA resulting from these actions to be negligible, as no birds are expected to be present in the placement footprint at the conclusion of a placement event.

Individuals in areas adjacent to the placement footprint (but outside of the placement boundary) are expected to experience similar effects to actions in the placement footprint, including flushing adults and/or young, increased exposure of individuals to weather and predation, nest abandonment and/or destruction. In addition, juveniles and young-of-the-year birds that move into the dredged material placement footprint are expected to have sufficient flight capabilities to flush from the area upon initiation of active material placement or other disturbances. If adults are

repeatedly flushed from nests as a result of human disturbance during post-placement modifications, nest abandonment, increased predation of adults and nestlings, decreased foraging opportunities, and increased energetic expenditures could occur.

Similar to the indirect effects resulting from the placement of dredged materials and habitat succession, some post-placement actions are expected to result in beneficial effects to SHLA. Where settling ponds are left undisturbed, vegetation is expected to establish sooner and create suitable habitat conditions favored by SHLA for nesting. Conversely, topographic modifications and/or dissuasion materials may be installed to prevent SHLA use of an area where anthropogenic use could be detrimental to SHLA. In these instances, while the loss of potential habitat could adversely affect birds by reducing the amount of nest habitat, these dissuasion actions would reduce direct harm or mortality of individuals later in time.

MONITORING

Implementing the monitoring plan discussed above would likely result in effects similar to those described in the dissuasion and site preparation sections. Birds will likely be flushed inadvertently while walking transects through the placement site. However, personnel conducting the surveys are expected to be trained in field protocols to minimize any unnecessary flushing and disturbance associated with monitoring, particularly to adults on nests and especially when predators (gulls, crows, ravens, falcons, etc.) are present in the vicinity. It is also very unlikely that monitoring personnel would inadvertently injure or kill eggs or young during survey efforts. As a result, any adverse effects that may occur during the monitoring surveys are expected to be minor and temporary in nature, and are not expected to result in permanent effects to SHLA or their habitats.

EFFECTS OF THE ACTION ON CRITICAL HABITAT

The PCEs contain the physical and biological features essential to the conservation of the species. The PCEs of SHLA designated critical habitat include areas having a minimum of 16% bare ground with sparse, low-stature vegetation comprised primarily of grasses and forbs less than 13 inches in height. In addition, these features are found in flat areas (zero to five percent slope), are 300 acres in size or within a landscape context where ground-dwelling SHLA have visual access to open water or fields.

The placement of dredged materials, site preparation for the placement of dredged materials, and the dissuasion of SHLA from nesting within planned placement locations will physically alter suitable nesting habitat within designated critical habitat subunits. These alterations are described above in the Proposed Action and Effects sections for site preparation, upland placement of dredged materials, and dissuasion of SHLA. These actions are expected to temporarily alter the PCEs of designated critical habitat by removing vegetation, leveling sites, and installing visual deterrents to preclude SHLA from nesting in planned placement locations. In one to three years, the placement areas within critical habitat are expected to transition into suitable nesting habitat that represents the PCEs of critical habitat on these subunits. This will be a beneficial effect to critical habitat by increasing the amount of nesting habitat.

SUITABILITY OF CRITICAL HABITAT IN UNIT 3: WASHINGTON COAST AND COLUMBIA RIVER ISLANDS

Critical Habitat Unit 3 is previously described in the Status Critical Habitat section. It totals 2,899 acres. The acreage of suitable SHLA nesting habitat on the four Washington coast subunits in Unit 3 is not quantified. Therefore, it is not feasible to determine the total acreage of suitable SHLA

nesting habitat within Unit 3 or the Washington coast subunits that is currently available and will be suitable through 2018. The Corps is able to collectively and individually estimate the availability of suitable SHLA nesting habitat for the lower Columbia River subunits from 2014 through 2018. The following narrative details the availability of suitable SHLA nesting habitat on designated critical habitat within the lower Columbia River collectively and individual subunits.

FIVE-YEAR DREDGED MATERIAL PLACEMENT PLAN ON SITES THAT OVERLAP WITH DESIGNATED CRITICAL HABITAT SUBUNITS

Of the 20 sites with planned placement in the next five years, seven (7) sites overlap with designated critical habitat subunits for SHLA: Rice Island, Miller Sands, Pillar Rock Island, Welch Island, Tenasillahe Island, Brown Island, and Crims Island. No placement is planned for the Sandy Island (RM 75.8) in the next five years; therefore, no placement will occur within the Sandy Island critical habitat subunit. For the seven placement sites that overlap with designated SHLA critical habitat and have planned placements of dredged materials in the next five years, only portions of each critical habitat subunit will be used in any given year, with the exception of Welch Island in 2015. In 2015, the entire 41-acre Welch Island site (RM 41) is planned for upland placement. However, only 37 acres of placement will overlap with the 43-acre Welch Island critical habitat subunit. Partial placements on all other critical habitat subunits will allow suitable breeding habitat to be available on each critical habitat subunit in every year. Placements of dredged material and availability of suitable SHLA nesting habitat on each designated critical habitat subunit in the Network are displayed on figures located in Appendix D.

Table 8 and the following discussion details the acreages of currently available suitable SHLA nesting habitat, placements of dredged material, regrading events, and the shifting mosaic of yet-to-be suitable to suitable to unsuitable SHLA nesting habitats on each of the designated critical habitat subunits that overlap with the Network from 2014 through 2018. The Wallace Island subunit is included even though it is not within the Corps Network, for reasons described in the following discussion. Figures for each subunit, placement event over the next five years, and suitable SHLA nesting conditions are located in Appendix D.

Table 8: Availability of Suitable Streaked Horned Lark Nesting Habitat within the Designated Critical Habitat Subunits of the Lower Columbia River (2014-2018)

Placement Site	Placement Site		Designated CH[2]		2014										2015										2016									
			Subunit	DCH w/in Placement Site	Baseline Suitable CH[3]		Placement (acres)	Suitable Affected		Yet-to-be Suitable		Suitable Remaining		Unsuitable Habitat		Baseline Suitable CH[4]		Placement (acres)[3]	Suitable Affected[4]		Yet-to-be Suitable CH		Suitable CH Remaining		Unsuitable Habitat		Baseline Suitable CH[2]		Placement (acres)[3]	Suitable Affected[4]		Yet-to-be Suitable CH		Suitable CH Remaining		Unsuitable Habitat	
	Acres	Timing	Acres	Acres	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%
Rice Island	264	*Post-breeding*	224	219	150	67%	52	28	13%	0	0%	150	67%	74	33%	122	54%	0	0	0%	56	25%	122	54%	46	21%	122	54%	0	0	0%	56	25%	122	54%	46	21%
Miller Sands	117	*During-breeding*	123	88	0	0%	5	0	0%	0	0%	0	0%	123	100%	0	0%	14	0	0%	34	28%	0	0%	89	72%	0	0%	11	0	0%	34	28%	0	0%	89	72%
Pillar Rock Island	52	*During-breeding*	44	41	4	9%	14	0	0%	0	0%	4	9%	40	91%	4	9%	14	0	0%	0	0%	4	9%	40	91%	4	9%	14	0	0%	0	0%	4	9%	40	91%
Group II Total	**433**		**391**	**348**	**154**	**39%**	**71**	**28**	**7%**	**0**	**0%**	**154**	**39%**	**237**	**61%**	**126**	**32%**	**28**	**0**	**0%**	**90**	**23%**	**126**	**32%**	**175**	**45%**	**126**	**32%**	**25**	**0**	**0%**	**90**	**23%**	**126**	**32%**	**175**	**45%**
Welch Island	41	*During-breeding*	43	37	10	23%	0	0	0%	0	0%	10	23%	33	77%	10	23%	37	10	23%	0	0%	0	0%	43	100%	0	0%	0	0	0%	37	86%	0	0%	6	14%
Tenasillahee Island	41	*During-breeding*	23	23	2.3	10%	2	0.3	1%	17	74%	2	9%	4	17%	19	83%	0	0	0%	2	9%	19	83%	2	9%	21	91%	12	10	43%	0	0%	9	39%	14	61%
Brown Island	102	*Post-breeding*	98	97	72	73%	68	51	52%	0	0%	72	73%	26	27%	21	21%	0	0	0%	68	69%	21	21%	9	9%	89	91%	50	50	51%	0	0%	39	40%	59	60%
Wallace Island[1]	0	*N/A*	13	N/A	3	23%	0	0	0	0	0	3	23%	10	77%	3	23%	0	0	0%	0	0%	3	23%	10	77%	3	23%	0%	0	0%	0	0%	3	23%	10	77%
Group III Total	**184**		**177**	**157**	**87.3**	**49%**	**70**	**51.3**	**29%**	**17**	**10%**	**87**	**49%**	**73**	**41%**	**53**	**30%**	**37**	**10**	**6%**	**70**	**40%**	**43**	**24%**	**64**	**36%**	**113**	**64%**	**62**	**60**	**34%**	**37**	**21%**	**51**	**29%**	**89**	**50%**
Crims Island	59	*During-breeding*	60	53	25	42%	0	0	0%	0	0%	25	42%	35	58%	25	42%	20	5	8%	0	0%	20	33%	40	67%	20	33%	0	0	0%	20	33%	20	33%	20	33%
Group IV Total	**59**		**60**	**53**	**25**	**42%**	**0**	**0**	**0%**	**0**	**0%**	**25**	**42%**	**35**	**58%**	**25**	**42%**	**20**	**5**	**8%**	**0**	**0%**	**20**	**33%**	**40**	**67%**	**20**	**33%**	**0**	**0**	**0%**	**20**	**33%**	**20**	**33%**	**20**	**33%**
Sandy Island	32	*N/A*	37	32	32	86%	0	0	0%	0	0%	32	86%	5	14%	32	86%	0	0	0%	0	0%	32	86%	5	14%	32	86%	0	0	0%	0	0%	32	86%	5	14%
Group V Total	**32**		**37**	**32**	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**
Total Acres	*708*		***665***	*590*	***298***	***45%***	***141***	***79.3***	***12%***	***17***	***3%***	***298***	***45%***	***350***	***53%***	***236***	***35%***	***85***	***15***	***4%***	***160***	***24%***	***221***	***33%***	***284***	***43%***	***291***	***44%***	***87***	***60***	***21%***	***147***	***22%***	***229***	***34%***	***289***	***43%***

Placement Site	2016										2017										2018									
	Baseline Suitable CH[2]		Placement (acres)[3]	Suitable Affected[4]		Yet-to-be Suitable CH		Suitable CH Remaining		Unsuitable Habitat		Baseline Suitable CH[2]		Placement (acres)[3]	Suitable Affected[4]		Yet-to-be Suitable CH		Suitable CH Remaining		Unsuitable Habitat		Baseline Suitable CH[2]		Placement (acres)[3]	Suitable Affected[4]		Yet-to-be Suitable CH		Suitable CH Remaining		Unsuitable Habitat	
	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%	Acres	%		Acres	%	Acres	%	Acres	%	Acres	%
Rice Island	122	54%	0	0	0%	56	25%	122	54%	46	21%	122	54%	104	64	29%	56	25%	122	54%	46	21%	85	38%	4	4	2%	104	46%	85	38%	35	16%
Miller Sands	0	0%	11	0	0%	34	28%	0	0%	89	72%	0	0%	9	0	0%	34	28%	0	0%	89	72%	34	28%	9	0	0%	0	0%	34	28%	89	72%
Pillar Rock Island	4	9%	14	0	0%	0	0%	4	9%	40	91%	0	0%	14	0	0%	0	0%	0	0%	44	100%	0	0%	14	0	0%	13	30%	0	0%	31	70%
Group II Total	**126**	**32%**	**25**	**0**	**0%**	**90**	**23%**	**126**	**32%**	**175**	**45%**	**122**	**31%**	**127**	**64**	**16%**	**90**	**23%**	**122**	**31%**	**179**	**46%**	**119**	**30%**	**27**	**4**	**1%**	**117**	**30%**	**119**	**30%**	**155**	**40%**
Welch Island	0	0%	0	0	0%	37	86%	0	0%	6	14%	37	86%	20	20	47%	0	0%	17	40%	26	60%	17	40%	0	0	0%	20	47%	17	40%	6	14%
Tenasillahee Island	21	91%	12	10	43%	0	0%	9	39%	14	61%	9	39%	0	0	0%	12	52%	9	39%	2	9%	21	91%	2	2	9%	0	0%	19	83%	4	17%
Brown Island	89	91%	50	50	51%	0	0%	39	40%	59	60%	39	40%	0	0	0%	50	51%	39	40%	9	9%	89	91%	0	0	0%	0	0%	89	91%	9	9%
Wallace Island[1]	3	23%	0%	0	0%	0	0%	3	23%	10	77%	3	23%	0	0	0%	0	0%	3	23%	10	77%	3	23%	0	0	0%	0	0%	3	23%	10	77%
Group III Total	**113**	**64%**	**62**	**60**	**34%**	**37**	**21%**	**51**	**29%**	**89**	**50%**	**88**	**50%**	**20**	**20**	**11%**	**62**	**35%**	**68**	**38%**	**47**	**27%**	**130**	**73%**	**2**	**2**	**1%**	**20**	**11%**	**128**	**72%**	**29**	**16%**
Crims Island	20	33%	0	0	0%	20	33%	20	33%	20	33%	20	33%	0	0	0%	0	0%	40	67%	20	33%	40	67%	0	0	0%	0	0%	40	67%	20	33%
Group IV Total	**20**	**33%**	**0**	**0**	**0%**	**20**	**33%**	**20**	**33%**	**20**	**33%**	**20**	**33%**	**0**	**0**	**0%**	**0**	**0%**	**40**	**67%**	**20**	**33%**	**40**	**67%**	**0**	**0**	**0%**	**0**	**0%**	**40**	**67%**	**20**	**33%**
Sandy Island	32	86%	0	0	0%	0	0%	32	86%	5	14%	32	86%	0	0	0%	0	0%	32	86%	5	14%	32	86%	0	0	0%	0	0%	32	86%	5	14%
Group V Total	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**	**32**	**86%**	**0**	**0**	**0%**	**0**	**0%**	**32**	**86%**	**5**	**14%**
Total Acres	***291***	***44%***	***87***	***60***	***21%***	***147***	***22%***	***229***	***34%***	***289***	***43%***	***262***	***39%***	***147***	***84***	***29%***	***152***	***23%***	***262***	***39%***	***251***	***38%***	***321***	***48%***	***29***	***6***	***2%***	***137***	***21%***	***319***	***48%***	***209***	***31%***

[1] Wallace Island is not included in the placement network, and therefore will not be impacted by placement activities.

[2] All calculations for baseline suitable habitat, suitable habitat affected (by the placement event), and the suitable, yet-to-be, and unsuitable habitat represent the number of acres within the Critical Habitat subunit, not those acres within the placement site boundary.

[3] Baseline suitable habitat in 2014 equals the extent of habitat within the CH boundary which is suitable for SHLA at the beginning of the breeding season based on the best scientific information available (Anderson 2013). In addition, the area is calculated by subtracting a 25m buffer from the edge of shorelines, unsuitable vegetation (trees, shrubs). While larks are known to forage in these areas, they are not known to nest and breed in these areas.

[4] Baseline suitable habitat for 2015, 2016, 2017, and 2018 estimate suitable habitat within the CH boundary at the beginning of the breeding season. These values are assumed to equal the quantity of suitable habitat remaining from the preceding year plus any areas that become suitable from previous placement events. Where placement occurs after the breeding season, any loss of suitable habitat acres are not realized until the beginning of the following breeding season, and thus reflected in the baseline suitable conditions.

NETWORK WIDE-DESIGNATED CRITICAL HABITAT SUITABILITY

Figure 76 below shows suitable SHLA nesting habitat on designated critical habitat subunits throughout the Network during to the 5-year placement plan, as detailed in Table 8. Suitable nesting habitat for SHLA typically contains all the PCEs of SHLA designated critical habitat. However, designated SHLA critical habitat is not always suitable for nesting because of natural vegetative succession both within and adjacent to specific subunits. A total of 665 acres of critical habitat are designated across the lower Columbia River, but only 590 acres of critical habitat overlap with the Corps dredged material placement Network. The remaining 75 acres of critical habitat in the lower Columbia River consist of the 13-acre Wallace Island subunit and numerous small areas adjacent to the Corps' site boundary that are open water, vegetated land, shorelines, or wetlands.

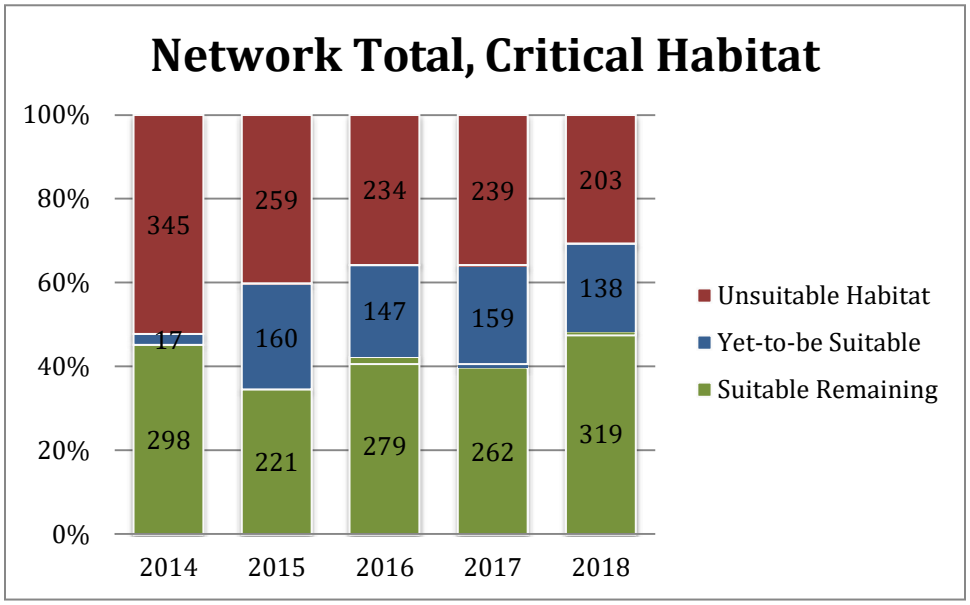

Figure 76: Availability of SHLA Nesting Habitat within Designated Critical Habitat across the Network including Wallace Island, 2014-2018

The Wallace Island critical habitat subunit is not in the Corps dredged material placement Network and no Corps placement will occur on Wallace Island. However, the 13-acre subunit is included in this discussion because it is within the same geographic reach of the lower Columbia River as the Corps' Network, it has been surveyed recently for breeding pairs, and it has been evaluated for suitable SHLA nesting habitat using the 2011 NDVI data. Therefore, this discussion will provide a more complete analysis of the availability of suitable SHLA nesting habitat within designated critical habitat on the lower Columbia River.

The 665 acres of designated critical habitat are categorized as suitable habitat (contains the PCEs of critical habitat), yet-to-be suitable habitat, or unsuitable habitat based on the assumptions previously discussed. Based on the 2011 NDVI habitat data, Corps placement events in 2011, 2012, 2013, and placement events during the 2014 nesting season, the Corps anticipates there will be 298 acres (45% of 665 acres) of suitable SHLA nesting habitat available within the designated critical habitat sub-units on the lower Columbia River for the nesting season in 2014. Following the placements in 2014, the suitable acreage of designated critical habitat will initially experience a

26% reduction (loss of 77 acres) of suitable SHLA nesting habitat to a low of 221 acres in 2015. The acreage of suitable nesting habitat available within designated critical habitat increases by 8 acres (4% of 221 acres) to 229 acres in 2016 due to placement of dredged materials and vegetation succession. The acreage of suitable nesting habitat available within designated critical habitat decreases 33 acres (14% of 229 acres) to 262 acres in 2017 due to placement of dredged materials and vegetation succession. The acreage of suitable nesting habitat available within designated critical habitat increases 57 acres (22% of 262 acres) to 319 acres in 2018 due to placement of dredged materials and vegetation succession. Overall, suitable SHLA nesting habitat within designated critical habitat will increase to 107% of the 2014 baseline conditions (298 acres) for the nesting season (319 acres) in 2018. Thereby, the proposed action will result in an increase of suitable nesting habitat containing the PCEs of critical habitat that will allow for further conservation and recovery of the species.

RICE ISLAND SUBUNIT

The Rice Island subunit is 224 acres, but only 219 acres are within the Corps placement site. Upland placement events on the Rice Island critical habitat subunit occur late in the summer, after the SHLA nesting season ends in mid-August/early-September. Therefore, placement actions on Rice Island are not expected to alter critical habitat during the year of dredged material placement. This subunit is within the Corps' Group II.

In 2014, the baseline of suitable breeding habitat within the 224-acre subunit is 150 acres with the remaining 74 acres of the site as unsuitable. The 2014 placement events will occur after the breeding season has ended and will cover 52 acres of critical habitat currently classified as a suitable (28 acres) and unsuitable (24 acres) conditions. The placement events will occur in two locations on the subunit: (1) on the downstream end of the island which is currently covered by short vegetation, and (2) along a strip of low-ground in the interior portion of the island. In addition to the placement of dredged materials, four acres on the upstream end of the subunit, which was trenched following placement activities in September 2013, will be smoothed out after the 2014 breeding season. This regraded area will develop into suitable breeding habitat in 2018.

Approximately 122 acres will remain in suitable nesting conditions within the subunit for the SHLA breeding season in 2015. No placement will occur in 2015 on the Rice Island subunit and therefore no designated critical habitat will be affected. The 56 acres covered by the 2014 placements and regrading work are expected to be mostly bare sand for the duration of 2015. Therefore, the 56 acres of yet-to-be suitable habitat do not possess the PCEs. All remaining areas (46 acres) of the subunit are considered unsuitable as breeding habitat in 2015 and do not possess the PCEs.

No placement will occur in 2016 on the Rice Island subunit, and therefore no designated critical habitat will be affected. Approximately 122 acres are available SHLA nesting habitat, possessing the PCEs. The areas covered by the 2014 placement events (56 acres total) will be yet-to-be suitable habitat and the remaining 46 acres are unsuitable.

Approximately 122 acres will be available as suitable nesting habitat on the Rice Island subunit in the 2017 breeding season. The 56 acres of yet-to-be suitable habitat from the 2014 re-grading and placement activities will be in the third year of vegetation succession and the remaining 46 acres of the site are still expected to unsuitable nesting habitat. The placement event in 2017 will cover approximately 104 acres in the center of the island after the breeding season, whereupon 64 acres of suitable habitat and 27 acres of yet-to-be suitable habitat would be lost to nesting SHLA in the following breeding season.

Approximately 85 acres will be suitable nesting habitat on the Rice Island subunit in the 2018 breeding season. The change is due to the loss of 64 acres of suitable habitat by the placement

event in 2017 and the addition of the remaining 27 acres from the 2014 placement and regraded areas that were yet-to-be suitable becoming suitable in 2018. The 104-acre placement event in 2017 is yet-to-be suitable habitat and the remaining 35 acres are expected to remain unsuitable in 2018. A 2018 placement event will cover approximately four acres at the upstream end of the subunit after the breeding season, resulting in a loss of four acres of suitable breeding habitat in the subsequent three years on the Rice Island subunit. These four acres had recently transitioned into viable nesting habitat from the 2014 re-grading event. The four-acre placement event will increase the acreage of yet-to-be suitable habitat in subsequent three years.

In summary, placement will occur in three of the five years on the Rice Island subunit resulting in a loss of suitable habitat from 150 acres to 122, a gain of yet-to-be suitable habitat from 0 acres to 104 acres, and a loss of unsuitable habitat from 74 acres to 35 acres. Figure 77 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Rice Island subunit.

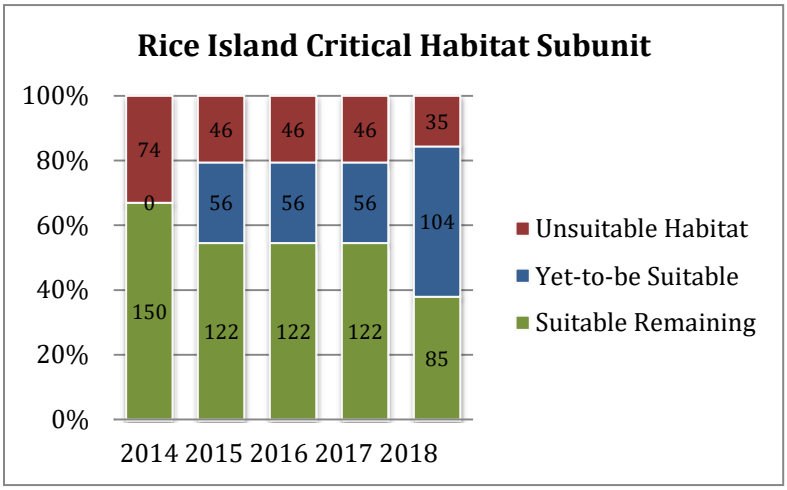

Figure 77: Availability of SHLA Nesting Habitat on the Rice Island Critical Habitat Subunit, 2014-2018

MILLER SANDS ISLAND SUBUNIT

The Miller Sands critical habitat subunit is 123 acres, but only 88 acres overlap with the Corps placement site. Shoreline placements occur during the SHLA nesting season and are not expected to affect critical habitat PCEs. Shoreline placements on Miller Sands are not expected to typically develop into the PCEs (suitable SHLA nesting habitat) of critical habitat because the placements are expected to erode away in subsequent years. The Miller Sands subunit is within the Corps' Group II.

In 2014, the baseline of suitable breeding habitat is zero (0) acres due to the succession of vegetation on the Miller Sands subunit. The entire 123-acre subunit are considered unsuitable and do not possess the PCEs of critical habitat. In 2014, a five-acre shoreline placement will occur during the breeding season on the upstream tip of the subunit. In addition to the shoreline placement, 34 acres on the middle of the island will be smoothed during the 2014 breeding season. This area was previously mounded to dissuade tern and cormorant use. This regraded area is expected to develop PCEs and become suitable SHLA breeding habitat in 2018.

No suitable SHLA nesting conditions will be present on the Miller Sands subunit in 2015. The 34-acre regraded mound area is expected to be yet-to-be suitable habitat and does not possess the PCEs of critical habitat. All remaining areas (89 acres), including the prior shoreline placement, are

considered unsuitable 2015. A 14-acre shoreline placement will occur on the mid-downstream portion of the subunit, during the 2015 breeding season.

No suitable SHLA nesting conditions will be present on the Miller Sands subunit in 2016. The 34-acre re-graded mound area is expected to be in its second year of yet-to-be suitable habitat and does not possess the PCEs of critical habitat. All remaining areas (89 acres), including the prior shoreline placements, are considered unsuitable in 2016. An 11-acre shoreline placement will occur on two downstream portions of the subunit, during the 2016 breeding season.

No suitable SHLA nesting conditions will be present on the Miller Sands subunit in 2017. The 34-acre re-graded mound area is expected to be in its third year of yet-to-be suitable habitat and does not possess the PCEs of critical habitat. All remaining areas (89 acres), including the prior shoreline placements, are considered unsuitable as breeding habitat in 2017. A nine-acre shoreline placement will occur where necessary to repair erosion, during the 2017 breeding season.

Approximately 34 acres will be develop PCEs of critical habitat and will be available as suitable SHLA nesting habitat on the Miller Sands subunit in the 2018. The 34 acres are the regraded mound area from 2014. All remaining areas (89 acres), including the prior shoreline placements, are considered unsuitable as breeding habitat in 2018. A nine-acre shoreline placement will occur where necessary to repair erosion, during the 2018 breeding season.

In summary, shoreline placement will occur each year on the Miller Sands subunit but will not affect the PCEs of critical habitat. The 2014 regrading event will result in 34 acres developing the PCEs of critical habitat by 2018. By 2018, unsuitable habitat will decrease from 123 acres in 2014 to 89 acres. No yet-to-be suitable habitat will be on the site in 2018. Figure 78 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Miller Sands Critical Habitat subunit.

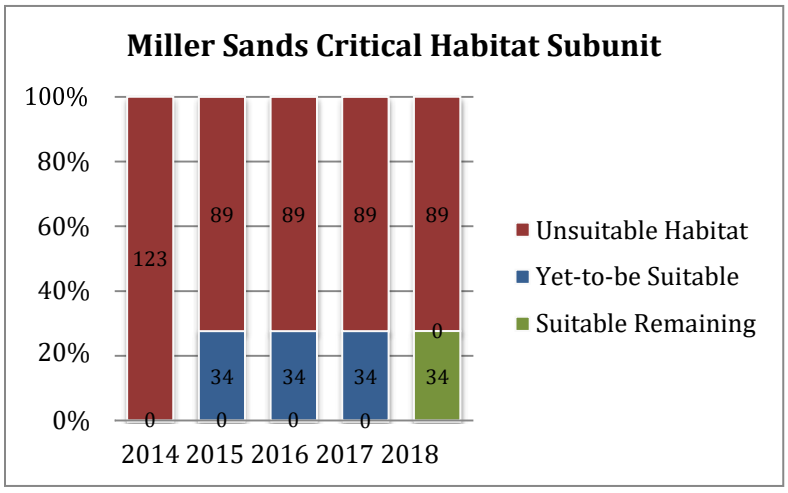

Figure 78: Availability of SHLA Nesting Habitat on the Miller Sands Critical Habitat Subunit, 2014-2018

PILLAR ROCK ISLAND SUBUNIT

The Pillar Rock Island critical habitat subunit is 44 acres, but only 41 acres overlap with the Corps placement site. Both shoreline and upland placement events on the subunit occur during the SHLA nesting season. Shoreline placements are not expected to affect critical habitat PCEs or to typically develop into the PCEs (suitable SHLA nesting habitat) of critical habitat because the placements are expected to erode away in subsequent years. Upland placement will require early season site preparation activities that will include vegetation removal and dissuasion techniques to preclude

SHLA nesting in planned upland placement locations. Upland placement could result in the loss of habitat containing the PCEs of critical habitat if suitable habitat is lost. However, no suitable habitat will be lost on the Pillar Rock Island subunit due to upland placement. The Pillar Rock Island subunit is within Corps' Group II.

In 2014, the baseline of suitable SHLA breeding habitat containing the PCEs is four acres due to the succession of vegetation and active erosion of the Pillar Rock Island subunit. The remaining 40 acres of the subunit are considered unsuitable and do not possess PCEs. In 2014, a 14-acre shoreline placement will occur on the northern portion to rebuild the shore. The 2014 shoreline placement event will occur during the breeding season.

In 2015, the baseline of suitable SHLA breeding habitat containing the PCEs is four acres. The remaining 40 acres of the subunit are considered unsuitable and do not possess PCEs. In 2015, a 14-acre shoreline placement will occur on the northern portion to rebuild the shore. The 2015 shoreline placement event will occur during the breeding season.

In 2016, the baseline of suitable SHLA breeding habitat containing PCEs is four acres. The remaining 40 acres of the subunit are considered unsuitable and do not possess PCEs. In 2016, a 14-acre shoreline placement will occur on the northern portion to rebuild the shore. The 2016 shoreline placement event will occur during the breeding season on the shore.

No habitat possessing the PCEs of critical habitat (suitable SHLA nesting habitat) will be present on the Pillar Rock Island subunit in 2017 due to the succession of vegetation since the upland placement last occurred in 2001, 15 years prior. A 14-acre placement will occur during the breeding season in 2017 on the subunit. Approximately one acre will be shoreline placement to maintain the shore and the other 13 acres will be placed in uplands that had vegetation removed and SHLA dissuasion techniques installed in the early spring. The entire 44-acre subunit is considered unsuitable for SHLA nesting in 2017.

No habitat possessing the PCEs of critical habitat (suitable SHLA nesting habitat) will be present on the Pillar Rock Island subunit in 2018. Approximately 13 acres of yet-to-be suitable habitat is expected from the 2017 upland placement. The remaining 31 acres of the subunit are considered unsuitable 2018. A 14-acre placement will occur during the breeding season in 2018 on the Pillar Rock Island subunit. Approximately one acre will be shoreline placement to maintain the shore and the other 13 acres will be placed in uplands that had vegetation removed and SHLA dissuasion techniques installed in the early spring. The 13-acre upland placement in 2018 will not overlap with the 2017 upland placement.

In summary, shoreline placement will occur each year on the Pillar Rock Island subunit but will not affect the PCEs of critical habitat. Upland placement will occur in 2017 and 2018, but no critical habitat containing PCEs will be affected because the subunit will become too vegetated in 2017. By 2018, upland placement will result in a gain of yet-to-be suitable habitat from 0 acres to 13 acres and a loss of unsuitable habitat from 44 acres to 31 acres. Figure 79 displays the suitability of SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Pillar Rock Island Critical Habitat subunit.

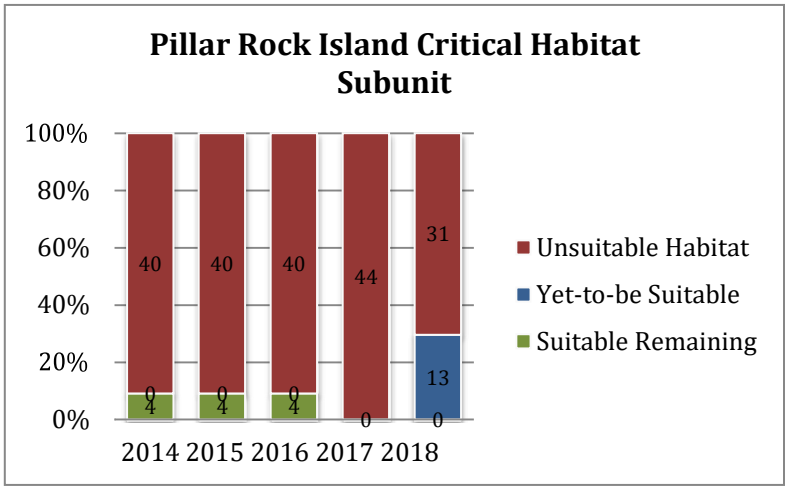

Figure 79: Availability of SHLA Nesting Habitat on the Pillar Rock Island Critical Habitat Subunit, 2014-2018

WELCH ISLAND SUBUNIT

The Welch Rock Island critical habitat subunit is 43 acres, but only 37 acres overlap with the Corps placement site. Placement events on the Welch Island critical habitat subunit occur in the summer, during the SHLA nesting season. Upland placement will require early season site preparation activities that will include vegetation removal and dissuasion techniques to preclude SHLA nesting in planned upland placement locations. Upland placement could result in the loss of habitat containing the PCEs of critical habitat if suitable habitat is lost. The Welch Island subunit is within Corps' Group III.

In 2014, the baseline of suitable SHLA breeding habitat containing critical habitat PCEs is 10 acres with the remaining 33 acres of the subunit as unsuitable habitat. No placements are planned in 2014 and critical habitat will not be affected.

In 2015, the baseline of suitable SHLA breeding habitat is 10 acres. However, the 37 acres of the subunit will used for upland placement during the breeding season resulting is a loss of 10 acres of suitable habitat containing the PCEs of critical habitat. Therefore, the entire 43-acre subunit would be unsuitable for SHLA nesting in 2015.

In 2016, no habitat containing the PCEs of critical habitat (suitable SHLA breeding habitat) will be available on the subunit. The 37-acre placement event from 2015 is classified as yet-to-be suitable and the remaining six acres of subunit are unsuitable and do not possess the PCEs of critical habitat. No placement is planned in 2016 and critical habitat will not be affected.

In 2017, the baseline of habitat containing the PCEs of critical habitat (suitable SHLA nesting habitat) is 17 acres. This increase is due to 37 acres of yet-to-be suitable habitat transitioning into suitable SHLA nesting habitat and a 20-acre placement during the breeding season on the upstream portion of the subunit. The remaining 26 acres of the subunit will be unsuitable habitat and do not possess the PCEs of critical habitat.

In 2018, the baseline of habitat containing the PCEs of critical habitat (suitable SHLA nesting habitat) is 17 acres. Approximately 20 acres of yet-to-be suitable habitat from the 2017 upland placement and the remaining six acres of the subunit will be unsuitable habitat and do not possess the PCEs of critical habitat. No placement is planned in 2018 and critical habitat will not be affected.

In summary, placement will occur in two of the five years on the Welch Island subunit resulting in a gain of suitable habitat from 10 acres to 17 acres, a gain of yet-to-be suitable habitat from 0 acres to 20 acres, and a loss of unsuitable habitat from 33 acres to six acres. Figure 80 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Welch Island subunit.

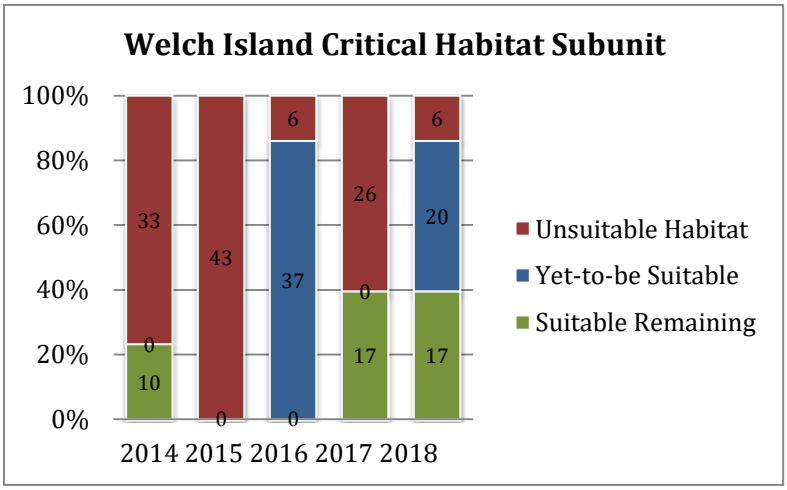

Figure 80: Availability of SHLA Nesting Habitat on the Welch Island Critical Habitat Subunit, 2014-2018

TENASILLAHE ISLAND SUBUNIT

The Tenasillahe Island critical habitat subunit is 23 acres and all 23 acres overlap with the Corps placement site. Upland placement events on the 23-acre Tenasillahe Island critical habitat subunit occur in the summer, during the SHLA nesting season. Upland placement will require early season site preparation activities that will include vegetation removal and dissuasion techniques to preclude SHLA nesting in planned upland placement locations. Upland placement could result in the loss of habitat containing the PCEs of critical habitat if suitable habitat is lost. The Tenasillahe Island subunit is within the Corps' Group III.

In 2014, a two-acre placement is planned during the breeding season on the downstream portion of the subunit, resulting in a loss of approximately 0.3 acre of habitat containing the PCEs of critical habitat (suitable SHLA nesting habitat). Therefore, the baseline of suitable SHLA breeding habitat in 2014 is two acres on the subunit. Approximately 17 acres of yet-to-be suitable habitat are anticipated due to placements in 2012 and 2013 and approximately four acres on the subunit is unsuitable and do not contain the PCEs of critical habitat.

In 2015, the baseline of suitable SHLA breeding habitat containing PCEs is 19 acres because the 17 acres of placement in 2013 have become suitable habitat. The two-acre placement in 2014 is classified as yet-to-be suitable in 2015 with the remaining two acres as unsuitable habitat on the subunit. No placement is planned in 2015 and critical habitat will not be affected.

In 2016, a 12-acre placement is planned during the breeding season on the downstream portion of the subunit, resulting in a loss of 10 acres of suitable nesting habitat that possess the PCEs of critical habitat. Therefore, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) on the subunit in 2016 is nine acres. The remaining 14 acres are unsuitable habitat.

In 2017, the baseline of habitat containing PCEs (suitable SHLA breeding habitat) on the subunit is nine acres. The 12-acre placement area from 2016 is yet-to-be suitable habitat and the remaining

two acres of the site is unsuitable habitat. No placement is planned in 2017 and critical habitat will not be affected.

In 2018, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) on the subunit is 19 acres. A two-acre placement is planned during the breeding season on the downstream portion the subunit, preventing two acres of suitable SHLA nesting habitat developing from the 12-acre placement event in 2016. However, there will be a net gain of 10 acres of suitable habitat. The remaining four acres are considered unsuitable habitat.

In summary, placement will occur in three of the five years on the Tenasillahe Island subunit resulting in a gain of suitable habitat from two acres to 19 acres, a loss of yet-to-be suitable habitat from 17 acres to 0 acres, and no change in unsuitable habitat (4 acres). Figure 81 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Tenasillahe Island subunit.

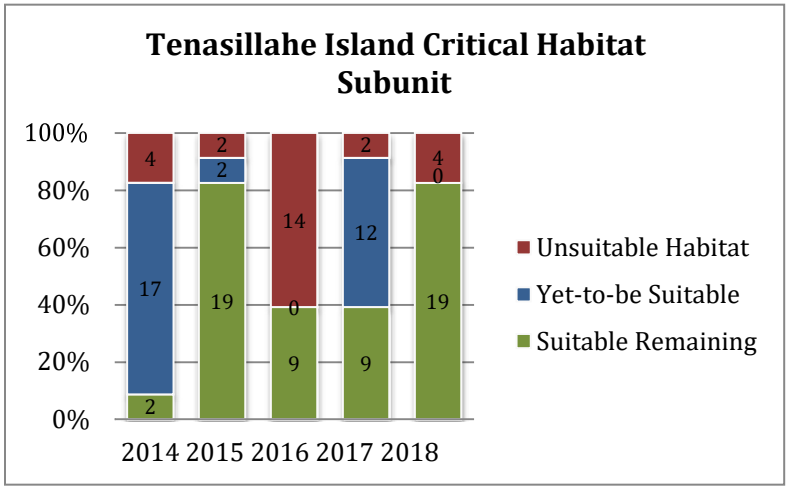

Figure 81: Availability of SHLA Nesting Habitat on the Tenasillahe Island Critical Habitat Subunit, 2014-2018

BROWN ISLAND SUBUNIT

The Brown Island critical habitat subunit is 98 acres, but only 97 acres overlap with the Corps placement site. Upland placement events on the Brown Island Critical Habitat subunit typically occur in the summer, during the SHLA nesting season. Upland placement will require early season site preparation activities that will include vegetation removal and dissuasion techniques to preclude SHLA nesting in planned upland placement locations. Upland placement could result in the loss of habitat containing the PCEs of critical habitat if suitable habitat is lost. Placement actions after the breeding season are not expected to alter critical habitat during the year of dredged material placement. The Brown Island subunit is within the Corps' Group III.

In 2014, the baseline of habitat containing PCEs (suitable breeding habitat) on the subunit is 72 acres due to placement activities in 2011. The remaining 26 acres of the subunit are unsuitable during the nesting season. A 68-acre placement is planned after the nesting season, resulting is a loss of 51 acres of suitable nesting habitat (PCEs) in the following year. The placement will occur adjacent the shoreline and downstream end of the subunit.

In 2015, the baseline of habitat containing PCEs (suitable breeding habitat) on the subunit is 21 acres. Approximately 68 acres of yet-to-be suitable habitat and nine acres of unsuitable habitat occur in the subunit. No placement is planned in 2015 on Brown Island and critical habitat will not be affected.

In 2016, 39 acres of habitat containing PCEs (suitable SHLA nesting habitat) will be available during 2016 breeding season due to a 50-acre placement on the north side and downstream end of the subunit will occur during the breeding season. The 50-acre placement will result in a loss of 21 acres of suitable nesting habitat and prevent 29 acres of yet-to-be habitat (68 acres) becoming suitable 2016. Therefore, the remaining 39 acres of the 68-acre placement event in 2014 will become suitable nesting habitat containing the PCEs of critical habitat. The remaining 59 acres of the subunit will be unsuitable habitat.

In 2017, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) will be 39 acres. The 50-acre placement event in 2016 will be yet-to-be suitable habitat with nine acres of unsuitable habitat. No placement is planned in 2017 on the Brown Island subunit and critical habitat will not be affected.

In 2018, the 50-acre placement event from 2016 will become suitable. Therefore, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) in 2018 on the Brown Island subunit is approximately 89 acres. The remaining nine acres will be unsuitable. No placement is planned in 2018 on the Brown Island subunit and critical habitat will not be affected.

In summary, placement will occur in two of the five years on the Brown Island subunit resulting in a gain of suitable habitat from 72 acres to 89 acres, no change in yet-to-be suitable habitat (0 acres), and a loss of unsuitable habitat from 26 acres to nine acres. Figure 82 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Brown Island subunit.

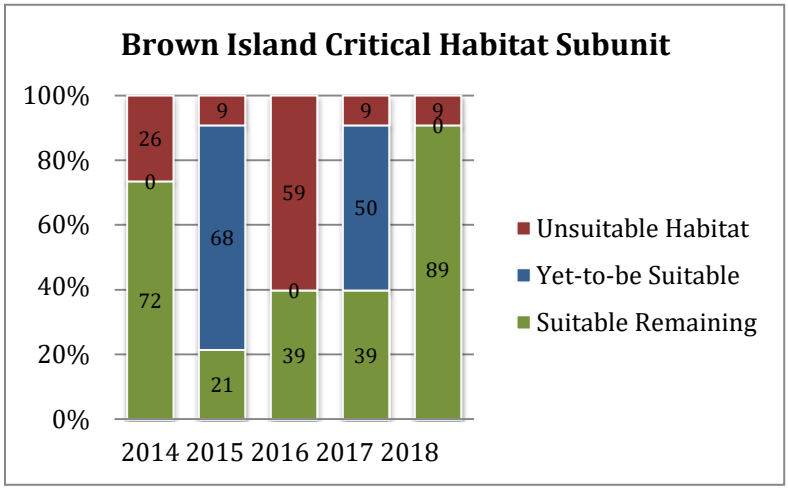

Figure 82: Availability of SHLA Nesting Habitat on the Brown Island Critical Habitat Subunit, 2014-2018

WALLACE ISLAND SUBUNIT

The Wallace Island critical habitat subunit is not in the Corps' dredged material placement Network and no Corps placement will occur on the subunit. However, the 13-acre subunit is included in this discussion because it is within the same geographic reach of the lower Columbia River as the Corps' Network, it has been surveyed recently for breeding pairs, and it has been evaluated for suitable SHLA nesting habitat using the 2011 NDVI data. Therefore, this discussion will provide a more complete analysis of the availability of habitat containing the PCEs of critical habitat (suitable SHLA nesting habitat) within designated critical habitat subunits on the lower Columbia River.

Wallace Island is located near RM 47, between the Corps' placement sites on Brown Island (RM 46.3) and Crims Island (RM 57.0). One pair of breeding larks was observed in 2012. No pairs were

observed in 2011 or 2013 surveys. In 2011, the NDVI analysis identified three suitable acres of SHLA nesting habitat on the 13-acre subunit.

From 2014 through 2018, the Corps anticipates that three acres of suitable SHLA nesting habitat will remain available on the Wallace Island subunit due to the absence of known placements of dredged materials by others or other habitat altering events.

Figure 83 displays no change in habitat containing the PCEs of critical habitat (suitable SHLA nesting habitat) over the next five years on the Wallace Island critical habitat subunit.

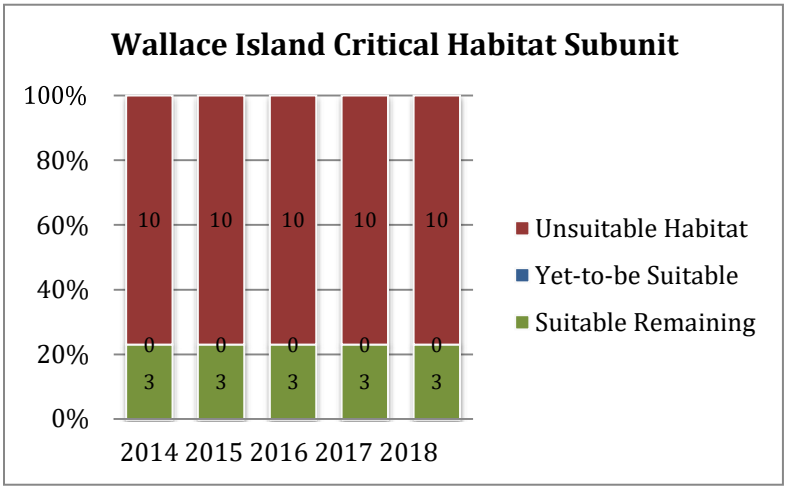

Figure 83: Availability of SHLA Nesting Habitat on the Wallace Island Critical Habitat Subunit, 2014-2018

CRIMS ISLAND SUBUNIT

The Crims Island critical habitat subunit is 60 acres, but only 53 acres overlap with the Corps placement site. Upland placement events on the Crims Island critical habitat subunit occur in the summer, during the SHLA nesting season. Upland placement will require early season site preparation activities that will include vegetation removal and dissuasion techniques to preclude SHLA nesting in planned upland placement locations. Upland placement could result in the loss of habitat containing the PCEs of critical habitat if suitable habitat is lost. The Crims Island subunit is within the Corps' Group IV.

In 2014, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) is 25 acres with the remaining 35 acres of the subunit as unsuitable habitat. No placements are planned in 2014 on the Crims Island subunit and critical habitat will not be affected.

In 2015, a 20-acre placement on the downstream end of the subunit during the breeding season will result in a loss of five acres of suitable SHLA nesting habitat. Therefore, there will be an estimated 20 acres of habitat containing PCEs (suitable SHLA nesting habitat) in 2015. The remaining 40 acres will be unsuitable habitat.

In 2016, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) is 20 acres. The 20-acre placement event in 2015 will be yet-to-be suitable habitat and the remaining 20 acres will be unsuitable habitat. No placement is planned in 2016 on the Crims Island subunit and critical habitat will not be affected.

In 2017, the 20-acre placement event in 2015 will transition to suitable habitat. Therefore, there will be an estimated 40 acres of habitat containing PCEs (suitable SHLA nesting habitat) in 2017.

The remaining 20 acres will be unsuitable habitat. No placement is planned in 2017 on the Crims Island subunit and critical habitat will not be affected.

In 2018, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) is 40 acres. The remaining 20 acres will be unsuitable habitat. No placement is planned in 2018 on the Crims Island subunit and critical habitat will not be affected.

In summary, placement will occur in one of the five years on the Crims Island subunit resulting in a gain of suitable habitat from 25 acres to 40 acres, no change in yet-to-be suitable habitat (0 acres), and a loss of unsuitable habitat from 35 acres to 20 acres. Figure 84 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Crims Island subunit.

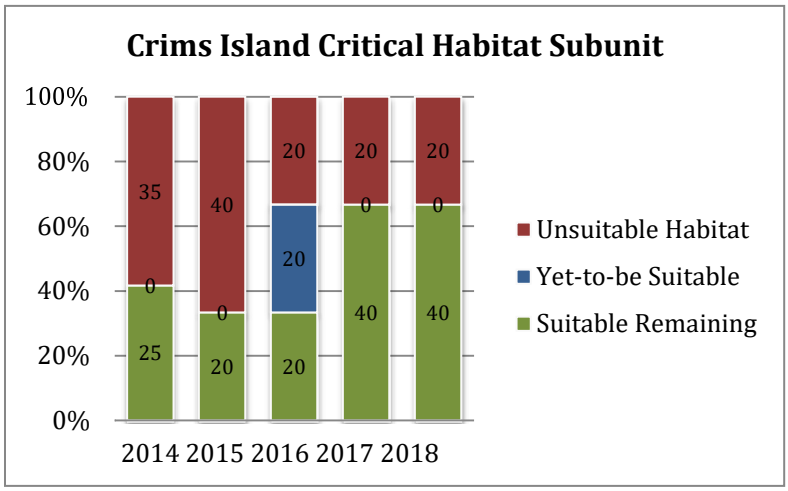

Figure 84: Availability of SHLA Nesting Habitat on the Crims Island Critical Habitat Subunit, 2014-2018

SANDY ISLAND SUBUNIT

The Sandy Island critical habitat subunit is 37 acres, but only 32 acres overlap with the Corps placement site. No placements are planned on the Sandy Island critical habitat subunit from 2014 to 2018. In 2014, the baseline of habitat containing PCEs (suitable SHLA nesting habitat) is 32 acres on the subunit due to a 32-acre placement in 2011. The remaining five acres of the subunit are unsuitable habitat through 2018. The 32 acres of suitable SHLA nesting habitat is expected to become unsuitable after the 2018 nesting season. The Sandy Island subunit is within the Corps' Group V. Figure 85 displays the availability of suitable SHLA nesting habitat containing the PCEs of critical habitat over the next five years on the Sandy Island subunit.

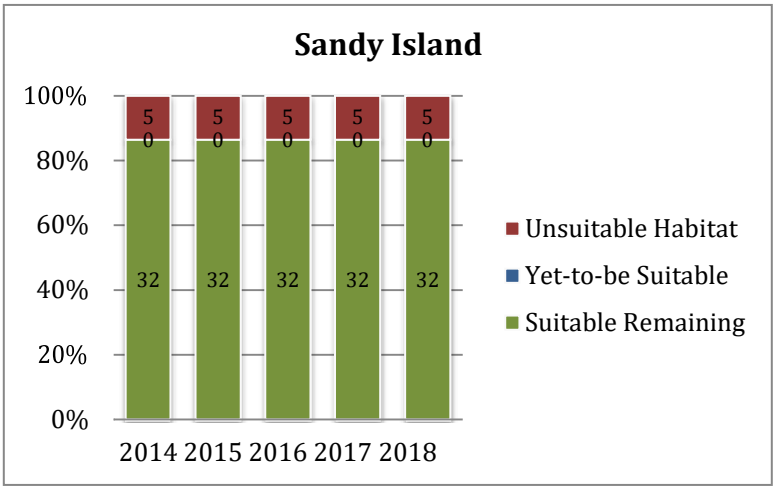

Figure 85: Availability of SHLA Nesting Habitat on the Sandy Island Critical Habitat Subunit, 2014-2018

In summary, the proposed action will result in an increase of suitable SHLA nesting habitat containing the PCEs of critical habitat that will allow for further conservation and recovery of the species.

EFFECTS FROM INTER-RELATED AND INTER-DEPENDANT ACTIONS

Interrelated actions are part of a larger action and depend on the larger action for their justification (50 CFR § 402-02). Interrelated actions are typically associated with the proposed action. The Corps considered whether the following action may be interrelated or interdependent to the continued dredging and placement activities of the Project:

Inter-related and interdependent effects of the Corps action include changes in other avian species that use the placement sites. The placement of dredged material at shoreline and upland sites in the lower Columbia River, particularly at Rice Island, Miller Sands, and Pillar Rock Island, has in part, increased the nesting habitat for Caspian terns and cormorants (FR 78, #192, 2013). The nesting of these larger avian species may reduce the quality, quantity, and success of SHLA nesting habitat on Corps placement sites in the Columbia River estuary. As described in the effects section above, efforts to reduce the establishment of other avian species (terns and cormorants) include habitat modifications and physical barriers (placing fences in open areas); these deterrent actions are also expected to reduce available habitat for larks; currently the overlap of potentially suitable habitat occurs only on Pillar Rock Island.

Commercial sand mining currently occurs at several upland placement sites within the Network. These commercial facilities operate as a result of the Corps' placement of dredged material at these sites. Due to the frequent site disturbance at active sediment borrow sites (Skamokawa, James River, Dibblee Point, Northport, Martin Bar, and Gateway) and Austin Point (heavy equipment training school) and lack of suitable nesting habitat, it is unlikely that SHLA will use these sites and be exposed to potential adverse effects in the future. However, the effects to SHLA from these actions are discussed above in the effects section and will not be analyzed in detail here. In summary, the effects from on-going commercial sand mining at upland placement sites within the Network will generally preclude SHLA from nesting due to the amount of human activity and constant habitat disturbance that prevents suitable nesting habitat from developing.

There may be requests in the future to mine or borrow placed dredged materials from current, non-commercial dredged material placement sites. On-going placement of dredged material creates a source of sediment for commercial purposes, independent from the Corps' action. The Corps does not own or maintain any of the placement sites, or own the dredged material following placement, and therefore the Corps has no authority for long-term management or control of the sites or the dredged materials. The Corps is aware that the State of Oregon, Department State Lands (DSL) has recently received a proposal for sediment extraction at Rice Island. It is uncertain at this point when or if this will occur. If the proposal is approved by Oregon DSL, the Corps expects modifications to SHLA critical habitat and adverse effects to individual SHLAs and its habitat. However, given the known use of the site by SHLA, it is reasonable to expect that the DSL will work with the USFWS to secure a Habitat Conservation Plan prior to issuing a permit to remove sand from the island.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the Action Area of the Federal Action subject to consultation (50 CFR § 402.02). To determine whether there are other future actions reasonably certain to occur in the Project Area, local and state government websites were reviewed and local entities queried. Current non-Federal activities in the area that are anticipated to continue at relatively the same levels include: upland and shoreline recreation, including camping, fishing, and all-terrain (ATV) and/or off-highway vehicle (OHV) operations, continued regional and shoreline development in support of economic growth by local communities, and non-federal actions to protect and restore habitat within the river and estuary.

The Portland/Vancouver metro area has grown 10.3% over the past decade. Residential, commercial, industrial, or recreational development may occur within the vicinity of the project area. As the metro area expands, there are increasing needs for recreational areas and greenspace. Easily accessible placement sites will likely continue to be popular recreational use areas for the foreseeable future, including ATV and/or OHV use. Those sites that are only accessible by boat generally will have very limited access, but still may receive some use, mostly for shoreline camping and recreational fishing. These recreational activities may cause adult SHLA to be disturbed, likely flush from the area that could result in nest abandonment, increased predation, decreased foraging opportunities and increased energetic expenditures. In the event that nests are in the area, recreational activities may result in the direct mortality to eggs and nestlings; adults are expected to flush from the area and avoid direct mortality. However, areas that receive a high amount of recreational activity likely preclude use by SHLA, so the number of birds directly affected is likely very low.

The Corps is not aware of any further non-federal actions within the Network that may affect SHLA or their designated critical habitat. Future federal actions that may affect SHLA or their designated critical habitat within the Network are required to undergo Section 7 consultation with the USFWS to evaluate the effects of those actions on species listed under the ESA.

SUMMARY OF EFFECTS

SUMMARY OF EFFECTS TO STREAKED HORNED LARKS AND THEIR HABITATS

Implementation of the proposed action will result in a range of beneficial and adverse effects to SHLA and their habitat. Site preparation and sediment placement will likely disturb adults and subadults from suitable nesting habitat and sediment placement may lead to the direct mortality of

eggs and nestlings. Disturbance-related effects are expected to cause flushing of adults and subadults and could result in nest abandonment, nest failure, and increased susceptibility of eggs and chicks to predation. While some very low levels of direct mortality of eggs and juvenile SHLA may occur during placement of dredged materials (via burial), it is anticipated that adults will not be buried during placement activities and would instead flush from the area. However, despite these short-term adverse effects to individual SHLAs, the on-going dredging and sediment placement activities over the next five-years will result in a considerable increase in the amount of suitable nesting habitat within the Network.

Dredged material placement at shoreline and upland sites results in temporary modifications of nesting habitat, but is outweighed by the long-term benefits of maintaining a broad network of large, suitable nesting habitat areas within the lower Columbia River. Because the natural process of vegetation succession reduces the suitability of habitats for SHLA over time, upland dredged material placement can periodically reset the vegetative successional clock returning these areas to a more suitable habitat condition. While some areas may experience an immediate, short-term loss of suitable nesting habitat in the first two – four years following placement of dredged materials, these areas are expected to transition into suitable habitat as vegetation becomes established soon thereafter and remain suitable for six to 12 years following the placement event, provided no additional disturbance occurs which alters the vegetation communities. Therefore, habitat modification throughout the Network will result in both short-term adverse and long-term beneficial effects depending on existing habitat condition, the timing of placement relative to nesting, as well as the extent, frequency, and location of upland dredged material placements.

Within the entire 1,826-acre Network, there are currently 315 acres (17% of Network acreages) of suitable nesting habitat for SHLA. Through the five-year placement plan, suitable habitat ranges from a low of 241 acres in 2015 to a high of 643 acres (35% of Network acreages) by 2018 (104% increase over 2014 acreage), the final year of the current placement plan. The proposed action effectively doubles that acreage of suitable SHLA nesting habitat across the Network. Similarly, given this potential increase in suitable habitat, the potential number of breeding pairs that could occupy nesting habitat across the Network also doubles over the five-year placement plan (see Figure 86). However, recent literature and the best available scientific information suggests the regional population of SHLA is not limited by a lack of suitable nesting habitat, but rather by demographics, specifically adult and juvenile survival (Pearson and Hopey, 2005, Schapaugh 2009, USFWS 2014). Therefore, even with the temporary reduction in amount of suitable habitat in 2015, there is adequate suitable habitat remaining across the Network to support more than the current SHLA population within the lower Columbia River.

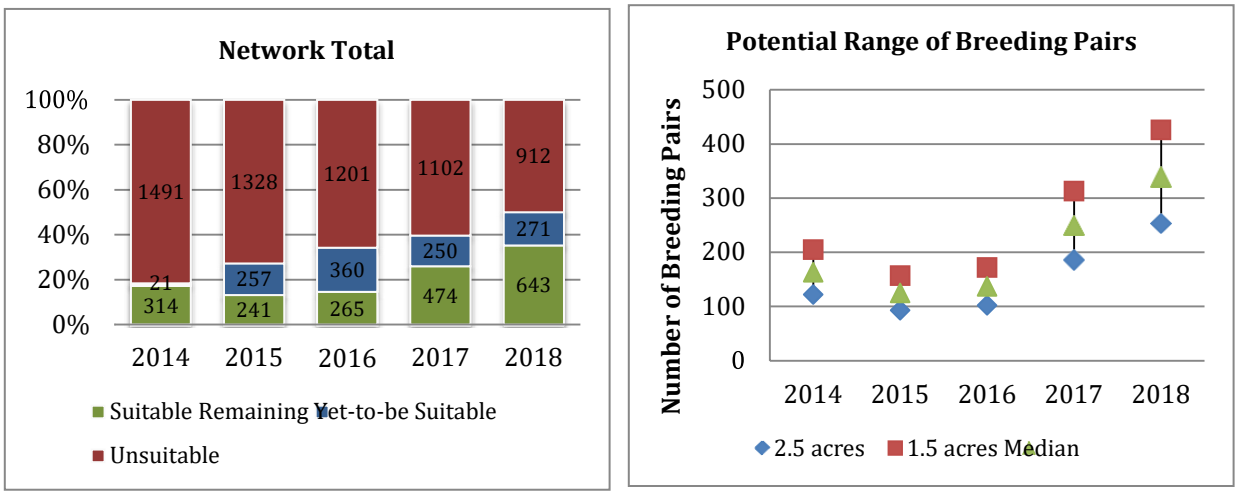

Figure 86: Summary of effects to suitable habitat and potential range of breeding pairs, 2014 – 2018.

Without periodic placement of dredged materials, the 1,826 acres of the Network would eventually transition to conditions unsuitable SHLA nesting habitat in the next 12 to 20 years. Figure 87 below shows habitat condition and associated number of potential SHLA breeding pairs without implementation of shoreline and upland placement of dredged material within the Network (compared to Figure 86 above). Implementation of the five-year dredged material placement plan more than doubles the amount of suitable nesting habitat within the Network, while also providing a substantial amount of yet-to-be suitable habitat acres ready to transition into suitable after 2018. Without implementation of the five-year dredging plan, suitable habitat acreage within the Network is reduced by about a third, with zero acres of yet-to-be suitable habitat available to transition into suitable after 2018. Therefore, while the analysis in this BA is only for the years 2014 – 2018, comparing Figure 86 Figure 87 clearly indicates the long term benefits to suitable SHLA habitat from the periodic placement of dredged materials at shoreline and upland sites across the Network and the downward trajectory of suitable habitat condition that could support the local population of SHLA that would result without these activities.

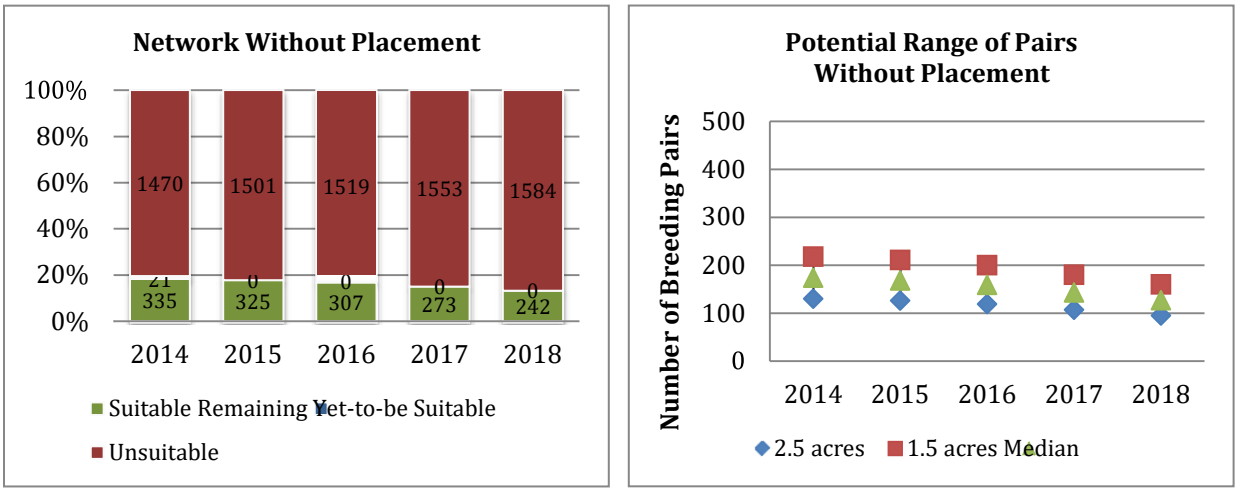

Figure 87: Summary of effects to suitable habitat and potential range of breeding pairs if no placement occurs, 2014-2018

As stated above, only eight dredged material sites overlap with designated critical habitat subunits for SHLA: Rice Island, Miller Sands, Pillar Rock Island, Welch Island, Tenasillahe Island, Brown Island, Crims Island, and Sandy Island. No placement is planned for the Sandy Island (RM 75.8) in the next five years; therefore, no effect to the Sandy Island critical habitat subunit will occur. The Wallace Island subunit is not within the Corps' Network and will not be affected by the proposed action. Only portions of each critical habitat subunit in the Corps' Network will be used in any given year. Placements on critical habitat subunits will allow suitable breeding habitat to be available on the Rice Island, Tenasillahe, Brown Island, Wallace Island, Crims Island, and Sandy Island subunits in every year. The Miller Sands subunit will not have suitable habitat until 2018, which would not form without the Corps' action. The Pillar Rock Island subunit will lose its suitable habitat to natural vegetation succession while the Corps rebuilds the site with shoreline placements. The Welch Island subunit will not have suitable habitat in 2015 and 2016, but will increase suitable habitat from 2014 (10 acres) to 2018 (17 acres)

Not all habitats within individual subunits are suitable nesting habitat for SHLA. Currently, only 298 acres of the 665 acres designated as critical habitat contain all the PCEs that correlate with suitable nesting habitat (approximately 45% of all designated critical habitat in the lower Columbia River). Through the five-year placement plan, suitable nesting habitat within the designated critical habitat subunits ranges from current baseline (2014) estimates of 298 acres to a low of 221 acres (33%) in 2015 and a high of 319 acres (48%) by 2018, a seven percent increase over 2014 baseline acreage.

Without periodic dredged material placement within the designated critical habitat subunits, these areas would all eventually transition to unsuitable habitat conditions that do not support the necessary PCEs for SHLA. The long-term beneficial effects from periodically resetting the vegetative successional clock through shoreline and upland placement of dredged materials cannot be overstated. Through implementation of the proposed action, the Corps sustains the important habitat elements identified as PCEs within the critical habitat subunits within the Network. Should shoreline and upland placement cease in these critical habitat subunits, the long-term viability of critical habitat in the lower Columbia River will be in doubt.

DETERMINATION AND CONCLUSION

The abundance and geographic distribution of SHLA is not expected to be affected from implementing the proposed action, and therefore the placement of dredged materials is not expected to directly contribute to population declines throughout the lower Columbia River. However, based upon the above analysis and assessment of the direct effects, indirect effects, effects from interrelated and interdependent actions, and cumulative effects to SHLA resulting from the placement of dredged materials in the CR FNC, together with the conservations measure implemented as part of the proposed action, the Corps has determined that the proposed five-year placement plan ***"may affect, and is likely to adversely affect"*** to individual SHLA and their habitats in the lower Columbia River. In addition, based on the analysis of effects to designated critical habitat resulting from implementation of the proposed action, the Corps has determined the proposed five-year placement plan ***"may affect, and is likely to adversely affect"*** designated critical habitat in Unit 3.

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Congressional Authorizations for the Columbia River Dredging Program

Congress authorized construction and maintenance of the Columbia River Federal Navigation Channel (CR FNC) from the Columbia River mouth to Bonneville Dam (River Mile (RM) -3.0 to 145). Several federally authorized projects are included in the CR FNC.

- Mouth of the Columbia River (MCR) Project (RM -3.0 to 3.0),
- Columbia River (RM 3.0 to 106.5) deep draft project, also includes lower 12 miles of Willamette River
- Columbia River from Vancouver to The Dalles (RM 106.5 to 145) Project,
- Nine (9) side channel projects (Baker Bay, Chinook Channel, Hammond Boat Basin, Skipanon Channel, Skamokawa Creek, Wahkiakum Ferry Channel, Westport Slough, Old Mouth Cowlitz River, and Upstream Entrance to Oregon Slough), and
- Portland-Vancouver Anchorages.

MOUTH OF THE COLUMBIA RIVER

The MCR Project was authorized under the Rivers and Harbors Act of 5 July 1884; however, the originally authorized project depth of 40 feet for the MCR was not completed until 1918. The South Jetty was completed in 1914 and the North Jetty completed in 1917. A spur jetty (Jetty A) was completed in 1939 for the purpose of channel stabilization. The Rivers and Harbors Act of 3 September 1954 authorized a 48-foot channel depth. Public Law 98-63 (30 July 1983) authorized deepening of the northernmost 2,000 feet of the channel to 55 feet.

Four to five MCY of sand are dredged from the MCR Project annually and placed at U.S. Environmental Protection Agency (EPA) approved disposal sites and one Clean Water Act site. In 2008, sand was placed on the north side of the MCR North Jetty for the purpose of protecting the jetty from scour as a result of storm surges. The South Jetty and North Jetty were constructed to maintain the FNC through the ocean entrance to the Columbia River. The South Jetty is about 6.6 miles long. The first 4.5 miles of the South Jetty were constructed from 1885 to 1895. It was extended to its present footprint length from 1913 to 1914; however, about 6,200 feet (head loss) have eroded. Portions of the South Jetty head loss were repaired in 1982. The North Jetty is about 2.5 miles long and was constructed from 1915 to 1917. Approximately 1,900 feet of head loss has occurred at the North Jetty. These existing project features were authorized by the Rivers and Harbors Acts of July 5, 1884; March 3, 1905; and September 3, 1954.

The jetties were constructed at the entrance to the Columbia River to confine tidal currents, to obtain scouring velocities in the bar and entrance channels for the purpose of maintaining the authorized channel dimensions, and to help protect vessels entering and exiting the river. The North and South Jetties at the MCR have experienced damage to both jetty heads and along the jetties at several locations. Some of these damages were repaired in 2005 to 2007.

COLUMBIA RIVER (DEEP DRAFT)

In the Rivers and Harbors Act of 18 June 1878, Congress authorized the Columbia River Project and directed the Corps to establish and maintain a 20-foot minimum channel depth. Maintaining this depth required dredging in only a few shallow reaches of the river where the natural controlling depths were in the 12 to 15 foot range. In the Rivers and Harbors Act of 13 July 1892, Congress increased the authorized navigation channel depth to 25 feet. The maintenance dredging associated with this increase was still limited to a few particularly shallow reaches where sporadic dredging was conducted, as needed. In the Rivers and Harbors Act of 13 June 1902, Congress adopted a 25-foot channel to the sea (which included the mouth of the Columbia River).

In the Rivers and Harbors Act of 25 July 1912, Congress increased the channel depth to 30 feet. At that time, the navigation channel width was established at 300 feet. Increasing the channel depth to 30 feet resulted in the need for increased maintenance dredging to ensure that authorized navigation depths were safe for shipping and to address shoaling associated with the new depth.

In the Rivers and Harbors Act of 3 July 1930, House Document 195, Congress increased the authorized depth from Portland to the sea to 35 feet. The navigation channel width was also increased to 500 feet and realigned in certain reaches. The channel modifications were completed in 1935. From 1936 to 1957, Congress authorized additional channel alignment adjustments that added to the dredging requirements. During this period, dredging averaged 6.7 million cubic yards (mcy) per year.

By 1958, the channel alignment had stabilized, but maintenance dredging was augmented to increase the advanced maintenance dredging (AMD) depth from two feet to five feet in areas of active shoaling. Advanced maintenance dredging removes additional material from a shoal for the purpose of maintaining the authorized depth of the navigation channel for a longer between dredging events. This AMD approach enhances navigational safety by maintaining the authorized channel depth (which is necessary to ensure adequate under-keel clearance) during periods of channel shoaling that occur between maintenance dredging events and is done at the same time as routine maintenance dredging.

The 40-foot deep by 600-feet wide navigation channel was authorized by the Rivers and Harbors Act of 23 October 1962, and construction took place in stages from 1964 to 1976.

The current 43-foot deep channel in the Columbia River from RM 3 to 106.5 was authorized by the Water Resources Development Act (WRDA) of 17 August 1999 (Public Law 106-53) and constructed from 2005 to 2010. The channel is 43 feet deep and 600 feet wide from RM 3.0 to 101.4; 43 feet deep and 400 feet wide from RM 101.4 to 105.5; 43 feet deep and 400 feet wide in the downstream 1.5 miles of Oregon Slough; and 35 feet deep from RM 105.5 to 106.5 (from the Burlington Northern and Santa Fe Railway Bridge to the Interstate 5 Bridge). Advanced maintenance dredging is authorized up to five feet below the authorized depth (-48 feet) and up to 100 feet outside the authorized channel width. The navigation channel generally follows the deepest part of the natural river channel. Most of the channel is naturally deeper than 43 feet; however, shoals tend to form in channel reaches where natural depths are less than 43 feet. The reach from RM 102.5 to 105.5 also includes the Portland/Vancouver Anchorage (Rivers and Harbors Act of 1960, Section 107 project), which consists of one deep-draft anchorage and one anchorage used primarily for empty vessels.

From 1976 to the onset of the most recent channel improvement, maintenance dredging averaged approximately 5.5 to 6.5 MCY per year, excluding emergency dredging related to the 1980 eruption of Mount St. Helens (Corps 1999). Since channel improvement was completed in 2010, the average volume of annual dredging required to maintain the channel has increased as expected. After unusually high flows in 2011 and 2012, it is difficult to predict shoaling volumes, which will need to be dredged over the next five years as the new channel, comes into equilibrium.

COLUMBIA RIVER FROM VANCOUVER TO THE DALLES

The portion of the Columbia River navigation channel from Vancouver, Washington to The Dalles, Oregon (RM 106.5-192), was authorized by the Rivers and Harbors Acts of 26 August 1937 and 24 July 1946. The portion of the navigation channel from Vancouver to Bonneville Dam is authorized for maintenance to a depth of 27 feet. Currently, this portion of the navigation channel is maintained for barge traffic only. Based on draft requirements of current users, the channel is maintained to a depth of 17 feet, with 2 feet of AMD for maximum channel depth of 19 feet.

AUXILIARY SIDE CHANNELS

The side-channel projects included in this BA were first authorized at various times, as shown below. Descriptions for the side channel projects, as well as their recent dredging history, can be provided, as requested for this consultation.

1933 – The Columbia River at Baker Bay was first authorized by the Rivers and Harbors Act of 11 December 1933. The Baker Bay West Channel is authorized by the Rivers and Harbors Act of 2 March 1945.

1938 – Chinook Channel was authorized by the Rivers and Harbors Act of 20 June 1938.

1975 – Hammond Boat Basin was authorized under Section 107 of the Rivers and Harbors Act of 1960.

1930 – Skipanon Channel was authorized by the Rivers and Harbors Act of 3 July 1930.

1919 – Skamokawa Creek was authorized by the Rivers and Harbors Act of 2 March 1919.

1993 – Wahkiakum Ferry was also authorized under Section 107 of the Rivers and Harbors Act of 1960.

1937 – Westport Slough was authorized by the Rivers and Harbors Act of 26 August 1937.

1945 – The Old Mouth of the Cowlitz River, as part of the Columbia (and Lower Willamette) deep draft project, was authorized by the Rivers and Harbors Act of 2 March 1945.

1946 – The Upstream Entrance to Oregon Slough, as part of the Columbia River from Vancouver to The Dalles project, was authorized by the Rivers and Harbors Act of 24 July 1946.

Columbia River Operations and Maintenance Dredging Program: Dredging, Placement, Ocean Disposal and the Placement Network

DREDGING

The Corps uses two general types of dredging equipment: hydraulic dredges and mechanical dredges. Hydraulic dredging is typically conducted by either a hopper dredge or a pipeline dredge. Mechanical dredging includes clamshell or backhoe dredging. Hopper and pipeline dredges currently handle the majority of operations and maintenance (O&M) dredging needs for the Columbia River Federal Navigation Channel (CR FNC). Each year, the Corps dredges 3-5 million cubic yards of sediment at mouth of the Columbia River (MCR) project to maintain the inlet's 6-mile long deep-draft navigation entrance channel, placing the dredging material in ocean disposal sites. In addition, approximately 6 to 9 million CY of material is dredged from the lower Columbia River and placed at upland, shoreline, or in-water dredged material placement sites.

DREDGING VESSELS

Figure 1 shows the four vessels, or types of vessels the Corps anticipates using to conduct the O&M dredging mission.

Figure 1: Dredging equipment

HYDRAULIC DREDGING

HOPPER DREDGE

Hopper dredges are typically self-propelled vessels that provide flexibility for dredging operations because of their maneuverability. They are most often used on small-volume sand wave shoals in the river, on large shoals in the estuary, and in the high-current areas at the mouths of rivers. As shown in Figure 2, hopper dredges use dragheads (1) at the end of drag- or trailer arms (2) located on both sides of the dredge. The dragheads are lowered to the channel bottom, and suction from the pump (3) is used to transport material through the dragarm and into the "hopper" or holding

area of the dredge (4). The Corps dredging procedures for hopper dredging (and pipeline dredging below) call for the draghead to be buried in the riverbed during operations or raised no more than three feet off the bottom when the pumps are running to prevent fish entrainment.

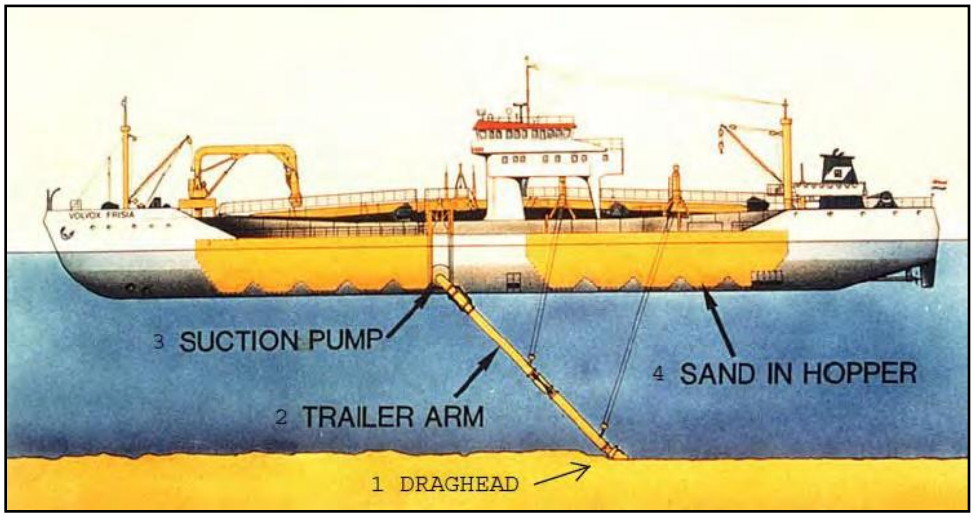


Figure 2: Hopper dredge

Hopper dredges collect dredged material in the hopper until it is near capacity. When the hopper is filled, the dragarms are raised and the vessel moves to the placement site. Some hopper dredges are of the "split hull" type, and some are of the "hopper door" type. Contractor hopper dredges typically employ a split-hull design. In split hull hopper dredges, the hull is split open for discharging and the rate of discharge is varied by how far the hull is opened. The split-hull method of placement is more rapid (time-efficient) than bottom-door hopper dredges and reduces the horizontal dispersal of dumped dredged material on the seabed. The Corps' hopper dredge, the *Essayons*, utilizes a series of doors located on the hull bottom to release each load of dredged material. The bottom doors are sequentially opened during placement until the entire load of dredged material is released from the vessel, resulting in a gradual release of dredged material from the vessel. In dredges with hopper doors, as the dredge is moving the hopper doors are opened and the material is discharged at varying rates, depending on how many hopper doors are opened. In some cases, the hopper dredge can use its pump to discharge the dredged material directly overboard or through a pipeline to a placement site not accessible by the hopper dredge (e.g. beach, upland or shallow nearshore locations). This process is often referred to as *pump-ashore* dredged material placement.

PIPELINE DREDGE

Pipeline dredges are used for large cutline shoals and areas with continuous sand wave shoals. Pipeline dredging in the Columbia River is typically used to remove material from the navigation channel between river mile (RM) 21 to 106.5. Only those shoals that have formed in a reach are dredged, not the entire reach. A typical shoal would include an area that is 250 to 300 feet wide by 2,000 to 4,000 feet long, though shoals vary in length, width and depth depending on flow conditions. Although many reaches of the navigation channel are annually dredged by pipeline, other reaches may require dredging on a less frequent basis depending upon the hydrographic surveys and flow conditions.

As shown in Figure 3, a pipeline dredge uses a "cutterhead" on the end of an arm that is buried three to six feet deep in the river bottom and swings in a 250- to 300-foot arc in front of the dredge. Spuds extend from the back of the dredge to the river bottom to anchor the dredge in place while

the cutterhead and suction arm are in operation. Dredged material is sucked up through the cutterhead, then pumped through the pipes to placement areas; the material is placed in upland sites, beach nourishment sites or in the flowlane.

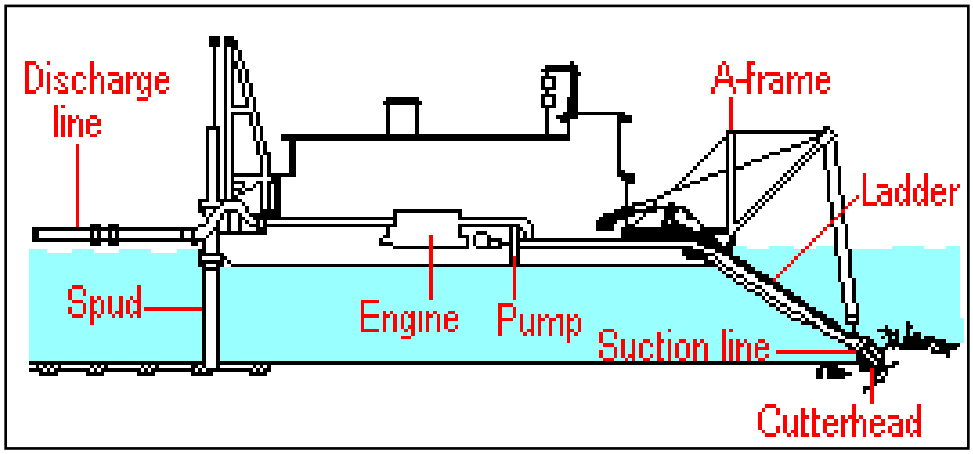


Figure 3: Pipeline dredge

MECHANICAL DREDGING

CLAMSHELL DREDGE

As shown in Figure 4, clamshell dredging is performed using a bucket operated from a crane or derrick that is mounted on a barge or operated from shore. Sediment from the bucket is usually placed on a barge for offloading and placement to an upland or in-water site. Because clamshell dredges are not self-propelled, they are not typically used in high traffic areas; rather, they are used in tighter spaces such as around docks and piers. Clamshell dredges can be used in restricted areas and shallow areas where draft restrictions may limit other dredges.

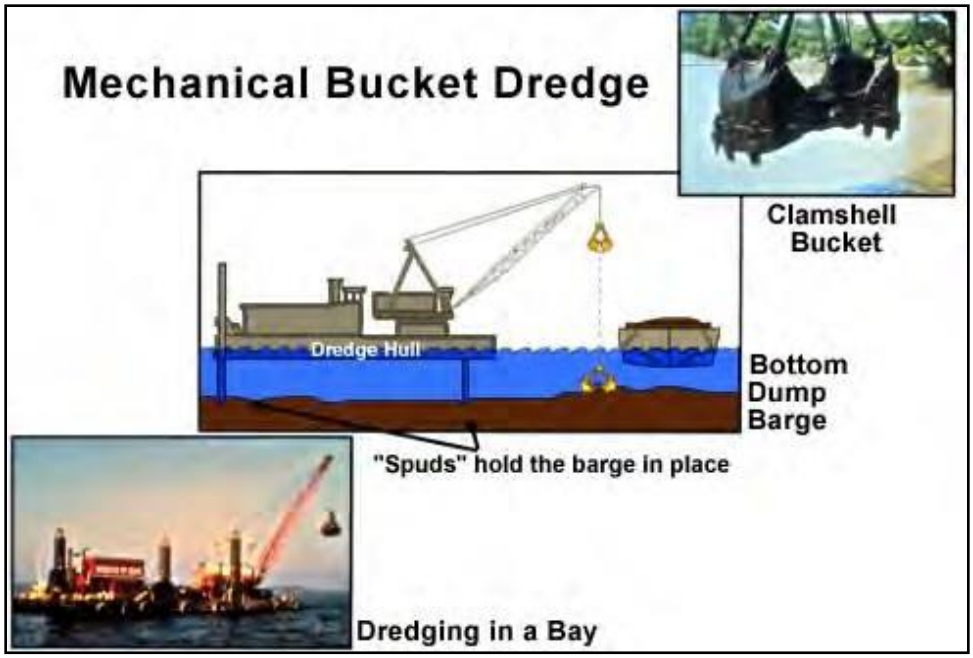


Figure 4: Clamshell dredge

Clamshell dredges equipped with special buckets are often regarded as being particularly useful when dredging silts or contaminated materials. Clamshell dredges are often used in areas with debris concerns which could damage other dredges. Also, a clamshell may be used if the placement site is very far from the dredging area, because multiple barges can be used to cycle to and from the placement area and keep the dredge working continuously, whereas hopper and pipeline dredges are limited by capacity and distance from the placement site. Clamshell dredges are primarily used for the side-channel projects related to the FNC.

BACKHOE DREDGE

Backhoe dredging, as seen in Figure 5, is performed using a bucket on the end of a backhoe arm. Although the backhoe is typically mounted on a barge, it can also be land-based and operated from shore. Backhoes can be used in both shallow- and deep-draft channels. Sediments removed by backhoe are usually placed on a barge for offloading and placement at an upland or in-water site. Backhoe dredges are often used to remove clays, rock, hard-packed materials, and fine-grained sediments, but also may be used in certain locations to remove sands. Like clamshell dredges, backhoes are often used in restricted areas near docks and in shallow-draft projects.

Figure 5: Backhoe dredge

BEST MANAGEMENT PRACTICES AND SPILL CONTROL FOR DREDGING

Table 1. Proposed Minimization Practices and BMPs for Dredging

Measure	Justification	Duration	Management Decision
Hopper Dredging			
Reverse purging of intake lines shall not be done with dragheads more than 3 ft off the bottom. If	This restriction minimizes or eliminates entrainment of juvenile	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.

Measure	Justification	Duration	Management Decision
water is pumped through the dragheads to clean the hopper, the dragheads must be -20 ft below the surface while dredging at the Mouth of the Columbia River, and the Columbia River RM 3 to RM 106.5; and -9 ft for RM 106.5-145 and the shallow-draft side channels.	salmon during normal dredging operations.		
Dredging in shallow water areas (less than 20 feet) outside of the Columbia River mainstem should occur only during the recommended ESA in-water work periods for the Columbia River.	The top 20 feet of the water column is considered salmon migratory habitat. Dredging or disposal in these areas could adversely impact salmonids, delay migration or reduce or eliminate food sources.	Continuous during dredging and disposal operations.	Maintain until new information becomes available that would warrant change.
Pipeline Dredging			
Maintain dragheads and/or cutterheads such that they do not exceed an elevation of 3 ft off the river bottom for dredging at the Mouth of the Columbia River, and the Columbia River RM 3 to RM 106.5; -9 ft for RM 106.5-145; and -9 ft for the shallow-draft side channels.	This restriction minimizes or eliminates entrainment of juvenile salmon during normal dredging operations.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
Typically, dredging in shallow water areas (less than 20 feet) only occurs during the recommended ESA in-water work periods for the Columbia River.	The top 20 feet is considered salmon migratory habitat. Dredging or placement in these areas could adversely impact salmonids, delay migration or reduce or eliminate food sources.	Continuous during dredging and placement operations.	Maintain until new information becomes available that would warrant change.
General Provisions for All Dredging			
The contractor shall not release any trash, garbage, oil, grease, chemicals, or other contaminants into the waterway.	The provision is enacted for the protection of water resources.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

Measure	Justification	Duration	Management Decision
The contractor, where possible, will use, or propose for use, materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal shall be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	The provision describes the accepted disposal of hazardous wastes.	Life of contract or action.	If material is released, it shall be immediately removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground shall be excavated and removed and the area restored as directed. Any in-water release shall be immediately reported to the nearest U.S. Coast Guard Unit for appropriate response.

PLACEMENT OF DREDGING MATERIALS

PLACEMENT SITES

The placement method and type of site used for placing dredged materials can vary depending on the type of dredge used, distance from the shoal, site capacity, and available funding. Typical placement sites for dredging the CR FNC include in-water, ocean, upland, and shoreline sites.

OCEAN DREDGED MATERIAL DISPOSAL SITES

As mentioned above and in Appendix A, dredged material placement sites actively used for maintenance at the MCR include the Shallow Water Site (SWS), Deep Water Site (DWS), the North Jetty Site (NJS), and the South Jetty Site (SJS) (Figure 6). The SWS and DWS are Ocean Dredged Material Disposal Site (ODMDS) locations, which were designated by the U.S. Environmental Protection Agency (EPA) in 2005, and they can be used for the placement of material dredged from either the MCR or the Lower Columbia River. The NJS and SJS are Clean Water Act (CWA), Section 404 Sites that are limited to placement of dredged material from the MCR. Historically, dredged material originating from maintenance of the CR FNC from RM 3 to RM 30 has been placed within estuarine placement sites and not at the ocean sites.

The beneficial uses of dredged material placed at nearshore sites make utilization of these sites (SWS, NJS, and SJS) preferred over allocations of dredged material to the DWS where the sediment is lost to the active littoral system. However, due to safety restrictions (which limit access to the nearshore sites to one dredge at a time) it is sometimes necessary to use the DWS before capacity of the nearshore sites is fully utilized.

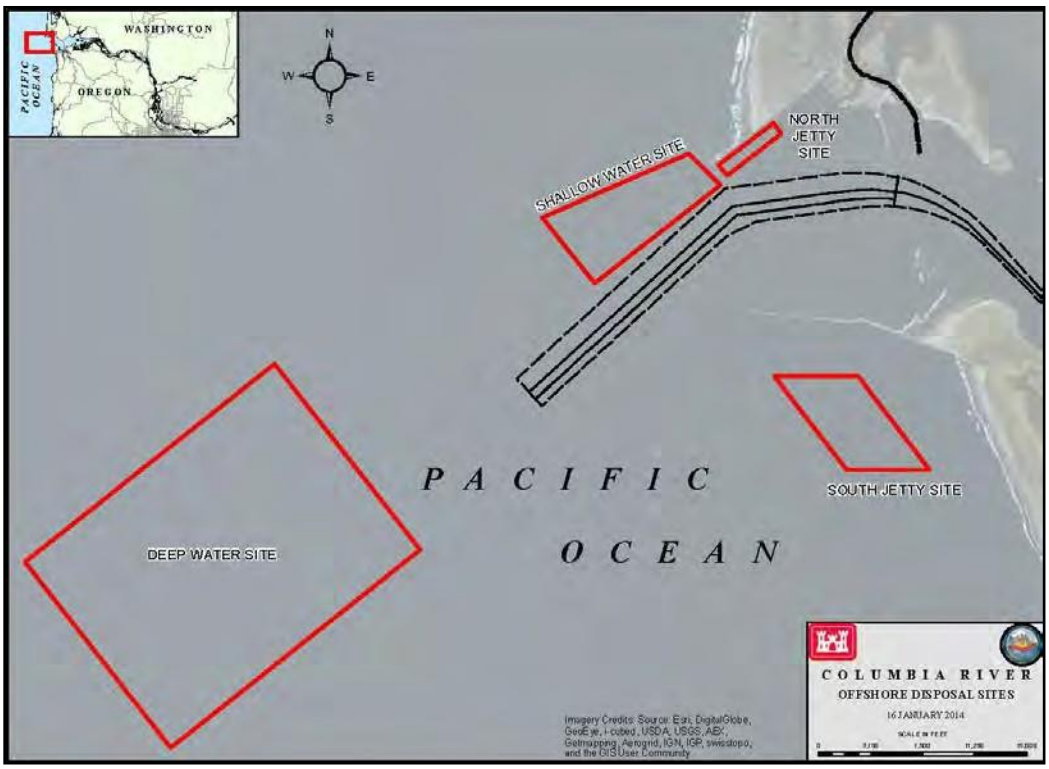


Figure 6: Shallow Water Site, Deep Water Site, North Jetty Site and South Jetty Site

Shallow Water Site

The Shallow Water Site (SWS), as seen in Figure 6, is a dispersive site that occupies a trapezoidal area of 3,100 to 5,600 feet wide by 11,500 feet long and lies within two miles of the MCR in a water ranging in depth from 45 feet to 75 feet. The overall site and placement area occupies approximately 1,198 acres or 1.4 square nautical miles (sq. nmi.). The SWS drop zone is 1,054 feet to 3,600 feet wide by 10,000 feet long and covers approximately 531 acres or 0.626 sq. nmi. The continual use of the SWS has supplemented Peacock Spit with 79 million cy of material since 1973, maintained the littoral sediment budget north of the MCR, protected the North Jetty from scour and wave attack, and has stabilized the MCR inlet. Site monitoring since 1997 has shown the released material temporarily deposits on the sea bottom, resulted in a truncated mound. The majority is subsequently eroded away to the north and northwest following the summer dredging season by the stronger winter waves and currents. Although this is a dispersive site, dredging operations in recent years have been limited in the use of this site and the North Jetty Site, described below, which is also a dispersive site because of bathymetric restrictions.

Deep Water Site

The Deep Water Site (DWS), as seen in Figure 6, is a non-dispersive site (material placed at the site remains in the site) that consists of an inner "placement area" and a surrounding buffer. The overall site (placement area and buffer) has a rectangular dimension of 17,000 feet by 23,000 feet and occupies approximately 8,975 acres or 10.5 sq. nmi. The inner placement area has a rectangular dimension of 11,000 feet by 17,000 feet, occupying an area of approximately 4,293 acres or 5.0 sq. nmi in the center of the site. Placement of dredged material within the DWS is limited to specific drop zones, which are inscribed within the DWS placement zone. Use of the DWS occurs only when the nearshore disposal sites have been used to the maximum extent practicable or when inclement weather conditions or operational constraints temporarily preclude the safe use of the other disposal sites. Sediment placed at these depths is lost to the active littoral system that feeds and maintains the coastline within the area.

North Jetty Site

The North Jetty Site, as seen in Figure 6, is located approximately 200 feet south of the MCR north jetty and occupies an area of 1,000 feet by 5,000 feet. The range in water depth within the NJs is 35 feet to 55 feet below MLLW. The NJS overall site boundaries coincide with the site's drop zone and placement area boundary. The NJS was selected in 1999, under Section 404 of the CWA, for the purpose of allowing placement of MCR dredged material along the toe of the North Jetty. Approximately 5.45 million cubic yards (MCY) were placed within the NJS during 1999-2012 to reduce erosion and scour. Approximately 100,000 to 500,000 CY of sand is placed at this site each year for these purposes.

South Jetty Site

The South Jetty Site, as seen in Figure 6, is a new nearshore site that was first used in 2012 under Section 404 of the CWA. The SJS occupies an area approximately 9,500 feet by 7,000 feet and is located approximately one mile south of the MCR inlet, in water ranging from 40 to 53 feet in depth. This sub-tidal site is intended to provide sand needed to reverse recent erosion in the nearshore area adjacent to the South Jetty. Erosion of nearshore substrates by the South Jetty is increasing, which, in turn, increases the intensity of waves hitting the jetty.

Dredged material disposal at this location would be a beneficial use, as the intent would be for dredged material to enter the littoral drift system along the coastline, mimicking conditions sediment accretion that existed historically at the mouth of the Columbia River. Studies indicate this area is losing between 88,000 and 270,000 CY per year and pre-historic clay layers are being

exposed. Use of this site is intended to reverse this trend and as the material gradually builds up at the new site, it would also serve to break waves at a distance from the South Jetty, which would decrease wave damage to the jetty itself. To protect aquatic wildlife, use of the site will be limited by site management provisions that only allow placement after August 15 when the crab season in Oregon ends. The estimated annual volume within the site is estimated to be between 200,000 to 500,000 cubic yards.

IN-WATER AND SUMPS

In-water dredged material placement is done throughout the CR FNC from RM 0 to RM 145, where placement depends on the condition of the channel each year. Most in-water placement occurs in the flowlane within or directly adjacent to the navigation channel by hopper or pipeline dredge, or by bottom-dump barges used with mechanical dredges. As deeper flowlane areas are filled with dredged material, new deep areas are formed elsewhere as a result of natural river processes. Maintenance activities within the navigation channel generally use flowlane sites between 20 and 65 feet in depth with occasional exceptions, when placement occurs in the flowlane where depths are greater than 65 feet. The average annual quantity of material disposed at in-water sites is approximately 4.5 MCY.

Hopper dredges collect material in the hopper of the vessel until it is near capacity and then move to a flowlane site and release material gradually while moving to avoid mounding. Conversely, discharge from pipeline dredges differs from hoppers in that material is continuously discharged during dredging operations. Placement of material at flowlane sites from a pipeline dredge is done using a down-pipe with a diffuser plate at the end. This down-pipe extends 20 feet below the water surface (-20 feet) to minimize impacts to migrating juvenile salmonids. During placement of dredged material, the down-pipe is frequently moved to minimize mounding on the river bottom.

A "sump" is a designated site outside the navigation channel, where a pipeline dredge can reach from the sump location to an upland or shoreline placement site. Sumps are used to most efficiently temporarily store and move material dredged from shoals to upland or shoreline placement sites. Material dredged from shoals may be initially placed in a sump until there is enough material in the sump to make it time and cost-efficient for a pipeline dredge to rehandle the material and place it at the nearby upland or shoreline placement site.

There are two sumps in the CR FNC: the Harrington Sump and the Puget Island Sump. The Harrington Sump, as seen in Figure 7, is located in the flow lane along Rice Island from RM 20 to 22 and is used by hopper and pipeline dredges for placement of dredged material when performing annual maintenance dredging between RM 17 to 25. Portions of the sump may be dredged annually to provide renewed capacity. The sump is dredged to -48 feet below Mean Lower Low Water (MLLW) with a pipeline dredge and the material is pumped to Rice Island for upland placement. On average, a total of approximately 0.2 to 1 MCY of sand is removed from Harrington Sump each time it is dredged. Its overall capacity is approximately 2 MCY.

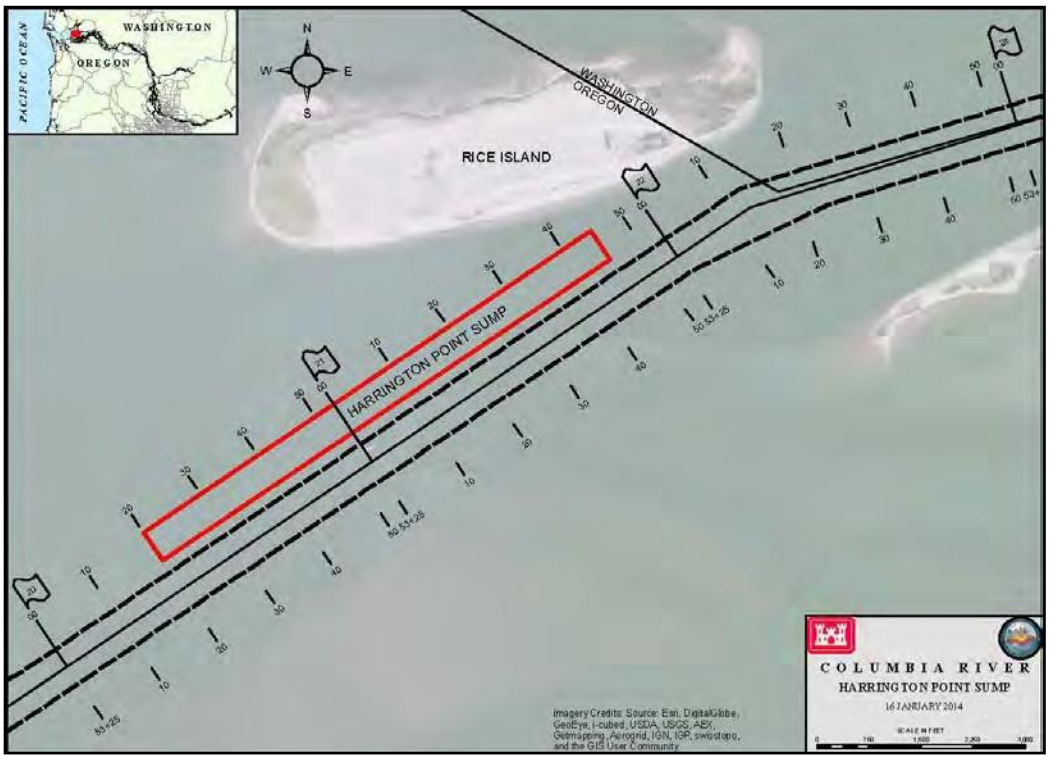


Figure 7: Harrington Point sump

The Puget Island sump (Figure 8) is located along the southern side of Puget Island from RM 44 to 45. The reach is used by hopper dredges and pipeline dredges for placement of dredged material when performing annual maintenance dredging in adjacent reaches. Portions of the sump may be dredged annually to provide renewed capacity. The Puget Island Sump may be dredged to -44 feet (CRD) with a pipeline dredge and the material is then pumped to Puget Island for upland placement. The 50-acre sump is located 300 feet north of the FNC and 400 feet south of Puget Island and is approximately 4,300 feet long and 500 feet wide. The depth of the existing profile is -30 to -40 feet. The initial material to be dredged is coarse grained sand, based on the proximity of the sump area to the FNC and nearby sandy beaches.

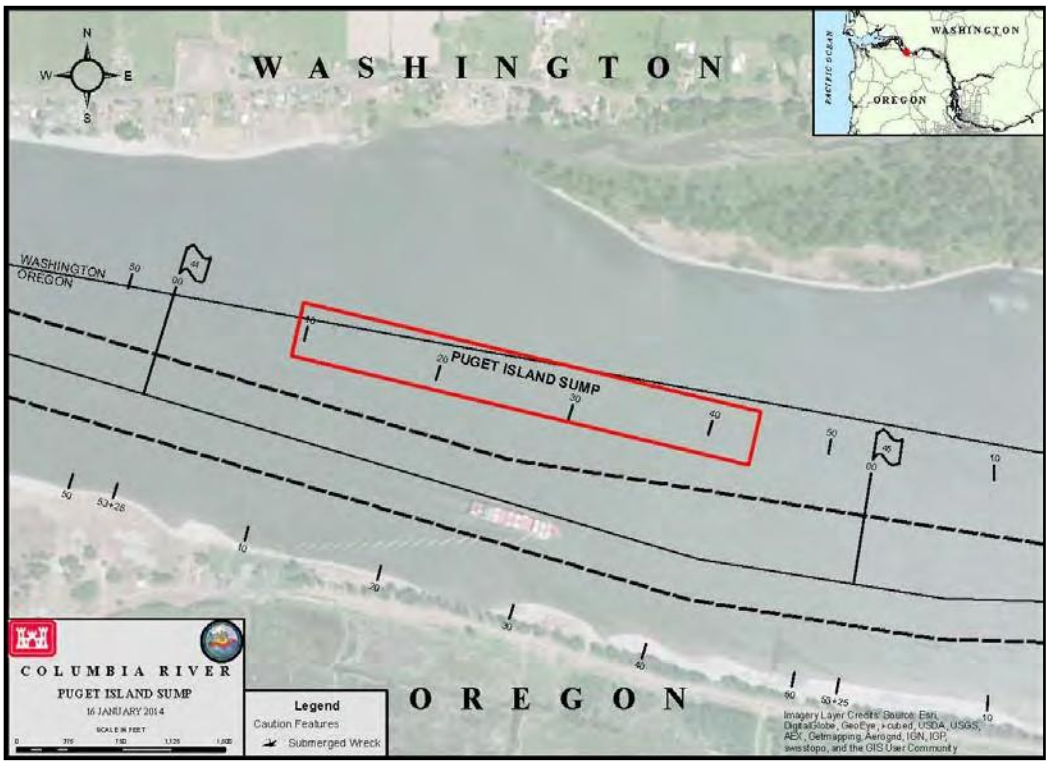


Figure 8: Puget Island sump

Additional in-water placement sites include Site BB-3 and Area D. Site BB-3 (Figure 9) is located immediately downstream of RM 3 and is primarily used when dredging side channel projects such as Baker Bay. The site may receive 100,000 to 150,000 CY of material annually.

Figure 9: In-water placement site BB-3

Area D (Figure 10) is within the Columbia River estuary north of the main CR FNC, at approximately RM 7. Area D is approximately 24-45 feet deep and it is not expected to receive more than 3.5 MCY of material between 2014 and 2018.

Figure 10: In-water placement Area D

Benson Beach Intertidal Site

The Benson Beach intertidal site, as seen in Figure 11, is located directly adjacent to the north side of the North Jetty. This27-acre beach placement site has been authorized for use since 2000 by Water Resources Development Act (WRDA). In 2002, sand was placed on Benson Beach for the first time. Since then, it has been a study placement area. The Corps identifies this intertidal placement area as a key component in the development of a network of ocean-based locations. This intertidal site was identified in 2007 as the zone within this region that would have the most potential for improved beach nourishment and drift restoration.

Dredged materials from the MCR Project would be placed directly onshore via pump-ashore hopper dredges, with the intent of minimizing erosion at Benson Beach and allow for sediment accretion along the beach. The materials would be naturally and mechanically distributed. Material placement would start 1,500 feet north of the North Jetty, in order to reduce the reintroduction of dredged materials southward towards the jetty. Typically, sand would be placed in the intertidal zone, between the elevations of -10 to +14 ft NAVD along a shoreline extent of 900 to 1,300 feet by 700 to 900 feet. A maximum of 500,000 CY of dredged material could be placed annually. The intent is for natural wave action to disperse the sediment within the littoral cell.

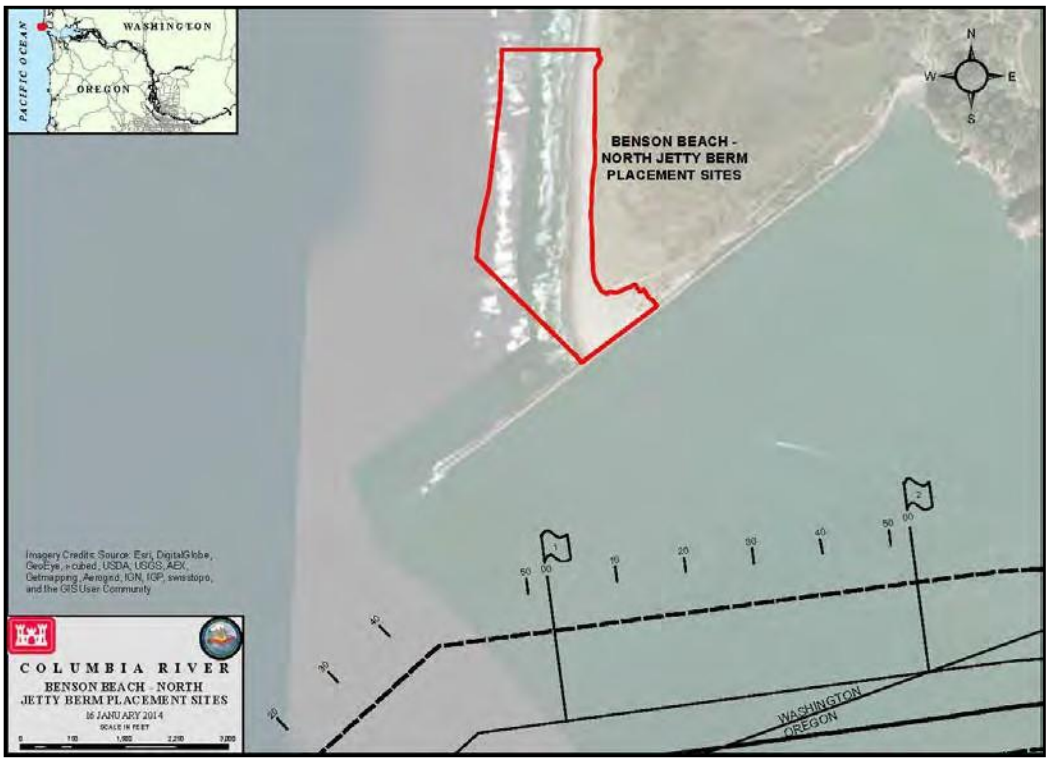


Figure 11: Benson Beach Intertidal Site

BEACH NOURISHMENT AND SHORELINE PLACEMENT

The combination of river flows, waves, and tidal effects naturally erodes material from shorelines. Beach nourishment is a method of replenishing material that has been eroded away from shorelines, and is conducted as needed. Beach nourishment or shoreline placement occurs at the sand/water interface, not in open water. Shoreline placement operations differ from beach nourishment operations in that the premise of placement is also used to directly protect a Corps asset. For example, shoreline placement is conducted when the integrity of an upland placement site is compromised by rapidly eroding shorelines. For the purposes of this Biological Assessment, shoreline placement and beach nourishment are used interchangeably with regards to placement methodology.

There are currently three beach nourishment sites available for use for the O&M program of the CR FNC: Miller Sands Island (RM 23.5), Skamokawa Vista Park beach (RM 33.4), and Sand Island (RM 86.2). Miller Sands and Sand Island are beach nourishments currently used in the State of Oregon; Skamokawa beach is in Washington. In 2011, the Corps placed approximately 227,586 CY of material at Washington and Oregon beach nourishment sites. In 2012, the Corps placed approximately 700,000 CY of material at Washington and Oregon beach nourishment sites. In 2013, the Corps placed approximately 300,000 CY of material at Washington and Oregon beach nourishment sites.

As part of the proposed action, the Corps is adding shoreline placement to the existing upland placement action at Pillar Rock Island. By conducting shoreline placement to the original footprint, the intended upland placement capacity will be restored and available. Once the site reaches upland capacity, shoreline placement will be used to maintain the integrity of the upland site.

Beach nourishment/shoreline placement involves pumping dredged material through a floating discharge pipe from the pipeline or hopper dredge to an existing shoreline. If necessary, the dredge

first pumps a landing area on the shoreline to establish a point from which additional material placement occurs. Dredged material is pumped out in a sand-and-water slurry (about 20 percent sand) and as it exits the pipe, sand settles out on the shoreline while the water returns to the river. Settling rates of Columbia River sands are very quick and turbidity from the operation is minimal. After sufficient sand has settled out and begins to increase in height, the settled sand is moved by bulldozers to match the elevation and profile of the existing shoreline at approximately the high water line.

During beach nourishment/shoreline placement, a temporary sand berm is constructed to retain sand on the beach during pump-out, otherwise much of the sand would be immediately lost to the river. The temporary berms typically are approximately 5 feet high and 12 feet wide at the base. The berms are built gradually by earth-moving equipment as pump-out continues and are created from existing beach sand, pumped sand, or a combination of both. The process continues by adding material to the shore and proceeding longitudinally along the shoreline. The length, width and depth of material placed on the shoreline are dependent on the quantity of material dredged from the channel and hydraulics of the river adjacent to the placement site. After placement, the slope of the shoreline is graded to a steepness of 10 to 15 percent to minimize the creation of areas where juvenile fish could be stranded from vessel wakes on the new shoreline.

UPLAND

Upland placement sites can be islands or locations on the mainland accessible from the riverbank. Upland placement is accomplished using clamshell, hopper, and pipeline dredges. Clamshell-dredged material deposited onto a barge can be off-loaded at a transfer point for placement at an upland site. Hopper and pipeline dredges pump sediments as a slurry mixture directly into a diked, upland site near the dredging area. Pipeline dredges are capable of placing material from approximately one mile away without a booster pump depending on site height; if a booster pump is available, the pipeline range can potentially increase up to two miles and pump to higher elevations. Hopper dredges can work in tandem with a pipeline dredge to maintain the navigation channel at distances farther than a pipeline dredge reach. When a hopper dredge is working in tandem with a pipeline dredge to place material upland or along the shoreline, the hopper dredge works on adjacent shoals and places its material temporarily in-water at the primary shoal which is being dredged or will be dredged by the pipeline dredge. The pipeline dredge then pumps all of the material from the primary and adjacent shoals to the upland or shoreline placement site.

Regardless of the type of dredge used, the placement area at an upland site is delineated and prepared prior to placement. Access to the site occurs either from the river via a landing barge or from local access roads if accessible from the mainland. Placement activities utilize earth-moving equipment (bulldozers, backhoes, etc.), and these vehicles are barged or driven to the site. Staging of all construction vehicles and placement equipment occurs within the boundary of the placement site. When equipment is barged in from the river, the barge(s) is maneuvered to the shoreline and anchored for the duration of the operation. A wide sand berm is constructed from the barge to land for movement of equipment. Sand from the site may be used to form a ramp to transport equipment from the shoreline up to higher elevations of the site.

To prepare a site for placement, a containment berm is constructed by pushing material from the center of the site outward to the edges of the placement footprint. One or two bulldozers are used to construct berms at each site. Woody vegetation may be removed from within the boundary of the dredged material placement site to prep the area for placement. Grassy forbs and shrubs may be covered during site preparations and/or placement of dredged material. A temporary weir system is installed for control of return water, consisting typically of two weirs, each having one 30-inch diameter outfall pipe. The weirs are typically installed and removed after each placement

event. Location of the outfall structures may vary with each placement event, but discharge typically occurs on the channel-ward side of the placement site.

A floating pipeline is used as a conduit for the slurry mixture between the dredge and the upland site, wherein the dredge pumps material directly into the interior of the placement site, pumping the sediment over the containment berm constructed during site preparations. As the slurry is discharged from the pipe, the sand quickly settles out and the water flows across the site before passing through the weir system and back to the river.

Discharged water is controlled by the strategic use of weirs and follows conditions permitted in state water quality certificates, such that as much sediment as possible settles out before water is discharged back to the river to minimize turbidity. Larger upland sites provide more distance/area/time for sediments to settle while the slurry flows across the site. Bulldozers are used throughout the placement process to move both the pipeline and discharged sediments at regular intervals to minimize unintentional mounding on the site. As the level of sand within the site nears berm height, some of the sand is pushed to the edges of the site (using bulldozers) to raise the containment berm and provide additional storage capacity. When placement is complete, all vehicles, piping, and temporary weirs are removed from the site.

BEST MANAGEMENT PRACTICES FOR PLACEMENT SITES

Table 2. Minimization Practices and BMPs for Placement

Measure	Justification	Duration	Management Decision
Ocean Disposal			
Placement in accordance with the site management and monitoring plan.	This action minimizes conflicts with users and impacts to ocean resources.	Continuous during dredging operations.	Maintain until new information becomes available that would warrant change.
Flow Lane Placement			
Placement of material in a manner that prevents mounding of the dredged material.	Spreading the material out will reduce the depth of the material on the river bottom, which minimizes adverse impacts to fish and invertebrate populations.	Life of contract or action.	Maintain until new information becomes available that would warrant change.
Maintain discharge pipe of pipeline dredge at or below 20 feet of water depth during placement.	This measure reduces the impact of placement and increased suspended sediment and turbidity to migrating juvenile salmonids, as they are believed to migrate principally in the upper 20 feet of the water column.	Continuous during placement operations.	Maintain until new information becomes available that would warrant change.
Shoreline Placement			
Grade placement site to a slope of 10 to 15 percent, with no swales, to reduce the possibility of stranding of juvenile salmonids.	Ungraded slopes can provide conditions on the shoreline that will create small pools or flat slopes that strand juvenile salmonids when washed up by wave action.	Continuous during placement operations.	Maintain until new information becomes available that would warrant change.
Upland Placement			
Berm upland placement	This action reduces the	Continuous during	Maintain until new

Measure	Justification	Duration	Management Decision
sites to maximize the settling of fines in the runoff water.	potential for increasing suspended sediments and turbidity in the runoff water	placement operations.	information becomes available that would warrant change.
Maintain 300-foot habitat buffer.	Maintains important habitat functions.	Life of contract or action.	Maintain until new information becomes available that would warrant a change.
Fine deposits should be deep-ripped after dredged material placement has occurred. Future settling area sediments should continue to be graded level or slightly convex to shed water and avoid concentrated low areas.	Prevent formation of wetlands within placement sites.	After placement operations.	Maintain until new information becomes available that would warrant a change.
General Provisions For All Placement			
The contractor, where possible, will use or propose for use, materials that may be considered environmentally friendly in that waste from such materials is not regulated as a hazardous waste or is not considered harmful to the environment. If hazardous wastes are generated, disposal of this material will be done in accordance with 40 CFR parts 260-272 and 49 CFR parts 100-177.	Dispose of hazardous waste.	Life of contract or action.	If material is released, it will immediately be removed and the area restored to a condition approximating the adjacent undisturbed area. Contaminated ground will be excavated and removed, and the area restored as directed. Any in-water discharge will be immediately reported the nearest U.S. Coast Guard Unit for appropriate response.

DREDGED PLACEMENT NETWORK

As mentioned above, the Columbia River Dredged Material Placement Network (Network) is a complex and varied assortment of upland and shoreline placement sites distributed throughout the lower river.

UPLAND AND SHORELINE/BEACH NOURISHMENT DREDGED MATERIAL PLACEMENT SITES

There are currently 25 dredged material placement sites associated with the CR FNC, between RM 3.1 to 105.0. These dredged material placement sites are strategically located throughout the lower Columbia River. Thirteen of the sites are located in Oregon. One site is shared by Oregon and Washington (Rice Island), and the remaining 11 sites are in Washington (see Table 3). There are 21 upland placement sites, two shoreline placement site, and two sites where both upland and shoreline placement occurs.

Table 3. Upland and Shoreline Dredged Material Placement Sites.

Site	State – River Mile	Site Type
West Sand Island	O-3.1	Upland
Rice Island	O/W-21.0	Upland, Sump
Miller Sands	O-23.5	Shoreline
Pillar Rock Island	O-27.2	Upland, Shoreline
Skamokawa - Vista Park	W-33.4	Upland, Shoreline
Welch Island	O-34.0	Upland
Tenasillahe Island	O-38.3	Upland
James River	O-42.9	Upland
Puget Island	W-44.0	Upland, Sump
Brown Island	W-46.3	Upland
Crims Island	O-57.0	Upland
Hump Island	W-59.7	Upland
Lord Island (Upstream)	O-63.5	Upland
Dibblee Point	O-64.8	Upland
Howard Island	W-68.7	Upland
Cottonwood Island	W-70.1	Upland
Northport	W-71.9	Upland
Sandy Island	O-75.8	Upland
Lower Deer Island	O-77.0	Upland
Martin Bar	W-82.0	Upland
Sand Island	O-86.2	Shoreline
Austin Point	W-86.5	Upland
Fazio Sand & Gravel	W-97.1	Upland, In-water
Gateway	W-101.0	Upland
W. Hayden Island	O-105.0	Upland

The narrative below describes the site history, existing environmental baseline conditions, details recent placement events, SHLA use, and human uses at each of the shoreline and/or upland placement sites in the dredged material placement Network for the CR FNC.

WEST SAND ISLAND (O-3.1)

The West Sand Island dredged material placement site is located on the west end of Sand Island. The irregularly shaped island is located in the Columbia River estuary in the southwestern end of Baker Bay and is approximately 530 acres, including approximately 50 acres of intertidal sand flats along the eastern and northern shorelines. Baker Bay is a shallow waterbody, totaling approximately 15 square miles. Sand Island separates the bay from the Columbia River. The island is in the state of Oregon, in Clatsop County.

West Sand Island is used for the placement of dredged material from the Baker Bay side channel, but was historically a low-lying island, rising only a few feet above the high tide line. The Corps has not used the site for placement since 1986. The West Sand Island dredged material placement site (Figure 12) is approximately 83 acres. The site is adjacent to the Baker Bay federal side channel project. Dredged materials from the Baker Bay side channel were historically placed on the site via pipeline.

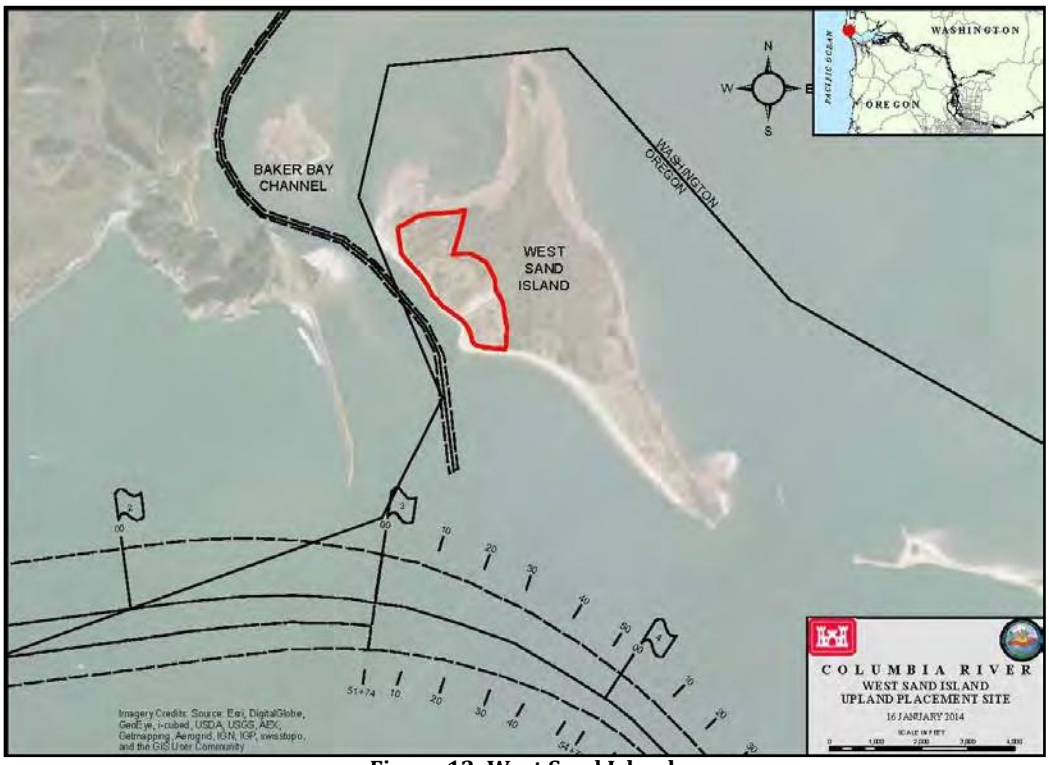


Figure 12: West Sand Island

West Sand Island is owned by the Corps. The estimated site capacity is 2,500,000 CY. Approximately 420,000 CY were placed between 1979 and 1986.

The site's elevations range from 0 feet (MLLW) to approximately 20 feet. There is a containment levee on the southern side of the site. The site is generally level, but slopes from east to west towards the water. No wetland delineation has been conducted on West Sand Island. The site is almost entirely vegetated, primarily with grasses, forbs, and low shrubs. Many low trees are visible in aerial photographs of the placement site, which are likely less than 30 years old. The shoreline is actively disturbed by wave action and does not support vegetation. The site is not designated critical habitat for SHLA. The site has not been assessed for suitable SHLA nesting habitat because of its dense vegetation and no lark surveys have been conducted. The Corps currently estimates that no suitable SHLA nesting habitat is available on the West Sand Island site.

There are two pile dikes that are perpendicular to the western boundary of the placement site. There are three other pile dikes west of the island that help maintain flows for the Baker Bay side channel. A third pile dike extends south from the southern tip of the island into the CR FNC. South of the West Sand Island placement site, native dune-grass communities dominant the southern tip of the island. Non-native plant species may be encroaching on this community. Revegetation of the placement site is restricted to plant species and planting techniques that would not negatively affect the native dune-grass community (CREST DMMP, 2002). The remaining portion of the island is heavily vegetated with low trees, scrub-shrub, and grasses.

RICE ISLAND (O/W-21.0)

Rice Island, which is located in the lower Columbia River estuary, is composed of approximately 365 acres, including approximately 100 acres of intertidal mudflats along the western and northern shorelines. The linear bar island is generally oriented from east-northeast to west-southwest, and it is bisected by the Oregon-Washington state line. The eastern tip of the island is within the State

of Washington. The states of Washington and Oregon own their respective portions of the island. The Harrington Sump is located adjacent to Rice Island, between RM 20 and 22.

Rice Island was created in the past with dredged material from the CR FNC. The Corps has used the site for upland placement of dredged material for several decades. The dredged material placement site (Figure 13) covers approximately 264 acres. The portion of the placement site in the State of Washington is approximately 37 acres; the remaining portion of the placement site in the State of Oregon and is approximately 227 acres. The entire placement site is located from approximate RM 21 to 22.3 and at its closest point, the site is 1,000 ft. north of the CR FNC.

Figure 13: Rice Island

The Port of Portland has 25-year easement with the State of Oregon (Department of State Lands [DSL]) for upland placement of dredged material by the Corps for the portion of the site in Oregon. The Port of Portland's easement from the Oregon DSL expires in 2030. The Washington ports have a 30-year easement with the State of Washington (Department of Natural Resources [DNR]) for upland placement of dredged material by the Corps for the portion of the site in Washington. The Washington ports' easement from the Washington DNR expires in 2037. Dredged material was last placed on the western tip prior to 2000. The Corps placed approximately 1,000,000 CY dredged material in 2002 on the remaining portion of the island in Oregon. In 2012, site preparation work was conducted on the Washington side of the island. In 2013, an estimated 3,350,000 CY of site capacity remained. In 2013, approximately 400,000 CY of dredged materials were placed on the Washington portion of the site.

Almost the entire upland portion of the island is above elevation 10 feet (Columbia River Datum [CRD]), up to 73 feet in the southwest portion of the placement area. The vast majority of the placement site is unvegetated, bare sands. One wetland was delineated in the Rice Island placement area in 2013. Wetland A is a 0.06-acre, palustrine emergent (PEMx) wetland-swale feature is located in the eastern portion of the placement area within the State of Oregon. It is approximately 20 feet above the river in the lowest part of a dredged material-settling basin. Itwas

formed as a depression and connecting swale near the vertical drainpipe. The wetland is dominated by hydrophytic plants, including dune willow, soft rush, Baltic rush, and Lyngbye's sedge. The wetland is fed by direct precipitation and subsurface water from precipitation within the eastern drainage basin area. There is no surface hydrologic connection between the wetland and Columbia River. Uplands immediately adjacent to Wetland A are dominated by broom fescue and silver hair grass, interspersed with thistle, yellow flag iris, blackberry, and clover.

One non-wetland aquatic feature, a 0.29-acre man-made pond, is located in the western settling basin, within the placement area in the State of Oregon. This basin area is used to infiltrate water during the placement of dredged material. This perennial retention pond is more than six feet deep, and it is fed by direct precipitation and runoff within the western drainage basin area. There is no hydrologic surface connection between the pond and Columbia River. Non-native, water milfoil is the dominant submerged aquatic vegetation in the pond.

Several bird species have been observed on the site, with nesting by gulls along the northwest portion of the site in 2013. Approximately 224 acres on the island have been designated as a critical habitat subunit for streaked horned larks. Approximately 219 acres of the placement site overlaps with designated critical habitat. Larks have been observed on this island during recent surveys. In 2013, 22 breeding pairs were recorded by the Center for Natural Lands Management (CNLM) on Rice Island. Based on USFWS information, larks are currently using the 180-acre bowl in the center of the site where placement occurred most recently in 2002. The CNLM estimated that approximately 146 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are approximately 150 acres of suitable SHLA breeding habitat on Rice Island and in the Rice Island critical habitat subunit.

The island's overall elevations range from 0 feet (CRD) at the riverward edge of the mudflats to 73 feet in placement area. The northern riparian edge adjacent to the placement area is dominated by cottonwood trees, Himalayan blackberry, dune willow, and Scotch broom. The northeastern tip of the island is dominated by dune grasses. A second wetland (Wetland B) is located outside the boundary of the Corps' placement area. It encompasses the northwest corner of the island and it is outside the toe of the dredged material placement slope. This approximately four-acre wetland transitions from an intertidal, estuarine emergent (E2EM) wetland to a palustrine, emergent (PEM) wetland. The palustrine portion of the wetland is dominated by Baltic rush, yellow flag iris, *Ludwigia* sp., *Eleocharis* sp., black cottonwood, and dune willow. Wetland B is directly influenced by the ebb and flow of tide and has a continuous hydrologic connection to the Columbia River. Dredged material is not placed in Wetland B on the northwest corner of island, nor along the northern shoreline's riparian edge. Fishermen use the island for shoreline fishing. The island has habitat for waterfowl, shorebirds, and sporadic aquatic mammals on the shores.

MILLER SANDS (O-23.5)

The Miller Sands dredged material placement site (Figure 14) is a horse shoe-shaped shoreline placement site. It forms a spit island in the lower Columbia River estuary, from approximate RM 22.2 to 24.6. The curvilinear site is oriented east to west with a sheltered embayment on the southern side.

Figure 14: Miller Sands

Historically, the site was formed as a flow control structure, approximately three miles long. It was a 90-acre site used primarily for the dredged material placement from the Miller Sands Bar. Currently, the site is approximately 117 acres. At its closest point, the site is approximately 400 feet south of the CR FNC. The Miller Sands site is in Clatsop County, Oregon.

The site is owned by the State of Oregon and the Port of Portland has a 25-year easement with Oregon DSL for placement by the Corps, expiring in 2030. Since the site is continually eroded by river currents, the available placement capacity is not fixed and it varies year to year. Shoreline placement occurred in 2007 on the center portion of the upstream edge, in 2008 on the upper portion of the upstream edge, in 2010 and 2011 on the center of the site, in 2012 on the downstream end of the site and the lower portion of the upstream edge, and in 2013 on the center of the upstream edge. Approximately 150,000 CY were placed in 2013.

The elevations on the site range from 0 feet (CRD) at the waterline to approximately 25 feet along the northern face at the site's midpoint. The site is relatively level, consisting of open sands. No wetland delineation has been conducted on the Miller Sands site. Beach grass, sparse shrubs, herbaceous plants, and trees form the southern edge of the site. Approximately 123 acres are designated as s critical habitat subunit for streaked horned larks at this island. Larks have been observed on this island during recent surveys. In 2013, five breeding pairs were recorded by the CNLM on Miller Sands. The CNLM estimated that approximately 29 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are zero (0) acres of suitable SHLA nesting habitat on Miller Sands due to vegetative succession on the site.

The embayment south of Miller Sands site is sheltered from the mainstem flows by the placement site. The embayment has a network of mud flats, tidal marsh, and sub-tidal waters and provides high value habitat for foraging shorebirds, waterfowl, eagles, other birds, and aquatic mammals. A secondary island is also located south of the site, separated by a narrow, tidal channel at the

upstream end of the placement site. The secondary island is vegetated with numerous trees, shrubs, and grasses.

PILLAR ROCK ISLAND (O-27.2)

Pillar Rock Island, which is in the Columbia River estuary, is a dredged material placement site for upland and shoreline placement. The linear island is oriented east to west and it is within the Lewis and Clark National Wildlife Refuge.

Historically, the island was a shoal and past placement practices in the 1980s and 1990s increased the island elevations. The current dredged material placement site (Figure 15) on the island is approximately 52 acres. Pillar Rock Island is in Clatsop County, Oregon. The site is located from approximate RM 26.8 to 28. At its closest point, the island is approximately 1,100 feet south of the CR FNC.

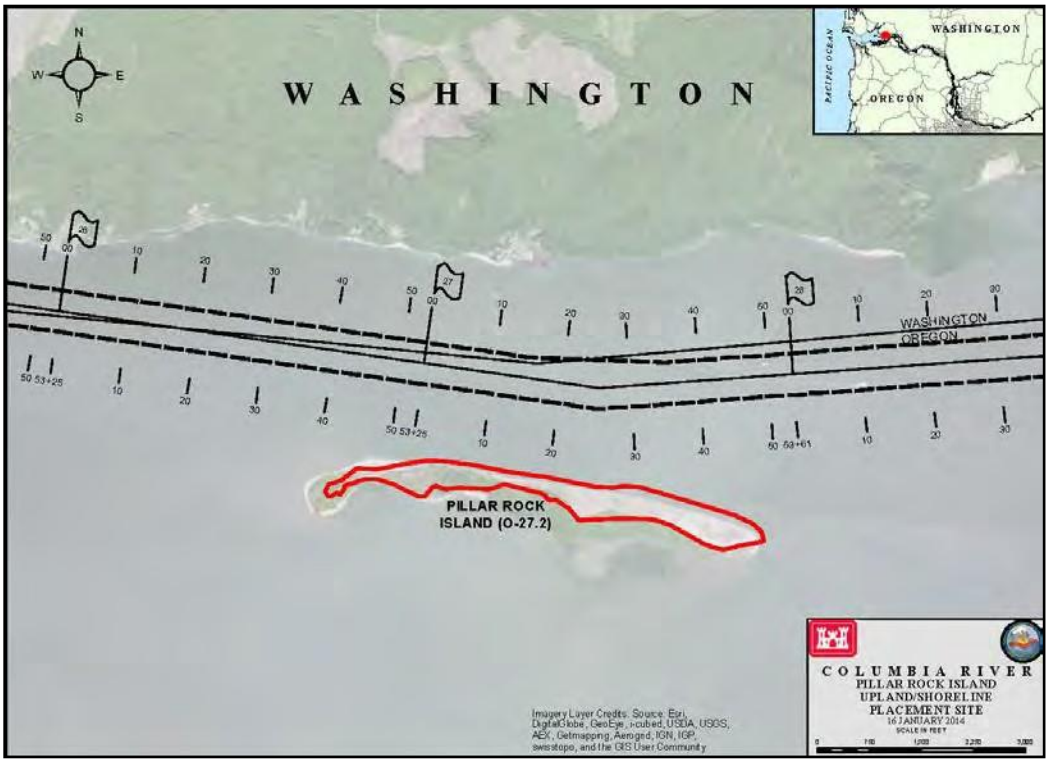


Figure 15: Pillar Rock Island

The site is owned by the State of Oregon and the Port of Portland has a 25-year easement with Oregon DSL for placement by the Corps. The Port of Portland's easement from the Oregon DSL expires in 2030. The Corps placed material on the downstream and middle portions of the site in 2000 and on the upstream quarter of the site in 2001. Approximately 250,000 CY were placed in 2001. In 2003, the estimated upland site capacity for placement of dredged material was 2,555,000 CY. Since the site is continually eroded by river currents, the site's available capacity is not fixed and it varies year to year. Between 2003 and 2013, approximately 32% of Pillar Rock Island eroded away, primarily from the north side of the island.

The elevations on the island range from 0 feet (CRD) at the low waterline to approximately 30 feet on the northern bank. Steep 10 to 25 feet banks exist along portions of the island but the island interior is relatively level. Two pile dikes extend north from the downstream portion of the island. Much of the placement site is covered in sandy dredged material. Stands of young cottonwoods, scattered shrubs, and forbs with grasses are visible on the island. The presence of vegetation is due

to Corps limited use of the site in the past five years. The upstream edge of the island has eroded away. Approximately 44 acres of Pillar Rock Island have been designated as a critical habitat subunit for streaked horned larks. Larks have been observed on this island during recent surveys. In 2013, two breeding pairs were recorded by then CNLM on Pillar Rock Island. The CNLM estimated that approximately two acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are less than four acres of suitable SHLA nesting habitat on Pillar Rock Island site and within the critical habitat subunit due to natural erosion of the shoreline and vegetation succession.

There are approximately 50 acres of tidal flats and marsh located outside the placement site, along the southern side of the island. These aquatic habitats have developed over time due to the wind and current protection provided by the placement area. The island and tidal wetlands are used by waterfowl during the fall and winter and aquatic mammals throughout the year. Mudflats and intertidal marsh areas are used by shorebirds.

SKAMOKAWA-VISTA PARK (W-33.4)

The Skamokawa-Vista Park, which is located in the upper Columbia River estuary, is a multi-use county parcel. The park is on the northern bank of the Columbia River, at RM 33.4, downstream of Skamokawa Creek.

Historically, the dredged material placement site was used for several years and was then developed into a county park. The current placement site (Figure 16) is approximately 15 acres and it is approximately 2,400 feet long. The site is currently used as a shoreline and upland placement site from which materials are excavated by others. The site is located in Wahkiakum County, Washington. At its closest point, the site is approximately 200 feet northeast of the CRFNC.

Figure 16: Skamokawa-Vista Park

The site is owned by the Port of Wahkiakum II and the other Washington ports are pursuing a multi-year easement for placement by the Corps. Since the riverward portion of site is continually

eroded by river currents and the upland area has sand removal activities by others, the site capacity is variable year to year. In 2012, approximately 150,000 CY were placed over the entire site.

The elevations on the site range from 2 feet (CRD) at the waterline to approximately 22 feet at the highest point in the site's center. The site has a steep 10 to 12 foot edge on the upstream portion of the site that is adjacent to an open area of the park. The downstream portion of the site has a gentle slope from the waterline to the landward edge of the site, adjacent to a forested edge of the park. Minimal wildlife use is associated with the site due to the human recreational use of the park and limited available habitat. The site is not designated as critical habitat for streaked horned larks. The CNLM habitat analysis estimated that approximately five acres of suitable lark breeding habitat existed on the site in 2011. The site was surveyed for larks in 2013 by CNLM, but no individuals were observed. Despite the suitable habitat that was mapped from the 2011 CNLM data, the Corps assumes that no suitable habitat is available for SHLA nesting Skamokawa-Vista Park due to the amount of human activity that occurs on the site from commercial sand extraction. The adjacent park and forestlands are used by songbirds and small mammals.

WELCH ISLAND (O-34.0)

Welch Island, which is located in the upper end of the Columbia River estuary, is approximately 950 acres with multiple interior waterways. Welch Island and Tenasillahe Island form a discontinuous island, separated by a narrow waterway called Multnomah Slough. Welch Island is within the Lewis and Clark National Wildlife Refuge.

Historically, the Corps' placement area on Welch Island was used for both upland and shoreline placement of dredged materials. Currently, the Corps utilizes a 41-acre area (Figure 17) for upland placement on the northeast bank of Welch Island in Clatsop County, Oregon. The site is located from approximate RM 33.5 to 34.5. At its closest point, the site is approximately 2,800 feet southwest of the CR FNC.

Figure 17: Welch Island

The site is owned by the State of Oregon. The Port of Portland acquired a 25-year easement with Oregon DSL for upland placement by the Corps which expires in 2030. In 2003, the estimated site capacity for placement of dredged material was 400,000 CY. The most recent action by the Corps was the placement of approximately 400,000 CY over 40 acres in 2008. In 2013, the revised site capacity was 700,000 CY.

The elevations on the Corps' placement site range from 0 feet (CRD) at the low waterline to approximately 36 feet along the face of the downstream portion. The site is generally level, but gently increases in elevation from upstream to downstream. The majority of the Welch Island placement site is devoid of vegetation. A few scattered shrubs and grasses are visible in the central portion of the site. The landward (southern) boundary of the site is a forested riparian edge. The shoreline of the placement site is utilized by foraging shorebirds. Approximately 43 acres, including the placement site, have been designated as a critical habitat subunit for streaked horned larks. In 2012, one breeding pair was recorded but no birds were observed by CNLM during 2013 survey efforts. The CNLM estimated that approximately 10 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are 10 acres of suitable SHLA nesting habitat on Welch Island and within the critical habitat subunit. In March 2009, the USFWS funded habitat restoration trials on Welch Island, which involved tilling plots of land on the upstream quarter of the site. The Corps is not aware of any further actions on the site.

The remainder of Welch Island, outside of the placement site, ranges from 4 feet to 12 feet. The majority of Welch Island outside the Corps placement site is dominated by tidal scrub-shrub and emergent wetlands. The adjacent wetlands on Welch Island provide high-quality wildlife habitats for birds and aquatic mammals.

TENASILLAHE ISLAND (O-38.3)

Tenasillahe Island, which is located in the upper end of the Columbia River estuary, is approximately 2,050 acres. Tenasillahe Island is generally heart-shaped and it is approximately 2.8 miles long by 1.7 miles wide. Tenasillahe Island is separated from the Oregon mainland by Clifton Channel. Tenasillahe Island is within the Julia Butler Hansen National Wildlife Refuge for Columbian white-tailed deer.

Historically, the Tenasillahe Island placement site was a shoreline placement site. Currently, the Corps utilizes a 41-acre site (Figure 18) on the southeastern, upstream tip of the island for upland placement. This tip of the island encompasses approximately 105 acres and is separated from the rest of Tenasillahe Island by a narrow tidal flat. The placement site is located from approximate RM 37.9 to 38.4, in Clatsop County, Oregon. The site is generally oriented south to north and at its closest point, it is approximately 1,000 feet west of the CR FNC.

Figure 18: Tenasillahe Island

The site is owned by the State of Oregon and the Port of Portland has a 25-year easement with Oregon DSL for placement by the Corps, which expires in 2030. The downstream portion of the site was last used for placement prior to 2000. In 2003, the estimated site capacity for placement of dredged material was 2,300,000 CY. In 2012, material was placed in the remaining upstream portion of the site, excluding an area where streaked horned larks were nesting in 2012. In 2013, the revised site capacity was 1,270,000 CY. In 2013, 300,000 CY of material were placed on the upstream portion of the site, excluding an area where larks were nesting in 2013. The 2013 lark nesting location was different from the 2012 location.

The elevations on the Corps' placement site range from 5 feet (CRD) at the low waterline to approximately 38 feet in southern portion of the site. The site is generally level, but gently slopes from upstream to downstream. A pile dike is located off the southeast corner of the site.

The northern portion of the site is dominated by grasses, but has a row of shrubs and trees in the center. The western and northern boundary of the site is bound by trees that transition to an adjacent tidal wetland and marsh. One 0.17-acre wetland was delineated in the northeast portion of the placement site. The wetland is classified as a palustrine shrub scrub (PSS) wetland-swale that is hydrologically connected to Columbia River during periodic high river flows. The dominant wetland vegetation is dune willow, red-osier dogwood, reed canary grass, and cocklebur. The adjacent upland vegetation with the placement area is dominated by scotch broom, blackberry, and silver hair grass, interspersed with thistle. The bank area provides a narrow foraging area for wading and shorebirds. The western site boundary of trees and shrubs provides additional riparian habitat for birds, small mammal, and other wildlife. Approximately 23 acres of the island has been designated as a critical habitat subunit for streaked horned larks. Larks have been observed on this island during recent years, but were not observed in 2013 CNLM surveys. In 2012 and 2013, one breeding pair was recorded by the Corps on Tenasillahe Island. The CNLM estimated that approximately 11 acres of suitable lark breeding habitat existed on the site in 2011. The Corps

currently estimates that there are three acres of suitable SHLA nesting habitat on Tenasillahe Island and two acres within the critical habitat subunit due to placement activities in 2012 and 2013. Bald eagles were historically known to nest near the Tenasillahe Island placement site.

JAMES RIVER (O-42.9)

The James River site, which is on the south bank of the Columbia River and immediately downstream of the lower entrance to Westport Slough, is located near RM 42.9 of the Columbia River. The site (Figure 19) is irregularly shaped and has an access road from State Highway 30 that crosses the Portland and Western Railroad. The site is in Clatsop County, Oregon.

Figure 19: James River

Historically, the site was used as an upland placement area for dredged material from federal navigation channels. Trees were removed in the past by the owner to expand the site to its current extent of 53 acres. The upland placement site is privately owned and actively used for commercial sand removal. At its closest points, the Corps' upland placement site is approximately 400 feet south of the CR FNC and approximately 600 feet west of the Westport Slough and Wahkiakum Ferry FNCs.

The site is owned by a private landowner and the Port of Portland has a 20-year easement for placement by the Corps, which expires in 2027. The Corps has not used the site since before 2000. In 2003, the estimated site capacity for placement of dredged material was 1,280,000 CY. In 2013, the revised site capacity was 1,350,000 CY.

The elevations on the placement site range from 10 feet (CRD) in the unused portions of the site to 30 feet along the top of the containment berm. The berm extends along the western, southern, and eastern boundaries of the 53-acre site. The recently used or disturbed portions of the site are bare sand, while the remaining portions of the site are covered in grasses and shrubs. Much of the site has been actively graded and leveled due to use by others and the Corps' placement of dredged materials. The site provides limited wildlife habitat due to its frequent use and disturbance by the

landowner. The site is not designated critical habitat for streaked horned larks and it has not been surveyed due to expected low habitat value and frequent site disturbance. The CNLM estimated that approximately 14 acres of suitable lark breeding habitat existed on the site in 2011. However, the Corps assumed that no suitable SHLA nesting habitat is available at James River because of the amount of human activity and commercial sand extraction that occurs.

The Columbia River is the northern site boundary and the railroad is the southern boundary. An open grassy area is adjacent to the northwest portion of the site and the remaining adjacent lands area forested. The adjacent upland habitats are used by songbird, deer, and small mammals.

PUGET ISLAND (W-44.0)

Puget Island, which is located in the lower Columbia River, is approximately 4,785 acres and it is oriented southeast to northwest. Cathlamet Channel separates Puget Island from the Washington shoreline. Puget Island has multiple sloughs and several smaller islands along its perimeter. The majority of Puget Island is protected by levees that sever direct hydrologic surface connections for the interior sloughs. Puget Island is entirely within the State of Washington.

Historically, the Puget Island site has been in agricultural use. The Puget Island upland placement site (Figure 20) is located in the southern interior of Puget Island, near RM 44. The Corps' 96-acre placement site (approximately 2 % of the entire island) is bound by East Sunny Sands Road to the south and agricultural fields on the remaining sides. The roughly rectangular site is in Wahkiakum County, Washington. At its closest point, the Corps' placement site is approximately 2,000 feet north of the CR FNC. The Puget Island Sump (Figure 8) is located immediately south of the placement site, between RM 44 and 45.

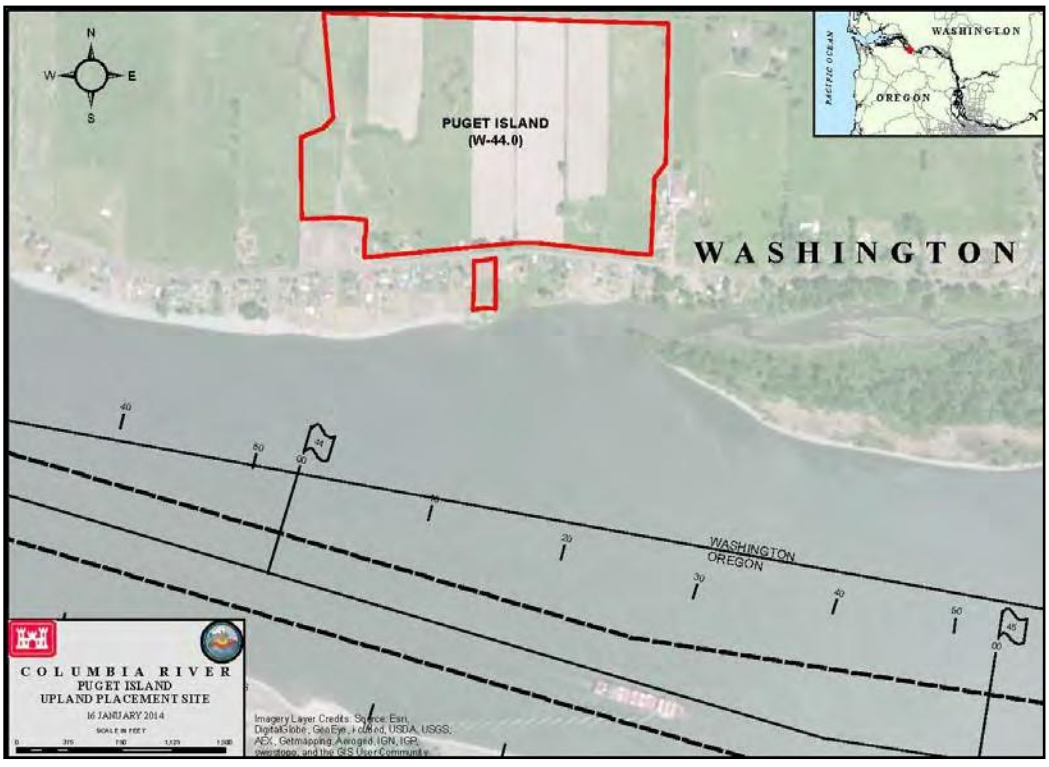


Figure 20: Puget Island

The site is composed of six contiguous properties, five of which are owned by ports in Washington and one by a private landowner. The Corps has 20-year right of entry (ROE) agreements for the five properties owned by the Washington ports, expiring in 2025 or 2030. The Washington ports

are currently in negotiation for access to the private property. As required by the Ports' the pending easement, the site will be reseeded with grass after each placement. Trees will be planted along the perimeter of the site to prevent wind erosion of the sand onto adjacent properties. The landowner may lease the site for cattle between placement events. The Corps has not placed material at the site. In 2013, the site capacity was 3,500,000 CY.

The sites elevations range from 5 feet to 10 feet (CRD) across the site. East Sunny Sands Road, south of the site, is a levee with a road top elevation of 16 feet. The site is generally flat due to agricultural practices. The site is partitioned by narrow fence lines that have scattered shrubs along their lengths. Farmed wetlands are known on the site and account for approximately 5.4 acres. The upper end of Gilbertson Slough extends west from the site. Due to existing levees, the site does not have a direct hydrologic surface connection to the Columbia River. The site has limited wildlife habitat value beyond foraging of croplands by birds and small mammals. The site is not designated critical habitat for streaked horned larks and has not been surveyed for larks. The CNLM estimated no suitable SHLA breeding habitat existed on the site in 2011 due to ongoing agricultural activities. The Corps currently estimates that there is no suitable SHLA nesting habitat on Puget Island.

The adjacent parcels are active farm lands and have limited wildlife habitat values. Deer, songbirds, raptors, waterfowl, and small mammals utilize the adjacent agricultural lands for foraging and resting.

BROWN ISLAND (W-46.3)

Brown Island is located off the upstream end of Puget Island in the Columbia River and is approximately 170 acres. Brown Island is currently connected to Whites Island but they are separated from Puget Island by Cut-Off Slough.

Historically, the placement site was a shoreline extension to Brown Island to reduce downstream erosion and to provide an upland placement area on the upstream end. This work was done to promote wildlife use in the created uplands. The Corps' upland placement site (Figure 21) currently encompasses 102 acres on the upstream portion of Brown Island. The site is from RM 45.8 to 46.9, in Wahkiakum County, Washington. At its closest point, the upland placement site is approximately 1,200 feet north of the CR FNC.

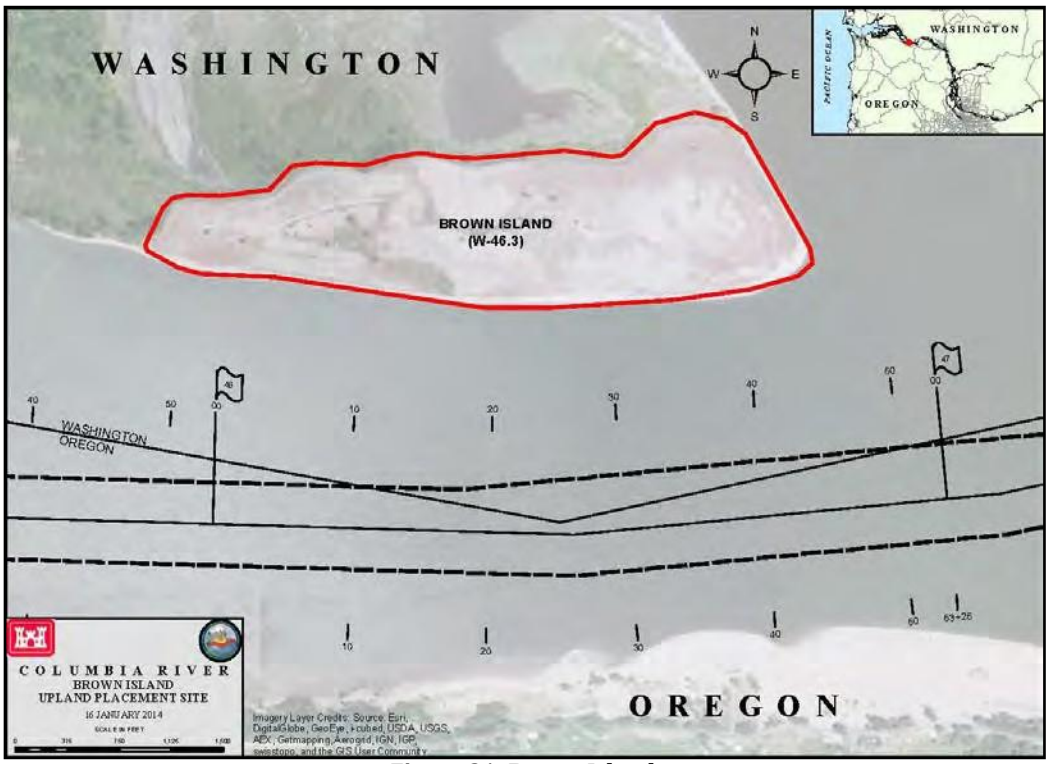


Figure 21: Brown Island

The site is owned by the State of Washington and the Washington ports have a 30-year easement with Washington DNR for placement by the Corps expiring in 2037. In 2003, the estimated site capacity for placement of dredged material was 4,700,000 CY. Material was placed on the entire site footprint in 2006. In 2011, 200,000 CY of material was placed in the upstream portion of the site. In 2013, the site capacity was 4,700,000 CY.

The elevations on site range from 5 feet (CRD) at the low water line to 50 feet in the west-central portion of the site and 56 feet at the upstream bank. The perimeter of the site has steep banks of 10 to 40 feet in height. The upstream portion of the site is bare sand while the lower third is vegetated with sparse grasses. A few scattered shrubs are visible in the central portion of the site. Waterfowl have nested on the upland portion of the site. Approximately 98 acres of the island have been designated as a critical habitat subunit for streaked horned larks. Larks were observed on this island during CNLM surveys. In 2013, 23 breeding pairs were recorded on Brown Island. The CNLM estimated that approximately 61 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are 72 acres of suitable SHLA nesting habitat on the site and the critical habitat subunit.

The adjacent portions of Brown Island have elevations of 5 to 15 feet (CRD). Wetlands and several tidal channels occur north and west of the placement site. The marsh habitats are used for foraging, resting, and rearing young waterfowl.

<u>CRIMS ISLAND (O-57.0)</u>

Crims Island is located in a bend of the lower Columbia River and it is separated from the Oregon shoreline by Bradbury Slough. Gull Island is located on the northern (downstream) end of Crims Island. Crims Island is dissected by several natural and manipulated waterways.

Historically, this site was used as a beach nourishment site on a former sand spit to shelter adjacent wetlands on Crims Island. The Corps' 59-acre, upland placement area (Figure 22) is oriented

southeast to northwest, upstream of Crims Island. The placement area is separated from Crims Island by a narrow channel. The placement area is located from approximate RM 56 to 57, in Columbia County, Oregon. A pile dike protects the upstream end of the placement area. Three short pile dikes extend perpendicular from the northeastern shore of the placement site. At its closest point, the upland placement site is approximately 2,400 feet southwest of the CR FNC.

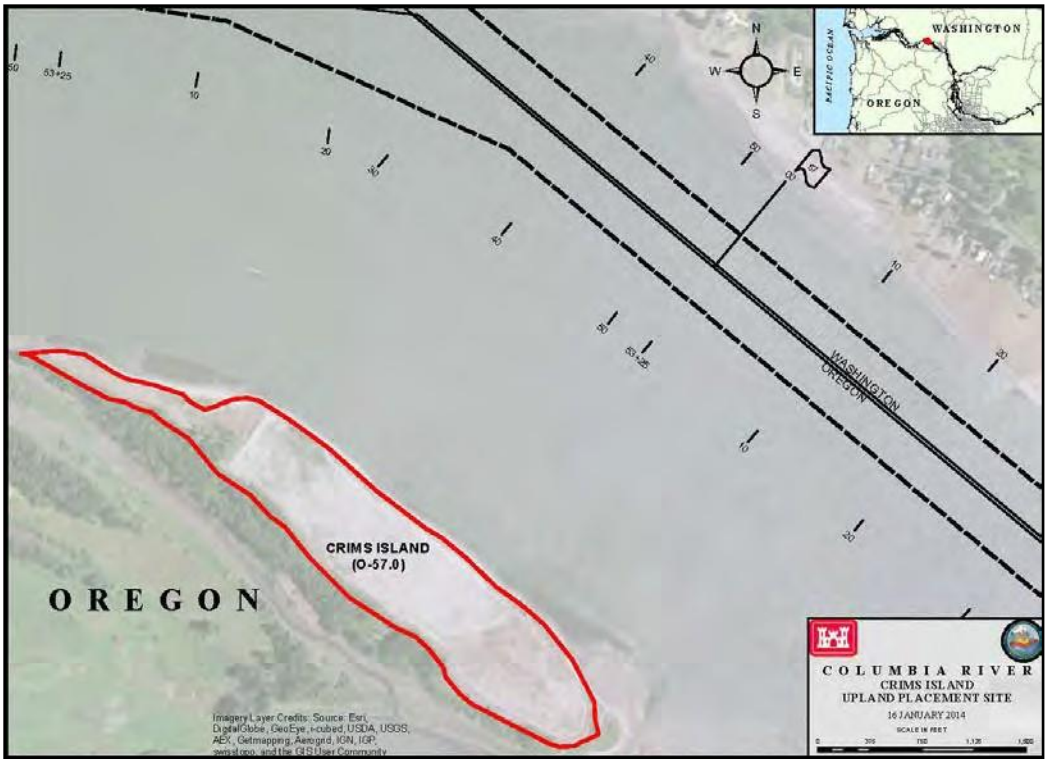


Figure 22: Crims Island

The site is owned by the State of Oregon and the Port of Portland has a 25-year easement with Oregon DSL for placement by the Corps. The Port of Portland's easement from the Oregon DSL expires in 2030. The downstream third of the site has not had material placed since before 2000. In 2003, the estimated site capacity for placement of dredged material was 1,600,000 CY. In 2008, the upper two thirds of the site received dredged materials. In 2010, approximately 250,000 CY of dredged materials were placed in the upstream end of the site. In 2013, the revised site capacity was 880,000 CY.

The elevations on site range from 5 feet (CRD) at the low waterline to 40 feet in the center of the site. The downstream (west) portion of the site tapers to a point and it has a level elevation of 12 feet. The downstream, tapered portion of the site is vegetated with grasses and herbaceous cover, and a few shrubs and trees. The 40-foot high center of the site is relatively flat. The upstream portion of the site is concave from 38 feet at its edge down to 20 feet in the center. The central and upstream portions of the 59-acre site are largely bare sand with very little vegetation and scattered shrubs. Known wildlife use of the site includes waterfowl and shorebirds. Approximately 60 acres of the island are a designated critical habitat subunit for streaked horned larks. Larks have been observed on this island during recent USFWS-sponsored surveys and in 2013, at least two breeding pairs were recorded on Crims Island. The CNLM estimated that approximately 25 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are 25 acres of suitable SHLA nesting habitat on placement site and critical habitat subunit.

The adjacent land, west of the site, is forested, with an elevation of approximately 16 feet. This forested area is densely covered with cottonwood trees and it has a marshy margin along the narrow channel. Nearby eagle nests are known on Crims Island and Gull Island. Shorebirds and waterfowl use both islands.

HUMP ISLAND (W-59.7)

Hump Island, which is located in the middle reach of the lower Columbia River, is approximately 77 acres. The linear island is oriented from southeast to northwest. The southeastern end of Hump Island is connected to Fisher Island by mudflats and vegetated lowlands. Hump Island is south of Fisher Island, separated by a shallow lagoon. Fisher Island Slough is a side channel of the Columbia River that separates Fisher Island from the Washington shoreline.

Historically, the Hump Island site had extensive placement activities since it acts as a flow control structure. As a properly functioning flow control structure, Hump Island minimizes the need for maintenance dredging of the CR FNC. Repeated upland placement and grading is necessary to maintain proper functioning. The Corps' 65-acre placement area (Figure 23) covers the riverward shore and inland area of Hump Island from its downstream (northwest) end to the island's upstream connection with Fisher Island. The site is in Cowlitz County, Washington, from RM 58.6 to 60.3. At its closest point, the Corps' upland placement site is approximately 500 feet north of the CR FNC.

Figure 23: Hump Island

The site is owned by the State of Washington and the Washington ports have a 30-year easement with Washington DNR for placement by the Corps, which expires in 2037. No materials have been placed on site since before 2000. In 2003, the estimated site capacity for placement of dredged material was 1,500,000 CY. In 2013, the revised site capacity was 550,000 CY.

The elevations of the placement site range from 10 feet (CRD) at the low water line to 30 feet at the downstream end. The site is vegetated with grasses, woody shrubs, saplings, and trees. Dominant

vegetation includes Scotch broom, cottonwood, blackberry, barnyard grass, and brome grasses. No wetlands were delineated within the Corps placement site in 2013. Fishermen use the site for shoreline fishing. Hump Island is not designated as critical habitat for streaked horned larks and it has not been surveyed recently due to the lack of open habitat larks prefer. The CNLM estimated that no suitable SHLA breeding habitat existed on the site in 2011 due to extensive vegetation and the Corps currently estimates that there is no suitable SHLA nesting habitat on Hump Island. The placement area provides avian and mammal terrestrial habitats.

The 10-acre riparian area on the backside (north) of the island ranges in elevation from 0 to 15 feet (CRD). The riparian area is densely vegetated and dominated by trees, shrubs, and blackberries. Tidally and non-tidally influenced forested wetlands were observed north of the riparian buffer. Historically, waterfowl and eagle nesting are known to occur near the site. The lagoon between the islands provides avian foraging habitat, as well as tidal and sub-tidal aquatic habitats for fish and small mammals.

LORD ISLAND UPSTREAM (O-63.5)

Lord Island, which is located in the middle reach of the lower Columbia River, is approximately 415 acres, excluding intertidal mudflats along the northwestern shorelines of the island. A 2,000-foot long pile dike runs parallel to the upstream end of the island, approximately 200 ft from shore. Lord Island is oriented from southeast to northwest.

Historically, the Lord Island placement site was an upland site that became vegetated with alder and cottonwoods. The current 24-acre upland dredged material placement site, Lord Island Upstream, (Figure 24) is situated on the southern-most tip of the island across from Longview, Washington. The site is located from approximately RM 63.4 to 63.8, in Columbia County, Oregon. At its closest point, the site is approximately 750 feet southwest of the CR FNC.

Figure 24: Lord Island Upstream

This island is owned by the State of Oregon and the Port of Portland has a 25-year lease with Oregon DSL for placement by the Corps, which expires in 2030. In 2003, the estimated site capacity for placement of dredged material was 1,500,000 CY. In 2009, approximately 200,000 CY of material was placed over the entire footprint. In 2013, the revised site capacity was 550,000 CY.

The dredged material placement site elevations range from 10 feet (CRD) at the low waterline to 56 feet at its high peak. Steep 20 to 40 foot banks drop off along the edges of the site to the Columbia River. The interior of the dredged material site slopes to the island profile adjacent to the dredged material placement site. The placement site's riparian edges are primarily vegetated with cottonwood trees. The vast majority of the Lord Island Upstream site is unvegetated, bare sands. Patches of Himalayan blackberry, dune willow, and Scotch broom populate the sandy interior parts of the dredged material placement site. The eastern tip of the site is dominated by dune grasses. An established riparian forest lies to the west and northwest boundary of the dredged material placement site. The island is not designated critical habitat for streaked horned larks and has not been surveyed for larks. The CNLM estimated that approximately four acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are 10 acres of suitable SHLA nesting habitat on the Lord Island Upstream site.

The remainder of Lord Island, aside from the dredged material placement site, is covered with riparian forest and shallow channels. The island is used for fishing access and waterfowl, foraging and resting.

DIBBLEE POINT (O-64.8)

The Dibblee Point peninsula is on the southern bank of the Columbia River, in Columbia County, Oregon. The point was created from dredged material placement. The artificial peninsula has been heavily modified over time by land clearing, dredged material placement, and excavation activities. Portions of the peninsula have been undisturbed and are vegetated with mature trees and shrubs.

The entire Dibblee Point peninsula was historically used for placement of dredged material. Currently, the approximately 52-acre placement site is used as an upland placement and borrow site. An approximately 500-foot long pile dike runs perpendicular out from the dredged material placement site. The site (Figure 25) is between RM 64 and 65, downstream of Rainier, Oregon. At its closest point, the site is approximately 650 feet southwest of the CR FNC.

Figure 25: Dibblee Point

The site is owned by the State of Oregon and the Port of Portland has a 25-year lease with Oregon DSL for placement by the Corps expiring in 2030. In 2003, the estimated site capacity for placement of dredged material was 2,235,000 CY. In 2009, 1,500,000 CY of the material was placed over the entire site. The site was last used in 2010 for placement of 1,000,000 CY of material from the CRCIP. Since the site is an active borrow site, its long-term capacity varies as material is removed by others.

The elevations on the site range from 10 feet (CRD) at the waterline to 65 feet in the western portion of the placement area. The southwest corner of the property is utilized by a sand and gravel mining operation. Dibblee Point has high levels of human activity and is sparsely vegetated with grasses with some shrubs clustered throughout the site. The west, south, and east perimeters of the current site boundary are comprised of well established stands of hardwoods. The site is not designated as critical habitat for streaked horned larks. The site was surveyed for larks in 2013, but none were observed by the CNLM. The CNLM estimated that approximately one acre of suitable lark breeding habitat existed on the site in 2011. However, the Corps assumes that no suitable nesting habitat occurs at Dibblee Point because sand extraction activities preclude site use by SHLA.

Outside of the placement site boundary, the ground surface slopes downhill from the center of the peninsula to the Columbia River on the north and towards a backwater slough to the south. Portions of this peninsula are heavily vegetated with mature cottonwoods, while other areas contain wetlands and pond areas. There is a tidal marsh to the south of the buffer of cottonwoods and willows. The peninsula shoreline is used for fishing access, while the backwater slough is used for waterfowl resting.

HOWARD ISLAND (W-68.7)

Howard and Cottonwood Islands were combined into an approximately 950-acre island during dredging and placement activities following the Mount St. Helen's eruption. This larger island extends from RM 68.2 to 71.7 of the Columbia River. The island is composed of two placement

areas, Howard Island and Cottonwood Island, as well as forests, shrub lands, wetlands, ponds, and several waterways. A disturbed area is largely a dredged material placement site, with approximately 500 acres of exposed sand or sand covered by a layer of moss and lichen. Carrolls Channel, on the northern and eastern sides of the larger island, separates the island from the Washington shoreline.

Historically, the Howard Island site was used as an upland and beach nourishment site. This site has been used for approximately 50 years. Currently, the Corps has a 315-acre site (Figure 26) for upland placement on the downstream end of the larger island. The Howard Island Site is located from RM 68.2 to 70, in Cowlitz County, Washington. At its closest point, the site is 450 feet northeast of the CR FNC.

Figure 26: Howard Island

The site is composed of two parcels, separately owned by the Washington ports and the State of Washington. The Corps' 20-year ROE agreement for the ports-owned parcel expires in 2033. The Washington ports have a 28-year easement with Washington DNR for the State's parcel for placement by the Corps that expires in 2037. In 2003, the estimated site capacity for placement of dredged material was 6,400,000 CY. Approximately 200,000 CY of material was placed on the downstream side of Carrolls Channel in 2007. The remainder of the site has not been used since prior to 2000. In 2013, the revised site capacity was 2,700,000 CY.

The site elevations range from 10 feet (CRD) at the waterline to 50 feet at the downstream tip of the site. Although the site slopes from northwest to southeast based on past placement efforts, it is uniformly level along certain reaches. There are steep banks (20 ft banks) that drop off to the Columbia River and Carrolls Channel. The vegetated area consists of mixed deciduous habitat. A lowland area with a pond and wetlands are located adjacent to the northwestern site boundary and Carrolls Channel. A small drainage channel runs north from the pond into the channel. The wetland area is avoided during placement activities. The island is not designated as critical habitat for streaked horned larks and has not been surveyed for larks. The CNLM estimated that

approximately seven acres of suitable lark breeding habitat existed on the Howard and Cottonwood sites, combined, in 2011. The Corps currently estimates that there are five acres of suitable SHLA nesting habitat on Howard Island. The site is used by deer, songbirds, and small mammals.

Forests, wetlands, and a former, inactive placement area abut the placement site's northeastern and eastern boundary. There are several ponds situated on the island near the site. Eight pile dikes are situated along the Columbia River side of the island, and other navigation aids and groins are distributed along the shoreline. The Corps also maintains a 110-acre wildlife mitigation site on Port-owned lands in the center of the Howard-Cottonwood Island that was constructed as part of the 43-foot Columbia River channel improvement project in 2011. The wildlife mitigation site includes tree and shrub plantings and wetland habitat. In 2012, the USFWS planted about 16 acres of forage grass for Columbian white-tailed deer on Port-owned lands outside the placement area. While there is no direct access to the island, the area is not closed to the public and it is commonly used as a recreational site for camping and fishing. Bald eagles nest on the island and the waters around the island are regularly used for waterfowl hunting.

COTTONWOOD ISLAND (W-70.1)

As described in the Howard Island narrative, Cottonwood and Howard Islands were combined into one island following emergency dredging in the wake of the Mount St. Helens eruption. Historically, the Cottonwood Island site was a beach nourishment site prior to the Mount St. Helens placement. The site has been continuously used for placement and the Corps currently uses the 62-acre site (Figure 27) for upland placement on Cottonwood Island. The site is located on the interior of the island, at the upstream end of the larger island. The Cottonwood Island site is located from RM 70.5 to 71.5, in Cowlitz County, Washington. At its closest point, the site is approximately 600 feet east of the CR FNC.

Figure 27: Cottonwood Island

The site is owned by Washington ports and is available for placement by the Corps. The Corps' 20-year ROE agreement from the Washington ports expires in 2027. In 2003, the estimated site capacity for placement of dredged material was 3,200,000 CY. In 2008, approximately 1,400,000 CY of material was placed on the upstream half of the site. In 2013, the revised site capacity was 640,000 CY.

The elevations on the site range from 20 to 30 feet (CRD) in upstream half of the site to 30 to 60 feet in the downstream portion of the site. Unlike Howard Island, the Cottonwood Island site does not abut the Columbia River or Carrolls Channel. The island is not designated as critical habitat for streaked horned larks. The downstream portion of the site has a few stands of trees but it is largely covered by grasses, mosses, and lichens. The elevated, upstream portion of the site is covered by grasses, mosses, and lichens. Surveys were conducted by CNLM staff in 2010 and no SHLA were detected, even though the vegetation structure appeared adequate to support breeding larks. The CNLM estimated that approximately seven acres of suitable lark breeding habitat existed on the combined Howard and Cottonwood island sites in 2011. The Corps currently estimates that there is no suitable SHLA nesting habitat on Cottonwood Island. Larks are not expected to utilize the site for nesting due to the trees that surround the placement site. Waterfowl are known to rest on the site and the site is used by deer, songbirds, and small mammals. In 2012, the USFWS planted forage grass for Columbian white-tailed deer on a portion of the site filled in 2008.

Forests and open lands abut the placement site. There are steep banks dropping to both the Columbia River and Carrolls Channel along the upstream reaches of this island. The island has some beacons and five timber pile dikes adjacent to or on the site. There are visible trails, but no developments are on the island other than the Corps wildlife mitigation site discussed in the Howard Island narrative above. There is no direct access to the island, but recreational camping and fishing has been observed. Bald eagles nest on the island and the waters around the island are used for waterfowl hunting.

NORTHPORT (W-71.9)

The Northport placement site is on a peninsula contiguous with the Port of Kalama. The peninsula is located on the eastern shore of the Columbia River from RM 71.7 to 72.2. The Port's developed land is from the upstream entrance to Carrolls Channel south to the Kalama River. This area includes the Port of Kalama's waste water treatment area, open industrial land, and an active industrial dock.

Historically, the Corps used the Northport site as a shoreline placement area. The Corps has a 31-acre site (Figure 28) for upland placement from which others borrow placed materials. The site is on the downstream end of the Port's property, in Cowlitz County, Washington. At its closest point, the site is approximately 1,000 feet west of the CR FNC.

Figure 28: Northport

The site is owned by the Port of Kalama and is available for placement by the Corps. The Corps' 20-year ROE agreement from the Port of Kalama expires in 2024. In 2003, the estimated site capacity for placement of dredged material was 900,000 CY. Approximately 500,000 CY of material was placed on 27 acres of the site in 2008. In 2013, the revised site capacity was 200,000 CY.

The elevations on the site range from 10 feet (CRD) to 41 feet. The western, riverward site boundary is 30 to 20 feet above the river. The site is used by others to excavate placed dredged materials during which the property is routinely traversed by vehicles and heavy equipment. A relic weir remains on the site, surrounded by dense Scotch broom. Portions of the site are covered in sparse moss, grasses, and lichens, as well as excavated bare areas. Streaked horned larks are known to use the site due to its sparse vegetation, but the site is not designated as critical habitat. Three pairs were observed during CNLM surveys in 2013, and for this reason, placed materials have not been removed recently, even though the site is regularly accessed by public vehicles. The CNLM estimated that approximately three acres of suitable lark breeding habitat existed on the site in 2011 which the Corps estimates is still available as suitable SHLA nesting habitat. While the site has little wildlife value, it is used by coyotes, raccoons, and birds, such as crows, killdeer, and various raptors. Bald eagles forage in the vicinity of the site.

The rectangular peninsula is bordered by the river to the west, port lands to the south and southeast, and forested lands to the east and northeast. Most of the peninsula and the adjoining properties to the south have received fill from previous placement operations. The public uses the site for dog walking.

SANDY ISLAND (O-75.8)

Sandy Island, which is located in lower Columbia River near Kalama, Washington, is approximately 340 acres, excluding several waterways and side channels. Sandy Island is bean shaped and is separated from the Oregon shore by a side channel of the Columbia River. There is a 5,500-foot

long pile dike along the upstream portion of the island, parallel to the flow of the river and the island.

Historically, the placement site on Sandy Island was used for upland and beach nourishment placement. The island is likely a relic sand bar and approximately 2.5 miles of beach nourishment have occurred on Sandy Island. The Corps currently uses 32 acres as an upland site (Figure 29). The upland placement site is located on the upstream, southern tip of Sandy Island, from RM 75.8 to 76.2. At its closest point, the site is approximately 1,300 feet west of the CR FNC, in Columbia County, Oregon.

Figure 29: Sandy Island

The site is owned by the State of Oregon and the Port of Portland has a 25-year lease with Oregon DSL for placement by the Corps. The Port of Portland's easement from the Oregon DSL expires in 2030. In 2003, the estimated site capacity for placement of dredged material was 1,100,000 CY. In 2011, approximately 400,000 CY of material was placed on the entire site footprint. In 2013, the site was evaluated and it was determined that the site had reached capacity, such that materials need to be removed to provide capacity for future placement.

The site elevations range from 10 feet (CRD) at the waterline to 50 feet on the upstream bank of the site. The topography of the site is relatively flat with a sloping center from east to west. Steep 40 to 50 foot banks are located along the northern, eastern, and southern boundaries of the site. Dikes were constructed to manage dredged material during prior placement events. The site is mostly bare sand with a small, triangular cluster of approximately 20 trees in the northwest portion of the site. Approximately 37 acres have been designated as a critical habitat subunit for streaked horned larks, including the 32-acre placement site. Larks have been observed on this island during recent USFWS-sponsored surveys. In 2013, four breeding pairs were recorded on Sandy Island. The CNLM estimated that approximately 13 acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there are 32 acres of suitable SHLA nesting habitat on the

Sandy Island site and within the critical habitat subunit. The site is used for fishing access, as well as low-quality songbird habitat and resting waterfowl, deer and small mammals.

The topography of Sandy Island is relatively flat. It is vegetated by forests, shrub land, wetlands, and some open grassland along the eastern bank.

LOWER DEER ISLAND (O-77.0)

Deer Island is located in the lower Columbia River near Saint Helens, Oregon and is approximately 2,900 acres. The island is approximately 5.2 mile long, with pointed tips and a wide middle. It is generally oriented south to north, and it is separated from the Oregon shore by Deer Island Slough. It has a levee around its perimeter that runs the entire western boundary of the island and physically separates the island's interior from the direct flows of the Columbia River. Pumps and tide gates are used to control interior water levels in the sloughs on the island.

Historically, the Corps' placement area was used to replace sediments that had eroded away. Currently the Corps uses the 24-acre Lower Deer Island site (Figure 30) for upland placement. The placement area is almost entirely composed of previously dredged material and it is located at the downstream, northern end of the island in Columbia County, Oregon. The site is located from approximate RM 76.5 to 77.1. At its closest point, the site is approximately 580 feet west of the CR FNC.

Figure 30: Lower Deer Island

This placement area is owned by the State of Oregon and the Port of Portland has a 25-year easement with Oregon DSL for placement by the Corps expiring in 2030. There has been no placement of dredged materials or site preparation work at the site since 1995. In 2003, the estimated site capacity for placement of dredged material was 1,500,000 CY. In 2013, the site capacity was revised to 650,000 CY.

The elevations in the placement area range from 8 feet (CRD) at the river's edge to 32 feet in the northern portion. The majority of the placement area is above elevation 10 feet. Dredged material has historically been placed above elevation of 10 feet. The Lower Deer Island placement area is riverward of the levee on Deer Island. There are three pile dikes perpendicular to the site which extend into the river, all of which are in satisfactory to poor condition. The dredged material placed near the southern tip of the placement area is partially stabilized with herbaceous vegetation, but the downstream portion is also eroding due to river currents.

Both a natural gas pipeline and a fiber optic cable pass through this site, dividing it roughly in half. Placement is not allowed within the 3.4-acre pipeline easement area. The site is dominated by herbaceous vegetation, moss, and lichens, with sparse shrubs. The shrubs on the site are typically scotch broom and the site is bounded by young stands of woody vegetation. No wetlands were delineated on the site in 2013. The island is not designated as critical habitat for streaked horned and it has not been surveyed. The CNLM estimated that no suitable SHLA breeding habitat existed on the site in 2011 due to extensive vegetation and visual separation from the river. The Corps currently estimates that there is no suitable SHLA nesting habitat on Lower Deer Island. Fishermen regularly use the site for shoreline fishing.

There is an extensive tidally influenced emergent, shrub, and forested wetland outside of the placement area, adjacent to the site's northern end. Forested wetlands are located west of the southern portion of the placement area. Vegetation adjacent to the dredged material placement site is either a mix of herbaceous plants and shrubs or stands of cottonwoods. The adjacent riparian habitat and forest on Deer Island provide good wildlife value.

MARTIN BAR (W-82.0)

The Martin Bar area is located on the eastern shoreline of the lower Columbia River. The area is composed of two separate parcels, Martin Bar North (~17 acres) and Martin Bar South (~23 acres). The parcels are separated by an unimproved road and a cluster of trees that form Lions Day Park and boat launch area. Both parcels are riverward of a levee.

Martin Bar North is leased for farming and Martin Bar South is used as for upland placement and it is a borrow site. Combined, the parcels form a 40-acre site (Figure 31) from RM 81.8 to 82.3, in Cowlitz County, Washington. At its closest point, the site is approximately 1,000 feet west of the CR FNC.

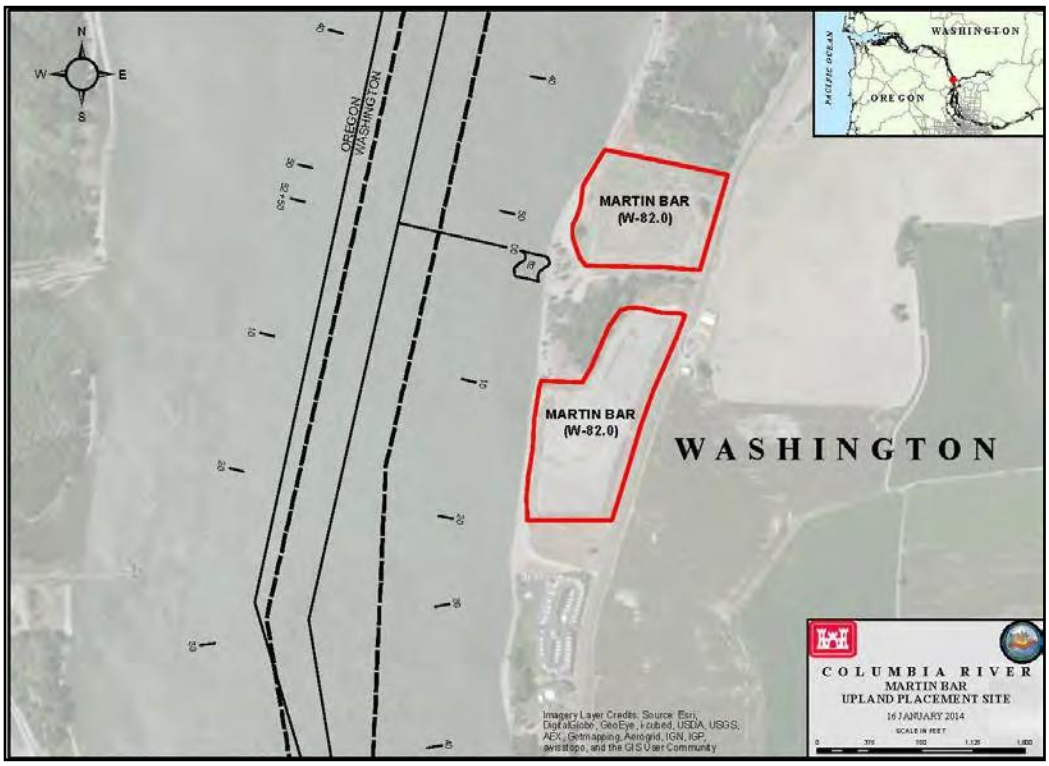


Figure 31: Martin Bar

The upland placement sites are owned by the Port of Woodland and available for placement by the Corps. The Corps' 20-year ROE agreement from the Port expires in 2025. In 2003, the estimated site capacity for placement of dredged material was 1,500,000 CY. In 2008, the Martin Bar South parcel was filled with 500,000 CY of material. The Port of Woodland leased the site for sand mining and most of the sand placed in 2008 has been removed. In 2008, the Martin Bar North site had exterior diking work, but no placement occurred even though the external berms remain in place. In 2013, the site capacity was estimated at 720,000 CY.

The elevation on the north parcel averages approximately 20 feet (CRD). The elevation on the south parcel averages approximately 29 feet (CRD). One pile dike protects the shoreline of the southern parcel. The northern parcel is vegetated with grasses, while the southern parcel is mostly bare sand with scattered low plants. The parcels are not designated as a critical habitat subunit for streaked horned larks due to the farming and borrowing activity. Larks are not known to use the site and it has not been recently surveyed. The CNLM estimated that approximately five acres of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there is no suitable SHLA nesting habitat on Martin Bar South due to the site's exterior berms and regular use as a borrow site. No habitat is expected on Martin Bar North due to current agricultural practices. Together, the parcels provide little to no wildlife habitat.

Cottonwoods populate the area north of the northern parcel. Nearby improvements include a beacon for navigational purposes and groin placed perpendicular to the shoreline, fencing, shed, an outhouse, and several unimproved roads. An RV park is located south of the southern parcel. The lands east of the levee are used for agricultural farming.

SAND ISLAND (O-86.2)

Sand Island is approximately 55 acres and is located at the downstream entrance to Multnomah Channel. The Multnomah Channel separates Sand Island from the town of Saint Helens, Oregon.

Sand Island is immediately downstream of Sauvie Island. The island is developed as a marine park, has two boating piers on its western shore, and it is used for public recreation.

Historically, Sand Island served as a flow control structure to minimize maintenance dredging of the adjacent St. Helens Bar. Dredged materials were placed on the east bank of the island to maintain the structure and replace eroded sediments. Currently, the Corps has 28-acre shoreline placement site (Figure 32) along the east side of Sand Island, in Columbia County, Oregon. The shoreline site extends beyond the existing island's footprint to the north, east, and south. A 1,920-foot long pile dike extends along the upstream end of the site. At its closest point, the site is approximately 750 west of the CR FNC.

Figure 32: Sand Island

The placement site is owned by the State of Oregon and the Port of Portland has 25-year easement for placement by the Corps expiring in 2030. In 2003, the estimated site capacity for placement of dredged material was 1,250,000 CY. In 2012, material was placed on the downstream shoreline of the site. In 2013, approximately 150,000 CY of material was placed on the upstream shoreline and tip of the island. The site capacity varies annually due to continual erosion of the shoreline by river flows.

The elevations in the placement site range from -15 feet (CRD) at the downstream limit to 20 feet on the landward edge adjacent to the park. The site is a highly erosive beach of mostly bare sand, with sparse grasses and ground cover on the higher portions. Current recreational use of island excluded the area from designation as critical habitat for streaked horned larks. Larks have historically occupied the site, but no larks were observed during 2013 surveys by the CNLM. The CNLM estimated that approximately one acre of suitable lark breeding habitat existed on the site in 2011. The Corps currently estimates that there is approximately one acre of suitable SHLA nesting habitat on Sand Island and due to the high level of human disturbance during the summer, SHLA are not expected to utilize the site for breeding.

The interior and western bank of the island is forested, interspersed open grassland and beach areas. The island has approximately 25 acres of well-established woody vegetation. Areas with woody vegetation are outside the dredged material placement boundaries. Dredged material is placed on the island to support beach nourishment along this reach. The wooded portions of site provide songbird and raptor habitats, while the beaches are used by shorebirds and a few waterfowl. Anglers use the site for shoreline fishing.

AUSTIN POINT (W-86.5)

The Austin Point placement site is located on east bank of the lower Columbia River, outside of the levee for Woodland, Washington. Austin Point is at the confluence of the Lewis River with the Columbia River.

Historically, this site was a beach nourishment site to facilitate wildlife mitigation efforts on Austin Point 30 to 40 years ago. The site was also used for upland placement. Currently, the Corps' 30-acre upland placement site (Figure 33) is used as a heavy equipment, crane, and rigging training school in Cowlitz County, Washington. The site is located from RM 86.0 to 86.3. At its closest point, the site is approximately 600 feet west of the CR FNC.

Figure 33: Austin Point

The Austin Point placement site is owned by the Port of Woodland and available for placement by the Corps. The Corps' 20-year ROE from the Port of Woodland expires in 2025. In 2003, the estimated site capacity for placement of dredged material was 1,645,000 CY. In 2008, material was placed on the entire site. In 2013, 250,000 CY of material was placed on the downstream 2/3 of the site. Material will need to be removed from the site to provide capacity for future placement events.

The site elevations range from15 to 35 feet (CRD). The topography of site is open, level, and devoid of vegetation. An elevated dike runs along the western edge of the property. The site is primarily a large, undulating sand pit. Current site uses excluded designating the site as critical habitat for

streaked horned larks. Although larks are not known to historically occupy the site and no formal lark surveys have been conducted recently, several juvenile larks were observed by the Corps in September 2013 prior to placing dredged material. The CNLM estimated that approximately 14 acres of suitable lark breeding habitat existed on the site in 2011. The Corps placed dredged material on the downstream two thirds of the site in 2013. The Corps currently estimates that there is no suitable SHLA nesting habitat on Austin Point due to ongoing heavy equipment school site grading activities. Overall, the site provides low wildlife habitat values.

A water supply well house and groundwater well for the equipment school are situated near the site. There is approximately 150 feet of open sand between the shoreline and the western edge of the dredged material placement site. Two pile dikes extend perpendicular from the shoreline into the river. Blackberries, weedy grasses, low-lying shrubs, and cottonwoods are located north and south of the site. Bald eagles nest in the area and forage downstream of the site. Fishermen use the area for shoreline fishing, while songbirds, small mammals, and waterfowl use the nearby lands and waterways.

FAZIO SAND & GRAVEL (W-97.1)

The Fazio Brothers Sand Company, Inc. has a 220-acre sand and gravel facility located on the east bank of the Columbia River, near RM 97. The company has been in operation at this site since the 1950's. This company has an open parcel upstream of their facility that is used for sorting and processing sandy materials removed from the river. The operation is located in Clark County, Washington upstream of the Ridgefield National Wildlife Refuge.

The Corps has placed dredged materials in-water near the 17-acre upland site (Figure 34). Materials are currently placed riverward of the shoreline. The placed materials are mined by dredging and processed by the company under a separate permit for commercial uses. The site is located from RM 97.1 to 97.3. At its closest point, the site is approximately 1,400 feet east of the CR FNC.

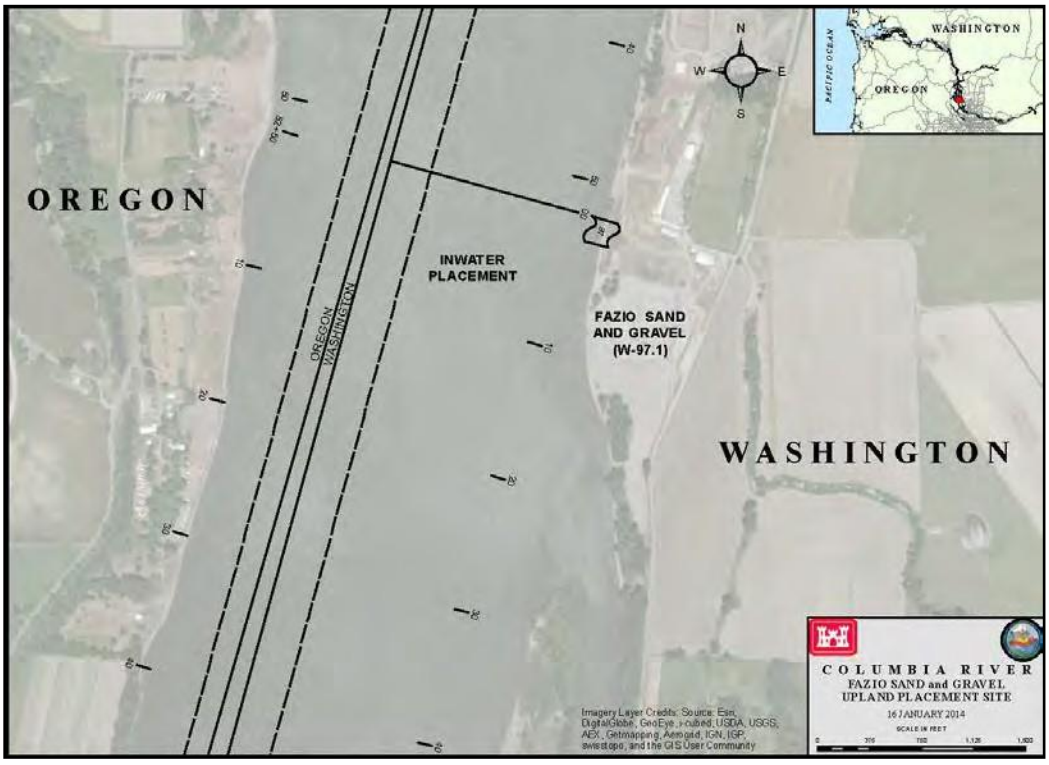


Figure 34: Fazio Sand & Gravel

The Washington Ports have an easement with the Fazio Brothers Sand Company, Inc. for direct placement of dredged material by the Corps into their upland processing area. However, the current practice by the Corps is to place material in-water in the State of Washington so Fazio Brothers Sand Company, Inc. can later mine the material for upland processing at their site under separate permitting. In 2003, the estimated upland site capacity for placement of dredged material was 1,200,000 CY for the life of the project. The Corps intends to continue placing material in-water annually as Fazio Brothers Sand Company, Inc. mining operations continue to provide in-water placement capacity each year.

The site elevations range from 10 feet (CRD) at the shoreline placement area to 45 feet in the processing area. The upland area is open, bare sands. A few stands of cottonwood trees are located along the shore. The site is not designated as critical habitat for streaked horned larks and has not been recently surveyed for larks. The CNLM did not map suitable habitat at Fazio Sand & Gravel in 2011 because the habitat status cannot be inferred through imagery. The Corps currently estimates there is no suitable SHLA nesting habitat on the Fazio Sand & Gravel site. Due to the active sand mining and processing activities, the site provides little wildlife habitat and it is assumed to provide no suitable nesting habitat for larks.

GATEWAY (W-101.0)

The Gateway upland placement site is located at RM 101 of the Columbia River, in Clark County, Washington. The site is located approximately 500 feet inland from the river and 450 feet south of a man-made channel, known as the Vancouver Lake Flushing Channel. This area is located between the Columbia River and Vancouver Lake, downstream from the City of Vancouver.

Historically, the Gateway site was a major placement area. Currently the 40-acre placement site (Figure 35) is used for upland placement and as an active borrow site. The site is located from approximately RM 100.9 to 101.2 and at its closest point is approximately 2,200 feet northeast of the CR FNC.

Figure 35: Gateway

The site is owned by the Port of Vancouver and available for placement by the Corps. The Corps' 20-year ROE agreement from the Port of Vancouver expires in 2025. The site was constructed in 2005 with a height-restricted capacity of 2,000,000 CY. In 2005 and 2007, the Corps placed approximately 1,150,000 CY of material over the entire site. The Port of Vancouver has removed all but 3,000 CY of materials, leaving a renewed site capacity of 2,000,000 CY.

The site elevations range from 20 feet (CRD) in the interior to 40 feet along portions of the site's containment berm. The site is actively used to borrow placed materials, which precludes the establishment of woody shrubs or trees onsite. The majority of the site is bare, with some areas of grasses and low herbaceous plants. The site was not designated as critical habitat and there is no known SHLA breeding at the site. The site has not been recently surveyed by the USFWS for larks but the Port performed surveys from April to July and in November 2013, following the Washington Department of Fish and Wildlife (WDFW) survey protocol. The only larks observed during the surveys were three females who touched down briefly (5-15 seconds). No other larks or any nests were observed by the Port in 2013. The CNLM did not map suitable habitat at Gateway in 2011 because the habitat status cannot be inferred through imagery. The site has exterior visual barriers (containment berms and trees), and therefore the Corps currently estimates there is no suitable SHLA nesting habitat on the Gateway site. Due to borrow activities, topography of the site, visual barriers (trees) between the site and the river, and lack of suitable foraging opportunities, the site provides little wildlife value.

This site is bounded to the north, east, and south by agricultural lands used for growing corn for silage. Woodlands are located to the west, separating the site from the Columbia River. The woodlands are cottonwoods and with some shrubs. The adjacent agricultural lands have limited wildlife habitat, though some songbirds, raptors, waterfowl, and small mammals utilize the adjacent agricultural lands for foraging and resting.

WEST HAYDEN ISLAND (O-105.0)

Hayden Island is located in the lower Columbia River, upstream of the confluence of the Willamette and Columbia Rivers. Hayden Island is approximately 1,400 acres and it is oriented southeast to northwest. Hayden Island is entirely within Multnomah County, Oregon and it is separated from the Oregon shore by Oregon Slough. The Oregon shore across from the island is developed for commercial and industrial land uses, including docks for the Port of Portland and others.

The eastern portion of the island is within the City of Portland and it is heavily developed for commercial, retail, residential, and recreational land uses. There are many houseboat and boat moorages along the banks of the eastern portion of the island, primarily along Oregon Slough. The western portion of island, which is delineated from the eastern portion by a railroad line, is not developed but has been altered by utility lines, prior dredged material placement, and land clearing.

Historically, the Corps has used the downstream portion of Hayden Island for placement of dredged material. Material has been placed as beach nourishment in the past. Currently, the Corps has a 116-acre upland placement site (Figure 36), referred to as the West Hayden Island site, on the northern side of the island from RM 104.6 to 105.4. At its closest point, the site is approximately 1,200 feet southwest of the CR FNC.

Figure 36: West Hayden Island

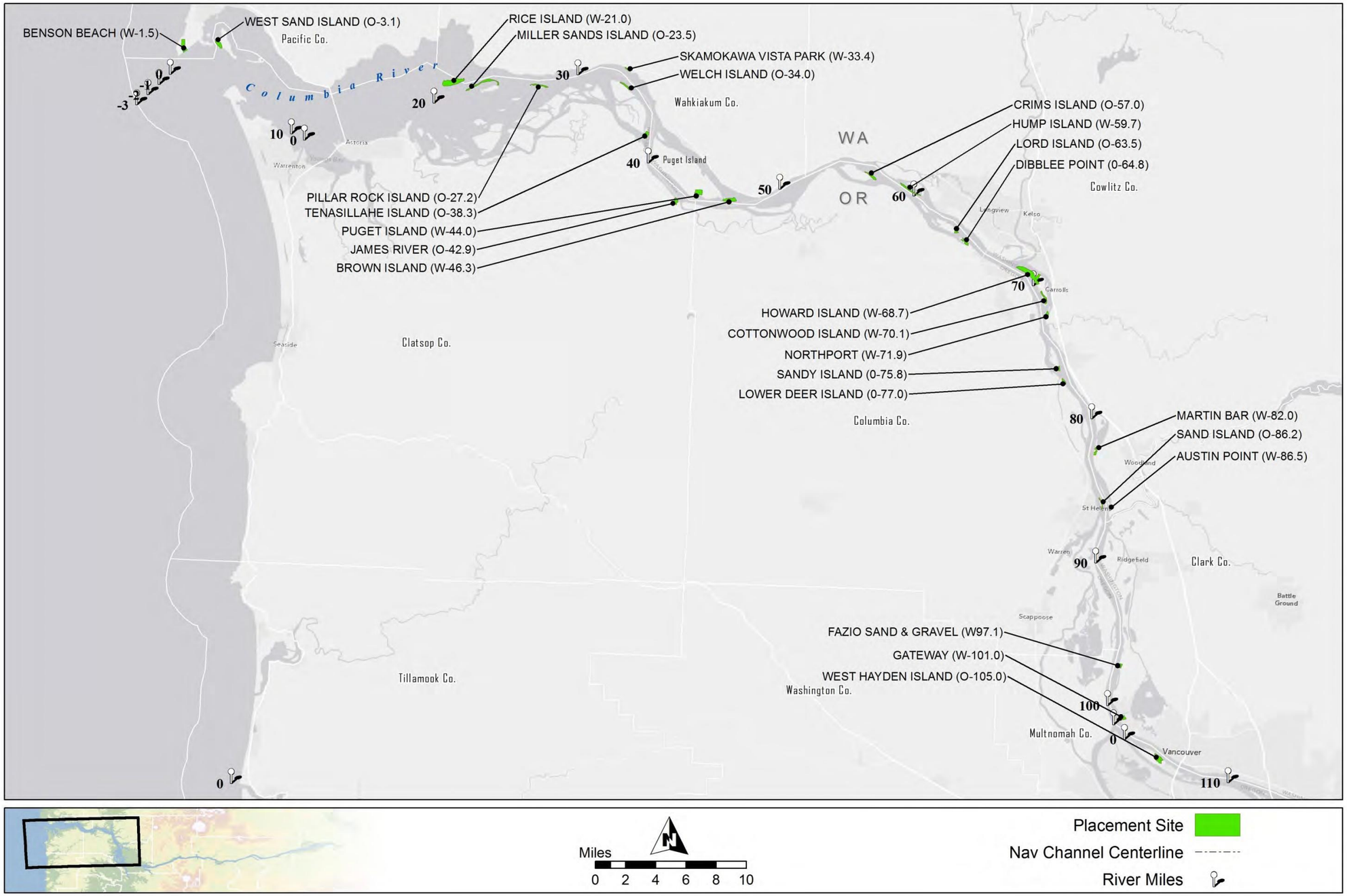
The site is owned by the Port of Portland and available for placement by the Corps. The Corps' 20-year ROE agreement from the Port of Portland expires in 2025. In 2003, the estimated site capacity was 5,750,000 CY. In 2011, approximately 50,000 CY of materials were placed in the southern corner of the site as part of the Corps maintenance program in the Willamette River. In 2013, the site capacity remained the same.

The site elevations range from 15 feet (CRD) at the top of the riverbank to 40 feet in the center of the site. The site is undulating due containment berms and grading activities from placement of dredged materials. Large portions of the site are comprised of open sand and weedy grasses. Two

stands of trees are located in the northwest portion of the site. An unimproved dirt road provides land access to the site and there are several weirs placed throughout the site. The site is actively used by the Port for placing their dredged materials, dredging equipment, and other storage. The Port maintains roads on the site and manages the island to prevent the establishment of trees. The site is not designated as a critical habitat subunit for streaked horned larks. The CNLM surveyed the site in 2013, but no larks were observed. The CNLM did not map suitable habitat at West Hayden Island in 2011 because the habitat status cannot be inferred through imagery. The site has exterior visual barriers (containment berms and trees), and therefore the Corps currently estimates there is no suitable SHLA nesting habitat on the West Hayden Island site. The site does provide open habitats for songbirds and shorebirds.

A deciduous forest is located to the east, south, and west of the placement site. The Columbia River is the northeast perimeter of the site. The western portion of Hayden Island is largely vegetated and provides high quality forested, riparian, wetland, and pond habitats for resident and migratory wildlife.

Suitable Streaked Horned Lark Nesting Habitat 2014-2018



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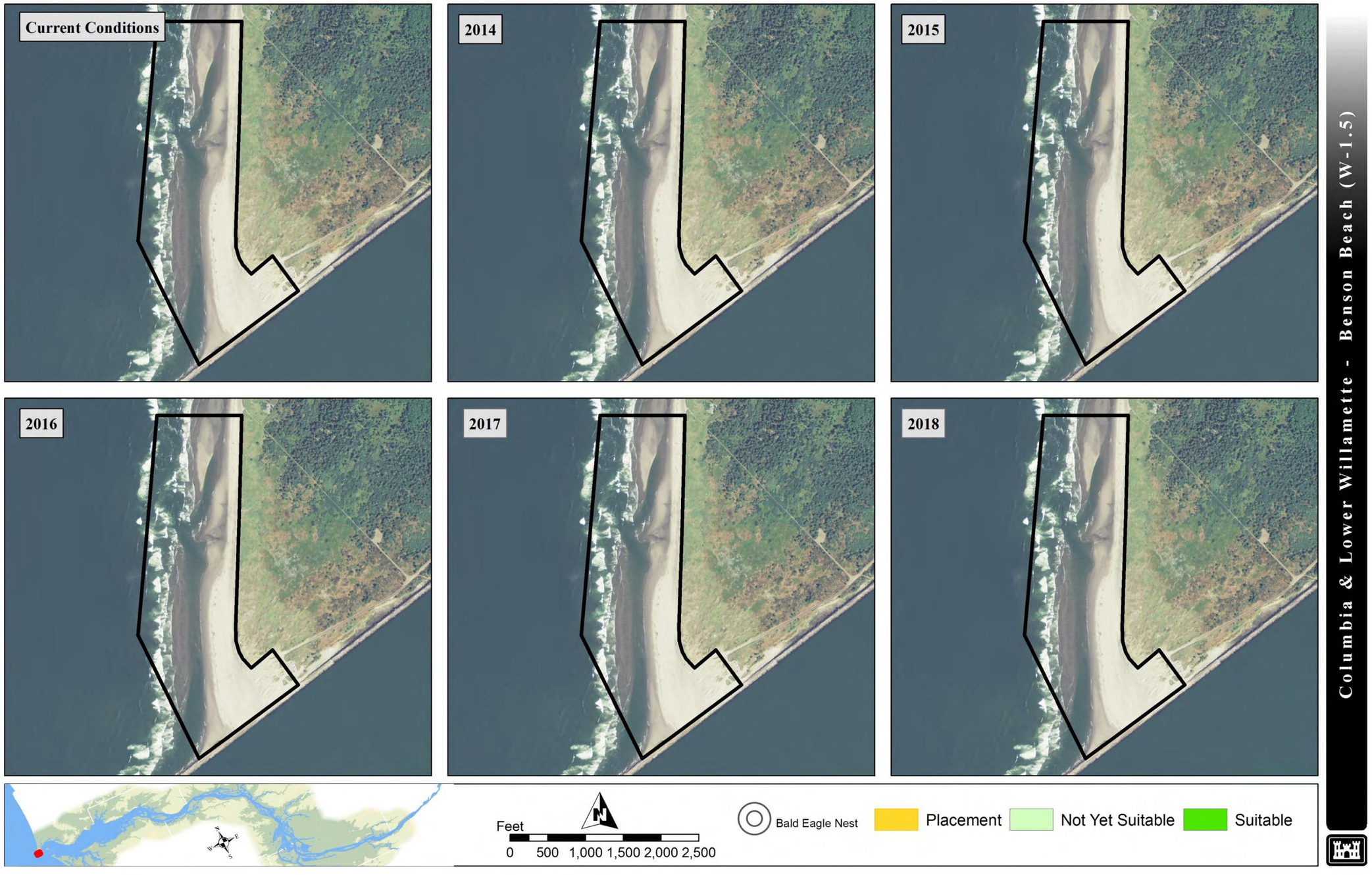

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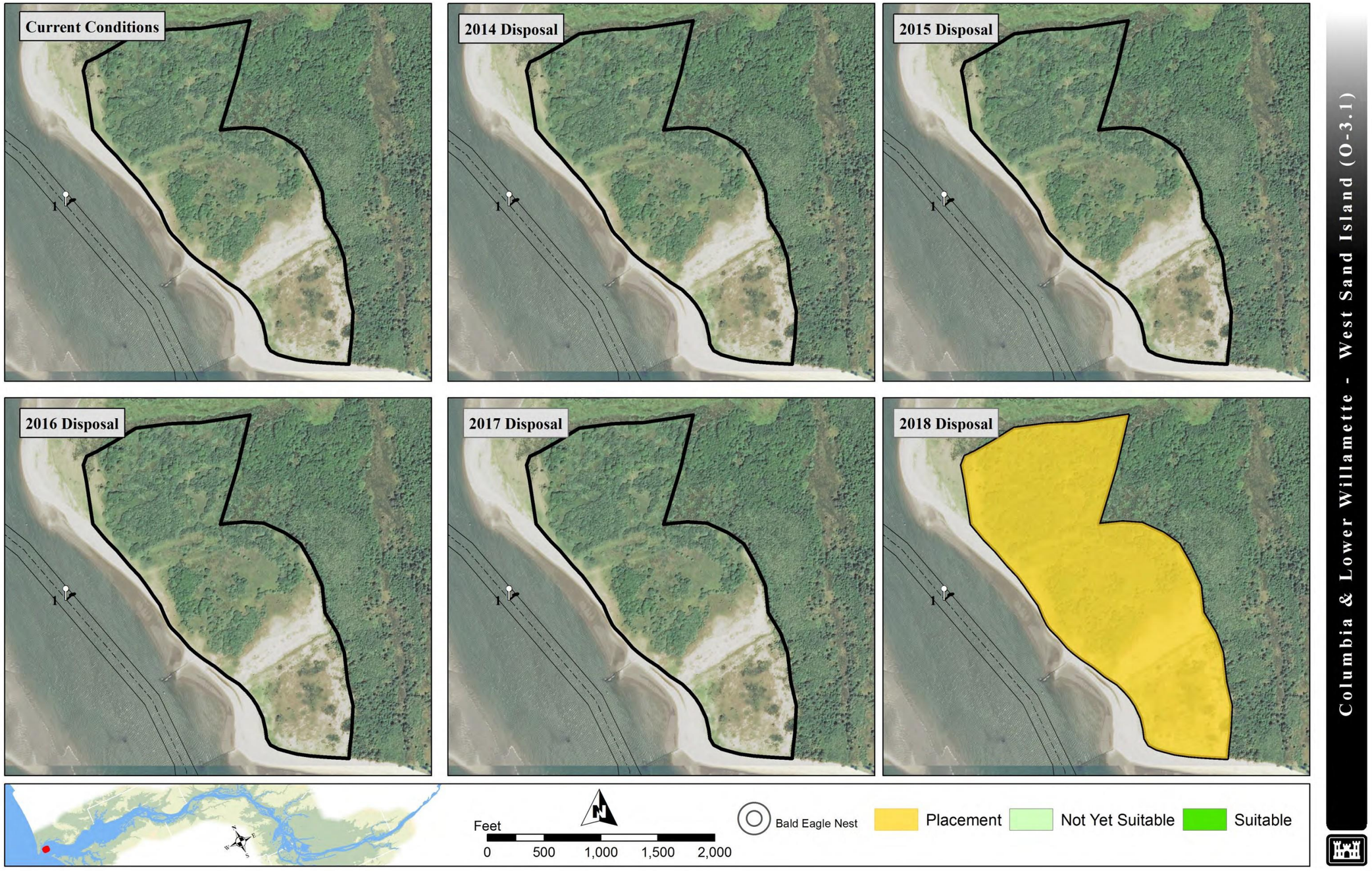

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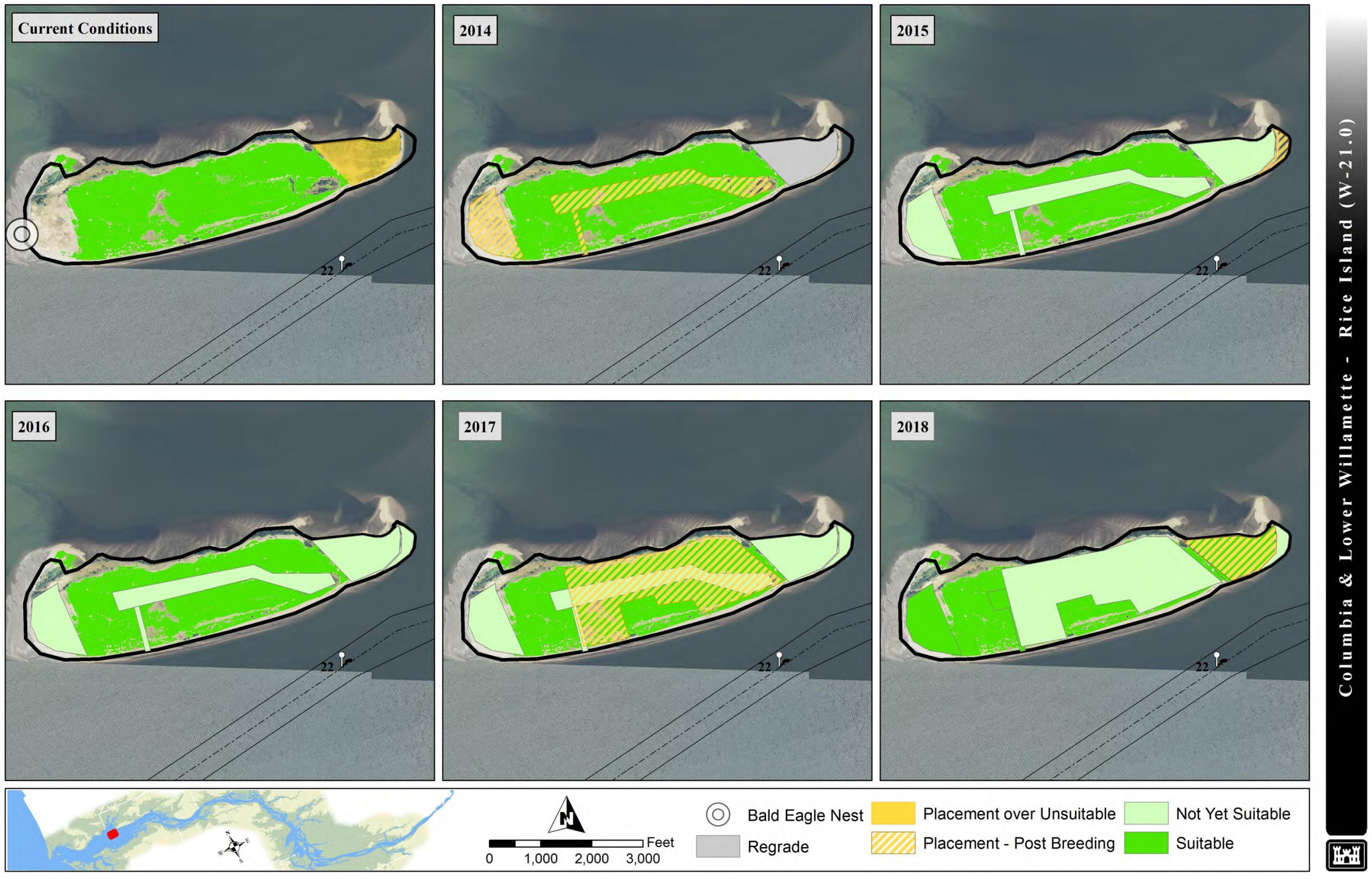

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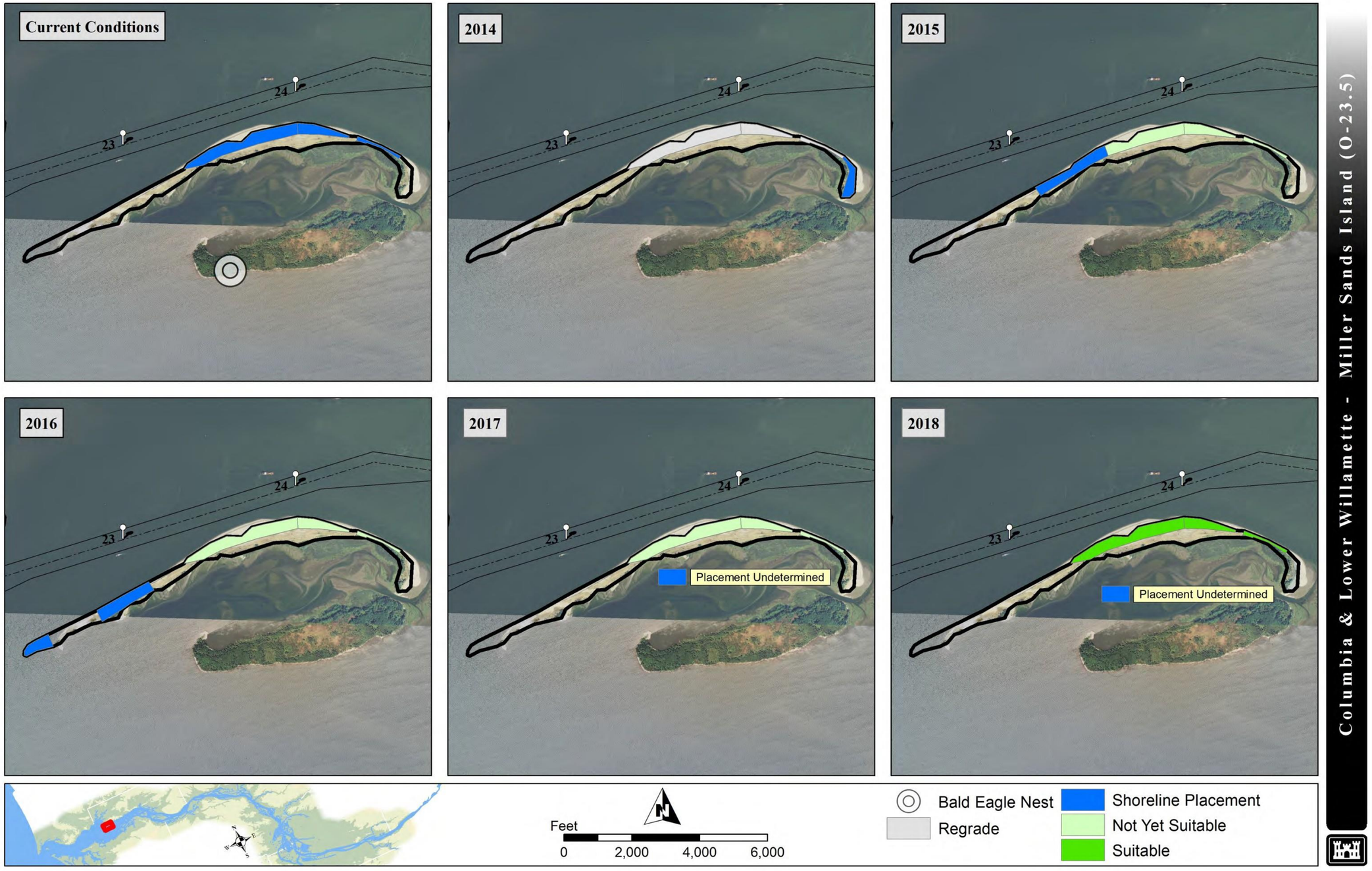

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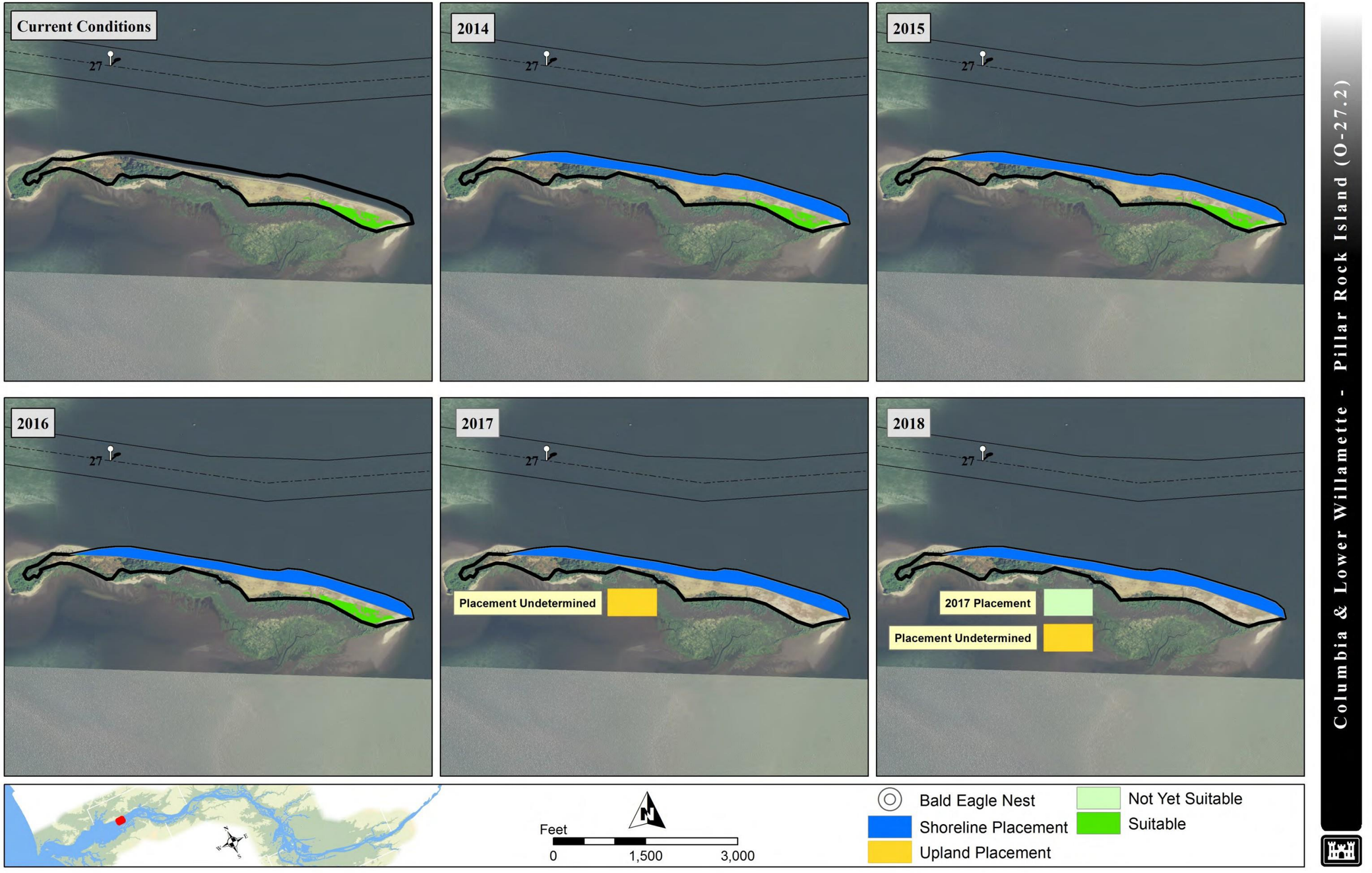

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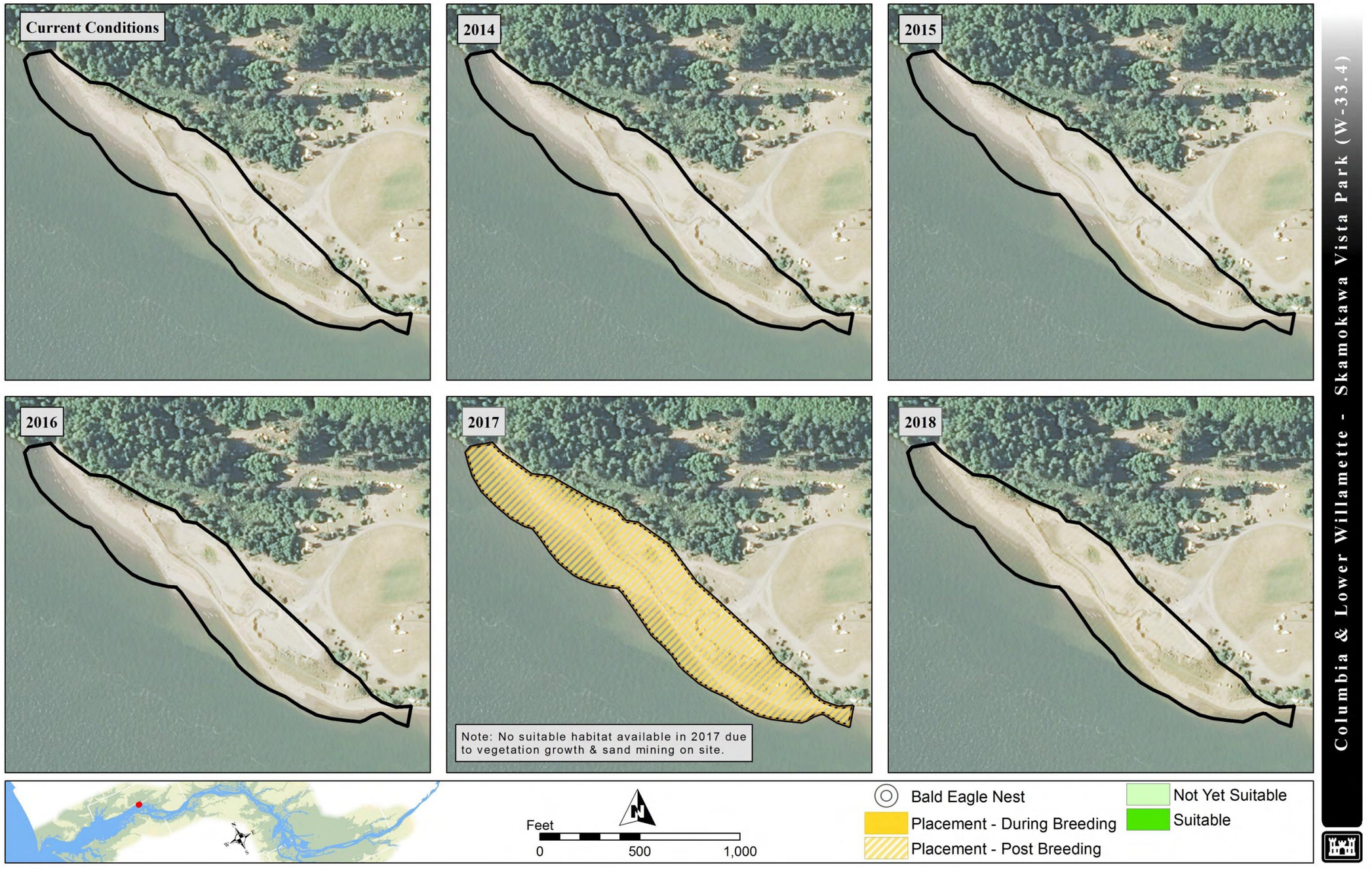

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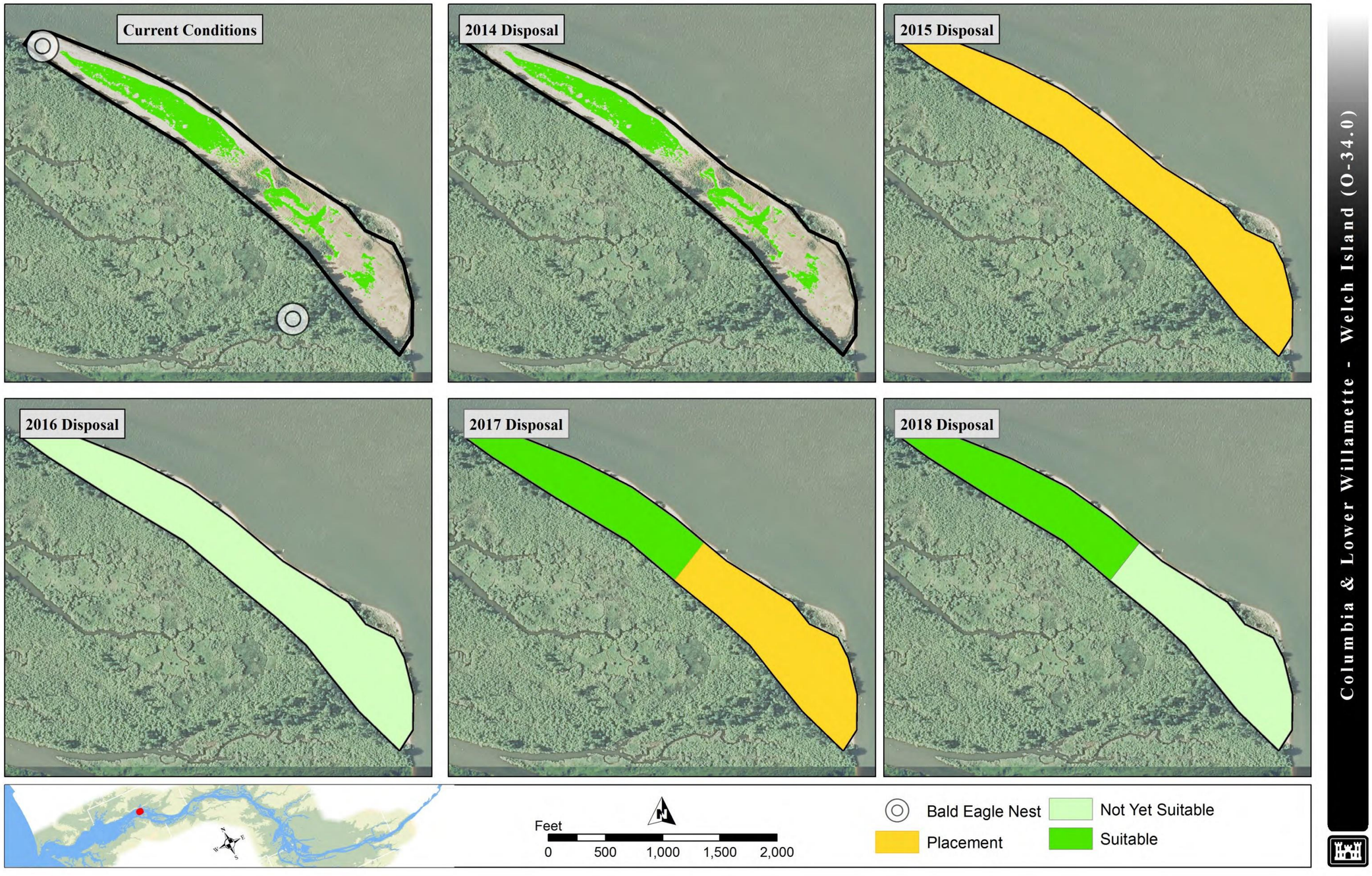

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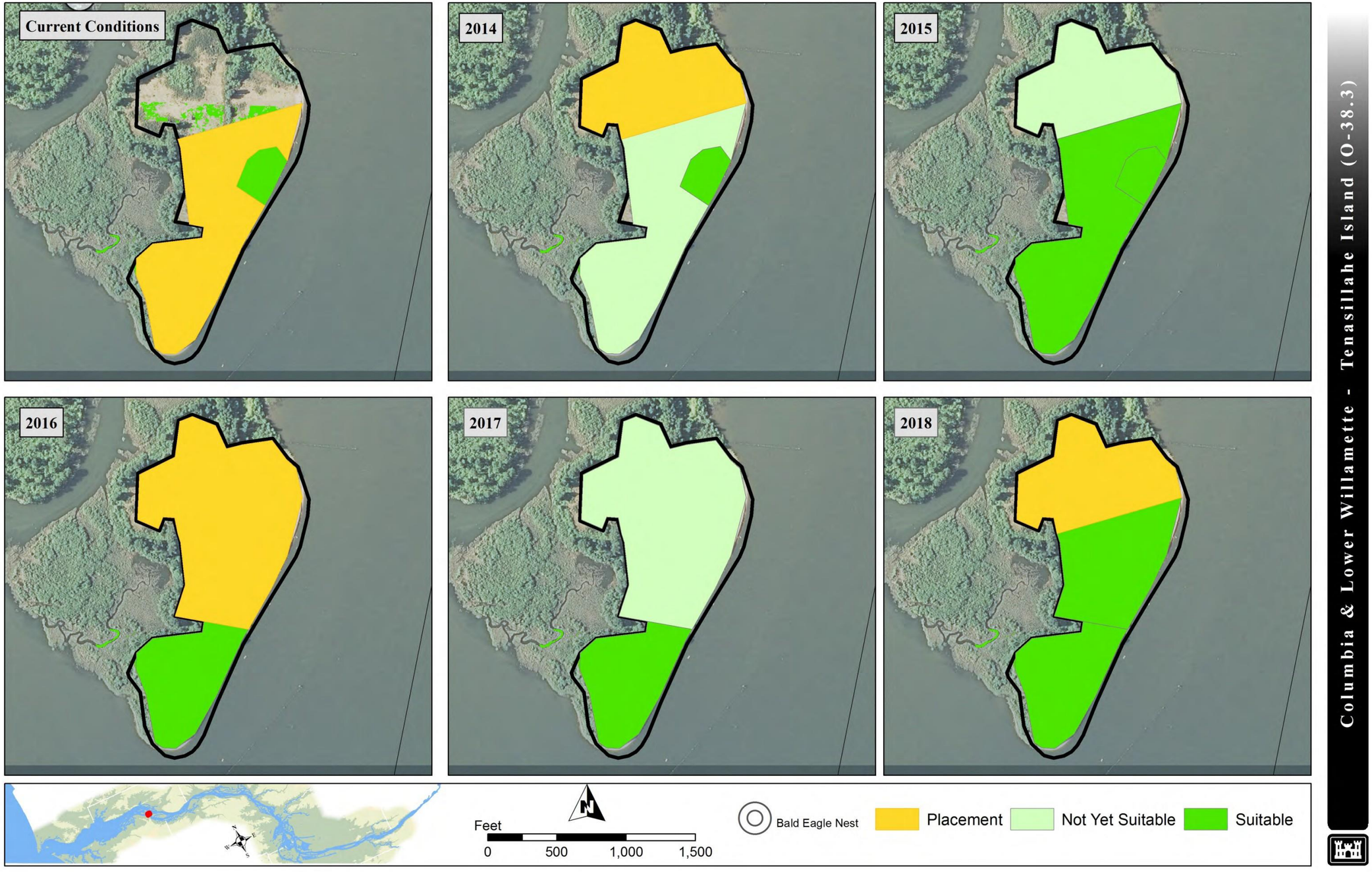

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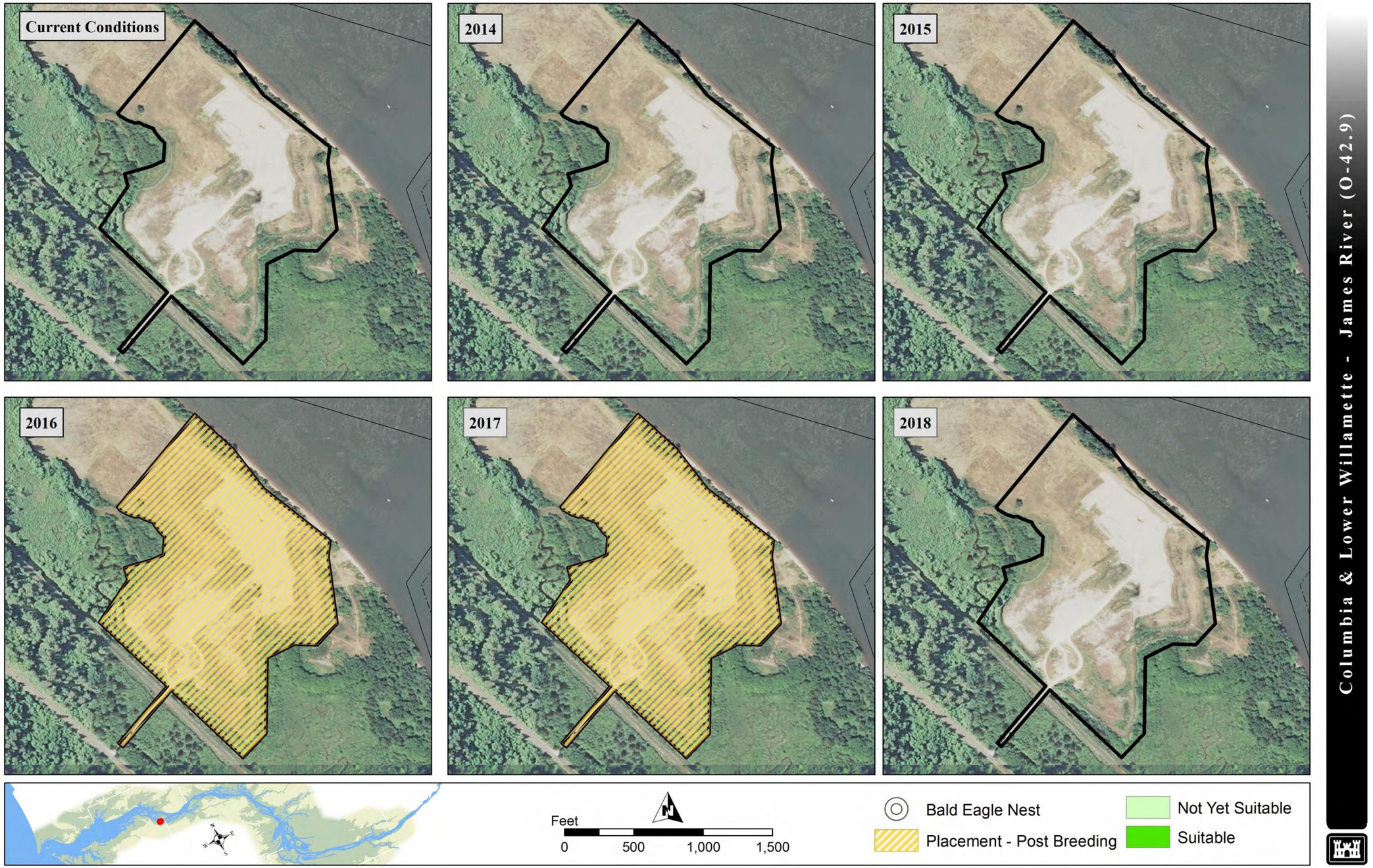

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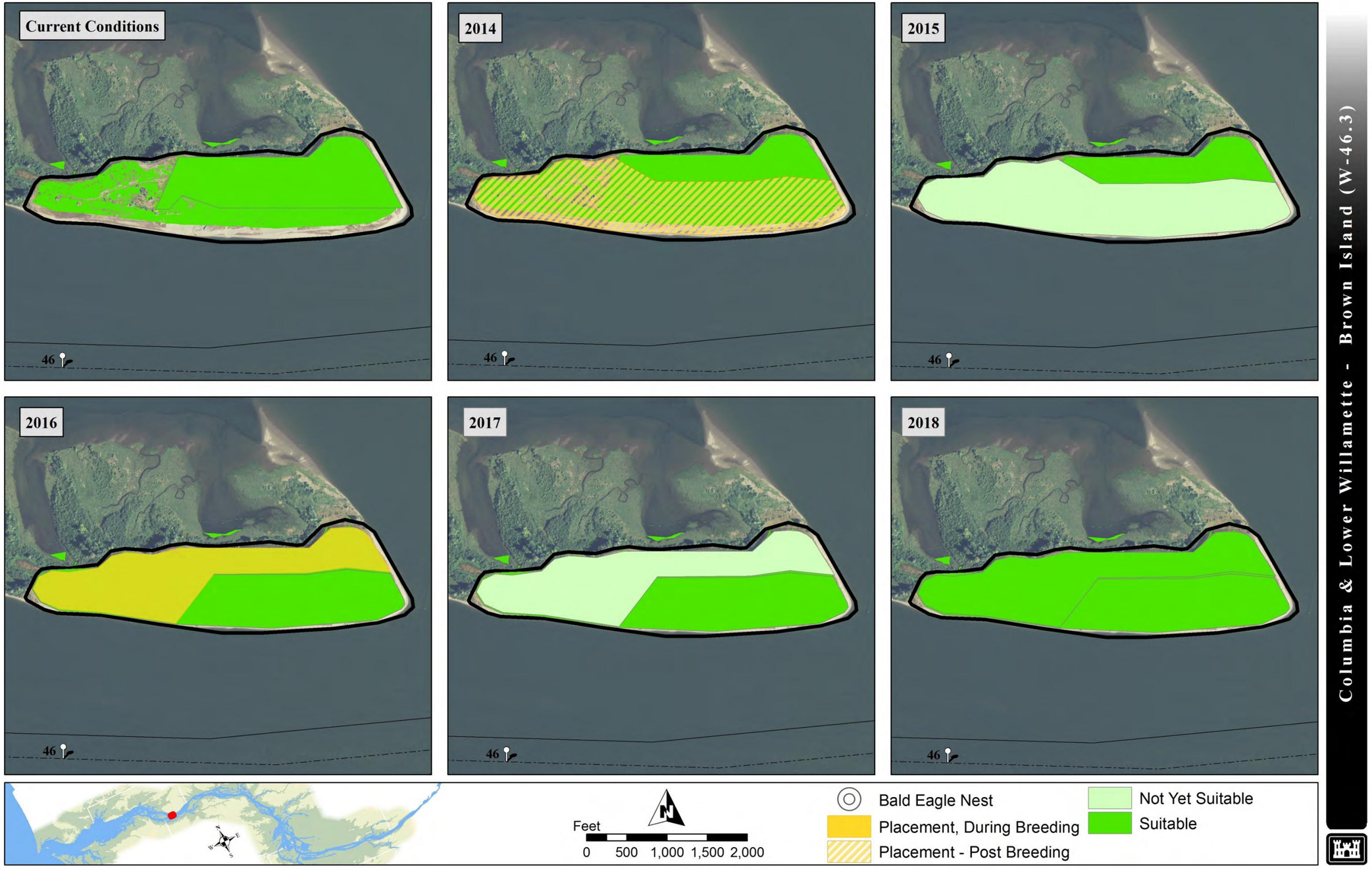

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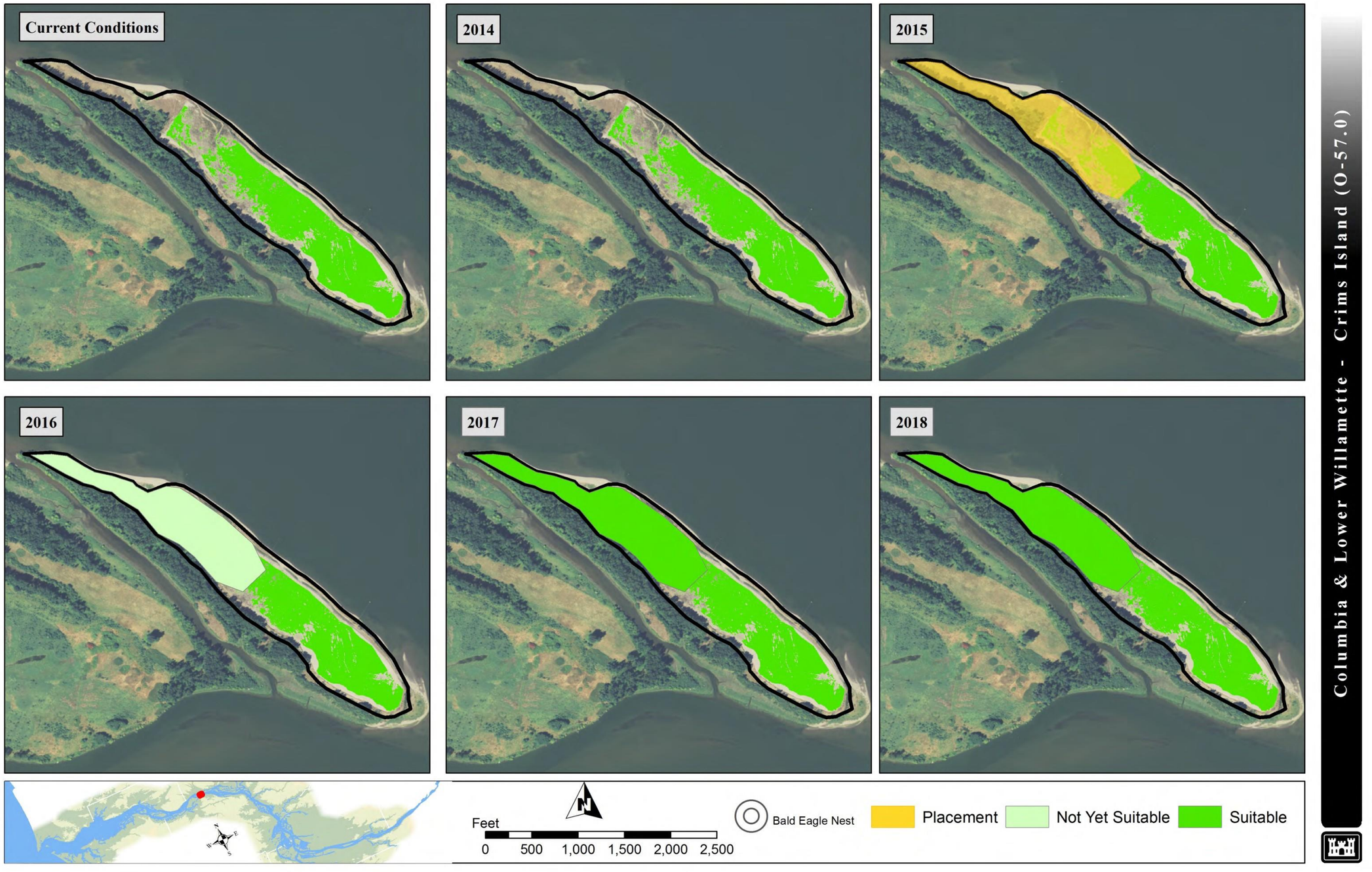

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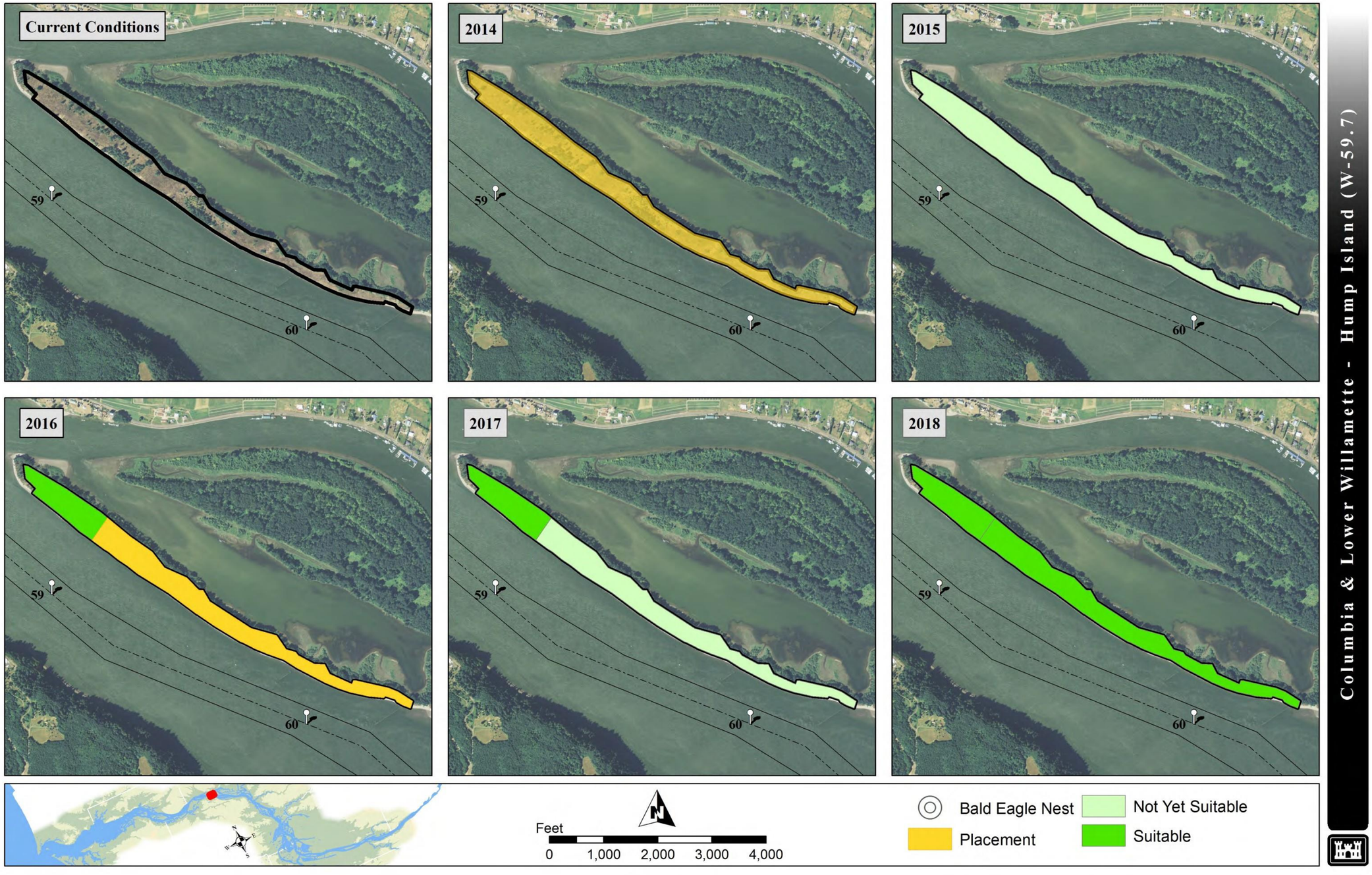

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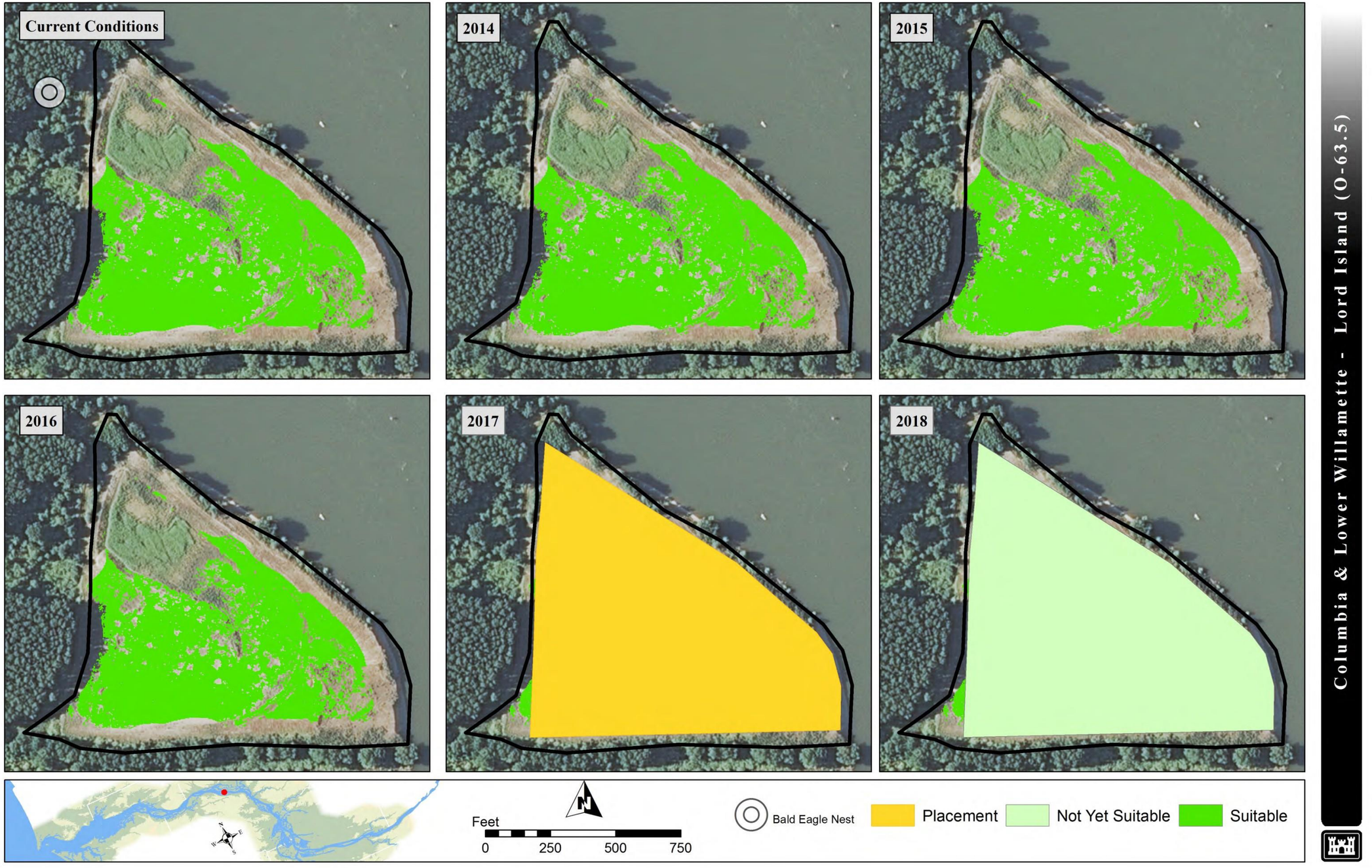

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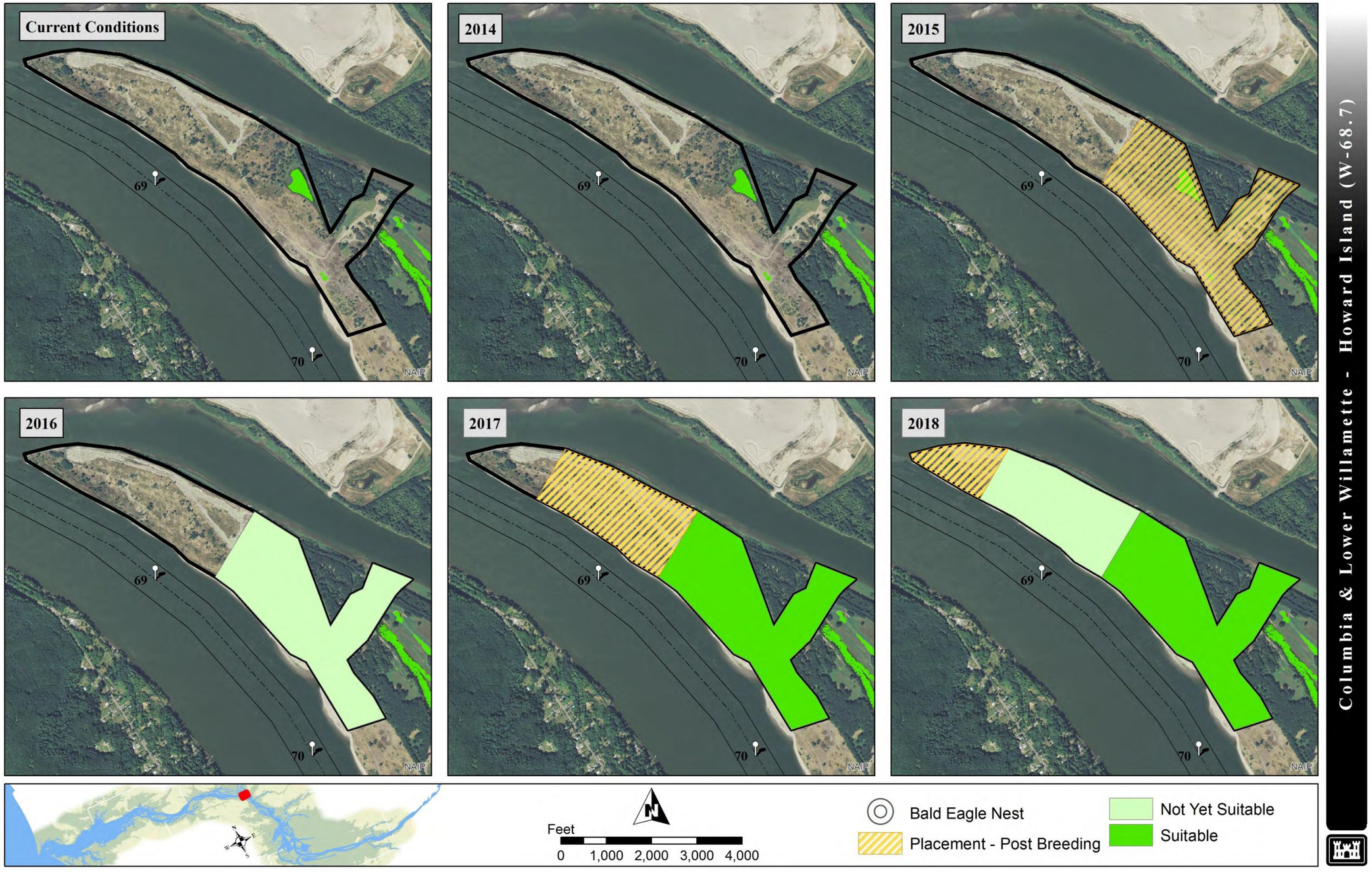

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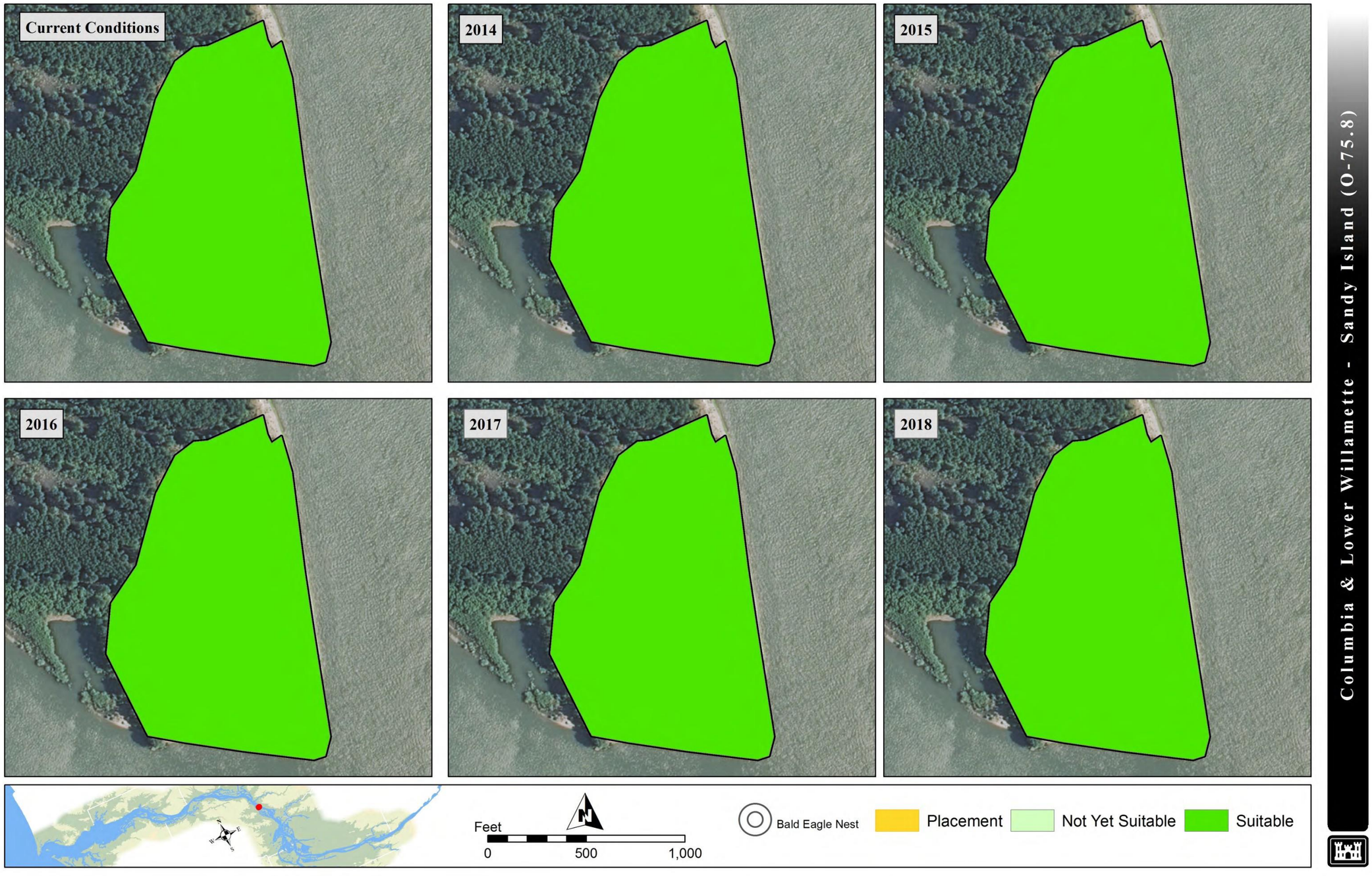

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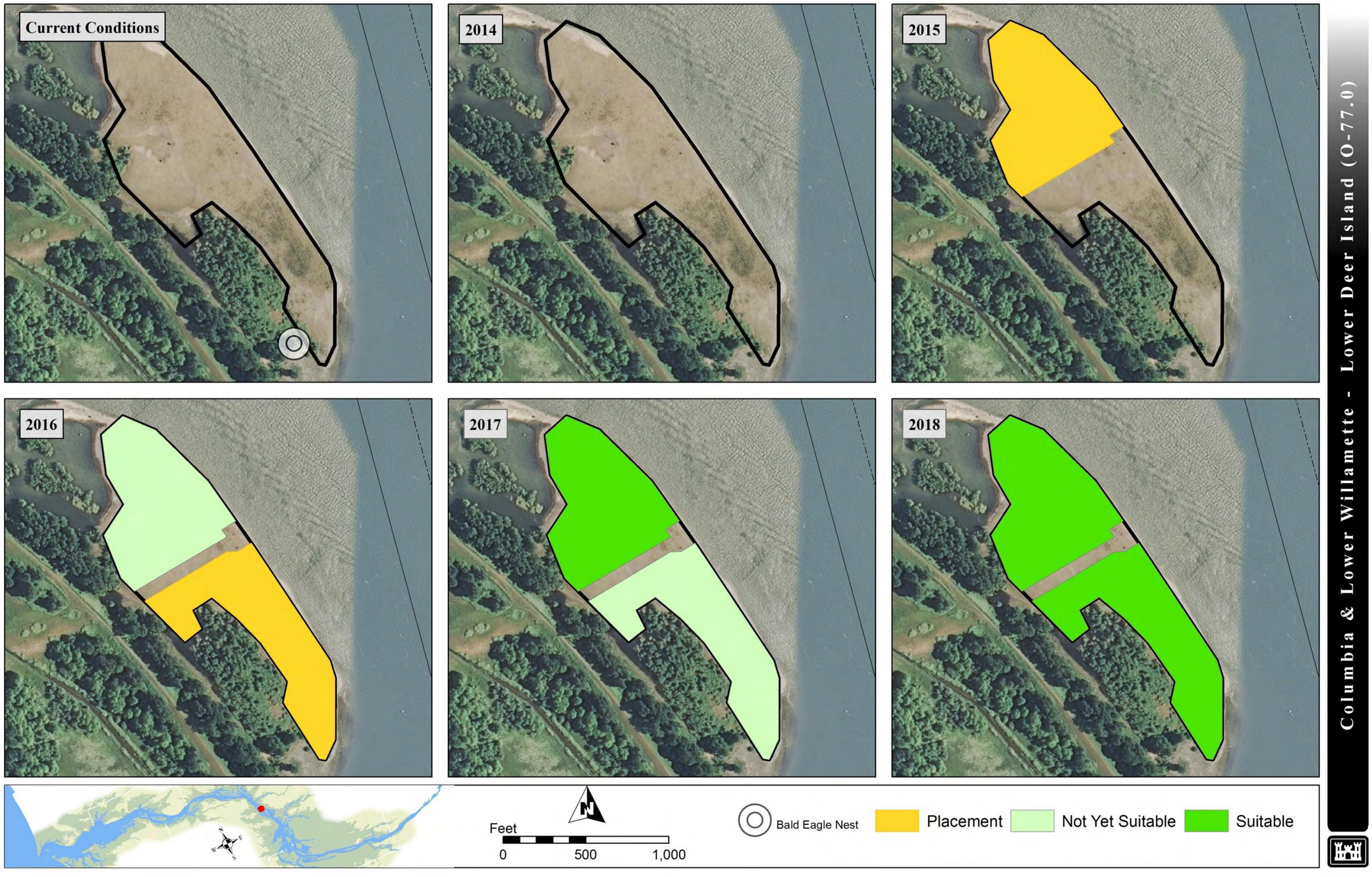

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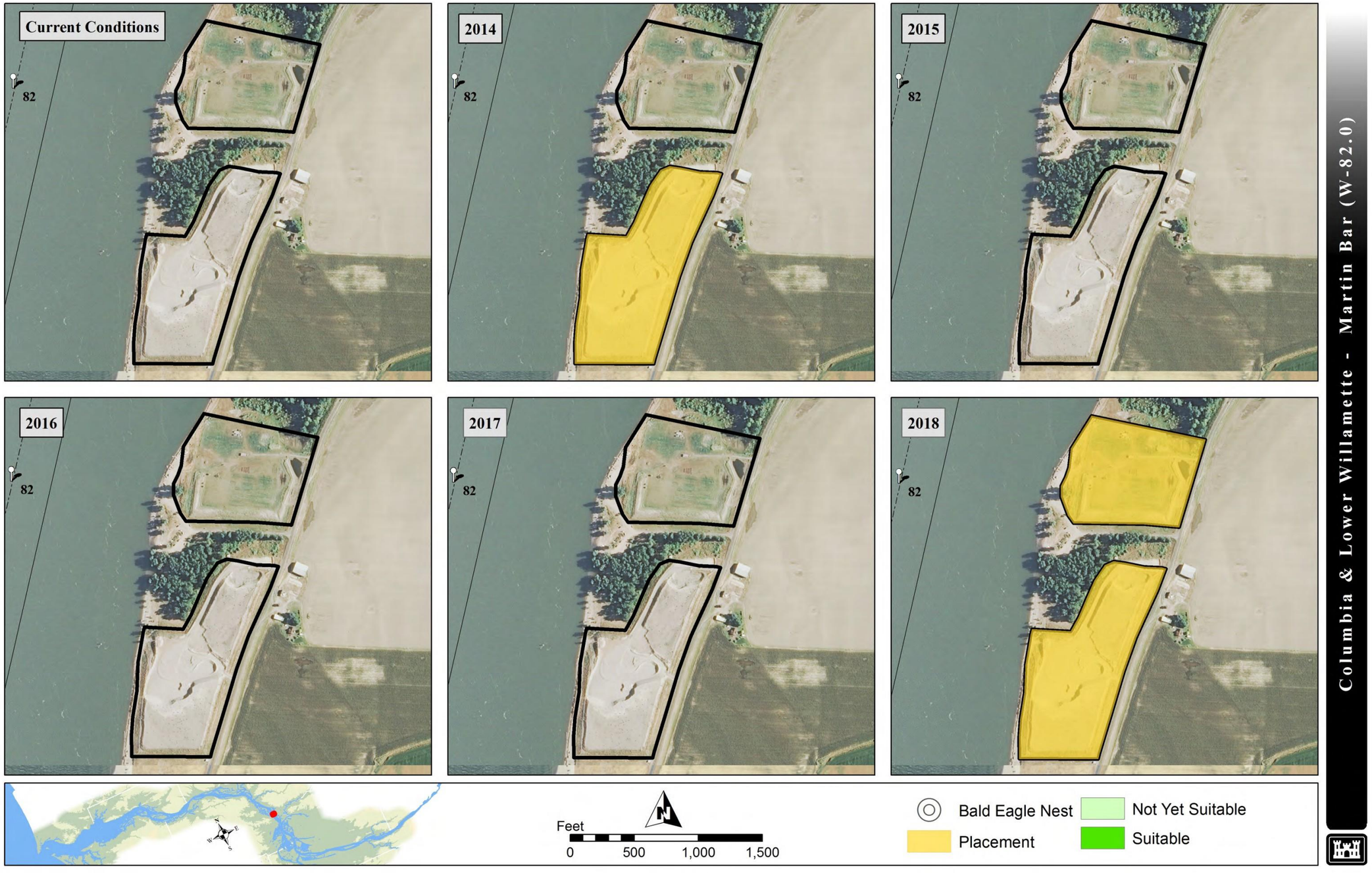

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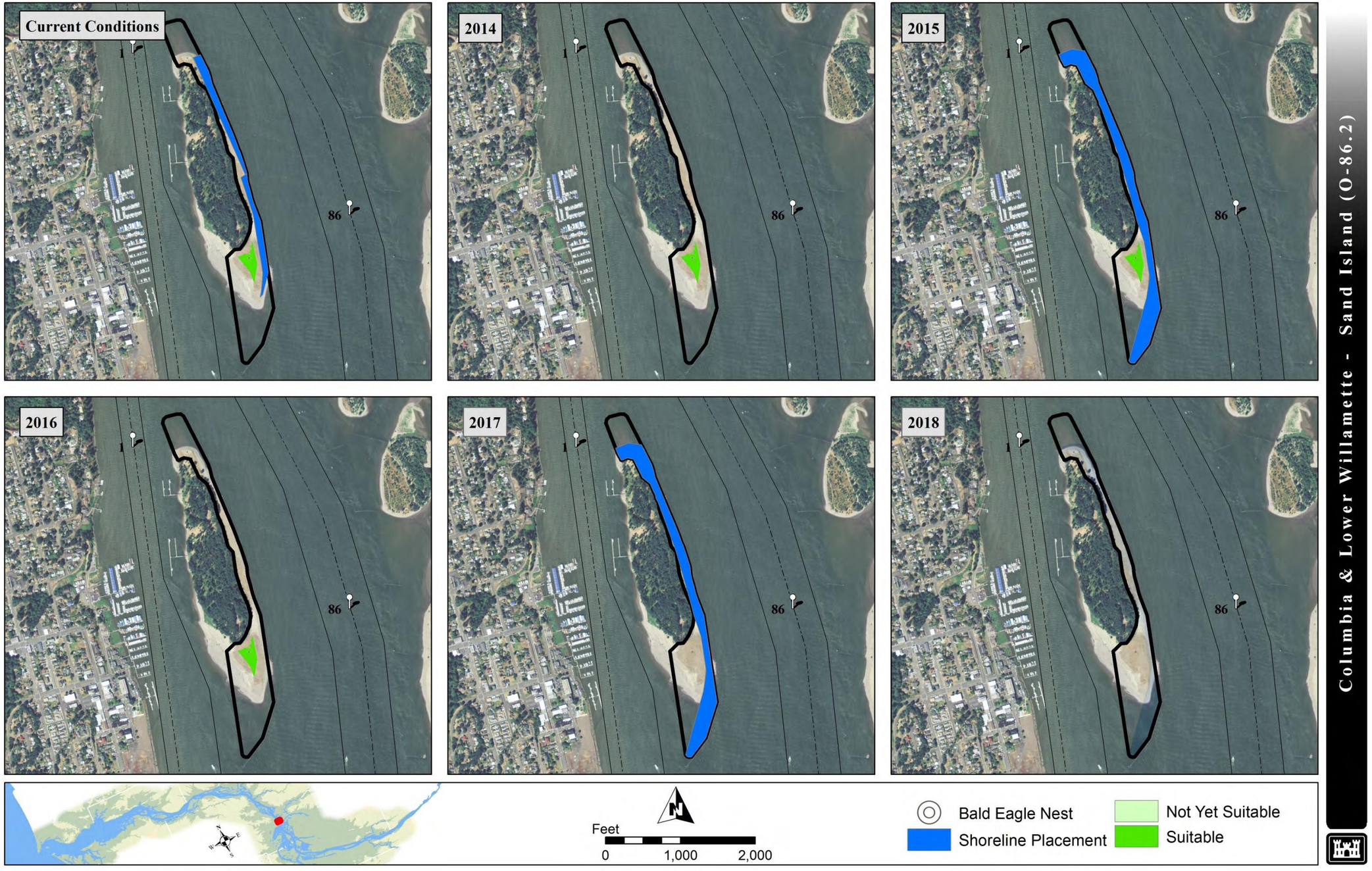

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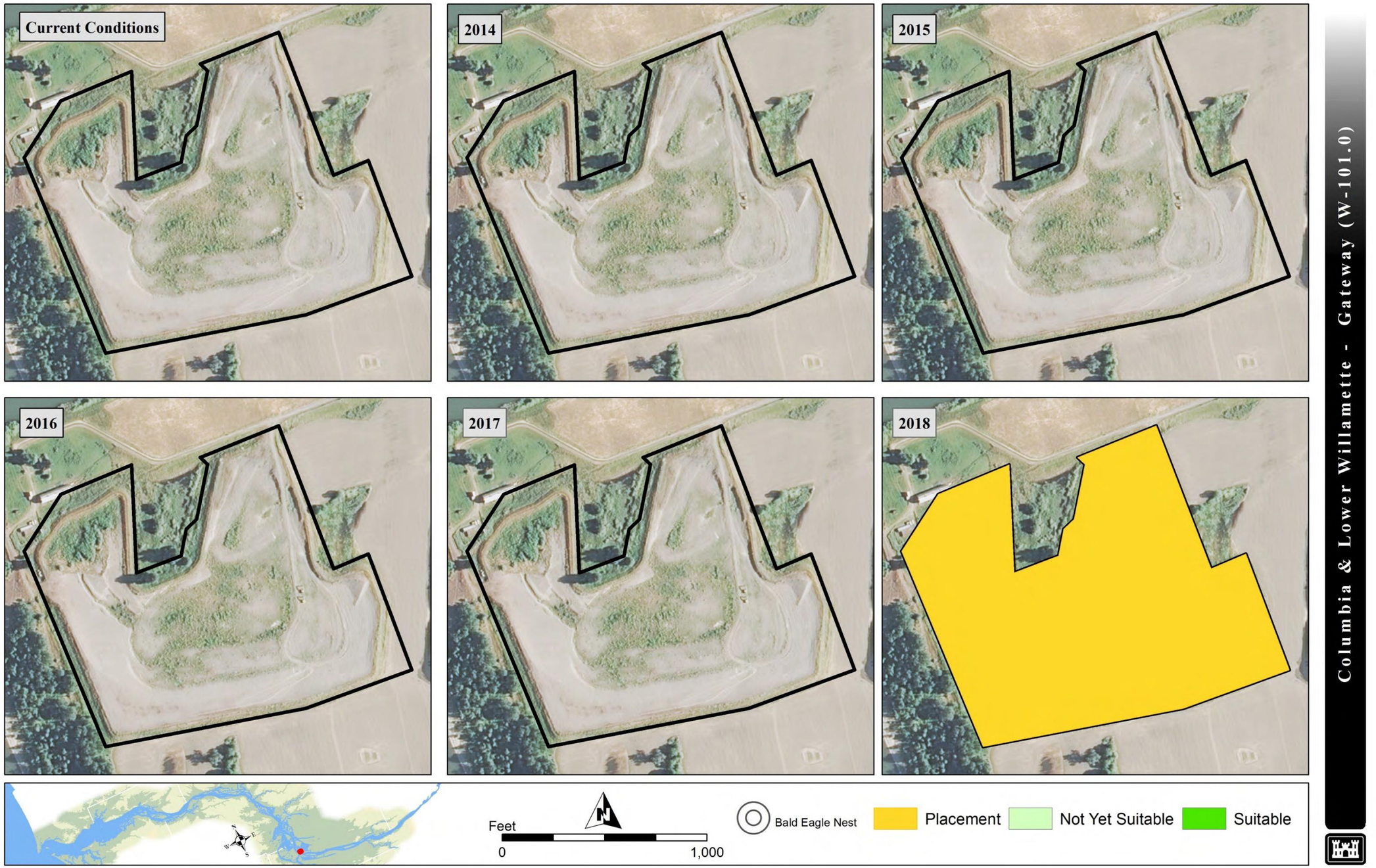

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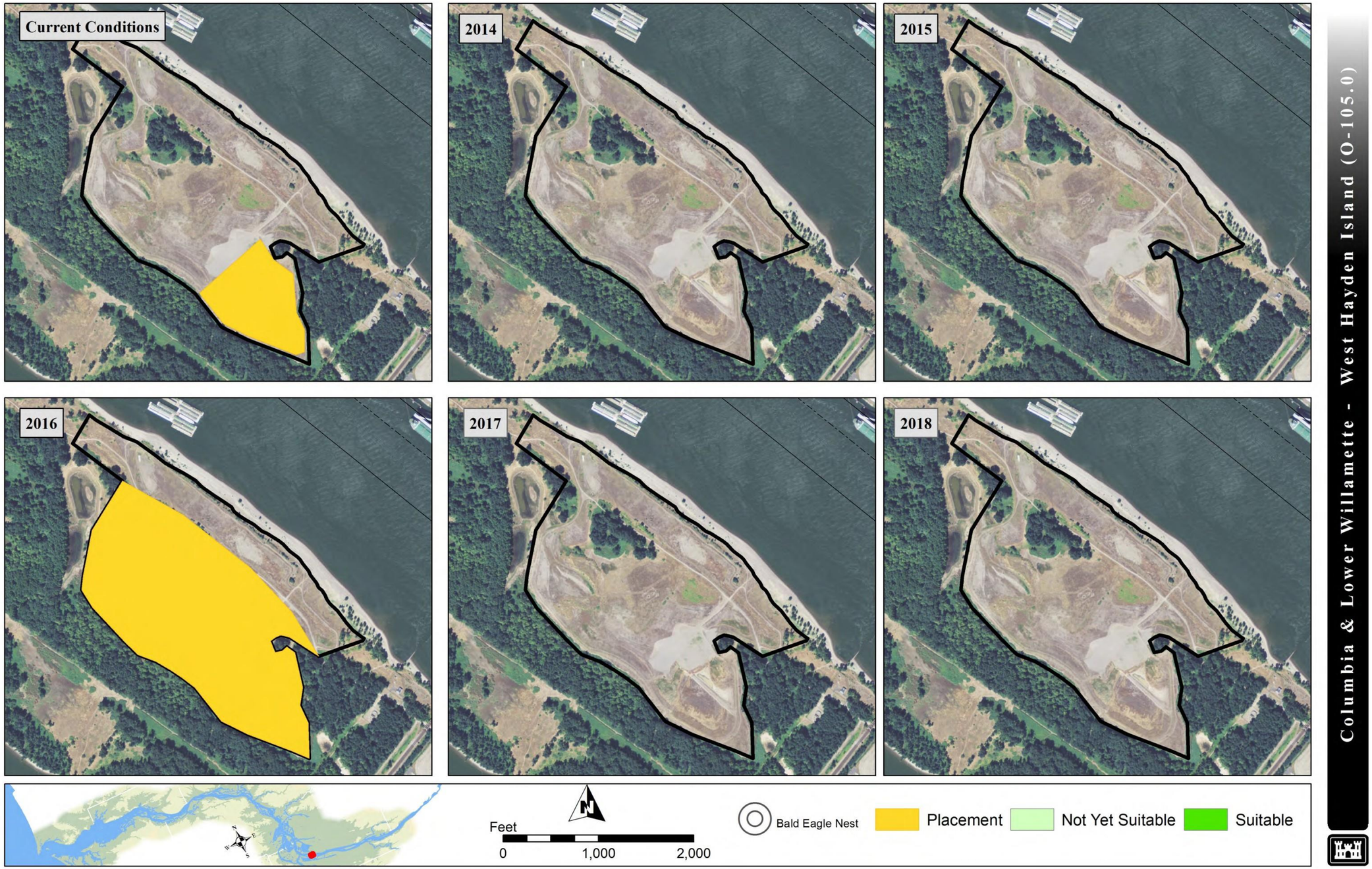
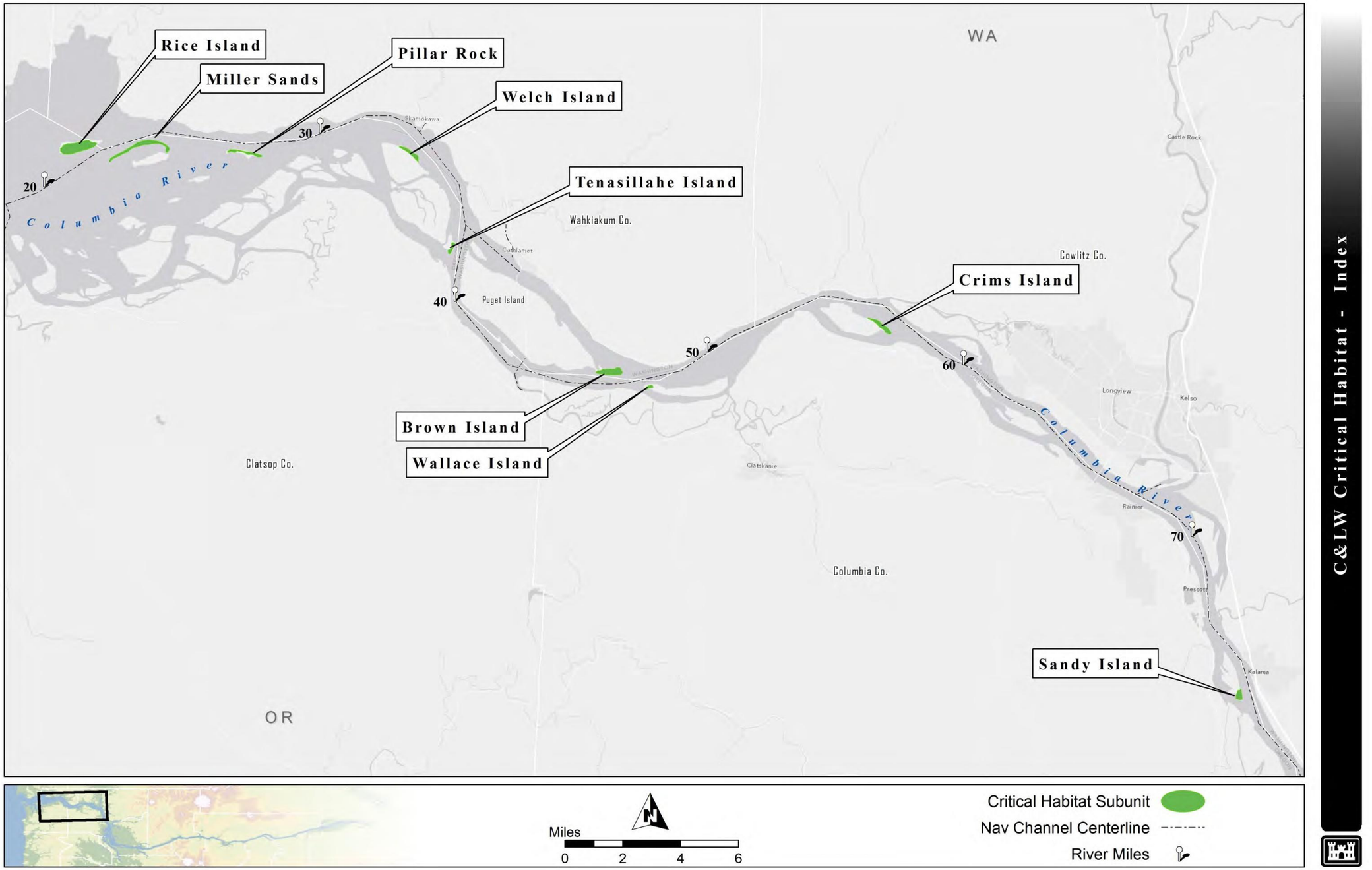
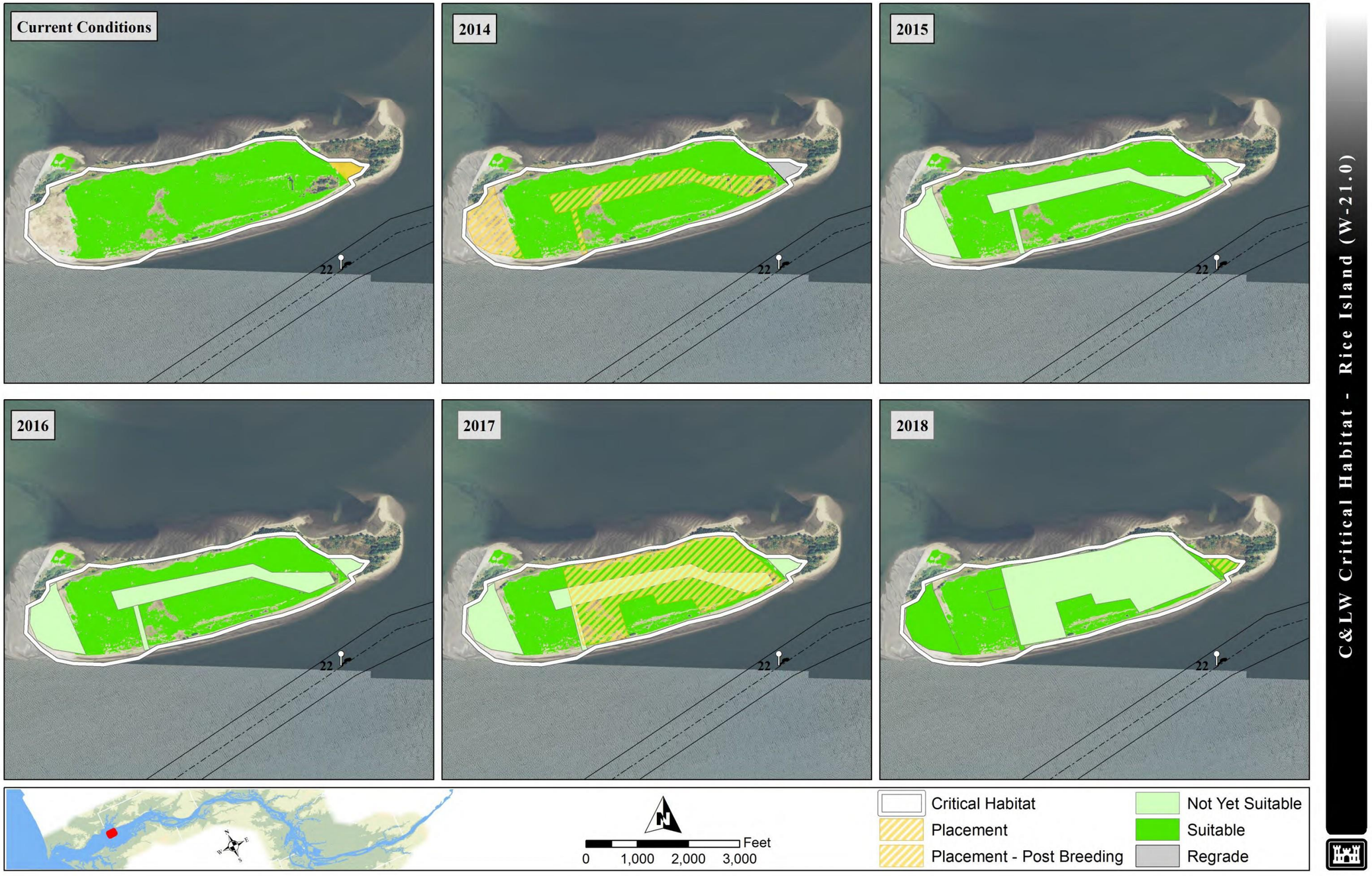


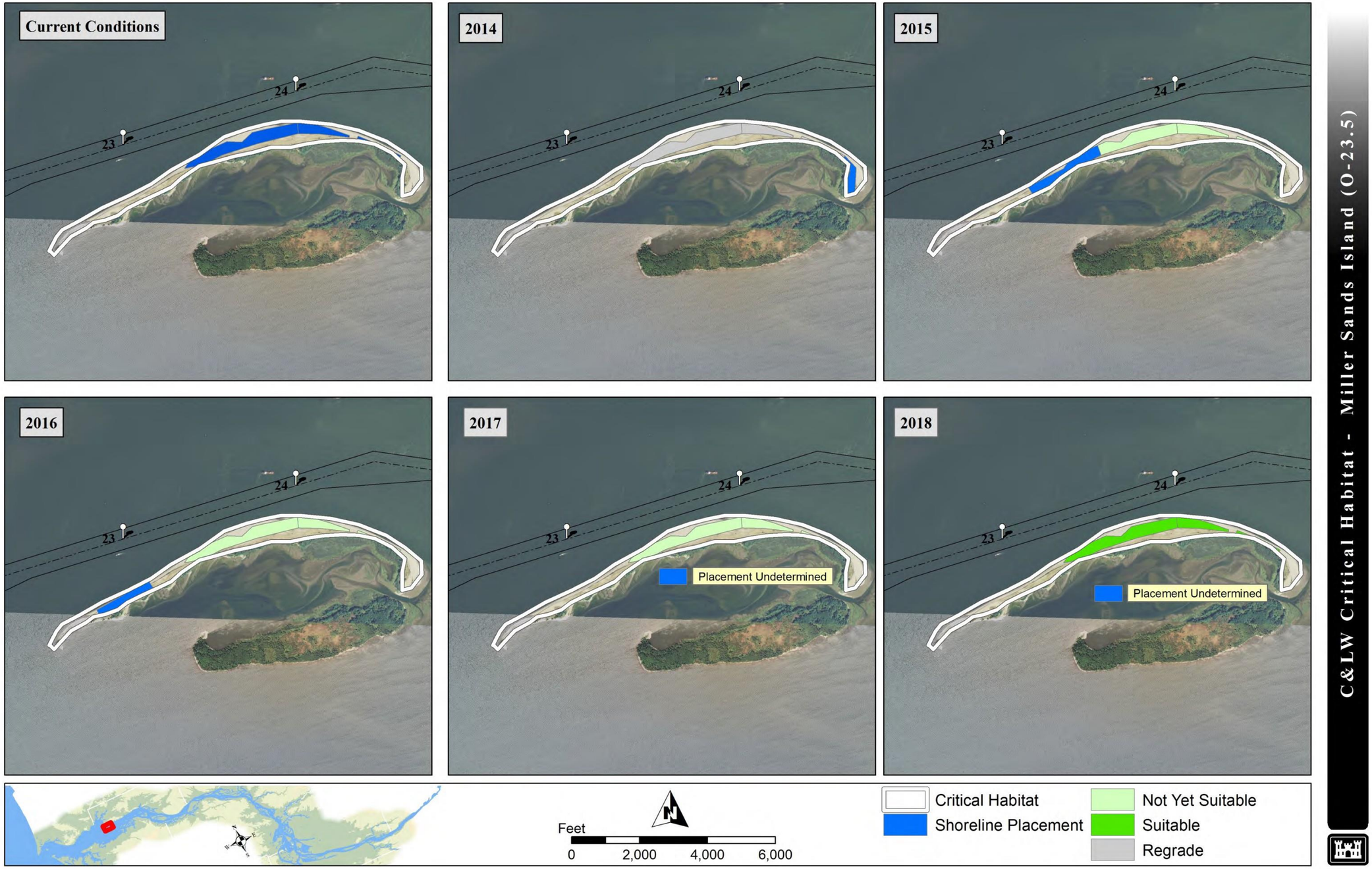
Streaked Horned Lark Critical Habitat 2014-2018 Figures



Streaked Horned Lark Critical Habitat 2014-2018 Figures



Streaked Horned Lark Critical Habitat 2014-2018 Figures



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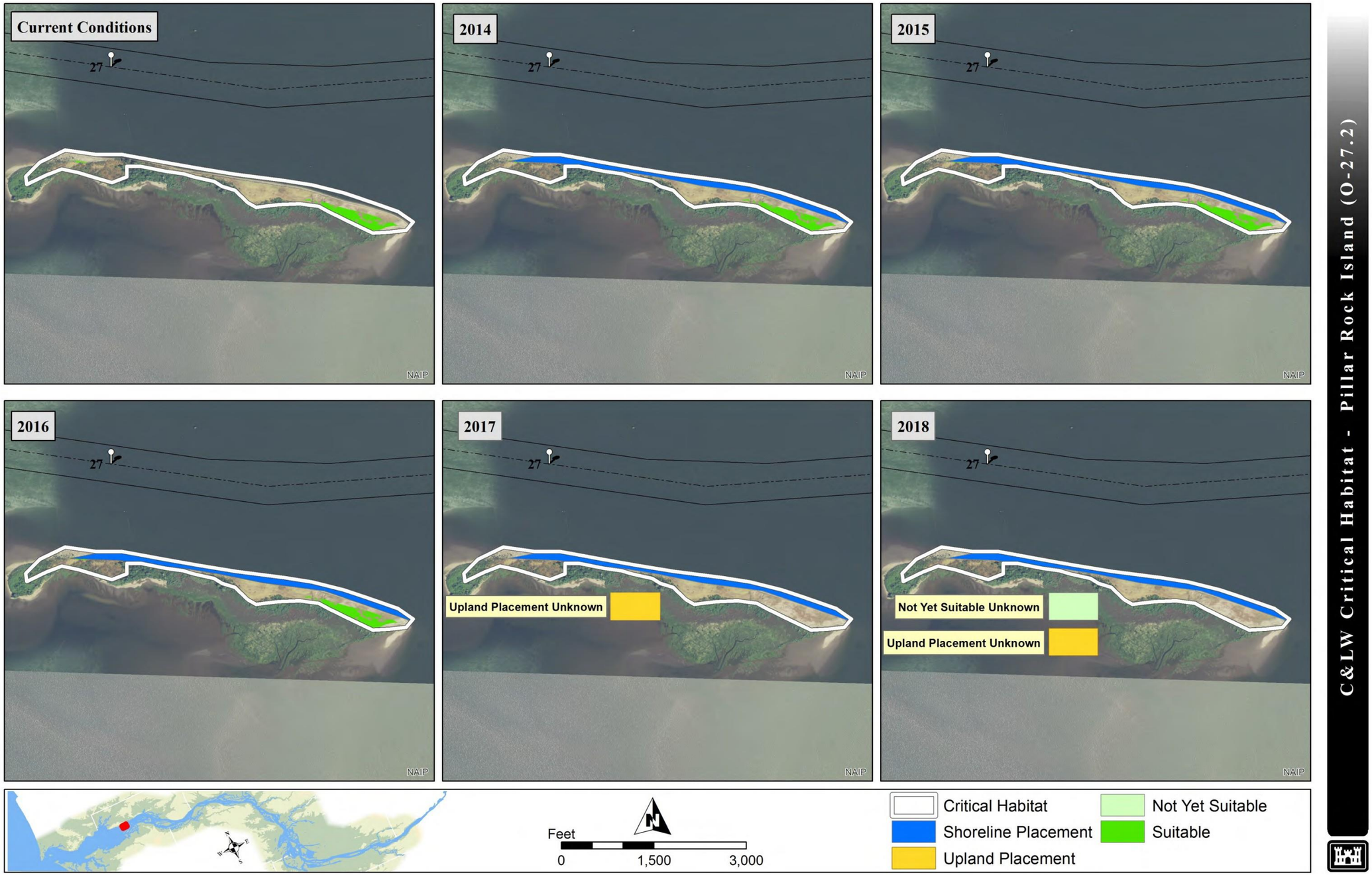

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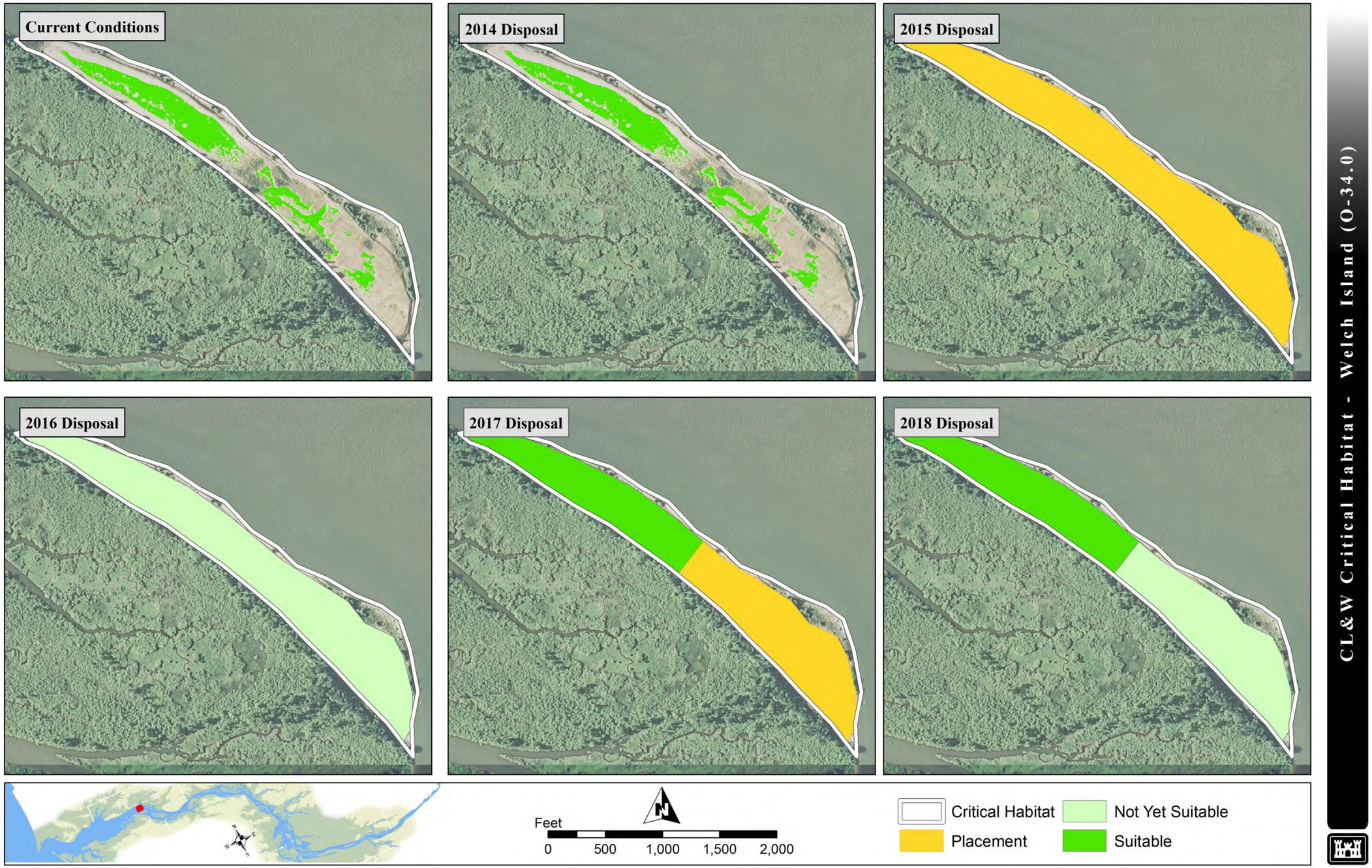

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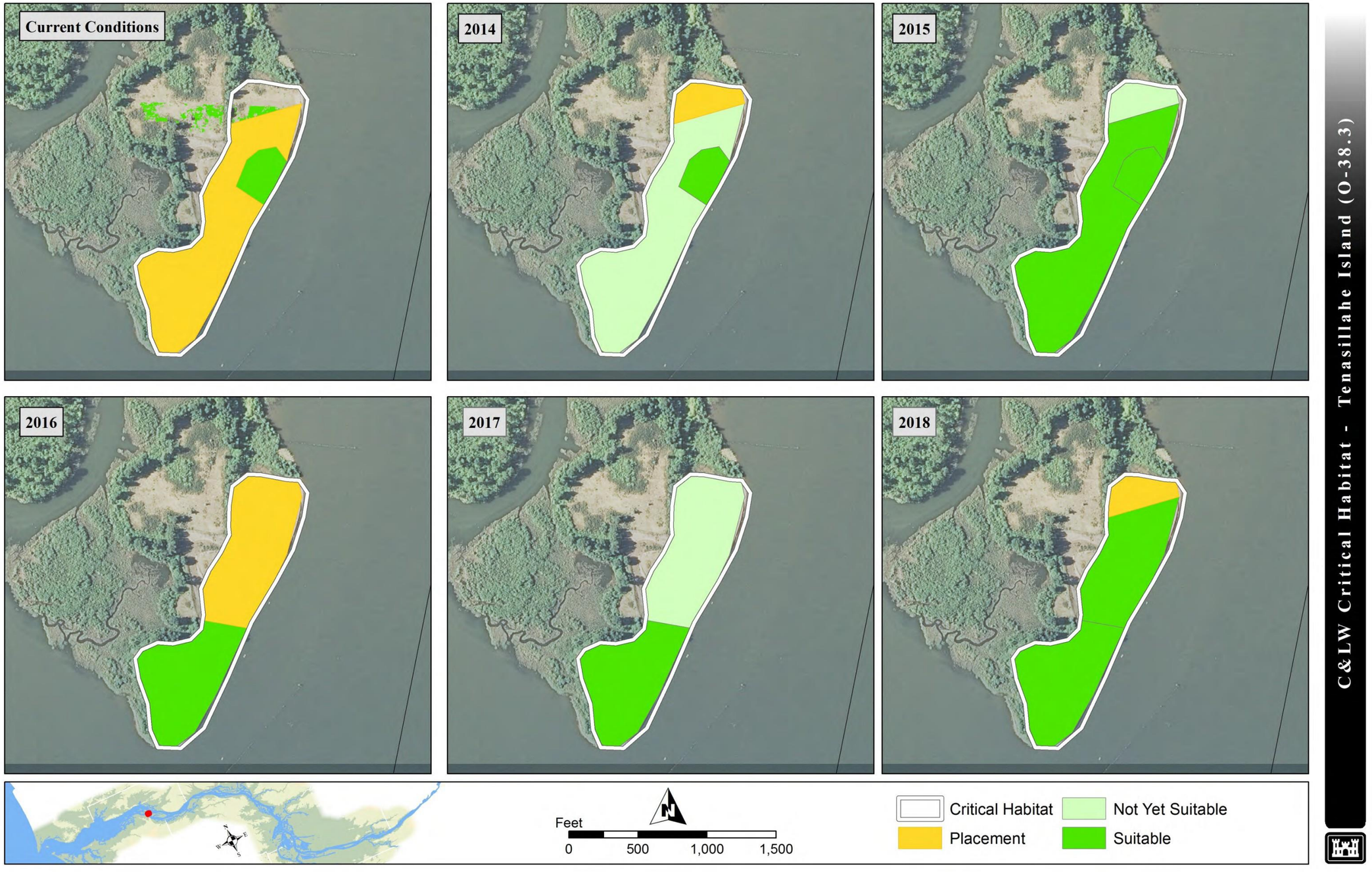
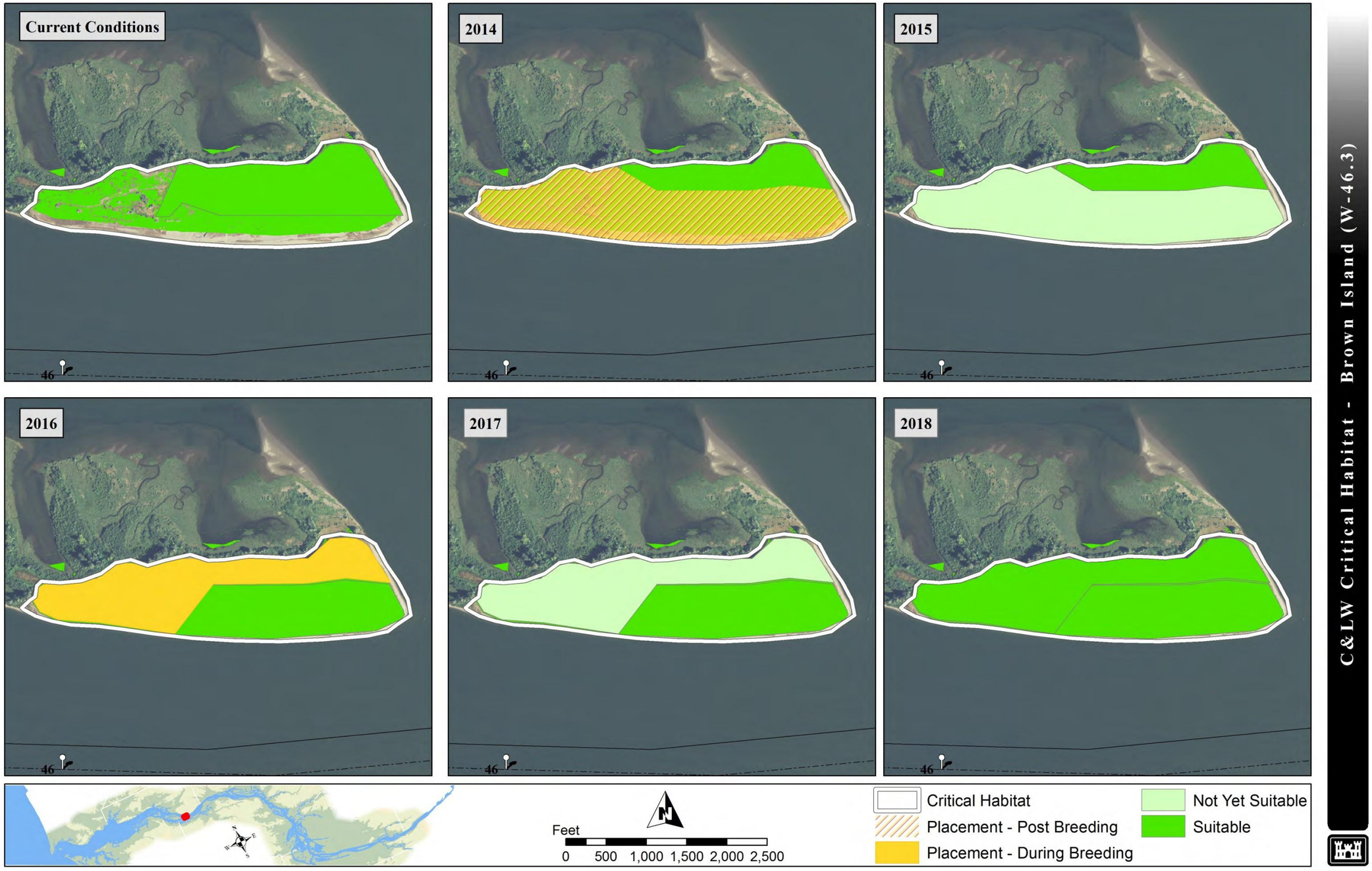
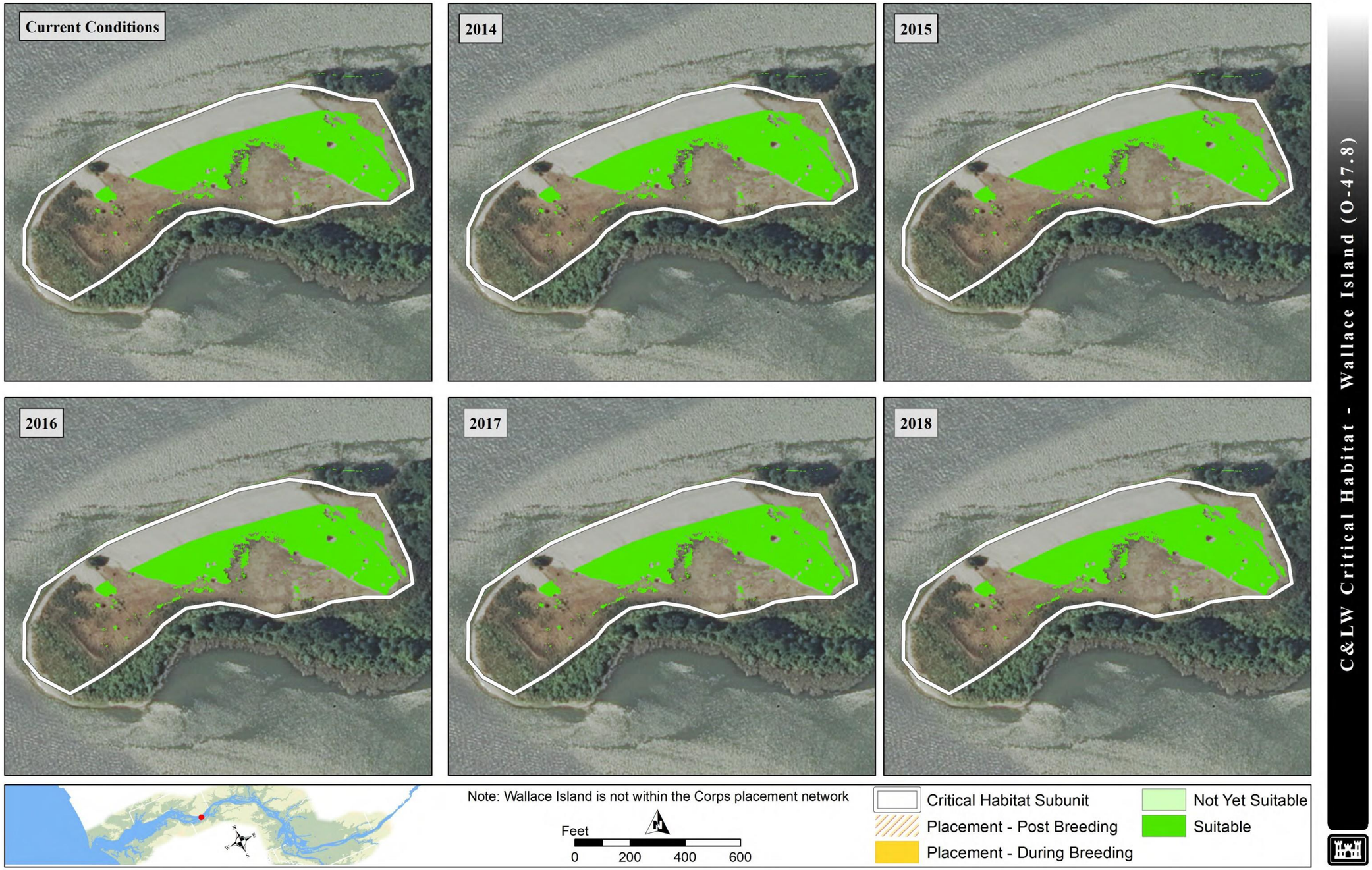


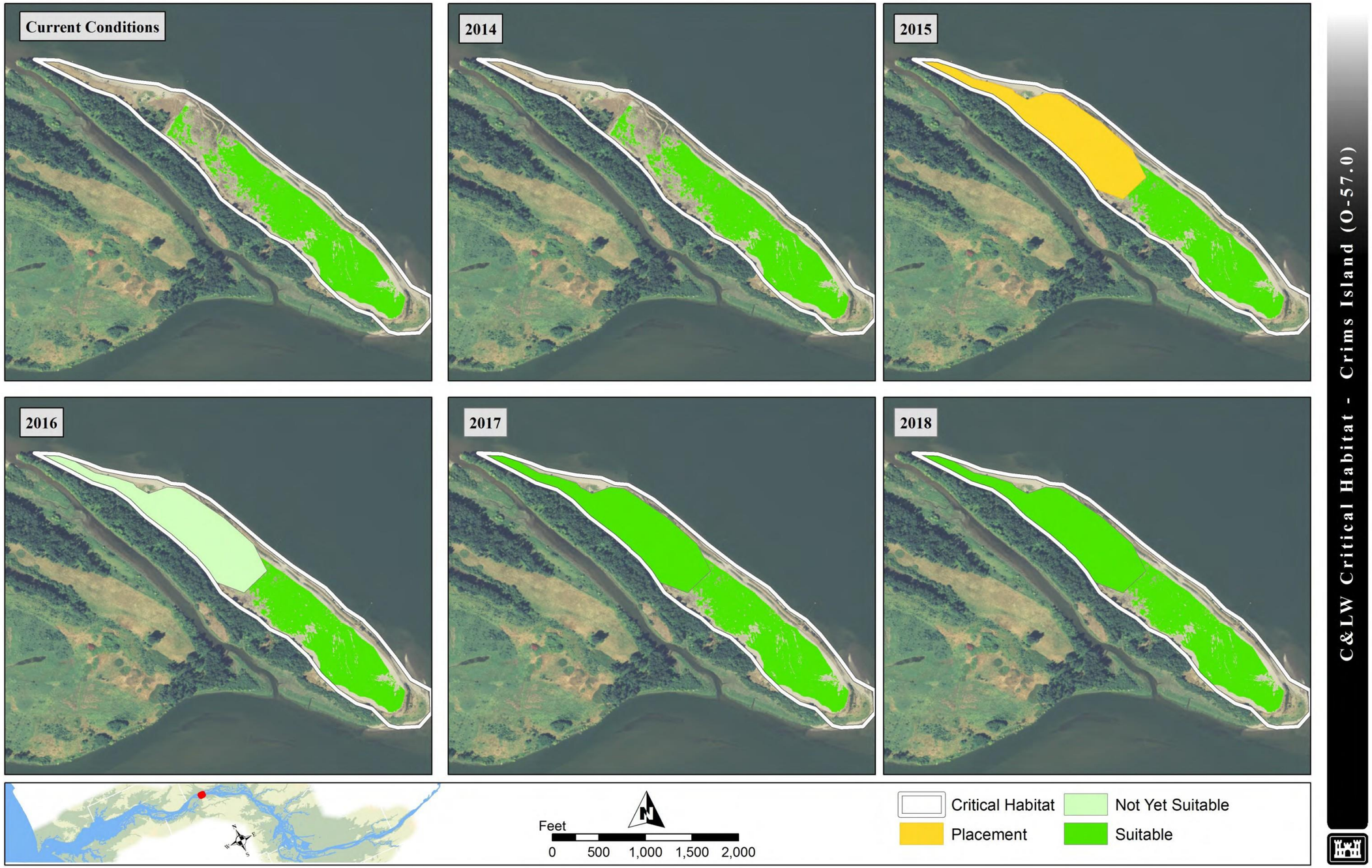
Streaked Horned Lark Critical Habitat 2014-2018 Figures



Streaked Horned Lark Critical Habitat 2014-2018 Figures



Streaked Horned Lark Critical Habitat 2014-2018 Figures



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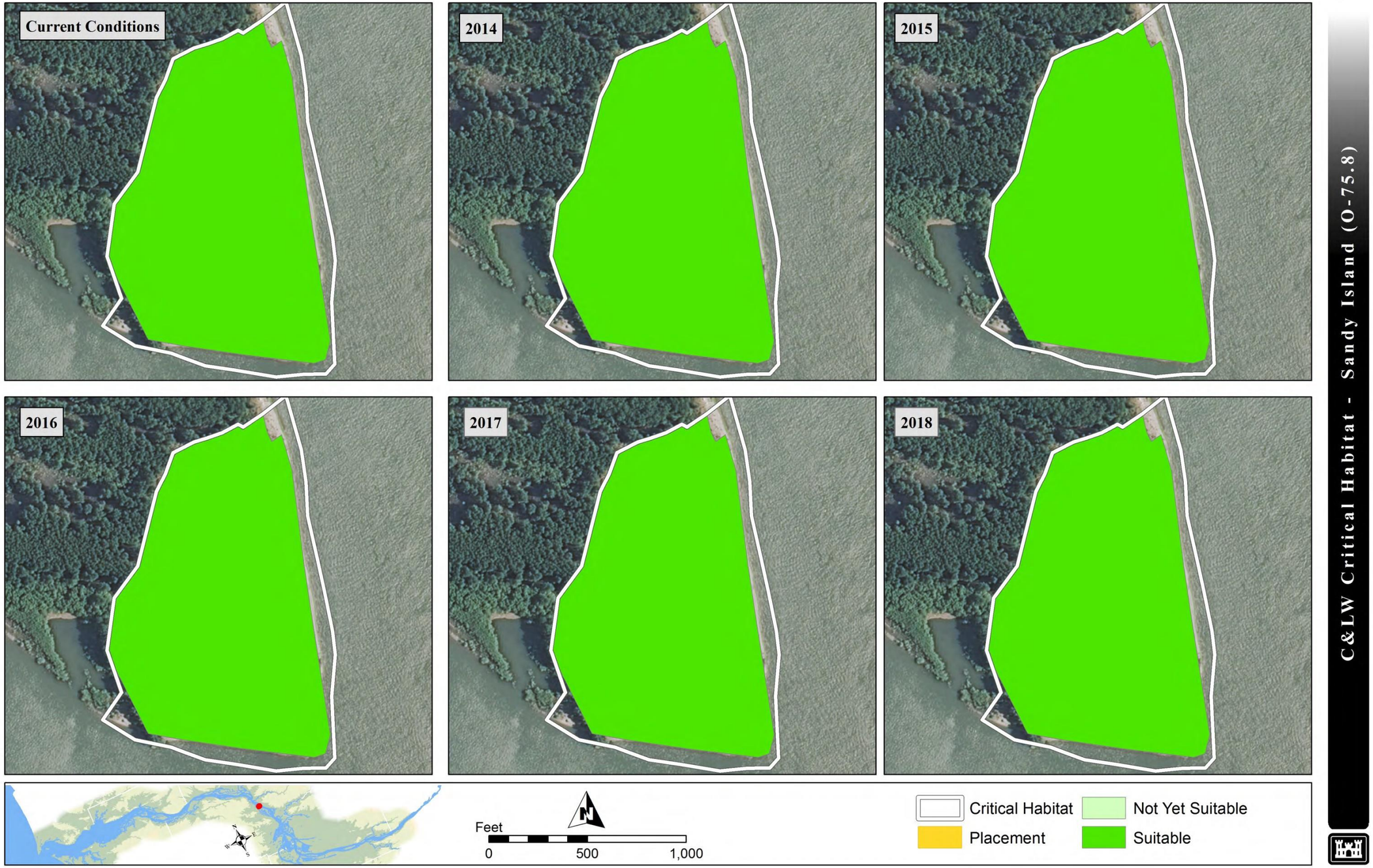


Washington Department of FISH and WILDLIFE

PROPOSED METHODS FOR WILDLIFE DATA COLLECTION "FORM B"

(Consult instructions before completing this form)

This form should be attached to "Form A" when completed

Submitted by:_____ Date:_____

Mailing Address:

Brief description of proposed activity (copy from Form A):	Conduct surveys to detect presence and acquire indices of abundance of the Streaked Horned Lark (*Eremophila alpestris*) by visual and/or auditory detection during the breeding season on known occupied habitat.
1. Species:	**Streaked Horned Lark (*Eremophila alpestris*)**
2. Objectives:	■Confirm the presence of Streaked horned larks by conducting line transect surveys throughout occupied habitat at Joint Base McChord-Ft Lewis -- airfields, artillery impact area, 13th Division Prairie, Ranges 74/76/51; Olympia Airport; Shelton Airport, outer WA coast; Columbia R islands. □ Acquire estimates of abundance □ Provide a non-invasive method of inventory □ Provide an efficient and repeatable survey design □ Provide consistency among surveyors □ Provide standardized protocol for survey and management

3. Describe in detail the methods that will be used to complete the above activity
(Or attach description to this form)**:**

Surveys to detect presence: Streaked horned larks are migrant, ground-dwelling passerines that have adapted to nesting on open grasslands, sparsely vegetated beaches and dredge spoil islands (Stinson 2005). They prefer bare ground and vegetation no more than several inches tall (Beason 1995, Altman 1999, Rogers 2000, Pearson and Hopey 2005). Streaked horned larks are loosely colonial nesters, with both males and females detectable during the breeding season, which occurs roughly from March through August. Survey timing is designed to coincide with clutch initiation curves – first clutches are initiated at the end of April at all sites and taper off dramatically in the Puget Sound area in early July; later on the coast and Columbia River (Pearson et at. 2005). Mates are socially monogamous for the breeding season. Males are easier to detect because they sing on the ground and also perform aerial courtship displays.

Methods: Surveys should begin within ½ hour of sunrise and end by 12:00 noon on days when wind is less than 20 mph with little to no precipitation (light drizzle and brief showers are fine). Surveys should end by 11:00 a.m. or earlier on days when the predicted maximum temperature is 80 F or higher. Four surveys per location should be conducted between 19 April and the first week of July in the Puget lowlands and between 19 April and mid-July for the outer coast and Columbia River as follows:

Survey 1: last two weeks of April **Survey 2:** mid two weeks of May **Survey 3:** mid two weeks of June
Survey 4: first week of July (Puget lowlands) through second week of July (outer coast and Columbia River).
At sites where access is limited, priority should be given to May – July surveys.

Line transects – observers should be positioned 75 m from the survey boundary and 150 m apart (to avoid

double-counting and to maximize detection ability) on predetermined transects/routes and should maintain a slow-moderate pace. Observers should stop every 150 m for approximately 1 minute to listen and scan for larks. Pausing to confirm a detection is allowed, however all observers should remain parallel. Transects should cover as much suitable habitat as possible in the allowed time window. Surveyors should familiarize themselves with vocalizations of male streaked horned larks, flight display behavior, and differentiating larks by sex and age. Young of the year birds look markedly different from adult birds. Every effort should be made to cover all areas with suitable habitat, preferably each time an area is surveyed. However, varying the area surveyed during each of the four surveys is acceptable for large expanses to ensure complete coverage. Observers should rotate between sites/transects and walk the survey route in the opposite direction on subsequent surveys.

Observers will independently record the approximate detection location of each bird on an area orthographic map, as well as the corresponding bird number from the field form. Environmental conditions, age, sex and behavior (see below). Observers may communicate with each other by radio or mobile if necessary. Waypoints should be verified at the beginning, end, and intermediate locations for each transect to verify observers remain on transect. Observers may briefly leave a line to avoid flushing birds or disturbing nests.

Data Recording: (field form attached)

- To avoid confusion between American (month/day/year) vs European (day/month/year) methods of writing dates with Arabic numbers, date should be written with a two-digit numeric for day first, the month using a three-letter abbreviation (e.g., Feb, Mar) second, and the year as a four-digit number last (ex. 26FEB2008).
- The lead observer should record surveyors' full names (not just initials), cloud cover, wind, precipitation, and air temperature at the beginning and end of the survey.
- Record the survey start/stop times. Time should be recorded on a 24-hour clock to avoid confusion with differentiating AM versus PM (e.g., 5:00 PM is 17:00).
- Each observer will receive an ortho map of the survey area, containing transect lines or routes and reference waypoints.
- Each observer will receive a data sheet for recording detections.
- Data to record for each detection include:
  AGE – AD (adult), YOY (young of the year), U (unknown)

  SEX – M (male), F (female), U (unknown and young of the year)

  BEHAVIOR (when first observed; can use more than one code) **–** S = Song, C = call, F = Foraging, FD = flight display, FL = flight, A = agonistic behavior, AI = alert posture (**standing erect with neck extended and appearing vigilant but not singing or calling)**, FC = food carry, CO = copulation, NM = carrying nest material.

- Record any incidental nests found (mark location on ortho, coordinates and contents on data form in Notes section).

Streaked Horned Lark Field Survey Form

SITE:_____ Month:_____Day:_____Year: _____

	Full Name	Affiliation/Ph#
Observer 1		
Observer 2		
Observer 3		
Observer 4		

	start	stop
Cloud cover (%)		
Wind (ave mph)		
Temp (F)		
Precip.		
W. meadowlarks		
Crows		
Ravens		
Unknown corvid		
N. Harrier		

Cloud Cover: 0=0%, 1=33%, 2=66%, 3=100%

Precip: N=None, R=Rain, F=Fog, D=Drizzle

Killdeer

Record est. abundance of negatively impacting bird species

Start time	
End time	

24 hr

24 hr

Total			[redacted]							[redacted]		

Bird number	Age	Sex	Perp. Distance (m)	Behavior	Notes	Bird number	Age	Sex	Perp. Distance (m)	Behavior	Notes
1						23					
2						24					
3						25					
4						26					
5						27					
6						28					
7						29					
8						30					
9						31					
10						32					
11						33					
12						34					
13						35					
14						36					
15						37					
16						38					
17						39					
18						40					
19						41					
20						42					
21						43					
22						44					

Age: A = Adult, YOY = young of the year, U = unknown **Sex**: M = Male, F = Female, U = unknown and YOY
Behavior (only when first observed; can use more than one code): A= agonistic behavior (chase or aggressive contact), Al = alert posture (standing erect w/ neck extended and appearing viligent but not singing or calling), C = call, CO = copulation, F = Foraging, FC = food carry, FD = flight display, FL = flight, FS = flushed, NM = carrying nest material, R = resting, S = Song

ORDINANCE NO. 1283
INTRODUCED BY ALL COMMISSIONERS

AN ORDINANCE AMENDING THE CITY OF WARRENTON COMPREHENSIVE PLAN AND WARRENTON MUNICIPAL CODE TO ADOPT AN EXCEPTION TO STATEWIDE PLANNING GOAL 16 AND MODIFY STANDARDS REGARDING FLOWLANE DISPOSAL IN THE COLUMBIA RIVER

WHEREAS, the United States Army Corps of Engineers (USACE) is federally mandated to maintain the Federal Navigation Channel of the Columbia River, which includes dredging and disposal of dredged material to maintain the deep draft channel; and

WHEREAS, in 2002, the Columbia River Estuary Study Taskforce (CREST) completed the *Columbia River Estuary Dredged Material Management Plan,* which refined the dredging and disposal policies in the City of Warrenton's Comprehensive Plan and inventoried an adequate number of disposal sites with sufficient capacity to accommodate projected disposal needs for at least a five-year period; and

WHEREAS, the City of Warrenton adopted the necessary provisions from the *Columbia River Estuary Dredged Material Management Plan* in Article 5 of the City of Warrenton Comprehensive Plan and Section 16.160 of the Warrenton Municipal Code; and

WHEREAS, Section 16.160 of the Warrenton Municipal Code currently allows flow lane disposal in areas designated aquatic development; and

WHEREAS, in approximately 2010, the United States Army Corps of Engineers (USACE) altered its dredge material disposal practices to include the river thalweg within contour depths of 20 feet or greater as part of its flowlane disposal area; and

WHEREAS, the expanded flowlane/thalweg area encompasses in-water areas that are designated Conservation Aquatic, which does not allow flowlane disposal; and

WHEREAS, this discrepancy between USACE practices and City of Warrenton policies was identified in 2023; and

WHEREAS, it has been demonstrated that the use of the expanded flowlane/thalweg is required to maintain the river's sediment budget and to reduce shoaling and that no other alternatives are available that would meet these requirements; and

WHEREAS, in September 2024, the Oregon Department of State Lands (DSL) submitted an application for an exception to Goal 16: Estuarine Resources, to allow the disposal of dredged materials in water areas designated Conservation Aquatic; and

WHEREAS, the application meets the criteria outlined in the City of Warrenton Comprehensive Plan and Warrenton Municipal Code and it is in the public's best interest to adopt this exception to Goal 16: Estuarine Resources; and

NOW THEREFORE, the City of Warrenton ordains as follows:

Section 1. Section 5.110 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.110 Estuary Channels Subarea Findings

(1) General Description - This subarea includes the deep water portions of the estuary from Jetty A (RM 3) to the upper end of Rice Island (RM 22.5). The subarea contains the authorized navigation channel. The subarea boundary generally follows the 20-foot bathymetric contour; however, it varies from this contour in the vicinity of cities and other subareas containing deep channels. There are no intertidal wetland or shoreland areas. Portions of Clatsop, Pacific and Wahkiakum Counties, and Astoria and Warrenton are within this subarea. The Warrenton portion comprises only a small portion of this 16,500 acre subarea.

(2) Aquatic Designations - All aquatic areas in the Estuary Channels Subarea in Warrenton are designated Conservation except:

(a) The main navigational channel and a flowlane disposal area on each side of the channel (either 600 feet wide or extending to the 20 foot bathymetric contour, whichever is narrower) is designated Aquatic Development.

(b) Dredged material disposal sites CC-E-8.5 and CC-E-2LO, listed in the *Columbia River Estuary Dredged Material Management Plan,* are designated Aquatic Development.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 2. Section 5.120 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.120 Tansy Point/Alder Cove Subarea Findings

(1) General Description - This subarea includes aquatic areas in Alder Cove and the Columbia River out to the pierhead line, and shorelands between the waterward extension of Railroad Drive (the old Warrenton/Hammond boundary) and the mouth of Alder Creek. This subarea contains about 600 acres of both shorelands and aquatic areas within the City of Warrenton.

(2) Aquatic and Shoreland Designations

(a) Development Aquatic:

- The aquatic area bounded by the shoreline on the South, the pierhead line to the North, the waterward extension of Railroad Drive on the West and Tansy Point on the East.
- The barge moorage area on the East side of Tansy Point.
- The flowlane disposal area south of the main channel (600 feet wide or to the 20-foot bathymetric contour, whichever is narrower).

(b) Conservation Aquatic:

- The area at the southern end of Alder Cove where effluent from the Warrenton sewage ponds is discharged.
- The mouth of Alder Cove from the 3-foot bathymetric contour north to the flowlane disposal area.

(c) Natural Aquatic:

- Remaining aquatic area within Alder Cove.

(d) Water-Dependent Development Shorelands:

- All shoreland areas are designated Water-Dependent Development Shorelands, except for a portion of dredged material disposal site Wa-S-9.4, which is designated Development Shorelands.

(e) The regulatory shoreland boundary is 50 feet from the Columbia River Estuary shoreline, or from the landward toe of dikes and associated toe drains, whichever is greatest, except where it extends further inland to include the following features:

- Shoreland areas designated Water-Dependent Development Shorelands.
- Mitigation site M3 from the *Mitigation and Restoration Plan for the Columbia River Estuary*.
- Dredged material disposal site Wa-S-9.4 from the *Columbia River Estuary Dredged Material Management Plan*.
- A wetland at Tansy Creek identified as significant under Oregon Statewide Planning Goal 17.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 3. Section 5.150 of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.150 Mouth of the Skipanon River Subarea Findings

(1) General Description - This subarea contains filled and diked shorelands north of Harbor Drive and east of Skipanon Drive; the Skipanon River from the Harbor Drive Bridge to its mouth; the East and West Skipanon Peninsulas; and adjacent Columbia River waters out to the navigation channel. Parts of downtown Warrenton are also included.

(2) Aquatic and Shoreland Designations

(a) Development Aquatic:

- The Skipanon waterway between the Harbor Drive Bridge and the main navigation channel.

- Approximately 7.8 acres of tidal marsh and flats on the west side of the West Peninsula.

- The flowlane disposal area south of the main channel (600 feet wide or to the 20-foot bathymetric contour, whichever is narrower).

- The area from the Skipanon Channel to the eastern boundary of the Subarea and from the line of aquatic vegetation on the East Peninsula north to the Columbia River navigation channel.

(b) Conservation Aquatic:

- The aquatic area between the shoreline and the flowlane disposal area west of the Skipanon Channel.

(c) Development Shoreland:

- The area adjacent to the mooring basin east to N.E. Iredale Avenue.

- The area north of Harbor Drive on the east side of the Skipanon waterway.

- An area on the south side of the West Peninsula.

- The area east of Holbrook Slough.

(d) Water-Dependent Development Shorelands:

- All other shorelands are designated Water-Dependent Development.

(e) The regulatory shoreland boundary is 50 feet from the Columbia River Estuary shoreline, or from the landward toe of dikes and associated toe drains, whichever is greatest, except where it extends further inland to include the following features:

- The East Skipanon Peninsula including all shoreland areas on the northern 96 acres of the East Skipanon Peninsula.

- The West Skipanon Peninsula including all upland adjacent to Alder Cove and east of N. E. Skipanon Drive, with the exception of the area designated commercial by the City of Warrenton Zoning Ordinance;

dredged material disposal site Wa-S-10.7 from the Columbia River Estuary Dredged Material Management Plan; and The Holbrook Slough wetland, classified as significant under Oregon Statewide Planning Goal 17.

(3) Goal Exception - An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic areas, was approved by Ordinance 1283 on January 28, 2024.

Section 4. Section 5.305(10) of the City of Warrenton Comprehensive Plan is amended to read as follows:

Section 5.305 Dredging and Dredged Material Disposal

(10) Flowlane disposal sites shall only be allowed in Development Aquatic areas within or adjacent to a channel or where an exception to Goal 16 has been approved. The Development Aquatic area adjacent to the channel shall be defined by a line 600 feet from either side of the channel or the 20-foot bathymetric contour, whichever is closer to the channel. Flowlane disposal within this area shall only be allowed where:

(a) Sediments can reasonably be expected to be transported downstream without excessive shoaling,

(b) Interference with recreational and commercial fishing operations, including snag removal from gillnet drifts, will be minimal or can be minimized by applying specific restrictions on timing or disposal techniques,

(c) Adverse hydraulic effects will be minimal,

(d) Adverse effects on estuarine resources will be minimal, and

(e) The disposal site depth is 20 feet below MLLW or deeper.

(f) An exception to Goal 16 to allow in-water disposal of dredged material in the expanded flowlane in depths greater than 20 feet and contiguous to the Federal Navigation Channel, which encroach into designated Conservation Aquatic or Natural Aquatic areas, has been approved.

Section 5. Section 16.76.030 of the Warrenton Municipal Code is amended to read as follows:

A. High-intensity water-dependent recreation including boat ramps, marinas, and individual docks.
B. Aquaculture and water-dependent portions of aquaculture facilities.
C. Active restoration for purposes other than protection of habitat, nutrient, fish, wildlife and aesthetic resources.
D. Temporary alterations.
E. Filling in conjunction with listed conditional uses, pursuant to the applicable standards in Section 16.160.060.
F. Minor navigational improvement.
G. Mining and mineral extraction.
H. Dredging in conjunction with any of the listed conditional uses pursuant to the applicable standards in Section 16.160.040.
I. Low-intensity water-dependent commercial or industrial uses requiring occupation of water-surface area by means other than fill.
J. In-water log storage.
K. Communication facilities subject to the standards of Chapter 16.148.
L. Piling in conjunction with any of the listed conditional uses.
M. Flow lane disposal of dredged material where an exception to Statewide Goal 16 has been approved.
N. Similar uses to those listed in this section.

Section 6. Section 16.160.050(E) of the Warrenton Municipal Code is amended to read as follows:

E. Flow lane disposal shall be in aquatic development areas, or areas where an exception to Goal 16 has allowed in-water disposal of dredged material in depths greater than 20 feet and contiguous to the Federal Navigation Channel which encroach into designated Conservation Aquatic areas, that have been identified as low in benthic productivity and use of these areas shall not have adverse hydraulic effects. Use of flow lane disposal areas in the estuary shall be allowed only when no feasible alternative land or ocean disposal sites with less damaging environmental impacts can be identified and the biological and physical impacts of flow lane disposal are demonstrated to be insignificant. The feasibility and desirability of alternative sites shall take into account, at a minimum:
    1. Operational constraints such as distance to the alternative sites;
    2. Sediment characteristics at the dredging site;
    3. Timing of the operation;
    4. Environmental Protection Agency constraints on the use of designated ocean disposal sites;

5. The desirability of reserving some upland sites for potentially contaminated material only. Long term use of a flow lane disposal area may only be allowed if monitoring confirms that the impacts are not significant. Flow lane disposal is contingent upon demonstration that:
   a. Significant adverse effects due to changes in biological and physical estuarine properties will not result; and
   b. Flow lane disposal areas shall be shown able to transport sediment downstream without excessive shoaling, interference with recreational and commercial fishing operations, including the removal of snags from gillnet drifts, undesirable hydraulic effects, or adverse effects on estuarine resources (fish runs, spawning activity, benthic productivity, wildlife habitat, etc.).
6. When determining whether a proposal is within the expanded flowlane/thalweg disposal area covered by an approved Goal 16 exception, the Columbia River Estuary Thalweg map adopted by Ordinance 1283 shall be consulted. It is important to note that the text description of "expanded flowlane/thalweg disposal" are the regulating boundaries of this exception area. Maps and GIS data layers used by the City are a representation of those boundaries. In cases of any doubt, the text description should be used to resolve any boundary confusion.

Section 7. The Columbia River Thalweg map shown in Exhibit 1 is hereby adopted and incorporated into the Warrenton Comprehensive Plan as Appendix III.

Section 8. This ordinance shall take full force and effect 30 days after its adoption by the Commission of the City of Warrenton.

First Reading: April 8, 2025
Second Reading:

ADOPTED by the City Commission of the City of Warrenton, Oregon this ___ day of _____, 2025.

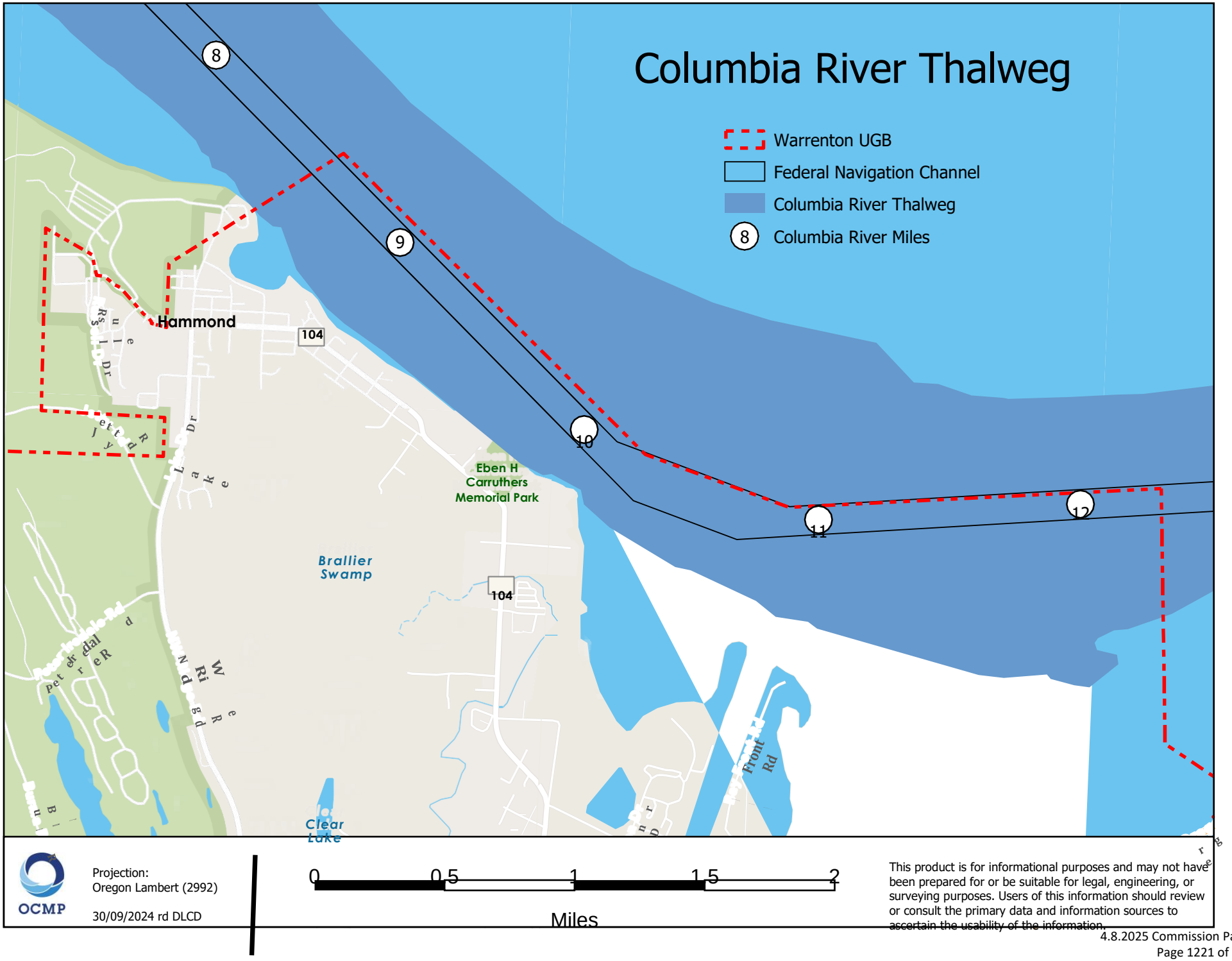
APPROVED:

_____
Henry A. Balensifer III, Mayor

ATTEST:

_____
Dawne Shaw, CMC, City Recorder

Exhibit 1


Columbia River Thalweg
Warrenton UGB
Federal Navigation Channel
Columbia River Thalweg
Columbia River Miles
8
9
10
11
12
Hammond
104
Eben H
Carruthers
Memorial Park
Brallier
Swamp
Clear
Lake
Front
Rd
OCMP
Projection:
Oregon Lambert (2992)
30/09/2024 rd DLCD
0
0.5
1
1.5
2
Miles
This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

City Commission Agenda Memo

Meeting Date: April 8th, 2025
From: Kevin Gorman, Public Works Director
Subject: Request for Commission Approval to Advertise for Bids – Hammond Transmission Waterline Phase 1

Summary:

Staff requests authorization to advertise for construction bids for the Hammond Waterline Phase 1 Project. The design for the entire project has been completed, and it will be constructed in two phases. Phase 1 involves the installation of approximately 4,500 linear feet of 18-inch diameter PVC water transmission pipe, isolation valves, and other water system appurtenances, along with connections to existing water mains and services. The transmission main will be installed along Fort Stevens Highway (OR-104) and NW 13th Street.

Phase 1 will provide significant improvements to the City's water infrastructure, with Phase 2 planned as the final phase to complete the project. The City is actively working to secure funding for Phase 2, which will follow Phase 1 as soon as resources are available.

Recommendation/Suggested Motion:

"I move to authorize the advertisement for construction bids for the Hammond Waterline Phase 1 Project."

Alternative:

Other action as deemed appropriate by the City Commission
OR
None recommended

Fiscal Impact:

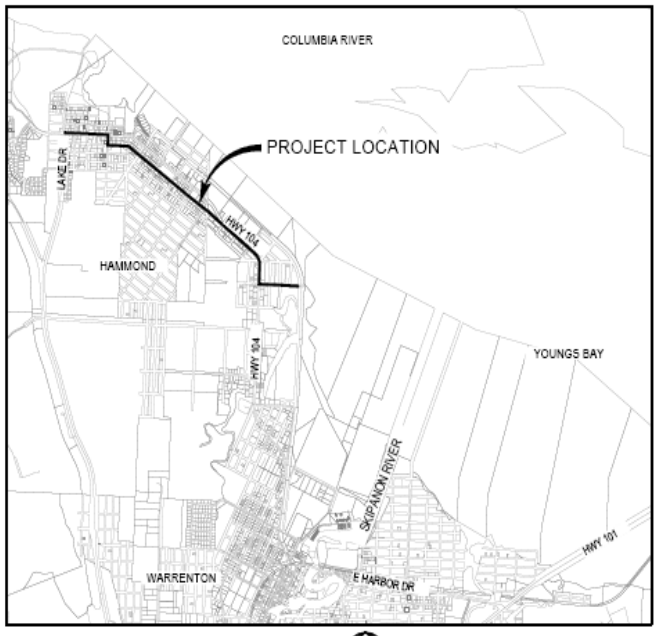
The project includes funding from Business Oregon's Safe Drinking Water Revolving Loan Fund (SDWRLF), the Environmental Protection Agency (EPA), and a smaller portion of local funds. The project is fully funded with no additional fiscal impact beyond the $3 million already allocated in the adopted FY 2024-2025 budget.

Attachments:

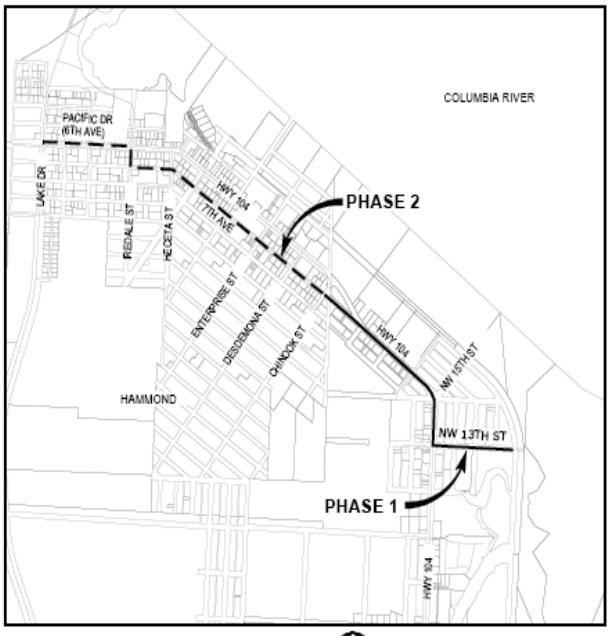
(All supporting documentation, i.e., maps, exhibits, etc., must be attached to this memorandum.)

- Hammond Transmission Waterline Project Map
- Hammond Transmission Waterline- Phase 1 Contract Documents

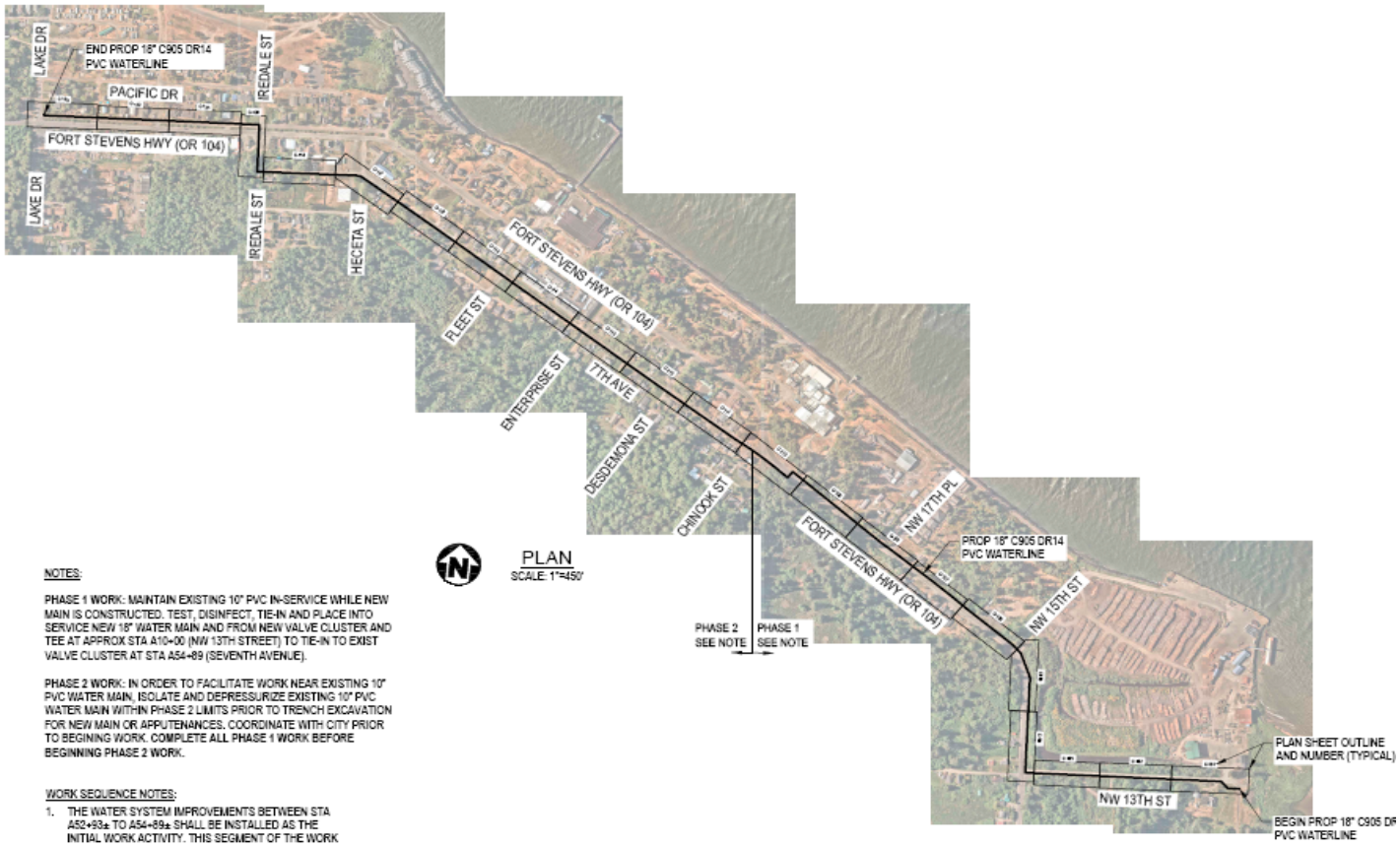
Approved by City Manager: Esther Moberg



VICINITY MAP
SCALE: 1" = 5000'



LOCATION MAP
SCALE: 1" = 1000'



PLAN
SCALE: 1"=450'

NOTES:

PHASE 1 WORK: MAINTAIN EXISTING 10" PVC IN-SERVICE WHILE NEW MAIN IS CONSTRUCTED. TEST, DISINFECT, TIE-IN AND PLACE INTO SERVICE NEW 18" WATER MAIN AND FROM NEW VALVE CLUSTER AND TEE AT APPROX STA A10+00 (NW 13TH STREET) TO TIE-IN TO EXIST VALVE CLUSTER AT STA A54+89 (SEVENTH AVENUE).

PHASE 2 WORK: IN ORDER TO FACILITATE WORK NEAR EXISTING 10" PVC WATER MAIN, ISOLATE AND DEPRESSURIZE EXISTING 10" PVC WATER MAIN WITHIN PHASE 2 LIMITS PRIOR TO TRENCH EXCAVATION FOR NEW MAIN OR APPURTENANCES. COORDINATE WITH CITY PRIOR TO BEGINING WORK. COMPLETE ALL PHASE 1 WORK BEFORE BEGINNING PHASE 2 WORK.

WORK SEQUENCE NOTES:

1. THE WATER SYSTEM IMPROVEMENTS BETWEEN STA A52+93± TO A54+89± SHALL BE INSTALLED AS THE INITIAL WORK ACTIVITY. THIS SEGMENT OF THE WORK REQUIRES ARCHAEOLOGIST MONITORING OF EXCAVATION AND TRENCHING ACTIVITIES. THIS SEGMENT OF WORK SHALL BE INSTALLED, TESTED AND DISINFECTED. THE CUT-OFF VALVES WILL BE CLOSED TO ISOLATE IT FROM THE EXISTING 10-INCH WATER MAIN, THE WATER SHALL BE DRAINED FROM THE PIPE AND A TEMPORARY CAP INSTALLED.
2. UPON COMPLETION OF THE PREVIOUS WORK SEGMENT, THE WATERLINE INSTALLATION SHALL RESUME BEGINNING AT STA A10+00 AND PROCEEDING WEST/NORTH IN STATION ASCENDING ORDER. THE WATER SYSTEM IMPROVEMENTS SHALL BE INSTALLED, TESTED, DISINFECTED AND ACCEPTED IN LOGICAL SEQUENCE.
3. UPON REACHING THE TEMPORARY CAP INSTALLED IN STEP 1, THE TEMPORARY CAP SHALL BE REMOVED, WATERLINE CONNECTED, AND THE PIPE SEGMENT SHALL BE TESTED, DISINFECTED, AND ACCEPTED.
4. REFER TO SECTIONS 00 73 00, SPECIAL PROVISIONS, AND 01 12 16, WORK SEQUENCE, FOR ADDITIONAL INFORMATION.

CONTRACT DOCUMENTS

FOR

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1

MARCH 2025

VOLUME 1 OF 2

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DIVISION 00 – PROCUREMENT & CONTRACTING REQUIREMENTS

INTRODUCTORY INFORMATION

CONTRACT DOCUMENTS

FOR

CONSTRUCTION OF

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1

FOR

CITY OF WARRENTON, OREGON

MARCH 2025

Consor Engineers

400 E. Mill Plain Blvd, Suite 400, Vancouver, WA 98660

Phone 360.448.4230

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SECTION 00 01 07 - SEALS PAGE

FOR
HAMMOND TRANSMISSION WATERLINE PROJECT
FOR
CITY OF WARRENTON, OREGON

See Table of Contents for author of each specification section, identified by author's initials as follows:

AUTHOR'S NAME = INITIALS

ANDREW T. MILES = ATM (Consor North America, Inc.)

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SECTION 00 01 10 – TABLE OF CONTENTS

FOR
HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1
FOR
CITY OF WARRENTON, OREGON

Section	Person Responsible	Title	Page
VOLUME I			
PROCUREMENT AND CONTRACTING REQUIREMENTS			
Division 00 – Procurement and Contracting Requirements			
INTRODUCTORY INFORMATION			
00 01 01	ATM	Project Title Page	1-2
00 01 07	ATM	Seals Page	1-2
00 01 10	ATM	Table of Contents	1-4
PROCUREMENT REQUIREMENTS			
00 11 13	ATM	Advertisement for Bid	1-2
00 41 43	ATM	Bid Proposal Form	1-6
00 43 13	ATM	Bid Bond	1-2
00 43 36	ATM	First Tier Subcontractor Disclosure Form	1-2
00 43 93	ATM	Bid Submittal Checklist	1-2
00 45 46.01	ATM	Certification of Non-Discrimination	1-2
00 45 46.02	ATM	Certification Regarding Lobbying	1-2
CONTRACTING REQUIREMENTS			
00 51 00	ATM	Notice of Award	1-2
00 51 00.01	ATM	Notice of Intent to Award	1-2
00 52 13	ATM	Contractor Agreement	1-4
00 55 00	ATM	Notice to Proceed	1-2
00 61 13.13	ATM	Performance Bond	1-2
00 61 13.16	ATM	Payment Bond	1-4
00 63 63	ATM	Change Order Form	1-2
00 72 00	ATM	General Conditions	1-154
00 73 00	ATM	Special Provisions	1-6
00 73 30.01	ATM	SDWRLF/EPA Grant Construction Contract Requirements	1-18
TECHNICAL SPECIFICATIONS			
Division 01 - General Requirements			
01 10 00	ATM	Summary of Work	1-6
01 12 16	ATM	Work Sequence	1-4
01 22 20	ATM	Unit Price Measurement & Payment	1-6
01 33 00	ATM	Submittal Procedures	1-10
01 45 00	ATM	Quality Control	1-4
01 50 00	ATM	Temporary Facilities and Controls	1-6
01 55 00	ATM	Site Access, Staging, and Storage	1-2

01 56 39	ATM	Temporary Tree & Plant Protection	1-4

Division 02 - Existing Conditions

02 30 00	ATM	Subsurface Investigation	1-2
02 41 00	ATM	Demolition	1-6

Division 03 - Concrete

03 11 00	ATM	Concrete Work	1-28
03 60 00	ATM	Grouting	1-4

Division 04 - Masonry
NOT USED

Division 05 - Metals
NOT USED

Division 06 – Wood, Plastics and Composites
NOT USED

Division 07 - Thermal and Moisture Protections
NOT USED

Division 08 - Openings
NOT USED

Division 09 - Finishes

09 90 00	ATM	Painting and Coating	1-18

Division 10 - Specialties
NOT USED

Division 11 - Equipment
NOT USED

Division 12 - Furnishings
NOT USED

Division 13 - Special Construction
NOT USED

Division 14 – Conveying Equipment
NOT USED

Division 21 – Fire Suppression
NOT USED

Division 22 - Plumbing
NOT USED

Division 23 – Heating, Ventilating, and Air Conditioning (HVAC)
NOT USED

Division 25 – Integrated Automation
NOT USED

Division 26 – Electrical
NOT USED

Division 27 - Communications
NOT USED

Division 28 – Electronic Safety and Security
NOT USED

Division 31 - Earthwork

31 05 13	ATM	Soils for Earthwork	1-6
31 05 16	ATM	Aggregates for Earthwork	1-6
31 10 00	ATM	Site Clearing	1-6
31 22 13	ATM	Rough Grading	1-4
31 23 16	ATM	Excavation	1-8
31 23 17	ATM	Trenching	1-22
31 23 18	ATM	Rock Removal	1-4
31 23 19	ATM	Dewatering	1-4
31 23 23	ATM	Fill	1-8
31 23 24	ATM	Flowable Fill	1-6
31 50 00	ATM	Excavation Support and Protection	1-6

Division 32 - Exterior Improvements

32 11 23	ATM	Aggregate Base Courses	1-6
32 12 16	ATM	Asphalt Concrete Pavement	1-6
32 91 13	ATM	Soil Preparation	1-8
32 91 21	ATM	Finish Grading and Seeding	1-12
32 93 00	ATM	Planting	1-12

Division 33 - Utilities

33 05 50	ATM	Existing Pipe Abandonment	1-4
33 05 64	ATM	Precast Concrete Valve Vaults and Meter Boxes	1-8
33 11 10	ATM	Water Utility Distribution and Transmission Piping	1-24
33 12 13	ATM	Water Service Connections	1-12
33 12 16	ATM	Water Utility Distribution Valves	1-8
33 12 19	ATM	Fire Hydrants	1-6
33 13 00	ATM	Testing and Disinfection of Water Utility Piping	1-10
33 41 10	ATM	Storm Utility Drainage Piping	1-12

Division 34 - Transportation
NOT USED

Division 35 – Waterway and Marine Construction
NOT USED

Division 40 - Process Interconnections

40 05 51	ATM	Common Requirements for Process Valves	1-8

40 05 61	ATM	Gate Valves	1-6
40 05 64	ATM	Butterfly Valves	1-4
40 05 78.19	ATM	Combination Air Valves for Water Service	1-6

Division 41 – Material Processing and Handling Equipment
NOT USED

Division 42 – Processing Heating, Cooling and Drying Equipment
NOT USED

Division 43 – Process Gas & Liquid Handling, Purification and Storage Equipment
NOT USED

Division 44 – Pollution and Waste Control Equipment
NOT USED

Division 46 – Water and Wastewater Equipment
NOT USED

Division 48 – Electrical Power Generation
NOT USED

SUPPLEMENTARY INFORMATION

1. *Geotechnical Engineering Report, Hammond Transmission Waterline, City of Warrenton*, dated March 2024, prepared by Shannon & Wilson.
2. *Archaeological and Human Remains Inadvertent Discovery Plan (IDP),* Hammond Transmission Waterline Phase 1 Project, dated 07/31/2024, SHPO Case Number 24-0018.
3. *Oregon Department of Transportation, Permit to Occupy or Perform Operations Upon a State Highway,* Permit No. 01M_41513.

VOLUME II

DRAWINGS
See Sheet G001 for Drawing Index

END OF SECTION

PROCUREMENT REQUIREMENTS

SECTION 00 11 13 - ADVERTISEMENT FOR BIDS

CALL FOR BIDS - PUBLIC WORKS IMPROVEMENT

Sealed bids will be received up to the hour of 2:00 PM, local time, on MONTH DAY, YEAR, by Kevin Gorman, Public Works Director, at the front desk of Warrenton City Hall, 225 South Main Street, Warrenton, OR 97146:

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1

PROJECT DESCRIPTION

The intent of this contract is to enhance the City's water transmission system in the Hammond community. The following is a summary of the major elements of Work that are to be provided by the Contractor.

1. Installation of approximately 4,500 linear feet of buried 18-inch diameter PVC C900 DR 18 water transmission pipe, isolation valves and other water system appurtenances, and connections to existing watermains and services. The water transmission main will be installed along Ft Stevens Highway (OR-104) and NW 13th Street.

Project Substantial Completion shall be 120 calendar days from Notice to Proceed and Project Final Completion shall be 150 calendar days from Notice to Proceed.

A voluntary pre-bid meeting will be held on MONTH DAY, YEAR, at 10:00 AM, local time, at Warrenton City Hall, PO Box 250, 225 South Main Street, Warrenton, OR 97146. A project site tour will follow the pre-bid meeting.

Any bids received after the above specified time will not be considered. The carrier, including the United States Postal Service, is considered an agent of the bidder.

Solicitation Documents may be obtained via email request to tvittetoe@warrentonoregon.us. Documents are available at no charge in electronic file format (PDF).

Questions regarding the project during the bid period shall be submitted to Twyla Vittetoe, Engineering Technician, City of Warrenton via phone at 503-861-0912 or email at tvittetoe@warrentonoregon.us.

Bids will be publicly opened and read by the Public Works Director at 2:00 PM, local time on MONTH DAY, YEAR, in the Warrenton Fire Training Room. All bids must be accompanied by a certified check, a cashier's check, or bid bond in an amount equal to at least 5% of the total bid.

If the total bid exceeds $50,000.00 the contract will be subject to Prevailing Wage Statute ORS 279C.800 to 279C.870. The contract is subject to federal prevailing wage rates under the Davis-Bacon Act (40 U.S.C. 3141 et seq).

Prior to submission of its bid, bidder shall be registered with the Oregon Construction Contractor's Board as required by ORS 701.055, and thereafter comply with the requirements of ORS 701.035 to 701.055.

Bidders shall be qualified in accordance with the applicable parts of ORS 279C in order to submit a bid for public works in Oregon.

Work under this contract is funded by the federal Safe Drinking Water Revolving Loan Fund through Business Oregon, a grant from the Environmental Protection Agency, and a partnership of Local and/or Private Funds.

This contract is subject to federal statutory requirements of American Iron and Steel (AIS) and Build America Buy America (BABA) Act.

By: Kevin Gorman, Public Works Director
City of Warrenton, Oregon

END OF SECTION

SECTION 00 41 43 - BID PROPOSAL FORM

The undersigned, having full knowledge of the quality and quantity of work and material required, hereby proposes to furnish all labor, material and equipment required to complete the work of:

HAMMOND TRANSMISSION WATERLINE – PHASE 1

in accordance with the ODOT/APWA 2015 Oregon Standard Specifications for Construction and the Special Provisions, Plans and Specifications hereto, and at the following Bid Schedule prices by the following completion dates:

- Substantial Completion –120 calendar days from Notice to Proceed
- Final Completion – 150 calendar days from Notice to Proceed

Enclosed herewith is a bid surety deposit in the amount of at least five percent (5%) of the bid.

The undersigned bidder hereby represents as follows: That this bid is made without connections with any person, firm or corporation making a bid for same, and is in all respects fair and without collusion or fraud.

Contractor agrees comply with ORS 279C.838 or ORS 279C.840 or 40 USC3141, et seq, if the contract is subject to state or federal prevailing wage laws.

The undersigned is _____YES _____NO a resident bidder, as defined in ORS 279A.120. (PLEASE CHECK ONE)

Oregon Construction Contractor Board No. _____.

The bidder acknowledges receiving and incorporating changes described in

Addenda No. _____ through _____.

Complete in black ink or by typewriter. If BIDDER is:

An Individual

Signature _____

_____

(Individual's Name, Typed or Printed)

Doing business as _____

Business address _____

_____

Phone No. _____

A Partnership

Firm Name _____

Signature _____

_____

(Individual's Name, Typed or Printed)

Business address _____

_____

Phone No. _____

A Limited Liability Company (LLC)

LLC Name _____

By _____

(Signature of general partner – attach evidence of authority to sign)

Name (typed or printed) _____

Business address _____

_____

State in which company was formed _____

Phone No. _____

A Corporation

Corporation Name _____

Signature _____

_____

(Officer's Name, Typed or Printed)

_____

(Title)

_____

(State of Incorporation)

Attest _____

(Secretary's Signature)

Business address _____

_____

Phone No. _____

Date of Qualification to do business _____

BID SCHEDULE HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1					
ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	BID AMOUNT ($)
1	Mobilization, Bonds, Insurance and Demobilization	1	LS		
2	Record Drawings	1	LS		
3	Temporary Work Zone Traffic Control	1	LS		
4	Temporary Erosion & Sediment Control	1	LS		
5	Construction Survey & Staking	1	LS		
6	Trench Safety System	1	LS		
7	Temporary Dewatering System	1	LS		
8	Rock Excavation	50	CY		
9	Trench Foundation Material	100	CY		
10	Trench Rock Drainage Layer	300	CY		
11	General Surfacing Restoration	1	LS		
12	Cold Plane Pavement Removal (4-in Depth)	1,545	SY		
13	AC Pavement Restoration (Level 3, ½-in HMA Mixture)	695	TON		
14	Water Pipe, C905 DR14 PVC, 18-in w/ 30-in Steel Casing	50	LF		
15	Water Pipe, C905 DR14 PVC, 18-in	3,857	LF		
16	Water Pipe, C900 DR14 PVC, 18-in, Restrained	632	LF		
17	Water Pipe, C900 DR14 PVC, 10-in, Restrained	115	LF		
18	Water Pipe, C900 DR14 PVC, 8-in, Restrained	25	LF		
19	18-in Butterfly Valve	3	EA		
20	10-in Gate Valve	3	EA		

BID SCHEDULE HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1					
ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	BID AMOUNT ($)
21	8-in Gate Valve	1	EA		
22	18-in DI 90° Bend	2	EA		
23	18-in DI 45° Bend	8	EA		
24	18-in DI 22.5° Bend	2	EA		
25	18-in DI 11.25° Bend	2	EA		
26	18x18 DI Tee	1	EA		
27	18x10 DI Tee	3	EA		
28	18x8 DI Tee	1	EA		
29	18x6 DI Tee	3	EA		
30	10-in DI 45° Bend	1	EA		
31	10x10 DI Tee	1	EA		
32	8-in DI 45° Bend	2	EA		
33	8x8 DI Tee	2	EA		
34	2-in CARV Assembly	3	EA		
35	6-in Blow-Off Assembly	1	EA		
36	Fire Hydrant Assembly	3	EA		
37	Adjustment to Exist Services - Water	8	EA		
38	Adjustment to Exist Services - Gas	5	EA		
39	Abandonment of Exist Services - Water	1	LS		
40	Conc Encasement of Exist Sanitary Sewer	40	LF		
41	Connect to Exist 18" Water Main - NW 13th St	1	LS		
42	Connect to Exist 10" Water Main - NW 13th St	1	LS		

BID SCHEDULE HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1					
ITEM NO.	DESCRIPTION	QTY	UNIT	UNIT PRICE ($)	BID AMOUNT ($)
43	Connect to Exist 10" Water Main - NW 13th St & Ft Stevens Hwy	1	LS		
44	Connect to Exist 10" Water Main - 7th Ave	1	LS		
45	Connect to Exist 8" Water Main - NW 17th PL	1	LS		
46	Testing, Flushing & Disinfection of Water Mains	1	LS		

TOTAL BID AMOUNT $_____

SECTION 00 43 13 - BID BOND

KNOW ALL PEOPLE BY THESE PRESENTS:

That we, _____, hereinafter called
(Name of Contractor)

the PRINCIPAL, as Principal, and _____.
(Name of Surety)

a corporation and existing under and by virtue of the laws of the State of _____ and authorized to transact a surety business in the State of Oregon, hereinafter called the SURETY, as Surety, are held and firmly bound unto the City of Warrenton, a Municipal Corporation of the State of Oregon, hereinafter called the OBLIGEE, in the penal sum of

_____Dollars ($_____) for the payment of which sum well and truly to be made, the said PRINCIPAL and the said SURETY bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATIONS IS SUCH THAT:

WHEREAS the PRINCIPAL has submitted a Bid Proposal for the HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1.

NOW, THEREFORE, if the Bid Proposal submitted by the PRINCIPAL is accepted, and the Contract awarded to the PRINCIPAL, and if the PRINCIPAL shall execute the proposed Agreement and shall furnish such Performance and Payment Bonds as required by the Contract Documents within the time fixed by the Documents, then this obligation shall be void; if the PRINCIPAL shall fail to execute the proposed Agreement and furnish the bonds, the SURETY hereby agrees to pay the OBLIGEE the penal sum as liquidated damages, within ten (10) days of such failure.

Signed and sealed this _____ day of _____, _____.

CONTRACTOR AS PRINCIPAL:	SURETY:
(Corp. Seal)	(Corp. Seal)
Company: _____	Company: _____
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
	(Attach Power of Attorney)

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SECTION 00 43 36 – FIRST TIER SUBCONTRACTOR DISCLOSURE FORM

PROJECT NAME: HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1

BID CLOSING: DATE: MONTH DATE, YEAR TIME: 2:00 PM Local Time

This form must be submitted at the location specified in the Call For Bids on the advertised bid closing date and within two working hours after the advertised bid closing time.

List below the name of each subcontractor who will be furnishing labor or materials and that is required to be disclosed, the category of work that the subcontractor will be performing and the dollar value of the subcontract. Enter "NONE" if there are no subcontractors that need to be disclosed.

(ATTACH ADDITIONAL SHEETS IF NEEDED.)

Name	Dollar Value	Category of Work
1)_____	$ _____	_____
2) _____	$ _____	_____
3) _____	$ _____	_____
4) _____	$ _____	_____

Failure to submit this form by the disclosure deadline will result in a nonresponsive bid. A nonresponsive bid will not be considered for award.

Form Submitted by (Bidder Name): _____

Contact Name: _____

Phone no.: _____

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SECTION 00 43 93 – BID SUBMITTAL CHECKLIST

FORMS TO EXECUTE FOR SUBMISSION OF BID

The Bidder's attention is especially called to the following forms which must be executed in full before bid is submitted:

(a) Bid Form: The Bid Form is to be filled in and signed by the bidder and returned with bid.

(b) Bond Accompanying Bid: All bids shall be accompanied by a guarantee equal to at least five percent (5%) of the bid amount. This guarantee may be in the form of a bond, certified check, or cashier's check. Bid bonds will be accompanied by a power of attorney bearing the same date as the bond.

(c) Certification of Nondiscrimination: This form must be signed and submitted with bid.

(d) Certification Regarding Lobbying: This form must be signed and submitted with bid.

(e) DBE Proposed Utilization: Documentation of good faith efforts for solicitation and proposed utilization/contracting with Disadvantaged Business Enterprises ("DBE").

(f) If applicable, First-Tier Subcontractor Disclosure form, within 2 hours of bid closing.

Facsimile transmissions of bids, bid security or subcontractor disclosure forms will not be accepted.

FORMS TO EXECUTE AFTER AWARD OF BID

(a) Contract: The agreement provided in these Solicitation Documents is to be executed by the successful bidder within 14 calendar days of award of the contract.

(b) Insurance must comply with the General Conditions and Special Provisions of the Contract Documents. Proof of such insurance and additional insured certificate must be delivered to the Agency at the same time the contract is signed.

(c) The contractor shall furnish a performance bond and a payment bond each in an amount equal to one hundred percent (100%) of the contract price as security for the faithful performance of this contract and for the protection of claimants under ORS 279C.600.

END OF SECTION

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SECTION 00 45 46.01 - CERTIFICATION OF NON-DISCRIMINATION

Pursuant to the requirements of ORS 279A.110, I certify that I have not discriminated and will not discriminate against a subcontractor in awarding a subcontract because the subcontractor is a minority, woman or emerging small business enterprise certified under ORS 200.055 or a business enterprise that is owned or controlled by or that employs a disabled veteran, as defined in ORS 408.225.

_____ _____

DATE BIDDER

NOTE: THIS STATEMENT MUST BE RETURNED WITH THE BID

END OF SECTION

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SECTION 00 45 46.02 - CERTIFICATION REGARDING LOBBYING

(Awards to Contractors and Subcontractors in Excess of $100,000)

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Signed _____

Title _____

Date _____

NOTE: THIS STATEMENT MUST BE RETURNED WITH THE BID

END OF SECTION

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CONTRACTING REQUIREMENTS

SECTION 00 51 00 – NOTICE OF AWARD

Date of Issuance: _____

Owner: _____ Owner's Project No.: _____

Engineer: _____ Engineer's Project No.: _____

Project: _____

Contract Name: _____

Bidder: _____

Bidder's Address: _____

You are notified that Owner has accepted your Bid dated_____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

Hammond Transmission Waterline Project – Phase 1

The Contract Price of the awarded Contract is $_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

_____ unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner _____counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the General Conditions, Section 00130.
3. Other conditions precedent (if any): _____

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in the General Conditions, Section 00130.

Owner: _____

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

END OF SECTION

SECTION 00 51 00.01 – NOTICE OF INTENT TO AWARD

Dated: _____

Project:

_____

Owner: Owner's Contract Number:
Project Number:

_____

This notice is hereby issued on behalf of the City of Warrenton to notify you the City intends to award the contract for construction of the above referenced project to the following Contractor:

_____

Contractor:

_____

Contractor's Address:

_____

_____

_____

_____

The City moved to authorize this intent to award during the City Commission meeting held on _____. The bid opening record is attached.

_____

Owner's Authorized Representative

Given by:

_____

Signature

_____

Title

_____

Date

Enclosure

END OF SECTION

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SECTION 00 52 13 – CONTRACTOR AGREEMENT

1.00 - GENERAL

THIS AGREEMENT, made and entered into this ____ day of _____, 20__, by and between _____, hereinafter called "CONTRACTOR" and the City of Warrenton, a municipal corporation, hereinafter called "CITY."

WITNESSETH:

That the said CONTRACTOR and the said CITY, for the consideration hereinafter named agree as follows:

2.00 - DESCRIPTION OF WORK

The CONTRACTOR agrees to perform the work of:

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1

and do all things required of it as per his Bid, all in accordance with the described Bid, a copy of which is hereto attached and made a part of this Contract.

3.00 - COMPLETION OF CONTRACT

The CONTRACTOR agrees that the Work under this Contract shall be completed by the following dates:

- Substantial Completion – 120 calendar days from Notice to Proceed
- Final Completion – 150 calendar days from Notice to Proceed

If said CONTRACTOR has not fully completed this Contract within the time set or any extension thereof, it shall pay liquidated damages in accordance with Section 00180.85 of the General Conditions.

4.00 - CONTRACT PRICE

The Contract Price for this project is _____. Payment will be made in accordance with ORS 279C.560 including progress payments at the end of each month. Retainage will be withheld in accordance with ORS 279C.550 - .565.

5.00 - CONTRACT DOCUMENTS

The CONTRACTOR and the CITY agree that the plans, specifications (including the ODOT/APWA 2015 Oregon Standard Specifications for Construction and Contract Documents defined in Section 00110.20 of the Contract Documents General Conditions and all modifications thereto) and bid are, by this reference, incorporated into this Contract and are fully a part of this contract.

6.00 - NONDISCRIMINATION

It is the policy of the City of Warrenton that no person shall be denied the benefits of or be subjected to discrimination in any City program, service, or activity on the grounds of age, disability, race, religion, color, national origin, sex, sexual orientation, gender identity and expression. The City of Warrenton also requires its contractors and grantees to comply with this policy.

7.00 - CONTRACTOR IS INDEPENDENT CONTRACTOR

A. CONTRACTOR acknowledges that for all purposes related to this Contract, CONTRACTOR is and shall be deemed to be an independent CONTRACTOR and not an employee of CITY, shall not be entitled to benefits of

any kind to which an employee of the CITY is entitled and shall be solely responsible for all payments and taxes required by law; and furthermore in the event that CONTRACTOR is found by a court of law or an administrative agency to be an employee of the CITY for any purpose, CITY shall be entitled to repayment of any amounts from CONTRACTOR under the terms of the Contract; to the full extent of any benefits or other remuneration CONTRACTOR receives (from CITY or third party) as result of said finding and to the full extent of any payments that CITY is required to make (to CONTRACTOR or to a third party) as a result of said finding.

B. The undersigned CONTRACTOR hereby represents that no employee of the CITY of Warrenton, or any partnership or corporation in which a CITY employee has an interest, has or will receive any remuneration of any description from the CONTRACTOR, either directly or indirectly, in connection with the letting or performance of this Contract, except as specifically declared in writing.

8.00 - SUBCONTRACTS - RELATIONS WITH SUBCONTRACTORS, ASSIGNMENTS AND DELEGATION

A. Assignment or Transfer Restricted. The CONTRACTOR shall not assign, sell, dispose of, or transfer rights nor delegate duties under the contract, either in whole or in part, without the CITY's prior written consent. Unless otherwise agreed by the CITY in writing, such consent shall not relieve the CONTRACTOR of any obligations under the contact. Any assignee or transferee shall be considered the agent of the CONTRACTOR and be bound to abide by all provisions of the contract. If the CITY consents in writing to an assignment, sale, disposal or transfer of the CONTRACTOR's rights or delegation of the CONTRACTOR's duties, the CONTRACTOR and its surety, if any, shall remain liable to the CITY for complete performance of the contract as if no such assignment, sale, disposal, transfer or delegation had occurred unless the CITY otherwise agrees in writing.

B. CONTRACTOR may not discriminate against a subcontractor in awarding a subcontract because the subcontractor is a minority, women or emerging small business enterprise certified under ORS 200.055 or a business enterprise that is owned or controlled by or that employs a disabled veteran, as defined in ORS 408.225. If CONTRACTOR violates this prohibition, the CITY will regard the violation as a breach of contract and may either terminate the contract or exercise any other remedy for breach of contract.

9.00 - NONWAIVER

The failure of the CITY to insist upon or enforce strict performance by CONTRACTOR of any of the terms of this Contract or to exercise any rights hereunder shall not be construed as a waiver or relinquishment to any extent of its right to assert or rely upon such terms or rights on any future occasion.

10.00 - LABORERS AND MATERIALMEN, CONTRIBUTIONS TO INDUSTRIAL ACCIDENT FUND, LIENS AND WITHHOLDING TAXES

CONTRACTOR shall make payment promptly, as due, to all persons supplying CONTRACTOR labor or material for the prosecution of the work provided for this contract.

CONTRACTOR shall pay all contributions or amounts due the Industrial Accident Fund from CONTRACTOR or any subcontractor incurred in the performance of the contract.

CONTRACTOR shall not permit any lien or claim to be filed or prosecuted against the CITY on account of any labor or material furnished.

CONTRACTOR shall pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

11.00 - CERTIFICATION OF COMPLIANCE WITH TAX LAWS

As required by ORS 305.385(6), CONTRACTOR certifies under penalty of perjury that the CONTRACTOR, to the best of CONTRACTOR's knowledge, is not in violation of any of the tax laws described in ORS 305.380(4).

12.00 - CITY BUSINESS LICENSE

Prior to starting work, CONTRACTOR shall pay the CITY business license tax and provide the Project Director with a copy of business license receipt. CONTRACTOR shall, likewise, require all subcontractors to pay the CITY business license tax and provide a copy of the receipt to the Project Director prior to commencement of work.

APPROVED AS TO FORM:

_____
City Attorney

CITY OF WARRENTON, a municipal of the State of Oregon

BY: _____
Mayor Date

ATTEST:

_____ _____
Contractor Date City Manager Date

END OF SECTION

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SECTION 00 55 00 – NOTICE TO PROCEED

Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:
	Effective Date of Contract:

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on_____.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, Contractor shall complete the Work under the following times:

- Substantial Completion on _____ (or ___ days after Notice to Proceed)
- Final Completion on _____ (or ___ days after Notice to Proceed)

Owner:

_____
Authorized Signature

By: _____

Title: _____

Date _____

Copy: Engineer

Contractor Acceptance of Notice to Proceed:

_____
Authorized Signature

By: _____

Title: _____

Date Issued: _____

END OF SECTION

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SECTION 00 61 13.13 - PERFORMANCE BOND

AMOUNT $ _____

BOND NO. _____

KNOW ALL PEOPLE BY THESE PRESENTS:

That we, _____, hereinafter called
(Name of Contractor)

the PRINCIPAL, as Principal, and _____,
(Name of Surety)

a corporation and existing under and by virtue of the laws of the State of _____ and authorized to transact a surety business in the State of Oregon, hereinafter called the SURETY, as Surety, are held and firmly bound unto the City of Warrenton, a Municipal Corporation of the State of Oregon, hereinafter called the OBLIGEE, in the

penal sum of _____ Dollars

($_____) for the payment of which sum well and truly to be made, the said PRINCIPAL and the said SURETY bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

Whereas on the _____ day of _____, 20___ the PRINCIPAL entered into a certain contract with the OBLIGEE, a copy of which is hereto attached and made a part hereof for the construction of:

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1
City of Warrenton, Oregon

NOW, THEREFORE, if the PRINCIPAL herein shall faithfully and truly observe and comply with the terms of the contract and shall well and truly perform all matters and things undertaken to be performed under said contract upon the terms proposed therein and shall promptly make payments to all persons supplying labor or material for any prosecution of the work provided for each contract and shall not permit any lien or claim to be filed or prosecute against the OBLIGEE on account of any labor or material furnished, and shall promptly pay all contributions or amounts due the State Accident Insurance Fund and all contributions or amounts due the State Un-employment Compensation Trust Fund incurred in the performance of said contract and shall promptly, as due, make payment to the person, co-partnership, association or corporation entitled thereto of the moneys and sums mentioned in Section 279 of the Oregon Revised Statutes, then this obligation is to be void, otherwise to remain in full force and effect.

This performance bond shall also guarantee the improvement against defects in materials or workmanship for a period of one (1) year from the date of written Substantial Completion acceptance of the subject project by the OBLIGEE.

The total amount of the SURETY's liability under this bond both to the OBLIGEE and to the persons furnishing labor or materials, provisions and goods and to any other person or persons, shall in no event exceed the penalty hereof.

Provided, however, that the conditions of the obligation shall not apply to any money loaned or advanced to the PRINCIPAL or to any subcontractor or other person in the performance of any such work, whether specifically provided for in the contract or not.

This bond is executed for the purpose of complying with Chapter 279 of Title 26, Oregon Revised Statutes, the provisions of which are hereby incorporated herein and made a part hereof.

IN WITNESS WHEREOF, this instrument is executed in three counterparts each one of which

shall be deemed an original, this the _____day of _____, 20___.

CONTRACTOR AS PRINCIPAL:	SURETY:
(Corp. Seal)	(Corp. Seal)
Company: _____	Company: _____
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____

(Attach Power of Attorney)

NOTE: Date of BOND must not be prior to date of Contract.
If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety company executing BOND must be authorized to transact business in the State of Oregon.

END OF SECTION

SECTION 00 61 13.16 - PAYMENT BOND

AMOUNT $ _____

BOND NO. _____

KNOW ALL PEOPLE BY THESE PRESENTS:

That we, _____, hereinafter called
(Name of Contractor)

the PRINCIPAL, as Principal, and _____,
(Name of Surety)

a corporation and existing under and by virtue of the laws of the State of _____ and authorized to transact a surety business in the State of Oregon, hereinafter called the SURETY, as Surety, are held and firmly bound unto the City of Warrenton, a Municipal Corporation of the State of Oregon, hereinafter called the OBLIGEE, and unto all persons, firms and corporations who or which may furnish labor, or who furnish materials to perform as described under the contract and to their successors and assigns in the total

aggregate penal sum of _____ Dollars

($_____) for the payment of which sum well and truly to be made, the said PRINCIPAL and the said SURETY bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

Whereas on the _____ day of_____, 20___ the PRINCIPAL entered into a certain contract with the OBLIGEE, a copy of which is hereto attached and made a part hereof for the construction of:

HAMMOND TRANSMISSION WATERLINE PROJECT – PHASE 1
City of Warrenton, Oregon

NOW, THEREFORE, if the PRINCIPAL shall promptly make payment to all persons, firms, and corporations furnishing materials for, or performing labor in the prosecution of the WORK provided for in such contract, and any authorized extensions or modification thereof, including all amounts due for materials consumed or used in connection with the construction of such WORK, and for all labor cost incurred in such WORK including that by a SUBCONTRACTOR, and to any mechanic or material man lien holder whether it acquires its lien by operation of State or Federal law; then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, that beneficiaries or claimants hereunder shall be limited to the SUBCONTRACTORS, and persons, firms, and corporations having a direct contract with the PRINCIPAL or its SUBCONTRACTORS.

PROVIDED, FURTHER, that the said SURETY for value received hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the WORK to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this BOND, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of this contract or to the WORK or to the SPECIFICATIONS.

PROVIDED, FURTHER, that no suit or action shall be commenced hereunder by any claimant: (a) Unless claimant, other than one having a direct contract with the PRINCIPAL shall have given written notice to any two of the following: the PRINCIPAL, the OBLIGEE, or the SURETY above named within one hundred twenty (120) days after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail, postage prepaid, in an envelope addressed to the PRINCIPAL, OBLIGEE, or SURETY, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer. (b) After the expiration of one (1) year following the date on which PRINCIPAL ceased work on said CONTRACT, it being understood, however, that if any limitation embodied in the BOND is prohibited by any law controlling the construction hereof, such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

PROVIDED, FURTHER, that it is expressly agreed that this BOND shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon amendment to the Contract not increasing the contract price more than 25 percent, so as to bind the PRINCIPAL and the SURETY to the full and faithful performance of the Contract as so amended. The term "Amendment", wherever used in this BOND and whether referring to this BOND, the contract or the loan Documents shall include any alteration, addition, extension or modification of any character whatsoever.

PROVIDED, FURTHER, that no final settlement between the OBLIGEE and the PRINCIPAL shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in three counterparts each one of which shall be deemed an original, this the _____day of _____, 20___.

CONTRACTOR AS PRINCIPAL:	SURETY:
(Corp. Seal)	(Corp. Seal)
Company: _____	Company: _____
Signature: _____	Signature: _____
Name: _____	Name: _____
Title: _____	Title: _____
	(Attach Power of Attorney)

NOTE: Date of BOND must not be prior to date of Contract.
If CONTRACTOR is partnership, all partners should execute BOND.

IMPORTANT: Surety company executing BOND must be authorized to transact business in the State of Oregon.

END OF SECTION

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SECTION 00 63 63 – CHANGE ORDER FORM

Date of Issuance:	Effective Date:
Owner:	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

The Contract is modified as follows upon execution of this Change Order:

Description:
Attachments:

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES
Original Contract Price: $	Original Contract Times: Substantial Completion: Ready for Final Payment:
No Change from previously approved Change Orders No. xx to No. xx: $	No Change from previously approved Change Orders No. xx to No. xx: Substantial Completion: Ready for Final Payment:
Contract Price prior to this Change Order: $	Contract Times prior to this Change Order: Substantial Completion: Ready for Final Payment:
Increase of this Change Order: $	No Change of this Change Order: Substantial Completion: Ready for Final Payment:
Contract Price incorporating this Change Order: $	Contract Times with all approved Change Orders: Substantial Completion: Ready for Final Payment:

RECOMMENDED:	ACCEPTED:	ACCEPTED:
By: _____	By: _____	By: _____
Engineer	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title _____	Title: _____
Date: _____	Date _____	Date: _____

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SECTION 00 72 00 – GENERAL CONDITIONS

TABLE OF CONTENTS

PART 00100 - GENERAL CONDITIONS 6

Section 00110 - Organization, Conventions, Abbreviations, and Definitions 6
00110.00 Organization of Specifications 6
00110.05 Conventions Used Throughout the Specifications Include 6
00110.10 Abbreviations 8
00110.20 Definitions 10

Section 00120 - Bidding Requirements and Procedures 20
00120.10 Bid Booklet 20
00120.15 Examination of Work Site and Solicitation Documents; Consideration of Conditions to be Encountered 21
00120.16 Material, Equipment, and Method Substitutions 21
00120.17 Use of Agency-Owned Land for Staging or Storage Areas 21
00120.20 Interpretation of Quantities in Bid Schedule 22
00120.25 Subsurface Investigations 22
00120.30 Changes to Plans, Specifications, or Quantities before Opening of Bids 23
00120.40 Preparation of Bids 23
00120.45 Submittal of Bids 25
00120.50 Submitting Bids for More than One Contract 25
00120.60 Revision or Withdrawal of Bids 25
00120.65 Opening and Comparing Bids 26
00120.70 Rejection of Nonresponsive Bids 26
00120.80 Reciprocal Preference for Oregon Resident Bidders 27
00120.90 Disqualification of Bidders 27
00120.91 Rejection of Bid on Grounds of Nonresponsibility of Bidder 28

Section 00130 - Award and Execution of Contract 29
00130.00 Consideration of Bids 29
00130.10 Award of Contract 29
00130.15 Right to Protest Award 30
00130.20 Cancellation of Award 31
00130.30 Contract Booklet 31
00130.40 Contract Submittals 31
00130.50 Execution of Contract and Bonds 32
00130.60 Failure to Execute Contract and Bonds 33
00130.70 Release of Bid Guaranties 33
00130.80 Project Site Restrictions 33
00130.90 Notice to Proceed 33

Section 00140 - Scope of Work 34
00140.00 Purpose of Contract 34
00140.10 Typical Sections 34
00140.20 Thickness 34

00140.30 Agency-Required Changes in the Work 34
00140.40 Differing Site Conditions 35
00140.50 Environmental Pollution Changes 35
00140.60 Extra Work 35
00140.65 Disputed Work 36
00140.70 Cost Reduction Proposals 36
00140.80 Use of Publicly Owned Equipment 37
00140.90 Final Trimming and Cleanup 37

Section 00150 - Control of Work 40
00150.00 Authority of the Engineer 40
00150.01 Project Manager's Authority and Duties 40
00150.02 Inspector's Authority and Duties 40
00150.10 Coordination of Contract Documents 41
00150.15 Construction Stakes, Lines, and Grades 42
00150.25 Acceptability of Materials and Work 43
00150.30 Delivery of Notices 43
00150.35 Submittals 30
00150.37 Equipment Lists and Other Submittals 49
00150.40 Cooperation and Superintendence by the Contractor 49
00150.50 Cooperation with Utilities 51
00150.55 Cooperation with Other Contractors 51
00150.55 Cooperation with Other Contractors 53
00150.60 Construction Equipment Restrictions 54
00150.70 Detrimental Operations 55
00150.75 Protection and Maintenance of Work During Construction 55
00150.80 Removal of Unacceptable and Unauthorized Work 56
00150.90 Final Inspection 56
00150.91 Post-Construction Review 57
00150.95 Final Acceptance 57
00150.96 Maintenance Warranties and Guarantees 57
00150.97 Responsibility for Materials and Workmanship 57

Section 00160 - Source of Materials 58
00160.00 Definitions 58
00160.01 Notification of Source of Supply and Materials 58
00160.05 Qualified Products List (QPL) 58
00160.10 Ordering, Producing, and Furnishing Materials 59
00160.20 Preferences for Materials 59
00160.30 Agency-Furnished Materials 60
00160.50 Agency-Controlled Land; Limitations and Requirements 60
00160.60 Contractor-Furnished Materials and Sources 61
00160.70 Requirements for Plant Operations 61
00160.80 Requirements for Sources of Borrow and Aggregate 62

Section 00165 - Quality of Materials 63
00165.00 General 63
00165.01 Rejected Materials 63

00165.02 Materials Conformance and Quality Compliance Documents 63
00165.03 Testing by Agency 63
00165.04 Costs of Testing 63
00165.10 Materials Acceptance Guides 64
00165.20 Materials Specifications and Test Method References 64
00165.30 Field-Tested Materials 64
00165.35 Nonfield-Tested Materials 65
00165.50 Statistical Acceptance Sampling and Testing 66
00165.70 Use of Materials without Acceptable Materials Conformance Documents 66
00165.75 Storage and Handling of Materials 67

Section 00170 - Legal Relations and Responsibilities 68
00170.00 General 68
00170.01 Other Agencies Affecting Agency Contracts 68
00170.02 Permits, Licenses, and Taxes 70
00170.03 Furnishing Right-of-Way and Permits 71
00170.04 Patents, Copyrights, and Trademarks 71
00170.05 Assignment of Antitrust Rights 72
00170.07 Record Requirements 72
00170.07 Record Requirements 72
00170.10 Required Payments by Contractors 76
00170.20 Public Works Bond 77
00170.32 Protection of Navigable Waters 77
00170.60 Safety, Health, and Sanitation Provisions 77
00170.61 Industrial Accident Protection 77
00170.62 Labor Nondiscrimination 77
00170.63 Payment for Medical Care 78
00170.65 Minimum Wage and Overtime Rates for Public Works Projects 78
00170.70 Insurance 80
00170.71 Independent Contractor Status 83
00170.72 Indemnity/Hold Harmless 83
00170.74 Employee Drug Testing Program 84
00170.78 Conflict of Interest 84
00170.79 Third Party Beneficiary 84
00170.80 Responsibility for Damage to Work 85
00170.82 Responsibility for Damage to Property and Facilities 85
00170.85 Responsibility for Defective Work 86
00170.89 Protection of Utility, Fire-control, and Railroad Property and Services; Repair; Roadway Restoration 88
00170.92 Fencing, Protecting Stock, and Safeguarding Excavations 88
00170.93 Trespass 89
00170.94 Use of Explosives 89
00170.94 Use of Explosives 89

Section 00180 - Prosecution and Progress 90
00180.00 Scope 90
00180.05 Assignment/Delegation of Contract 90
00180.06 Assignment of Funds Due under the Contract 90

00180.10 Responsibility for Contract 90
00180.15 Agency's Right to Do Work at Contractor's Expense 91
00180.20 Subcontracting Limitations 91
00180.21 Subcontracting 92
00180.22 Payments to Subcontractors and Agents of the Contractor 94
00180.30 Materials, Equipment, and Work Force 94
00180.31 Required Materials, Equipment, and Methods 95
00180.32 Alternative Materials, Equipment, and Methods 96
00180.40 Limitation of Operations 96
00180.41 Project Work Schedules 97
00180.42 Preconstruction Conference 106
00180.43 Commencement and Performance of Work 106
00180.44 Project Meetings 106
00180.50 Contract Time to Complete Work 108
00180.60 Notice of Delay 110
00180.65 Right-of-Way and Access Delays 110
00180.70 Suspension of Work 111
00180.80 Adjustment of Contract Time 111
00180.85 Failure to Complete on Time; Liquidated Damages 114
00180.90 Termination of Contract and Substituted Performance 114
00180.95 Project Closeout 85

Section 00190 - Measurement of Pay Quantities 121
00190.00 Scope 121
00190.10 Measurement Guidelines 121
00190.20 Contractor to Provide Vehicle Weigh Scales 123
00190.30 Plant Scales 126

Section 00195 - Payment 127
00195.00 Scope and Limit 127
00195.10 Payment For Changes in Materials Costs 127
00195.20 Changes to Plans or Character of Work 128
00195.30 Differing Site Conditions 129
00195.40 Unreasonable Delay by the Agency 129
00195.50 Progress Payments and Retained Amounts 130
00195.70 Payment under Terminated Contract 134
00195.80 Allowance for Materials Left on Hand 135
00195.90 Final Payment 136
00195.95 Error in Final Quantities and Amounts 137

Section 00196 - Payment for Extra Work 138
00196.00 General 138
00196.10 Negotiated Price 138
00196.20 Force Account 138

Section 00197 - Payment for Force Account Work 139
00197.00 Scope 139

00197.01 General 139
00197.10 Materials 139
00197.20 Equipment 140
00197.30 Labor 142
00197.80 Percentage Allowances 142
00197.90 Billings 143

Section 00199 - Disagreements, Protests and Claims 144
00199.00 General 144
00199.10 Procedure for Resolving Disagreements 144
00199.20 Protest Procedure 144
00199.30 Claims Procedure 146
00199.40 Claim Decision; Review; Exhaustion of Administrative Remedies 150
00199.50 Mediation 152
00199.60 Review of Determination Regarding Records 152

PART 00100 - GENERAL CONDITIONS

Section 00110 - Organization, Conventions, Abbreviations, and Definitions

Organization

00110.00 Organization of Specifications - The Specifications are comprised of the following:

- The "General Conditions for Construction for the City of Warrenton (Agency)," published by the Agency, which contain Part 00100 "General Conditions", which deal with the solicitation process and contractual relationships;
- The "2018 Oregon Standard Specifications for Construction," which contain Parts 00200 through 03000, published by the Oregon Department of Transportation which contain the detailed "Technical Specifications" involved in prosecution of the Work, organized by subject matter; and
- The Special Provisions.

In addition, throughout the Specifications:

- Each Part is divided into Sections and Subsections.
- Reference to a Section includes all applicable requirements of the Section.
- When referring to a Subsection, only the number of the Subsection is used; the word "Subsection" is implied.
- Where Section and Subsection numbers are not consecutive, the interval has been reserved for use in the Special Provisions or future expansion of the Standard Specifications.

Conventions

00110.05 Conventions Used Throughout the Specifications Include:

(a) Grammar – The "General Conditions for Construction for the City of Warrenton (Agency)", part 00100 "General Conditions", is written in the indicative mood, in which the subject is expressed. The "2018 Oregon Standard Specifications for Construction", published by the Oregon Department of Transportation, which contain parts 00200 through 03000, the detailed "Technical Specifications", are generally written in the imperative mood, in which the subject is implied. Therefore, throughout Parts 00200 through 03000, and on the Plans:

- The subject, "the Contractor", is implied.
- "Shall" refers to action required of the Contractor, and is implied.
- "Will" refers to decisions or actions of the Agency and/or the Engineer.
- The following words, or words of equivalent meaning, refer to the actions of the Agency and/or the Engineer, unless otherwise stated: "allowed", "directed", "established", "permitted", "ordered", "designated", "prescribed", "required", "determined".

- The words "approved", "acceptable", "authorized", "satisfactory", "suitable", "considered", and "rejected", "denied", "disapproved", or words of equivalent meaning, mean by or to the Agency and/or the Engineer, subject in each case to Section 00150 of the General Conditions.
- The words "as shown", "shown", "as indicated", or "indicated" mean "as indicated on the Plans".
- Certain Subsections labeled "Payment" contain statements to the effect that "payment will be made at the Contract amounts for the following items" (followed by a list of items). In such cases the Agency shall pay for only those Pay Items listed in the Schedule of Items.

(b) Capitalization of Terms - Capitalized terms, other than titles, abbreviations, and grammatical usage, indicate that they have been given a defined meaning in the Standard Specifications. Refer to Section 00110.20 "Definitions". Defined terms will always be capitalized in Part 00100; in Parts 00200 through 03000, defined terms will generally not be capitalized, with the notable exception of "the Contractor", "the Agency", and "the Engineer".

(c) Punctuation - In this publication the "outside method" of punctuation is employed for placement of the comma and the period with respect to quotation marks. Only punctuation that is part of the quoted matter is placed within quotation marks.

(d) References to Laws, Acts, Regulations, Rules, Ordinances, Statutes, Orders, and Permits - References are made in the text of the Specifications to "laws", "acts", "rules", "statutes", "regulations", "ordinances", etc. (collectively referred to for purposes of this Subsection as "Law"), and to "orders" and "permits" (issued by a governmental authority, whether local, State, or federal, and collectively referred to for purposes of this Subsection as "Permits"). Reference is also made to "applicable laws and regulations". The following conventions apply in interpreting these terms, as used in the Specifications.

- Statutes and Rules - Oregon Revised Statutes (ORS) and Oregon Administrative Rules (OAR) referenced in the Specifications are accessible on line, including through the Oregon Legislative Counsel Committee web site and through the Oregon Secretary of State Archives Division web site.

- Law - In each case, unless otherwise expressly stated therein, the Law is to be understood to be the current version in effect. This also applies where a specific Law is referenced or cited, regardless of whether the text of the Law has been included in the Specifications or not, and regardless of whether the text of the Law has been summarized or paraphrased. In each case, the current version of the Law is applicable under any Contract. The reader is therefore cautioned to check the actual text of the Law to confirm that the text included in the Specifications has not been modified or superseded.

- Permits - Orders and permits issued by a government agency may be modified during the course of performing the Work under a Contract. Therefore, wherever the term "order" or "permit" is used in the Specifications, it is intended to refer to the then-current version. That version may be embodied in a modified, superseding order or permit, or it may consist of all terms and conditions of prior orders or permits that have not been superseded, as well as the additional terms added by amendment or supplement. In certain cases, the orders and/or permits are identified by name in the Specifications; in other cases the terms are used in the generic sense. The reader is cautioned to check the text(s) of each order and permit identified either by name or by generic reference.

- **Applicable Laws and Regulations** - Where the phrase "applicable laws and regulations" appears, it is to be understood as including all applicable laws, acts, regulations, administrative rules, ordinances, statutes, and orders and permits issued by a governmental or regulatory authority.

Abbreviations

00110.10 Abbreviations - Following are meanings of abbreviations used in the Standard Specifications, in the Special Provisions, on the Plans, and in other Contract Documents. Other abbreviations and meanings of abbreviations may be in the individual Sections of the Standard Specifications to which they apply, in the Special Provisions, and in OAR 731-005 and OAR 731-007.

AAR - Association of American Railroads
AASHTO - American Association of State Highway and Transportation Officials
ABC - Associated Builders and Contractors, Inc.
AC - Asphalt Concrete
ACI - American Concrete Institute
ACP - Asphalt Concrete Pavement
ACWS - Asphalt Concrete Wearing Surface
AGC - Associated General Contractors of America
AIA - American Institute of Architects
AISC - American Institute of Steel Construction
AISI - American Iron and Steel Institute
AITC - American Institute of Timber Construction
ANSI - American National Standards Institute
APA - Engineered Wood Association
APWA - American Public Works Association
AREMA - American Railway Engineering and Maintenance of Right-of-Way Association
ASCE - American Society of Civil Engineers
ASME - American Society of Mechanical Engineers
ASTM - American Society for Testing and Materials
ATPB - Asphalt Treated Permeable Base
AWG - American Wire Gauge
AWPA - American Wood Protection Association
AWS - American Welding Society
AWWA - American Water Works Association
CAgT - Certified Aggregate Technician
CAT-I - Certified Asphalt Technician I
CAT-II - Certified Asphalt Technician II
CBM - Certified Ballast Manufacturers
CCO - Contract Change Order
CCT - Concrete Control Technician

CDT - Certified Density Technician
CEBT - Certified Embankment and Base Technician
CMDT - Certified Mixture Design Technician
CPF - Composite Pay Factor
CRSI - Concrete Reinforcing Steel Institute
CFR - Code of Federal Regulations
CS - Commercial Standard, Commodity Standards Division, U.S. Department of Commerce
D1.1 - Structural Welding Code - Steel, American Welding Society, current edition
D1.5 - Bridge Welding Code, American Welding Society, current edition
DBE - Disadvantaged Business Enterprise
DEQ - Department of Environmental Quality, State of Oregon
DOGAMI - Department of Geology and Mineral Industries, State of Oregon
DSL - Department of State Lands, State of Oregon
EAC - Emulsified Asphalt Concrete
EPA - U.S. Environmental Protection Agency
ESCP - Erosion and Sediment Control Plan
FHWA - Federal Highway Administration, U.S. Department of Transportation
FSS - Federal Specifications and Standards, General Services Administration
GSA - General Services Administration
ICEA - Insulated Cable Engineers Association (formerly IPCEA)
IES - Illuminating Engineering Society
IMSA - International Municipal Signal Association
ISO - International Standards Organization
ITE - Institute of Transportation Engineers
JMF - Job Mix Formula
MFTP - Manual of Field Test Procedures (ODOT)
MIL - Military Specifications
MSC - Minor Structure Concrete
MUTCD - Manual on Uniform Traffic Control Devices for Streets and Highways, FHWA, U.S. Department of Transportation
NEC - National Electrical Code
NEMA - National Electrical Manufacturer's Association
NESC - National Electrical Safety Code
NIST - National Institute of Standards and Technology
NPDES - National Pollutant Discharge Elimination System
NPS - Nominal Pipe Size (dimensionless)
OAR - Oregon Administrative Rules
ODA - Oregon Department of Agriculture
ODOT - Oregon Department of Transportation
ORS - Oregon Revised Statutes
OR-OSHA - Oregon Occupational Safety and Health Division of the Department of Consumer and Business Services
OSHA - Occupational Safety and Health Administration, U.S. Department of Labor
PCA - Portland Cement Association
PCC - Portland Cement Concrete

PCI	-	Precast/Prestressed Concrete Institute
PCP	-	Pollution Control Plan
PF	-	Pay Factor of a constituent
PLS	-	Professional Land Surveyor
PMBB	-	Plant Mixed Bituminous Base
PTI	-	Post-Tensioning Institute
PUC	-	Public Utility Commission, State of Oregon
QA	-	Quality Assurance
QC	-	Quality Control
QCT	-	Quality Control Technician
QL	-	Quality Level
QPL	-	Qualified Products List
RAP	-	Reclaimed Asphalt Pavement
REA	-	Rural Electrification Administration, U.S. Department of Agriculture
RMA	-	Radio Manufacturers Association or Rubber Manufacturers Association
SAE	-	Society of Automotive Engineers
SI	-	International System of Units (Système Internationale)
SRCM	-	Soil and Rock Classification Manual (ODOT)
SSPC	-	Society for Protective Coatings
T	-	Tolerances, AASHTO Test Method
TM	-	Test Method (ODOT)
TV	-	Target Value
UBC	-	Uniform Building Code (as adopted by the State of Oregon)
UL	-	Underwriters Laboratory, Inc.
UPC	-	Uniform Plumbing Code (as adopted by the State of Oregon)
USC	-	United States Code
WAQTC	-	Western Alliance for Quality Transportation Construction
WCLIB	-	West Coast Lumber Inspection Bureau
WWPA	-	Western Wood Products Association

Definitions

00110.20 Definitions - Following are definitions of words and phrases used in the Standard Specifications, in the Special Provisions, on the Plans, and in other Contract Documents. Other definitions may be in the individual Sections of the Standard Specifications to which they apply, in the Special Provisions, and in OAR 731-005 and OAR 731-007.

Act of God or Nature - A natural phenomenon of such catastrophic proportions or intensity as would reasonably prevent performance.

Addendum - A written or graphic modification, issued before the opening of Bids, which revises, adds to, or deletes information in the Solicitation Documents or previously issued Addenda.

Additional Work - Increased quantities of any Pay Item for which a unit price has been established, or the increase of Work within the scope of the Contract.

Advertisement - The public announcement (Call for Bids) inviting Bids for Work to be performed or Materials to be furnished.

Agency - The City of Warrenton, a municipal corporation of the State of Oregon, which has entered into a Contract with the Contractor.

Agency-Controlled Lands - Lands owned by the Agency, or controlled by the Agency under lease or agreement, or under the jurisdiction and control of the Agency for the purposes of the Contract.

Aggregate - Rock of specified quality and gradation.

Attorney in Fact - An Entity appointed by another to act in its place, either for some particular purpose or for the transaction of business in general.

Award - Written notification to the Bidder that the Bidder has been awarded a Contract.

Base - A Course of specified material of specified thickness placed below the Pavement.

Bid - A competitive offer, binding on the Bidder and submitted in response to an invitation to bid.

Bid Bond - The Surety bond for Bid guarantee.

Bid Booklet - The bound paper version included in the Solicitation Documents that contain the information identified in 00120.10.

Bid Closing - The date and time after which Bids, Bid modifications, and Bid withdrawals will no longer be accepted.

Bid Documents - See under Solicitation Document.

Bid Opening - The date and time Bids are opened.

Bid Schedule – The lump sum Pay Item; or the list of Pay Items, their units of measurement, and estimated quantities. (When a Contract is awarded, the Bid Schedule becomes the Schedule of Items.)

Bid Section - The portion of the Bid Booklet containing all pages after the Bidder's checklist and before the appendix.

Bidder - An Entity that submits a Bid in response to an invitation to bid.

Bike Lane - A lane in the Traveled Way, designated by striping and Pavement markings for the preferential or exclusive use of bicyclists.

Borrow - Material lying outside of planned or required Roadbed excavation used to complete Project earthwork.

Boulders - Particles of rock that will not pass a 12 inch square opening.

Bridge - A single or multiple span Structure, including supports, that carries motorized and non-motorized vehicles, pedestrians, or utilities on a Roadway, walk, or track over a watercourse, highway, railroad, or other feature.

Buttress - A rock fill placed at the toe of a landslide or potential landslide in order to resist slide movement.

Calendar Day - Any day shown on the calendar, beginning and ending at midnight.

Call for Bids - The public announcement inviting Bids for Work to be performed or Materials to be provided.

Camber - A slight arch in a surface or Structure to compensate for loading.

Change Order - A written order issued by the Engineer to the Contractor modifying Work required by the Contract, or adding Work within the scope of the Contract, and, if applicable, establishing the basis of payment for the modified Work.

Class of Work - A designation referring to the type of Work in which Bidders must be pre-qualified.

Clay - Soil passing a No. 200 sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents.

Clear Zone - Roadside border area, starting at the edge of the Traveled Way, that is available for safe use by errant vehicles. Establishing a minimum width Clear Zone implies that rigid objects and certain other hazards within the Clear Zone should be relocated outside the Clear Zone, or shielded, or remodeled to make them break away on impact or be safely traversable.

Close Conformance - Where working tolerances are given on the Plans or in the Specifications, Close Conformance means compliance with those tolerances. Where working tolerances are not given, Close Conformance means compliance, in the Engineer's judgment, with reasonable and customary manufacturing and construction tolerances.

Coarse Aggregate - Crushed Rock or crushed Gravel retained on a 1/4 inch sieve, with allowable undersize.

Cobbles - Particles of Rock, rounded or not, that will pass a 12 inch square opening and be retained on a 3 inch sieve.

Commercial Grade Concrete - Concrete furnished according to Contractor proportioning, placed in minor Structures and finished as specified.

Construction Contracts Unit - Agency's office that administers construction contracts.

Contract - The written agreement between the Agency and the Contractor, including without limitation all Contract Documents, describing the Work to be completed and defining the rights and obligations of the Agency and the Contractor.

Contract Administration Engineer - The Agency representative presiding over Agency-level claims review under 00199.40.

Contract Amount - Lump sum Pay Item or the sum of the Pay Item amounts computed by multiplying the Pay Item quantities by the unit prices in the Schedule of Items.

Contract Documents - Solicitation Documents, Specifications, Plans, Contract booklet, Change Orders, Force Account Work orders, pay documents issued by the Agency, Materials certifications, Project Work schedules, final estimate, written orders and authorizations issued by the Agency, Material source development and reclamation plans, and permits, orders and authorizations obtained by the Contractor or Agency applicable to the Project, as well as all documents incorporated by reference therein.

Contract Time - The amount of time allowed to complete the Work under the Contract.

Contractor - The Entity awarded the Contract according to the solicitation.

Correction Period - Period from Second Notification to Final Acceptance as per Subsection 00170.85(b).

Course - A specified Surfacing Material placed in one or more Lifts to a specified thickness.

Coverage - One Pass by a piece of Equipment over an entire designated area.

Cross Section - The exact image formed by a plane cutting through an object, usually at right angles to a central axis, to determine area.

Day - A Calendar Day including weekdays, weekends, and holidays, unless otherwise specified.

Defective – An adjective which when modifying the word "Work" refers to work that: (1) is unsatisfactory, faulty or deficient; (2) does not conform to the Contract Documents; (3) does not meet the requirements of any inspection, test for approval referred to in the Contract Documents; or (4) has been damaged prior to Engineer's recommendation for final payment.

Durable Rock - Rock that has a slake durability index of at least 90% based on a two-cycle slake durability test, according to ASTM D 4644. In the absence of test results, the Engineer may evaluate the durability visually.

Emulsified Asphalt - Emulsified asphalt cement.

Emulsified Asphalt Concrete - A mixture of Emulsified Asphalt and graded Aggregate.

Engineer - The Engineer who represents the Agency and who is designated by the Agency to administer the Contract.

Entity - A natural person capable of being legally bound, sole proprietorship, limited liability company, corporation, partnership, limited liability partnership, limited partnership, profit or nonprofit unincorporated association, business trust, two or more persons having a joint or common economic interest, or any other person with legal capacity to contract, or a government or governmental subdivision.

Equipment - All machinery, tools, manufactured products, and fabricated items needed to complete the Contract or specified for incorporation into the Work.

Establishment Period - The time specified to assure satisfactory establishment and growth of planted Materials.

Existing Surfacing - Pavements, slabs, curbs, gutters, walks, driveways, and similar constructions of bricks, blocks, portland cement concrete, bituminous treated materials, and granular surfacing materials on existing Highways.

Extra Work - Work not included in the Contract, but deemed by the Engineer to be necessary to complete the Project.

Field Order – A written order issued by the Engineer which requires minor changes in the Work but which may not involve a change in the Contract Amount or the Contract Times.

Final Acceptance - Written confirmation by the Agency that the Project has been completed according to the Contract including all corrective work identified by the Agency during the Correction Period, with the exception of latent defects and Warranty obligations, if any, and has been accepted.

Final Inspection - The inspection conducted by the Engineer to determine that the Project has been completed according to the Contract.

Fine Aggregate - Crushed Rock, crushed Gravel, or Sand that passes a 1/4 inch sieve, with allowable oversize.

First Notification - Written Notice to Proceed provided by the Engineer.

Force Account Work - Items of Extra Work ordered by the Engineer that are to be paid according to Section 00197.

Granular Material - Graded and selected free-draining material composed of particles of Rock, Sand, and Gravel.

Gravel - Particles of Rock, rounded or not, that will pass a 3 inch sieve and be retained on a No. 4 sieve.

Highway - Every road, street, thoroughfare and place, including bridges, viaducts and other structures within the boundaries of the State, open, used or intended for use by vehicular traffic.

Incidental - A term identifying those acts, services, transactions, property, Equipment, labor, Materials, or other items for which the Agency will make no separate or additional payment.

Inspector - The representative of the Engineer authorized to inspect and report on Contract performance.

Leveling - Placing a variable-thickness Course of Materials to restore horizontal and vertical uniformity to existing Pavements, normally continuous throughout the Project.

Lift - The compacted thickness of material placed by Equipment in a single Pass.

Mandatory Source - A material source provided by the Agency from which the Contractor is required to obtain Materials. (see 00160.00(b) and 00160.40)

Materials - Any natural or manmade substance specified for use in the construction of the Project or for incorporation into the Work.

Median - The portion of a divided Highway separating traffic traveling in opposite directions.

Milestone – A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

Multiple Course Construction - Two or more Courses, exclusive of Patching or Leveling, placed over the entire Roadway width.

Multi-Use Path - That portion of the Highway Right-of-Way or a separate Right-of-Way, physically separated from motor vehicle traffic and designated for use by pedestrians, bicyclists and other non-motorized users.

Neat Line - Theoretical lines specified or indicated on the Plans for measurement of quantities.

Nondurable Rock - Rock that has a slake durability index of less than 90% based on a two-cycle slake durability test, as tested by ASTM D 4644, or Rock that is observed to readily degrade by air, water, and mechanical influence.

Notice to Proceed - Written notice authorizing the Contractor to begin performance of the Work.

On-Site Work - Any Work taking place on the Project Site, including designated staging areas adjacent to the Project Site, except for installation of covered temporary signs according to Section 00225.

Organic Soil - A Soil with sufficient organic content to influence the Soil properties.

Panel - The width of specified Material being placed by Equipment in a single Pass.

Pass - One movement of a piece of Equipment over a particular location.

Patching - Placing a variable-thickness Course of Materials to correct sags, dips, and/or bumps to the existing grade and Cross Section, normally intermittent throughout the Project.

Pavement - Asphalt concrete or portland cement concrete placed for the use of motor vehicles, bicycles, or pedestrians on Roadways, Shoulders, Multi-Use Paths and parking areas.

Pay Item (Contract Item) - A specific unit of Work for which a price is provided in the Contract.

Payment Bond - The approved security furnished by the Contractor's Surety as a guaranty of the Contractor's performance of its obligation to pay promptly in full all sums due for Materials, Equipment, and labor furnished to complete the Work.

Peat - A Soil composed primarily of vegetative matter in various stages of decomposition, usually with an organic odor, dark brown to black color, and a spongy consistency.

Performance Bond - The approved security furnished by the Contractor's Surety as a guaranty of the Contractor's performance of the Contract.

Plans - Standard and Supplemental Drawings, and approved unstamped and reviewed stamped Working Drawings. (see 00150.10 and 00150.35)

Project - The sum of all Work to be performed under the Contract.

Project Manager - The Engineer's representative directly responsible for administration of a Contract.

Project Site - The geographical dimensions of the real property on which the Work is to be performed, including designated contiguous staging areas.

Prospective Source - A Material source provided by the Agency, from which the Contractor has the option of obtaining Materials. (see 00160.00(a) and 00160.40)

Publicly-Owned Equipment - Equipment acquired by a state, county, municipality or political subdivision primarily for use in its own operations.

Public Traffic - Vehicular or pedestrian movement, not associated with the Contract Work, on a public way.

Railroad - Publicly or privately owned rail carriers, including passenger, freight, and commuter rail carriers, their tenants, and licensees. Also, Utilities that jointly own or use such facilities.

Right-of-Way - Land, property, or property interest, usually in a strip, acquired for or devoted to transportation or other public works purposes.

Roadbed - Completed excavations and embankments for the Subgrade, including ditches, side slopes, and slope rounding, if any.

Roadside - The area between the outside edges of the Shoulders and the Right-of-Way boundaries. Unpaved median areas between inside Shoulders of divided Highways and infield areas of interchanges are included.

Roadway - That portion of a Highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or Shoulder. If a Highway includes two or more separate Roadways, the term "Roadway" refers to any such Roadway separately, but not to all such Roadways collectively. (see Traveled Way)

Rock - Natural deposit of solid material composed of one or more minerals occurring in large masses or fragments.

Sand - Particles of Rock that will pass a No. 4 sieve and be retained on a No. 200 sieve.

Schedule of Items - The list of Pay Items, their units of measurement, estimated quantities, and prices.

Schedule of Values - The breakdown of the values of the component elements comprising a lump sum Pay Item.

Second Notification - Written acknowledgment by the Engineer of the Substantial Completion of the Work according to 00180.50(g).

Shoulder - The part of a Roadbed contiguous to the Traveled Way or Roadway, whether paved or unpaved, for accommodating stopped vehicles, for emergency use and for lateral support of Base and surface Courses.

Silt - Soil passing a No. 200 sieve that is nonplastic or exhibits very low plasticity.

Single Course Construction - A wearing Course only, not including patching or leveling Courses or partial width Base Course.

Slope - Vertical distance to horizontal distance, unless otherwise specified.

Soil - Accumulations of particles produced by the disintegration of Rock, which sometimes contains organic matter. Particles may vary in size from Clay to Boulders.

Solicitation Document - Documents which define the procurement of a public improvement Project, including, but not limited to, the Bid Booklet, Agency-provided Plans, Standard Specifications, Special Provisions, Addenda, and which includes all documents incorporated by reference. May also be called Bid Documents.

Special Provisions - The special directions, provisions, and requirements specific to a Project that supplement or modify the Standard Specifications. Permits and orders governing the Project that are issued directly to the Agency by a governmental or regulatory authority are considered to be part of the Special Provisions, to the extent and under the conditions stipulated in the Special Provisions.

Specifications - The Standard Specifications and Special Provisions, together with all provisions of other documents incorporated therein by reference.

Standard Drawings - The Agency-prepared detailed drawings for Work or methods of construction that normally do not change from project to project.

Standard Specifications – The "General Conditions for Construction for the City of Warrenton" published by the Agency, and the "2018 Oregon Standard Specifications for Construction", Parts 00200 through 03000, "Technical Specifications", published by the Oregon Department of Transportation as amended by the Agency. It provides directions, provisions, and requirements necessary for performing public improvement projects.

State - The State of Oregon.

Structures - Bridges, retaining walls, endwalls, cribbing, buildings, culverts, manholes, catch basins, drop inlets, sewers, service pipes, underdrains, foundation drains, and other similar features which may be encountered in the Work.

Subbase - A Course of specified material of specified thickness between the Subgrade and a Base.

Subcontractor - An Entity having a direct contract with the Contractor or another Subcontractor, to perform a portion of the Work.

Subgrade - The top surface of completed earthwork on which Subbase, Base, Surfacing, Pavement, or a Course of other Material is to be placed.

Substantial Completion – The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended.

Substructure - Those parts of a Structure which support the Superstructure, including bents, piers, abutments, and integrally built wingwalls, up to the surfaces on which bearing devices rest. Substructure also includes portions above bearing surfaces when those portions are built integrally with a Substructure unit (e.g., backwalls of abutments). When Substructure and Superstructure elements are built integrally, the division between Substructure and Superstructure is considered to be at the bottom soffit of the longitudinal or transverse beam, whichever is lower. Culverts and rigid frames are considered to be entirely Substructure.

Superstructure - Those parts of a Structure above the Substructure, including bearing devices.

Supplemental Drawings - The Agency-prepared detailed drawings for Work or methods of construction that are Project specific, and are denoted by title in the Project title block.

Supplier - The Entity that furnishes goods to be incorporated into the Work.

Surety - The Entity that issues the bond.

Surfacing - The Course or Courses of material on the Traveled Way, auxiliary lanes, Shoulders, or parking areas for vehicle use.

Third Notification - Written acknowledgment by the Engineer, subject to Final Acceptance, that as of the date of the notification the Contractor has achieved Final Completion of the Project according to the Contract, including without limitation completion of all minor corrective work, Equipment and plant removal, site clean-up, and submittal of all certifications, bills, forms and documents required under the Contract.

Ton - One short ton of 2,000 pounds (Ton, ton, Tn, or T).

Topsoil - Soil ready for use in a planting bed.

Traffic Lane - That part of the Traveled Way marked for moving a single line of vehicles.

Traveled Way - That part of the Highway for moving vehicles, exclusive of berms and Shoulders.

Typical Section - That Cross Section established by the Plans which represents in general the lines to which the Contractor shall work in the performance of the Contract.

Unsuitable Material - Frozen material, or material that contains organic matter, muck, humus, peat, sticks, debris, chemicals, toxic matter, or other deleterious materials not normally suitable for use in earthwork.

Utility - A line, facility, or system for producing, transmitting, or distributing communications, power, electricity, heat, gas, oil, water, steam, waste, storm water not connected with highway drainage, or any other similar commodity which directly or indirectly serves the public. The term may also mean the utility company, district, or cooperative owning and operating such facilities, including any wholly-owned or controlled subsidiary.

Warranty Bond - The approved security furnished by the Contractor's, Subcontractor's, Manufacturer's, Installer's or Supplier's Surety as a guaranty of performance of their respective warranty obligations.

Wetlands - Areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated Soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Work - The furnishing of all Materials, Equipment, labor, and Incidentals necessary to successfully complete any individual Pay Item or the entire Contract, and the discharge of duties and obligations imposed by the Contract.

Work Change Directive – A written statement to Contractor issued on or after the Date of the Agreement and signed by Owner and recommended by Engineer ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Amount or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Amount or Contract Times.

Work Day - Every Calendar day excluding Saturdays, Sundays and legal holidays as listed in ORS187.010.

Worker - Any person performing work under the contract, including employees of the Contractor or subcontractor, and persons having full or partial ownership of the Contractor or subcontractor. (This definition is not intended to nor does it alter the definition or meaning of the term "worker" as used in any applicable laws or regulations, including but not limited to for purposes of paying prevailing wage rates.)

Working Drawings - Supplemental Plans, not furnished by the Agency, that the Contractor is required to submit to the Engineer. (see 00150.35)

Workplace Violence - Any act of physical, verbal or written aggression by an individual in or related to the work place and/or project sites. This includes, but is not limited to, verbal abuse, threats or intimidation and physical intimidation, assault or battery by a worker or former worker. Work place violence may also include destruction or abuse of property.

Section 00120 - Bidding Requirements and Procedures

00120.01 Receipt of Bids; Opening – See Special Provisions.

00120.02 Prequalification of Bidders – See Special Provisions.

00120.03 Request for Solicitation Documents – See Special Provisions.

00120.04 Pre-Bid Meeting – See Special Provisions

00120.10 Bid Booklet - The Bid Booklet may include, but is not limited to:

- Call for Bids
- Bidder's Checklist
- Bid Section
- Appendix, which includes required time-sensitive forms, sample forms, and other informational pages

The Call for Bids and Bid Section may include, but is not limited to:

- Description and location of the proposed Project
- Time, date, and location for opening Bids
- Project completion time
- Class of Work
- Bid statement
- Certificate of non-collusion
- Certificate of Nondiscrimination
- Certificate of noninvolvement in any debarment or suspension (for Federal-Aid Projects)
- Certificate regarding lobbying activities (for Federal-Aid Projects)
- Certificate of residency (for State Projects)
- Certificate of compliance with Oregon tax laws
- Bid Schedule
- Identification of Bidder(s) and Sureties
- Bid signature page
- Bid Bond form
- First-tier Subcontractor Disclosure form

Other certificates or statements may be bound within the Bid Section. Plans, Specifications, and other documents referred to in the Bid Section will be considered part of the Bid.

00120.15 Examination of Work Site and Solicitation Documents; Consideration of Conditions to be Encountered - Before submitting a Bid, Bidders shall make a careful visual examination of the site of the proposed Work, the Bid Booklet, Plans, and Specifications. Bidders shall also review any subsurface investigation material referenced in 00120.25 that may be available and conduct additional investigation of any unusual condition apparent during the visual site examination. As soon as reasonably practicable after noting any such unusual condition, Bidder shall notify Agency, in writing, of any such unusual condition and the additional investigation undertaken by Bidder. Submission of a Bid will constitute confirmation that the Bidder has examined the Project Site and finds the Plans and Specifications to be sufficiently detailed and accurate to enable Bidder to properly perform the Work, and understands the conditions to be encountered in performing the Work and all requirements of the Contract.

The Bidder is responsible for loss or unanticipated costs suffered by the Bidder because of the Bidder's failure to fully examine the site and become fully informed about all conditions of the Work, or failure to request clarification of Plans and Specifications Bidder believes to be erroneous or incomplete.

Any clarification of Plans and Specifications needed by the Bidder shall be requested in writing by email through the Engineer. Unless the procurement period is shorter than one week, requests for changes or clarification shall be submitted at least seven days prior to the date of Bid Closing. The Agency will respond to each request at least 72 hours prior to the date of Bid Closing. If the Procurement period is less than seven days, requests shall be submitted within one day after the Procurement is issued and the Agency will issue its response to each such request at least 24 hours prior to Bid Closing. Failure to timely request clarification or changes shall be deemed acceptance of all of the terms and conditions of the Procurement. Oral explanations or interpretations given before receiving Bids for a Project will not be binding. To be binding, interpretation of the Plans and Specifications by the Agency must be made by written Addendum furnished to all Holders of Bidding Plans according to 00120.30. Notification of erroneous or incomplete Plans or Specifications shall also be submitted to the Engineer. Such notification shall also be made in sufficient time for the Agency to make any necessary modifications and issue Addenda to Bidders prior to Bid Closing.

00120.16 Material, Equipment, and Method Substitutions - When the Contract specifies certain Materials, Equipment, and/or methods, the Bidder shall include those Materials, Equipment, and/or methods in the Bid. Substitution after execution of Contract is specified in 00180.31(b), 00180.31(c), and 00180.31(d).

00120.17 Use of Agency-Owned Land for Staging or Storage Areas - The Contractor may use Agency-owned property for staging or storage areas, subject to the following limitations:

(a) Within Normal Right-of-Way Limits - If approved by the Engineer, the Contractor may use available property within the normal Right-of-Way limits for the purpose of constructing improvements under the Contract. Where the Agency owns, or has rights to, other adjacent properties in the Project area, "normal Right-of-Way" is limited to a line drawn across that property connecting the normal Right-of-Way limits on either side of the property.

(b) Outside Normal Right-of-Way Limits - The Contractor may not use Agency-owned property outside of normal Right-of-Way limits for the Project without the approval of the Engineer.

If a Bidder obtains approval before submitting a Bid, use of the property will be at no cost to the Contractor, or at a cost stated by the Engineer upon granting approval, as confirmed by Addendum.

If approval is not obtained before submitting a Bid, and the Contractor proposes to use Agency-owned property outside the normal Right-of-Way limits, then use of the property may be approved by the Engineer, but the Contractor will be assessed fair market value, as determined by the Engineer, for use of the property.

(c) Restrictions on Use - Contractors shall comply with all applicable laws, ordinances, and regulations pertaining to use of Agency-owned property, and shall:

- Not cause unreasonable impacts on traffic and other facility users.
- Clean up all hazardous materials deposited by, or resulting from, Contractor operations.
- Be responsible for all costs associated with use of the property.

00120.20 Interpretation of Quantities in Bid Schedule - Quantities appearing in the Bid Schedule are approximate and are provided only for comparison of Bids. The Agency does not warrant that the actual individual items, amount of Work, or quantities will correspond to those shown in the Bid Schedule. Payment to the Contractor will be made only for actual quantities of Work performed and accepted or Materials furnished and accepted, as required by the Contract. Quantities of Work to be performed and Materials to be furnished may each be increased, decreased, or omitted as provided in 00120.30 and 00140.30.

00120.25 Subsurface Investigations - If the Agency or its consultant has conducted subsurface or geologic investigations of the proposed Project Site or contiguous to the Project Site, the results of the investigations may be included in written reports. If reports have been prepared, such reports shall be included in the Solicitation Documents and shall be considered as part of the Contract Documents to the extent that the Contractor may rely upon the accuracy of the "technical data" contained in such reports. If the Agency has retained subsurface samples, they will also be available for inspection. Bidders and the Contractor may make arrangements for viewing the samples through the Engineer's office.

The availability of subsurface information from the Agency is solely for the convenience of the Bidder and shall not relieve the Bidder or the Contractor of any risk, duty to make examinations and investigations as required by 00120.15, or other responsibility under the Contract Documents. It is mutually agreed to by all parties that:

- The subsurface investigations made by the Agency are for the purpose of obtaining data for planning and design of the Project.
- The data for individual test boring logs apply only to that particular boring and is not intended to be conclusive as to the character of any material between or around test borings.
- If Bidders use this information in preparing a Bid, it is used at their own risk, and Bidders are responsible for all conclusions, deductions, and inferences drawn from this information.

- Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, consultants, or subcontractors with respect to any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

00120.30 Changes to Plans, Specifications, or Quantities before Opening of Bids - The Agency reserves the right to issue Addenda making changes or corrections to the Plans, Specifications, or quantities. Only holders of Solicitation Documents obtained from the Agency's office who have been identified by the Agency as Holders of Bidding Plans will be notified of these Addenda by mail, delivery service, electronic facsimile (FAX) or email sent to the Bidder's mail, street or email address or FAX number as it appears in the Agency's files.

The Agency may extend Bid closing if Agency determines prospective bidders need additional time to review and respond to addenda. Agency will not, except to the extent required by a countervailing public interest, issue Addenda less than 72 hours before Bid closing unless the Addendum also extends Bid closing.

The Agency will not be responsible for failure of Bidders to receive Addenda sent as described in the preceding paragraph. Bids shall incorporate all Addenda. Bids may be rejected if opened and found by the Agency to not be based on all Addenda issued before Bid Closing.

00120.40 Preparation of Bids:

(a) General:

(1) Bids - The Bidders shall not alter, in any manner, the documents within the Bid Section. Bidders shall complete the certifications and statements included in the Bid Section of the Bid Booklet according to the instructions. Signature of the Bidder's authorized representative thereon constitutes the Bidder's confirmation of an agreement to all certifications and statements contained in the Bid Booklet. Entries on the documents in the Bid Section shall be in black or blue ink or typed. Signatures and initials shall be in ink.

The Bidder shall properly complete and bind all the documents in the Bid Section, as specified in 00120.10, between the front and back covers of the Bid Booklet, except that the Bid Bond is not required if another permissible type of Bid guaranty is provided. (see 00120.40(d))

(b) Bid Schedule Entries:

(1) Bid Schedule Entries - Using figures, Bidders shall fill in all blank spaces in the Bid Schedule. For each item in the Bid Schedule, Bidders shall enter the unit price and the product of the unit price multiplied by the quantity given. The unit price shall be greater than zero, shall contain no more than two decimal places to the right of the decimal point, and shall be expressed in U.S. dollars and cents (for example, $150.25 or $0.37). Unit prices submitted which contain more than two decimal places, will be truncated by the Agency at the second decimal place to determine the product of the unit price and quantity. No rounding will be considered or paid. Bidders Bid shall also enter the total amount of the Bid obtained by adding amounts for all items in the paper Bid Schedule. Corrections or changes of item entries shall be in ink, with incorrect entry lined out and correct entry entered and initialed.

(c) Bidder's Address and Signature Pages - Bidders shall include in the Bid the address to which all communications concerning the Bid and Contract should be sent. The Bid must be signed by a duly authorized representative of the Bidder.

d) Bid Guaranty - All Bids shall be accompanied by a Bid guaranty in the amount of 5% of the total amount of the Bid.

(1) Bid Guaranty The Bid guaranty shall be either a Surety bond, irrevocable letter of credit issued by an insured institution as defined in ORS 706.008 or security in the form of a cashier's check or certified check made payable to the Agency. (see ORS 279C.365(4))

If a Surety bond is submitted, Bidders shall use the Agency's standard Bid Bond form included with the Bid Booklet. Bidders shall submit the bond with original signatures and the Surety's seal affixed. The Bid guaranty shall be submitted by mail, delivery service, or hand delivered to the offices and addresses, and at the times given in the Bid Booklet.

- Acceptable Surety companies are limited to those authorized to do business in the State of Oregon.

- Forfeiture of Bid guaranties is covered by 00130.60, and return of guaranties is covered by 00130.70.

(e) Disclosure of First-Tier Subcontractors - If a Bidder's Bid on a public improvement Project exceeds $100,000, the Bidder shall, within 2 working hours of the time Bids are due to be submitted, submit to the Agency, on a form provided by the Agency, a disclosure identifying any first-tier Subcontractors that will furnish labor or labor and Materials, and whose contract value is equal to or greater than:

- 5% of the total Project Bid, but at least $15,000; or
- $350,000, regardless of the percentage of the total Project Bid.

For each Subcontractor listed, Bidders shall state:

- The name of the Subcontractor;
- The dollar amount of the subcontract; and
- The category of Work that the Subcontractor would be performing.

If no subcontracts subject to the above disclosure requirements are anticipated, a Bidder shall so indicate by entering "NONE" or by filling in the appropriate check box. For each Subcontractor listed, Bidders shall provide all requested information. An incomplete form will be cause for rejection of the Bid.

The Subcontractor Disclosure Form may be submitted for a Bid either:

- By filling out the Subcontractor Disclosure Form included in the Bid Booklet and submitting it together with the Bid at the time and place designated for receipt of Bids;
- By removing it from the Bid Booklet, filling it out and submitting it separately to the Agency at the address given in the Bid Booklet; or

- The Subcontractor Disclosure Form shall be sealed in a separate envelope, addressed to Public Works Director, City of Warrenton, 225 S Main Ave, Warrenton, OR 97146, showing on the outside of the envelope the name of the Bidder and the Contract title preceded by the words "Subcontractor Disclosure Form". **Facsimile submissions of Subcontractor Disclosure Form will not be accepted.**

Subcontractor Disclosure Forms submitted by any method will be considered late if not received by the Agency within two 2 working hours of the time designated for receiving Bids.

THE AGENCY MUST REJECT A BID IF THE BIDDER FAILS TO SUBMIT THE DISCLOSURE FORM WITH THIS INFORMATION BY THE STATED DEADLINE (see OAR 137-049-0360).

00120.45 Submittal of Bids:

(a) **Bids** - Bids may be submitted by mail, parcel delivery service, or hand delivery to the Agency, and at the times given in the Bid Booklet. Bids may not be submitted by FAX or electronic means. Submit Bids in a sealed envelope addressed to Public Works Director, City of Warrenton, 225 S Main Ave, Warrenton, Oregon 97146. Date of opening and Project title must be plainly marked on the outside of the sealed envelope preceded by the words "Sealed Bid". If a delivery or courier service is used, the Bidder shall place the sealed envelope containing the paper Bid inside the delivery or courier service's envelope.

Bids submitted after the time set for receiving Bids will not be opened or considered. The Agency assumes no responsibility for the receipt and return of late Bids.

Preparation and submission of Bids is at the sole risk and expense of the Bidder and is not a cost of contract performance.

00120.60 Revision or Withdrawal of Bids:

(a) **Bids** - Information entered into the Bid Booklet by the Bidder may be changed after the Bid has been delivered to the Agency, provided that:

- Changes are prepared according to the instructions identified in the Bid Booklet; and
- Changes are received at the same offices, addresses, and times identified in the Bid Booklet for submitting Bids; and
- The changes are submitted in writing, signed by an individual authorized to sign the Bid.

A Bidder may withdraw its Bid after it has been delivered to the Agency, provided that:

- The written withdrawal request is submitted in person on the Bidder's letterhead; and
- The request is signed by an individual who is authorized to sign the Bid, and proof of authorization to sign the Bid accompanies the withdrawal request; and
- The request is received at the same offices, addresses, and prior to the time identified in the Bid Booklet for submitting Bids.

No Bid can be withdrawn after having been opened.

00120.65 Opening and Comparing Bids - Bids will be opened and the total price for each Bid will be read publicly at the time and place indicated in the Call for Bids. Bidders and other interested parties are invited to be present.

Bids for each Project will be compared on the basis of the total amount of each Bid. The total amount of the Bid will be the total sum computed from quantities listed in the Bid Schedule and unit prices entered by the Bidder.

In case of conflict between the unit price and the corresponding extended amount, the unit price shall govern, and the Agency may make arithmetic corrections on extension amounts.

00120.70 Rejection of Nonresponsive Bids - A Bid will be considered irregular and will be rejected if the irregularity is deemed by the Agency to render the Bid non-responsive. Examples of irregularities include without limitation:

- The Bid Section documents provided are not properly used or contain unauthorized alterations.
- The Bid is incomplete or incorrectly completed.
- The Bid contains improper additions, deletions, alternate Bids, or conditions.
- The Bid is submitted on documents not obtained directly from the Agency, or is submitted by a Bidder who has not been identified by the Agency as a Holder of Bidding Plans, as required by 00120.03.
- The Bid or Bid modifications are not signed by a person authorized to submit Bids or modify Bids, as required by 00120.40 and 00120.60.
- A member of a joint venture and the joint venture submit Bids for the same Project. Both Bids may be rejected.
- The Bid has entries not typed or in ink, or has signatures or initials not in ink.
- Each change or correction is not individually initialed.
- White-out tape or white-out liquid is used to correct item entries.
- The price per unit cannot be determined.
- The Bid guaranty is insufficient or improper.
- The original Bid Bond form is not used or is altered.
- The Oregon Construction Contractors Board registration number and expiration date are not shown on the Bid if required in the Solicitation Document. This requirement applies to Agency and State-funded Projects, with the exception of Aggregate production and landscape Projects. (not required on Federal-Aid Projects)
- A disclosure of qualified first-tier Subcontractors, if required under 00120.40(e), is not received within 2 working hours of the time Bids are due to be submitted, or the disclosure form is not complete.
- The Bidder has not complied with the DBE requirements of the solicitation.
- The Bid does not acknowledge all issued Addenda.
- The Bid contains entries that are not greater than zero.
- The Bid entries are not expressed in U.S. dollars and cents.

- The Agency determines that any Pay Item is significantly unbalanced to the potential detriment of the Agency.

In addition, the Agency may reject all Bids for good cause upon its finding that it is in the public interest to do so. The Agency may also waive minor informalities or irregularities.

00120.80 Reciprocal Preference for Oregon Resident Bidders - This Subsection applies only to Contracts for Projects financed without federal funds.

Bidders shall complete the certificate of residency provided by the Agency in the Bid Booklet. Failure to properly complete the form will be cause to reject the Bid.

As used in the certificate of residency and this Subsection, "Resident Bidder" means a Bidder who has:

- Paid unemployment taxes or income taxes in the State of Oregon during any of the 12 calendar months immediately preceding submission of the Bid;
- A business address in the State of Oregon; and
- Certified in the Bid that the Bidder qualifies as a Resident Bidder.

"Nonresident Bidder" means a Bidder who is not a Resident Bidder as defined above.

In determining the lowest Bid, the Agency will, for the purpose of awarding the Contract, add a percentage increase to the Bid of a Nonresident Bidder equal to the percentage, if any, of the preference given to that Bidder in the state in which the Bidder resides (ORS 279A.120). The percentage preference applied in each state will be published on or before January 1 of each year by the Oregon Department of Administrative Services. The Agency may rely on these percentages without incurring liability to any Bidder (ORS 279A.120).

This increase will only be applied to determine the lowest Bid, and will not cause an increase in payment to the Contractor after Award of the Contract.

00120.90 Disqualification of Bidders - The Bid(s) of a disqualified Bidder will be rejected. Any of the following reasons is sufficient to disqualify a Bidder:

- More than one Bid is submitted for the same Work by an Entity under the same or different name(s).
- Evidence of collusion among Bidders. Participants in collusion will be found not responsible, and may be subject to criminal prosecution.
- Any of the grounds for disqualification cited in ORS 279C.440.

A Bidder will be disqualified if the Bidder has:

- Not been prequalified as required by 00120.02;
- Been declared ineligible by the Commissioner of the Bureau of Labor and Industries under ORS 279C.860;

- Not been registered (licensed) by the Oregon Construction Contractors Board (CCB) or been licensed by the State Landscape Contractors Board before submitting a Bid (ORS 279C.365(1)(k), ORS 701.021, ORS 701.026, and ORS 671.530). The Bidder's registration number and expiration date shall be shown in the Bid form, if requested. Failure to furnish the registration number, if requested, will render the Bid non-responsive and subject to rejection. (not required on Federal-Aid projects); or
- Been determined by the CCB under ORS 701.227 not to be qualified to hold or participate in a public contract for a public improvement.

00120.91 Rejection of Bid on Grounds of Nonresponsibility of Bidder - The Bid of a Bidder who is found to be nonresponsible according to the criteria listed in 00130.10 or ORS 279C.375(3) will be rejected.

Section 00130 - Award and Execution of Contract

00130.00 Consideration of Bids - After opening and reading Bids, the Agency will check them for correct extensions of unit prices and totals. (see 00120.65) The total of extensions, corrected where necessary, will be used by the Agency for Award purposes. Discrepencies between words and figures will be resolved in favor of words. In selecting the lowest responsive Bid, the Agency reserves the right to take into consideration any or all alternatives called for in the Bid Form.

The Agency reserves the right to waive minor informalities and irregularities, and to reject any or all Bids for irregularities under 00120.70 or for good cause after finding that it is in the public interest to do so (ORS 279C.395). An example of good cause for rejection in the public interest is the Agency's determination that any of the unit Bid prices are materially unbalanced to the Agency's potential detriment. A materially unbalanced Bid is defined as, “a Bid which generates a reasonable doubt that award to the Bidder submitting a mathematically unbalanced Bid will result in the lowest ultimate cost to the Agency.

The Agency may correct obvious errors, when the correct information can be determined from the face of the document, if it finds that the best interest of the Agency and the public will be served thereby.

Bids will be considered and a Contract awarded, if at all, within 30 Calendar Days from the date of Bid Opening, unless an extension beyond that time is agreed to by both parties and acknowledged in writing by the Bidder.

00130.10 Award of Contract - After the Bids are opened and a determination is made that a Contract is to be awarded, the Contract will be awarded to the lowest responsible Bidder. For the purposes of this Section, "lowest responsible Bidder" means the responsible Bidder that submitted the lowest responsive Bid who is not on the list created by the Construction Contractors Board according to ORS 701, and who has:

- Substantially complied with all prescribed public bidding procedures and requirements.
- Available the appropriate financial, Materials, Equipment, facility and personnel resources and expertise, or ability to obtain the resources and expertise, necessary to indicate the capability of the prospective Bidder to meet all contractual responsibilities.
- A satisfactory record of performance. In evaluating a Bidder's record of performance, the Agency may consider, among other things, whether the Bidder completed previous contracts of a similar nature with a satisfactory record of performance. For purposes of evaluating a Bidder's performance on previous contracts of a similar nature, a satisfactory record of performance means that to the extent that the costs associated with and time available to perform a previous contract remained within the Bidder's control, the Bidder stayed within the time and budget allotted for the procurement and otherwise performed the contract in a satisfactory manner.
- A satisfactory record of integrity. In evaluating a Bidder's record of integrity, the Agency may consider, among other things, whether the Bidder has previous criminal convictions for offenses related to obtaining or attempting to obtain a contract or subcontract or in connection with the Bidder's performance of a contract or subcontract.
- Qualified legally to contract with the Agency.
- Supplied all necessary information in connection with the Agency’s inquiry concerning responsibility. If a prospective Bidder fails to promptly supply information requested by the Agency concerning

responsibility, the Agency shall base the determination of responsibility upon any available information, or may find the prospective Bidder not to be responsible.

- Not been disqualified by the public contracting agency under ORS 279C.440.

If the Bidder is found not to have a satisfactory record of performance or integrity, the Agency will document the record and the reasons for the unsatisfactory finding.

The Agency will provide the Notice of Intent to Award to the Bidders, and may provide Notice of Intent to Award on the Agency's web site.

The Award will not be final until the later of the following:

- Seven calendar days after the Notice of Intent to Award has been issued; or
- The Agency has provided a written response to each timely protest, denying the protest and affirming the Award.

If the Agency accepts a Bid and awards a Contract, the Agency will send the successful Bidder written notice of acceptance and Award.

Notice of Award and Contract booklets ready for execution will be sent within 60 Calendar Days of the opening of Bids or within the number of Calendar Days specified in the Special Provisions or a written mutual agreement.

00130.15 Right to Protest Award - Adversely affected or aggrieved Bidders, limited to the three apparent lowest Bidders and any other Bidder directly in line for Contract Award, may submit to the Agency a written protest of the Agency's intent to Award within seven Calendar days following the date of the Notice of Intent to Award. The protest shall specify the grounds upon which it is based.

An aggrieved Bidder may protest an award only if the Bidder alleges, in its written protest, that it should have received the award because:

(a) All lower Bids are non-responsive;

(b) The Agency failed to conduct the Bid process as described in the Bid Document;

(c) The Agency has abused its discretion in rejecting the protestor's Bid as non-responsive or non-responsible; or

(d) The Agency's evaluation of Bids or subsequent determination of award is otherwise in violation of ORS Chapters 279A and 279C or the Agency's public contracting rules.

The written protest must describe the facts that support the protest. The Agency may not consider late protests or protests that do not describe facts that would support a finding that the Bidder is aggrieved for one of the reasons in clauses (a) through (d) above.

00130.20 Cancellation of Award - Without liability to the Agency, the Agency may for good cause cancel Award at any time before the Contract is executed by all parties to the Contract, as provided by ORS 279C.395 for rejection of Bids, upon finding it is in the public interest to do so.

00130.30 Contract Booklet - The Contract booklet may include but is not limited to:

- Special Provisions
- Addenda
- Schedule of Items
- Contract (Agreement)
- Performance Bond
- Payment Bond
- Certification of workers' compensation coverage

00130.40 Contract Submittals - Before the Agency will execute the Contract, the successful Bidder shall furnish the following:

(a) Performance and Payment Bonds - When Awarded the Contract, the successful Bidder shall furnish a Performance Bond and a Payment Bond of a Surety authorized to do business in the State of Oregon.

The successful Bidder shall submit the standard bond forms, which are bound in the Contract booklet. Faxed or photocopied bond forms will not be accepted. The amount of each bond shall be equal to the Contract Amount. The Performance Bond and the Payment Bond must be signed by the Surety's authorized Attorney-in-Fact, and the Surety's seal must be affixed to each bond. A power of attorney for the Attorney-in-Fact shall be attached to the bonds in the Contract booklet, which must include bond numbers, and the Surety's original seal must be affixed to the power of attorney. Bonds shall not be canceled without the Agency's consent, nor will the Agency normally release them, prior to Contract completion. The amount of the Performance and Payment Bonds shall be increased to equal the new Contract Amount whenever the Contract Amount is increased for any reason.

(b) Certificates of Insurance - The successful Bidder shall furnish the Agency certificates of insurance applicable to the Project, according to 00170.70. The insurance coverages shall remain in force throughout the performance of the Contract and shall not be allowed to lapse without prior written approval of the Agency. Bidders shall refer to 00170.70 for minimum coverage limits and other requirements.

For specified Contracts, certified copies, and in some instances the original, of insurance policies may be required by the Special Provisions.

(c) Workers' Compensation - To certify compliance with the workers' compensation insurance coverage required by 00170.61(a) and 00170.70(d), the successful Bidder shall complete and sign the "Certification of Workers' Compensation Coverage" form bound in the Contract booklet.

(d) Registration Requirements:

(1) ORS 701.021, ORS 701.026, and ORS 671.530 require that Bidders be registered with the Oregon Construction Contractors Board or licensed by the State Landscape Contractors Board prior to submission of a Bid on a Project not involving federal funds. Registration with the Construction Contractors Board or licensing by the State Landscape Contractors Board is not a prerequisite to bidding on Federal-Aid Projects; however, the Agency will not execute a Contract until the Contractor is so registered or licensed.

(2) Bidders must be registered with the Corporation Division, Oregon Secretary of State, if bidding as a corporation, limited liability company, joint venture, or limited liability partnership, or if operating under an assumed business name and the legal name of each person carrying on the business is not included in the business name.

(3) A Contractor registered under ORS 701 may bid on a landscaping Project or perform a construction project that includes landscape contracting as a portion of the project if the landscape contracting is subcontracted to a licensed landscaping business as defined in ORS 671.520.

(4) A landscaping business may bid on a Project or perform a Contract that includes the phase of landscape contracting for which it is not licensed if it employs a landscape contractor, or subcontracts with another licensed landscaping business, licensed for that phase.

(e) Tax Identification Number - The successful Bidder shall furnish the Agency the Bidder's Federal Tax Identification Number.

00130.50 Execution of Contract and Bonds:

(a) By the Bidder - The successful Bidder shall deliver the required number of Contract booklets with the properly executed Contract, Performance Bond, Payment Bond, certification of workers' compensation coverage, and the required certificates of insurance, to the Agency within 14 Calendar Days after the date on which the Contract booklets are sent or otherwise conveyed to the Bidder under 00130.10. The Bidder shall return the originals of all documents received from the Agency and named in this Subsection, with original signatures. Certificates of insurance shall also be originals. Certificates of insurance for coverages that are permitted by the Agency under 00170.70(a) to be obtained by appropriate subcontractors shall be delivered by the Contractor to the Agency together with the Contractor's request under 00180.21 for approval of the subcontract with that subcontractor. No copies of these documents will be accepted by the Agency.

Proper execution requires that:

- If the Contractor is a partnership, limited liability partnership, joint venture, or limited liability company, an authorized representative of each Entity comprising it shall sign the Contract, Performance Bond, and Payment Bond, and an authorization to sign shall be attached.
- If the Contractor is a corporation, the President and the Secretary of that corporation shall sign the Contract, Performance Bond, and Payment Bond. However, if other corporate officers are authorized to execute contracts and bonds, the successful Bidder shall furnish with those documents a certified, true and correct copy of the corporate bylaws or minutes stating that authority. If only one officer is signing, then the bylaws or minutes must include the authority to

sign without the signature of others. The successful Bidder shall also include the title(s) or corporate office(s) held by the signer(s).

(b) By the Agency - Within 10 Working Days after the Agency has received and verified the properly executed documents specified in 00130.50(a), and received legal sufficiency approval from the Agency's attorney (if required), the Agency will execute the Contract. The Agency will then send a fully-executed original Contract booklet to the successful Bidder, who then officially becomes the Contractor.

00130.60 Failure to Execute Contract and Bonds - Failure of the successful Bidder to execute the Contract and provide the required certificates, certifications, and bonds may be cause for cancellation of the Award, and may be cause for forfeiture of the Bid guaranty under ORS 279C.385.

Award may then be made to the next lowest responsible Bidder, the Project may be re-advertised, or the Work may be performed otherwise as the Agency decides.

The forfeited Bid guaranty will become the Agency's property, not as a penalty but as liquidation of damages resulting from the Bidder's failure to execute the Contract and provide the certificates, certifications, and bonds as required by these Specifications.

00130.70 Release of Bid Guaranties - Bid guaranties will be released and checks returned 7 Calendar Days after Bids are opened, except for those of the three apparent lowest Bidders on each Project. The guaranties of the three apparent lowest Bidders will be released and checks returned to unsuccessful Bidders within 7 days of the Agency's execution of the Contract.

00130.75 City's Business License – Successful Bidder shall have current business license with the City of Warrenton prior to entering into an agreement. Before permitting a subcontractor to begin work, Contractor shall verify that subcontractor has a current City of Warrenton business license.

00130.80 Project Site Restriction - Until the Agency sends the Contractor written Notice to Proceed with the Work, and the Contractor has filed the public works bonds required in 00170.20, the Contractor shall not go onto the Project Site on which the Work is to be done, nor move Materials, Equipment, or workers onto that Project Site.

The Contractor will not automatically be entitled to extra compensation because the commencement of Work is delayed by failure of the Agency to send the Contract for execution. However, if more than 60 Calendar Days elapse between the date the Bid is opened and the date the Agency sends the Contract to be executed, the Agency will consider granting an adjustment of time for completion of the Work to offset any actual delay to Contract completion resulting directly from delay in commencement.

00130.90 Notice to Proceed - Notice to Proceed will be issued within 5 Calendar Days after the Contract is executed by the Agency.

Should the Agency fail to issue the Notice to Proceed within 5 Calendar Days of Contract execution, the Contractor may apply for an adjustment of Contract Time according to 00180.80(c).

Section 00140 - Scope of Work

00140.00 Purpose of Contract - The purpose of the Contract is to set forth the rights and obligations of the parties and the terms and conditions governing completion of the Work. The Contractor's obligations shall include without limitation the following:

- The Contractor shall furnish all Materials, Equipment, labor, transportation, and Incidentals required to complete the Work according to Plans, Specifications, and terms of the Contract.
- The Contractor shall perform the Work according to the lines, grades, Typical Sections, dimensions, and other details shown on the Plans, as modified by written order, or as directed by the Engineer.
- The Contractor shall perform all Work determined by the Engineer to be necessary to complete the Project.
- The Contractor shall contact the Engineer for any necessary clarification or interpretation of the Contract.

00140.10 Typical Sections - The Typical Sections are intended to apply in general. At other locations where the Typical Section is not appropriate, the Contractor shall perform construction to the identified alignment as directed by the Engineer.

00140.20 Thickness - The thickness of Courses of Materials shown on the Plans, given in the Specifications, or established by the Engineer is considered to be the compacted thickness. Minor variations are acceptable when within tolerances specified in the Specifications or Plans, or when approved by the Engineer.

00140.30 Agency-Required Changes in the Work - Changes to the Plans, quantities, or details of construction are inherent in the nature of construction and may be necessary or desirable during the course of Project construction.

Without impairing the Contract, the Agency reserves the right to require changes it deems necessary or desirable within the scope, which in the Specifications means general scope, of the Project. These changes may modify, without limitation:

- Specifications and design
- Grade and alignment
- Cross Sections and thicknesses of Courses of Materials
- Method or manner of performance of Work
- Project Limits

or may result in:

- Increases and decreases in quantities
- Additional Work
- Elimination of any Contract item of Work
- Acceleration or delay in performance of Work

Upon receipt of a Change Order, the Contractor shall perform the Work as modified by the Change Order. If the Change Order increases the Contract Amount, the Contractor shall notify its Surety of the increase and direct the Surety to increase the amount of the performance and payment bonds to equal the new Contract Amount. The Contractor's performance of Work according to Change Orders shall neither invalidate the Contract nor release the Surety. Payment for changes in the Work will be made according to 00195.20. Contract Time adjustments, if any, will be made according to 00180.80. A Change Order signed by the Contractor is the agreement that the adjustment in the Contract Amount or Contract Time indicated is full compensation for all change order items including the impact of the change order on the balance of the Work to be accomplished.

00140.40 Differing Site Conditions - The following constitute differing Project Site conditions provided such conditions are discovered at the Project Site after commencement of the Work:

- Type 1 - Subsurface or latent physical conditions that could not have been discovered by careful examination of the Project Site, utilities and available records as described in 00120.15 and differ materially from those indicated in the Contract Documents; or
- Type 2 - Unknown physical conditions of unusual nature that differ materially from those ordinarily encountered and generally recognized as inherent in the Work provided for in the Contract.

The party discovering such a condition shall promptly notify the other party, in writing, of the specific differing conditions before they are disturbed and before the affected Work is performed. The Contractor shall not continue Work in the affected area until the Engineer has inspected such condition according to 00195.30 to determine whether an adjustment to Contract Amount or Contract Time is required.

Payment adjustments due to differing Project Site conditions, if any, will be made according to 00195.30. Contract Time adjustments, if any, will be made according to 00180.80.

00140.50 Environmental Pollution Changes - ORS 279C.525 will apply to any increases in the scope of the Work required as a result of environmental or natural resources laws enacted or amended after the submission of Bids for the Contract. The Contractor shall comply with the applicable notice and other requirements of ORS 279C.525. The applicable rights and remedies of that statute will also apply.

In addition to ORS 279C.525, the Agency has compiled a list at 00170.01 of those federal, State, and local agencies, of which the Agency has knowledge, that have enacted ordinances, rules, or regulations dealing with the prevention of environmental pollution and the preservation of natural resources that may affect the performance of Agency contracts.

00140.60 Extra Work - If directed by the Engineer's written order, the Contractor shall perform work not included in the Contract. The Contractor shall perform this work according to:

- Standard Specifications
- Standard Drawings
- Other Plans and Specifications issued by the Engineer

Payment for Extra Work will be made according to Section 00196. Contract Time adjustments, if any, will be made according to 00180.80.

00140.65 Disputed Work - The Contractor may dispute any part of a Change Order, written order, or an oral order from the Engineer by the procedures specified in Section 00199.

00140.70 Cost Reduction Proposals - The Contractor may submit written proposals to the Engineer that modify Plans, Specifications, or other Contract Documents for the sole purpose of reducing the total cost of construction. Unless otherwise agreed to in writing by the Agency, a proposal that is solely or primarily a proposal to reduce estimated quantities or delete Work, as determined by the Engineer, is not eligible for consideration as a cost reduction proposal and will instead be addressed under 00140.30, whether proposed or suggested by the Agency or the Contractor.

(a) Proposal Requirements - The Agency will not adopt a cost reduction proposal that impairs essential functions or characteristics of the Project including but not limited to service life, economy of operation, ease of maintenance, designed appearance, or design and safety standards.

To conserve time and funds, the Contractor may first submit a written request for a feasibility review by the Engineer. The request should contain a description of the proposal together with a rough estimate of anticipated dollar and time savings. The Engineer will, within a reasonable time, advise the Contractor in writing whether or not the proposal would be considered by the Agency, should the Contractor elect to submit a detailed cost reduction proposal.

A detailed cost reduction proposal shall include without limitation the following information:

- A description of existing Contract requirements for performing the Work and the proposed change;
- The Contract items of Work affected by the proposed change, including any quantity variation caused by the proposed change;
- Pay Items affected by the proposed change including any quantity variations;
- A detailed cost estimate for performing the Work under the existing Contract and under the proposed change. Cost estimates shall be made according to Section 00197. Costs of re-design, which are incurred after the Agency has accepted the proposal, will be included in the cost of proposed work; and
- A date by which the Engineer must accept the proposal in order to accept the proposed change without impacting the Contract Time or cost reduction amount.

(b) Continuing to Perform Work - The Contractor shall continue to perform the Work according to Contract requirements until the Engineer issues a Change Order incorporating the cost reduction proposal. If the Engineer fails to issue a Change Order by the date specified in the proposal, the proposal shall be deemed rejected.

(c) Consideration of Proposal - The Engineer is not obligated to consider any cost reduction proposal. The Agency will not be liable to the Contractor for failure to accept or act upon any cost reduction proposal submitted.

The Engineer will determine in its sole discretion whether to accept a cost reduction proposal as well as the estimated net savings in construction costs from the adoption of all or any part of the proposal. In determining the estimated net savings, the Engineer may disregard the Schedule of Items. The Engineer

will establish prices that represent a fair measure of the value of Work to be performed or to be deleted as a result of the cost reduction proposal.

(d) Sharing Investigation Costs - As a condition for considering a Contractor's cost reduction proposal, the Agency reserves the right to require the Contractor to share in the Agency's costs of investigating the proposal. If the Agency exercises this right, the Contractor shall provide written acceptance of the condition to the Engineer. Such acceptance will authorize the Agency to deduct its share of investigation costs from payments due or that may become due to the Contractor under the Contract.

(e) Acceptance of Proposal Requirements - If the Contractor's cost reduction proposal is accepted in whole or in part, acceptance will be made by a Change Order that will include without limitation the following:

- Statement that the Change Order is made according to 00140.70;
- Revised Contract Documents that reflect all modifications necessary to implement the approved cost reduction measures;
- Any conditions upon which the Agency's approval is subject;
- Estimated net savings in construction costs attributable to the approved cost reduction measures; and
- A payment provision according to which the Contractor will be paid 50% of the estimated net savings amount as full and adequate consideration for performance of the Work of the Change Order.

The Contractor's cost of preparing the cost reduction proposal and the Agency's costs of investigating the proposal, including any portion paid by the Contractor, will be excluded from determination of the estimated net savings in construction costs. Costs of re-design, which are incurred after the Agency has accepted the proposal, will be included in the cost of the Work attributable to cost reduction measures.

If the Agency accepts the cost reduction proposal, the Change Order that authorizes the cost reduction measures will also address any Contract Time adjustment.

(f) Right to General Use - Once submitted, the cost reduction proposal becomes the property of the Agency. The Agency reserves the right to adopt the cost reduction proposal for general use without additional compensation to the Contractor when it determines that a proposal is suitable for application to other contracts.

00140.80 Use of Publicly Owned Equipment - The Contractor is prohibited from using publicly-owned Equipment except in the case of emergency. In an emergency, the Contractor may rent publicly-owned Equipment provided that:

- The Engineer provides written approval that states that such rental is in the public interest; and
- Rental does not increase the Project cost.

00140.90 Final Trimming and Cleanup - Before Final Inspection as described in 00150.90, the Contractor shall neatly trim and finish the Project and remove all remaining unincorporated Materials and debris. Final trimming and cleanup shall include without limitation the following:

- The Contractor shall retrim and reshape earthwork, and shall repair deteriorated portions of the Project Site.
- Where the Work has impacted existing facilities or devices, the Contractor shall restore or replace those facilities to their pre-existing condition.
- The Contractor shall clean all drainage facilities and sanitary sewers of excess Materials or debris resulting from the Work.
- The Contractor shall clean up and leave in a neat, orderly condition, Rights-of-Way, Materials sites, and other property occupied in connection with performance of the Work.
- The Contractor shall remove temporary buildings, construction plants, forms, falsework and scaffolding, surplus and discarded Materials, and rubbish.
- The Contractor shall dispose of Materials and debris including without limitation forms, falsework, scaffolding, and rubbish resulting from clearing, grubbing, trimming, clean-up, removal, and other Work. These Materials and debris become the property of the Contractor. The Contractor shall dispose of these Materials and debris immediately.
- The Contractor shall restore and replant or resurface adjoining properties to match existing grades and existing surfaces.
- The Contractor shall install erosion and sediment control needed to stabilize the Project Site.

Unless the Contract specifically provides for payment for this item, the Agency will make no separate or additional payment for final trimming and cleanup.

00140.95 "AS-BUILT" Records – The Contractor shall maintain a current and accurate record of Work completed during the course of this Contract and submit to the Engineer updated copies of the project "As-Builts" on a weekly basis. These "As-Builts" drawings shall be kept by accurately marking a designated set of the Contract plans with the specified information as Work proceeds. Accurate, complete and current "As-Built" drawings are a specified requirement for full or partial payment of the Work completed. "As-Builts" shall be reviewed for completeness before recommendation of payment is granted. Incomplete or insufficient "As-Builts" will be returned to the Contractor and recommendation for progress payment denied. At project completion and as a condition of final payment, the Contractor shall deliver an acceptable complete and legible set of "As-Built" drawings to the Engineer.

The "As-Built" drawings shall show the information listed below. Where the term "locate" or "location" is used, it shall mean record of position with respect to both the construction vertical datum and either construction horizontal datum or a nearby permanent improvement.

- Record location of underground services and utilities as installed
- Record location of existing underground utilities and services that are to remain and that are encountered during the course of the Work
- Record changes in dimension, location, grade or detail to that shown on plans
- Record changes made by change order
- Record details not in original plans
- Provide fully completed shop drawings reflecting all revisions

Upon completion of the construction, the Contractor shall review and certify the construction set of “As-Built” drawings for completeness and accuracy of representation of any changes. Final payment will not be processed until “As-Built” drawings have been submitted and approved.

Section 00150 - Control of Work

00150.00 Authority of the Engineer - The Engineer has full authority over the Work and its suspension. (see Section 00180) The Contractor shall perform all Work to the complete satisfaction of the Engineer. The Engineer's determination shall be final on all matters, including but not limited to the following:

- Quality and acceptability of Materials and workmanship
- Measurement of unit price Work
- Timely and proper prosecution of the Work
- Interpretation of Contract Documents
- Payments due under the Contract

The Engineer's decision is final and, except as provided in 00180.80 for adjustments of Contract Time and Section 00199 for claims for additional compensation, may be challenged only through litigation.

Work performed under the Contract will not be considered complete until it has passed Final Inspection by the Engineer and has been accepted by the Agency.

Interim approvals issued by the Engineer, including but not limited to Third Notification, will not discharge the Contractor from responsibility for errors in prosecution of the Work, for improper fabrication, for failure to comply with Contract requirements, or for other deficiencies, the nature of which are within the Contractor's control.

00150.01 Project Manager's Authority and Duties - The Engineer may designate a Project Manager as its representative on the Project with authority to enforce the provisions of the Contract.

When the Engineer has designated a Project Manager, the Contractor should direct all requests for clarification or interpretation of the Contract, in writing, to the Project Manager. The Project Manager will respond within a reasonable time. Contract clarification or interpretation obtained from persons other than the Project Manager will not be binding on the Agency.

The Project Manager shall have the authority to appoint Inspectors and other personnel as required to assist in the administration of the Contract.

00150.02 Inspector's Authority and Duties - To the extent delegated under 00150.01, Inspectors are authorized to represent the Engineer and Project Manager to perform the following:

- Inspect Work performed and Materials furnished, including without limitation, the preparation, fabrication, or manufacture of Materials to be used;
- Orally reject defective Materials and to confirm such rejection in writing;
- By oral order, temporarily suspend the Work for improper prosecution pending the Engineer's decision; and
- Exercise additional delegated authority.

Inspectors are not authorized to:

- Accept Work or Materials.
- Alter or waive provisions of the Contract.
- Give instructions or advice inconsistent with the Contract Documents.

00150.10 Coordination of Contract Documents - The Contract Documents, including but not limited to Contract Change Orders, the Special Provisions, the Plans, and the Standard Specifications are intended to collectively describe all of the items of Work necessary to complete the Project. The Contract Documents are complementary; what is required by one is as binding as if required by all.

(a) Order of Precedence - The Engineer will resolve any discrepancies between these documents in the following order of precedence:

1. Permits from outside agencies;
2. Contract (Agreement)
3. Addenda;
4. Bid Schedule;
5. Special Provisions;
6. General Conditions;
7. Standard Specifications;
8. Geotechnical Data Reports;
9. Agency-prepared drawings specifically applicable to the Project and bearing the Project title;
10. Standard Drawings;
11. Reviewed and accepted, stamped Working Drawings;
12. Approved Unstamped Working Drawings.

Change Orders, Work Change Directives, Field Orders, and Engineer's written interpretation and clarifications, in precedence listed, will take precedence over all other Contract Document components referenced herein.

Notes on a drawing shall take precedence over drawing details. Dimensions shown on the drawings, or that can be computed, shall take precedence over scaled dimensions. The Drawings with the higher level of detail take precedence over less detailed Drawings.

(b) Immaterial Discrepancies - The Contract Documents specify details for the construction and completion of the Work. If Contract Documents describe portions of the Work in sufficient detail but are silent in some minor respect, the Contractor may proceed utilizing the current best industry practices.

(c) Material Discrepancies - If the Contractor identifies a discrepancy, error, or omission in the Contract Documents that cannot be resolved by the approach specified in (b) above, the Contractor shall immediately request clarification from the Engineer.

00150.15 Construction Stakes, Lines, and Grades:

(a) Agency Responsibilities - The Engineer will provide the location of the existing benchmarks and horizontal control locations used to design the project and prepare the Plans.

(b) Contractor Responsibilities - The Contractor shall:

- Accurately measure detailed dimensions, elevations, and slopes from the Engineer's benchmarks and horizontal control locations;
- Provide all labor, materials and equipment to properly stake out the project so that it can be constructed in accordance with the Contract Documents. Any changes made shall be recorded and the changed vertical and horizontal locations incorporated into the “as-built” drawings.
- Inform the Engineer of any property corners monuments and/or survey markers that are not shown on the Plans and are found during construction activities prior to disturbing the monuments. Allow the Agency 2 Work days for referencing all found markers before they are removed. Monuments that are noted on the Plans to be protected and are disturbed by the Contractor's activities shall be replaced by the Contractor’s surveyor at the Contractor's expense in accordance with ORS Chapter 209.

00150.20 Inspection:

(a) Inspection by the Engineer - The Engineer may test Materials furnished and inspect Work performed by the Contractor to ensure Contract compliance. The Contractor shall notify the Engineer 48 hours (two full Work Days) in advance for inspection of each portion of the Work.

Contractor shall not begin placing successive Courses or portions of Work until preceding Courses or portions of the Work have been inspected.

If the Contractor performs Work without the Engineer's inspection or uses Materials that the Engineer has not approved, the Engineer may order affected portions of the Work removed at the Contractor's expense.

At the Engineer's direction, any time before the Work is accepted, the Contractor shall uncover portions of the completed Work for inspection. After inspection, the Contractor shall restore these portions of Work to the standard required by the Contract. If the Engineer rejects Work due to Materials or workmanship, or if the Contractor performed such Work without providing sufficient advance request for inspection to the Engineer, the Contractor shall bear all costs of uncovering and restoring the Work. If the Engineer accepts the uncovered Work, and the Contractor performed the Work only after providing the Engineer with sufficient advance notice, the costs of uncovering and restoring the Work will be paid for by the Agency according to 00195.20.

(b) Inspection Facilities - The Contractor shall furnish walkways, railings, ladders, shoring, tunnels, platforms, and other facilities necessary to permit the Engineer to have safe access to the Work to be inspected. The Contractor shall require producers and fabricators to provide safe inspection access as requested by the Engineer.

(c) Sampling - When directed by the Agency, the Contractor shall furnish the Engineer with samples of Materials that the Engineer will test. All of the Contractor's costs related to this required sampling are Incidental.

(d) Inspection by Third Parties - Where third parties have the right to inspect the Work, the Contractor shall coordinate with the Engineer and shall provide safe inspection access.

(e) Contractor's Duty to Make Corrections - The Contractor shall perform all Work according to the Contract Documents. The Contractor shall correct Work that does not comply with the Contract Documents at its own expense. Inspection of the Work by the Engineer does not relieve the Contractor of responsibility for improper prosecution of the Work.

00150.25 Acceptability of Materials and Work - The Contractor shall furnish Materials and shall perform Work in Close Conformance to the Contract Documents. If the Engineer determines that the Materials furnished or the Work performed are not in Close Conformance with the Contract Documents, the Engineer may:

- Reject the Materials or Work and order the Contractor, at the Contractor's expense, to remove, replace, or otherwise correct any non-conformity; or
- Accept the Materials or Work as suitable for the intended purpose, adjust the amount paid for applicable Pay Items to account for diminished cost to the Contractor or diminished value to the Agency, document the adjustment, and provide written documentation to the Contractor regarding the basis of the adjustment.

The Engineer's decisions concerning acceptability of Materials or Work will be final.

00150.30 Delivery of Notices - Written notices to the Contractor by the Engineer or the Agency will be delivered:

- In person;
- by electronically confirmed facsimile transmission;
- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested), to the current office address as shown in the records of the Agency; or
- By overnight delivery service of a private industry courier, to the current office address as shown in the records of the Agency.

Notices shall be considered as having been received by the Contractor:

- At the time of actual receipt when delivered in person or by facsimile transmission;

- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or
- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

Written notices to the Engineer or the Agency by the Contractor shall be delivered to the Agency address shown in the Special Provisions, unless a different address is agreed to by the Engineer, and shall be delivered:

- In person;
- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested); or
- By overnight delivery service of a private industry courier.

Notices will be considered as having been received by the Agency:

- At the time of actual receipt when delivered in person or by facsimile transmission;
- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or
- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

00150.35 Submittals:

(a) Description - Submittals covered by these requirements include manufacturers' information, shop drawings, test procedures, test results, samples, requests for substitutions, and miscellaneous Workrelated submittals. Submittals shall also include, but not be limited to, all mechanical, electrical and electronic equipment and systems, materials, reinforcing steel, fabricated items, and piping and conduit details. The Contractor shall furnish all drawings, specifications, descriptive data, certificates, samples, tests, methods, schedules, and manufacturer's installation and other instructions as specifically required in the Contract Documents to demonstrate fully that the materials and equipment to be furnished and the methods of work comply with the provisions and intent of the Contract Documents.

(b) Contractor's Responsibilities

(1) The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall assure that the material, equipment or method of work shall be as described in the submittal. The Contractor shall verify that all features of all products conform to the specified requirements. Submittal documents shall be clearly edited to indicate only those items, models, or series of equipment, which are being submitted for review. All extraneous materials shall be crossed out or otherwise obliterated. The Contractor shall ensure that there is no conflict with other submittals and notify the Engineer in each case where his submittal may affect the work of another contractor or the Agency. The Contractor shall coordinate submittals among its subcontractors and suppliers including those submittals complying with unit responsibility requirements specified in applicable technical sections.

(2) The Contractor shall coordinate submittals with the Work so that Work will not be delayed. It shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with Work related to a submittal until the submittal process is complete. This requires that submittals for review and comment shall be returned to the Contractor with the indication "No Exceptions Taken" or "Make Corrections Noted."

(3) The Contractor shall certify on each submittal document that it has reviewed the submittal, verified field conditions, and complied with the contract documents.

(4) The Contractor may authorize in writing a material or equipment supplier to deal directly with the Engineer or with the Agency with regard to a submittal. These dealings shall be limited to contract interpretations to clarify and expedite the Work.

(c) Shop Drawings and Product Submittals

(1) Wherever called for in the Contract Documents or where required by the Engineer, the Contractor shall furnish to the Engineer for review, five (5) copies plus one reproducible copy or electronic file, of each Shop Drawing or Product submittal. Shop Drawings may include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. If a list, graph, catalog sheet, data sheet, etc. includes more than one item, clearly mark which item is the subject of the submittal. Shop Drawings shall bear the signature and seal of an engineer registered in the appropriate branch and in the state of Oregon, unless otherwise indicated. Whenever the Contractor is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an engineer registered in the appropriate branch and in the state of Oregon, unless otherwise indicated.

(2) Shop Drawing and Product submittals shall be accompanied by the Engineer's standard submittal transmittal form, a reproducible copy of which is available from the Engineer. A submittal without the form or where applicable items on the form are not completed will be returned for resubmittal.

(3) Organization

- A single submittal transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: if a pump section references other sections for the motor, shop-applied protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be acceptable. A single submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

- On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title, room number, or building name, as applicable.

- Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

(4) Format

- Minimum sheet size shall be 8.5 inches by 11 inches. Maximum sheet size shall be 22 inches by 34 inches. Every page in a submittal shall be numbered in sequence. Each copy of a submittal shall be collated and stapled or bound, as appropriate. The Engineer will not collate sheets or copies.

- Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient level of detail shall be presented for assessment of compliance with the Contract Documents.

- Each submittal shall be assigned a unique number. Submittals shall be numbered sequentially, and the submittal numbers shall be clearly noted on the transmittal. Original submittals shall be assigned a numeric submittal number (e.g., 25). If submittal “25” requires a resubmittal, the first resubmittal will bear the designation "25.A" and the second resubmittal will bear the designation "25.B" and so on.

- If there is a follow-up submittal related to a previously submitted class of material or type of equipment (e.g., follow-up submittal to submittal “25”), it shall be assigned the number “25.1”. If submittal “25.1” requires a resubmittal, the first resubmittal will bear the designation "25.1.A" and the second resubmittal will bear the designation "25.1.B" and so on.

(5) Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

(6) Except as may otherwise be indicated, the Engineer will return prints of each submittal to the Contractor with comments noted thereon, within 21 Days following receipt by the Engineer. It is considered reasonable that the Contractor will make a complete and acceptable submittal to the Engineer by the first resubmittal on an item. The Owner reserves the right to withhold monies due to the Contractor to cover additional costs of the Engineer's review beyond the first resubmittal. The Engineer's maximum review period for each submittal or resubmittal will be 21 Days.

(7) If a submittal is returned to the Contractor marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.

(8) If a submittal is returned marked "MAKE CORRECTIONS NOTED," Contractor shall make the corrections on the submittal, but formal revision and resubmission will not be required, except where specifically required by Engineer as indicated on the submittal review form.

(9) If a submittal is returned marked "AMEND-RESUBMIT," the Contractor shall revise it and shall resubmit the required number of copies to the Engineer for review. Resubmittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND - RESUBMIT," the submittal as a whole is deemed "AMEND - RESUBMIT," and 10 drawings are required to be resubmitted.

(10) If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with the General Conditions. In the first 2 cases, the Contractor shall prepare a new submittal and shall submit the required number of copies to the Engineer for review. In the latter case, the Contractor shall submit the substitution request according to the General Conditions.

(11) Resubmittal of rejected portions of a previous submittal will not be allowed. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

(12) Fabrication of an item may commence only after the Engineer has reviewed the pertinent submittals and returned copies to the Contractor marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED". Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the Contract requirements.

(13) Submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Engineer. Each submittal shall be dated and signed by the Contractor as being correct and in strict conformance with the Contract Documents. In the case of Shop Drawings, each sheet shall be so dated and signed. Any deviations from the Contract Documents shall be noted by the Contractor on the transmittal form and such deviation shall be subject to approval in writing by the Engineer and Agency. The Engineer will only review submittals that have been so verified by the Contractor. Non-verified submittals will be returned to the Contractor without action taken by the Engineer, and any delays caused thereby shall be the total responsibility of the Contractor.

(14) Corrections or comments made on the Contractor's Shop Drawings during review do not relieve the Contractor from compliance with Contract Drawings and Specifications. Review is for conformance to the design concept and general compliance with the Contract Documents only. The Contractor is responsible for confirming and correlating quantities and dimensions, fabrication processes and techniques, coordinating Work with the trades, and satisfactory and safe performance of the Work.

(d) Quality Control (QC) Submittals

(1) Quality control submittals are defined as those required by the Specifications to present documentary evidence to the Engineer that the Contractor has satisfied certain requirements of the Contract Documents.

(2) Unless otherwise indicated, QC submittals shall be submitted:

- Before delivery and unloading, for the following types of submittals:
  - Manufacturers' installation instructions
  - Manufacturers' and Installers' experience qualifications
  - Ready mix concrete delivery tickets
  - Design calculations
  - Affidavits and manufacturers' certification of compliance with indicated product requirements
  - Laboratory analysis results
  - Factory test reports

- For the following types of submittals, the manufacturer's field representative shall submit a draft

certification prior to leaving the Project site and a final certification within 7 days of the event documented:

  - Manufacturers' field representative certification of proper installation

- Within 30 Days of the event documented for the following types of submittals:
  - Field measurement
  - Field test reports
  - Receipt of permit
  - Receipt of regulatory approval

(3) The Engineer will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.

(e) Deferred Submittals to Agency

(1) For the purposes of this section, Deferred Submittals are defined as those portions of the Project that are Contractor-designed and must be submitted to the Agency's building official for approval and to meet Building Permit plan review requirements.

(2) The Engineer will schedule a pre-submittal conference with the Contractor and Agency's building official to discuss proposed Deferred Submittal items, requirements, and review schedule.

(3) The Contractor shall list the Deferred Submittals on the title or cover sheet of the Drawings for submission to the Agency and shall state the design criteria/assumptions of the Deferred Submittal items on the plans. Deferred Submittals shall include details for connection of materials to the structure and calculations showing that the specified structural requirements are met.

(4) The Contractor shall submit Deferred Submittals to the Engineer for review for general conformance to the design of the structure. Neither the Agency nor the Engineer is responsible for coordination of Deferred Submittal components with Contract Documents. Review does not lessen nor shift burden or responsibility from Contractor or assigned subcontractor/supplier to the Agency or Engineer. The Engineer, upon confirming the Deferred Submittals are in general conformance with the design, shall forward the Deferred Submittals to the building official. Contractor is responsible, with no exceptions, to ensure that building official's Deferred Submittal review will not adversely affect Project's construction schedule. The Deferred Submittal items shall not be installed by the Contractor until the design and Deferred Submittals have been approved by the building official.

(f) Effect of Review of Contractor's Submittals

(1) Review of Contract drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide, shall not relieve the Contractor of its responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Engineer or the Agency, or by any officer or employee thereof, and the Contractor shall have no claim under the contract on account of the failure, or partial failure, of the method of work, material, or equipment so reviewed. An indication of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the Agency or Engineer has no objection to the Contractor, upon its own responsibility, using the plan or method of Work proposed, or providing the materials or equipment proposed.

00150.37 Equipment Lists and Other Submittals - The Contractor shall submit Equipment lists, and other required submittals for approval by the Engineer. With each submittal, the Contractor shall clearly identify the applicable specification sub-section and the product make, model, size and proposed options.

00150.40 Cooperation and Superintendence by the Contractor:

The Contractor is responsible for full management of all aspects of the Work, including superintendence of all Work by Subcontractors, Suppliers, and other providers. The Contractor shall appoint a single Superintendent and may also appoint alternate Superintendents as necessary to control the Work. The form of appointment of the alternate shall state, in writing, the alternate's name, duration of appointment in the absence of the Superintendent, and scope of authority. The Contractor shall:

- Provide for the cooperation and superintendence on the Project by:
  - Furnishing the Engineer all data necessary to determine the actual cost of all or any part of the Work, added Work, or changed Work.

    - Allowing the Engineer reasonable access to the Contractor's books and records at all times. To the extent permitted by public records laws, the Engineer will make reasonable efforts to honor the Contractor's request for protection of confidential information.
    - Keeping one complete set of Contract Documents on the Project Site at all times, available for use by all the Contractor's own organization, and by the Engineer if necessary.
- Appoint a single Superintendent and any alternate Superintendent who shall meet the following qualifications:
    - Appointees shall be competent to manage all aspects of the Work.
    - Appointees shall be from the Contractor's own organization.
    - Appointees shall have performed similar duties on at least one previous project of the size, scope and complexity as the current Contract.
    - Appointees shall be experienced in the types of Work being performed.
    - Appointees shall be capable of reading and thoroughly understanding the Contract Documents.
- The appointed single Superintendent, or any alternate Superintendent shall:
    - Be present for all On-Site Work, regardless of the amount to be performed by the Contractor, Subcontractors, Suppliers, or other providers, unless the Engineer provides prior approval of the Superintendent's or alternate Superintendent's absence.
    - Be equipped with a two way radio or cell phone capable of communicating throughout the project during all the hours of Work on the Project Site and be available for communication with the Engineer.
    - Have full authority and responsibility to promptly execute orders or directions of the Engineer.
    - Have full authority and responsibility to promptly supply the Materials, Equipment, labor, and Incidentals required for performance of the Work.
    - Coordinate and control all Work performed under the Contract, including without limitation the Work performed by Subcontractors, Suppliers, and Owner Operators.
    - Diligently pursue progress of the Work according to the schedule requirements of Section 00180.
    - Cooperate in good faith with the Engineer, Inspectors, and other contractors in performance of the Work.
    - Provide all assistance reasonably required by the Engineer to obtain information regarding the nature, quantity, and quality of any part of the Work.
    - Provide access, facilities and assistance to the Engineer in establishing such lines, grades and points as the Engineer requires.
    - Carefully protect and preserve the Engineer's benchmarks and horizontal control locations.

Any Superintendent or alternate Superintendent who repeatedly fails to follow the Engineer's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project.

If the Contractor fails or neglects to provide a Superintendent, or an alternate Superintendent, and no prior approval has been granted, the Engineer has the authority to suspend the Work according to 00180.70. Any continued Work by the Contractor, Subcontractors, Suppliers, or other providers may be subject to rejection and removal. The Contractor's repeated failure or neglect to provide the superintendence required by these provisions constitutes a material breach of the Contract, and the Engineer may impose any remedies available under the Contract, including but not limited to Contract termination.

00150.50 Cooperation with Utilities:

(a) General - Unless otherwise specified in the Special Provisions or on the Plans, existing Utilities requiring adjustment may be adjusted by the Utility before, during, or after Project construction. "Adjustment of Utilities" shall mean the alteration, improvement, connection, disconnection, relocation, or removal of existing Utility lines, facilities, or systems in temporary or permanent manner.

(b) Contractor's Responsibilities - The Contractor shall:

- Follow applicable rules adopted by the Oregon Utility Notification Center;
- Contact Utility owners after the Contract is awarded to verify all Utilities' involvement on the Project Site;
- Coordinate Project construction with the Utilities' planned adjustments, take all precautions necessary to prevent disruption of Utility service, and perform its Work in the manner that results in the least inconvenience to the Utility owners;
- Include all Utility adjustment work, whether to be performed by the Contractor or the Utilities, on the Contractor's Project Work schedule submitted under 00180.41;
- Protect from damage or disturbance any Utility that remains within the area in which Work is being performed;
- Not disturb an existing Utility if it requires an unanticipated adjustment, but shall protect it from damage or disturbance and promptly notify the Engineer; and
- Report to the Engineer any Utility owner who fails to cooperate or fails to follow the planned Utility adjustment.

Subject to the Engineer's approval, the Contractor may propose adjustments to the Utilities by asking the Utility owners to move, remove, or alter their facilities in ways other than as shown on the Plans or in the Special Provisions. The Contractor shall conduct all negotiations, make all arrangements, and assume all costs that arise from such changes.

(c) Notification - If the Project is located within the area served by the Oregon Utility Notification Center, the Contractor shall notify owners of Utilities prior to the performance of Work in the vicinity of their facilities. The Utilities notification system telephone number is 1-800-332-2344.

The Contractor shall comply with the rules of the Oregon Utility Notification Center, OAR 952-001-0010 through OAR 952-001-0090, and ORS 757.993. The Contractor may contact the Oregon Utility Notification Center at 503-232-1987 about these rules.

00150.53 Utilities and Existing Improvements:

(a) General – Information shown on the plans as to the location of existing water courses and utilities has been compiled from available sources and may not be accurate. The Contractor shall determine the location and nature of affected water courses, utilities and underground improvements prior to commencing Work.

The Contractor shall provide for the flow of water courses and essential utilities that may be interrupted during the progress of the Work and shall restore such water courses or utilities after completion of the Work.

The plans will not normally show the new location of utilities that have been adjusted immediately prior to the project or will be adjusted as part of the project Work.

Except where the plans indicate, utilities have been field located during design or certain utility locations shall be exposed as part of the Work. The Contractor shall be responsible for exploratory excavations as it deems necessary to determine the exact locations and depths of utilities which may interfere with Work. All such exploratory excavations shall be performed as soon as practicable after Notice to Proceed and, in any event, a sufficient time in advance of construction to avoid possible delays to the Contractor's progress. When such exploratory excavations show the utility location as shown on the plans to be in error, the Contractor shall so notify the Engineer.

The number of exploratory excavations required shall be that number which is sufficient to determine the alignment and grade of the utility. Unless otherwise provided herein, all potholing and exploratory work shall be incidental to the Work and no separate payment shall be made therefore.

The Contractor shall coordinate project construction with the adjustment of utilities, take all necessary precautions to prevent disturbing the utilities, and perform work so that utility owners and users are caused a minimum of inconvenience.

The Contractor shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or the not the utilities are indicated on the plans. The Contractor shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

To ease or streamline the work, the Contractor may desire to adjust the utilities by asking the utility owners to move, remove, or alter their equipment in ways other than those shown on the plans or in the Contract Documents. The Contractor shall conduct the negotiations, make the arrangements, and pay all costs that arise from such changes.

(b) Utilities to be Moved – In case it shall be necessary to move the property of any public utility or franchise holder, such utility company or franchise holder shall be notified by the Contractor to move such property within a specified reasonable time. When utility lines that are to be removed are encountered within the area of operations, the Contractor shall notify the utility company and the Engineer a sufficient time in advance for the necessary measures to be taken to prevent the interruption of service.

(c) Utilities to be Removed – Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement which is indicated, the Contractor shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in manner satisfactory to the Engineer and the owner of the facility. In all cases of such temporary removal or relocation, restoration to the former location shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement

as nearly as possible to its former locations and to as good or better condition than found prior to removal.

(d) Underground Utilities and Improvements Indicated – Existing utility lines and underground improvements that are indicated or the locations of which are made known to the Contractor prior to excavation and that are to be retained, and all utility lines and underground improvements that are encountered during excavation operations shall be protected from damage during excavation and backfilling and, if damaged, shall be immediately repaired or replaced by the Contractor, unless otherwise repaired by the owner of damaged utility. If the owner of the damage facility performs its own repairs, the Contractor shall reimburse said owner for the costs of repair.

(e) Underground Utilities and Improvements Not Indicated – In the event that the Contractor damages existing utility lines or underground improvements that are not indicated in the plans or marked in the field, or are not indicated or marked with reasonable accuracy, or the locations of which are not made known to the Contractor prior to excavation, the Contractor shall immediately provide a verbal report of such damage to the Engineer, and provide a written report thereof promptly thereafter. The Contractor shall immediately notify the owner of the damaged utility. If directed by the Engineer, repairs shall be made by the Contractor under the provisions for changes and extra work contained in the General Conditions.

This subsection applies only to main line utilities. For service lines, see Subsection 00150.53(f).

For purposes of this section, "reasonable accuracy" is defined as within 4 feet horizontally from actual location. No representation shall be made concerning the accuracy of vertical elevations of existing utilities, even if indicated in the plans, and no additional payment will be made for damage to utilities encountered at depths differing from those indicated.

(f) Underground Services Indicated or Not – If service lines are encountered, whether shown, marked or not, the Contractor shall take precautions to carefully work around them and repair them if they are damaged by the Contractor, at no additional cost to the Agency.

(g) Approval of Repairs – All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other Work.

(h) Owner's Right of Access – The right reserved to the Owner and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-f-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.

00150.55 Cooperation with Other Contractors - The Agency reserves the right to perform other work on or near the Project Site, including without limitation any Materials site, with forces other than those of the Contractor.

If such work takes place on or near the Project Site, the Contractor shall have the following obligations:

- The Contractor shall coordinate Work with other contractors or forces.

- The Contractor shall cooperate in good faith with all other contractors or forces.

- The Contractor shall perform the Work specified in the Contract in a way that will minimize interference and delay for all forces involved.

- The Contractor shall place and dispose of the Materials being used so as not to interfere with the operations of other forces.

- The Contractor shall join the Work with that of other forces in a manner acceptable to the Engineer or the Agency, and shall perform it in the accepted sequence with the work of the other force.

The Engineer will resolve any disagreements under this Subsection that may arise among the Contractor and other work forces, or between the Contractor and the Agency. The Engineer's decision in these matters is final, as provided in 00150.00.

When the schedules for Work of the Contractor and the work of other forces overlap, each contractor involved shall submit a current, realistic progress schedule to the Engineer. Before the Engineer accepts the schedule, each party shall have the opportunity to review all schedules. After this review and any necessary consultations, the Engineer will determine acceptable schedules.

The Contractor waives any right it may have to make claims against the Agency for any damages or claims that may arise because of inconvenience, delay, or loss due solely to the presence of other contractors working on or near the Project Site.

If the Contract gives notice of work to be performed by other forces that may affect the Contractor's Work under the Contract, the Contractor shall include any costs associated with coordination of the Work in the appropriate Pay Item or as a portion of a Pay Item.

In an emergency, the contractor most immediately able to respond may repair a facility or Utility of another contractor in order to prevent further damage to the facility, Utility, or other Structure as a result of the emergency.

00150.60 Construction Equipment Restrictions:

(a) Load and Speed Restrictions for Construction Vehicles and Equipment - The Contractor shall comply with legal weight and speed restrictions when moving Materials or Equipment beyond the limits of the Project Site.

The Contractor shall control vehicle and Equipment loads and speeds within the Project Site according to the following restrictions, unless the Special Provisions provide otherwise:

- The Contractor shall restrict loads and speeds as necessary to avoid displacement or loss of Materials on Subgrades and Aggregate Bases.

- The Contractor shall restrict weights to legal loads, and shall travel at speeds of no more than 45 mph or the posted construction speed, whichever is less, on treated Bases, Pavement, or wearing Courses.
- The Contractor shall not cross Bridges or other Structures with Equipment or vehicles exceeding the legal load limit without prior written permission of the Engineer. The Contractor shall make any such request in writing, describing the loading details and the arrangement, movement, and position of the Equipment on the Structure. The Contractor shall comply with any restrictions or conditions included in the Engineer's written permission.

(b) Protection of Buried Items - The Contractor shall use temporary fill or other methods to avoid overload of pipes, box culverts, and other items that are covered, or to be covered, by fill or backfill.

(c) Responsibility for Damages - The Contractor shall assume responsibility for damages caused by excessive Equipment speed or loads while performing the Work, both inside and outside the Project Site. The Engineer's permission to cross Bridges and other Structures, according to 00150.60(a) will not relieve the Contractor from responsibility for load-caused damages.

00150.70 Detrimental Operations - The Contractor shall avoid operations whose methods, conditions, or timing may injure people or damage property or the Work. Damage may include without limitation, staining surfaces with mud or asphalt. (also see 00150.60, 00150.75, and Section 00170)

When any such damage occurs, the Engineer will determine if it is to be corrected by repair, replacement, or compensatory payment by the Contractor. If compensatory payment is required, the Engineer will determine the amount. Compensatory payment may be deducted from monies due or to become due to the Contractor under the Contract.

00150.75 Protection and Maintenance of Work During Construction - The Contractor shall protect and maintain the Work during construction and until Third Notification has been issued, unless otherwise provided in the Contract. For the purposes of this Subsection, "maintenance" shall include measures to prevent deterioration of Roadway and Structures at the Project Site, and to keep them in good condition at all times during the prosecution of the Work. The Contractor shall continuously allocate sufficient Equipment and workers to achieve such maintenance.

If the Contract requires the placement of a Course upon a previously constructed Course or Subgrade, the Contractor shall maintain the previous Course or Subgrade during all construction operations.

The Contractor shall include costs of protecting and maintaining the Work during construction in the unit prices bid for the various Pay Items. The Contractor will not be paid an additional amount for this Work, unless otherwise specified.

The Engineer will timely notify the Contractor of Contractor's noncompliance with this Subsection. If the Contractor fails to remedy unsatisfactory protection or maintenance within 24 hours after receipt of such

notice, the Engineer may proceed to remedy the deficiency, and deduct the entire cost from monies due or to become due the Contractor under the Contract.

00150.80 Removal of Unacceptable and Unauthorized Work - The Contractor shall correct or remove unacceptable Work and remove unauthorized work, as directed by the Engineer in writing. The Contractor shall replace such work with Work and Materials conforming to the requirements of the Contract.

For the purposes of this Subsection, "unauthorized work" shall include without limitation the following:

- Work that extends beyond lines shown on the Plans or otherwise established by the Engineer;
- Work that is contrary to the Engineer's instructions; and
- Work that is conducted without the Engineer's written authorization.

The Agency will not pay the Contractor for unacceptable Work or unauthorized work. The Engineer may issue a written order for the correction or removal of such work at the Contractor's expense.

If, when ordered by the Engineer, the Contractor fails to correct or remove unacceptable Work or unauthorized work, the Engineer may have the correction, or removal and replacement, done by others and deduct the entire cost from monies due or to become due the Contractor under the Contract.

00150.90 Final Inspection:

(a) On-site Construction Work - The Engineer will inspect the Project at a time close to the completion of On-Site Work for Contractor's compliance with the Contract Documents.

When all On-Site Work on the Project is completed, including but not limited to Change Order Work and Extra Work, the Engineer will issue Second Notification as specified in 00180.50(g).

Within 15 Calendar Days after the Engineer receives the Contractor's written notification that all punch list items, final trimming and cleanup according to 00140.90 have been completed, the Engineer will review the Project and notify the Contractor that all Work is complete, or will give the Contractor written instruction regarding incomplete or unsatisfactory Work.

(b) All Contract Work - The Engineer will issue the Third Notification when the Contractor has satisfactorily accomplished all of the following:

- The Contractor has completed all On-Site Work required under the Contract, including the punch list items from (a) above;
- The Contractor has removed all Equipment; and
- The Contractor has submitted all required certifications, bills, forms, warranties and other documents.
- The Contractor has submitted complete and acceptable "As-Built" drawings as specified in 00140.95.

00150.91 Post-Construction Review - The Contractor or the Engineer may request a Post-Construction Review meeting, to be held at a time prior to issuance of Third Notification but not earlier than 15 Days following the date of Second Notification. The meeting may be held if agreed to by both parties. The party making the request will conduct the meeting, and will announce the time and place of the meeting at least 15 Days prior to the meeting date. The purpose of this meeting is to examine the Project for possible process improvements that may benefit future projects.

00150.95 Final Acceptance - After the Engineer completes Final Inspection of all Correction Period work and deems it satisfactorily completed, the Agency will acknowledge Final Acceptance. The Agency will notify the Contractor in writing of the date of Final Acceptance within 7 Calendar Days after Final Acceptance, or as soon thereafter as is practicable.

00150.96 Maintenance Warranties and Guarantees - Prior to Third Notification, the Contractor shall transfer to the Agency all unexpired manufacturer's, installer's or supplier's warranties and guarantees for Materials and Equipment installed on the Project. Such warranties and guarantees shall recite that they are enforceable by the Agency.

00150.97 Responsibility for Materials and Workmanship:

(a) The Contractor shall perform the Work according to the terms, conditions, and requirements of the Contract.

(b) Whether before or after the Agency's acceptance of the Work, the Contractor shall be responsible for:

- Correcting or repairing any defects in, or damage to, the Work which results from the use of improper or defective materials or workmanship; or
- Replacing, in its entirety, the Work affected by the use of improper or defective materials or workmanship to the extent provided by law; and
- Correcting or repairing any Work, Materials, Structures, Existing Surfacings, Pavement, Utilities, or sites, including without limitation Wetlands, damaged or disturbed in that correction, repair, or replacement. (see 00170.80 to 00170.85)

Section 00160 - Source of Materials

00160.00 Definitions - The following definitions apply to Section 00160:

(a) Prospective Source - Agency-furnished Materials source, use of which by the Contractor is optional. The Agency makes no guarantee or representation, by implication or otherwise, of the land use status, quantity, quality, or acceptability of Materials available from it, except as may be stated in the Special Provisions.

(b) Mandatory Source - Agency-furnished Materials source, use of which by the Contractor is required.

00160.01 Notification of Source of Supply and Materials:

(a) All Materials - The Contractor shall notify the Engineer in writing of all proposed Materials sources of supply, including without limitation any steel or other fabricators within the following time frames:

- At least 15 Calendar Days before using or fabricating Materials, if source is within the State; or
- At least 45 Calendar Days before using or fabricating Materials, if source is outside the State

(b) Prospective Source Materials - When given an option to use Prospective Sources of Materials to be incorporated into the Work, the Contractor shall notify the Engineer in writing of the option selected within 15 Calendar Days from date of Notice to Proceed. Otherwise, such Materials sources may become unavailable.

(c) Approval Required - Before allowing production or delivery of Materials to begin from any source, the Contractor must obtain the Engineer's approval. Approval to use any source does not imply that Materials from that source will be accepted. If approved sources do not provide Materials that meet Specifications, the Materials will be rejected. The Contractor will then be responsible for locating other sources and obtaining the Engineer's approval.

00160.05 Qualified Products List (QPL) - The QPL is a listing of manufactured products available on the market (shelf items) that ODOT has evaluated and found suitable for a specified use in construction. The QPL is published twice a year and is available from ODOT's Construction Section; 800 Airport Road SE; Salem, OR 97301-4798; phone 503-986-3000. It may also be viewed on ODOT's web site.

The current version of the QPL at the time of Bid Closing is the version in effect for the Project. The Engineer may approve for use a conditionally qualified product, or a product qualified for inclusion in a later edition of the QPL, if the Engineer finds the product acceptable for use on the Project.

Use of listed products shall be restricted to the category of use for which they are listed. The Contractor shall install all products as recommended by the manufacturer. The Contractor shall replace qualified products not conforming to Specifications or not properly handled or installed at the Contractor's expense.

00160.10 Ordering, Producing, and Furnishing Materials - The Contractor shall not place orders for or produce full quantities of Materials anticipated to be required to complete the Work until the Work has advanced to a stage that allows the quantities to be determined with reasonable accuracy.

(a) Contractor's Duties - In purchasing, producing, or delivering Materials, the Contractor shall take into account the following:

- Kind of work involved;
- Amount of work involved;
- Time required to obtain Materials; and
- Other relevant factors.

(b) Quantity of Materials - Materials quantities shown on the Plans, or indicated by quantities and Pay Items, are subject to change or elimination. The Contractor is responsible for payment for excess Materials delivered to the Project Site or storage sites. Unless otherwise specified in the Contract, the Agency will not be responsible for:

- Materials the Contractor may deliver or produce in excess of Contract requirements;
- Extra expense the Contractor may incur because Materials were not ordered or produced earlier; or
- The Contractor's expenses related to Materials ordered by the Contractor that are not subsequently approved for use.

Excess Materials, ordered or produced by the Contractor, without approval of the Engineer, may be purchased by the Agency at the sole discretion of the Agency. (see 00195.80)

00160.20 Preferences for Materials:

(a) Buy America - If federal highway funds are involved on the Project, the Contractor shall limit the quantity of foreign Materials incorporated into the Work as follows. Section 635.410 of Title 23, Code of Federal Regulations, and the Intermodal Surface Transportation Efficiency Act require that all iron or steel manufacturing processes, including without limitation the casting of ingots, for iron or steel Materials permanently incorporated into the Project shall occur in the United States, unless the cost of foreign-origin iron or steel Materials does not exceed one-tenth of one percent (0.1%) of the Contract Amount or $2,500, whichever is greater. The Contractor shall not incorporate foreign-origin iron or steel Materials in excess of this amount into the Project. All foreign-origin iron or steel Materials incorporated in the Project in excess of the amount indicated above shall be removed and replaced with domestic iron or steel Materials at the Contractor's expense. For purposes of this Specification, the cost of foreign-origin iron or steel Materials shall be the value of the iron or steel products as of the date they are delivered to the Project Site.

Manufacturing processes include without limitation the application of coatings to finished iron or steel products or components. Coatings include epoxy coating, galvanizing, painting, and any other coating that protects or enhances the value of the steel or iron product or component.

The Contractor shall provide the Engineer with a Certificate of Materials Origin, on a form furnished by the Engineer, before incorporating any iron or steel products into the Project. Unless a Certificate of Materials Origin has been provided to the Engineer, the Materials shall be considered of foreign origin.

The Contractor shall retain manufacturers' certificates verifying the origin of all domestic iron or steel Materials for 3 years after the date of final payment for the Project, and shall furnish copies to the Engineer upon request.

(b) Buy Oregon - According to ORS 279A.120, the Contractor shall give preference to goods or services produced in Oregon if price, fitness, availability, and quality are equal. This provision does not apply to Contracts financed wholly or in part by federal funds.

(c) Recycled Materials - According to ORS 279A.010, ORS 279A.125, ORS 279A.145, ORS 279A.150, and ORS 279A.155, and subject to the approval of the Engineer, the Contractor shall use recycled products to the maximum extent economically feasible.

00160.30 Agency-Furnished Materials - Unless otherwise specified in the Special Provisions, Materials listed as Agency-furnished will be available to the Contractor free of charge.

The Contractor shall be responsible for all Materials furnished by the Agency and shall pay all demurrage and storage charges. The Contractor shall replace at its expense Agency-furnished Materials lost or damaged due to any cause.

The locations at which Agency-furnished Materials are available will be specified in the Special Provisions. If the locations are not listed in the Special Provisions, the Agency-furnished Materials will be furnished to the Contractor at the Project Site. In either case, all costs of handling, hauling, unloading, and placing Agency-furnished Material shall be considered included in the price paid for the Pay Item involving such Material.

All Agency-furnished Materials not incorporated into the Work remains the property of the Agency. The Contractor shall deliver such Materials as directed by the Engineer.

00160.50 Agency-Controlled Land; Limitations and Requirements:

(a) General - The Contractor shall have no property rights in, or right of occupancy on, Agency-Controlled Land. Nor shall the Contractor have the right to sell, use, remove, or otherwise dispose of any material from Agency-Controlled Land, areas, or property, except as specified in the Special Provisions or by the written authorization of the Engineer.

Unless authorized in the Contract, the Contractor shall not disturb any material within Rights-of-Way without written authorization from the Engineer.

Unless otherwise specified in the Contract, the ownership of all materials originating on Agency-Controlled Lands will at all times vest in, and remain within the control of, the Agency.

(b) Waste, Excess, and By-Product Materials - All waste, excess, and by-product materials, collectively referred to in this Subsection as "By-Products", from the manufacture or production of Materials from Agency-Controlled Lands shall remain Agency property. Unless otherwise ordered by the Engineer in writing, By-Products shall be placed as required in the Special Provisions:

- In stockpiles at designated locations;
- At locations and in shapes that are readily accessible; and
- In such a manner as to avoid fouling areas containing useable materials, or interfering with future plant setups to use materials from the property.

The Agency will not compensate the Contractor for handling and stockpiling By-Products according to the Special Provisions requirements. If by written order the Engineer directs the Contractor to stockpile or place designated By-Products at alternate sites, the By-Products designated shall be loaded, hauled, and placed as directed, and this work will be paid for according to 00195.20.

00160.60 Contractor-Furnished Materials and Sources:

(a) General - The Contractor shall furnish, at its own expense, all products and Materials required for the Project from sources of its own choosing, unless such sources have been specified in the Special Provisions or Plans as Prospective or Mandatory Sources.

(b) Acquisition of Sources - The Contractor shall acquire, at its own expense, the rights of access to, and the use of, all sources the Contractor chooses which are not Agency-controlled and made available by the Agency to the Contractor.

(c) Additional Requirements - Except for continuously-operated commercial sources, Work shall not begin, nor will any Materials be accepted by the Engineer, until the Contractor has:

(1) Given to the Engineer a copy of permits from, or proof that permits are not required from:

- The Department of Geology and Mineral Industries, as required under ORS 517.790;
- The Department of State Lands, as required under ORS 196.815 (when removing material from the bed or banks of any waters or from any Wetland); and
- Local governmental authorities having jurisdiction over land use at the source location.

(2) Furnished to the Engineer written approval of the property owner, if other than the Contractor, for the Contractor's proposed plans of operation in, and reclamation of, the source. The Contractor shall include in the document containing the property owner's written approval a summary of the requirements of the permits described above, which shall be subject to the Engineer's approval.

00160.70 Requirements for Plant Operations - Before operating mixing plants, Rock crushers, or other Equipment, the Contractor shall provide the Engineer copies of all applicable discharge permits for noise, air contaminants, and water pollutants from DEQ or applicable local jurisdictions, or a letter from DEQ or the local jurisdiction stating that no permits are required for the use of the Equipment and sites.

00160.80 Requirements for Sources of Borrow and Aggregate - The Contractor shall conduct operations according to all applicable federal, State, and local laws (including without limitation ORS 517 and OAR 632-030) when developing, using, and reclaiming all sources of Borrow material and Aggregate. The Contractor shall provide erosion control at Borrow sources that are not within the Project Site. The Contractor shall not operate in Wetlands except as allowed by permit. The Contractor shall comply with all requirements for pollution and sediment control, including without limitation the National Pollutant Discharge Elimination System where applicable.

Except for continuously-operated commercial sources, the Contractor shall also conform to the following:

(a) If a natural growth of trees or shrubs is present, preserve a border of such to conceal land scars.

(b) Excavate Borrow sources and Aggregate sources, except for those in streams and rivers, to provide:

- Reasonably uniform depths and widths;
- Natural drainage so no water stands or collects in excavated areas, when practicable;
- Slopes trimmed to blend with the adjacent terrain upon completion of operations;
- Slopes covered with native soil, or acceptable plant rejects to support plant growth, if required by Specifications, Plans, or permits; and
- A vegetative cover that blends with the adjacent natural growth.

(c) Excavate in quarries so that:

- Faces will not be steeper than vertical (no overhang);
- Vertical faces conform to Oregon OSHA standards, Division 3, and as shown on an approved development plan;
- Floors or benches are excavated to a uniform Slope free of depressions and will drain and not interfere with the downland owner's property; and
- Upon completion, the quarry is left appearing neat and compatible with surrounding terrain.

(d) Obliterate haul roads specifically built for access to sources, and restore the areas disturbed by these roads as nearly as practicable to the conditions that existed before the roads were built, unless otherwise directed by the landowner or regulatory body.

Section 00165 - Quality of Materials

Description

00165.00 General - The Contractor shall incorporate into the Work only Materials conforming to the Specifications and approved by the Engineer. The Contractor shall incorporate into the Work only manufactured products made of new materials unless otherwise specified in the Contract. The Agency may require additional testing or retesting to determine whether the Materials or manufactured products meet Specifications.

Materials or manufactured products not meeting the Specifications at the time they are to be used are unacceptable and must be removed immediately from the Project Site, unless otherwise directed by the Engineer.

00165.01 Rejected Materials - The Engineer may reject any Materials that appear to be defective (00150.25) or that contain asbestos. The Contractor shall not incorporate any rejected Materials into the Work. Rejected Materials whose defects have been corrected may not be incorporated into the Work until the Engineer has approved their use. The Engineer may order the removal and replacement by the Contractor, at Contractor's expense, of any defective Materials. (refer also to 00150.20)

00165.02 Materials Conformance and Quality Compliance Documents - For purposes of this Section, "Materials Conformance Documents" means the Contractor's quality-control, the Agency's verification, and the independent assurance test results, and the identity of the testing facility, as specified in the ODOT Manual of Field Test Procedures (MFTP), unless otherwise specified in the Contract.

For purposes of this Section, "Quality Compliance Documents" means those documents specified in ODOT's Nonfield-Tested Materials Acceptance Guide, unless otherwise specified in the Contract.

00165.03 Testing by Agency - When testing Materials, the Agency will conduct the tests in its central laboratory, field laboratories, or other laboratories designated by the Engineer, even though certain AASHTO, ASTM, and other Materials specifications may require testing at the place of manufacture. Results of the Agency's tests will be made available to the Contractor.

00165.04 Costs of Testing - When the Contract requires that the Agency performs the testing, the testing will be at the Agency's expense. The Agency will pay the cost of Contractor-requested source-review tests on unprocessed Aggregates from no more than two sources for each Project, and on no more than three unprocessed samples from each source. Additional source-review tests performed at the Contractor's request shall be at the Contractor's expense.

Unless otherwise provided in the Contract, all testing required to be performed by the Contractor will be at the Contractor's expense.

Provisions and Requirements

00165.10 Materials Acceptance Guides - Unless otherwise specified elsewhere in the Contract, Materials will be accepted according to the following guides:

(a) Field-Tested Materials - Field-tested Materials will be accepted according to the ODOT Manual of Field Test Procedures (MFTP). The MFTP is published once per year and is available from the ODOT – Construction Section, 800 Airport Road SE; Salem, OR 97301-4798; phone 503-986-3000. The MFTP is also available on the ODOT Construction Section web site.

(b) Nonfield-Tested Materials - Nonfield-tested Materials will be accepted according to the ODOT Nonfield Tested Materials Acceptance Guide (NTMAG), unless otherwise specified in the Contract. The NTMAG is available on the ODOT Construction Section web site.

00165.20 Materials Specifications and Test Method References - References to Materials specifications and test methods of ODOT, WAQTC, AASHTO, ASTM, other governmental agencies, or other recognized organizations mean those officially adopted and in current use by the agency or organization on the date of Bid Opening.

If there are conflicting references, or if no reference is made to Materials specifications or test method, Materials must meet the Materials specifications or test methods required by the first applicable of the following agencies and organizations:

- Field-Tested Materials:
  - Special Provisions;
  - MFTP as modified by the Local Public Agency Quality Assurance Program; and
  - Standard Specifications.

- Nonfield Tested Materials:
  - ODOT;
  - WAQTC;
  - AASHTO;
  - ASTM;
  - Other recognized national organizations, such as ANSI, AWPA, IMSA, and UL; and
  - Industry standards in the location where the Work is being performed.

If there are conflicting references in the Contract or the Quality Assurance program, to required sampling and testing frequencies, the Contractor shall sample and test the Materials according to the first applicable of the following:

- Special Provisions;
- MFTP as modified by the Local Public Agency Quality Assurance Program; and
- Standard Specifications.

00165.30 Field-Tested Materials:

(a) Contractor's Duties - The Contractor shall:

- Furnish Materials of the quality specified in the Contract;
- Provide and administer a quality control program as described in the Quality Assurance Manual portion of the MFTP. Upon request, the Contractor shall provide to the Engineer the names, telephone numbers, and copies of certifications for all personnel performing field testing; and
- Perform other testing as required by the Contract.

(b) Types of Tests - The types of tests and testing methods generally required by the Agency are described in the MFTP.

(c) Acceptance of Field-Tested Materials The Contractor's test results for field-tested Materials will be verified by the Agency according to the Quality Assurance program outlined in the MFTP. Materials will be analyzed as determined by the Engineer for acceptance before the Engineer will accept them for incorporation into the Work. Incorporated Materials that do not meet Specifications will be evaluated according to 00165.01 and 00150.25.

If the Agency's verification testing reveals that the Contractor's data is incorrect, the Agency may require additional testing to determine whether the Materials meet Specifications. The Contractor shall perform additional quality control testing or provide split samples to the Agency for additional testing as directed. If the Materials do not meet Specifications, the Contractor shall reimburse the Agency for the cost of the additional testing, which may be deducted from monies due or to become due the Contractor under the Contract. Incorporated Materials that do not meet Specifications will be evaluated according to 00165.01 and 00150.25. If the Materials meet Specifications the Agency will pay the cost for the additional testing.

00165.35 Nonfield-Tested Materials - The Contractor shall furnish Materials meeting Specifications, along with all Materials Conformance and Quality Compliance Documents.

(a) Test Results Certificate - The Certificate shall:

- Be from the manufacturer verifying that the Material furnished has been sampled and tested and the test results meet the Specifications.
- Include, or be accompanied by, a copy of the specified test results (ODOT, AASHTO, ASTM, UL or other).
- Identify the testing agency and the representative responsible for the test results.
- Permit positive determination that Material delivered to the Project is the same Material covered by the test results.
- Be delivered to the Engineer with the shipment of the material.

(b) Quality Compliance Certificate - The Certificate from the manufacturer shall:

- Verify that the Material meets the Specifications, and identify by number the specified test methods used, (ODOT, AASHTO, ASTM, UL, or other)

- Permit positive determination that Material delivered to the Project is the same Material covered by the certificate,
- Be delivered to the Engineer with the shipment of the Material, or be an identification plate or mark, decal, sticker, label, or tag attached to the container or Material,

(c) Equipment List and Drawings - These consist of lists of proposed Equipment and Materials, such as:

- Shop drawings
- Material lists
- Equipment lists
- Catalog description sheets
- Manufacturer's brochures

Submit these lists to the Engineer for review of conformance with the Specifications.

(d) Certificate of Origin of Steel Materials - When specified, complete this document (ODOT Form 734-2126) as required by 00160.20 for Federal-aid projects.

Materials will be subject to acceptance testing if the Engineer so elects. The Engineer may reject damaged or non-Specification Materials regardless of the Materials Conformance Documents furnished.

00165.50 Acceptance Sampling and Testing -The Contractor shall sample and test Materials for acceptance, as required by the Contract. Materials will be analyzed as determined by the Engineer for acceptance before the Engineer will accept them for incorporation into the Work. When the Engineer determines the Materials or Work does not conform to the Specifications the Engineer may accept the Materials or Work with pay adjustments or reject the Materials or Work per 00150.25.

00165.70 Use of Materials without Acceptable Materials Conformance Documents:

(a) General - The Contractor shall not incorporate Materials into the Project prior to submittal of Materials Conformance Documents acceptable to the Engineer. The Engineer may waive this requirement temporarily if Materials are necessary for immediate traffic safety.

(b) Materials Incorporated for Immediate Traffic Safety - If Materials are incorporated into the Project for immediate traffic safety before acceptable Materials Conformance Documents are available, no payment will be made for the value of the Materials, or the costs of incorporating them, until Materials Conformance Documents have been submitted to and approved by the Engineer, or the Materials are otherwise found through testing to comply with Specifications.

(c) Contractor's Request for Testing Assistance - If acceptable Materials Conformance Documents are not available, the Contractor may either have the necessary tests performed at a private laboratory or request in writing that the Engineer:

- Determine if the Agency or its agents can sample and test;
- Estimate the cost to the Contractor for the testing service; and

- Estimate the time required to obtain the test results.

The Engineer will provide this information to the Contractor in writing. If the Contractor requests the Engineer, in writing, to proceed, the Engineer will arrange for the sampling and testing, at the Contractor's expense. If these tests determine the Material complies with the Specifications, the Materials may be incorporated into the Project, or for Materials previously incorporated according to (b) above, payment will be authorized.

00165.75 Storage and Handling of Materials - The Contractor shall store and handle Materials so as to preserve their quality and fitness for incorporation into the Work. The Contractor shall restore all storage sites to their original condition according to 00140.90, or to comply with any applicable permits, orders, or agreements, at the Contractor's expense.

Stored Materials:

- Shall be readily accessible for inspection;
- May be stored on approved parts of the Right-of-Way; and
- May be stored on private property if written permission of the owner or lessor is obtained.

Section 00170 - Legal Relations and Responsibilities

Description

00170.00 General - The Contractor shall comply with all laws, ordinances, codes, regulations and rules, (collectively referred to as "Laws" in this Section), that relate to the Work or to those engaged in the Work. Where the provisions of the Contract are inconsistent or in conflict, the Contractor shall comply with the more stringent standard.

The Contractor shall indemnify, defend, and hold harmless the Agency and its representatives from liability arising from or related to the violation of Laws by those engaged in any phase of the Work. This provision does not apply to Work performed by Agency employees.

In any litigation, the entire text of any order or permit issued by a governmental or regulatory authority, as well as any documents referenced or incorporated therein by reference, shall be admissible for the purpose of Contract interpretation.

The Contract shall not be construed against either party regardless of which party drafted it. Other than as modified by the Contract, the applicable rules of contract construction and evidence shall apply. This Contract shall be governed by and construed according to the laws of the State of Oregon without regard to principles of conflict of laws.

Any dispute between the Agency and the Contractor that arises from or relates to this Contract and that is not resolved under the provisions of Section 00199 shall be brought and conducted solely and exclusively within the Circuit Court for the State of Oregon in the county where the Agency's main office is located; provided, however, if a dispute must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this Subsection be construed as a waiver by the State of Oregon on any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR BY EXECUTION OF THE CONTRACT HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.

Provisions and Requirements

00170.01 Other Agencies Affecting Agency Contracts - Representatives of regulatory bodies or units of government whose Laws may apply to the Work shall have access to the Work according to 00150.20(d). These may include but are not limited to those in the following (a), (b), (c), and (d).

(a) Federal Agencies:

Agriculture, Department of
- Forest Service
- Natural Resource Conservation Service

Army, Department of the
- Corps of Engineers

Commerce, Department of

National Marine Fisheries Service

Defense, Department of

Energy, Department of

Environmental Protection Agency (EPA)

Federal Energy Regulatory Commission

Geology Survey

Health and Human Services, Department of

Homeland Security, Department of
U.S. Coast Guard (USCG)

Housing and Urban Development, Department of

Interior, Department of
Heritage, Conservation, and Recreation Service
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Mines
Bureau of Reclamation
Geological Survey
Minerals Management Service
Office of Surface Mining, Reclamation, and Enforcement

Minerals Management Service

Solar Energy and Energy Conservation Bank

U.S. Fish and Wildlife Service

Labor, Department of
Mine Safety and Health Administration
Occupational Safety and Health Administration (OSHA)

Transportation, Department of
Federal Highway Administration

Water Resources Council

(b) State of Oregon Agencies:

Administrative Services, Department of

Agriculture, Department of
Natural Resources Division
Soil and Water Conservation District

Columbia River Gorge Commission

Consumer and Business Services, Department of
Insurance Division
Oregon Occupational Safety and Health Division (OR-OSHA)

Energy, Office of

Environmental Quality, Department of (DEQ)

Fish and Wildlife, Department of
Forestry, Department of
Geology and Mineral Industries, Department of
Human Resources, Department of
Labor and Industries, Bureau of
Land Conservation and Development Department
Parks and Recreation, Department of
State Lands, Department of
Water Resources Department

(c) Local Agencies:

City Commissions
County Courts
County Commissioners, Boards of
Design Commissions
Historical Preservation Commissions
Lane Regional Air Pollution Authority (LRAPA)
Planning Commissions
Port Districts
Special Districts

(d) Oregon Federally Recognized Tribal Governments:

Burns Paiute Tribe
Confederated Tribes of Coos, Lower Umpqua and Siuslaw Indians
Confederated Tribes of Grand Ronde
Confederated Tribes of Siletz
Confederated Tribes of Umatilla Indian Reservation
Confederated Tribes of Warm Springs
Coquille Tribe
Cow Creek Band of Umpqua Indians
Klamath Tribe

00170.02 Permits, Licenses, and Taxes - As required to accomplish the Work, the Contractor shall do the following:

- Obtain all necessary permits and licenses, except for those noted in 00170.03;
- Pay all applicable charges, fees and taxes, except for those noted in 00170.03;

- Give all notices required by applicable Laws, or under the terms of the Contract;
- Comply with ORS 274.530 relating to lease of stream beds by Oregon Division of State Lands;
- License, in the State of Oregon, all vehicles subject to licensing;
- Comply with ORS 477.625 and ORS 527.670 relating to clearing and fire hazards on forest lands; and
- Comply with all orders and permits issued by a governmental authority, whether local, State, or federal.

00170.03 Furnishing Right-of-Way, Easements and Permits - Unless required to be obtained in the name of the Contractor, the Agency will obtain and pay for the following when they are required by the applicable Laws or by Plans or Specifications:

- All necessary Rights-of-Way and Easements;
- Permits required for crossing or encroaching upon navigable streams;
- Permits required for removing materials from or depositing materials in waterways;
- Permits required for operating in Agency-controlled source of Materials or disposal area;
- System development fees charged by local units of government;
- Building construction permits, not including specialty work such as heating, ventilation, air conditioning, or electrical;
- Cost of referencing and replacing endangered survey monuments; and
- Environmental permits, including erosion control permits.

If, after the Bid Closing date, the Agency obtains any Permits, Rights of Way or Easements which require changes to the Work and thereby causes an increase or decrease in the cost of, or the time required for the performance of the Work, the Contractor shall submit information sufficient for the Engineer to determine the extent of the effects on the cost and/or schedule. If the Engineer agrees the cost and/or schedule will be affected by such changes, such effects will be handled in accordance with the General Conditions. The Engineer will provide the Contractor with a copy of any such Permits, Rights-of-Way or easements.

00170.04 Patents, Copyrights, and Trademarks - Prior to use of designs, devices, materials, or processes protected by patent, copyright, or trademark, the Contractor shall obtain from the Entity entitled to enforce the patent, copyright, or trademark all necessary evidence of legal right.

The Contractor shall indemnify, defend and hold harmless the Agency and all third parties and political subdivisions having a possessory or ownership interest or regulatory authority over the Project or Project Site from claims of patent, copyright or trademark infringement, and from costs, expenses and damages the Contractor or Agency may be obligated to pay as a result of such infringement during or after completing the Work.

00170.05 Assignment of Antitrust Rights - The Contractor irrevocably assigns to the Agency any claim for relief or cause of action the Contractor acquires during the term of the Contract, or which may accrue thereafter, by reason of any violation of:

- Title 15 (Commerce and Trade), United States Code;
- ORS 646.725; and
- ORS 646.730.

In connection with this assignment, it is an express obligation of the Contractor to take no action that would in any way impair or diminish the value of the rights assigned to the Agency according to the provisions of this Subsection. Further, it is the express obligation of the Contractor to take all action necessary to preserve the rights assigned. It is an express obligation of the Contractor to advise the Agency's legal counsel:

- In advance, of its intention to commence any action involving such claims for relief or causes of action;
- Immediately upon becoming aware of the fact that an action involving such claims for relief or causes of action has been commenced by some other person or persons;
- The date on which it notified the obligor(s) of any such claims for relief or causes of action of the fact of the Contractor's assignment to the Agency according to the provisions of this Subsection; and
- Immediately upon the discovery of any such antitrust claim for relief or cause of action.

In the event any payment is made to the Contractor under any such claims for relief, the Contractor shall promptly pay the full sum over to the Agency. In the event the Contractor fails to make such payment, the Agency may deduct the amount from monies due or to become due the Contractor under the Contract.

00170.06 Taxes - The Contract unit or lump sum prices shall include full compensation for any payroll taxes which may be incurred under State and Federal Unemployment and Social Security Acts, and all Sales Taxes on materials furnished by Contractor. The Contractor shall promptly pay such taxes to the proper agency, and shall indemnify and save harmless the Agency from any liability which may or could arise therefrom.

00170.07 Record Requirements - For purposes of this Subsection the term "Contractor" includes the Contractor, all subcontractors, Material Suppliers, and providers of rented operated Equipment (except non-DBE truck drivers), at all tiers, for all subcontracts with first-tier Subcontractors, all subcontracts between the first-tier Subcontractors and their subcontractors and any other lower tier subcontracts, and "Related Entities" as that term is defined in OAR 731-005-0780. The Material Suppliers included in this definition are those for Aggregates, Asphalt Cement Concrete, Portland Cement Concrete and the supply and fabrication of structural steel items or Material Suppliers that provide quotes.

(a) Records Required - The Contractor shall maintain all records, whether created before or after execution of the Contract, or during Contract performance, or after Contract completion, to clearly document:

- The Contractor's performance of the Contract or a subcontract;

- The Contractor's ability to continue performance of the Contract or a subcontract; and
- All claims arising from or relating to performance under the Contract or a subcontract.

These records shall include all records, including fiscal records, regardless of when created for the Contractor's business. The records for the Contractor's business include without limitation the:

- Bidding estimates and records, worksheets, tabulations or similar documents.
- Job cost detail reports, including monthly totals.
- Payroll records (including without limitation the ledger or register, and tax forms) and all documents which establish the periods, individuals involved, the hours for the individuals, and the rates for the individuals.
- Records that identify the Equipment used by the Contractor and subcontractors in the performance of the Contract or subcontracts, including without limitation, Equipment lists, rental contracts and any records used in setting rental rates.
- Invoices from vendors, rental agencies, and subcontractors.
- Material quotes, invoices, purchase orders and requisitions.
- Contracts with subcontractors and contracts with Material Suppliers, Suppliers and providers of rented equipment.
- Contracts or documents of other arrangements with any Related Entity as defined in OAR 731-005-0780.
- General ledger.
- Trial Balance.
- Financial statements (including without limitation the balance sheet, income statement, statement of cash flows, and financial statement notes).
- Income tax returns.
- All worksheets used to prepare bids or claims, or to establish the cost components for the Pay Items, including without limitation, the labor, benefits and insurance, Materials, Equipment, and subcontractors.

The following are examples, but not an exhaustive list, of records that would be included, if generated by the Contractor. If the Contractor generates such records, or equivalent records, they are included among the records subject to 00170.07.

- Daily time sheets and supervisor's daily reports.
- Collective bargaining agreements.
- Earnings records.
- Journal entries and supporting schedules.
- Insurance, welfare, and benefits records.
- Material cost distribution worksheet.
- Subcontractors' and lower tier subcontractors' payment certificates.
- Payroll and vendor's cancelled checks.

- Cash disbursements journal.
- All documents related to each and every claim together with all documents that support the amount of damages as to each claim.
- Additional financial statements (including without limitation the balance sheet, income statement, statement of cash flows, and financial notes) preceding the execution of the Contract and following final payment of the Contract.
- Depreciation records on all business Equipment maintained by the business involved, its accountant, or other Entity. (If a source other than depreciation records is used to develop cost for the Contractor's internal purposes in establishing the actual cost of owning and operating Equipment, all such other source documents.)

The Contractor shall maintain all fiscal records in material compliance with generally accepted accounting principles, or other accounting principles that are accepted accounting principles and practices for the subject industry and adequate for the nature of the Contractor's business, and in such a manner that providing a complete copy is neither unreasonably time consuming nor unreasonably burdensome for the Contractor or the Agency. Failure to maintain the records in this manner shall not be an excuse for not providing the records.

The Contractor shall include in its subcontracts, purchase orders, and all other written agreements, a provision requiring all subcontractors, Material Suppliers and providers of rented operated Equipment, (except non-DBE truck drivers), at all tiers to comply with 00170.07. The Contractor shall also require all subcontractors, Material Suppliers, and providers of rented operated Equipment, (except non-DBE truck drivers), at all tiers and Related Entities to include in their contracts, purchase orders, and all other written agreements, a provision requiring all lower tier subcontractors, Material Suppliers and providers of rented operated Equipment (except non-DBE truck drivers) to comply with 00170.07. The Material Suppliers to which this applies are those for Aggregates, Asphalt Cement Concrete, Portland Cement Concrete and the supply and fabrication of structural steel items or Material Suppliers that provide Material quotes and Related Entities as defined in OAR 731-005-0780.

(b) Access to Records - The Contractor shall provide the Engineer access to or a copy of all Contractor records upon request. A Project Manager's authority to request or access records is subject to OAR 731-005-0780(9). During the record retention period the Engineer, employees of the Agency, representatives of the Agency, or representatives of regulatory bodies or units of government may:

- Inspect, examine and copy or be provided a copy of all Contractor records;
- Audit the records, a Contract or the performance of a Contract;
- Inspect, examine and audit the records when, in the Agency's sole discretion, the records may be helpful in the resolution of any claim, litigation, administrative proceeding or controversy arising out of or related to a Contract.

Reasons for access to audit, inspect, examine and copy records include without limitation, general auditing, reviewing claims, checking for collusive bidding, reviewing or checking payment of required wages, performance and contract compliance, workplace safety compliance, evaluating related Entities, environmental compliance, and qualifications for performance of the Contract, including the ability to perform and the integrity of the Contractor.

Where such records are stored in a computer or in other digital media, the Engineer may request, and the Contractor shall provide, a copy of the data files and such other information or access to software to allow the Engineer review of the records.

Nothing in 00170.07 is intended to operate as a waiver of the confidentiality of any communications privileged under the Oregon Evidence Code. Nothing in 00170.07 limits the records or documents that can be obtained by legal process.

(c) Record Retention Period - The Contractor shall maintain the records and keep the records accessible and available at reasonable times and places for at least 3 years from the date of final payment under the Contract, or until the conclusion of all audits, litigation, administrative proceedings, disputes and claims arising out of or related to the Contract, whichever date is later.

(d) Public Records Requests - If records provided under this section contain any information that may be considered exempt from disclosure as a trade secret under either ORS 192.501(2) or ORS 646.461(4), or under other grounds specified in Oregon Public Records Law, ORS 192.410 through ORS 192.505, the Contractor shall clearly designate on or with the records the portions which the Contractor claims are exempt from disclosure, along with a justification and citation to the authority relied upon. Entire records or documents should not be designated as a trade secret or otherwise exempt from disclosure. Only specific information within a record or document should be so designated.

To the extent allowed by the Oregon Public Records Law or other applicable law related to the disclosure of public records, Agency will not disclose records or portions of records the Contractor has designated as trade secrets to a third party, who is not a representative of the Agency, to the extent the records are exempt from disclosure as trade secrets under the Oregon Public Records Law or other applicable law, except to the extent Agency is ordered to disclose in accordance with the Oregon Public Records Law or by a court of competent jurisdiction. Application of the Oregon Public Records Law or other applicable law shall determine whether any record, document or information is actually exempt from disclosure.

In addition, in response to a public records request, the Agency will not produce or disclose records so identified as exempt by the Contractor to any person other than representatives of the Agency, and others with authorized access under 00170.07(b), without providing the Contractor a copy of the public records request, unless:

The Contractor consents to such disclosure; or

Agency is prohibited by applicable law or court order from providing a copy of the public records request to the Contractor.

00170.10 Required Payments by Contractors - The Contractor shall comply with ORS 279C.505 and ORS 279C.515 during the term of the Contract.

(a) Prompt Payment by Contractor for Labor and Materials - As required by ORS 279C.505, the Contractor shall:

- Make payment promptly, as due, to all Entities supplying labor or Materials under the Contract;
- Pay all contributions or amounts due the Industrial Accident Fund, whether from the Contractor or a subcontractor, incurred in the performance of the Contract;
- Not permit any lien or claim to be filed against the State or any political subdivision thereof, on account of any labor or Material furnished in performance of the Contract; and
- Pay to the Department of Revenue all sums withheld from employees according to ORS 316.167.

(b) Prompt Payment by Contractor to First-Tier Subcontractor(s) - According to ORS 279C.580(3)(a), after the Contractor has determined and certified to the Agency that one or more of its Subcontractors has satisfactorily performed subcontracted Work, the Contractor may request payment from the Agency for the Work, and shall pay the Subcontractor(s) within 10 Calendar Days out of such amounts as the Agency has paid to the Contractor for the subcontracted Work.

(c) Interest on Unpaid Amount - If the Contractor or a first-tier Subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract within 30 Days after the Contractor's receipt of payment, the Contractor or first-tier Subcontractor shall owe the Entity the amount due plus interest charges that begin at the end of the 10 day period within which payment is due under ORS 279C.580(3) and that end upon final payment, unless payment is subject to a good-faith dispute as defined in ORS 279C.580(5)(b). The rate of interest on the amount due shall be in accordance with ORS 279C.515(2). The amount of interest shall not be waived.

(d) Agency's Payment of the Contractor's Prompt Payment Obligations - If the Contractor fails, neglects or refuses to make prompt payment of any invoice or other demand for payment for labor or services furnished to the Contractor or a Subcontractor by any Entity in connection with the Contract as such payment becomes due, the Agency may pay the Entity furnishing the labor or services and charge the amount of the payment against monies due or to become due the Contractor under the Contract.

The payment of a claim by the Agency in the manner authorized in this Subsection shall not relieve the Contractor or the Contractor's Surety from obligations with respect to any such claims.

(e) Right to Complain to the Construction Contractors Board - If the Contractor or a subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract, the Entity may file a complaint with the Construction Contractors Board, unless payment is subject to a good-faith dispute as defined in ORS 279C.580(5)(b).

(f) Notice of Claim Against Bond - An Entity (which by definition includes a natural person) claiming not to have been paid in full for labor or Materials supplied for the prosecution of the Work may have a right of action on the Contractor's Payment Bond as provided in ORS 279C.600 and ORS 279C.605.

The Commissioner of the Bureau of Labor and Industries (BOLI) may have a right of action on the Contractor's and Subcontractors' public works bonds and Payment Bonds for workers who have not been paid in full, as provided in ORS 279C.600 and ORS 279C.605.

00170.20 Public Works Bond - Before starting Work, the Contractor and subcontractors shall each file with the Construction Contractors Board, and maintain in full force and effect, a separate public works bond, in the amount of $30,000 unless otherwise exempt, as required by ORS 279C.830(3) and ORS 279C.836. The Contractor shall verify subcontractors have filed a public works bond before the subcontractor begins Work.

00170.32 Protection of Navigable Waters - The Contractor shall comply with all applicable Laws, including without limitation the Federal River and Harbor Act of March 3, 1899 and its amendments.

The Contractor shall not interfere with waterway navigation or impair navigable depths or clearances, except as U.S. Coast Guard or Corps of Engineer permits allow.

00170.60 Safety, Health, and Sanitation Provisions - The Contractor shall comply with all Laws concerning safety, health, and sanitation standards. The Contractor shall not require workers to perform Work under conditions that are hazardous, dangerous, or unsanitary.

Workers exposed to traffic shall wear upper body garments or safety vests that are highly visible and meet the requirements of 00225.25.

Workers exposed to falling or flying objects or electrical shock shall wear hard hats.

Upon their presentation of proper credentials, the Contractor shall allow inspectors of the U.S. Occupational Safety and Health Administration (OSHA) and the Oregon Occupational Safety and Health Division (OR-OSHA) to inspect the Work and Project Site without delay and without an inspection warrant.

According to ORS 468A.715 and ORS 468A.720, the Contractor or a Subcontractor who performs Project Work involving asbestos abatement shall possess a valid DEQ asbestos abatement license.

00170.61 Industrial Accident Protection:

(a) Workers' Compensation - The Contractor shall provide workers' compensation coverage for on-the-job injuries as required by 00170.70(d).

(b) Longshoremen's and Harbor Workers' Compensation - If Work to be performed is over or adjacent to navigable waters, the Longshoremen's and Harbor Workers' Compensation Act, (Chapter 18, Title 33 of the USC) may apply, and the Contractor shall be responsible for complying with its provisions (which may include the provision of additional workers' compensation benefits to employees).

00170.62 Labor Nondiscrimination - The Contractor shall comply with all Laws concerning equal employment opportunity, including without limitation those prohibiting discrimination because of race, religion, color, sex, disability, or national origin.

00170.63 Payment for Medical Care - According to ORS 279C.530, the Contractor shall promptly, as due, make payment to any person, copartnership, association or corporation furnishing medical, surgical and hospital care services or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums that the Contractor agrees to pay for the services and all moneys and sums that the Contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

00170.65 Minimum Wage and Overtime Rates for Public Works Projects:

(a) General - The Contractor is responsible for investigating local labor conditions. The Agency does not imply that labor can be obtained at the minimum hourly wage rates specified in State or federal wage rate publications, and no increase in the Contract Amount will be made if wage rates paid are more than those listed.

(b) State Prevailing Wage Requirements - The Contractor shall comply with the prevailing wage provisions of ORS 279C.800 through ORS 279C.870.

(1) Minimum Wage Rates - The Bureau of Labor and Industries (BOLI) determines and publishes the existing State prevailing wage rates in the publication "Prevailing Wage Rates for Public Works Contracts in Oregon". The Contractor shall pay workers not less than the specified minimum hourly wage rate according to ORS 279C.838 and ORS 279C.840 and shall include this requirement in all subcontracts.

See the Project Wage Rates page included with the Special Provisions for additional information about which wage rates apply to the project and how to access the applicable wage rates.

(2) Payroll and Certified Statements - As required in ORS 279C.845, the Contractor and every subcontractor shall submit written certified statements to the Engineer on the form prescribed by the Commissioner of BOLI in OAR 839-025-0010 certifying compliance with wage payment requirements and accurately setting out the Contractor's or subcontractor's weekly payroll records for each worker employed upon the project.

The Contractor and subcontractors shall preserve the certified statements for a period of 6 years from the date of completion of the Contract.

(3) Additional Retainage:

a. Agency - As required in ORS 279C.845(7) the Agency will retain 25% of any amount earned by the Contractor on the project until the Contractor has filed the certified statements required in ORS 279C.845 and in FHWA Form 1273, if applicable. The Agency will pay to the Contractor the amount retained within 14 Days after the Contractor files the required certified statements, regardless of whether a subcontractor has failed to file certified statements.

b. Contractor - As required in ORS 279C.845(8) the Contractor shall retain 25% of any amount earned by a first tier subcontractor on the project until the first tier subcontractor has filed with the

Agency the certified statements required in ORS 279C.845 and in FHWA Form 1273, if applicable. Before paying any amount retained, the Contractor shall verify that the first tier subcontractor has filed the certified statement. Within 14 Days after the first tier subcontractor files the required certified statement the Contractor shall pay the first tier subcontractor any amount retained.

(4) Owner/Operator Data - For a project funded by the FHWA, the Contractor shall furnish data to the Engineer for each owner/operator providing trucking services. Furnish the data before the time the services are performed and include without limitation for each owner/operator:

- Drivers name;
- Copy of driver's license;
- Vehicle identification number;
- Copy of vehicle registration;
- Motor vehicle license plate number;
- Motor Carrier Plate Number;
- Copy of ODOT Motor Carrier 1A Permit; and Name of owner/operator from the side of the truck.

(c) State Overtime Requirements - As a condition of the Contract, the Contractor shall comply with the pertinent provisions of ORS 279C.540.

(1) Maximum Hours of Labor and Overtime Pay - According to ORS 279C.540, no person shall be employed to perform Work under this Contract for more than 10 hours in any 1 Day, or 40 hours in any 1 week, except in cases of necessity, emergency, or where public policy absolutely requires it. In such instances, the Contractor shall pay the employee at least time and a half pay:

- For all overtime in excess of 8 hours a day or 40 hours in any 1 week when the work week is 5 consecutive days, Monday through Friday; or
- For all overtime in excess of 10 hours a day or 40 hours in any 1 week when the work week is 4 consecutive days, Monday through Friday; and
- For all Work performed on Saturday and on any legal holiday specified in ORS 279C.540.

For additional information on requirements for overtime and establishing a work schedule see OAR 839-025-0050 and OAR 839-025-0034.

(2) Notice of Hours of Labor - The Contractor shall give written notice to employees of the number of hours per day and days per week the employees may be required to work. Provide the notice either at the time of hire or before commencement of work on this Contract, or by posting a notice in a location frequented by employees.

(3) Exception - The maximum hours of labor and overtime requirements under ORS 279C.540 will not apply to the Contractor's Work under this Contract if the Contractor is a party to a collective bargaining agreement in effect with any labor organization. For a collective bargaining agreement to be in effect it shall be enforceable within the geographic area of the project, and its terms shall extend to workers who are working on the project (see OAR 839-025-0054).

(d) State Time Limitation on Claim for Overtime - According to ORS 279C.545, any worker employed by the Contractor is foreclosed from the right to collect any overtime provided in ORS 279C.540 unless a claim for payment is filed with the Contractor within 90 Days from the completion of the contract, provided the Contractor posted and maintained a circular as specified in this provision. Accordingly, the Contractor shall:

(1) Cause a circular, clearly printed in boldfaced 12-point type containing a copy of ORS 279C.545, to be posted in a prominent place alongside the door of the timekeeper's office or in a similar place which is readily available and freely visible to any or all workers employed to perform Work; and

(2) Maintain such circular continuously posted from the inception to the completion of the Contract on which workers are or have been employed.

(e) Additional Requirements When Federal Funds are Involved - When federal funds are involved, the following requirements shall apply in addition to the requirements of 00170.65(a) through 00170.65(d). The Contractor shall include these provisions in all subcontracts as well as ensure that all Subcontractors include these provisions in their lower tier subcontracts.

(1) FHWA Requirements - For Federal-Aid projects, the Contractor shall comply with the provisions of FHWA Form 1273, "Required Contract Provisions Federal-Aid Construction Contracts".

(2) Minimum Wage Rates - The Contractor shall pay each worker in each trade or occupation employed to perform any work under the contract not less than the existing State (BOLI) prevailing wage rate or the applicable federal prevailing wage rate required under the Davis-Bacon Act (40 U.S.C. 3141 et seq.), whichever is higher. The Contractor shall include this provision in all subcontracts.

See the Project Wage Rates page included with the Special Provisions for additional information about which wage rates apply to the project and how to access the applicable wage rates.

(3) Payroll and Certified Statements - In addition to providing the payroll information and certified statements required under ORS 279C.845 (see 00170.65(b-2)), the Contractor and every subcontractor shall submit written certified statements that also meet the requirements in Section IV of FHWA Form 1273 except the Contractor and every subcontractor shall preserve the certified statements for a period of 6 years from the date of completion of the Contract.

(4) Overtime - With regard to overtime pay, the Contractor shall comply with the overtime provision affording the greatest compensation required under FHWA Form 1273 and ORS 279C.540.

00170.70 Insurance:

(a) Insurance Coverages - Prior to starting work hereunder, CONTRACTOR, at CONTRACTOR'S cost, shall secure and continue to carry during the term of this contract, with an insurance company acceptable to CITY, the following insurance, written on an occurrence basis, in amounts not less than the limitations on liability for local public bodies provided in ORS 30.272 and ORS 30.273:

Commercial General Liability - CONTRACTOR shall obtain, at CONTRACTOR'S expense and keep in effect during the term of this Contract, Commercial General Liability Insurance covering bodily injury and property damage. Coverage shall include CONTRACTORs, SUBCONTRACTORs and anyone directly or indirectly employed by either.

Pollution Liability - If indicated by Special Provisions, Pollution Liability Insurance covering the Contractor's liability, or the liability of an appropriate subcontractor, if the coverage is obtained by the subcontractor, for bodily injury and property damage, and environmental damage resulting from sudden and accidental pollution, gradual pollution, and related clean-up costs incurred by the Contractor, or by the subcontractor if the coverage is obtained by the subcontractor, while performing Work required by the Contract. If the coverage is obtained by the Contractor, the coverage may be written in combination with the Commercial General Liability Insurance with separate limits for Pollution Liability and Commercial General Liability. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions. The annual aggregate limit shall not be less than the dollar amount indicated in the Special Provisions. The policy shall be endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

Asbestos Liability - If indicated by Special Provisions, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide an Asbestos Liability endorsement to the pollution liability coverage. If an endorsement cannot be obtained, The Contractor or subcontractor shall provide separate Asbestos Liability Insurance at the same combined single limit per occurrence and annual aggregate limit as the Pollution Liability Insurance with the policy endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

Lead Liability - If indicated by Special Provisions, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide a Lead Liability endorsement to the pollution liability coverage. If an endorsement cannot be obtained, the Contractor or subcontractor shall provide separate Lead Liability Insurance at the same combined single limit per occurrence and annual aggregate limit as the Pollution Liability Insurance with the separate policy endorsed to state that the annual aggregate limit of liability shall apply separately to the Contract.

Commercial Automobile Liability - CONTRACTOR shall obtain, at CONTRACTOR'S expense and keep in effect during the term of the resulting contract, Commercial Business Automobile Liability Insurance covering all owned, non-owned, or hired vehicles. This coverage may be written in combination with the Commercial General Liability Insurance (with separate limits).

Commercial Automobile Liability with Pollution Coverage - If indicated by Special Provisions, the Contractor, or the subcontractor, if the coverage is obtained by the subcontractor, shall provide Commercial Automobile Liability Insurance with Pollution coverage covering the Contractor's liability, or the liability of an appropriate subcontractor, if the coverage is obtained by the subcontractor, for bodily injury and property damage, and environmental damage arising out of the use of all owned, non-owned, or hired vehicles while performing Work under the Contract. If the coverage is obtained by the Contractor, the coverage may be written in combination with the Commercial General Liability Insurance with separate limits for Commercial Automobile Liability with Pollution Coverage and Commercial General Liability. Combined single limit per occurrence shall not be less than the dollar amount indicated in the Special Provisions or the amount required by the U.S. Department of Transportation, whichever is greater. If this coverage is written in combination with the Commercial

General Liability, the policy shall be endorsed to state that the Commercial General Liability annual aggregate limit shall apply separately to the Contract.

Commercial Automobile Liability with Pollution Coverage is required for this Project because the Project includes pollution related Work. If the Contractor will be performing pollution related Work, this coverage covering the Contractor must be provided. If an appropriate subcontractor, but not the Contractor, will perform the pollution related Work, Commercial Automobile Liability with Pollution Coverage covering the subcontractor, but not the Contractor, must be provided, however, the Contractor shall provide Commercial Automobile Liability insurance coverage covering the Contractor as provided in the Commercial Automobile Liability bullet above. If both the Contractor and an appropriate subcontractor will be performing pollution related Work, Commercial Automobile Liability with Pollution Coverage covering both the Contractor and the subcontractor shall be provided, and the Contractor may provide the coverage covering both the Contractor and the subcontractor, or the Contractor and the subcontractor may provide their own, separate Commercial Automobile Liability with Pollution coverages.

(b) Tail Coverage - If any of the required liability insurance coverages of 00170.70(a) are on a "claims made" basis, "tail" coverage will be required at the completion of the Contract for a duration of 24 months, or the maximum time period reasonably available in the marketplace. The Contractor shall furnish certification of "tail" coverage as described, or continuous "claims made" liability coverage for 24 months following Contract completion. Continuous "claims made" coverage will be acceptable in lieu of "tail" coverage, provided its retroactive date is on or before the effective date of the Contract. If Continuous "claims made" coverage is used, the Contractor shall keep the coverage in effect for a duration of not less than 24 months from the end of the Contract. This will be a condition to the Engineer's issuance of a Third Notification.

(c) Additional Insured - The liability insurance coverage shall include CITY and its officers and employees as Additional Insured but only with respect to CONTRACTOR'S activities to be performed under this Contract. Coverage will be primary and non-contributory with any other insurance and self-insurance. Prior to starting work under this Contract, CONTRACTOR shall furnish a certificate to CITY from each insurance company providing insurance showing that the CITY is an additional insured, the required coverage is in force, stating policy numbers, dates of expiration and limits of liability, and further stating that such coverage is primary and not contributory.

(d) Professional Liability Insurance - Professional Liability Insurance. The CONTRACTOR shall have in force a policy of Professional Liability Insurance. The CONTRACTOR shall keep such policy in force and current during the term of this contract.

(e) Workers' Compensation - All employers, including the Contractor and its Subcontractors, if any, that employ subject workers who are performing Work or providing labor or Materials under the Contract in the State shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. The Contractor shall ensure that each of its Subcontractors complies with these requirements.

The Contractor shall certify in the Contract that the Contractor is registered by the Oregon Workers' Compensation Division either as a carrier-insured employer, a self-insured employer, an exempt employer, or is an independent contractor who will perform the Work without the assistance of others.

The Contractor shall ensure that its insurance carrier files a guaranty contract with the Oregon Workers' Compensation Division before performing any Work.

(f) Notice of Cancellation or Change - There will be no cancellation, material change, potential exhaustion of aggregate limits or non-renewal of insurance coverage(s) without thirty (30) days written notice from CONTRACTOR or its insurer(s) to CITY. Any failure to comply with the reporting provisions of this clause will constitute a material breach of this Contract and will be grounds for immediate termination of this Agreement.

(g) Certificate(s) of Insurance - As evidence of the insurance coverages required by this Contract, the Contractor shall furnish Certificate(s) of Insurance to the Agency at the time(s) provided in 00130.50(a). As evidence of insurance coverages required by this Contract but permitted by the Agency under 00170.70(a) to be obtained by an appropriate subcontractor, the Contractor shall furnish Certificate(s) of Insurance to the Agency for such coverages together with the Contractor's request under 00180.21 for approval of the subcontract with that subcontractor. The Certificate(s) will specify all of the parties who are Additional Insureds. The Contractor shall obtain, or ensure that the appropriate subcontractors obtain, insurance coverages required under this Contract from insurance companies or entities acceptable to the Agency and authorized to issue insurance in the State. The Contractor, or the appropriate subcontractor, but not the Agency, shall be responsible for paying all deductibles, self-insured retentions and/or self-insurance included under these provisions.

(h) Builders' Risk - If indicated by Special Provision, the Contractor shall obtain, at its expense, and keep in effect during the term of the Contract, Builders' Risk insurance on an all risks of direct physical loss basis, including, without limitation, earthquake and flood damage, for an amount equal to at least the value indicated in the Special Provisions. Any deductible shall not exceed $50,000 for each loss, except that the earthquake and flood deductible shall not exceed 5% of each loss or $50,000, whichever is greater. The policy shall include the Agency as loss payee.

00170.71 Independent Contractor Status - The service or services to be rendered under this Contract are those of an independent contractor. The Contractor is not an officer, employee, or agent of the Agency as those terms are used in ORS 30.265.

00170.72 Indemnity/Hold Harmless - To the fullest extent permitted by law, and except to the extent otherwise void under ORS 30.140, the Contractor shall indemnify, defend (with counsel approved by the Agency) and hold harmless the Agency, Agency's Authorized Representative, Architect/Engineer, Architect/Engineer's consultants, and their respective officers, directors, agents, employees, partners, members, stockholders and affiliated companies, and when federal transportation funding is involved the State of Oregon, the Oregon Transportation Commission and the Oregon Department of Transportation and their respective officers and members and employees (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses (including reasonable attorney fees), demands and actions of any nature whatsoever which arise out of, result from or are related to the following:

- Any damage, injury, loss, expense, inconvenience or delay described in this Subsection.

- Any accident or occurrence which happens or is alleged to have happened in or about the Project Site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects.
- Any failure of the Contractor to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor contained in the Contract Documents or in any subcontract.
- The negligent acts or omissions of the Contractor, a subcontractor or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder.
- Any lien filed upon the project or bond claim in connection with the Work.

Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Subsection.

In claims against any person or entity indemnified under this Subsection by an employee of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Subsection shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

00170.74 Employee Drug Testing Program - As required by ORS 279C.505(2), the Contractor shall have in place, and maintain during the period of the Contract, an employee drug-testing program. The Agency retains the right to audit and/or monitor the program. On request by the Engineer, the Contractor shall furnish a copy of the employee drug-testing program.

00170.78 Conflict of Interest - The Contractor shall not give or offer any gift, loan, or other thing of value to any member of the Agency's governing body or employee of the Agency in connection with the award or performance of any Contract.

The Contractor shall not rent, lease, or purchase Materials, supplies, or Equipment, with or through any Agency employee or member of the Agency's governing body.

No ex-employee of the Agency who has worked for the Agency on any phase of the Project within the prior 2 years may be employed by the Contractor to perform Work on the Project.

00170.79 Third Party Beneficiary - There are no third-party beneficiaries of the Contract, unless federal transportation funding is involved then the State of Oregon, the Oregon Transportation Commission and the Oregon Department of Transportation and their respective officers and members and employees, are third-party beneficiaries of the Contract.

00170.80 Responsibility for Damage to Work:

(a) Responsibility for Damage in General - The Contractor shall perform Work, and furnish Materials and Equipment for incorporation into the Work, at the Contractor's own risk, until the entire Project has been completed and accepted by the Agency. The Contractor shall repair all damages to Work performed, Materials supplied, and Equipment incorporated into the Work, except as otherwise provided in this Section.

(b) Repair of Damage to Work - Until Final Acceptance, the Contractor shall promptly rebuild, repair, restore, and make good damages to all portions of the permanent or temporary Work. The Contractor shall perform all repairs of damage to Work at no additional cost to the Agency, except for repairs necessitated by damage caused by:

- Acts of God or Nature, as defined in Section 00110; or
- Actions of governmental authorities.

(c) Vandalism and Theft - Vandalism includes damage to or destruction of Work or portions of Work that remain on the Project Site resulting from vandalism, criminal mischief, arson, or other criminal or illegal behavior.

Theft includes the loss of Work or portions of Work that are lost or stolen or otherwise unaccounted for from the Project Site or from Materials or fabrication locations. The Contractor shall remain solely responsible for all losses caused by theft, including without limitation theft that occurs in conjunction with vandalism.

The Contractor shall provide protection of the Work from vandalism and theft until Third Notification.

00170.82 Responsibility for Damage to Property and Facilities:

(a) In General - As used in this Subsection, the term "Contractor" shall include the Contractor's agents, Subcontractors, and all workers performing Work under the Contract; and the term "damage" shall include without limitation soiling or staining surfaces by tracking or splashing mud, asphalt, and other materials, as well as damage of a more serious nature.

The Contractor shall be solely responsible for damages arising from:

- The Contractor's operations;
- The Contractor's negligence, gross negligence, or intentional wrongful acts; and
- The Contractor's failure to comply with any Contract provision.

The Agency may withhold funds due the Contractor or the Contractor's Surety until all lawsuits, actions, and claims for injuries or damages are resolved, and satisfactory evidence of resolution is furnished to the Agency.

(b) Protection and Restoration of Agency Property and Facilities - The following requirements apply to highways, highway Structures and other improvements that are existing, under construction, or completed. The Contractor shall:

- Provide adequate protection to avoid damaging Agency property and facilities;
- Be responsible for damage to Agency property and facilities caused by or resulting from the Contractor's operations; and
- Clean up and restore such damage by repair, rebuilding, replacement, or compensation, as determined by the Engineer.

(c) Protection and Restoration of Non-Agency Property and Facilities - The Contractor shall determine the location of properties and facilities that could be damaged by the Contractor's operations, and shall protect them from damage. The Contractor shall protect monuments and property marks until the Engineer has referenced their location and authorized their removal. The Contractor shall restore property or facilities damaged by its operations to the condition that existed before the damage, at no additional compensation.

The Contractor shall provide temporary facilities when needed, e.g., to maintain normal service or as directed by the Engineer, until the required repair, rebuilding, or replacement is accomplished.

The Contractor shall protect specific service signs, e.g., business logos, and tourist-oriented directional signs (TODS) from damage, whether the signs are to remain in place or be placed on temporary supports. The Contractor shall repair or replace damaged signs at no cost to the Agency. Liquidated damages will be assessed against the Contractor in the amount of $200 per day for each sign out of service for more than 5 Calendar Days because of the Contractor's operations.

00170.85 Responsibility for Defective Work - The Contractor shall make good any defective Work, Materials or Equipment incorporated into the Work, according to the provisions of Section 00150.

(a) Latent Defects - The Contractor shall remain liable for all latent defects resulting from causes other than fraud or gross mistakes that amount to fraud until the expiration of all applicable statutes of limitation and ultimate repose, the Performance Bond, Warranty Bond, or Correction Period, whichever expires last. The Contractor shall remain liable for all latent defects resulting from fraud or gross mistakes that amount to fraud regardless of when those latent defects may be discovered, and regardless of whether such discovery occurs outside any applicable statutes of limitation or ultimate repose or any applicable Performance Bond, Warranty Bond, or Correction Period.

(b) Correction Period Warranty for Agency Projects: - The Contractor shall warrant all Work and workmanship, including Changed Work, Additional Work, Incidental Work, On-Site Work, and Extra Work, and Materials and Equipment incorporated in the Work, for one year from the date of Second Notification (Correction Period), except that manufacturers' warranties and extended warranties according to 00170.85(c) shall not be abridged. The Correction Period warranty described herein shall include extension of the Performance Bond for a period of one year from the date of Second Notification.

The Contractor shall be responsible for meeting the technical and performance Specifications required, making good the Work, and for all repairs of damage to the Work and other improvements, natural and

artificial structures, systems, equipment, and vegetation caused by, or resulting in whole or in part from occurrences beginning during the Correction Period and are the result of defects in Materials, Equipment, and workmanship. The Contractor shall be responsible for all costs associated with completing the repair of the defects and for associated Work including but not limited to permitting, mobilization, traffic control, erosion control, surface restoration, site cleanup and remediation caused by, or resulting in whole or in part from, defects in Materials, Equipment, or workmanship, and other Work determined by the Engineer to be necessary to complete the repair of the defects.

Within 10 Calendar Days of the Agency's written notice of defects, the Contractor, or the Contractor's Surety, shall vigorously and continuously correct and repair the defects and all related damage. If the Contractor or the Contractor's Surety fails to correct and repair the defects, the Agency may have the correction and repair done by others. The Contractor or Contractor's Surety shall promptly reimburse the Agency for all expenses incurred to correct and repair the defects.

In the event of an emergency, where delay could result in serious loss or damage, the Agency may make emergency corrections and repairs, without written notice. The Contractor or Contractor's Surety shall promptly reimburse the Agency for all expenses incurred to correct and repair the defects.

Corrections, repairs, replacements or changes shall be warranted for an additional one year period beginning on the date of the Agency's acceptance of the corrections, repairs, replacements or changes.

Without limiting the general applicability of other survival clauses under the Contract, this warranty provision shall survive expiration or termination of the Contract.

(c) Manufacturer, Installer or Supplier Warranties and Guarantees:

(1) Manufacturer, Installer or Supplier Warranties - For those Specification Sections referencing this 00170.85(c-1) Subsection, the Contractor shall furnish Warranties from the Manufacturer, Installer or Supplier and signed by an authorized Representative.

The warranty period will be specified in the applicable Specification Section for which it applies.

The warranty period will begin on the date the Engineer issues Second Notification unless otherwise specified in the Contract.

Corrections, repairs, replacements or changes shall be warranted for an additional Warranty period beginning on the date of the Agency's acceptance of the corrections, repairs, replacements or changes.

When the Agency makes written notification to the Manufacturer of failure of an item covered by this warranty, the warranty period will stop for the effected item or the portion of the effected item that failed, as applicable, until the required repairs or replacements are made and accepted. All repaired or replaced items shall meet current specifications, unless otherwise specified in the Contract, and will be warranted for the remaining warranty period.

Warranty work shall be performed when weather permits. If, in the opinion of the Engineer, temporary repairs are necessary, the temporary repairs will be made by the Agency or an independent

contractor at the Manufacturer's expense. The Manufacturer shall replace all temporary repairs at no additional cost to the Agency.

The Manufacturer shall provide all required traffic control during repair or replacement of failed items at no additional cost to the Agency.

(2) Trade Practice Guarantees - For those Items installed on the Project that have customary trade practice guarantees, the Contractor shall furnish the guarantees to the Engineer at the completion of the Contract.

00170.89 Protection of Utility, Fire-control, and Railroad Property and Services; Repair; Roadway Restoration:

(a) Protection of Utility, Fire-Control, and Railroad Property and Services; Coordination - The Contractor shall avoid damaging the properties of Utilities, Railroads, railways, and fire-control authorities during performance of the Work. The Contractor shall cooperate with and facilitate the relocation or repair of all Utilities and Utility services, as required under 00150.50, and of Railroad and fire-control property and railways.

The Contractor shall conduct no activities of any kind around fire hydrants until the local fire-control authority has approved provisions for continued service.

The Contractor shall immediately notify any Utility, Railroad, or fire-control authority whose facilities have been damaged.

If an Entity has a valid permit from the proper authority to construct, reconstruct, or repair Utility, Railroad, or fire-control service in the Roadway, the Contractor shall allow the permit holder to perform the work.

(b) Restoration of Roadway after Repair Work - The Contractor shall restore the Roadway to a condition at least equal to that which existed before the repair work addressed under this Subsection was performed, as directed by the Engineer. All restoration work required as a result of Contractor’s failure to protect Utilities, Railroads, railways and fire-control facilities shall be at the Contractor’s expense. Restoration which constitutes Extra Work will be paid as Extra Work.

00170.92 Fencing, Protecting Stock, and Safeguarding Excavations - The Contractor shall be responsible for loss, injury, or damage that results from its failure to restrain stock and persons.

(a) At the Contractor's Expense - The Contractor shall restrain stock to lands on which they are confined using temporary fences or other adequate means. The Contractor shall provide adequate temporary fences or other protection around excavations to prevent animals and unauthorized persons from entering.

The Contractor shall repair, at Contractor's expense and to the Engineer's satisfaction, fences damaged by the Contractor's operations and the operations of the Contractor's agents, employees and Subcontractors.

(b) At the Agency's Expense - The Contractor shall construct fences, or move and reconstruct fences, as shown on the Contract Documents or as directed by the Engineer. The Contractor shall tear down and remove fencing within the Right-of-Way when no longer needed, as part of the removal Work described in and paid for according to Section 00310.

00170.93 Trespass - The Contractor shall be responsible for its own, its agents' and employees', and its Subcontractors' trespass or encroachment upon, or damage to, property during performance of the Contract.

00170.94 Use of Explosives - The Contractor shall comply with all Laws pertaining to the use of explosives. The Contractor shall notify anyone having facilities near the Contractor's operations of Contractor's intended use or storage of explosives. The Contractor shall be responsible for all damage resulting from its own, its agents' and employees', and its Subcontractors' use of explosives. (see 00330.41(e) and Section 00335)

00170.95 Unlawful Discrimination Policy - Agency – It is the policy of the City of Warrenton that no person shall be denied the benefits of or be subjected to discrimination in any City program, service, or activity on the grounds of age, disability, race, religion, color, national origin, sex, sexual orientation, gender identity and expression. The City of Warrenton also requires its contractors and grantees to comply with this policy.

Section 00180 - Prosecution and Progress

00180.00 Scope - This Section consists of requirements for assignment of the Contract, subcontracting, time for performance, Contract responsibility, suspensions, terminations, and related provisions.

00180.05 Assignment/Delegation of Contract - Unless the Agency gives prior written consent, the Contractor shall not assign, delegate, sell, or transfer to any Entity, or otherwise dispose of any Contract rights or obligations, including without limitation:

- The power to execute or perform the Contract; or
- Any of its right, title or interest in the Contract.

Any attempted assignment, delegation, or disposition without prior Agency consent shall be void.

Such Agency consent will not normally be given except for the assignment of funds due under the Contract, as provided in 00180.06.

If written Agency consent is given to assign, delegate, or otherwise dispose of any Contract rights or obligations, it shall not relieve the Contractor or its Surety of any part of their responsibility under the Contract.

00180.06 Assignment of Funds Due under the Contract - Assignment of funds due or to become due under the Contract to the Contractor will not be permitted unless:

- The assignment request is made on the form acceptable to the Agency;
- The Contractor secures the written consent of the Contractor's Surety to the assignment; and
- The Engineer approves the assignment.

00180.10 Responsibility for Contract - The Contractor shall direct and coordinate the operations of its employees, Subcontractors and agents performing Work, and see that the Engineer's orders are carried out promptly. The Contractor's failure to direct, supervise and control its employees, Subcontractors and agents performing Work will result in one or more of the following actions, or other actions as the Engineer deems appropriate:

- Suspension of the Work;
- Withholding of Contract payments, as necessary to protect the Agency;
- Ordering removal of individuals from the Project Site; or
- Termination of the Contract.

Action by the Agency under this provision will not prejudice any other remedy it may have.

00180.15 Agency's Right to Do Work at Contractor's Expense - Except as otherwise provided in 00150.75 and 00220.60, if the Contractor neglects to prosecute the Work properly or fails to perform any provision of the Contract, the Agency may, after 2 Calendar Days' written notice, correct the deficiencies at the Contractor's expense. In situations where the Engineer reasonably believes there is danger to life or property, the Agency may immediately and without notice correct the deficiencies at the Contractor's expense.

Action by the Agency under this provision will not prejudice any other remedy it may have.

00180.20 Subcontracting Limitations:

(a) General - The Contractor's own organization shall perform Work amounting to at least the percentage of the original Contract Amount as indicated in the Special Provisions. The value of subcontracted Work is the full compensation to be paid to the Subcontractor(s) for all pay items in the Subcontract(s).

(b) Own Organization - The term "own organization", as used in Section 00180, includes only employees of the Contractor, Equipment owned or rented by the Contractor, Incidental rental of operated Equipment, and Materials and Equipment to be incorporated into the Work purchased or produced by the Contractor.

(c) Rental of Operated Equipment - For projects funded by FWHA, the Agency will not allow a Disadvantaged Business Enterprise (DBE) firm to provide services without a subcontract covering all Work to be performed by the DBE firm. For non-DBE firms, the use of Equipment rented with operators will be allowed without a subcontract only when the following requirements are met:

(1) Written Request - The Contractor has submitted to the Engineer a written request describing the service to be provided, its estimated cost, and the estimated duration. The Engineer must approve the request before the service is provided.

(2) Limitations - The use of Equipment rented with operators is limited to the following services:

- Truck hauling of Materials (If the trucking is by an owner/operator, in addition to the requirements of 00170.65(e), each truck shall have the name of the owner/operator clearly displayed on the side of the truck); or
- Performing minor, Incidental, short-duration work under the direct supervision of the Contractor or Subcontractor, with Equipment not customarily owned, leased, or operated by a Contractor, or with Equipment that is temporarily unavailable to the Contractor.

(3) Submittals - The Contractor shall provide the Engineer with a copy of the rental agreement or purchase order covering the service to be provided. For owner/operator trucking, attach copies of the data required under 00170.65(e). The Contractor shall make certain that the provider of approved services submits payrolls required under Section 00170 and complies with applicable Contract provisions, including without limitation 00170.07. The service provider will not be considered a Subcontractor under the Contract, but will be considered an agent of the Contractor in the performance of Work.

(4) Revocation of Approval - The Engineer may revoke approval for the services provided through rented, operated Equipment at any time the Engineer determines that the work is outside that authorized under 00180.20(c-2). Unless the Contractor promptly submits to the Engineer a subcontract agreement for consent under 00180.21, the service provider shall be immediately removed from the Project Site.

00180.21 Subcontracting:

(a) Substitution of Disclosed Subcontractors - The Contractor may only substitute a previously disclosed first-tier Subcontractor according to the provisions of ORS 279C.585. The Contractor shall provide the Engineer with a written notification that identifies the name of the proposed new Subcontractor and the reason for the substitution. Authorized reasons for substitution are limited to the following circumstances (see ORS 279C.585(1) through ORS 279C.585(10)):

- The disclosed Subcontractor fails or refuses to execute a written contract that is reasonably based either upon the Project Plans and Specifications, or the terms of the Subcontractor's written Bid, after having had a reasonable opportunity to do so;
- The disclosed Subcontractor becomes bankrupt or insolvent;
- The disclosed Subcontractor fails or refuses to perform the contract;
- The disclosed Subcontractor fails or refuses to meet the bond requirements of the prime Contractor that had been identified prior to the Bid submittal;
- The Contractor demonstrates to the Agency that the Subcontractor was disclosed as the result of an inadvertent clerical error;
- The disclosed Subcontractor does not hold a license from the Construction Contractors Board and is required to be licensed by the board;
- The Contractor determines that the Work performed by the disclosed Subcontractor is not in substantial compliance with the Plans and Specifications, or that the Subcontractor is substantially delaying or disrupting the progress of the Work;
- The disclosed Subcontractor is ineligible to work on a public improvement according to the applicable statutory provisions;
- The substitution is for "good cause" as defined by State Construction Contractors Board rule; or
- The substitution is reasonably based on the Contract alternates chosen by the Agency.

(b) Terms of Subcontracts - Subcontracts shall provide that work performed under the subcontract shall be conducted and performed according to the terms of the Contract. Compliance with 00170.07 is required. All subcontracts, including Contractor's with the first-tier Subcontractors and those of the first-tier Subcontractors with their subcontractors, and any other lower tier subcontracts shall contain a clause or condition that if the Contractor or a subcontractor fails, neglects, or refuses to make payment to an Entity furnishing labor or Materials in connection with the Contract, the Entity may file a complaint with the Construction Contractors Board, unless payment is subject to a good-faith dispute as defined in ORS 279C.580. Additionally, according to the provisions of ORS 279C.580, subcontracts shall include:

(1) A payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under the subcontract within 10 Calendar Days out of amounts the Agency pays to the Contractor under the Contract.

(2) A clause that requires the Contractor to provide the first-tier Subcontractor with a standard form that the first-tier Subcontractor may use as an application for payment or as another method by which the Subcontractor may claim a payment due from the Contractor.

(3) A clause that requires the Contractor, except as otherwise provided in this subsection, to use the same form and regular administrative procedures for processing payments during the entire term of the subcontract. The Contractor may change the form or the regular administrative procedures the Contractor uses for processing payments if the Contractor:

- Notifies the Subcontractor in writing at least 45 Calendar days before the date on which the Contractor makes the change; and
- Includes with the written notice a copy of the new or changed form or a description of the new or changed procedure.

(4) An interest penalty clause that obligates the Contractor, if the Contractor does not pay the first-tier Subcontractor within 30 Calendar Days after receiving payment from the Agency, to pay the first-tier Subcontractor an interest penalty on amounts due in each payment the Contractor does not make in accordance with the payment clause included in the subcontract under 00180.21(d-1). The Contractor or first-tier Subcontractor is not obligated to pay an interest penalty if the only reason that the Contractor or first-tier Subcontractor did not make payment when payment was due is that the Contractor or first-tier Subcontractor did not receive payment from the Agency or the Contractor when payment was due. The interest penalty applies to the period that begins on the day after the required payment date and ends on the date on which the amount due is paid; and shall be computed at the rate specified in 00170.10(c).

(5) A clause that requires the Contractor's first-tier Subcontractor to include a payment clause and an interest penalty clause that conform to the standards of ORS 279C.580 (see 00180.21(d-1) and 00180.21(d-4)) in each of the first-tier Subcontractor's subcontracts and to require each of the first-tier Subcontractor's subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or Material supplier.

These payment clauses shall require the Contractor to return all retainage withheld from the Subcontractor, whether held by the Contractor or the Agency, as specified in 00195.50(d).

As required by ORS 279C.800 through ORS 279C.870, subcontracts shall include:

- A provision requiring the subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work on the Project, unless exempt.
- A provision requiring that the workers shall be paid not less than the specified minimum hourly rate of wage.

(c) Contractor's Responsibilities - The Contractor shall remain solely responsible for administration of the subcontract, including but not limited to:

- Performance of subcontracted Work;
- Progress of subcontracted Work;
- Payments for accepted subcontracted Work; and
- Disputes and claims for additional compensation regarding subcontracted Work.

It shall be the direct responsibility of the Contractor to ensure that each and every subcontractor will not only be issued a complete and current set of Plans and Specifications, but also that these Plans and Specifications are on the project site and in use by the subcontractor when it is performing its portion of the project.

Subcontracted Work shall not create a contract between the Agency and the Subcontractor, will not convey to the Subcontractor any rights against the Agency, and will not relieve the Contractor or the Contractor's Surety of any of their responsibilities under the Contract.

(f) Failure to Comply - Failure to comply with 00180.21 will be cause for the Engineer to take action reasonably necessary to obtain compliance. This action may include, but is not limited to:

- Suspension of the Work;
- Withholding of Contract payments as necessary to protect the Agency; and
- Termination of the Contract.

00180.22 Payments to Subcontractors and Agents of the Contractor - To the extent practicable, the Contractor shall pay in the same units and on the same basis of measurement as listed in the Schedule of Items for subcontracted Work or other Work not done by the Contractor's own organization. In making payment to Subcontractors and to its other agents performing Work and furnishing Materials and Equipment to be incorporated into the Work, the Contractor shall assume all losses resulting from overpayment.

If requested in writing by a first-tier Subcontractor, the Contractor shall send to the Subcontractor, within 10 Calendar Days of receiving the request, a copy of that portion of any invoice or request for payment submitted to the Agency, or pay document provided by the Agency to the Contractor, specifically related to any labor, Equipment, or Materials supplied by the first-tier Subcontractor.

00180.30 Materials, Equipment, and Work Force - The Contractor shall furnish suitable and sufficient Materials, Equipment, and personnel to properly prosecute and complete the Work. The Contractor shall use only Equipment of adequate size and condition to meet the requirements of the Work and Specifications, and to produce a satisfactory quality of Work. Upon receipt of the Engineer's written order, the Contractor shall immediately remove, and not use again on the Project without the Engineer's prior written approval, Equipment that, in the Engineer's opinion, fails to meet Specifications or produce a satisfactory product or result.

The work force shall be trained and experienced for the Work to be performed. Upon receipt of the Engineer's written order, the Contractor shall immediately remove from the Project Site, and shall not employ again on the Project without the Engineer's prior written approval, any supervisor or employee of

the Contractor or any subcontractor who, in the Engineer's opinion, does not perform satisfactory Work or whose conduct interferes with the progress of the Work.

If the Contractor fails to remove Equipment or persons as ordered, or fails to furnish suitable and sufficient Materials, Equipment and personnel for the proper prosecution of the Work, the Engineer may suspend the Work by written notice until such orders are complied with and such deficiencies are corrected, or the Engineer may terminate the Contract under the provisions of 00180.90(a).

00180.31 Required Materials, Equipment, and Methods - The Engineer's decisions under this Section are final.

(a) General - When the Equipment and methods to be used are not specified in the Contract, any Equipment or methods that accomplish the Work as required by the Contract will be permitted.

When the Contract specifies certain Equipment or methods, the Contractor shall use the Equipment or methods specified unless otherwise authorized by the Engineer in writing.

(b) Substitution of Materials and Equipment to be Incorporated into the Work - After execution of the Contract, the Engineer may approve substitution of Materials and Equipment to be incorporated into the Work as follows:

(1) Reasons for Substitution - The Engineer will consider substitution only if:

- In the judgement of the Engineer, the proposed Materials or Equipment are equal to or superior to the specified items in construction, efficiency and utility; or
- Due to reasons beyond the control of the Contractor, the specified Materials or Equipment cannot be delivered to the Project in sufficient time to complete the Work in proper sequence.

(2) Submittal of Request - The Contractor shall submit requests for substitution to the Engineer, including manufacturers' brochures and other information needed to verify equality of the proposed item(s).

(c) Substitution of Equipment Specified to Perform Work - The Agency encourages development of new or improved Equipment and innovative use of Equipment. When the Specifications require Equipment of a particular size or type to be used to perform certain portions of the Work, the Contractor may submit a request to the Engineer to use Equipment of a different size or type. The request will not be considered as a cost reduction proposal under 00140.70. The request shall:

- Be in writing and include a full description of the Equipment proposed and its intended use;
- Include the reasons for requesting the substitution; and
- Include evidence, obtained at the Contractor's expense and satisfactory to the Engineer, that the proposed Equipment is capable of functioning as well as or better than the specified Equipment.

The Engineer will consider the Contractor's request and will provide a written response to the Contractor, either permitting or denying use of the proposed Equipment.

Permission may be granted on a trial basis to test the quality of Work actually produced, subject to the following:

- There will be no cost to the Agency, either in Contract Amount or in Contract Time;
- The permission may be withdrawn by the Engineer at any time if, in the Engineer's opinion, the Equipment is not performing in all respects equivalent to the Equipment specified in the Contract;
- If permission is withdrawn, the Contractor shall perform the remaining Work with the originally-specified Equipment; and
- The Contractor shall remove and replace nonspecification Work resulting from the use of the Contractor's proposed Equipment, or otherwise correct it as the Engineer directs, at no additional compensation.

(d) Substitution of Methods - The Agency encourages development of new, improved, and innovative construction methods. When the Plans or Specifications require a certain construction method for a portion of the Work, the Contractor may submit a request for a change by following the provisions of 00140.70, "Cost Reduction Proposals".

00180.32 Alternative Materials, Equipment, and Methods - Whenever the Contract authorizes certain alternative Materials, Equipment, or methods of construction for the Contractor's use to perform portions of the Work, and leaves the selection to the Contractor, the Agency does not guarantee that all listed alternative Materials, Equipment, or methods of construction can be used successfully throughout all or any part of the Work.

The Contractor shall employ only those alternatives that can be used to satisfactorily perform the Work. No additional compensation will be paid for corrective work necessitated by the Contractor's use of an inappropriate alternative.

00180.40 Limitation of Operations:

(a) In General - The Contractor shall comply with all Contract provisions and shall:

- Conduct the Work at all times so as to cause the least interference with traffic, and
- Not begin Work that may allow damage to Work already started.

(b) On-Site Work - The Contractor shall not begin On-Site Work until the Contractor has:

- Received Notice to Proceed;

- Filed with the Construction Contractors Board the public works bond as required in 00170.20;
- An approved Project Work schedule;
- An approved Traffic Control Plan;
- An approved Spill Prevention Control and Countermeasure Plan, if required;
- An approved Pollution Control Plan;
- An approved Erosion and Sediment Control Plan;
- Met with the Engineer at the required preconstruction conference; and

Assembled all Materials, Equipment, and labor on the Project Site, or has reasonably assured that they will arrive on the Project Site, so the Work can proceed according to the Project Work schedule.

00180.41 Project Work Schedules - The Contractor shall submit a Project Work schedule meeting the requirements of this Subsection to the Engineer. The Project Work schedule is intended to identify the sequencing of activities and time required for prosecution of the Work. The schedule is used to plan, coordinate, and control the progress of construction. Therefore, the Project Work schedule shall provide for orderly, timely, and efficient prosecution of the Work, and shall contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities.

The Contractor shall submit a schedule or plan for each activity that is behind schedule showing, in sufficient detail, the proposed corrective action to complete Contract Work within the Contract Time. Sufficient detail shall include all required double shifts, overtime work, or combination of both.

Contractor's activity related to developing, furnishing, monitoring, and updating these required schedules is Incidental.

The Contractor shall submit a supplemental "look ahead" Project Work schedule to the Engineer prior to or at each Progress Meeting. The "look ahead" Project Work schedule is supplemental to the Type A, B, or C schedule specified below. The supplemental "look ahead" Project Work schedule shall:

- Identify the sequencing of activities and time required for prosecution of the Work.
- Provide for orderly, timely, and efficient prosecution of the Work.
- Contain sufficient detail to enable both the Contractor and the Engineer to plan, coordinate, analyze, document, and control their respective Contract responsibilities.

The supplemental "look ahead" Project Work schedule shall be written in common terminology and show the planned Work activities broken down into logical, separate activities by area, stage, and size and include the following information:

- The resources the Contractor, subcontractors, or services will use.
- The locations of each activity that will be done including the limits of the work by mile posts, stations, or other indicators.
- The time frames of each activity by Calendar Days, shifts, and hours.
- All anticipated shoulder, lane, and road closures.

At a minimum, the Contractor shall prepare a bar chart that:

- Shows at least 3 weeks of activity including the week the bar chart is issued.
- Uses a largest time scale unit of 1 Calendar Day. Smaller time scale units may be used if needed.
- Is appropriate to the activities.
- Identifies each Calendar Day by month and day.

Include the Contract name, Contract number, Contractor's name, and date of issue on each page of the bar chart.

The Contractor shall submit the supplemental "look ahead" Project Work schedule starting at First Notification and continuing each week until Second Notification has been issued and all punch list items and final trimming and clean-up has been completed. The Contractor shall meet with the Engineer each week to review the supplemental "look ahead" Project Work schedule. If the Engineer or the Contractor determines that the current supplemental "look ahead" Project Work schedule requires changes or additions, either notations can be made on the current schedule or the Engineer may require the submittal of a revised supplemental "look ahead" Project Work schedule. Review of the current and subsequent supplemental "look ahead" Project Work schedules does not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

One of the following Type "A", "B", or "C" schedules will be required under the Contract. The type of schedule will be identified in the Special Provisions.

(a) Type "A" Schedule - When a Type "A" schedule is required, the Contractor shall do the following:

(1) Schedule -At the preconstruction conference, the Contractor shall provide to the Engineer four copies of a Project Work schedule, including a time-scaled bar chart and narrative, showing:

- Expected beginning and completion dates of each activity, including all staging; and
- Elements of the Traffic Control Plan as required under 00225.05.

The schedule shall show detailed Work activities as follows:

- Construction activities;
- The time needed for completion of the utility relocation work;
- Submittal and approval of Materials samples and shop drawings;
- Fabrication, installation, and testing of special Materials and Equipment; and
- Duration of Work, including completion times of all stages and their sub phases.

For each activity, the Project Work schedule shall list the following information:

- A description in common terminology;
- The quantity of Work, where appropriate, in common units of measure;
- The activity duration in Calendar Days; and
- Scheduled start, completion, and time frame shown graphically using a time-scaled bar chart.

The schedule shall show the Work broken down into logical, separate activities by area, stage, or size. The duration of each activity shall be verifiable by manpower and Equipment allocation, in common units of measure, or by delivery dates.

The bar chart shall be prepared as follows:

- The length of bar shall represent the number of workdays scheduled.
- The time scale shall be appropriate for the duration of the Contract.
- The time scale shall be in Calendar Days.
- The smallest unit shown shall be 1 Calendar Day.
- The first day and midpoint of each month shall be identified by date.
- Distinct symbols shall be used to denote multiple shift, holiday, and weekend Work.

Each page of the bar chart shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the bar chart shall be drawn on a reasonable size of paper up to a maximum of 36 inch by 36 inch, using multiple sheets when needed.

Within 7 Calendar Days after the preconstruction conference, the Engineer and the Contractor shall meet to review the Project Work schedule as submitted. The Engineer will review the schedule for compliance with all Contract Time limitations and other restraints. Review of this and subsequent schedules by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract. Within 10 Calendar Days of this meeting, the Contractor shall resubmit to the Engineer four copies of the Project Work schedule, including required revisions.

(2) Review by the Engineer - The Project Work schedule may need revision as the Work progresses. Therefore, the Contractor shall periodically review the Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the Project Work schedule.

The Contractor shall compile an updated Project Work schedule incorporating any changes to the Project completion time(s). The bar chart shall reflect the updated information. The Contractor shall submit four copies of the updated Project Work schedule to the Engineer within 7 Calendar Days after the meeting. The report shall include without limitation the following:

- Sufficient narrative to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule; and
- Proposed corrective actions.

(b) Type "B" Schedule - When a Type "B Schedule is required, the Contractor shall do the following:

(1) Initial Schedule - 5 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer four copies of a time-scaled bar chart Project Work schedule showing:

- Expected beginning and completion date of each activity, including all staging; and
- Elements of the Traffic Control Plan as required under 00225.05.

The initial schedule shall show all Work intended for the first 60 Days of the Contract to the level of detail described in (2) below, and shall show the priority and interdependence (sequencing and network logic) of all major segments of the remainder of the Work.

(2) Detailed Schedule - In addition to the above requirements, and within 30 Calendar Days after the Notice to Proceed, the Contractor shall provide the Engineer one digital copy and four paper copies of a detailed time-scaled bar chart Project Work schedule indicating the critical course of the Work. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer.

Detailed work schedule activities shall include the following:

- Construction activities;
- The time needed for completion of the utility relocation work;
- Submittal and approval of Material samples and shop drawings;
- Procurement of critical Materials;
- Fabrication, installation, and testing of special Material and Equipment; and
- Duration of Work, including completion times of all stages and their sub phases.

For each activity, the Project Work schedule shall list the following information:

- A description in common terminology;
- The quantity of Work, where appropriate, in common units of measure;
- The activity duration in normal workdays; and
- Scheduled start, completion, and time frame shown graphically using a time-scaled bar chart.

The schedule shall show the Work broken down into logical, separate activities by area, stage, or size. The duration of each activity shall be verifiable by manpower and Equipment allocation, in common units of measure, or by delivery dates.

The bar chart shall be prepared as follows:

- The length of bar shall represent the number of normal workdays scheduled.
- The time scale shall be appropriate for the duration of the Contract.
- The time scale shall be in normal workdays (every day except Saturday, Sunday, and legal holidays).
- The smallest unit shown shall be 1 Calendar Day.

- The first day and midpoint of each month shall be identified by date.
- Distinct symbols shall be used to denote multiple shift, holiday, and weekend Work.

The bar chart drawing(s) shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the bar chart shall be drawn on a reasonable size of paper up to a maximum of 36 inch x 36 inch, using multiple sheets when needed.

Within 10 Calendar Days after submission of the Project schedule the Engineer and the Contractor shall meet to review the Project schedule as submitted. Within 10 Days of the review meeting, the Contractor shall resubmit to the Engineer one digital and four paper copies of the Project schedule, including required revisions.

The accepted Project schedule shall represent all Work, as well as the planned sequence and time for the Work. Review of this and subsequent schedules by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(3) Review and Reporting - The Project Work schedule may require revision as the Work progresses. Therefore, the Contractor shall monitor and when necessary revise the Project Work schedule as follows:

a. Review with the Engineer - The Contractor shall perform ongoing review of the Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the Project Work schedule. After any necessary action has been agreed upon, the Contractor shall make required changes to the Project Work schedule.

The Contractor shall collect information on all activities worked on or scheduled to be worked on during the previous report period, including shop drawings, Material procurement, and Contract Change Orders that have been issued. Information shall include commencement and completion dates on activities started or completed, or if still in progress, the remaining time duration.

The Contractor shall develop detailed sub-networks to incorporate changes, Additional Work, and Extra Work into the Project Work schedule. Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. The restraints shall include those activities from the Project Work schedule that initiated the sub-network as well as those restrained by it.

The Contractor shall evaluate this information and compare it with the Contractor's project schedule. If necessary, the Contractor shall make an updated bar chart schedule to incorporate the effect changes may have on the Project completion time(s). For any activity that has started, the Contractor shall add a symbol to show the actual date the activity started and the number of normal workdays remaining until completion. For activities that are finished, a symbol shall be added to show the actual date. The Contractor shall submit one digital and four paper copies of the updated

bar chart to the Engineer within 7 Days after the progress meeting, along with a progress report as required by "b." below.

b. Progress Report - The Contractor shall submit a progress report to the Engineer each month. The report shall include the following:

- Sufficient narrative to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule; and
- Proposed corrective actions.

(c) Type "C" Schedule - When a Type "C" Schedule is required, the Contractor shall do the following:

(1) Initial Schedule - 10 Calendar Days prior to the preconstruction conference, the Contractor shall provide to the Engineer one digital copy and four paper copies of a time-scaled bar chart Project Work schedule. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer. The initial schedule shall show:

- The expected beginning and completion date of each activity, including all stages and phases;
- The time needed for completion of the utility relocation work; and
- The elements of the traffic control plan as required under 00225.05.

A logic diagram and a time-scaled bar chart will be acceptable in lieu of a time-scaled logic diagram.

The initial schedule shall show all Work intended for the first 60 Days of the Contract to the level of detail described in (2) below, and shall show the priority and interdependence (sequencing and network logic) of all major segments of the remainder of the Work.

(2) Detailed Project Work Schedule - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide the Engineer one digital copy and four paper copies of a detailed time-scaled critical path method (CPM) network Project Work schedule and computer analysis printout, both clearly indicating the critical path. The digital copy shall be compatible with MS Project 2003, Primavera P3, SureTrak Project Manager 3.0, or another scheduling program approved by the Engineer. The first submitted detailed time-scaled critical path method (CPM) network Project Work schedule shall also contain a listing of the quantity of Work for each activity, when appropriate, in common units of measure.

Detailed work schedule activities shall include the following:

- Construction activities;
- Any limitations of operation specified in 00180.40;
- The time needed for completion of the utility relocation work;
- Implementation of TCP for each stage and phase;
- Submittal and approval of Material samples, mix designs, and shop drawings;

- Agency timeframes to process and return Contractor submitted plans, working drawings, equipment lists and other submittals;
- Procurement of critical Materials;
- Fabrication, installation, and testing of special Material and Equipment;
- Duration of Work, including completion times of all stages and their sub-phases; and
- Specified cure times for all concrete elements.

The activities shall be separately identifiable by coding or use of sub-networks or both. The duration of each activity shall be verifiable and consistent with the description in the Project narrative required in (3) below.

Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. In the restraints, include those activities from any Project Work schedule that initiated the sub-network as well as those restrained by it.

The time scale used on the Contractor's detailed time-scaled critical path method (CPM) network Project Work schedule shall be appropriate for the duration of the activities and the Project duration. The time scale shall be in normal workdays, defined as every day except Saturday, Sunday and legal holidays, with calendar dates identified no less than the first and midpoint of each calendar month. The smallest unit shown shall be 1 Day. The network shall show the length of the activity or part scaled to accurately represent the number of normal workdays scheduled. Distinct symbols or graphics shall be used to show multiple shift, holiday, or weekend work.

The schedule network drawing(s) shall include a title block showing the Contract name and number, Contractor's name, date of original schedule, and all update dates; and a legend containing the symbols used, their definitions, and the time scale, shown graphically. To ensure readability the drawings shall be on a reasonable size of paper up to a maximum of 36 inch x 36 inch, using multiple sheets when needed.

The Contractor shall include a tabulation of each activity in the computer mathematical analysis of the network diagram. The following information represents the minimum required for each activity:

- Event (node) number(s) for each activity;
- Maintain event (node) numbers throughout the Project;
- Activity description;
- Original duration of activities (in normal workdays);
- Estimated remaining duration of activities (in normal workdays);
- Earliest start date and actual start date (by calendar date);
- Earliest finish date and actual finish date (by calendar date);
- Latest start date (by calendar date);
- Latest finish date (by calendar date); and
- Slack or float time (in workdays).

Computer print-outs shall consist of at least a node sort and an "early start/total-float" sort.

Within 14 Calendar Days after submission of the detailed time-scaled critical path method (CPM) network Project Work schedule, the Engineer and the Contractor shall meet to review the detailed time-scaled critical path method (CPM) network Project Work schedule as submitted. Within 7 Calendar Days of the meeting, the Contractor shall resubmit to the Engineer one digital and four paper copies of the detailed time-scaled critical path method (CPM) network Project Work schedule, including required revisions.

This first accepted detailed time-scaled critical path method (CPM) network Project Work schedule, also called the accepted Project Work schedule, shall represent all Work, as well as the planned sequence and time for the Work. Review and acceptance of any Project Work schedules and Project narratives by the Engineer shall not relieve the Contractor of responsibility for timely and efficient execution of the Contract.

(3) Project Narrative - In addition to the above requirements, and within 30 Calendar Days after First Notification, the Contractor shall provide to the Engineer a final written Project narrative that discusses the planning, coordinating, scheduling and resourcing of the Work. The Project narrative shall include the following written description:

- Plans for staging the project.
- All critical activities.
- All near critical activities defined as those with less than 30 Days of float.
- All subcontractor activities that are critical, near critical, and those that are greater than two weeks in duration.
- Labor resourcing, by stage and phase, to include the number of crews, average crew size and planned night/weekend shifts including that of subcontractors.
- Equipment allocation, by stage and phase to include mobilization, demobilization and planned activities including that of subcontractors.
- Notifications required under the Contract during each stage and phase which may include but is not limited to road closures, lanes closures, night work, cold plane pavement removal, and pile driving.
- Provide discussion on addressing reasonably predictable weather conditions and their impact on all weather sensitive activities. Also, provide discussion on other weather limitations that may affect the project schedule.
- Submittal and approval of material samples, mix designs, and shop drawings.
- Procurement of critical materials.
- Plans for dealing with "unique" construction items.
- Coordination of utilities and any immediate concerns for impacts/delays.
- Constructability issues.
- Cost Reduction Proposals and/or immediate requests for changes to the specifications.
- Concerns/issues that need to be addressed within the first 90 Days following First Notification.

The accepted Project narrative shall represent all critical and near critical Work, as well as the planned sequence and time for the Work.

(4) Review and Reporting - The Project Work schedule may require revision as the Work progresses. Therefore, the Contractor shall monitor and when necessary revise the Project Work schedule as follows:

a. Review with the Engineer - The Contractor shall perform ongoing review of the accepted Project Work schedule and progress of the Work with the Engineer. If the Engineer or the Contractor determines that the accepted Project Work schedule no longer represents the Contractor's own plans or expected time for the Work, a meeting shall be held between the Engineer and the Contractor. At this meeting, the Contractor and the Engineer shall review Project events and any changes for their effect on the accepted Project Work schedule. After any necessary action has been agreed upon, the Contractor shall make required changes to the accepted Project Work schedule and associated Project narrative. Upon acceptance by the Engineer, this will become the new accepted Project Work schedule and associated Project narrative.

The Contractor shall collect information on all activities worked on or scheduled to be worked on during the previous report period, including shop drawings, Material procurement, and Contract Change Orders that have been issued. Information shall include actual start and completion dates on activities started or completed, or if still in progress, the remaining time duration.

The Contractor shall develop detailed sub-networks to incorporate changes, Additional Work, and Extra Work into the Project Work schedule. Detailed sub-networks shall include all necessary activities and logic connectors to describe the Work and all restrictions on it. The restraints shall include those activities from the Project Work schedule that initiated the sub-network as well as those restrained by it. The procedure for acceptance of the revised or updated Project Work schedule as the new accepted Project Work schedule will be as provided above.

The Contractor shall evaluate this information each month and compare it with the accepted Project Work schedule. The Contractor shall make an updated bar chart schedule to incorporate the effect changes may have on the Project completion time(s). For any activity that has started, the Contractor shall add a symbol to show the actual date the activity started and the number of normal workdays remaining until completion. For activities that are finished, a symbol shall be added to show the actual date. The Contractor shall submit , digitally and in paper, copies of the updated bar chart to the Engineer within 7 Days after the progress meeting, along with a progress report as required by "b." below.

b. Progress Report - Each month the Contractor shall submit a progress report and an update of the Project Work schedule to the Engineer. The report and updated schedule shall be submitted both digitally and in paper copy and shall include the following:

- A sufficient description, in narrative form, to describe the past progress, anticipated activities, and stage Work;
- A description of any current and expected changes or delaying factors and their effect on the construction schedule;
- Proposed corrective actions;

- Proposals to keep the Project on schedule in the event of a delay; and
- Any changes to the logic as compared to the accepted Project Work schedule.

(d) Substitution of Schedules - When a Type "A" schedule is required, a Type "B" or Type "C" schedule may be substituted for the Type "A" schedule.

When a Type "B" schedule is required, a Type "C" schedule may be substituted for the Type "B" schedule.

(e) Specified Contract Time Not Superseded by Schedule Revisions - The completion dates in any Project Work schedule and any revised or updated Project Work schedules shall be within the Contract Time(s) specified for the Project, or within adjusted Contract Times approved according to 00180.80(c). Acceptance of any Project Work schedule or any revised or updated Project Work schedules shall not constitute approval of any completion dates that exceed such Contract Time(s). If the Contractor believes that additional Contract Time is due, the Contractor shall submit, with a revised Project Work schedule, a request for adjustment of Contract Time according to 00180.80(c). A request for an adjustment of Contract Time will be evaluated using the most recently accepted Project Work schedule.

(f) Float Time - Float time shown on the Project Work schedule, including any time between a Contractor's scheduled completion date and the specified Contract Time(s), does not exist for the exclusive use of either party to the Contract and belongs to the Project.

(g) Schedules Do Not Constitute Notice - Submittal of a Project Work schedule, with supporting Project narrative, does not constitute or substitute for any notice the Contractor is required under the terms of the Contract to give the Agency.

(h) Failure to Provide Schedule - The Project Work schedule is essential to the Agency. The Contractor's failure to provide the schedule, schedule information, progress reports, Project narratives, or schedule updates when required will be cause to suspend the Work, or to withhold Contract payments as necessary to protect the Agency, until the Contractor provides the required information to the Engineer.

00180.42 Preconstruction Conference - Unless otherwise approved in writing by the Engineer, before any Work is performed and within 7 Calendar Days of the Notice to Proceed, the Contractor shall meet with the Engineer for a preconstruction conference at a time mutually agreed upon.

00180.43 Commencement and Performance of Work - From the time of commencement of the Work to the time of Final Acceptance the Contractor shall:

- Provide adequate Materials, Equipment, labor, and supervision to perform and complete the Work;
- Perform the Work as vigorously and as continuously as conditions permit, and according to a Project Work schedule that ensures completion within the Contract Time or the adjusted Contract Time;
- Not voluntarily suspend or slow down operations without prior written approval from the Engineer; and
- Not resume suspended Work without the Engineer's written authorization.

00180.44 Project Meetings – The Contractor shall participate in conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest to the Contractor, Engineer and Agency.

(a) Meeting Participants - Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

(b) Meet in Agency's meeting room facility, or in a location otherwise agreed to by Agency and Contractor.

(c) Engineer will distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.

(d) Require attendance of Contractor's superintendent and project manager, and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.

(e) Engineer will invite agencies, utility companies or others when the Work affects their interests, and others necessary to agenda.

(f) Engineer will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

(g) Progress Meetings

(1) Purpose of Progress Meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.

(2) Attend regularly scheduled bi-weekly progress meetings conducted by Engineer.

(3) Review progress of the Work, Progress Schedule, 3-week look-ahead schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.

(4) Verify:

- Actual start and finish dates of completed activities since last progress meeting.
- Durations and progress of activities not completed.
- Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and Application for Payment.
- Percentage completion of items on Application for Payment.
- Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Amount.

(5) Review status of Requests for Clarification/Information and Submittals review.

(6) Discuss Project safety and security.

(7) Discuss traffic control.

(8) Discuss potential problems which may impede scheduled progress and corrective measures.

(h) Coordination Meetings

(1) Purpose of Coordination Meetings: To coordinate the Work of this Contract with the work of the Agency and with work of other contractors.

(i) Pre-Event Meetings

(1) Prior to start of critical activities, the Contractor shall schedule a meeting with Engineer review applicable specifications and drawings, coordination of inspection requirements and other key activities.

(j) Pre-Survey Conference

(1) The Contractor, applicable subcontractors, Contractor's surveyor, Agency and Agency's surveyor shall meet with the Engineer two weeks prior to beginning survey work. The purpose of the meeting is to discuss methods and practices of accomplishing the survey work.

(k) Other Meetings

(1) The Contractor shall prepare for and attend other meetings as identified elsewhere in the Contract Documents.

00180.50 Contract Time to Complete Work:

(a) General - The time allowed to complete the Work or Pay Item is stipulated in the Solicitation Documents, and will be known as the "Contract Time". (see 00110.20)

(b) Kinds of Contract Time - The Contract Time will be expressed in one or more of the following ways:

(1) Fixed Date Calculation - The calendar date on which the Work or Pay Item shall be completed; or

(2) Calendar Day Calculation - The number of Calendar Days from a specified beginning point in which the Work or Pay Item shall be completed.

(3) Work Day Calculation – The number of Work Days from a specified beginning point in which the Work or Pay item shall be completed.

(c) Beginning of Contract Time - When the Contract Time is stated in Calendar Days, counting of Contract Calendar Days will begin at the date of the Notice to Proceed. When the Contract Time is stated in Work Days, counting of Contract Work Days will begin at the date of the Notice to Proceed.

(d) Recording Contract Time - All Contract Time will be recorded and charged to the nearest one-half Day.

Contract Times may be extended because of delays in the completion of the Work due to abnormal weather conditions provided that the Contractor shall, within 10 days of the beginning of such delay, notify Engineer in writing of the cause of the delay and request an extension of time. Such requests shall be accompanied with supporting documentation referenced to the NOAA INDEX weather in the Project vicinity. Engineer will make recommendations to Agency to extend the Contract Times for completing the Work when, in Engineer's judgement, the findings of facts and extent of delay justify such an extension. Contractor shall not be entitled to any additional compensation of any kind arising out of or relating to abnormal weather conditions.

On Contracts with Calendar Day or Work Day counts, the Engineer will furnish the Contractor a weekly statement of Contract Time charges. The statement will show the number of Calendar Days counted for the preceding week and the number of Calendar Days remaining prior to the established completion date.

For Contracts with fixed completion dates, or fixed completion dates for Pay Items or fixed milestone dates, the Engineer will furnish the Contractor a weekly statement of Contract Time charges only after expiration of the Contract Time. The statement will show the number of Calendar Days of liquidated damages that have been assessed, if any.

These statements will include any exclusions from, or adjustments to, Contract Time.

(e) Exclusions from Contract Time - Regardless of the way Contract Time is expressed in the Contract, certain Calendar Days will not be charged against Contract Time. These exclusions will be allowed when the Contractor is prevented from performing Work due to one of the following reasons, resulting in delay:

- Acts of God or Nature;
- Court orders enjoining prosecution of the Work;
- Strikes, labor disputes or freight embargoes that, despite the Contractor's reasonable efforts to avoid them, cause a shutdown of the entire Project or one or more major operations. "Strike" and "labor dispute" may include union action against the Contractor, a Subcontractor, a Materials supplier, or the Agency; or
- Suspension of the Work by written order of the Engineer for reasons other than the Contractor's failure or neglect.

(f) Time Calculation Protest - In the event the Contractor disputes the accuracy of the statement of Contract Time charges, it shall immediately contact the Engineer and attempt to resolve the dispute. If the dispute cannot be resolved informally, the Contractor shall submit a formal written protest to the Engineer within 7 Calendar Days of the date the Engineer mailed or delivered the statement. Failure to submit a formal written protest within the 7 Calendar Day period constitutes the Contractor's approval of the time charges, or adjusted time charges, itemized in the statement.

(g) End of Contract Time - When the Engineer determines that the On-Site Work has been completed, except for the items listed below, the Engineer will issue a Second Notification.

The Second Notification will list:

- The date the time charges stopped;
- Final trimming and cleanup tasks (see 00140.90);
- Equipment to be removed from the Project Site;
- Minor corrective work not involving additional payment to be completed; and
- Submittals, including without limitation all required certifications, bills, forms, warranties, certificate of insurance coverage (00170.70(b)), and other documents, required to be provided to the Engineer before Third Notification will issue.

The Contractor shall complete all tasks listed in the Second Notification in an expeditious manner within the time frame proposed by the Contractor and accepted by the Engineer. Unless otherwise agreed by the Agency, failure of the Contractor to complete all tasks listed in the Second Notification within the time frame accepted, will result in the Agency rescinding the Second Notification. Counting of time charges will resume upon expiration of the accepted time frame.

00180.60 Notice of Delay - The Contractor shall notify the Engineer of any delay that will likely prevent completion of the Work or a Pay Item by the date specified in the Project Work schedule. The notice shall be in writing and shall be submitted within 7 Calendar Days of when the Contractor knew or should have known of the delay. The notice shall include, to the extent available, the following:

- The reasons or causes for the delay;
- The estimated duration of the delay and the estimated resulting cumulative delay in Contract completion;
- Except for 00180.50(e) and 00180.65 delays, whether or not the Contractor expects to request an adjustment of Contract Time due to the delay;
- Whether or not the Contractor expects to accelerate due to the delay; and
- Whether or not the Contractor expects to request additional compensation due to the delay. Except for 00180.50(e) and 00180.65 delays, failure to include this information will constitute waiver of the Contractor's right to later make such a request.
- If Contractor is delayed and has stopped Contract Item work for less than 60 minutes, neither additional Contract Time nor additional compensation will be considered.

00180.65 Right-of-Way and Access Delays - Right-of-Way and access delays will be taken into consideration in adjusting Contract Time, and in approving additional compensation if the performance of the Work is delayed because of the Agency's failure to make available to the Contractor:

- Necessary Rights-of-Way;
- Agency-owned or Agency-controlled Materials sources that are offered in the Contract for the Contractor's use; or
- Access to, or rights of occupancy of, buildings and other properties the Contractor is required to enter or to disturb according to Contract requirements.

If the ending date of an anticipated delay is stated in the Special Provisions, only the delay occurring after that date will be considered for adjusting Contract Time or providing additional compensation.

00180.70 Suspension of Work:

(a) General - The Engineer has authority to suspend the Work, or part of the Work, for any of the following causes:

- Failure of the Contractor to correct unsafe conditions;
- Failure of the Contractor to carry out any provision of the Contract;
- Failure of the Contractor to carry out orders issued by the Engineer, the Agency, or any regulatory authority;
- Existence of conditions unsuitable to proper or safe performance of the Work; or
- Any reason considered by the Agency to be in the public interest.

When Work has been suspended for any reason, the Contractor shall not resume Work without the Engineer's written authorization.

(b) Contractor's Responsibilities during and after Suspension - During periods of suspension of the Work, the Contractor shall continue to be responsible for protecting and repairing the Work according to 00170.80, and for ensuring that a single designated representative responsible for the Project remains available according to 00150.40(b).

When Work is resumed after suspension, unless otherwise specified in the Contract, the Contractor shall perform the following at no additional compensation:

- Replace or repair any Work, Materials, and Equipment to be incorporated into the Work that was lost or damaged because of the temporary use of the Project Site by the public; and
- Remove Materials, Equipment, and temporary construction necessitated by temporary maintenance during the suspension, as directed by the Engineer.

(c) Compensation and Allowances for Suspension - Compensation and allowance of additional Contract Time due to suspension of any portion of the Work will be authorized only for Agency-initiated suspensions for reasons other than the Contractor's failure or neglect. (refer to 00180.50(e), 00180.65, and 00195.40)

00180.80 Adjustment of Contract Time:

(a) General - Contract Time established for the Work will be subject to adjustment, either by increase or decrease, for causes beyond the control of the Contractor, according to the terms of this Subsection. After adjustment, the Contract Time will become, and be designated as, the "Adjusted Contract Time". Except as provided in 00180.65 and 00195.40, an adjustment of Contract Time shall be the Contractor's only remedy for any delay arising from causes beyond the control of the Contractor.

(b) Contractor's Request Not Required - The Engineer may increase or decrease the Contract Time or the Adjusted Contract Time if Change Orders or Extra Work orders issued actually increase or decrease the amount of time required to perform the Work. The Engineer may also increase Contract Time in the event of Right-of-Way and Access delays (see 00180.65), and those delays due to causes beyond the Contractor's control specified in 00180.50(e). The Engineer will promptly inform the Contractor of adjustments made to Contract Time according to this Subsection, and will include the reasons for adjustment.

If the Agency anticipates delay during performance of the Contract, and specifies its expected duration in the Special Provisions, the Engineer will only consider additional delay beyond the stipulated duration in determining whether to adjust Contract Time.

(c) Contractor's Request Required - In the event the Contractor believes that additional Contract Time is due, the Contractor shall submit to the Engineer a timely request for adjustment of Contract Time. The Engineer will not consider untimely requests. The Agency regards as timely only those requests for adjustment of Contract Time that:

- Accompany a proposed revised Project Work schedule submitted according to 00180.41, for comparison with the last revision of the Project Work schedule; or
- Are not otherwise deemed waived and are submitted within 15 Days after the date of Second Notification, if Second Notification has been issued.

The Engineer will not grant an adjustment of Contract Time for events that occurred prior to the date of the last revision of the Project Work schedule. The Engineer will not authorize, nor the Agency pay, acceleration costs incurred by the Contractor prior to its submittal of a request for adjustment of Contract Time to which the acceleration costs relate.

The Contractor's request for adjustment of Contract Time shall be submitted to the Engineer on a form provided by, or in a format acceptable to, the Engineer, and shall include a copy of the written notice required under 00180.60. The request shall include without limitation:

- Consent of the Contractor's Surety if the request totals more than 30 Calendar Days of additional Contract Time;
- Sufficient detail for the Engineer to evaluate the asserted justification for the amount of additional Contract Time requested;
- The cause of each delay for which additional Contract Time is requested, together with supporting analysis and data;
- Reference to the Contract provision allowing Contract Time adjustment for each cause of delay;
- The actual or expected duration of delay resulting from each cause of delay, expressed in Calendar Days; and
- A schedule analysis based on the current approved Project Work schedule for each cause of delay, indicating which activities are involved and their impact on Contract completion.

(d) Basis for Adjustment of Contract Time - In the adjustment of Contract Time, the Engineer will consider causes that include, but are not limited to:

- Failure of the Agency to submit the Contract and bond forms to the Contractor for execution within the time stated in 00130.50, or to submit the Notice to Proceed within the time stated in 00130.90;
- Errors, changes, or omissions in the Supplemental Drawings, quantities, or Specifications;
- Performance of Extra Work;
- Failure of the Agency or Entities acting for the Agency to act promptly in carrying out Contract duties and obligations;
- Acts or omissions of the Agency or Entities acting for the Agency that result in unreasonable delay referenced in 00195.40;
- Causes cited in 00180.50(e); and
- Right-of-way and access delays referenced in 00180.65.

The Engineer will not consider requests for adjustment of Contract Time based on any of the following:

- Contentions that insufficient Contract Time was originally specified in the Contract;
- Delays that do not affect the specified or Adjusted Contract Time;
- Delays that affect the Contractor's planned early completion, but that do not affect the specified or adjusted Contract Time;
- Shortage or inadequacy of Materials, Equipment or labor;
- Work stoppage required by the Engineer to determine the extent of Work defects
- Time for the Contractor to correct the Work defects from date of notification of the defects until the correction work is completed and has been approved by the Engineer.
- Late delivery of Materials and Equipment to be incorporated into the Work, except under those conditions referenced in 00180.50(e);
- Different area of Material source in 00160.40(a);
- Substitution of Equipment in 00180.31(c);
- Reasonably predictable weather conditions; or
- Other matters within the Contractor's control or Contract responsibility.

(e) Consideration and Response by Agency - The Engineer will only consider a Contractor's request for Contract Time adjustment submitted according to the requirements of 00180.80(c). The Engineer may elect not to consider claimed delays that do not affect the specified or adjusted Contract Time required to complete the Work.

The Engineer may adjust Contract Time for causes not specifically identified by the Contractor in its request.

The Engineer will review a properly submitted request for Contract Time adjustment, and within a reasonable time will advise the Contractor of the Engineer's findings. If the Contractor disagrees with the Engineer's findings, the Contractor may request review according to the procedure specified in 00199.40.

00180.85 Failure to Complete on Time; Liquidated Damages:

(a) Time is of the Essence - Time is of the essence in the Contractor's performance of the Contract. Delays in the Contractor's performance of the Work may inconvenience the traveling public, interfere with business and commerce, and increase cost to the Agency. It is essential and in the public interest that the Contractor prosecute the Work vigorously to Contract completion.

The Agency does not waive any rights under the Contract by permitting the Contractor to continue to perform the Contract, or any part of it, after the Contract Time or adjusted Contract Time has expired.

(b) Liquidated Damages - The Agency will sustain damage if the Work is not completed within the specified Contract Time. However, in certain Agency projects it may be unduly burdensome and difficult to demonstrate the exact dollar value of such damages. The Agency will identify such projects in the Special Provisions related to them. In these projects, the Contractor agrees to pay to the Agency, not as a penalty but as liquidated damages, the amount specified in the Special Provisions for each Calendar Day the Contractor expends performing the Contract in excess of the Contract Time or adjusted Contract Time.

Payment by the Contractor of liquidated damages does not release the Contractor from its obligation to fully and timely perform the Contract according to its terms. Nor does acceptance of liquidated damages by the Agency constitute a waiver of the Agency's right to collect any additional damages it may sustain by reason of the Contractor's failure to fully perform the Contract according to its terms. The liquidated damages shall constitute payment in full only of damages incurred by the Agency due to the Contractor's failure to complete the Work on time.

If the Contract is terminated according to 00180.90(a), and if the Work has not been completed by other means on or before the expiration of Contract Time or adjusted Contract Time, liquidated damages will be assessed against the Contractor for the duration of time reasonably required to complete the Work.

00180.90 Termination of Contract and Substituted Performance:

(a) Termination for Default - Termination of the Contract for default may result if the Contractor:

- Fails to comply with the requirements for records;
- Violates any material provision of the Contract;
- Disregards applicable laws and regulations or the Engineer's instructions;
- Refuses or fails to supply enough Materials, Equipment or skilled workers for prosecution of the Work in compliance with the Contract;
- Fails to make prompt payment to Subcontractors;
- Makes an unauthorized general assignment for the benefit of the Contractor's creditors;
- Has a receiver appointed because of the Contractor's insolvency;

- Is adjudged bankrupt and the court consents to the Contract termination; or
- Otherwise fails or refuses to faithfully perform the Contract according to its terms and conditions.

If the Contract is terminated by the Agency, upon demand the Contractor and the Contractor's Surety shall provide the Engineer with immediate and peaceful possession of the Project Site, and of all Materials and Equipment to be incorporated into the Work, whether located on and off the Project Site, for which the Contractor received progress payments under 00195.50.

If the Contract is terminated for default, neither the Contractor nor its Surety shall be:

- Relieved of liability for damages or losses suffered by the Agency because of the Contractor's breach of Contract; or

- Entitled to receive any further progress payments until the Work is completed. However, progress payments for completed Work that remain due and owing at the time of Contract termination may be made according to the terms of 00195.50, except that the Engineer will be entitled to withhold sufficient funds to cover costs incurred by the Agency as a result of the termination. Final payment to the Contractor will be made according to the provisions of Section 00195.

If a termination under this provision is determined by a court of competent jurisdiction to be unjustified, the termination shall be deemed a termination for public convenience.

(b) Substituted Performance - According to the Agency's procedures, and upon the Engineer's recommendation that sufficient cause exists, the Agency, without prejudice to any of its other rights or remedies and after giving the Contractor and the Contractor's Surety 10 Calendar Days' written notice, may:

- Terminate the Contract;
- Substitute the Contractor with another Entity to complete the Contract;
- Take possession of the Project Site;
- Take possession of Materials on the Project Site;
- Take possession of Materials not on the Project Site, for which the Contractor received progress payments under 00195.50;
- Take possession of Equipment on the Project Site that is to be incorporated into the Work;
- Take possession of Equipment not on the Project Site that is to be incorporated into the Work, and for which the Contractor received progress payments under 00195.50; and
- Finish the Work by whatever method the Agency deems expedient.

If, within the 10 Calendar Day notice period provided above, the Contractor and/or its Surety corrects the basis for declaration of default to the satisfaction of the Engineer, or if the Contractor's Surety submits a proposal for correction that is acceptable to the Engineer, the Contract will not be terminated.

(c) Termination for Public Convenience - The Engineer may terminate the Contract for convenience in whole or in part whenever the Engineer determines that termination of the Contract is in the best interest of the public.

The Engineer will provide the Contractor and the Contractor's Surety 7 Calendar Days' written notice of termination for public convenience. After such notice, the Contractor and the Contractor's Surety shall provide the Engineer with immediate and peaceful possession of the Project Site, and of Materials and Equipment to be incorporated into the Work, whether located on and off the Project Site, for which the Contractor received progress payments under 00195.50.

If the Contract is terminated for public convenience, neither the Contractor nor its Surety shall be relieved of liability for damages or losses suffered by the Agency as a result of defective, unacceptable or unauthorized Work completed or performed.

Compensation for Work terminated by the Engineer under this provision will be determined according to the provisions of 00195.70(b).

00180.95 Project Closeout

(a) Description of Requirements – Project Closeout is defined to include general requirements near the end of the Contract Time, in preparation for Substantial Completion, Final Completion, final payment, normal termination of Contract, occupancy by Agency and similar actions evidencing completion of the Work. Specific requirements for individual units of Work are specified in various technical specification sections.

(b) Prerequisites To Substantial Completion

(1) Prior to requesting Engineer's inspection for certification of Substantial Completion for the entire work, complete the following and list known exceptions in request:

- In progress payment request, coincide with or first following date claimed, show either 100% completion for portion of work claimed as "substantially complete", or list incomplete items, value of incompletion, and reasons for being incomplete. Include supporting documentation for completion as indicated in these Contract Documents.
- Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents.
- Obtain and submit releases enabling Agency's full and unrestricted use of the Work and access to services and utilities.
- Deliver tools, spare parts, extra stocks of materials, and similar physical items to Agency.
- Where applicable, make final change-over of locks and transmit keys to Agency and advise Agency's personnel of change-over in security provisions.

- Complete start-up testing of systems, and instructions of Agency's operating/maintenance personnel. Discontinue (or change-over) and remove from Project site temporary facilities and services, along with construction tools and facilities, mock-ups, and similar elements.

- Touch-up and otherwise repair and restore marred exposed finishes.

(2) Upon receipt of Contractor's request, Engineer will either proceed with inspection or advise Contractor of prerequisites not fulfilled. Following initial inspection, Engineer will either prepare Certificate of Substantial Completion, or advise Contractor of Work which must be performed prior to issuance of certificate; a repeat inspection will be performed when requested and assured by the Contractor that Work has been substantially completed. Results of completed inspection will form initial "punch-list" requirements for Final Completion. If more than two visits are required to complete the final inspection for Substantial Completion then the Contractor shall pay the Agency for the Engineer's time, for all categories of labor required to complete the inspection for Substantial Completion at the Engineer's standard billing rates at the time of inspection. This time shall include time for travel and time to prepare inspection reports. Contractor shall also pay the Engineer's expenses at cost plus 10% and $0.55 per mile for travel to and from the site.

(c) Prerequisites To Final Completion

(1) Prior to requesting Engineer's final inspection for final payment and acceptance, complete the following and list known exceptions (if any) in request:

- Submit final payment request with final releases and supporting documentation which have not previously been submitted and accepted. Include certificates of insurance for products and completed operations where required.

- Submit updated final statement, accounting for additional (final) changes to Contract Amount.

- Submit certified copy of Engineer's final punch-list of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by Engineer.

- Submit final meter readings for utilities, measured record of stored fuel, and similar data as of time of Substantial Completion or when Agency took possession of and responsibility for corresponding elements of the work.

- Submit consent of surety.

- Submit final liquidated damages settlement statement, acceptable to Agency.

- Submit record drawings, maintenance manuals, and similar final record information.

(2) Re-inspection Procedure: Upon receipt of Contractor's notice that the Work has been completed, including punch-list items resulting from earlier inspections, and accepting incomplete items delayed because of acceptable circumstances, Engineer will re-inspect the work. Upon completion of re-inspection, Engineer will either make recommendation for final payment and acceptance by the Agency or advise Contractor of work not completed or obligations not fulfilled as required for final payment. If necessary, procedure will be repeated. If more than two visits are required to complete the final inspection for final payment then the Contractor shall pay the Agency for the Engineer's time, for all categories of labor required to complete the inspection for final acceptance at the Engineer's standard billing rates at the time of inspection. This time shall include time to travel and time to prepare inspection reports. Contractor shall also pay the Engineer's expenses at cost plus 10% and $0.55 per mile for travel to and from the site.

(d) Closeout Documents

(1) Submit following Closeout Submittals after receipt of Second Notification and at least seven (7) days prior to Application for Final Payment:

- Evidence of Compliance with Requirements of Governing Authorities.
- Project Record Documents.
- Operation and Maintenance Manuals.
- Warranties and Bonds.
- Keys and Keying Schedule.
- Evidence of Payment and Release of Liens as outlined in Conditions of the Contract.
- City of Warrenton Certificate of Compliance provided at the end of this Section

"Making a difference through excellence of service"

CITY OF WARRENTON

CERTIFICATE OF COMPLIANCE

City of Warrenton
225 S Main Ave
Warrenton, OR 97146

ATTN: Public Works Director

PROJECT NAME: _____

PROJECT LOCATION: _____

I hereby certify that:

A. All work on the above referenced contract has been performed and materials supplied in accordance with the plans, specifications and contract documents for the above work;

B. There have been no substitutions of Subcontractors without prior notification to the City in accordance with ORS279C.585;

C. Contractor and subcontractors performing work under this contract were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.138 before commencing work under the contract;

D. All payments due to all persons supplying labor or material for the performance of the work provided for in this contract have been made;

E. All contributions or amounts due the Industrial Accident Fund from the contractor or subcontractors incurred in the performance of the contract have been paid;

F. All sums withheld from employees under ORS 316.167 have been paid to the Department of Revenue.

Authorized Signature_____ Date_____

Section 00190 - Measurement of Pay Quantities

Description

00190.00 Scope - The Engineer will measure pay quantities for accepted Work according to the United States standard measure unless otherwise provided in the Contract. Unless otherwise specified in the Contract, the Engineer will round off all quantity computations using the following convention:

- The final significant digit will not be changed when the succeeding digit is less than 5.
- The final significant digit will be increased by one when the succeeding digit is 5 or greater.

The measurement provisions contained in the Specifications for each Pay Item will supplement or modify the above convention by:

- Imposing measurement limitations
- Describing measurement or computation procedures
- Giving conversion factors or adjustment conditions
- Providing for determination of reasonably accurate and representative Pay Item quantities

Measurements required or allowed to be made by the Contractor will be subject to the Engineer's verification. The Engineer's decision about measurement is final.

00190.10 Measurement Guidelines - Measurement of quantities will be made on the following bases, unless otherwise specified in the Contract:

(a) Unit Basis - Unit will be each, unless otherwise specified in the Contract and will be determined by actual count of units in place.

(b) Length Basis - Length will be feet or mile, unless otherwise specified in the Contract and will be determined by measuring the length at least to the nearest 0.1 foot or at least to the nearest 0.1 mile, as applicable, unless otherwise specified in the Contract. Measurements will be limited to the dimensions shown or specified, or as directed by the Engineer.

(c) Area Basis - Area will be square foot, square yard, or acre, unless otherwise specified in the Contract and will be determined by measuring the width and the length (or height) at least to the nearest 0.1 foot and computed at least to the nearest 0.1 square foot, nearest 0.1 square yard, or nearest 0.1 acre, as applicable, unless otherwise specified in the Contract.

(d) Weight Basis - Weight will be pound or ton, unless otherwise specified in the Contract and will be determined as follows:

(1) Pound - Pound weight will be determined by the net weight identified on the manufacturer's packaged labels, subject to periodic check weighing. Weight by pound will be measured at least to the nearest 1.0 pound unless otherwise specified in the Contract.

Provide a certificate with each shipment together with a certified copy of the weight of each delivery. If the check weight is less than the manufacturer weight by more than 0.4%, the discrepancy will be resolved by the Engineer.

(2) Ton - Ton weight will be determined on Contractor-provided scales as required under 00190.20 unless otherwise allowed by the Specifications. Weight by ton will be measured at least to the nearest 0.01 ton unless otherwise specified in the Contract.

If bituminous materials, portland cement, lime, and similar bulk Materials are shipped by truck or rail, the supplier's shipping invoice with net scale weights, or volumes converted to weights, may be used for Pay Item quantity determination in place of weights determined on the Contractor-provided vehicle scales.

Shipping invoice weights of the supplier's truck or transport shall be subject to periodic check weighing on the Contractor's vehicle scales, or other scales designated, according to 00190.20. If the check weight is less than the supplier weight by more than 0.4%, the discrepancy will be resolved by the Engineer.

No payment will be made:

- For quantities in excess of the supplier weight
- When Materials have been lost, wasted, or otherwise not incorporated into the Work
- For additional hauling costs resulting from the check weighing

(e) Volume Basis - Volume will be cubic yard truck measure or in-place measure, gallons, foot board measure (FBM), or thousand foot board measure (MFBM), unless otherwise specified in the Contract and will be measured at least to the nearest 0.1 cubic yard, nearest 1.0 gallon, nearest 0.1 FBM, or nearest 0.1 MFBM, as applicable, unless otherwise specified in the Contract.

Truck measure will be the measured and calculated maximum "water level" capacity of the vehicle. Quantities will be determined at the point of delivery, with no allowance for settlement of Material during transit. When required to facilitate measurement, the vehicle load shall be leveled at the point of delivery. Payment will not be made for Material in excess of the maximum "water level" capacity. Deductions will be made for loads below the maximum "water level" capacity.

When bituminous materials are measured by volume, the volume will be measured at 60 °F or will be corrected to the volume at 60 °F using the correction factors found in the MFTP (ODOT TM 321).

(f) Time Basis - Time will be hour, Day, or year, unless otherwise specified in the Contract, and will be measured to at least the nearest 0.5 hour, nearest 1.0 Day, or nearest 1.0 year, as applicable, unless otherwise specified in the Contract.

(g) Standard Manufactured Items - If standard manufactured items, such as fence, wire, plates, rolled shapes, pipe, conduit and other similar items are specified in the Contract by properties such as gauge, unit weight, or section dimensions, the manufacturing tolerances established by the industry involved will be accepted unless more stringent tolerances are cited in the Contract.

(h) Lump Sum Basis - Lump sum, when used, means the Work described shall be completed and accepted without measurement unless changes are ordered in writing by the Engineer. If estimated quantities of the Work to be performed are listed in the Special Provisions, they provide only a basis for adjusting payment amounts. Estimated quantities are approximate only, and are made from a reasonable interpretation of the Contract Documents. Computations based on the details and dimensions shown on the Contract Documents are not guaranteed to equal estimated quantities.

If the Agency issues no Change Order, the Agency will make no pay adjustment for quantities based on the Contractor's computations that overrun or underrun the estimated quantities.

If the Agency issues Change Orders for changes in the Work, the Engineer will measure such changes according to the standards set by 00195.20 to determine adjustment of payment.

00190.20 Contractor to Provide Vehicle Weigh Scales:

(a) General - If the Specifications require measurement by weighing on vehicle weigh scales, the Contractor shall provide vehicle weigh scales and shall transport Materials to the scales. Subject to the Engineer's approval, weights may be determined by plant or hopper scales according to 00190.30.

Contractor-provided scales shall be furnished, installed and maintained by the Contractor or its supplier, or, subject to the Engineer's approval, may be commercial scales located in the vicinity of the Project.

Unless otherwise provided in the Contract, Pay Items to be measured by weight shall include all Contractor costs for providing, maintaining, inspecting, and testing scales; for furnishing appropriate weigh tickets; for self-printing scales; and for transporting Materials to the scales or to check weighing.

(b) Requirements - The scales shall conform to ORS 618, or the laws of the state in which they are located, and NIST Handbook 44, and shall be:

- Licensed by the Oregon Department of Agriculture, or by the analogous regulatory body for scales located outside the State;
- Technically suitable for weighing the Materials;
- Properly installed and maintained; and
- Accurate to the required tolerances.

The weight of any Materials weighed by anyone other than the Engineer will be subject to check weighing as the Engineer directs.

(c) Approaches - Vehicle scale approaches shall be:

- At each end of the scale platform;
- Straight and in line with the platform; and
- Long enough to accommodate combination vehicles longer than the scale platform so that they are level and allow release of brakes before weighing.

(d) Inspections - Contractor shall have all scales certified, that is inspected and their accuracy tested, by the Oregon Department of Agriculture, an analogous regulatory body for scales located outside the State, or a scale service company as follows:

- Before use if installed at a new site;
- 60 Calendar Days after initial inspection;
- Every 6 months thereafter; and
- When the Engineer directs additional inspections.

No Materials weighed on scales without current certifications according to this Subsection will be accepted. The Contractor shall provide a copy of all required certifications to the Engineer.

Testing by a scale service company within the State of Oregon shall comply with ORS 618.

If additional inspections directed by the Engineer confirm that the scale accuracy is within the required tolerances, the Agency will pay the cost for inspecting and testing the scales. If the scale accuracy is not within these tolerances, the Contractor shall pay the cost for inspecting and testing the scales.

(e) Inspection Results - If an inspection indicates the scales have been under-weighing (indicating less than the true weight), the Agency will make no additional payment to the Contractor for Materials previously weighed.

If an inspection indicates the scales have been over-weighing (indicating more than the true weight), the weights will be reduced for Materials received after the time the Engineer determines the overweighing began or, if that is not possible, after the last acceptable certification of the scales. The reduction will be the amount of error in excess of the 0.2% maintenance tolerance allowed in the Contract.

(f) Contractor-Provided Weigh Technician - The Contractor shall provide a technician to operate Contractor-provided vehicle weigh scales. The Agency may observe procedures and require check weighing according to the following:

(1) Scale with Automatic Printer - If the scales have an automatic weigh memo printer that does not require manual entry of gross weight information, the Agency may periodically have a representative at the scales to observe the weighing procedures. In addition, the Engineer may periodically check the weight for a load of Materials by directing the haul vehicle to reweigh on a different scale that has been inspected and certified according to 00190.20(b) and 00190.20(d).

If a different scale is not available within a 30 mile round trip from the regular haul route the Agency will allow check weighing on an approved alternate basis. Check weights within 0.4% of the Contractor-provided weight are acceptable.

The Engineer will resolve discrepancies found by check weighing. Agency employee costs will be paid by the Agency. The Contractor shall pay all other costs resulting from the check weighings, including without limitation the use of other scales.

If more than 50 tons per Day of all types of Materials are received from a scale, the Contractor shall make random check weighings at least every tenth Day on which more than 50 tons is received or at each interval that 10,000 tons has been weighed, whichever occurs first, or as directed by the Engineer. The Contractor shall make at least one check weighing on projects where more than 2,000 tons of all types of Materials are received from a scale. The Contractor shall provide the Engineer with the results of the check weighing.

(2) Scale Without Automatic Printer - If the scales require manual entry of gross weight information, the Agency may periodically have a representative weigh witness at the scales to observe the weighing procedures. The Contractor shall inform the Engineer of his intent to use a scale without an automatic printer at least 3 working Days before weighing begins or before the Contractor changes to a scale that does not have an automatic printer. The Contractor shall pay costs for the weigh witness. The hourly cost of the weigh witness will be as stated in the Special Provisions. In addition, the Engineer may periodically check the weight for a load of Materials by directing the haul vehicle to reweigh on a different scale that has been inspected and certified according to 00190.20(b) and 00190.20(d).

If a different scale is not available within a 30 mile round trip from the regular haul route the Agency will allow check weighing on an approved alternate basis. Check weights within 0.4% of the Contractor-provided weight are acceptable.

The Engineer will resolve discrepancies found by check weighing. Agency employee costs for check weighings will be paid by the Agency. The Contractor shall pay all other costs resulting from the check weighings, including without limitation the use of other scales.

If more than 50 tons per Day of all types of Materials are received from a scale, the Contractor shall make random check weighings at least every tenth day on which more than 50 tons is received or at each interval that 10,000 tons has been weighed, whichever occurs first, or as directed by the Engineer. The Contractor shall make at least one check weighing on all projects where materials are received from a scale without an automatic printer. The Contractor shall provide the Engineer with the results of the check weighing.

(3) Duties of Weigh Technician - The Contractor's weigh technician shall:

- Determine twice a Day, or as otherwise directed by the Engineer, the empty haul weights (tare weights) of hauling vehicles, unless vehicles are tared before each load;
- Furnish daily a listing of the tare weights if 10 or more loads are hauled during that Day;
- Furnish a note listing the net weight for each consecutive ten loads with the following load;
- Furnish a daily listing of the net weights and total weight for each type of Material hauled during that Day; and
- Furnish a legible, serially numbered weigh memo for each load of Materials to the Agency's Materials receiver at the point of delivery, or as directed by the Engineer. The memo shall identify the Project, the Materials, the date, net weight (gross and tare as appropriate), and identification of vehicle, driver and weigh technician.

(g) Agency-Provided Weigh Technician - If the Contractor provides vehicle weigh scales without a weigh technician meeting the requirements of this Subsection, the Agency will provide a weigh technician at

the Contractor's expense. The Contractor shall provide a weighhouse for the weigh technician according to Section 00205. The Agency's weigh technician will:

- Determine tare weights;
- Prepare weigh memos for each load;
- Compile the weigh records; and
- Not participate in the production of Materials or the loading of haul vehicles.

00190.30 Plant Scales - The Contractor, with the Engineer's written approval, may weigh plant-mixed Materials on scales that have either:

- An automatic weight batching and mixing control printer system; or
- A weigh hopper printer system.

Any additional costs resulting from the use of these scales shall be borne by the Contractor. Check weighing will be done according to 00190.20(f).

Except for 00190.20(c) regarding approaches, the Contractor's use of plant scales shall comply with all provisions of 00190.20.

The Engineer's approval for the Contractor's use of plant scales to determine pay weights will be rescinded if check weighing or scale inspections indicate the scales do not consistently determine weights within the tolerances allowed by state law.

Section 00195 - Payment

Description

00195.00 Scope and Limit:

(a) General - The Agency will pay only for measured Pay Item quantities incorporated into the Work or performed according to the terms of the Contract. The Contractor understands and agrees that Pay Item quantities listed in the Schedule of Items do not govern payment.

Payment constitutes full compensation to the Contractor for furnishing all Materials, Equipment, labor, and Incidentals necessary to complete the Work; and for risk, loss, damage, and expense arising from the nature or prosecution of the Work or from the action of the elements, subject to the provisions of 00170.80. The Contractor shall include the costs of bonds and insurance for the Project in the unit price for each Pay Item of Work to be performed.

(b) Essential or Incidental Materials or Work - When the Specifications state that the unit price for a Pay Item is compensation for certain Materials or Work essential or Incidental to the Pay Item, the same Materials or Work will not be measured or paid under any other Pay Item.

Provisions and Requirements

00195.10 Payment For Changes in Materials Costs - On certain projects, as identified in the Special Provisions, an escalation/de-escalation clause with respect to certain materials will be in effect during the life of the Contract.

00195.13 Asphalt Cement Material Price Escalation/De-Escalation Clause - Subsections 00195.13, 00195.13(a), 00195.13(b), 00195.13(c), and 00195.13(d) contain the price escalation/de-escalation clause relating to asphalt cement materials (as defined in 00195.13(d)).

(a) Monthly Asphalt Cement Material Price (MACMP) - The Monthly Asphalt Cement Material Price (MACMP) will be established by ODOT each month. For information regarding the calculation of the MACMP, and for the actual MACMP, go to the ODOT website at:

http://www.oregon.gov/ODOT/HWY/ESTIMATING/asphalt_fuel.shtm

If the ODOT selected index ceases to be available for any reason, the Agency in its discretion will select and begin using a substitute price source or index to establish the MACMP each month. The MACMP will apply to all asphalt cement including but not limited to paving grade, polymer modified, and emulsified asphalts, and recycling agents. The Agency does not guarantee that asphalt cement will be available at the MACMP

(b) **Base Asphalt Cement Material Price (Base) -** The Base price for this Project is the MACMP published on the ODOT website for the month immediately preceding the bid opening date.

(c) Monthly Asphalt Cement Adjustment Factor - The Monthly Asphalt Cement Adjustment Factor will be determined each month as follows:

- If the MACMP is within ± 5% of the Base, there will be no adjustment.
- If the MACMP is more than 105% of the Base, then:

  Adjustment Factor (%) = ((MACMP)/(Base)) x (100) – 5

- If the MACMP is less than 95% of the Base, then:

  Adjustment Factor (%) = ((MACMP)/(Base)) x (100) + 5

(d) Asphalt Cement Price Adjustment – If specified in the Special Provisions, an asphalt cement escalation/de-escalation clause will be in effect during the life of the Contract. A price adjustment will be made for each pay item in the bid schedule containing asphalt cement. The price adjustment as calculated in 00195.13(c) above will use the MACMP for the month the asphalt is incorporated into the Project. The price adjustment per a ton of HMAC incorporated that month will be the difference between the cost submitted by the Contractor in the bid schedule for "Asphalt Cement in HMAC Per Ton of HMAC Complete" and the adjusted cost found by multiplying the "Asphalt Cement in HMAC Per Ton Of HMAC Complete" by the Adjustment Factor. The Agency reserves all of its rights under the Contract, including, but not limited to, its rights for suspension of the Work under 00180.70 and its rights for termination of the Contract under 00180.90, and this escalation/de-escalation provision shall not limit those rights.

00195.20 Changes to Plans or Character of Work:

(a) Insignificant Changed Work - If the changes made under 00140.30 do not significantly change the character or unit cost of the Work to be performed under the Contract, the Agency will pay for such work at the Pay Item price.

If the Work involved in the change is measured on a lump sum basis and its character is not significantly changed, payment for the Changed Work will be determined:

- As described in the applicable Section of the Specifications;
- If not described there, on a theoretical unit price determined by dividing the Contractor's lump sum price by the estimated quantity of the Pay Item listed in the Special Provisions; or
- If neither of the above apply, the Engineer will make an equitable adjustment.

(b) Significant Changed Work - If the changes made under 00140.30 significantly alter the character, quantity, unit cost, or lump sum cost of the Work, the Agency will adjust the Contract. The Contractor shall not be entitled to compensation for any loss in profits resulting from elimination of, reduction of, or other change to, a part of the Work.

Any such adjustments may be less than, but will not be more than the amount justified by the Engineer on the basis of the established procedures set out in Section 00197 for determining rates for Extra Work, but those procedures shall account for the decrease or elimination of Work as well as for increases in the Work. This does not limit the application of Section 00199.

The term "Significant Changed Work" shall apply only to that circumstance in which the character of the Work, as changed, differs materially in kind, nature, or unit cost from that involved or included in the originally proposed construction.

For purposes of this Section, “Significant” is defined as:

a) An increase or decrease of more than 25 percent of the total cost of the Work calculated from the original proposal quantities and the unit contract prices; or,
b) An increase or decrease of more than 25 percent in the quantity of any one major contract item.

For condition b) above, a major item is defined as any item that amounts to 10 percent or more of the original total contract price.

00195.30 Differing Site Conditions - Upon written notification, as required in 00140.40, the Engineer will investigate the identified conditions. If the Engineer determines that the conditions are differing Project Site conditions under 00140.40 and cause an increase or decrease in the cost or time required to perform any Work under the Contract, an adjustment in the Contract Amount or Contract Time, excluding loss of anticipated profits, will be made, and the Contract modified accordingly, in writing. The Engineer will notify the Contractor as to whether or not an adjustment of the Contract is warranted.

No Contract adjustment which benefits the Contractor will be allowed unless the Contractor has provided the required written notice. Any such adjustments will be made according to 00195.20.

00195.40 Unreasonable Delay by the Agency - If the Contractor believes that performance of all or any portion of the Work is suspended, delayed, or interrupted for an unreasonable period of time in excess of that originally anticipated or customary in the construction industry, due to acts or omissions of the Agency, or persons acting for the Agency, and that additional compensation, Contract Time, or both, are due the Contractor because of the suspension, delay or interruption, the Contractor shall immediately file a written notice of delay according to 00180.60. The Contractor shall then promptly submit a properly supported request for any additional compensation, Contract Time, or both, according to the applicable provisions in 00180.60 through 00180.80 and Section 00199.

The Engineer will promptly evaluate a properly submitted request for additional compensation. If the Engineer determines that the delay was unreasonable, and that the cost required for the Contractor to perform the Contract has increased as a result of the unreasonable suspension, delay or interruption, the Engineer will make an equitable adjustment, excluding profit, and modify the Contract in writing accordingly. The Engineer will notify the Contractor of the determination and whether an adjustment to the Contract is warranted.

Under this provision, no Contract adjustment will be allowed:

- Unless the Contractor has provided the written notice required by 00180.60;
- For costs incurred more than 10 Calendar Days before the Engineer receives the Contractor's properly submitted written request;
- For any portion of a delay that the Engineer deems to be a reasonable delay, or for which an adjustment is provided for or excluded under other terms of the Contract; or
- To the extent that performance would nevertheless have been suspended, delayed or interrupted by causes other than those described in this Subsection.

00195.50 Progress Payments and Retained Amounts:

(a) **Progress Payments** - The Agency's payment of progress payments, or determination of satisfactory completion of Pay Items or Work or release of retainage under 00195.50(d), shall not be construed as Final Acceptance or approval of any part of the Work, and shall not relieve the Contractor of responsibility for defective Materials or workmanship or for latent defects and warranty obligations.

The estimates upon which progress payments are based are not represented to be accurate estimates. All estimated quantities are subject to correction in the final estimate. If the Contractor uses these estimates as a basis for making payments to Subcontractors, the Contractor assumes all risk and bears any losses that result.

(1) **Progress Estimates** - At the same time each month, the Engineer will make an estimate of the amount and value of Pay Item Work completed. The amount of Work completed will be the sum of the estimated number of units completed for unit price Pay Items plus the estimated percentage completed of lump sum Pay Items.

The estimated value of the Work completed will then be determined by using the Contract unit price for unit price Pay Items, and by using one of the following methods to determine the value of the lump sum Pay Items:

- The "theoretical unit price", when the Special Provisions contain an estimated number of units;
- A Contractor-submitted, Engineer-approved Schedule of Values, when there is no theoretical unit price available; or
- Engineer's determination, when there is neither an available theoretical unit price, nor an approved, Contractor-submitted Schedule of Values.

The amounts to be allowed for lump sum Pay Items in progress payments will not exceed the reasonable value of the Work performed, as determined by the Engineer.

Incidentals such as formwork, falsework, shoring, and cribbing shall be included in the unit prices for the various Pay Items requiring their use, unless specified as a separate Pay Item. No payment will be made for Pay Items that include Incidentals until units or portions of such Pay Item Work are in place and completed. The costs of Incidentals will be paid in proportion to the percentage of Pay Item Work completed.

(2) Value of Materials on Hand - The Engineer will also make an estimate of the amount and value of acceptable Materials on hand, i.e., already delivered and stored according to 00195.60(a), to be incorporated into the Work.

(3) Value of Work Accomplished - The sum of the values in (1) and (2) above will be collectively referred to in this Subsection as the "value of Work accomplished", subject to (4) below.

(4) Limitations on Value of Work Accomplished - In determining the "value of Work accomplished", the Engineer's estimate will be based on the unit prices for the various Pay Items. Any amounts not included in progress payments due to substantial mathematical unbalancing of Pay Item prices will be included in the final payment issued according to 00195.90(b).

(5) Reductions to Progress Payments - With each progress payment, the Contractor will receive a Contract payment voucher and summary setting forth the value of Work accomplished reduced by the following:

- Amounts previously paid;
- Amounts deductible or owed to the Agency for any cause specified in the Contract;
- Additional amounts retained to protect the Agency's interests according to Subsection (e) below.

(b) Retainage - The amount to be retained from progress payments will be 5% of the value of Work accomplished, and will be retained in one of the forms specified in Subsection (c) below.

As provided in 00170.65(a) additional retainage of 25% of amounts earned will be withheld and released according to ORS 279C.845 when the Contractor fails to file the certified statements required in ORS 279C.845, FHWA Form 1273, and 00170.65.

(c) Forms of Retainage - Moneys retained by the Agency under ORS 279C.570(7) shall be retained in a fund by the Agency and paid to the Contractor in accordance with ORS 279C.570. Upon written request from the Contractor, other forms of acceptable retainage are specified below in Subsections (1) and (2). "Cash, Alternate A" is the Agency-preferred form of retainage. If the Agency incurs additional costs as a result of the Contractor's election to use a form of retainage other than Cash, Alternate A, the Agency may recover such costs from the Contractor by a reduction of the final payment.

(1) Cash, Alternate A - Retainage will be deducted from progress payments and held by the Agency until final payment is made according to 00195.90, unless otherwise specified in the Contract.

The Agency will deposit the cash retainage withheld in an interest-bearing account in a bank, trust company, or savings association for the benefit of the Agency, as provided by ORS 279C.560(5). Interest earned on the account shall accrue to the Contractor. Amounts retained and interest earned will be included in the final payment made according to 00195.90.

Any retainage withheld on Work performed by a Subcontractor will be released to the Contractor according to 00195.50(d).

2) Bonds, Securities, and Other Instruments - In accordance with ORS 279C.560, unless the Agency finds in writing that accepting a bond, security or other instrument poses an extraordinary risk that is

not typically associated with the bond, security or other instrument, the Agency will approve the Contractor's written request to deposit bonds, securities or other instruments with the Agency or in a custodial account or other account satisfactory to the Agency with an approved bank or trust company, to be held instead of cash retainage for the benefit of the Agency. In such event, the Agency will reduce the cash retainage by an amount equal to the value of the bonds, securities and other instruments. Interest or earnings on the bonds, securities and other instruments shall accrue to the Contractor.

Bonds, securities and other instruments deposited instead of cash retainage shall be assigned to or made payable to the Agency and shall be of a kind approved by the Director of the Oregon Department of Administrative Services, including but not limited to:

- Bills, certificates, notes or bonds of the United States;
- Other obligations of the United States or agencies of the United States;
- Obligations of a corporation wholly owned by the federal government;
- Indebtedness of the Federal National Mortgage Association;
- General obligation bonds of the State of Oregon or a political subdivision of the State of Oregon;
- Irrevocable letters of credit issued by an insured institution, as defined in ORS 706.008.

The Contractor shall execute and provide such documentation and instructions respecting the bonds, securities and other instruments as the Agency may require to protect its interests. When the Engineer determines that all requirements for the protection of the Agency's interest have been fulfilled, the bonds and securities deposited instead of cash retainage will be released to the Contractor.

(d) Reduction of Retainage - As the Work progresses, the amounts to be retained under (b) of this Subsection are subject to reduction in the Engineer's sole discretion. Retainage reductions will be considered only as follows:

- When the Work is 97.5% or more completed, the Engineer may, without application by the Contractor, reduce the retained amount to 100% of the value of the Work remaining.

- For a project funded by the FHWA, when a subcontractor has satisfactorily completed all of its Work, it may request release of retainage for that Work from the Contractor. The Contractor shall request reduction of retainage in the amount withheld for the subcontractor's Work after certifying to the Agency that the subcontractor's Work is complete, and that all contractual requirements pertaining to the subcontractor's Work have been satisfied. Within 60 Calendar Days of the end of the month in which the Agency receives the Contractor's certification regarding the subcontractor's Work, the Agency will either notify the Contractor of any deficiencies which require completion before release of retainage, or verify that the subcontractor's Work complies with the Contract and release all retainage for that Work with the next scheduled progress payment. Within 10 Calendar Days of receipt of retainage, the Contractor shall pay to the subcontractor all such retainage released except for latent defects or warranty.

- The Agency will only release retainage for satisfactorily completed portions of the Work represented by Pay Items in the Schedule of Items, or by Pay Items added by Change Order. Work

not represented by a Pay Item, but which constitutes part of an uncompleted Pay Item, will not be regarded as satisfactorily completed Work for the purposes of this Subsection.

If retainage has been reduced or eliminated, the Agency reserves the right to protect its interests by retaining amounts from further progress payments at the rates provided in 00195.50(b).

(e) Withholding Payments - In addition to any other rights the Agency may have to withhold payments under other provisions of the Contract, the Engineer may withhold such amounts from progress payments or final payment as may reasonably protect the Agency's interests until the Contractor has:

- Complied with all orders issued by the Engineer according to the Specifications; and
- Satisfied all legal actions filed against the Agency, the Agency's governing body and its members, and Agency employees that the Contractor is obliged to defend. (see 00170.72)

Notwithstanding ORS 279C.555 or ORS 279C.570 or 00195.50(d), if a Contractor is required to file statements on the prevailing rate of wages, but fails to do so, the Agency will retain 25% of any amount earned as required in 00170.65.

(f) Prompt Payment Policy - Payments shall be made promptly according to ORS 279C.570.

00195.60 Advance Allowance for Materials on Hand:

(a) General - If the total value of Materials on hand is at least $1,000 or the total value of a single class of Materials on hand is at least $500, the Engineer may authorize an advance allowance for the Materials in the progress payments. The Agency will not make advance allowances on the Materials unless the following three conditions are satisfied:

(1) Request for Advance Allowance - If Materials on hand meet the requirement of (2) below, an advance allowance will be made if:

- A written request for advance allowance for Materials on hand has been received by the Engineer at least 5 Calendar Days before the pay period cutoff date; and
- The request is accompanied by written consent of the Contractor's Surety, if required by the Agency.

(2) Stored or Stockpiled Conditions - The Materials shall have been delivered and/or acceptably stored or stockpiled according to the Specifications and as follows:

- At the Project Site;
- On Agency-owned property;
- On property in the State of Oregon on which the property owner has authorized storage in writing. The written authorization must allow the Agency to enter upon the property and remove Materials for at least 6 months after completion of the Project. The Contractor shall furnish a copy of the written permission to the Agency; or
- On property outside the State of Oregon on which the property owner has authorized storage in writing, provided that such storage location is allowed by the Special Provisions or authorized in

writing by the Engineer. The permit must allow the Agency to enter upon the property and remove Materials for at least 6 months after completion of the Project. The Contractor shall furnish a copy of the written permission to the Agency.

To be eligible for advance allowance, the Materials shall:

- Meet Specification requirements;
- Have the required Materials conformance and quality compliance documents on file with the Engineer (see Section 00165);
- Be in a form ready for incorporation into the Work; and
- Be clearly marked and identified as being specifically fabricated, or produced, and reserved for use on the Project.

(3) Responsibility for Protection - The Contractor has full control and responsibility for the protection of Materials on hand from the elements and against damage, loss, theft, or other impairment until the entire Project has been completed and accepted by the Agency.

If Materials are damaged, lost, stolen, or otherwise impaired while stored, the monetary value advanced for them, if any, will be deducted from the next progress payment.

If these conditions in 00195.60(a-1) through 00195.60(a-3) have been satisfied, the amount of advance allowance, less the retainage described in 00195.50, will be determined by one of the following methods as elected by the Engineer:

- Net cost to the Contractor of the Materials, f.o.b. the Project Site or other approved site; or
- Price (or portion of it attributable to the Materials), less the cost of incorporating the Materials into the Project, as estimated by the Engineer.

(b) Proof of Payment - The Contractor shall provide the Engineer with proof of payment to the Materials suppliers for purchased Materials within 30 Calendar Days of the date of the progress payment that includes the advance allowance.

If proof of payment is not provided, sums advanced will be deducted from future progress payments, and the Engineer will not approve further prepayment advance allowance requests.

(c) Terminated Contract - If the Contract is terminated, the Contractor shall provide the Agency immediate possession of all Materials for which advance allowances have been received, as provided above. If, for any reason, immediate possession of the Materials cannot be provided, the Contractor shall immediately refund to the Agency the total amount advanced for the Materials. The Agency may deduct any amount not so refunded from final payment.

00195.70 Payment under Terminated Contract - Payment for Work performed under a Contract that is terminated according to the provisions of 00180.90 will be determined under (a) or (b) of this Subsection.

(a) Termination for Default - Upon termination of the Contract for the Contractor's default, the Agency will make no further payment until the Project has been completed. The Agency will make progress payments to the party to whom the Contract is assigned, but may withhold an amount sufficient to cover anticipated Agency costs, as determined by the Engineer, to complete the Project.

Upon completion of the Project, the Engineer will determine the total amount that the defaulting Contractor would have been entitled to receive for the Work, under the terms of the Contract, had the Contractor completed the Work (the "cost of the Work").

If the cost of the Work, less the sum of all amounts previously paid to the Contractor, exceeds the expense incurred by the Agency in completing the Work, including without limitation expense for additional managerial and administrative services, the Agency will pay the excess to the Contractor, subject to the consent of the Contractor's Surety.

If the expense incurred by the Agency in completing the Work exceeds the Contract Amount, the Contractor or the Contractor's Surety shall pay to the Agency the amount of the excess expense.

The Engineer will determine the expense incurred by the Agency and the total amount of Agency damage resulting from the Contractor's default. That determination will be final as provided in 00150.00.

If a termination for default is determined by a court of competent jurisdiction to be unjustified, it shall be deemed a termination for public convenience, and payment to the Contractor will be made as provided in Subsection (b) below.

(b) Termination for Public Convenience:

(1) General - Full or partial termination of the Contract shall not relieve the Contractor of responsibility for completed or performed Work, or relieve the Contractor's Surety of the obligation for any just claims arising from the completed or performed Work.

(2) Mobilization - If mobilization is not a separate Pay Item, and payment is not otherwise provided for under the Contract, the Agency may pay the Contractor for mobilization expenses, including moving Equipment to and from the Project Site. If allowed, payment of mobilization expenses will be based on cost documentation submitted by the Contractor to the Engineer.

(3) All Other Work - The Agency shall pay the Contractor at the unit price for the number of Pay Item units of completed, accepted Work. For units of Pay Items partially completed, payment will be as mutually agreed, or, if not agreed, as the Engineer determines to be fair and equitable. No claim for loss of anticipated profits will be allowed. The Agency will purchase Materials left on hand according to 00195.80.

00195.80 Allowance for Materials Left on Hand:

(a) Purchase of Unused Materials - If Materials are delivered to the Project Site, or otherwise acceptably stored at the order of the Engineer, but not incorporated into the Work due to complete or partial elimination of Pay Items, changes in Plans, or termination of the Contract for public convenience according to 00180.90, and it is not commercially feasible for the Contractor to return them for credit or

otherwise dispose of them on the open market; the Agency will purchase them according to the formula and conditions specified in Subsection (b) below.

(b) Purchase Formula and Conditions:

(1) Formula - The Agency will apply the following formula in determining the Contractor's allowance for Materials left on hand:

Contractor's Actual Cost, plus 5% Overhead Allowance, minus Advance Allowances under 00195.60, but no markup or profit.

(2) Conditions - The Agency will not purchase the Contractor's Materials left on hand unless the Contractor satisfies the following conditions:

- Requests the Agency's purchase of unused Materials;
- Shows acquisition of the Materials according to 00160.10;
- Shows that the Materials meet Specifications;
- Provides receipts, bills and other records of actual cost of Materials delivered to the designated delivery points; and
- Demonstrates to the satisfaction of the Engineer that the materials cannot be returned for credit or otherwise disposed of on the open market.

00195.90 Final Payment:

(a) Final Estimate - As soon as practicable after Final Inspection of the Project, as provided in 00150.90, the Engineer will prepare a final estimate of the quantities of the Pay Items completed. With this estimate of quantities as a base, the total amount due the Contractor will be determined according to the terms of the Contract including without limitation any amounts due for Extra Work performed.

(b) Final Payment - The amount of final payment will be the difference between the total amount due the Contractor and the sum of all payments previously made. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

After computation of the final amount due, and after the Engineer's issuance of Third Notification, final payment will be mailed to the Contractor's last known address as shown in the records of the Agency.

(c) No Waiver of Right to Make Adjustment - The fact that the Agency has made any measurement, estimate, determination or certification either before or after completion of the Project, Final Acceptance, Agency assumption of possession of the Project Site, determination of satisfactory completion of Pay Items or Work or release of retainage under 00195.50(d) or payment for any part of the Work, shall not prevent either party from:

- Showing the true amount and character of the Work;

- Showing that any measurement, estimate, determination or certification is incorrect;
- Recovering from the other party damages that may have been suffered because the other party failed to comply with the Contract.

00195.95 Error in Final Quantities and Amounts:

(a) Request for Correction of Compensation - If the Contractor believes the quantities and amounts detailed in the final Contract payment voucher, prepared by the Engineer according to 00195.90, to be incorrect, the Contractor shall submit an itemized statement to the Engineer detailing all proposed corrections.

This statement must be submitted to the Engineer within 90 Calendar Days from the date the voucher was mailed to the Contractor, according to 00195.90(b). Any request for compensation not submitted and supported by an itemized statement within the 90 Calendar Day period will not be paid by the Agency. This does not limit the application of Section 00199.

(b) Acceptance or Rejection of Request:

(1) Consideration of Request - The Engineer will consider and investigate the Contractor's request for correction of compensation submitted according to 00195.95(a), and will promptly advise the Contractor of acceptance or rejection of the request in full or in part.

(2) Acceptance of Request - If the Engineer accepts the Contractor's request(s) in full or in part, the Engineer will prepare a post-final Contract payment voucher, including all accepted corrections, and will forward it to the Contractor.

(3) Rejection of Request - If the Engineer rejects the request(s) in full, the Engineer will issue a written notice of rejection and mail it to the Contractor.

(4) Contractor Objection to Revised Voucher or Notice of Rejection - If the Contractor disagrees with the revised voucher or notice of rejection, the Contractor may seek review and resolution according to the procedure specified in 00199.40. If the Contractor fails to submit a request for 00199.40 review within 30 Calendar Days after the Engineer mails a post-final Contract payment voucher or notice of rejection, the Contractor waives all rights to a claim based on errors in quantities and amounts.

Section 00196 - Payment for Extra Work

Description

00196.00 General - Only work not included in the Contract as awarded but deemed by the Engineer to be necessary to complete the Project (see 00140.60) will be paid as Extra Work. Regardless of alterations and changes, any item of Work provided for in the Contract will not constitute Extra Work. Payment for alterations and changes to Work will be made according to 00195.20.

Compensation for Extra Work will be paid only for Work authorized in writing by the Engineer and performed as specified. Work performed before issuance of the Engineer's written authorization shall be at the Contractor's risk. Extra Work will be paid as determined by the Engineer, according to 00196.10 and 00196.20.

Provisions and Requirements

00196.10 Negotiated Price - If the Engineer can reasonably determine a price estimate for Extra Work, the Engineer may then give written authorization to the Contractor to begin the Extra Work. As soon as practicable, but within 10 Calendar Days after that authorization, the Contractor shall respond in writing to the Engineer's Extra Work price estimate by submitting to the Engineer an Extra Work price quote. The price quote shall detail the following items related to the Extra Work:

- Types and amounts of Materials
- Hours of Equipment use and hours of labor
- Travel
- Overhead and profit
- Other costs associated with the proposed Extra Work

Pending approval of the price quote, the Engineer will maintain force account records of the Extra Work. As soon as practicable, but within 10 Calendar Days of receipt of a properly supported price quote, the Engineer will review the price quote and advise the Contractor if it is accepted or rejected. The Engineer will not accept a price quote that cannot be justified on a Force Account basis. If the Contractor's price is accepted, the Engineer will issue a Change Order, and the Extra Work will be paid at the accepted price.

00196.20 Force Account - If the Engineer and the Contractor cannot agree on a price for the Extra Work, the Engineer may issue a Force Account Work order requiring the Extra Work to be paid as Force Account Work. Force Account Work records and payment will be made according to Section 00197.

Section 00197 - Payment for Force Account Work

00197.00 Scope - The Materials, Equipment and labor rates and procedures established in this Section apply only to Extra Work ordered by the Engineer to be performed as Force Account Work.

00197.01 General - Before ordering Force Account Work, the Engineer will discuss the proposed work with the Contractor, and will seek the Contractor's comments and advice concerning the formulation of Force Account Work specifications. The Engineer is not bound by the Contractor's comments and advice, and has final authority to:

- Determine and direct the Materials, Equipment and Labor to be used on the approved Force Account Work; and
- Determine the time of the Contractor's performance of the ordered Force Account Work.

Force account work performed by subcontractors will be measured and paid for on the same basis and in the same manner as force account work performed directly by the Contractor.

If the Engineer orders the performance of Extra Work as Force Account Work, the Engineer will record, on a daily basis, the Materials, Equipment and Labor used for the Force Account Work during that day. Engineer and the Contractor shall sign the record daily to indicate agreement on the Materials, Equipment and Labor used for the Force Account Work performed on that day.

The following shall be reflected on the daily record:

- Materials used in the Force Account Work as directed by the Engineer, except those furnished and paid under rental rates for use of Equipment;
- Equipment which the Engineer considers necessary to perform the Force Account Work. Equipment hours will be recorded to the nearest quarter hour;
- Labor costs, including that of Equipment operators and supervisors in direct charge of the specific operations while engaged in the Force Account Work; and
- The Engineer's and Contractor's signatures confirming its accuracy.

00197.10 Materials:

(a) General - The Contractor will be paid for Materials actually used in the Force Account Work as directed by the Engineer, except for those furnished and paid for under rental rates included with the use of Equipment. Payments will be at actual cost, including transportation costs to the specified location, from the supplier to the purchaser, whether the purchaser is the Contractor, a Subcontractor, or other forces. All costs are subject to the provisions of this Subsection.

(b) Trade Discount - If a commercial trade discount is offered or available to the purchaser, it shall be credited to the Agency, even though the discount may not have actually been taken. The Agency will not take any discounts for prompt or early payment, whether or not offered or taken.

(c) Not Directly Purchased From Supplier - If Materials cannot be obtained by direct purchase from and direct billing by the supplier, the cost shall be considered to be the price billed to the purchaser less commercial trade discounts, as determined by the Engineer, but not more than the purchaser paid for the Materials. No markup other than actual handling costs will be permitted.

(d) Purchaser-Owned Source - If Materials are obtained from a supply or source wholly or partly owned by the purchaser, the cost shall not exceed the price paid by the purchaser for similar Materials furnished from that source on Pay Items, or the current wholesale price for the Materials delivered to the Project Site, whichever is lower.

00197.20 Equipment:

(a) General - Equipment approved by the Engineer to perform the Force Account Work will be eligible for payment at the established rates only during the hours it is operated or on standby if so ordered by the Engineer. Equipment hours will be recorded on the daily record to the nearest quarter hour.

Except as modified by these provisions, Equipment use approved by the Engineer will be paid at the rental rates given in the most current edition of the Rental Rate Blue Books for Construction Equipment ("Blue Book"), Volumes 1, 2, and 3, published by Penton Media, Inc., and available from EquipmentWatch (phone 1-800-669-3282).

(b) Equipment Description - On the billing form for Equipment costs, the Contractor shall submit to the Engineer sufficient information for each piece of Equipment and its attachments to enable the Engineer to determine the proper rental rate from the Blue Book.

(c) Rental Rates (without Operator):

(1) Rental Rate Formula - Rental rates for Equipment will be paid on an hourly basis for Equipment and for attachments according to the following formula:

$$\text{Hourly Rate} = \frac{\text{Monthly Base Rate x Rate Adjustment Factor}}{\text{176 hours/month}} + \text{Hourly Operating Rate}$$

Some attachments are considered "standard Equipment" and are already included in the monthly base rate for the Equipment. That information can be obtained from EquipmentWatch.

(2) Monthly Base Rate - The monthly base rate used above for the machinery and for attachments represents the major costs of Equipment ownership, such as depreciation, interest, taxes, insurance, storage, and major repairs.

(3) Rate Adjustment Factor - The rate adjustment factor used above will be determined as per page iii of each section of the Blue Book.

(4) Hourly Operating Rate - The hourly operating rate used above for the machinery and for attachments represents the major costs of Equipment operations, such as fuel and oil, lubrications, field repairs, tires or ground engaging components, and expendable parts.

(5) Limitations - The Blue Book "Regional Adjustment Factor" shall not apply.

If multiple attachments are included with the rental Equipment, and are not considered "standard Equipment", only the attachment having the higher rental rate will be eligible for payment, provided the attachment has been approved by the Engineer as necessary to the Force Account Work.

Rental will not be allowed for small tools that have a daily rental rate of less than $5, or for unlisted Equipment that has a fair market value of $400 or less.

The above rates apply to approved Equipment in good working condition. Equipment not in good working condition, or larger than required to efficiently perform the work, may be rejected by the Engineer or accepted and paid for at reduced rates.

(d) Moving Equipment - If it is necessary to transport Equipment located beyond the Project Site exclusively for Force Account Work, the actual cost to transport the Equipment to, and return it from, its On-Site Work location will be allowed as an additional item of expense. However, the return cost will not exceed the original delivery cost. These costs will not be allowed for Equipment that is brought to the Project Site for Force Account Work if the Equipment is also used on Pay Item or related Work.

If transportation of such Equipment is by common carrier, payment will be made in the amount paid for the freight. No markups will be allowed on common carrier transportation costs. If the Equipment is hauled with the Contractor's own forces, transportation costs will include the rental rate of the hauling unit and the hauling unit operator's wage. If Equipment is transferred under its own power, the rental rate allowed for transportation time will be 75% of the appropriate hourly rate for the Equipment, without attachments, plus the Equipment operator's wage.

(e) Standby Time - If ordered by the Engineer, standby time will be paid at 40% of the hourly rental rate calculated according to this Subsection, excluding the hourly operating rate. Rates for standby time that are calculated at less than $1 per hour will not be paid. Payment will be limited to not more than 8 hours in a 24-hour period or 40 hours in a 1 week period.

(f) Blue Book Omissions - If a rental rate has not been established in the Blue Book, the Contractor may:

- If approved by the Engineer, use the rate of the most similar model found in the Blue Book, considering such characteristics as manufacturer, capacity, horsepower, age and fuel type;
- Request EquipmentWatch to furnish a written response for a rental rate on the Equipment, which shall be presented to the Engineer for approval; or
- Request that the Engineer establish a rental rate.

(g) Outside Rental Equipment - If Contractor-owned or Subcontractor-owned Equipment is not available, and Equipment is rented from outside sources, payment will be based on the actual paid invoice. Approval of the Engineer to rent from outside sources must be obtained prior to renting the equipment.

If the invoice specifies that rental rate does not include fuel, lubricants, field repairs, and servicing, an amount equal to the Blue Book hourly operating cost may be added for those items that were excluded.

The Agency may reduce the payment when the invoice amount plus allowance is higher than the amount authorized under (c) through (f) of this Subsection.

The provisions of 00180.20(c) apply to owner-operated Equipment.

00197.30 Labor - The Contractor will be paid for all labor engaged directly on Force Account Work, including Equipment operators and supervisors in direct charge of the specific force account operations, as follows:

(a) Wages - The actual wages paid to laborers and supervisors, if those wages are paid at rates not more than those for comparable labor currently employed on the Project, or at the recognized, current, prevailing rates in the locality of the Project.

(b) Required Contributions - The actual cost of industrial accident insurance, unemployment compensation contributions, payroll transit district taxes, and social security for old age assistance contributions incurred or required under statutory law and these Specifications. The actual cost of industrial accident insurance is the National Council on Compensation Insurance (NCCI) rate for the assigned risk pool for the appropriate work class multiplied by the experience modification factor for the Contractor.

(c) Required Benefits - The actual amount paid to, or on behalf of, workers as per diem and travel allowances, health and welfare benefits, pension fund benefits, or other benefits when such other benefits are required by a collective bargaining agreement or other employment contract generally applicable to the classes of labor employed on the Project.

No overtime will be compensated unless authorized in advance of performing the work by the Engineer.

00197.80 Percentage Allowances - To the Contractor's actual costs incurred, as limited in this Section 00197, amounts equal to a percentage markup of such costs will be allowed and paid to the Contractor as follows:

Subsection	Percent
00197.10 Materials	17
00197.20 Equipment	17
00197.30 Labor	22

When a Subcontractor performs ordered Force Account Work, the Contractor will be allowed a supplemental markup of 8% on each Force Account Work order.

These allowances made to the Contractor will constitute complete compensation for bonds, insurance, overhead, general and administrative expense, profit, and all other Force Account Work costs that were incurred by the Contractor, or by other forces that the Contractor furnished. No other reimbursement, compensation, or payment will be made.

00197.90 Billings - Billings for Force Account Work by the Contractor shall be submitted for the Engineer's approval on forms provided by the Agency or approved by the Engineer. Billings for Materials (other than Incidental items out of the inventory of the Contractor or Subcontractors), rental Equipment from sources other than the Contractor or Subcontractors, and Special Services, shall be accompanied by copies of invoices for the goods and services. The invoices shall be fully itemized showing dates, quantities, unit prices, and complete descriptions of goods and services provided. Invoices for amounts of $10 or less per invoice are not required, unless requested by the Engineer.

Costs included on the billings shall comply with 00197.01(a) and 00197.10 through 00197.40.

When a billing for Force Account Work has been paid at the Project level, no further corrections will be made because of further review if those corrections amount to less than $10.

Section 00199 - Disagreements, Protests, and Claims

Description

00199.00 General - This Section details the process through which the parties agree to resolve any disagreement concerning additional compensation or concerning a combination of additional compensation and Contract Time. (See 00180.80 for disagreements and claims concerning additional Contract Time only, and 00195.95 for disagreements and claims concerning correction of final compensation.) The Agency will not consider direct disagreements, protests, or claims from subcontractors, Suppliers, or any other Entity not a party to the Contract.

Provisions and Requirements

00199.10 Procedure for Resolving Disagreements - When disagreements occur concerning additional compensation or a combination of additional compensation and Contract Time, the Contractor shall first pursue resolution through the Engineer of all issues in the dispute, including without limitation the items to be included in the written notice in 00199.20. If the discussion fails to provide satisfactory resolution of the disagreement, the Contractor shall follow the protest procedures outlined in 00199.20. If the Engineer denies all or part of the Contractor's protest, and the Contractor desires to further pursue the issues, the Contractor shall submit a claim for processing according to 00199.30.

00199.15 Inappropriate Protest or Claim - It shall be presumed that the Contractor submits a protest or claim for additional compensation in good faith, based upon facts which reasonably support the Contractor's position and with full knowledge and understanding of the injury done to the Agency when notice of differing Project Site conditions or claims for additional compensation are not submitted in a timely manner as required under the Contract. Accordingly, the submission of a protest or claim without the concurrent submission of evidence that reasonably supports the protest or claim, or the submission of a protest or claim in an untimely manner will constitute a waiver of the protest or claim.

00199.20 Protest Procedure - If the Contractor disagrees with anything required in a Change Order or other written or oral order from the Engineer, including any direction, instruction, interpretation, or determination, or if the Contractor asserts a disagreement or dispute on any other basis, except 0195.95, that, in the Contractor's opinion, entitles or would entitle the Contractor to additional compensation or a combination of compensation and Contract Time, the Contractor shall do all of the following in order to pursue a protest and preserve its claim:

(a) Oral Notice - Give oral notice of protest to the Engineer and outline the areas of disagreement before starting or continuing the protested Work.

(b) Written Confirmation of Oral Notice – Not later than the end of the next business day following the day that oral notice of protest is given, deliver written documentation to the Engineer of the oral notice that includes the notice of protest and the areas of disagreement.

(c) Written Notice - File a proper written notice of protest with the Engineer within 7 Calendar Days after receiving the protested order. In the notice the Contractor shall:

- Describe the acts or omissions of the Agency or its agents that allegedly caused or may cause damage to the Contractor or to the Project, citing specific facts, persons, dates and Work involved;
- Describe the Contractor's proposed alternative to the Work ordered, if any, which will avoid damage to Contractor or to the Project;
- Describe the nature of the damages;
- Cite the specific Contract provision(s), if any, that support the protest;
- Include the estimated dollar cost, if any, of the protested Work, and furnish a list of estimated Materials, Equipment and labor for which the Contractor might request additional compensation; and
- If additional compensation is estimated to be due, include the estimated amount of additional time required, if any.

FAILURE TO COMPLY WITH THIS NOTICE REQUIREMENT RENDERS THE NOTICE IMPROPER AND SHALL CONSTITUTE A WAIVER OF ANY CLAIM FOR ADDITIONAL COMPENSATION OR A COMBINATION OF ADDITIONAL COMPENSATION AND CONTRACT TIME FOR ANY PART OF THE PROTESTED WORK.

(d) Engineer's Record and Response – The Engineer will file a copy of each written notice of protest in the Project records and will issue a written response to the protest within seven (7) work days of receipt of a timely filed written notice of protest. The Engineer has no responsibility to evaluate the protest unless the Contractor has timely filed a proper notice submitting all of the above information.

(e) Final Documentation of Claim - Within 60 Calendar Days following completion of the protested work, Contractor shall provide the Engineer with complete documentation of protested work, listing exact materials, equipment and labor used for the work and the dollar amount requested for each. If the claim is accepted, no additional compensation will be awarded based on documentation submitted after this deadline. If the claim is denied or if the Contractor is not satisfied with the decision by the Engineer, the amount claimed by the Contractor in any subsequent Step or proceeding may not exceed the dollar amount requested under this subsection.

(f) Records - Keep complete records of all costs and time incurred throughout the protested Work, and allow the Engineer access to those and other supporting records. Provide daily records of protested Work, on a weekly basis, on a schedule to be set by agreement with the Engineer.

(g) Comparison of Records - Provide the Engineer adequate facilities for keeping cost and time records of the protested Work. The Contractor and the Engineer will compare records and either bring them into agreement at the end of each day, or record and attempt to explain any differences.

(h) Work to Proceed - In spite of any protest, proceed promptly with the Work ordered by the Engineer.

(i) Evaluation of Protest - The Engineer has no responsibility for evaluating a protest that is not timely filed, or for which adequate supporting documentation has not been made available to the Engineer. Provided the procedures above are followed, the Engineer will promptly evaluate all protests, after the Contractor has fully complied with the requirements described in 00199.20(c), Written Notice. If the protest is denied, the Engineer will notify the Contractor in writing of the reasons for full or partial denial.

If a protest is found to be valid, the Engineer will, within a reasonable time, make an equitable adjustment of the Contract. Adjustment of time will be evaluated according to 00180.80.

The Engineer has no responsibility for evaluating and may reject a protest that does not comply with 00199.20(b). If the protest is rejected, the Engineer will notify the Contractor in writing of the reasons for rejection.

(j) Protest Evaluation by Third Party Neutral - If the Engineer agrees that the Contractor has fully complied with the requirements described in 00199.20(b), and if the Engineer fully or partially denies, in writing, the Contractor's protest according to 00199.20(f), the Contractor may request that a mutually selected Third Party Neutral review the protest. Procedures for selecting, using, and paying for the cost of the Third Party Neutral will be specified by Change Order.

If the Contractor does not accept the Engineer's evaluation of the protest, or either the Contractor or Engineer disagrees with the resolution recommended by the Third Party Neutral, the Contractor may pursue a claim as described in 00199.30.

00199.30 Claims Procedure:

(a) General - If the Contractor believes that additional compensation is due, or a combination of additional compensation and Contract Time, and has pursued and exhausted all the procedures provided in 00199.10 and 00199.20 to resolve a disagreement and protest, the Contractor may file a claim.

The Agency's Contract is with the Contractor. There is no contractual relationship between the Agency and any subcontractors, Suppliers or any Entity other than the Contractor. It is the Contractor's responsibility to fully evaluate any claim before presenting it to the Agency. In addition, when a claim includes Work done or costs incurred by any subcontractors, Suppliers, or any Entity other than the Contractor, the Contractor remains solely responsible for presenting the claim to the Agency.

Claims that include Work done or costs incurred by subcontractors, Suppliers, or any Entity other than the Contractor will not be considered by the Agency unless the Contractor has:

- Completed and provided its own written evaluation of the claim;
- Verified by its own independent review and evaluation of the amount of compensation sought; and
- Certified the claim in accordance with 00199.30(b) (Part 10).

(b) Claims Requirements - At any time during the progress of the Work, but not later than 45 Calendar Days following the date of the Second Notification, the Contractor shall submit to the Engineer in writing, claims for additional compensation or a combination of additional compensation and Contract Time additional to that specified in the Contract. For a claim not submitted within the 45 day limit, that has not met the requirements of 00199.20, or is not filed as provided in 00199.30, the Contractor waives any claim for additional compensation or for additional compensation and Contract Time, and the Agency may reject the claim.

Written claims to the Engineer or the Agency by the Contractor shall be delivered to the Agency address shown in the Special Provisions, unless a different address is agreed to by the Engineer, and shall be delivered:

- By U.S. Postal Service first class mail or priority mail (which at the sender's option may include certified or registered mail return receipt requested); or
- By overnight delivery service of a private industry courier.

Claims will be considered as having been received by the Agency:

- At the time of actual receipt or 7 Calendar Days after the postmarked date when deposited for delivery by first class or priority mail, whichever is earlier; or
- At the time of actual receipt or 3 Calendar Days after deposit with a private industry courier for overnight delivery service, whichever is earlier.

The Agency reserves the right at any time and at any step in the claim decision or review process to request additional information, records or documentation related to the claim or the Contract either directly or through agents working toward resolution of the disputed or claimed events and issues.

Claims shall be made in writing, and shall include all information, records and documentation necessary for the Agency to properly and completely evaluate the claim.

To be considered, claims for additional compensation, or for additional compensation and Contract Time, shall be completed according to 00199.30 and shall be submitted with the required information and in the format below and labeled as required below for each claimed issue:

(Part 1) Summary (label page 1.1 through page 1.X) - In the summary, include a detailed, factual statement of the claim for additional compensation and Contract Time, if any, with necessary dates and locations of Work involved in the claim and the dates of when the event arose. Also include detailed facts supporting the Contractor's position relative to the Engineer's decision (see 00199.20(f));

(Part 2) Proof of notice (label page 2.1 through page 2.X) - Submit a copy of the written notice, with all attachments, that was given to the Agency. Include the date when that written notice and the date when oral notice was given:

(Part 3) Copies of the Contract Specifications that support the Contractor's claim (label page 3.1 through page 3.X);

(Part 4) Theory of entitlement supporting the claim (label page 4.1 through page 4.X) - Include a narrative of how or why the specific Contract Specifications support the claim and a statement of the reasons why such Specifications support the claim;

(Part 5) Itemized list of claimed amounts (label page 5.1 through page 5.X) - Claimed damages that resulted from the event with a narrative of the theories and records and documents used to arrive at the value of the damages;

(Part 6) Additional Contract Time requests (label page 6.1 through page 6.X) - If the claim is for a combination of additional compensation and Contract Time, submit a copy of the schedule that was

in effect when the event occurred and a detailed narrative which explains how the event impacted Contract Time. In addition, if an Agency-caused delay is claimed:

- Include the specific days and dates under claim;
- Provide detailed facts about the specific acts or omissions of the Agency that allegedly caused the delay, and the specific reasons why the resulting delay was unreasonable; and
- Provide a schedule evaluation that accurately describes the impacts of the claimed delay.
- Also see 00180.80 for additional requirements regarding claims for Contract Time and causes that are eligible and ineligible for consideration;

(Part 7) Copies of actual expense records (label page 7.1 through page 7.X) - Include documents that contain the detailed records and which support and total to the exact amount of additional compensation sought. Include the information and calculations necessary to support that amount. That amount may be calculated on the basis of Section 00197, if applicable, or may be calculated using direct and indirect costs presented in the following categories:

- Direct Materials;
- Direct Equipment. The rate claimed for each piece of Equipment shall not exceed the actual cost. In the absence of actual Equipment costs, the Equipment rates shall not exceed 75 percent of those calculated under the provisions of 00197.20. For each piece of Equipment, the Contractor shall include a detailed description of the Equipment and attachments, specific days and dates of use or standby, and specific hours of use or standby;
- Direct labor;
- Job overhead;
- General and administrative overhead; and
- Other categories as specified by the Contractor or the Agency;

(Part 8) Supporting records and documents (label page 8.1 through page 8.X) - Include copies of, or excerpts from the following:

- Any documents that support the claim, such as manuals standard to the industry and used by the Contractor; and
- Any daily reports or diaries related to the event, photographs or media that help explain the issue or event (optional), or all other information the Contractor chooses to provide (optional);

(Part 9) Certification (label page 9.1 through 9.X) - A certified statement, signed by a person authorized to execute Change Orders, by the Contractor, subcontractor, Supplier, or Entity, originating the claim, as to the validity of facts and costs with the following certification:

Under penalty of law for perjury or falsification, the undersigned, (Name), (Title), (Company) certifies that this claim for additional compensation for Work on the Contract is a true statement of the actual costs incurred (in the amount of $_____, exclusive of interest) and is fully documented and supported under the Contract between the parties.

Signature: _____

Date: _____, 20___

Subscribed and sworn before me this ____ day of _____, 20___

_____

Notary Public

My commission expires _____.

(Part 10) Contractor evaluation of a lower tier claim (label page 10.1 through 10.X) - If the claim includes Work done or costs incurred by any subcontractors, Suppliers, or any Entity other than the Contractor, the following are required:

- Data required by the other Subsections of 00199.30(b);
- Copies of the Contractor's, subcontractor's, Supplier's and Entity's, at all tiers above the level of which the claim originates, separate evaluation of entitlement;
- Copies of the Contractor's, subcontractor's, Supplier's and Entity's, at all tiers above the level of which the claim originates, independent verification and evaluation of the amount of damages sought; and
- A person authorized to execute Change Orders on behalf of the Contractor, subcontractor, Supplier and Entity, at all tiers above the level of which the claim originates, must sign a statement with the following certification:

  Under penalty of law for perjury or falsification, the undersigned, (Name) (Title), (Company) certifies that this claim originating from the subcontractor, Supplier or Entity (Company) for additional compensation for Work on the Contract is a reasonable statement, independently verified, of the costs incurred (in the amount of $_____, exclusive of interest) and is fully documented and supported under the Contract between the parties.

  Signature: _____

  Date: _____, 20___

  Subscribed and sworn before me this ____ day of _____, 20__

  _____

  Notary Public

  My commission expires _____.

If the Engineer determines that additional information, records or documentation is needed to allow proper evaluation of the claim submittal, the Engineer will request the information, records or documentation. The Contractor shall submit to the Engineer within 14 Calendar Days, or as otherwise agreed by the parties, the required additional information, records and documentation.

If the Engineer determines that the claim submittal with the additional information, records and documentation submitted is incomplete and not accepted as a claim, the Engineer will notify the Contractor in writing and the submittal will be rejected and will not be considered under 00199.40.

(c) Records Requirements - The Contractor shall comply with 00170.07.

(d) Compliance Required - Full compliance by the Contractor with the provisions of this Section is a condition precedent to the commencement of any lawsuit by the Contractor to enforce any claim.

00199.40 Claim Decision; Review; Exhaustion of Administrative Remedies - The Agency intends to resolve all claims at the lowest possible administrative level. The Engineer will also determine whether multiple claims should be advanced separately or together.

If the Engineer denies the claim for additional compensation or a combination of additional compensation and Contract Time, in full or in part, according to 00199.40(a), the Contractor may request review of the denial. The disputed claim for additional compensation or a combination of additional compensation and Contract Time may then be resolved, in full or in part, at any of the progressive steps of claim review procedure as specified in (b) through (c) of this Subsection.

If the Engineer has denied a claim, in full or in part, for Contract Time only according to 00180.80, or has denied a claim, in full or in part, for correction of final compensation according to 00195.95, those disputed claims may then be resolved, in full or in part, at either of the two progressive steps of claim review procedure as specified in (b) through (c) of this Subsection.

A person authorized by the Contractor to execute Change Orders on behalf of the Contractor must be present and attend all claim hearings. For all claims, all of the actions and review under each step of the review process shall occur before the review can be advanced to the next higher step.

If, at any step in the claim decision or review process, the Contractor fails to promptly submit requested information or documentation that the Agency deems necessary to analyze the claim, the Contractor is deemed to have waived its right to further review, and the claim will not be considered properly filed and preserved.

(a) Decision by the Engineer - The Engineer will, as soon as practicable, consider, investigate, and evaluate a Contractor's claim for additional compensation, or for a combination of additional compensation and Contract Time, if submitted as required by 00199.30.

Once the Engineer determines the Agency is in receipt of a properly submitted claim, the Engineer will arrange a meeting, within 21 Calendar Days or as otherwise agreed by the parties, with the Contractor in order to present the claim for formal review and discussion.

If the Engineer determines that the Contractor must furnish additional information, records or documentation to allow proper evaluation of the claim, the Engineer will schedule a second meeting, to be held within 14 Calendar Days or as otherwise agreed by the parties, at which the Contractor shall present the requested information, records and documentation.

The Engineer will provide a written decision to the Contractor within 30 Calendar Days of the last Engineer-level meeting.

If the Contractor does not accept the Engineer's decision, the Contractor may, within 10 Calendar Days of receipt of the written decision, request in writing that the Engineer arrange a review at Step 1 (see (b) below).

(b) Step 1: Public Works Director Level Review - The Contractor shall request that the Engineer arrange a meeting with the Public Works Director or the Public Works Director's designee, as determined by the Public Works Director, in order to present the denied or partially denied claim for formal review and discussion. The meeting will take place within 21 Calendar Days of the Agency's receipt of the request, or as otherwise agreed by the parties.

If the Public Works Director (or designee) determines that the Contractor must furnish additional information, records or documentation to allow proper evaluation of the claim, the Public Works Director (or designee) will schedule a second meeting, to be held within 14 Calendar Days, or as otherwise agreed by the parties, at which the Contractor shall present the requested information, records and documentation.

The Public Works Director (or designee) will provide a written decision to the Contractor within 30 Calendar Days of the last meeting with the Public Works Director (or designee).

The claim is subject to 00199.60, if not all of the records requested by the Public Works Director (or designee) were furnished. If applicable, advancement of the claim is subject to the provisions of 00199.60 regarding waiver and dismissal of the claim or portions of the claim.

If the Contractor does not accept the decision, the Contractor may, within 180 Calendar Days from the date of receipt of the Public Works Director (or designee) written decision or within 90 Calendar Days of the date of Second Notification, whichever is later, initiate Step 2 as set forth in subsection (c) below.

(c) Step 2: Arbitration and Litigation - The Contractor must follow each step in order, and exhaust all available administrative remedies before resort to arbitration and litigation. Litigation of a claim that cannot be resolved in Step 1 shall be initiated by filing a complaint in the Circuit Court for the State of Oregon in the county where the Agency's main office is located that contains a stipulation to arbitration under ORS 36.410. The claim and all cross and counter-claims filed in response to the complaint shall be submitted to the Court Arbitration Program set forth in ORS 36.400 to 36.425, Chapter 13 of the Oregon Uniform Trial Court Rules and the Circuit Court supplemental local rules concerning arbitration. Either party may seek, and shall be entitled to, an order directing the other party to submit to arbitration as provided herein and to judgment for its costs, expenses and attorney fees in obtaining and enforcing the order

In no event shall this Subsection be construed as a waiver by the Agency or by the State of Oregon on any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court.

(d) Payment of Costs, Expenses and Attorney's Fees – The prevailing party shall be entitled to an award for reasonable costs and expenses incurred after the initiation of Step 2, including costs and expenses incurred for arbitration, trial de novo and on appeal. Costs and Expenses shall include, but shall not be limited to, reasonable attorney fees and expenses, arbitrator fees and expenses, and costs of discovery

As used in this subsection 00199.40(d), "prevailing party" for an arbitration award means (1) a Contractor who has received an arbitration award, exclusive of interest, costs and expenses, that is more than the dollar amount claimed by the Contractor in its Final Documentation of Claim under 00199.20(d) or (2) the Agency if there is no arbitration award to the Contractor or if the arbitration award to the Contractor, exclusive of interest, costs and expenses, is less than the dollar amount of the award in the Step 1 decision. For all other arbitration awards, there shall not be a "prevailing party."

The award of costs and expenses after trial de novo shall be made as provided for in ORS 36.425. The award of costs and expenses after appeal from a judgment entered after trial de novo shall be to the prevailing party designated as such by the appeals court.

The Contractor shall comply with 00170.00.

00199.50 Mediation - Notwithstanding the formal claims procedure specified above, the parties may enter into nonbinding mediation by mutual agreement at any time, in which case the parties may also agree to suspend the time requirements in Section 00199 pending the outcome of the mediation process. The rules, time and place for mediation, as well as selection of the mediator, shall be established by mutual agreement. Costs shall be divided equally between the Contractor and the Agency. Either party may terminate mediation at any time upon 5 Calendar Days notice to the other, after which the time requirements of Section 00199 shall be automatically reinstated and shall resume from the point at which the time requirements were suspended.

00199.60 Review of Determination Regarding Records - If not all of the records requested by the Agency under 00199.40(c) Step 2 were provided, then the Agency will determine:

- If the records are of the type described in 00170.07; and
- If the records have not been maintained or the records, or access to the records, has not been provided to the Agency as required by 00170.07 and this Section; and
- If the records are material and necessary for proper evaluation of part or all of the claim; and
- The portions of the claim for which the records are material and necessary for proper evaluation.

If the Agency makes the foregoing determinations, then subject to the review process described below, all portions of the claim for which the Agency determined the records are material and necessary for proper evaluation are immediately waived and irrevocably dismissed.

Even if the records have not been maintained or the records, or access to the records, have not been provided to the Agency in a given instance, the Agency may determine that sufficient records have been provided for the Agency to properly evaluate the claim in that instance. If the Agency makes this determination, the claim or portions of the claim will not be waived or dismissed under this provision.

If the Contractor does not accept the Agency written determination that the records are material and necessary for proper evaluation of part or all of the claim, and the portions of the claim for which the records are material and necessary, the Contractor may, within 14 Calendar Days of receipt of the Agency determination, request, in writing, a review of such determination by the Public Works Director (or designee). If the Contractor does not request a review of the Agency determination, the Agency

determination shall then become the Agency's final determination as of the expiration of the time limit to request review.

If the Contractor requests the review, the Public Works Director (or designee) will schedule a review meeting within 14 Calendar Days, or as otherwise agreed by the parties, of when the Public Works Director (or designee) receives the written review request. The Agency and the Contractor will each have an opportunity to explain their respective positions at the review meeting in a manner determined by the Public Works Director (or designee).

Within 10 Calendar Days of the review meeting, the Public Works Director (or designee) will issue a written proposed finding of whether the records not maintained or not provided to the Agency, or for which access was not provided to the Agency, are material and necessary for proper evaluation of part or all of the claim. If the Public Works Director (or designee) makes that finding, then the Public Works Director (or designee) will also make a proposed written finding as to what portions of the claim the records are material and necessary and, therefore, waived and irrevocably dismissed.

Even if the records have not been maintained or the records, or access to the records, have not been provided to the Agency in a given instance, the Public Works Director (or designee) may determine that sufficient records have been provided for the Agency to properly evaluate the claim in that instance. If the Public Works Director (or designee) makes this determination, then the claim or portions of the claim will not be waived or dismissed under this provision.

The Public Works Director's (or designee) findings will be submitted to the Contractor. The Public Works Director's (or designee) findings are the Agency's final determination.

If the Agency's final determination is that the records are material and necessary for proper evaluation of part or all of the claim, then the claim or that portion of the claim for which the records are material and necessary is waived and irrevocably dismissed, unless the Contractor provides the records, or access to the records, to the Agency within 5 Calendar Days of the Agency's final determination. If the Contractor provides the records, or access to the records, within this time limit, the Agency will schedule a meeting with the Contractor within 14 Calendar Days or as otherwise agreed by the parties, to discuss the records.

The Agency's final determination that records are material and necessary for proper evaluation of part or all of the claim, and the Agency's final determination of the portions of the claim for which the records are material and necessary, shall be final and binding.

If the entire claim is waived and irrevocably dismissed pursuant to the Agency's final determination there will be no further decision by the Agency on the claim or further review of the claim under 00199.40 and the claim will not be eligible for mediation under 00199.50. If only portions of the claim are waived and irrevocably dismissed pursuant to the Agency's final determination, the Agency will provide a written decision to the Contractor regarding the remaining portions of the claim within 30 Calendar Days of the final Step 2 meeting, or the Agency's final determination regarding the records, whichever is later. There will be no further decision by the Agency on or further review under 00199.40 of the portions of the claim waived and irrevocably dismissed pursuant to Agency's final determination and those portions will not be eligible for mediation under 00199.50.

END OF SECTION

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SECTION 00 73 00 – SPECIAL PROVISIONS

PART 00100 – GENERAL CONDITIONS

Section 00110 – Organization, Conventions, Abbreviations, and Definitions

00110.10 Organization of Specifications – Modify the third bullet as follows:

- The Special Provisions, which include the Technical Specifications, Divisions 01 through 48.

00110.20 Definitions – The definition of "ENGINEER" is modified as follows:
ENGINEER – Consor North America, Inc. is designated ENGINEER and is to act as AGENCY's representative, assume duties and responsibilities, and have the rights and authority assigned to ENGINEER in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Section 00120 – Bidding Requirements and Procedures

00120.01 Receipt of Bids; Opening - Add the following:
Bids must be delivered to Kevin Gorman, Public Works Director, at the front desk of Warrenton City Hall, 225 South Main Street, Warrenton, OR 97146, by 2:00 PM local time on MONTH DAY, YEAR. Bids will be publicly opened and read by the Public Works Director at 2:00 PM, local time on MONTH DAY, YEAR in the Warrenton Fire Training Room. Bids may not be submitted by fax or electronic means.

00120.02 Prequalification of Bidders – No prequalification is required.

00120.03 Request for Solicitation Documents – Add the following:
Solicitation Documents may be obtained via email request to Twyla Vittetoe, Engineering Technician, tvittetoe@warrentonoregon.us. Documents are available at no charge in electronic file format (PDF).

00120.04 Pre-Bid Meeting – Add the following:
A voluntary pre-bid meeting will be held on MONTH DAY, YEAR, at 10:00 AM, local time, at Warrenton City Hall, P.O. Box 250, 225 South Main Street, Warrenton, OR 97146. A project site tour will follow the pre-bid meeting.

00120.17 Use of Agency-Owned Land for Staging and Storage Areas – Add the following:
CONTRACTOR may use the following lands for staging or storage areas: as delineated in the Drawings. CONTRACTOR shall comply with all Restrictions on Use as defined in the General Conditions, Technical Specifications and Drawings.

Section 00150 – Control of Work

00150.30 Deliver of Notices – CONTRACTOR written notice to ENGINEER or AGENCY shall be delivered to:

Kevin Gorman, Public Works Director
P.O. Box 250
Warrenton, OR 97146

Section 00160 – Source of Materials

00160.20(a) Buy America – Federal highway funds are not involved on the project.

Add the following Sections:
00160.20(d) American Iron and Steel – The Project is being funded by the Drinking Water State Revolving Fund which has federal statutory requirements commonly known as "American Iron and Steel." See Solicitation Documents, Section 00 73 30.01, SDWRLF/EPA Grant Construction Contract Requirements.

00160.20(e) Build America Buy America Act Requirements – The Project is being funded by the Build America Buy America Act which has federal statutory requirements commonly known as "BABA." See Solicitation Documents, Section 00 73 30.01, SDWRLF/EPA Grant Construction Contract Requirements.

Section 00165 – Quality of Materials

00165.03 Testing by AGENCY - Replace with the following:
Reference the Technical Specifications, Section 01 45 00 Quality Control, for responsibilities and costs of testing.

00165.04 Costs of Testing – Replace with the following:
Reference the Technical Specifications, Section 01 45 00 Quality Control, for responsibilities and costs of testing.

Section 00170 – Legal Relations and Responsibilities

00170.02 Permits, Licenses, and Taxes – Add the following:

- Obtain business license from CITY of Warrenton.

00170.03 Furnishing Rights of Way and Permits – Add the following:
The AGENCY will apply and pay for the following Permits:

- CITY of Warrenton Public Works Construction Permit
- Oregon DOT Permit to Occupy or Perform Operations on a State Highway

CONTRACTOR is required to comply with all terms and conditions of Permits.

Prior to commencement of respective work, the CONTRACTOR shall confirm that required permits have been issued and obtain copies of such permits. CONTRACTOR shall provide such CONTRACTOR information to the respective permitting authority as is necessary for issuance of permits in accordance with the procedures required by the permitting authority.

The CONTRACTOR shall be responsible for coordinating and scheduling all inspections required by applicable permits with the respective permitting authorities, including those for permits issued by the AGENCY.

The CONTRACTOR shall be responsible for paying all permit reinspection fees, investigation fees, penalties, and other permit fees arising from the CONTRACTOR's failure to properly request, coordinate, schedule, and obtain required inspections; CONTRACTOR's failure to properly prepare the work for inspection; CONTRACTOR's commencement of work prior to issuance of required permits; or

CONTRACTOR's failure to comply with the provisions of any permit. The CONTRACTOR shall pay such fees or penalties promptly to the respective permitting authority, and no separate payment, reimbursement, or other compensation will be paid to the CONTRACTOR by the AGENCY for such penalties or fees. If any such penalties or fees are levied against the AGENCY and the permitting authority requires the AGENCY to pay them directly to the permitting authority, the CONTRACTOR shall reimburse the AGENCY, which may include deducting such amounts from payments due to the CONTRACTOR.

Any delays in the Work arising from the CONTRACTOR's failure to properly request, coordinate, schedule, and obtain required inspections; CONTRACTOR's failure to properly prepare the work for inspection; CONTRACTOR's commencement of work prior to issuance of required permits; or CONTRACTOR's failure to comply with the provisions of any permit; or CONTRACTOR's failure to remit payment to the permitting authority any reinspection fees, investigation fees, penalties, or other fees or penalties as provided in this section, shall be counted against the Contract Time. No additional Contract Time will be provided for such delays.

00170.65(b)(1) Minimum Wage Rates – BOLI Prevailing Wage Rates (Effective January 1, 2025) title page is included at the end of these Special Provisions.

00170.70(a) Insurance Coverages

Required minimum Insurance coverage levels are as follows:

Commercial General Liability	$2,000,000 Combined Single Limit Per Occurrence
Pollution Liability Coverage	$2,000,000
Asbestos Liability Endorsement	Not Required
Lead Liability Endorsement	Not Required
Commercial Automobile Liability	$2,000,000 Combined Single Limit Per Occurrence
with Pollution Coverage	Required
Builder's Risk	Contract Value

00170.70(c) Additional Insured - The liability insurance coverages of 00170.70(a) shall include the AGENCY, the AGENCY's governing body, board, or Commission and its members, and the AGENCY's officers and employees as Additional Insureds, but only with respect to the CONTRACTOR's activities to be performed under the Contract. When federal transportation funding is involved, the liability coverages of 00170.70(a) shall also include the State of Oregon, the Oregon Transportation Commission and the Oregon Department of Transportation and their respective officers, members and employees as additional insureds, but only with respect to the CONTRACTOR's activities to be performed under the Contract. Coverage shall be primary and non-contributory with any other insurance and self-insurance. The liability coverages of 00170.70(a) that are permitted by the AGENCY to be obtained by an appropriate SUBCONTRACTOR shall include all of the foregoing as Additional Insureds and shall also include CONTRACTOR and its officers and employees as Additional Insureds.

Section 00180 – Prosecution and Progress

00180.20(a) Subcontracting Limitations; General – The CONTRACTOR's own organization shall perform work amounting to at least 50% of the original Contract Amount.

00180.40(a) Limitation of Operations; In General – Add the following to subsection:

- As further detailed in the Technical Specifications, Section 01 10 00 Summary of Work.

00180.40(b) Limitation of Operations; On-Site Work – Add the following item to the bulleted list:

- An approved ODOT Permit to Occupy or Perform Operations on a State Highway

00180.41 Project Work Schedules – A Type "A" Schedule shall be required for the Project.

00180.85(b) Liquidated Damages – Add the following:
CONTRACTOR shall pay to the Agency, not as a penalty but as liquidated damages, one thousand two dollars ($1,200) per calendar day for each Calendar Day the CONTRACTOR expends performing the Contract in excess of the Contract Time or adjusted Contract Time.

Section 00190 – Measurement of Pay Quantities

00190.00 Scope – This section is supplemented by the Technical Specifications, Section 01 22 20 Unit Price Measurement and Payment.

Section 00199 – Disagreements, Protests, and Claims

00199.30(b) Claims Requirements – CONTRACTOR written claims to ENGINEER or AGENCY shall be delivered to:

Kevin Gorman, Public Works Director
P.O. Box 250
Warrenton, OR 97146

PREVAILING WAGE RATES

This Contract is for a project that is subject to ORS 279C.800 to 279C.870. All persons working under this contract and all associated subcontracts must be paid not less than the applicable state prevailing rate of wage. ***"Prevailing Wage Rates for Public Works Contracts in Oregon" (effective January 1, 2025)*** are the appropriate prevailing wage rate publications for this contract. These documents are published by the Oregon Bureau of Labor and Industries (BOLI) and are available on-line at:

http://www.oregon.gov/BOLI/WHD/PWR/Pages/pwr_state.aspx

BOLI Office Locations

Bend	1645 NE Forbes Rd, Suite 106 Bend, OR 97701	541-322-2435
Eugene	1400 Executive Pkwy., Suite 200 Eugene, OR 97401	541-686-7623
Medford	119 N Oakdale Ave. Medford, OR 97501	541-776-6270
Portland	800 NE Oregon St., Suite 1045 Portland, OR 97232	971-673-0761
Salem	3865 Wolverine Ave. NE Building E, Suite 1 Salem, OR 97305	503-378-3292

The successful Bidder and all subsequent subcontracts shall comply with ORS 279C.845 wage rate requirements and produce appropriate certificates that they have compiled.

END OF SECTION

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SECTION 00 73 30.01 – SDWRLF/EPA GRANT CONSTRUCTION CONTRACT REQUIREMENTS

The following clauses shall be incorporated into construction contracts receiving financial assistance from the Safe Drinking Water Revolving Loan Fund (SDWRLF) and the EPA Community Grant. In the event of conflict within the contract these clauses shall take precedence.

Required Bid Submittals

The following submittals are required to be submitted with the bid proposal:

- Certification Regarding Lobbying (Section 00 45 46.02)
- DBE Proposed Utilization: Documentation of good faith efforts for solicitation and proposed utilization/contracting with Disadvantaged Business Enterprises ("DBE")

SAM Registration

SAM Registration is required for all entities that enter into direct contracts with the recipients of SDWRLF. SAM Registration Link: https://www.sam.gov/SAM/ *(NOTE: The SAM registration expires annually and must be kept active until the SDWRLF project is closed.)*

Termination for Cause and for Convenience & Breach of Contract

Contractor shall address termination for cause and for convenience, including the manner by which it will be effected and the basis for settlement. In addition, contractor shall address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

Equal Employment Opportunity

Contractor shall comply with Executive Order 11246 of September 24, 1965, entitled ''Equal Employment Opportunity,'' as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR chapter 60).

Procurement of Recovered Materials

Contractor must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, including procurement of recovered materials in a manner designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247.

Whistleblower

Contractor receiving SDWRLF funds shall under or through this contract to, post notice of the rights and remedies provided to whistleblowers under No Fear Act Pub. L. 107-174. 29 CFR § 1614.703 (d).

Source of Funds

Work under this contract is funded by the federal Safe Drinking Water Revolving Loan Fund through Business Oregon and a partnership of Local and/or Private Funds.

Suspension and Debarment

Contractor certifies that it is not debarred or suspended or is otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549, ‘‘Debarment and Suspension”, and shall not contract or permit any subcontract at any level with any party similarly excluded or ineligible. A list of excluded parties is available in the System for Award Management (SAM) at www.sam.gov, under “search records”.

Copeland “Anti-Kickback” Act

Contractor shall comply with the Copeland “Anti-Kickback” Act (18 U.S.C. 847) as supplemented in Department of Labor regulations (29 CFR part 3).

Intellectual Property

Contractor hereby grants to the U.S. E.P.A. a royalty-free, nonexclusive, and irrevocable license to reproduce, publish or otherwise use, and to authorize others to use, for federal government purposes, any intellectual property developed under this contract. Contractor shall secure from third parties the same license in the name of the U.S. E.P.A. regarding any intellectual property developed by third parties as subcontractors under this contract, or developed under contract with the Contractor specifically to fulfill Contractor’s obligations related to this contract.

Inspections; Information

Contractor shall permit, and cause its subcontractors to allow City of Warrenton, the State of Oregon, the federal government and any party designated by them to:

- Examine, visit and inspect, at any and all reasonable times, the property, if any, constituting the Project.
- Inspect and make copies of any accounts, books and records, including, without limitation, its records regarding receipts, disbursement, contracts, and any other matters relating to the Project, and to its financial standing, and shall supply such reports and information as reasonably requested.
- Interview any officer or employee of the Contractor, or its subcontractors, regarding the Project.

Contractor shall retain all records related to the Project for three years after final payments are made and any pending matters are closed.

Disadvantaged Business Enterprises

Recipient will implement the good faith efforts for solicitation and contracting with Disadvantaged Business Enterprises (“DBE”) described in Section 4.1 of the Safe Drinking Water Handbook. This applies to all solicitation and contracting for construction, equipment, supplies, engineering or other services that constitute the Project financed by this Contract. Recipient will maintain documentation in a Project file on Disadvantaged Business Enterprises. Recipient will maintain documentation in a Project file and submit required forms, as described in Section 4.1 of the Safe Drinking Water Handbook. Recipient will ensure that all prime contractors and subcontractors implement the good faith efforts for solicitation and contracting, and comply with all DBE procurement forms, statements, and reporting requirements. Recipient will ensure

that each procurement contract (prime plus all subcontractor contracts) includes the following term and condition:

> "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies."

Recipient will ensure that all prime contractors and subcontractors implement the good faith efforts for solicitation and contracting, and comply with all DBE procurement forms, statements, and reporting requirements.

The DBE Six Good Faith Efforts and Forms and included at the end of this document.

Prohibition on Certain Telecommunication and Video Surveillance Services or Equipment

As required by 2 CFR 200.216, federal grant or loan recipients and subrecipients are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment, video surveillance services or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

Prohibitions extend to the use of Federal funds by recipients and subrecipients to enter into a contract with an entity that "uses any equipment, system, or service that uses covered telecommunications equipment or services" as a substantial or essential component of any system, or as critical technology as part of any system. Certain equipment, systems, or services, including equipment, systems, or services produced or provided by entities subject to the prohibition are recorded in the System for Award Management exclusion list.

American Iron and Steel

The Contractor acknowledges to and for the benefit of the City of Warrenton ("Purchaser") and the State of Oregon (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the Purchaser or the State. Notwithstanding any other provision of this Agreement,

any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the

Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Federal Labor Standards

Oregon Bureau of Labor and Industries (BOLI) prevailing wage requirements apply to public entities for projects over $50,000 and private entities for projects that utilize more than $750,000 of public funds.

Prevailing Wage Requirements

Construction projects assisted in whole or in part with the Safe Drinking Water Revolving Loan Fund Program (SDWRLF) must be carried out in compliance with Federal Davis Bacon and Related Acts and the Oregon Bureau of Labor and Industries (BOLI) requirements. Contractor shall pay each worker employed in the performance of this contract not less than the higher of the wage rate for the type of work being performed as set forth in either the Oregon Prevailing Wage "Prevailing Wage Rate for Public Works Contracts in Oregon" (if applicable) or the applicable federal Davis-Bacon Wage Decision. Contractor shall download a U.S. Department of Labor Employee Fair Compensation Notice and post it at the work site along with a list of locally prevailing wage rates. Contractor shall prepare and submit weekly Certified Payroll Reports on forms to be supplied by Business Oregon. Contractor shall permit access to construction site in order to conduct on-site interviews with workers during working hours."

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each

classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

Sub recipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The sub recipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sub recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the sub recipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the sub recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The sub recipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the sub recipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the sub recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and

Hour Division Web site at http://www.dol.gov/whd/forms/wh347instr.htm or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the sub recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sub recipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually

registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may by appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and sub recipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

Contract Provisions for Contracts in Excess of $100,000

(a) Contract Work Hours and Safety Standards Act. The sub recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall

be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

(b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Sub recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Sub recipient shall insert in any such contract a clause providing hat the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The sub recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The sub recipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The sub recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Sub recipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB.

Sub recipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

(c) The sub recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The sub recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the sub recipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial payroll data and two weeks prior to the completion date the contract or subcontract. Sub recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the sub recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The sub recipient shall periodically review contractors and subcontractor's use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Sub recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at http://www.dol.gov/whd/america2.htm.

Environmental and Natural Resource Laws

Contractor shall comply with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15).

Build America Buy America (BABA) Act Requirements

The Contractor acknowledges to and for the benefit of the City of Warrenton ("Owner") and the Environmental Protection Agency (the "Funding Authority") that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "Build America, Buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States ("Build America, Buy America Requirements") including iron and steel, manufactured products, and construction materials provided by the Contactor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and Funding Authority (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the Funding Authority. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or Funding Authority to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or Funding Authority resulting from

any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the Funding Authority or any damages owed to the Funding Authority by the Owner). If the Contractor has no direct contractual privity with the Funding Authority, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the Funding Authority is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the Funding Authority.

END OF SECTION

Six Good-Faith Efforts

Any public water system receiving an award from the Safe Drinking Water Revolving Loan Fund and the Drinking Water Source Protection Fund must ensure implementation of the six good-faith efforts comprising the federal "Fair Share Program," for the solicitation of all contractors providing construction, equipment, supplies, engineering or other services that constitute the project financed by the award.

Documentation demonstrating that these six good-faith efforts have been taken must be included and maintained in the water system's project files. Likewise, once a **contractor** has been selected by the water system, that contractor must adhere to the following six good-faith efforts in soliciting its subcontractor:

1. Ensure Disadvantaged Business Enterprises (DBEs) are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, state and local government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources. (Note: The acronym DBE used throughout this document is a global term for Minority Business Enterprises (MBEs) and Women's Business Enterprises (WBEs).
2. Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.
3. Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, state and local government recipients, this will include dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
4. Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.
5. Utilize the services of the Small Business Administration (SBA) and the Minority Business Development Agency of the Department of Commerce.
6. If the prime contractor awards subcontracts, require the prime contractor to take these six good-faith efforts in subcontracting with Disadvantaged Business Enterprises for any subcontract that they let.

Locating Disadvantaged Business Enterprises for Outreach

Applicable MBE/WBEs are certified by the Oregon Certification Office of Business Inclusion and Diversity, Small Business Administration, or by another federal agency.

The following sites may be of assistance for locating Minority or Women Owned business firms and others may exist too:

- Oregon directory of certified firms at Certification Office of Business Inclusion and Diversity
- http://www.oregon4biz.com/How-We-Can-Help/OMWESB/
- Federal System for Award Management at www.sam.gov/
- Minority Business Development Agency, US Dept. of Commerce at http://www.mbda.gov/
- EPA's Office of Small Business Programs at ~~www.epa.gov/osbp/~~
- U.S. Department of Transportation at https://www.transportation.gov/civil-rights/disadvantaged-business-enterprise

Prevention of Unfair Practices

Finally, there are a number of provisions designed to prevent unfair practices that may adversely affect DBEs that are now required of the prime contractor for every SDWRLF funded project:

- A SWRLF loan recipient must require its prime contractor to pay its subcontractor for satisfactory performance no more than 30 days from the prime contractor's receipt of payment.
- A SWRLF loan recipient must be notified in writing by its prime contractor prior to any termination of a DBE subcontractor for convenience by the prime contractor.
- If a DBE subcontractor fails to complete work under the subcontract for any reason, the SDWRLF loan recipient must require the prime contractor to employ the Six Good-Faith Efforts if soliciting a replacement subcontractor.
- A SDWRLF loan recipient must require its prime contractor to employ the Six Good-Faith Efforts even if the prime contractor has achieved its fair share objectives.

Project File Documentation of Good-Faith Efforts

In addition to narrative summaries of actions and decisions taken to fulfill each of the above affirmative steps, project file documentation must include any relevant information. The following are some examples, with the above step numbers in parentheses (#):

- Copies of solicitation lists including identified certified MBE/WBEs and small businesses (1 & 2)
- Printed lists of certified MBE/WBE businesses that may be qualified contractors, as obtained from web sites or other official sources (1 & 5)
- Options for dividing up or adjusting the pace of contracts in excess of $500,000 (3 & 4)
- Copies of advertisements, web postings, etc., for bid calls in relevant media (1 & 2)
- Correspondences with/information from relevant federal/state agencies, contractor clearinghouses and the like (2 & 5)
- Correspondences/bids from any disadvantaged business enterprise (2)
- Copies of any bid documentation and instructions to any general/prime contractor for purposes of that contractor's fulfillment of the six good faith efforts (6)**.**

State or federal officials overseeing the SDWRLF may ascertain the existence of such project file documentation at any time, including but not limited to audits.

Each procurement contract (prime plus all subcontractor contracts) must include the following term and condition:

> "The contractor shall not discriminate on the basis of race, color, national origin or sex in the performance of this contract. The contractor shall carry out applicable requirements of 40 CFR part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the contractor to carry out these requirements is a material breach of this contract which may result in the termination of this contract or other legally available remedies."

Data Reporting

FORM: Procurement of Disadvantaged Business Enterprises by Quarter The form on the next page must be submitted at the end of any quarter, in which the water system receiving an SDWRLF award, a prime contractor for the system or a subcontractor to the prime procures/contracts for construction, equipment, supplies or services from an applicable business in conjunction with the award. The system must submit this form to Business Oregon, Regional Project Manager. Without these reports Business Oregon may not be able to process subsequent requests for cash to pay for procurements.

FORM: Disbursements Attributable to Certified Disadvantaged Business Enterprises Included here is a second form, which is **required each time** that the water system requests cash draw down of its award. The draw-down request must include this sheet in order for the request to be processed.

Safe Drinking Water Revolving Loan Fund

Procurement of Disadvantaged Business Enterprises by Quarter

Submit to Business Oregon Regional Project Manager within 30 days following any quarter in which applicable procurements have been made or modified

Letter of Interest Year _____ **Quarter** _____

Project Number _____

Loan Recipient _____

Procurement Made by (check one)			Business Enterprise (check one or both)		Value of Procurement ($)	Date of Contract (MM/DD/YY)	Type of Product or Service (Enter Code No.)*	Name & Address and Certification Number of MBE/WBE Contractor or Vendor
Loan Recipient	Prime Contractor	Sub-Contractor	Minority Owned	Woman Owned				

* 1. Actual building of structures, installations; 2. Intangible/soft costs, such as consultants, engineers, design, surveyors; 3. Direct purchases of materials needed for project, will often comprise subcontractors; 4. Purchases (and installation if by vendor) of devices, machines; 5. Trucking and other activities.

Safe Drinking Water Revolving Loan Fund

Disbursements Attributable to Disadvantaged Business Enterprises

Must be included with every cash draw request to the department

Project Number _____ **Cash Request #** _____

Disadvantaged Business Enterprise

	Total Draw Amount	Minority-Owned	Women-Owned
1. Construction	$	$	$
2. Services	$	$	$
3. Supplies	$	$	$
4. Equipment	$	$	$
5. Other	$	$	$
Totals	**$ 0**	**$ 0**	**$ 0**

1. Actual building of structures, installations; 2. Intangible/soft costs, such as consultants, engineers, design, surveyors; 3. Direct purchases of materials needed for project, will often comprise subcontractors; 4. Purchases (and installation if by vendor) of devices, machines; 5. Trucking and other activities.

6 Good Faith Efforts Checklist

Project Name: _____ Project No: _____

Type of Service Solicited: ___ Engineering ___ Construction Contractor

___ Construction Sub-contractor ___ Equipment/Supplies ___ Other _____

Name of Solicitor: _____ Name of Company Selected: _____

#	Six Good-Faith Efforts	Did you pursue this effort?	**If yes**, please explain what you did and attach the supporting document. **If no**, please explain why this effort is not being pursued.
1	Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. For Indian Tribal, state and local government recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.	Yes No	
2	Make information on forthcoming opportunities available to DBEs and arrange time frames for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. This includes, whenever possible, posting solicitations for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date.	Yes No	
3	Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs. For Indian Tribal, state and local government recipients, this will include dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.	Yes No	
4	Encourage contracting with a consortium of DBEs when a contract is too large for one of these firms to handle individually.	Yes No	
5	Utilize the services of the Small Business Administration (SBA) and the Minority Business Development Agency of the Department of Commerce.	Yes No	
6	If the prime **contractor** awards subcontracts, require the prime contractor to take these six good-faith efforts in subcontracting with Disadvantaged Business Enterprises for any subcontract that they let.	Yes No	

TECHNICAL SPECIFICATIONS

DIVISION 01 – GENERAL REQUIREMENTS

SECTION 01 10 00 – SUMMARY OF WORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Work covered by Contract Documents.
2. Contractor's use of Site.
3. Permits.
4. Specification conventions.
5. Prevailing wage rates for public works contracts in Oregon
6. Oregon products.
7. Use of explosives.
8. Contaminated material.
9. Extended warranty provisions for paving in Clatsop County and ODOT rights-of-way.
10. Work with existing asbestos water pipelines.
11. Inadvertent Discovery Plan for cultural resources.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of the Project includes furnishing all permits, labor, materials, and equipment necessary for the construction of the following:

1. Installation of approximately 4,500 linear feet (LF) of buried 18-inch diameter PVC C900 DR 18 water transmission pipe, isolation valves and other water system appurtenances, and connections to existing watermains and services. The water transmission main will be installed along Ft Stevens Highway (OR-104) and NW 13th Street.

B. The defined Work elements are a general outline of principal features of the Work and do not in any way limit the responsibility of the Contractor(s) to perform all Work and furnish all equipment, labor and materials required by the Contract Documents.

C. Work of each separate Contract Bid Schedule is identified in the following and on Drawings:

1. Phase 1: Work includes the installation of approximately 4,500 LF of 18-in diameter water transmission pipe, isolation valves and related system appurtenances. The Work begins at the existing 18-in water main terminus near the intersection of NW 13th Street and ends at a location near the intersection of Ft Stevens Hwy (OR-104) and 7th Avenue. The new 18-in water main will connect to the existing 10-in waterline. A stub-out of 18-in pipe with blind flange will be installed for the future Phase 2 Work.

1.3 NOT USED

1.4 NOT USED

1.5 NOT USED

1.6 CONTRACTOR'S USE OF SITE

A. The Work included in the Contract Documents is to be performed within public rights-of-way along State and City highways. Contractor shall have use of Project site for construction operations as indicated on Drawings, requirements of this Section, and terms and conditions of ODOT Permit to Occupy or Perform Operations on a State Highway.

B. Maintain all ODOT and City rights-of-way clear and available to the public in accordance with terms and conditions of respective rights-of-way use permits or other written permission from authorities having jurisdiction.

C. Noisy and Disruptive Operations (such as Use of Jack Hammers and Other Noisy Equipment): Not allowed in close proximity to existing buildings during regular hours of operation. Coordinate and schedule such operations with Owner to minimize disruptions.

D. Time Restrictions for Performing Work: All work shall be conducted between the hours of 7:00 a.m. and 6:00 p.m. on non-holiday weekdays only. Weekend work will only be allowed with prior approval. Requests for variations in work hours shall be made in writing for consideration by the Owner. No work shall be conducted outside of the above-described days and hours without prior approval of the Owner.

E. Utility Outages and Shutdown:

1. Coordinate and schedule electrical and other utility outages with Owner.

2. Outages: Allowed only at previously agreed upon times.

3. At least one week before scheduled outage, submit Outage Request Plan to Owner itemizing the dates, times, and duration of each requested outage.

F. Sound Level Restrictions: Shall comply with local Noise Ordinance.

G. Construction Plan: Before start of construction, submit three copies of construction plan regarding access to Work, use of Site, and utility outages for acceptance by Owner. After acceptance of plan, construction operations shall comply with accepted plan unless deviations are accepted by Owner in writing.

1.7 NOT USED

1.8 NOT USED

1.9 PERMITS

A. Responsibilities for permits, licenses and fees shall be in accordance with Section 00 73 00, Special Provisions, 00170.02 and 00170.03.

1.10 SPECIFICATION CONVENTIONS

A. These Specifications are written in imperative mood and streamlined form. This imperative language is directed at the Contractor unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.11 PREVAILING WAGE RATES FOR PUBLIC WORKS CONTRACTS IN OREGON

The Contractor shall abide by ORS 279C.800 through 279C.870 which relate to the prevailing wage rates for the building and construction trades in the State of Oregon. These prevailing wage rates are shown in the Bureau of Labor and Industries document which is included elsewhere in these contract documents.

1.12 OREGON PRODUCTS

Contractor's attention is directed to the provisions of Oregon Law, ORS 279A.120 regarding the preference for products that have been manufactured or produced in Oregon. Contractor shall use Oregon-produced or manufactured materials with respect to common building materials such as cement, sand, crushed rock, gravel, plaster, etc., and Oregon-manufactured products in all cases where price, fitness, availability, and quality are otherwise equal.

1.13 USE OF EXPLOSIVES

The use of explosives shall not be allowed on this Project. Alternative methods of excavation shall be utilized.

1.14 CONTAMINATED MATERIAL

A. General

It is possible that the Contractor may encounter contaminated material (soil and/or water) during excavation activities. This specification identifies requirements for handling and disposing contaminated media.

B. Definitions

1. “Contaminated material” is defined as soil, water, free product, Underground Storage Tanks (UST), buried abandoned utility lines containing residual or free product, solid waste, treated wood waste, chemical containers, or other solid, liquid, or gas substances with contamination levels above background levels.

2. “Hazardous substances” shall mean those substances or materials defined in the ORS 465.200, as amended.

3. “Release” shall have the meaning as defined in ORS 465.200, as amended.

4. “Environmental laws” shall mean any applicable statute, law, ordinance, order, consent decree, judgment, permit, license, code, covenant, deed, common law, treaty, convention, or other requirement pertaining to protection of the environment, health or safety, natural resources, conservation, wildlife, waste management or disposal, hazardous substances, or pollution, including but not limited to regulation of releases to air, land, water, and groundwater.

C. Execution

1. Discovery of Contaminated Material

In the event that the Contractor, during the course of construction or during any other activities authorized under this contract, should encounter suspected contaminated material or any other materials suspected of posing a threat to human health and the environment, the Contractor shall notify the Engineer immediately and manage according to requirements identified below.

2. Discovery of Contaminated Soil

Contractor shall note evidence of contamination (odor, visual staining of soil, free liquid product seeping from soil, sheen on groundwater, etc.) and note location of evidence on a sketch of the excavation and provide to the Engineer.

Contractor shall report the discovery to the Engineer immediately. Contractor shall stop all excavation activities and secure the site to prevent entry by the public. The excavation shall not be backfilled. Protect all open excavations with berms, plates, and fencing. Contractor may continue with work in other non-contaminated areas.

Contractor shall assist Engineer in collecting sample(s) of suspected contaminated media for testing and characterization. Contractor shall allow 21 days, at no cost to Owner, for testing, results, and instructions as to how to proceed with contaminated materials.

The Contractor shall obtain a copy of an approved soil disposal/acceptance permit (Disposal/Treatment Facility requires transporter to have a copy of the permit.)

Contractor will transport and dispose of contaminated material at an approved disposal/treatment facility.

Contractor shall provide the Engineer with a copy of the contaminated soil disposal receipt.

3. Handling of Contaminated Soil

After approval from the Engineer, excavate the soil in a manner that prevents commingling of contaminated and non-contaminated soil. Engineer will make determination (based on soil saturation) if contaminated soil can be directly transported to a treatment or disposal facility, or if soil needs to be stockpiled to reduce water content. Engineer will determine when stockpiled soil can be transported off-site.

Contractor will be responsible for stockpiling contaminated soil in containers or on impervious surface to prevent the spread of contamination. Any water runoff from the contaminated soil stockpile area(s) must be contained by Contractor and handled as contaminated water.

Minimize movement of excavation equipment over or through contaminated soil to prevent movement of contaminated soil into areas where no contaminated soil exists.

Stockpiles will be created on an approved site and shall be surrounded by a fence to limit access. The stockpiles must be covered and bermed during periods of rainfall to prevent

run-on and run-off. The stockpiles shall be covered with a minimum 10-mil high density polyethylene (HDPE) plastic during periods of strong winds, nightfall, over the weekends, or during extended work stoppages. If dust is observed coming from the stockpiles, the stockpiles shall be either covered or the dust controlled with water.

Maintain excavation equipment in good working order. Prevent spillage of oil, fuel, or hazardous substances from equipment. In particular, promptly repair oil leaks from equipment and clean up any contaminated soil.

4. Transport of Contaminated Materials

Contractor shall comply with all applicable Federal, State, or local laws, codes, and ordinances that govern or regulate contaminated substance transportation. Contaminated soils placed in stockpiles shall be loaded into trucks in a manner that prevents the spilling or tracking of contaminated soil into areas of the site with uncontaminated soil. Loose material falling onto the exterior of the truck during loading shall be removed before the truck leaves the loading area. Any material collected in the loading area shall either be placed back into the truck or back into the stockpile. If loading areas are unpaved, the surface soil shall be sampled at the conclusion of the loading activities to confirm that contaminated soil is not present. If loading areas are paved, any loose soil shall be cleaned from the pavement at the conclusion of the loading activities.

Specific truck haul routes shall be established before beginning off-site contaminated media transport. On-site truck routes shall be established to minimize or prevent movement of trucks over contaminated soils. Off-site truck routes shall be established to reduce the risk of releases of contaminated soils and impact on local traffic. The Contractor shall be responsible for ensuring that loaded truck weights are within acceptable limits. All trucks shall be covered before they leave the loading area.

The Contractor shall ensure that all drivers of vehicles transporting contaminated substances have in their possession during transport all applicable Oregon State and local vehicle insurance requirements, valid driver's license, and vehicle registration and license. The Contractor shall be responsible for informing all drivers of transport vehicle about:

a. The nature of the material transported.

b. Required routes to and from the off-site thermal treatment or disposal facility.

c. Applicable City/County Street regulations and requirements, and State of Oregon Department of Transportation codes, regulations, and requirements.

d. The City/County's requirement for proper handling and transportation of the substances.

The Contractor shall not allow contaminated substances to be spilled or tracked off-site at any time during the Project. Trucks used for the transportation of contaminated substances off-site shall be watertight, substance compatible, licensed, insured, and permitted pursuant to federal, state, and local statutes, rules, regulations, and ordinances.

If contaminated media is discarded prior to removal of contaminated material, the price per cubic yard of soil materials and price per 100 gallons of contaminated water will be negotiated with Owner.

1.15 NOT USED

1.16 EXTENDED WARRANTY PROVISIONS FOR PAVING IN CLATSOP COUNTY AND ODOT RIGHTS-OF-WAY

The Contractor shall provide an extended warranty for all paving work performed in Clatsop County and ODOT rights-of-way. The warranty for this work shall extend an additional one year beyond that provided for the overall project.

1.17 NOT USED

1.18 WORK WITH EXISTING ASBESTOS WATER PIPELINES

The Contractor shall comply with all requirements of the State of Oregon, Department of Environmental Quality (DEQ) with respect to the safe handling, removal, and disposal of asbestos cement pipe, including all reporting requirements.

1.19 INADVERTENT DISCOVERY PLAN FOR ARCHAEOLOGICAL AND HUMAN REMAINS

The Contractor shall follow the Inadvertent Discovery Plan (IDP) if cultural material including archaeological and human remains are encountered during construction. The IDP is found in the Supplementary Information section.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 12 16 - WORK SEQUENCE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes general sequencing, project phasing and coordination requirements for the Work.

B. Contract Requirements:

1. Water Distribution Facilities

a. The existing water distribution facilities within the Project provide drinking water service to residential and commercial customers. Plan and prosecute the Work such that water service is not interrupted, expect as specified herein.

b. The Project is delineated into two phases which is summarized as follows and on the Drawings:

1) Phase 1: Installation of approximately 4,500 linear feet (LF) of buried 18-inch diameter PVC C900 DR 18 water transmission pipe, isolation valves and other water system appurtenances, and connections to existing watermains and services. The water transmission main will be installed along Ft Stevens Highway (OR-104) and NW 13th Street.

2) Phase 2: Installation of approximately 5,500 LF of buried 18-inch diameter PVC C900 DR 18 water transmission pipe, isolation valves and other water system appurtenances, and connections to existing watermains and services. The water transmission main will be installed along Ft Stevens Highway (OR-104) and NW 13th Street.

c. The Work involves the installation, testing, disinfection, and acceptance of Phase 1 water system improvements.

1) STEP 1: The water system improvements between STA A52+93± to A54+89± shall be installed as the initial Work activity. This segment of the Work requires archaeologist monitoring of excavation and trenching activities. This segment of Work shall be installed, tested and disinfected. The cut-off valves will be closed to isolate it from the existing 10-inch water main, the water shall be drained from the pipe and a temporary cap installed.

2) STEP 2: Upon completion of the previous Work segment, the waterline installation shall resume beginning at STA A10+00 and proceeding west/north in Station ascending order. The water system improvements shall be installed, tested, disinfected and accepted in logical sequence.

3) STEP 3: Upon reaching the temporary cap installed in STEP 1, the temporary cap shall be removed, waterline connected, and the pipe segment shall be tested, disinfected, and accepted.

d. Phase 2 is not included in the Work but will be implemented in the future.

e. The water main Work may involve adjustment of existing sanitary sewer service laterals to provide required separation with the installed water main. The sewer lateral adjustments must be coordinated with the water main installation to allow logical construction sequencing that could potentially result in utility service disruptions, water leakage, sewage spillage or other adverse effects.

2. Sanitary Sewer Service Facilities

a. The existing sanitary sewer facilities within the Project provide sewer collection service to residential and commercial customers. Plan and prosecute the Work such that sewer service is not interrupted, expect as specified herein.

b. Spillage or discharge of raw sewage to surface waters or drainage courses is prohibited during construction. Penalties imposed on Owner as a result of any sewage bypass of this type caused by Contractor, its employees or Subcontractors, and legal fees and other expenses to Owner resulting directly or indirectly from the bypass shall be borne in full by Contractor.

c. Control any and all leakage resulting from or integral to making all temporary and permanent piping connections. Provide any and all devices required to control, stop, divert, or dispose of any and all leakage.

d. Plan and prosecute the Work such that temporary sewage control activities are provided in accordance with Section 01 57 19.11, Temporary Sewage Control and Bypass Pumping.

C. Related Sections:

1. Section 01 10 00, Summary of Work.

2. Section 01 57 19.11, Temporary Sewage Control and Bypass Pumping.

1.2 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Work Sequencing Plan: At a minimum, to include the following:

1. Complete sequence of construction for all activities contained herein.

1.3 NOT USED

1.4 GENERAL WORK CONSTRAINTS

A. Constraints primarily relate to interfacing with and tying into existing pipelines, water and sanitary sewer services, and other aspects of Owner enterprise utilities.

B. Make every effort to give proper attention to each of these items so as to minimize interruptions of the existing facilities and avoid delays that may result if the constraints are not observed.

C. Constraints listed below involve limits on activities during construction. These limits relate to the critical nature of the existing water distribution and sanitary sewer facilities.

1. Coordinate construction schedule with Owner.

2. Owner recognizes portions of the water distribution and sanitary sewer facilities may have to be interrupted, shut down, or interfered with in order to accommodate construction activities. Owner will, through its personnel, attempt to accommodate Work, provided that proper notification is given. Owner reserves the right to deny permission for interruption or shutdown on any day.

3. Do operate any of the Owner utility facilities. Contractor is liable for any loss or damage caused to property, equipment or any personal injury resulting from or related to this unauthorized operation or use.

D. Extended Working Hours: If it is desired to perform any Work outside the specified working hours, obtain written permission from Owner and all necessary permitting agencies, and make all necessary arrangements prior to commencing.

1.5 TEMPORARY SHUTDOWNS

A. Provide 14-day minimum advance notice to request approval of a temporary shutdown of a facility.

B. Each Notice of Request for Approval of a Temporary Shutdown submitted to Owner shall include the following:

1. Dates, times, and duration of proposed shutdown.

2. Work activities to be performed during the shutdown.

3. Assistance required of Owner's personnel before, during, and after shutdown.

4. Personnel to be on Site during shutdown.

5. Contingency plan if work during shutdown is not completed during allotted time or critical equipment fails.

C. Upon receipt of such request, Owner will decide what action(s) is required by Owner and if the requested shutdown is acceptable. The request from Contractor will be returned to Contractor with the Owner's written decision noted. If Owner deems that the requested shutdown is unacceptable, Owner will state such reasons, and Contractor shall reschedule the shutdown as required.

D. It is hereby agreed between the Contractor and Owner that disapproval by Owner of the Contractor's shutdown request does not entitle Contractor to any time extension unless Contractor can demonstrate to the satisfaction of Owner, through an updated CPM schedule, that the overall project completion date will not be met as a result of this disapproval.

E. Owner may postpone a planned and approved shutdown at any time for critical water or sanitary sewer service demands or safety reasons.

1.6 INTERRUPTION OF UTILITY SERVICE

A. Indicate required shutdowns of existing utilities or interruptions of existing operations on Progress Schedule. Interruptions to utility service will be allowed to the extent that customer service will not be adversely compromised.

B. Submit requests for interruptions to utility service not less than 14-days in advance of the date scheduled for the interruption.

C. Following receipt of the request, Engineer will notify Contractor if the requested date will be permitted. Evaluation of the request will be based upon the availability of the utility owner's personnel to assist and monitor utilities during the shutdown period and impact to customer service.

D. Minimize the period of interruption by thorough advance planning. Procure and provide all required materials, equipment, and labor on site during the shutdown.

E. Do not begin interruption until written authorization is received from Engineer.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01 22 20 - UNIT PRICE MEASUREMENT AND PAYMENT

PART 1 GENERAL

Measurement and payment will be on a unit price basis in accordance with the prices set forth in the proposal for individual work items. Where work is required but does not appear as a separate item in the proposal, the cost for that work shall be included and absorbed in the unit prices named in the proposal. Contractor shall make a careful assessment when preparing the bid.

A. Mobilization, Bonds, Insurance and Demobilization: Payment for mobilization, bonds, insurance, and demobilization will be on a lump sum basis. The amounts paid for mobilization in the contract progress payment will be based on the percent of the original contract amount that is earned from other contract items, as follows:

1. When 5 percent is earned, either 100 percent of the amount for mobilization or 5 percent of the original contract amount, whichever is the least.

2. When all work is completed, amount of mobilization exceeding 5 percent of the original contract amount.

This schedule of mobilization progress payments will not limit or preclude progress payments otherwise provided by the contract.

B. Record Drawings: Payment for record drawings will be on a lump sum basis. Payment will include all labor and materials necessary to prepare and maintain a set of construction drawing markups at the project site to document work completed including any approved changes.

C. Temporary Work Zone Traffic Control: No measurement of quantities will be made. Payment will be on a lump sum basis and shall include furnishing, installing, moving, operating, maintaining, inspecting, and removing materials and traffic control devices, and for furnishing all equipment, labor, and incidentals necessary to complete the work as specified. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00, Submittal Procedures.

D. Temporary Erosion & Sediment Control: No measurement of quantities will be made. Payment for temporary erosion and sedimentation control will be on a lump sum basis. The lump sum price shall include compensation for all labor, equipment, materials, planning and design for temporary erosion and sedimentation control measures, upkeep and maintenance of all measures, removal of erosion and sedimentation control measures at the completion of the Project and after vegetation is fully established, and all other materials and work necessary.

E. Construction Survey & Staking: No measurement of quantities will be made. Payment for construction survey and staking will be on a lump sum basis and shall include all labor, materials, and equipment necessary to complete the work.

F. Trench Safety System: No measurement of quantities will be made. Payment for trench safety system shall be made on lump sum basis. Payment shall include all labor, equipment, and materials necessary for selection, design, installation, maintenance, protection, and removal of excavation support systems as required in Section 31 50 00, Excavation and Support Protection.

G. Temporary Dewatering System: No measurement of quantities will be made. Payment for all temporary dewatering work that is not included in other bid items shall be made on a lump sum basis. Payment shall include all labor, equipment and materials to design, construct, test, operate, maintain, and decommission the temporary dewatering system as required by Section 31 23 19, Dewatering. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00, Submittal Procedures.

H. Rock Excavation: Payment for rock excavation, as defined in Section 31 23 18, Rock Removal and approved by the Engineer, will be made at the unit price per cubic yard of rock excavated and rock excavation will be paid for in addition to the linear foot price for pipe, trench excavation and backfill. Measurement for rock excavation in pipe trench shall be for the length and depth of rock encountered to 6-inches below the pipe invert and the pay width shall be the nominal pipe diameter plus 12-inches on each side of the pipe for all pipe sizes. Measurement for rock excavation for vaults and other structures shall be for the depth of rock encountered to the depth necessary to install the structure and to a maximum of 18-inches beyond the outside walls of the vault or structure. No payment will be made for rock excavation beyond these limits.

I. Trench Foundation Material: Payment for trench foundation material, where its installation is directed by written direction from Engineer, shall include the excavation, removal and disposal of unsuitable material and furnishing, placing, and compacting the trench foundation material. No payment will be made for trench foundation material required because the Contractor excavates below the grade required by the Drawings in suitable material or in unsuitable material without the Engineer's written approval. Measurement for trench foundation material shall be in cubic yards of foundation material determined from weight receipts corrected to 0% moisture from each truck delivering material for installation.

J. Trench Rock Drainage Layer: Payment for trench rock drainage layer, where its installation is directed by written direction from Engineer, shall include the excavation, removal and disposal of native material and furnishing, placing, and compacting the trench rock drainage layer. No payment will be made for trench foundation material required because the Contractor excavates below the grade required by the Drawings in suitable material or in unsuitable material without the Engineer's written approval. Measurement for trench rock drainage layer shall be in cubic yards of rock drainage material determined from weight receipts corrected to 0% moisture from each truck delivering material for installation.

K. General Surfacing Restoration: No measurement of quantities will be made. Payment will be made on a lump sum basis for general surface restoration, including stripping and stockpiling topsoil, regrading to original contours, bark mulching planting areas, resurfacing gravel surfaces, and cleanup following construction as required. Measurement and payment for surface restoration of asphaltic concrete pavement and concrete surfaces such as streets, sidewalks, and curbs, will be paid under separate bid items.

L. Cold Plane Pavement Removal (4-in Depth): Measurement and payment for cold plane pavement removal to a depth of 4-inches including all work and materials, testing, inspection, and acceptance will be made on a square yard basis. Payment will include but not limited to milling, grinding, and removal of existing asphalt as shown and specified in the Drawings. Measurement will be based on total area in square yards of completed cold plane pavement removal to depth of 4-inches.

M. AC Pavement Restoration (Level 3, ½-in HMA Mixture): Measurement and payment for AC pavement restoration including all work and materials, testing, inspection, and acceptance will be made on a weight (tons) basis. Payment will include but not limited to placement of Level 3, ½-in hot mix asphalt mixture to the depth and locations indicated in the Drawings. Measurement will be based on the total weight in tons of completed and in place hot mix asphalt supporting the utility trench surfacing restoration.

N. Water Pipe, C905 DR14 PVC, 18-in w/ 30" Steel Casing: Measurement and payment for furnishing and installing C905 DR14 PVC, 18-in diameter water carrier pipe within 30-in diameter steel casing pipe, including all work and materials, testing, inspection, and acceptance, will be made on a linear foot basis. Payment will include but not limited to excavation and disposal of waste material, jacking/receiving trench shoring, furnishing and installing casing pipe by auger/jack-and-bore, installing carrier pipe with spacer supports, end seals, exterior casing grouting, filling the casing pipe with sand, backfill and compaction of jacking/receiving trenches, and all other items of the Work required by the Drawings and ODOT Utility Permit. Measurement will be based on the total horizontal length of piping constructed as indicated on the plans.

O. Water Pipe, C900/905 DR14 PVC: Measurement and payment for furnishing and installing C900/905 DR14 PVC water pipe, at all depths as shown on the plans, including all work and materials, testing, inspection, and acceptance, will be made on a linear foot basis for the pipe diameters and the trench backfill specified. Payment will include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), pipe installation, and the placement, compaction, and testing of the Class of trench backfill shown and specified. Measurement will be based on the total horizontal length of piping constructed as indicated on the plans without deduction for fittings and valves. Polyethylene encasement of pipe, fitting and other appurtenances are considered incidental to the installation and no separate measurement or payment will be made. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

P. Water Pipe, C900/905 DR14 PVC, Restrained: Measurement and payment for furnishing and installing C900/905 PVC restrained water pipe, at all depths as shown on the plans, including all work and materials, testing, inspection, and acceptance, will be made on a linear foot basis for the pipe diameters and the trench backfill specified. Payment will include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), pipe installation, and the placement, compaction, and testing of the Class of trench backfill shown and specified. Measurement will be based on the total horizontal length of piping constructed as indicated on the plans without deduction for fittings and valves. Polyethylene encasement of pipe, fitting and other appurtenances are considered incidental to the installation and no separate measurement or payment will be made. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

Q. Water Valves: Measurement and payment for furnishing and installing water valves, at all depths shown on the plans, including all work and materials, testing, inspection, and acceptance, will be made on a per each basis for the valve types and sizes specified. Valve accessories, including valve boxes, covers, risers, and extensions, are considered incidental to the installation of the valves and no separate measurement or payment will be made.

Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

R. Water Pipe Fittings, DI: Measurement and payment for furnishing and installing water pipe Ductile Iron (DI) fittings, at all depths shown on the plans, including all work and materials, testing, inspection, and acceptance, will be made on a per each basis for the fitting types and sizes specified. Fitting accessories, including glands, bolts, and gaskets, restraints, thrust blocks, and polyethylene encasement are considered incidental to the installation of the fittings and no separate measurement or payment will be made. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

S. Air Release Valve Assembly: Measurement and payment for air release valve assemblies will be on a per each basis for the assembly type and size specified. Payment will include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), pipe, valves, fittings, boxes and covers, risers and extensions if required; installation, testing, and acceptance of water system materials as shown in the plans and specifications. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

T. Blow-Off Assembly: Measurement and payment for blow off assemblies will be on a per each basis for the assembly type and size specified. Payment will include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), pipe, valves, fittings, boxes and covers, risers and extensions if required; installation, testing, and acceptance of water system materials as shown in the plans and specifications. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

U. Fire Hydrant Assembly: Measurement and payment for fire hydrant assemblies will be on a per each basis. Payment will include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), shackles, tie rods, pier blocks, gravel, painting, and all other items for the complete installation of the hydrant including the pipe connecting the hydrant to the main; installation, testing, and acceptance of water system materials as shown in the plans and specifications. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

V. Adjustment to Existing Services – Water, Gas: Payment for adjustments to existing water and natural gas services will be made at the unit price for each utility service indicated in the Drawings. Payment will include all labor, equipment and materials to adjust the existing service piping above/under the proposed water pipping, providing required minimum clearances as indicted in the Drawings and in accordance with utility service provider requirements. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

W. Abandonment of Existing Services – Water: No measurement of quantities will be made. Payment will be made on a lump sum basis for the completion of all work for abandoning the existing water services as shown on the plans. Lump sum payment under this item shall cover

all particular elements of the project, whether or not specifically or specially identified, as specified herein, in the contract documents and as shown on the plans, except for work included separately under separate bid items. Payment shall be full and complete compensation for all work shown in the drawings and other work required for abandonment of the existing water pipe in place, including materials, equipment, and labor for construction. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00, Submittal Procedures. Measurement and payment for surface restoration will be paid under separate bid items.

X. Conc Encasement of Existing Sanitary Sewer: Measurement and payment for furnishing and installing concrete encasement of existing sanitary sewer pipes, including all work and materials, testing, inspection, and acceptance, will be made on a linear foot basis. Payment will include but not limited to excavation, installation of formwork, steel reinforcement, concrete, removal of formwork, backfill and compaction as shown on the Drawings. Measurement will be based on the total horizontal length of sanitary sewer pipe encased in concrete as constructed.

Y. Water Main Connections: No measurement of quantities will be made. Payment will be made on a lump sum basis for the completion of each water main connection as indicated on the Bid Form and in the Drawings. Lump sum payment under this item shall include but not limited to excavation, loading, hauling, disposal, pipe and trench zone materials (including aggregate base course[s] for surface restoration), pipe, fittings, restraints, valves; installation, testing and acceptance of water system materials within the pay limits as shown in the plans and specifications. Polyethylene encasement of pipe, fitting and other appurtenances are considered incidental to the installation and no separate measurement or payment will be made. The CONTRACTOR shall provide a breakdown of contract price as required by Section 01 33 00, Submittal Procedures. Measurement and payment for surface restoration, trench foundation material and trench rock drainage layer will be paid under separate bid items.

Z. Testing, Flushing, and Disinfection of Water Mains: Payment for testing, flushing and disinfection of water mains will be on a lump sum basis and shall include furnishing, installing, and removing temporary blowoff piping including miscellaneous piping, valves, fittings, and thrust restraint. The Owner shall provide off-site laboratory analysis. Payment for any retesting shall be paid by the Contractor.

END OF SECTION

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This Section contains administrative and procedural requirements for submittals for review, information, and for Project closeout.

B. Section includes:

1. Schedule of Submittals.
2. Submittal requirements.
3. Submittal procedures.
4. ENGINEER review.
5. Resubmittal procedures.
6. Product data.
7. Shop Drawings.
8. Samples.
9. Design data.
10. Test reports.
11. Certificates.
12. Manufacturer's instructions.
13. Manufacturer's field reports.
14. Construction progress schedules.
15. Breakdown of contract price.
16. Construction photographs.
17. Other Submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require ENGINEER's responsive action.

B. Informational Submittals: Written and graphic information and physical Samples that do not require ENGINEER's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SCHEDULE OF SUBMITTALS

A. Within 10 days after the Effective Date of the Contract, CONTRACTOR shall submit to ENGINEER a preliminary Schedule of Submittals, including proposed list of major products proposed for use, with specification section reference, name of Manufacturer, supplier, trade name, SUBCONTRACTOR, and model number of each

product. Provide a schedule of specific target dates for the submission and return of submittals and shop drawings required by the Contract Documents.

B. For products specified only by reference standards, indicate Manufacturer, trade name, model or catalog designation, and reference standards.

C. The list and schedule shall be updated and resubmitted when requested by the ENGINEER.

D. CONTRACTOR's Schedule of Submittals will be acceptable to the ENGINEER if it provides a workable arrangement for reviewing and processing the required submittals.

1.4 SHOP DRAWING AND SAMPLE SUBMITTAL REQUIREMENTS

A. Before submitting a Shop Drawing or Sample, CONTRACTOR shall have:

1. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. determined and verified all information relative to CONTRACTOR's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

B. Each submittal shall bear a stamp or specific written certification that CONTRACTOR has satisfied CONTRACTOR's obligations under the Contract Documents with respect to CONTRACTOR's review of that submittal, and that CONTRACTOR approves the submittal.

C. With each submittal, CONTRACTOR shall give ENGINEER specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to ENGINEER for review of each such variation.

1.5 SUBMITTAL PROCEDURES

A. CONTRACTOR shall submit Shop Drawings and Samples to ENGINEER for review in accordance with the accepted Schedule of Submittals.

B. Transmit each submittal with ENGINEER-accepted transmittal form certifying compliance with requirements of Contract Documents.

C. Sequentially number transmittal forms. Mark transmittal forms for resubmittals with original number and sequential alphabetic suffix.

D. Show each Submittal with the following numbering and tracking system:

1. Submittals shall be numbered according to specification section. For example, the first product submittal for Section 05 50 00 would be “05 50 00-1”. Resubmittals of that submittal would be “05 50 00-1.1”, followed by “05 50 00-1.2”, and so on. The second product submittal for that Section would be “05 50 00-2”.

2. Submittals containing product information from multiple sections of the specifications will not be reviewed. CONTRACTOR and/or their supplier shall divide submittals in a manner that meets the numbering and tracking system requirements stated herein.

3. Alternative method of numbering may be used if acceptable to ENGINEER.

E. Identify: Project, CONTRACTOR, SUBCONTRACTOR and supplier, pertinent drawing and detail number, and specification Section number appropriate to submittal.

F. Apply CONTRACTOR's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is according to requirements of the Work and Contract Documents.

G. Coordinate submission of related items.

1. All shop drawings for interrelated items shall be scheduled for submission at the same time.

2. The ENGINEER may hold shop drawings in cases where partial submission cannot be reviewed until the complete submission has been received or where shop drawings cannot be reviewed until correlated items affected by them have been received. When such shop drawings are held, the ENGINEER will advise the CONTRACTOR in writing that the shop drawing submitted will not be reviewed until shop drawings for all related items have been received.

H. When hard copies of submittals are provided by the CONTRACTOR, six copies of all materials shall be provided to the ENGINEER. Two copies of reviewed submittals will

be kept by the ENGINEER, two copies of reviewed submittals will be transmitted to the OWNER, and two copies of reviewed submittals will be returned to the CONTRACTOR. If the CONTRACTOR requests that more than two copies of the reviewed submittal be returned, then the CONTRACTOR shall submit the appropriate quantity of submittals.

I. When electronic transmittals of submittals are provided by the CONTRACTOR under established protocols described elsewhere in the Contract Documents or as jointly developed by the OWNER, ENGINEER and CONTRACTOR, provide electronic submittals in portable document format (PDF) in addition to the source document format (Word, Excel, AutoCAD, etc.). Reviewed submittals will be returned to the CONTRACTOR as PDF electronic files.

J. For each submittal for review, allow not less than 14 days for ENGINEER review, excluding delivery time to and from CONTRACTOR.

K. Identify variations in Contract Documents and product or system limitations that may be detrimental to successful performance of completed Work.

L. Allow space on submittals for CONTRACTOR and ENGINEER review stamps or comments.

M. When revised for resubmission, the CONTRACTOR shall identify changes made since previous submission. A narrative of changes shall be provided, and shop drawings or calculations shall indicate that a revision was made.

N. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with review comments.

O. Submittals not requested will not be recognized nor processed.

P. Incomplete Submittals: ENGINEER will not review. Complete submittals for each item are required. Delays resulting from incomplete submittals are not the responsibility of ENGINEER.

1.6 ENGINEER REVIEW

A. Informational submittals and other similar data are for ENGINEER's information, do not require ENGINEER's responsive action, and will not be reviewed or returned with comment.

B. The ENGINEER’s review of submittals and shop drawings is not a check of any dimension or quantity and will not relieve the CONTRACTOR from responsibility for errors of any sort in the submittals and shop drawings.

C. Submittals made by CONTRACTOR that are not required by Contract Documents may be returned without action.

D. The ENGINEER will review the submitted data and shop drawings and return to the CONTRACTOR with notations thereon indicating "No Exception Taken", "Make Corrections Noted", "Rejected", "Revise and Resubmit", or "Submit Specified Item".

E. If more than two submissions of an item are required to meet the Project specifications, CONTRACTOR shall be responsible for ENGINEER's charges to OWNER for its review time, and OWNER may impose a set-off against payments due to CONTRACTOR to secure reimbursement for such charges, unless the need for such change is beyond the control of CONTRACTOR.

F. ENGINEER will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to ENGINEER. ENGINEER's review will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

G. ENGINEER's review will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.

H. ENGINEER's review of a separate item as such will not indicate approval of the assembly in which the item functions.

I. ENGINEER's review of a Shop Drawing or Sample shall not relieve CONTRACTOR from responsibility for any variation from the requirements of the Contract Documents unless CONTRACTOR has complied with the requirements of Paragraph 1.4.C and ENGINEER has given written acceptance of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. ENGINEER will document any such accepted variation from the requirements of the Contract Documents in a Field Order.

J. ENGINEER's review of a Shop Drawing or Sample shall not relieve CONTRACTOR from responsibility for complying with the requirements of Paragraph 1.4 A. and B.

K. ENGINEER's review of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

L. Neither ENGINEER's receipt, review, return of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.

M. CONTRACTOR shall perform the Work in compliance with the requirements and commitments set forth in returned Shop Drawings and Samples, subject to the provisions of Paragraph 1.6.I.

1.7 RESUBMITTAL PROCEDURES

A. CONTRACTOR shall make corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals.

B. CONTRACTOR shall furnish required submittals with sufficient information and accuracy to obtain required review of an item with no more than two submittals. ENGINEER will record ENGINEER's time for reviewing a third or subsequent submittal of a Shop Drawings, sample, or other item requiring review, and CONTRACTOR shall be responsible for ENGINEER's charges to OWNER for such time. OWNER may impose a set-off against payments due to CONTRACTOR to secure reimbursement for such charges.

C. If CONTRACTOR requests a change of a previously reviewed submittal item, CONTRACTOR shall be responsible for ENGINEER's charges to OWNER for its review time, and OWNER may impose a set-off against payments due to CONTRACTOR to secure reimbursement for such charges, unless the need for such change is beyond the control of CONTRACTOR.

PART 2 PRODUCTS

2.1 CONSTRUCTION PROGRESS SCHEDULES

A. Within 10 days after the Effective Date of the Contract, prepare and submit to the ENGINEER a practicable schedule showing the order in which the CONTRACTOR proposes to carry out the Work, the dates on which the important features of the work will start, and the contemplated dates for completing same. A time-scaled bar chart schedule shall include the following:

- Construction activities
- Submittal and review of critical material samples and shop drawings
- Procurement and delivery of critical materials
- Duration of work, including completion times of all stages and their sub-phases

B. Attention is drawn to typical local climatic weather patterns and Work shall be coordinated accordingly.

C. Complete Project schedule shall be revised and resubmitted to the ENGINEER at a minimum occurrence of every three (3) weeks for review.

D. Three Week Lookahead Schedules: Provide each week at the weekly construction meeting. The previous week's completed work shall be shown on the schedule for a total of 4 weeks shown.

2.2 BREAKDOWN OF CONTRACT PRICE

A. Within 10 days after the Effective Date of the Contract, submit a complete breakdown of all lump sum bid items showing the value assigned to each part of the work, including an allowance for profit and overhead adding up to the total lump sum contract price.

B. Breakdown of lump sum bids shall be coordinated with the items in the schedule and shall be in sufficient detail to serve as the basis for progress payments during construction.

C. ENGINEER will review the contract price breakdown and may request items to be further broken down or for more items be added in order to facilitate tracking of work progress for payment.

D. Preparatory work, bonds, and insurance required in setting up the job will be allowed as a separate entry on the cost breakdown but shall not exceed 5 percent of the total base bid.

E. Upon acceptance of the breakdown of the contract price by the ENGINEER, it shall be used as the basis for all requests for payment.

2.3 PRODUCT DATA

A. Product Data: Action Submittal: Submit to ENGINEER for review for assessing conformance with information given and design concept expressed in Contract Documents. Submitted data shall be sufficient in detail for determination of compliance with the Contract Documents.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement Manufacturers' standard data to provide information specific to this Project.

1. Note submittal will be returned to CONTRACTOR without review of submittal if products, models, options, and other data are not clearly marked or identified.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.4 SHOP DRAWINGS

A. Shop Drawings: Action Submittal: Submit to ENGINEER for assessing conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. When required by individual Specification Sections, provide Shop Drawings signed and sealed by a professional ENGINEER licensed in the state of Project, responsible for designing components shown on Shop Drawings.

1. Include signed and sealed calculations to support design.

2. Submit Shop Drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.

3. Make revisions and provide additional information when required by authorities having jurisdiction.

D. All dimensioned shop drawings shall be scalable and provided as full-sized (22-inch x 34-inch) sheets. PDF electronic files shall print as scalable full-sized sheets.

E. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.5 SAMPLES

A. Samples: Action Submittal: Submit to ENGINEER for assessing conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:

1. Submit to ENGINEER for aesthetic, color, and finish selection.

2. Submit Samples of finishes, textures, and patterns for OWNER selection.

C. Submit Samples to illustrate functional and aesthetic characteristics of products, with integral parts and attachment devices. Coordinate Sample submittals for interfacing work.

D. Include identification on each Sample, with full Project information.

E. Submit number of Samples specified in individual Specification Sections; ENGINEER will retain one Sample.

F. Reviewed Samples that may be used in the Work are indicated in individual Specification Sections.

G. After review, produce copies and distribute according to Paragraph 1.5.M and for record documents.

2.6 DESIGN DATA

A. Informational Submittal: Submit data for ENGINEER's knowledge as Contract administrator or for OWNER.

B. Submit information for assessing conformance with information given and design concept expressed in Contract Documents.

2.7 TEST REPORTS

A. Informational Submittal: Submit reports for ENGINEER's knowledge and records as Contract administrator or for OWNER.

B. Submit test reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.8 CERTIFICATES

A. Informational Submittal: Submit certification by Manufacturer, installation/application SUBCONTRACTOR, or CONTRACTOR to ENGINEER, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or product but must be acceptable to ENGINEER.

2.9 MANUFACTURER'S INSTRUCTIONS

A. Informational Submittal: Submit Manufacturer's installation instructions for ENGINEER's knowledge as Contract administrator or for OWNER.

B. Submit printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing, to ENGINEER in quantities specified for Product Data.

C. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

2.10 MANUFACTURER'S FIELD REPORTS

A. Informational Submittal: Submit reports for ENGINEER's knowledge and records as Contract administrator or for OWNER.

B. Submit report within 48 hours of observation to ENGINEER for information.

C. Submit reports for information for assessing conformance with information given and design concept expressed in Contract Documents.

2.11 ERECTION DRAWINGS – NOT USED

2.12 PROJECT HEALTH AND SAFETY PROGRAM – NOT USED

2.13 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of Site and construction throughout progress of Work.

B. Submit photographs with Application for Payment.

C. Photographs: Electronic, PDF, or JPEG format.

D. Take photographs of key construction elements: lateral connections, valve connections, creek crossings, and connections to existing piping. Take photographs with different angles and with varying zoomed in/out perspective to provide details of work and relative reference of the trench and Site.

E. Identify each photo in the electronic file name. Identify name of Project, pipe stationing, orientation of view, and date photo is taken.

2.14 OPERATION AND MAINTENANCE (O&M) INSTRUCTIONS – NOT USED

2.15 OTHER REQUIRED SUBMITTALS

A. Other required submittals include the items listed below. This list is provided for CONTRACTOR's convenience only and may not be complete in all respects. CONTRACTOR shall provide all submittals specified or required, whether or not listed here.

1. CONTRACTOR Emergency Contact List.
2. Erosion and Sediment Control Plan.
3. Traffic Control and Protection Plan.
4. Work Sequencing Plan.
5. Dewatering Plan.
6. Record Drawings.

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 01 45 00 - QUALITY CONTROL

PART 1 GENERAL

1.1 DESCRIPTION

A. This Section covers quality control requirements supplementary to those of the General Conditions and Technical Specifications.

1.2 PROVISIONS

A. CONTRACTOR's Responsibility for Testing

The CONTRACTOR shall be responsible for the cost of all testing as specified in this section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

B. OWNER's Right to Perform Additional Tests

The OWNER or ENGINEER reserves the right to complete additional testing. In such cases, the CONTRACTOR shall provide safe access for the OWNER or ENGINEER and their inspectors to adequately inspect the quality of work and the conformance with Project specifications.

1.3 QUALITY ASSURANCE

A. Testing Requirements

An independently owned and operated laboratory approved by the ENGINEER shall perform all testing as specified herein.

B. Testing

1. General

a. All required testing of work and/or materials shall be conducted in the presence of the ENGINEER. The CONTRACTOR shall provide 48-hour notification to the OWNER and OWNER's Representative prior to conducting any and all quality assurance testing. Where applicable, work and materials shall only be buried with the consent of the ENGINEER.

b. Where such inspection and testing are to be conducted by an independent laboratory or agency, the sample, or samples of material to be tested shall be selected by such laboratory or agency or by the ENGINEER. The CONTRACTOR shall furnish such samples of all materials without charge to OWNER.

c. The results from any and all tests are made for the information of the OWNER. Regardless of any test results, the CONTRACTOR is solely responsible for the quality of workmanship and materials and for compliance with the requirements of the Drawings and Specifications.

2. Costs of Testing

a. The CONTRACTOR shall be responsible for and shall pay for all tests as specified in Part 3 of this Section. Additional information has been provided regarding the payment responsibility for the OWNER with regards to the Project.

b. With regards to all materials to be tested, where test results demonstrate that the material or workmanship does not meet the minimum requirements of the Contract Documents, additional testing shall be completed and shall be paid for by the CONTRACTOR with no reimbursement by the OWNER.

1.4 SPECIAL INSPECTIONS – NOT USED

1.5 SUBMITTALS

A. Laboratory Test or Inspection Reports

Each report shall be signed and certified by the independently owned and operated testing laboratory. Unless otherwise specified, submit three copies of each report to the OWNER or OWNER's Representative.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 FIELD TESTING SCHEDULE

A. The CONTRACTOR shall complete field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of work completed by the CONTRACTOR. Testing locations to be determined by the ENGINEER.

Material to be Tested	Payment Responsibility for Initial Testing	Minimum Testing Frequency
Trench Backfill	CONTRACTOR	In-place compaction testing (w/ nuclear compaction gauge) performed at the surface and on each lift of backfill for every 200 lineal feet of pipeline trench as measured along pipe centerline. ENGINEER may reduce frequency to one test per lift for every 1,500 lineal feet of pipeline trench when satisfied with CONTRACTOR's method of compaction. See Article 3.16, Field Quality Control of Section 31 23 17, Trenching for further details.
Asphalt Concrete	CONTRACTOR	As required when placed. See detailed requirements in Article 3.3, Field Quality Control of Section 32 12 16, Asphalt Paving.
Concrete	CONTRACTOR	As required when placed. See Section 03 11 00, Concrete Work.
Sanitary Sewer Pipes	CONTRACTOR	As required. See Sections 33 30 00.13, Sewer and Manhole Testing and 33 30 10.16, TV Inspection of Sewer Pipelines.
Waterline – Hydrostatic testing and disinfection	CONTRACTOR	As required. See Section 33 13 00, Testing and Disinfection of Water Utility Piping.
Waterline – Bacteriological testing	OWNER	As required. See Section 33 13 00, Testing and Disinfection of Water Utility Piping.

END OF SECTION

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Temporary construction facilities and control requirements for the Work include the following. CONTRACTOR is responsible for providing all temporary facilities and controls necessary to complete the Work as described in the Contract Documents.

1. Utilities including lighting, electricity and water.
2. Water truck and backflow device for connection to water system.
3. Sanitary facilities.
4. Fire protection.
5. Security fencing.
6. Enclosures.
7. Parking area.
8. Traffic Control.
9. OWNER's access to facilities.
10. Secured storage for materials.

B. Maintain temporary facilities in proper and safe condition throughout progress of Work.

C. Comply with federal, state, and local codes and regulations, and utility company requirements.

1.2 LAYOUT OF TEMPORARY FACILITIES

A. Before starting Work, submit to OWNER, for approval, proposed layout of temporary facilities.

B. Should CONTRACTOR require space in addition to that shown on Drawings, CONTRACTOR shall make arrangements for storage of materials and equipment in locations off Site.

1.3 UTILITY PROPERTIES AND SERVICE

A. In areas where the CONTRACTOR's operations are adjacent to or near a utility and such operations may cause damage which might result in significant expense, loss and inconvenience, the operations shall be suspended until all arrangements necessary for the protection thereof have been made by the CONTRACTOR.

B. The CONTRACTOR shall notify all utility offices which may be affected by the construction operation at least 48 hours in advance. Before exposing any utility, the utility having jurisdiction shall grant permission and may oversee the operation. Should service of any utility be interrupted due to the CONTRACTOR's operation, the proper authority shall be notified immediately. It is of the utmost importance that the CONTRACTOR cooperates with the said authority in restoring the service as promptly as possible. Any costs shall be borne by the CONTRACTOR.

C. CONTRACTOR to contact one-number locator service (811) at least 48 hours in advance in advance of all excavations or other activities that may disturb and/or damage existing utilities. Existing utilities which may be impacted include the following:

UTILITY	UTILITY PROVIDER
Potable Water	City of Warrenton
Storm Water	ODOT, City of Warrenton
Sanitary Sewer	City of Warrenton
Natural Gas	Northwest Natural
Telephone/Data	
Power	Pacific Power (PacifiCorp)

1.4 TEMPORARY LIGHTING AND ELECTRICITY

A. General:

1. Temporary lighting shall be sufficient to enable CONTRACTOR and SUBCONTRACTORs to complete Work and enable OWNER to observe Work. Illumination shall meet or exceed state code requirements.

B. Temporary Electric Power:

1. Provide portable generator(s) as needed.

1.5 TEMPORARY HEAT – NOT USED

1.6 TEMPORARY COMMUNICATIONS – NOT USED

1.7 PROJECT IDENTIFICATION – NOT USED

1.8 WATER FOR CONSTRUCTION AND TESTING

A. CONTRACTOR is responsible for making all arrangements necessary for temporary water for construction.

1. Non-potable water for construction purposes will be purchased from the OWNER through an approved hydrant meter permit application and payment of necessary fees.

2. The CONTRACTOR shall furnish all valves, hoses, connections, and other devices as necessary to obtain sufficient water for construction and for filling and testing of water lines as required. Fire hydrant use is allowed only by permission of the utility OWNER.

3. Backflow protection is required on all connections to potable water systems.

1.9 SANITARY FACILITIES

A. Provide temporary sanitary facilities conforming to state and local regulations, in sufficient numbers for use of CONTRACTOR's and SUBCONTRACTOR's employees.

B. Maintain in sanitary condition and properly supply with toilet paper.

C. Use of OWNER's existing sanitary facilities is not allowed.

1.10 TEMPORARY FIRE PROTECTION

A. Provide and maintain fire extinguishers and other fire protection equipment and devices as would be reasonably effective in extinguishing fires during early stages by personnel at Site.

1.11 TEMPORARY SITE AND OTHER ROADS

A. Maintain existing roads used during construction free from accumulation of dirt, mud, and construction debris.

B. CONTRACTOR shall repair or replace existing roads that remain to original or better condition prior to Final Completion. Survey and record condition of existing roads prior to construction.

1.12 CONTRACTOR'S WORK AREA

A. Work Area:

1. Limit construction operations and storage of equipment and materials to areas shown on Drawings and as determined by OWNER.

2. Except as provided herein, no private property, or other area adjacent to Site shall be used for storage of CONTRACTOR's equipment and materials unless prior written approval is obtained from legal OWNER of the respective locations.

3. CONTRACTOR shall maintain staging areas during construction in a manner that will not obstruct operations of existing facilities. Work shall proceed in an orderly manner, maintaining construction Site and staging area free of debris and unnecessary equipment or materials.

B. Storage and Protection of Equipment and Materials:

1. The CONTRACTOR shall be solely responsible for the protection and security of all equipment and materials stored on the site. Equipment and materials stored at the site shall be placed neatly on the job site in an area and environment that will provide protection and security. Materials that are not adequately protected or stored in

conformance with the Manufacturer's recommendations will be rejected. Unusable materials (i.e., rejected, or damaged liner material, old concrete chunks, metal scraps, etc.) shall be expeditiously removed from the job site.

2. Provide appropriate barricades, signs, and traffic control devices in like-new condition where necessary to protect the public and OWNER employees from any hazards associated with the storage of materials and equipment used for this Project.

3. No equipment and/or materials shall be stored outside the immediate work area, in the following locations, or in the following manner:

   a. In any maintained landscape or lawn area.

   b. In a manner that would totally eliminate an individual residents' street parking, or parking for the OWNER's existing buildings.

   c. In front of any business.

   The "immediate work area" is the area where work is taking place or will be taking place within one calendar day. The CONTRACTOR shall immediately move stored material or equipment which causes a nuisance or creates complaints.

1.13 SECURITY

A. CONTRACTOR shall be responsible for loss or injury to persons or property where Work is involved and shall provide security and take precautionary measures to protect CONTRACTOR's and OWNER's interests.

B. Provide and maintain temporary fencing of design and type needed to prevent entry into active construction areas.

1.14 ENCLOSURES

A. Provide and maintain all enclosures, scaffolds, tarpaulins, canopies, warning signs, steps, platforms, bridges, and other temporary construction necessary for proper completion of Work.

1.15 PARKING

A. Staging area and designated areas within construction limits may be used for parking of construction personnel's private vehicles and CONTRACTOR's lightweight vehicles. Parking shall not impede access or traffic on adjacent roadways.

B. Make arrangements for additional parking off site as required.

C. No overnight parking, camping, or storage of personal vehicles, trailers or other items will be authorized.

1.16 TRAFFIC CONTROL AND PROTECTION

A. The Contractor shall maintain traffic control and protection in the work areas 24 hours per day. Traffic control shall conform to the requirements set forth by the ODOT as well as the standards set forth in the Manual on Uniform Traffic Control Devices (MUTCD) and local jurisdiction.

B. The Contractor shall conduct its operations so as to keep one lane of traffic open for public and private access at all times on City, County and Public streets, roads and highways. Permits obtained for the Project may have more stringent requirements than noted in this section.

C. Prior to beginning construction and as necessary or required by local or state agencies, the Contractor shall submit a detailed street closure and traffic control plan to the OWNER and ODOT for approval, which meets the requirements of the of ODOT. As construction proceeds, the Contractor shall notify the OWNER and ODOT as to the status of street closures and detours, if required.

D. All work shall be carried on with due regard for safety to the public. Open trenches shall be backfilled or covered with steel plates at the end of each day.

1.17 CONTRACTOR'S FIELD OFFICES AND BUILDINGS – NOT USED

1.18 ENGINEER'S FIELD OFFICE AND EQUIPMENT – NOT USED

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Maintain and operate systems to ensure continuous service for duration of construction.

B. Modify and extend systems, as Work progress requires.

3.2 REMOVAL

A. Completely remove temporary materials, equipment, signs, and structures when no longer required.

B. In unfinished areas, clean and repair damaged caused by temporary installations or use of temporary facilities, restore drainage, and evenly grade, seed, or plant as necessary to provide appearance equal to or better than original.

C. In finished areas, restore existing or permanent facilities used for temporary services to specified, or original condition.

3.3 DAMAGE TO EXISTING PROPERTY

A. CONTRACTOR is responsible for replacing or repairing damage to existing buildings, structures, sidewalks, roads, parking areas, and other existing assets.

B. CONTRACTOR shall have option of having OWNER contract for such Work and have cost deducted from Contract Price.

3.4 OWNER'S USE – NOT USED

END OF SECTION

SECTION 01 55 00 - SITE ACCESS, STAGING, AND STORAGE

PART 1 GENERAL

1.1 CONTRACTOR'S WORK AND STORAGE AREAS

A. Portions of the Site and off-Site areas for CONTRACTOR's use during the term of the Contract as a stockpiling, storage, staging and shop area for construction operations for the WORK are identified on the Drawings as those areas enclosed by erosion control methods and as identified in Article 3.2 below. At completion of the WORK, the CONTRACTOR shall restore these areas to their original condition, including grading, surfacing and landscaping, unless otherwise indicated in this Section, on the Drawings, or by the ENGINEER.

B. Other lands to be furnished by the OWNER for storage, staging, construction operation, roads and other purposes are indicated on the Drawings. Should the CONTRACTOR find it necessary to use any additional land for its operations or for other purposes during the construction of the WORK, it shall arrange for the use of such lands at its own expense.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 PUBLIC ACCESS

A. Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, private residences, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Continuous emergency vehicle access shall be provided through work areas in public roadways. The CONTRACTOR shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time, as approved by the ENGINEER.

1. If exceptions are necessary, notify OWNER so that OWNER can secure written consent of individuals or authorities concerned to permit such temporary construction associated with access points.

2. Plan and perform the construction work so that all adjacent businesses have access at all times. Maintain clear communication and scheduling with the business owners and residents at all times.

3. Access to the WORK shall be provided as may be required by the OWNER or its representatives, and all authorized representatives of the state and federal governments and any other agencies having jurisdiction over any phase of the work, for inspection of the progress of the work, the methods of construction or any other required purposes.

3.2 STAGING AND STORAGE AREAS

A. Staging areas for CONTRACTOR personnel, materials, and equipment may occur at the following sites. Staging area use shall only be allowed with the following limitations stated in this specification and as noted on the Drawings. CONTRACTOR will inspect and become familiar with the existing conditions at each site prior to Mobilization. CONTRACTOR shall not be required to use or develop all sites. The following conditions apply to the sites if they are used by the CONTRACTOR:

Location	Allowed Activities
As Delineated in the Drawings	CONTRACTOR may utilize delineated area as shown in the Drawings for staging and material storage. Contractor shall prepare a detailed staging plan for approval which incorporates all OWNER requirements including but not limited to temporary chain-link security fencing and erosion control.

3.3 TEMPORARY CONSTRUCTION ACCESS AND PARKING AREAS

A. Locate any temporary construction roads, drives, walks, and parking facilities to provide uninterrupted access to construction offices, mobilization, work and storage areas, and other areas required and approved by the OWNER.

B. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials.

3.4 WORK AND STORAGE AREA

A. Make arrangements for any additional off-site storage or shop areas necessary for the proper execution of the WORK at no additional cost to the OWNER.

3.5 ROADWAY LIMITATIONS

A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK. It shall be the CONTRACTOR's responsibility to construct and maintain any temporary haul roads required for its construction operations.

END OF SECTION

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes provisions for temporary protection of trees and other plant life in preparation for trenching, site or building excavation Work.

B. This specification shall be applied concurrently and in conjunction with other plant material protection measures herein described and specified.

C. Related Sections:

1. Section 31 10 00 - Site Clearing
2. Section 31 22 13 - Rough Grading
3. Section 31 23 16 - Excavation
4. Section 31 23 17 - Trenching

PART 2 MATERIALS - Not Used

PART 3 EXECUTION

3.1 INSPECTION

A. Inspect all trees specified on the Drawings for protection prior to construction.

1. Document with written memorandum and photographs any unusual conditions.
2. Submit copies of documentation to Engineer prior to beginning work.

B. Verify all conditions on the Drawings with actual conditions at Site regarding tree protection prior to any site disturbance.

C. The Engineer must be present during demolition of existing conditions occurring within the drip line of trees designated to remain.

D. Notify Engineer 24 hours prior to inspections and/or tagging of protected trees.

3.2 PROTECTION

A. Install barricades specified in the Drawings at drip lines of trees designated to remain prior to the commencement of construction.

B. Clearly designate protected trees and clear of any material storage, personnel, or vehicular movement.

C. Provide temporary fencing, barricades, and guards as necessary or required to protect trees designated on the Drawings to remain, from damage above and below grade.

D. Protect root systems of trees and plant life to remain.

1. Protect from damage due to noxious materials in solution caused by runoff or spillage during mixing and placement of construction materials.

2. Protect from flooding, erosion, or excessive wetting resulting from dewatering operations and compaction.

3. Protect against unauthorized cutting, breaking, skinning roots and branches, or bruising bark.

4. Protect from smothering and compaction.

a. Do not store construction materials or permit vehicles to drive or park within the drip line area of any tree to remain.

5. Protect from dumping of refuse in close proximity.

E. Where cutting is necessary, review conditions with the Engineer before proceeding, and comply with directives of Engineer.

3.3 EXCAVATION AROUND TREES

A. Excavate within drip lines of trees only where indicated on the Drawings or as directed by Engineer.

B. Where trenching for utilities is required within drip lines, tunnel under or around roots by hand excavating.

1. Where possible trench toward trunk of tree and tunnel under central root mass to avoid severing all lateral roots on side of trench.

2. Do not cut main lateral roots or tap roots over 1-inch in diameter.

3. Temporarily support and protect trees from damage until permanently covered with approved backfill.

C. Do not allow exposed roots to dry out before backfill is placed.

1. Provide temporary earth or burlap cover.

2. Water roots daily when exposed and maintain in a moist condition.

D. Backfill roots only upon inspection approval from the Engineer.

1. Backfill around root excavations only with clean imported topsoil free from materials deleterious to root growth.

2. Backfill to eliminate voids and compact only by means of manual tamping at root areas.

3. Water sufficiently to settle topsoil and eliminate voids or air pockets around roots.

4. Allow for natural settlement of soil surface and furnish and apply topsoil sufficient to bring to original finish grade after backfill settlement.

E. If during excavation, any condition arises that threatens the survivability of the protected tree, or an unknown condition arises that affects the stability or integrity of the root system, notify the Engineer immediately.

3.4 REPAIR AND REPLACEMENT OF DAMAGED TREES

A. In the event of damage to existing trees:

1. Immediately prune limbs smaller than 3-inch caliper or roots smaller than 2-inch caliper to repair trees damaged by construction operations.

2. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees.

3. Any such pruning and/or repairs shall be approved in advance and at completion by Engineer.

4. The Engineer shall reserve the right, at cost to the Contractor, to obtain the services of a Certified Consulting Arborist with current membership in the American Society of Consulting Arborists to determine the severity of damage.

5. The Contractor is responsible for the cost of repairs caused by their actions or by the actions of subcontractors engaged by the Contractor.

B. Remove and replace dead or damaged trees which are determined by the Engineer to be incapable of restoration to normal growth patterns at no additional cost to Owner.

1. Provide new trees of the same species as those removed or damaged, with size and/or quantity to be determined by Engineer.

2. Furnish replacement trees and plant life to the Site and plant, maintain, and warranty as directed by the Engineer.

3. If trees are not replaceable with the same species, and size, compensate the Owner for the replacement cost of the trees based on the evaluation of a Certified Consulting Arborist.

4. The Contractor is responsible for additional costs of removing damaged trees and labor for planting new specimens.

3.5 DESIGNATED TREE REMOVAL PROCEDURES

A. If designated tree removal is specified by Engineer, furnish labor, material, and equipment necessary for removing and/or salvaging existing trees, if necessary, as designated on the Drawings for removal.

1. Verify location and species with Engineer prior to removal.

B. Salable logs or timber may be sold to Contractor's benefit upon notification and prior approval of Owner. Upon approval, remove salable logs or timber promptly from site.

3.6 DESIGNATED TREE TRANSPLANTING PROCEDURES

A. If designated tree transplanting is specified by Engineer, verify, and identify existing trees to be transplanted.

B. All work shall be in accordance with the standards and practices outlined in the following: Tree and Shrub Transplanting Manual, E.B. Himelick, 1981 Ed., International Society of Arboriculture.

C. Prior to commencement of Work, submit a coordination schedule, method of transplanting, traffic control, routing, etc., to Engineer, for review and approval.

D. Warranty for transplanted trees shall be determined and directed on a case-by-case basis by the Engineer, upon contracting of specified transplanting work.

E. Review and verify location of utilities in area of operation. Obtain location and jurisdictional approval from utilities prior to transplanting activities. Protect utilities and the public at all times.

F. Prior to transplanting, spray trees with an anti-desiccant emulsion-type film forming agent, "Dowax" by Dow Chemical Company, "Wilt-Pruf" by Nursery Specialty Products Inc., "D-Wax", by Plant Products Inc., or equal, prior to digging with two separate applications allowing 48 hours apart. Use a power sprayer to provide an adequate film over trunks, branches, stems, twigs, and foliage. Anti-desiccant must be dry prior to relocation.

G. Dig, ball, and burlap, and move designated trees for relocation to the new planting location shown on the Drawings. In the event the new planting area is not prepared, place tree in a storage area approved by the Engineer solely designated for healing-in of plant materials until final planting may occur. Brace in a vertical position, provide shade, wind protection, and irrigation at plant storage area. Utilize all horticulturally proper methods for plant storage. Plants shall be maintained by Contractor while in storage.

3.7 GRADING AND FILLING AROUND TREES

A. Maintain existing grade within drip line of trees unless otherwise indicated on the Drawings or directed by the Engineer.

3.8 MAINTENANCE OF PROTECTIVE MEASURES

A. Maintain protective measures throughout the construction process. Immediately repair any alteration to protection measures throughout construction process. Repair or reinstall protective measures immediately upon alteration. Monitor protective measures daily.

B. Remove and clear area of debris and fencing, barricades, etc., upon final written approval of Engineer.

END OF SECTION

DIVISION 02 – EXISTING CONDITIONS

SECTION 02 30 00 - SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.1 SUMMARY

A. Subsurface investigations and reporting have been performed for the purpose of obtaining data for the planning and design of this Project. Copies of such reporting are attached to the Contract Documents as Supplementary Information.

1.2 LIMITATIONS

A. The subsurface investigations and reporting are being made available solely for the convenience of the Bidder and shall not relieve the Bidder or the Contractor of any risk, duty to make examinations and investigations as required by Article 4 of the Instructions to Bidders, or any other responsibility under the Contract Documents.

B. It is mutually agreed to by all parties:

1. Written reports are reference documents and are not part of the Contract Documents.

2. Subsurface investigations are for the purpose of obtaining data for planning and design of the Project.

3. Data concerning borings and test pits is intended to represent with reasonable accuracy conditions and material found in specific borings and test pits at the time the borings and test pits were made.

C. It is expressly understood and agreed the Owner and Engineer assume no responsibility whatsoever in respect to the sufficiency or accuracy of the investigation thus made, the records thereof, or of the interpretations set forth therein, or made by the Owner in the Owner's use thereof; and there is no warranty or guarantee, either expressed or implied, that the conditions indicated by such investigations, or records thereof, are representative of those existing throughout such areas, or any part, or that unforeseen developments may not occur.

D. The Owner's subsurface investigations and reporting are made available to Bidder or Contractor only on the basis of the understandings and agreement herein stated.

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION - Not Used

END OF SECTION

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SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of existing facilities.

2. Abandoning and removing utilities.

B. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork

2. Section 31 10 00 - Site Clearing

3. Section 31 22 13 - Rough Grading

4. Section 31 23 16 - Excavation

5. Section 33 05 50 - Existing Pipe Abandonment

1.2 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Submit to Engineer a copy of written permission of private property owners, with copy of fill permit for said private property, as may be required for disposal of materials.

1.3 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of work required and limitations before proceeding with Work.

B. Conform to applicable local, state, and federal codes for environmental requirements in relation to disposal of debris.

1. Burning at the Site for the disposal of refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be permitted.

C. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

D. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the Work and requirements of the General Provisions.

E. If the existing material to be demolished and removed contains any hazardous materials which will require special handling upon removal, such as asbestos or lead, it is the responsibility of

the Contractor to remove and dispose of the material in accordance with all applicable federal, state, and local regulations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring, or resulting from demolition, clearing, and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated in the Drawings or Specifications.

B. Crushed Rock: As specified in Section 31 05 16-2.1, Aggregates for Earthwork. Of the size shown in the Drawings or specified herein.

C. Sand: As specified in Section 31 05 16-2.2, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. The Owner assumes no responsibility for the actual condition of the facilities to be demolished. The Contractor shall visit the site, inspect all facilities and be familiar with all existing conditions and utilities.

B. Demolition drawings identify major equipment and structures to be demolished only. Auxiliary utilities such as water, air, chemicals, drainage, lubrication oil, hydraulic power fluid, electrical wiring, controls, and instrumentation are not necessarily shown shall be considered incidental to all demolition work.

C. Identify waste and salvage areas for placing removed materials.

3.2 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

B. Call Local Utility Line Information service at 1-800-332-2344, not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

3. Keep all active utilities intact and in continuous operations.

3.3 PROTECTION

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated in the Drawings to remain from damage.

B. Survey control: Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Preservation and Trimming of Trees, Shrubs and Other Vegetation: As specified in Section 31 10 00-3.4.C, Site Clearing.

D. Landscaped Areas: Protect existing landscaped areas as specified in Section 31 10 00-3.4.D, Site Clearing.

E. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, guy wires, utility poles, and curbs.

F. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired, or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of Work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.4 DEMOLITIONS

A. Areas which are to be excavated for the purpose of demolition shall be cleared and stripped in accordance with Section 31 10 00-3.6, Site Clearing.

B. Carefully consider all bearing loads and capacities for placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, consult with Engineer prior to the placement of such equipment or material.

C. Demolition of Existing Structures:

1. Excavate around existing structures as required to perform demolition operations and to plug associated existing pipelines where shown in the Drawing.

2. Provide shoring, bracing, and supports, as required, to ensure adjacent structures are not damaged and structural elements of existing structures are not overloaded during demolition activities.

a. Increase structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under any part of this Contract.

b. Remove all temporary protection when the Work is complete or when so authorized by the Engineer.

3. Any floors that are to remain in place shall be completely cracked through to allow for drainage. Cracking shall be accomplished by dropping a demolition ball or by other methods approved by the Engineer.

4. Remove and dispose of all exposed and/or protruding metalwork, piping, plumbing, and conduits resulting from demolition activities, and all woodwork, roofing, and electrical and mechanical equipment removed from demolished structures.

    a. Reinforcing bars shall be cut flush with final wall elevations as shown in the Drawings.

    b. No detached metalwork, excluding concrete reinforcing bars, shall be buried with the concrete and masonry rubble.

D. Backfill at Demolished Structures:

1. For structures designated to be abandoned and/or demolished in place, concrete and/or masonry rubble and excavated soils resulting from demolition activities shall be used for backfill or placed in the bottoms of said structures only as directed by the Engineer.

2. Concrete and masonry rubble used for backfilling shall be broken into pieces no larger than 12 inches on any one side.

3. Materials resulting from abandonment/demolition activities approved for backfill shall be combined with imported filler sand to create a dense, compacted backfill.

4. Backfilling or placement of the excavated material in the structures shall meet the following requirements.

    a. Furnish, place and compact filler sand along with the concrete and masonry rubble so that all voids are filled and a dense, compacted backfill is obtained.

    b. Filler sand shall be placed in horizontal layers completely filling all voids between pieces of rubble and not exceeding 12 inches in thickness.

    c. Each layer of filler sand shall be compacted to obtain at least 90 percent of maximum density as determined by ASTM Method D-698-78 (AASHTO T-99).

    d. Water shall be furnished by the Contractor and added to each layer as required to maintain optimum moisture content.

    e. The amount of filler sand used shall only be the amount needed to fill all voids created by placement of the concrete and asphalt rubble, as directed by the Engineer.

    f. At locations where concrete and masonry rubble are used for backfill, they shall be placed such that a minimum of 3 feet of compacted non-rubble backfill material (crushed rock) exists between any rubble and finished grade. Protruding reinforcing bars shall be cut to lengths that allow granular backfill to be placed and compacted to required levels in and above the rubble.

5. Disposal of all materials not used for backfill shall be performed off-site and in compliance with applicable local, state, and federal codes and requirements.

6. In areas where new construction will take place, no trace of these structures shall remain prior to placing of backfill.

E. Backfilling within the footprint of new structures with rubble material resulting from demolition activities will not be allowed.

F. All existing improvements designated in the Drawings or specified to be removed, including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing, and similar structures occurring above, at, or below existing ground surface shall be included in the demolition work.

G. Unless otherwise specified, any resulting voids shall be backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

3.5 EXISTING WATER UTILITY PIPING ABANDONMENT

A. As specified in Section 33 05 50, Existing Pipe Abandonment.

3.6 NOT USED

3.7 NOT USED

3.8 ASPHALTIC CONCRETE DEMOLITION

A. Asphalt pavement shall be removed to the limits shown in the Drawings.

B. The limits of the removal shall be saw cut.

C. Asphalt pavement may not be used as rubble fill.

3.9 REMOVAL

A. Remove debris, rock, excavated materials, rubble, abandoned piping, and extracted plant life resulting from abandonment and/or demolition activities from site.

B. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

C. Removal: All material resulting from demolition, clearing, grubbing, and trimming operations shall be removed from the Project Site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

3.10 GRADING

A. All grading work shall be completed in accordance with Section 31 22 13, Rough Grading.

3.11 CLEANUP

A. During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, debris, and dust and shall leave all areas affected by the work in a clean condition, as may be subject to Engineer approval.

B. Adjacent structures shall be cleaned of dust, dirt, and debris resulting from demolition.

C. Adjacent areas shall be returned to their existing condition prior to the start of work.

3.12 NOT USED

END OF SECTION

DIVISION 03 - CONCRETE

SECTION 03 11 00 - CONCRETE WORK

PART 1 GENERAL

1.1 SUMMARY

A. The extent of concrete work is shown on the Drawings.

B. Work includes providing formwork and shoring for cast-in-place concrete and installation into formwork of items such as reinforcing steel bar (rebar), anchor bolts, setting plates, bearing plates, anchorages, inserts, reveals, frames, nosings, sleeves and other items to be embedded in concrete.

1.2 QUALITY ASSURANCE

A. Codes and Standards

Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified here:

ACI 301 "Specifications for Structural Concrete for Buildings"

ACI 311 "Recommended Practice for Concrete Inspection"

ACI 318 "Building Code Requirements for Reinforced Concrete"

ACI 347 "Recommended Practice for Concrete Formwork"

ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

Comply with building code requirements which are more stringent than the above and all Occupational Safety and Health Administration (OSHA) requirements.

B. ASTM International (ASTM)

1. C31, Making and Curing Concrete Test Specimens in the Field
2. C33, Specification for Concrete Aggregate
3. C39, Compressive Strength of Cylindrical Concrete Specimens
4. C40, Organic Impurities in Fine Aggregate for Concrete
5. C85, Cement Content of Hardened Portland Cement Concrete
6. C88, Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate
7. C94, Standard Specifications for Ready-Mixed Concrete

8. C131, Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

9. C136, Method for Sieve Analysis to Fine and Coarse Aggregate

10. C143, Slump of Portland Cement Concrete

11. C150, Standard Specification for Portland Cement

12. C156, Water Retention by Concrete Curing Materials

13. C173, Air Content of Freshly Mixed Concrete by the Volumetric Method

14. C231, Air Content of Freshly Mixed Concrete by the Pressure Method

15. C233, Standard Method of Testing Air-Entraining Admixtures for Concrete

16. C260, Standard Specifications for Air-Entraining Admixtures for Concrete

17. C289, Standard Test Method for Potential Reactivity of Aggregates (Chemical Method)

18. C441, Standard Test Method for Effectiveness of Mineral Admixtures in Preventing Excessive Expansion of Concrete Due to the Alkali-Aggregate Reaction

19. C457, Microscopical Determination of Air-Void Content and Parameters of the Air-Void System in Hardened Concrete

20. C494, Standard Specifications for Chemical Admixtures for Concrete

21. C670, Preparing Precision Statements for Test Methods for Construction Materials

22. C803, Penetration Resistance of Hardened Concrete

C. Workmanship

The Contractor is responsible for correction of concrete work that does not conform to the specified requirements, including strength, tolerances, and finishes. Correct deficient concrete as directed by the Engineer. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

D. Concrete Testing Service

The Contractor will engage a special inspector/testing laboratory to perform material evaluation tests and to design concrete mixes. See detailed requirements in Part 3.14 “Quality Control Testing during Construction”. Per the Owner or Engineer’s requirements the Contractor shall notify the designated representative to schedule the special inspections and materials testing required by the Project documents.

E. Testing Requirements

Materials and installed work may require testing and retesting, as directed by the Engineer, at any time during the progress of the work. Allow free access to material stockpiles and facilities

at all times. All testing, including the retesting of rejected materials and installed work shall be done at the Contractor's expense.

F. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the methods of test of ASTM C150.

3. Submit written reports to the Engineer, for each material sampled and tested prior to the start of work. Provide the Project identification name and number, date of report, name of Contractor, name of concrete testing service, source of concrete aggregates, Material Manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

4. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing. The materials producer and the Contractor must sign certificates of compliance.

G. Allowable Tolerances:

1. Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:

a. Variation from plumb in lines and surfaces of columns, piers, walls and rises; 1/4-inch per 10 feet, but not more than 1-inch. For exposed corner columns, control joint grooves, and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum; 1/2-inch maximum in 40 feet or more.

b. Variation from level or grade in slab soffits, ceilings, beam soffits, and rises 1/4-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum, and 3/4-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4-inch in any bay or 20 feet maximum and 1/2-inch in 40 feet or more.

c. Variation from position of the linear lines and related columns, walls, and partitions, 1/2-inch in any bay or 20 feet maximum, and 1-inch in 40 feet or more.

d. Variation in sizes and locations of sleeves, floor openings, and wall openings, 1/4-inch.

e. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.

f. Variations in footing plan dimensions, minus 1/2-inch and plus 2 inches; misplacement or eccentricity, 2 percent of the footing width in direction of misplacement but not more than 2 inches; thickness reduction, minus 5 percent.

g. Variation in steps - In a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.

h. Circular structures shall be constructed in a true circular form, with maximum variation of 1/4-inch from the dimensions shown on the plans.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

3. During concrete placement check formwork and related supports to ensure that forms are not displaced, and that completed work will be within specified tolerances.

H. Quality Control Testing During Construction

See Section 3 - Execution.

1.3 SUBMITTALS

A. For information only, submit six copies of Manufacturer's data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, water stops, joint systems, chemical floor hardeners, dry-shake finish materials, and others. Bind and submit in one submittal.

B. Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with the ACE 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Submit shop drawings for fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of forms including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually. Submit form drawings for building columns, walls, fascias, and intersections, and concrete pan and joist system. Submit for typical sections only. Engineer's review is for general architectural applications and features only. Design of formwork for structural stability and efficiency is the Contractor's responsibility.

D. Submit six copies of laboratory test reports for concrete materials and mix design tests as specified.

E. Material Certificates may be provided in lieu of materials laboratory test reports. The Material Manufacturer and the Contractor, certifying that each material item complies with, or exceeds, the specified requirements shall sign material certificates.

1.4 CONCRETE MIX DESIGNS

A. All concrete materials shall be proportioned so as to produce a workable mixture in which the water content will not exceed the maximum specified.

B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier or if directed by the Engineer, mix proportions and concrete strength curves for regular cylinder tests, based on the relationship of 7-, 14- and 28-day strengths versus slump values of 2, 4, and 6 inches, all conforming to these Specifications, shall be established by an

approved ready-mix supplier or an independent testing laboratory. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs and testing of concrete and materials shall be borne by the Contractor.

C. The exact proportions by weight of all materials entering into the concrete delivered to the jobsite shall conform to the approved mix design unless specifically so directed by the Engineer or Laboratory for improved specified strength or desired density, uniformity and workability.

D. The proportions of such mix design shall be based on a full cubic yard of hardened concrete.

E. Ready-mix companies or jobsite batch plants shall furnish delivery tickets, signed by a Certified Weighmaster, on which each shall state the weight of aggregates, sand, cement, admixtures and water, and the number of cubic yards of concrete furnished, which will be compared against the approved mix design.

F. There shall be no variation in the weights and proportions of materials from the approved mix design.

G. There shall be no variation in the quality and source of materials once they have been approved for the specific mix design.

1.5 READY-MIXED CONCRETE

Ready-mixed concrete shall conform to the requirements of ACI 301 and ASTM C 94. In case of conflict, ACI 301 shall govern.

1.6 SAMPLE

Contractor shall pour and finish one 2-foot square exposed aggregate concrete sample for Engineer's approval prior to construction if exposed aggregate is included on job.

1.7 JOB CONDITIONS

Maintain continuous traffic control and access for vehicular and pedestrian traffic as required for other construction activities as well as to adjoining facilities for regular operation. Utilize flagmen, barricades, warning signs and warning lights as required, to maintain a safe entrance and passage on all roads or drives abutting the Project.

PART 2 PRODUCTS

2.1 WALL FORMS

A. Full Height Pours: The wall form design shall be such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.

B. Wall Form Ties

1. Form ties which remain in the wall of a subgrade water-retaining structure shall have waterstops and a 1-inch minimum break back or cone depth.

2. Snap ties, if used, shall not be broken until the concrete has reached the design concrete strength. Snap ties, designed so that the ends must be broken off before the forms can be removed, shall not be used. The use of tie wires as form ties will not be permitted. Fully threaded stub bolts may be used in lieu of smooth ties with waterstops.

3. Taper ties with plastic or rubber plugs of an approved and proven design may also be used. The plugs must be driven into the hole with a steel rod, placed in a cylindrical recess made therefore in the plug. At no time shall plugs be driven on the flat area outside the cylindrical recess. Plugs shall be A-58 SURE PLUG as manufactured by DAYTON SUPERIOR, Santa Fe Springs, CA; phone: (714) 522-3442.

4. Ties shall positively secure the wall to the required dimension and hold the wall to that dimension prior to and during concrete placement.

C. Wall Form Stiffeners

1. Horizontal walers shall consist of structural steel channels, angles, or tubing of adequate size to retain the concrete without deflecting.

2. The walers shall be rolled or welded to the proper radii or offset brackets shall be used for shaping the wall to the dimensions shown on the Drawings and shall be used both for inside and outside wall forms in direct contact with the wall panels and at vertical spacings of no more than 96 inches on center.

3. There shall be at least one such waler within 24 inches of the top and bottom of the wall.

4. The largest dimension of the steel waler shall be in the radial direction.

5. Vertical structural steel or wood members shall be used at a minimum horizontal spacing of 74 inches and shall have sufficient rigidity and strength to insure the proper vertical alignments with the aid of braces under all predictable stress conditions.

6. In lieu of the above, a different system and spacings may be used if it is satisfactorily demonstrated to the Engineer that it will be equally effective.

2.2 FORMS FOR EXPOSED FINISH CONCRETE

Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Finish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection. Use overlaid plywood complying with U.S. Product Standard PS-1 “B-B High Density Overlaid Concrete Form”, Class I. Use flexible spring steel forms or laminated boards free of distortion and defects to form radius bends as required.

2.3 FORMS FOR UNEXPOSED FINISH CONCRETE

A. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

2.4 FORM MATERIALS

A. Form Coatings

Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compound. Petroleum based coatings shall not be used for structures in creeks and waterways. Biodegradable coatings shall be used which will not contaminate the creeks/waterways or an alternate method for stripping the form shall be proposed.

B. Chamfers, Reveals, Drips

Provide preformed PVC or shaped wood or metal of size and profile as shown on drawings.

C. Cylindrical Columns and Supports

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation. Provide units having “seamless” interior to minimize spiral gaps or seams.

D. Pan Forms

Provide forms for concrete pan-type construction complete with covers and end enclosures to form a true, clean, smooth concrete surface. Design units for easy removal without damaging placed concrete. Block adjoining pan units if required to avoid lateral deflection of formwork during concrete placement and compaction. Provide standard or tapered end forms, as shown.

If required, factory-fabricate pan form units to required sizes and shapes of the following:

1. Steel – 16-gauge minimum, free of dents, irregularities, sag, and rust, or

2. Glass-Fiber Reinforced Plastic - Molded under pressure with matched dies, 0.11 inches minimum wall thickness.

E. Inserts

Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work. Provide “Parabolt” by the Molly Company, “Phillips Red-Head”, or “Burke” products. The Contractor is responsible for ensuring that all required anchorage not specified in the Project documents is installed per current building code and applicable ICC report requirements.

2.5 REINFORCING MATERIALS

A. Reinforcing Bar (rebar): ASTM A615 and as follows below>

Stirrups and Ties Grade 60 (Grade 40 may be used for #3 and smaller)

All other Uses Grade 60

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric (WWF): ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement

Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting and fastening reinforcing bars, and welded wire fabric in place. Use wire bar type supports complying with CRSI recommendations, unless otherwise specified. Wood, brick, concrete blocks, and other devices will not be acceptable. For slabs-on-grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are hot-dip galvanized, after fabrication, or plastic protected or stainless steel protected.

E. Fiber Reinforcement – Collated polypropylene fiber, 3/4-inch, manufactured from 100 percent virgin homopolymer polypropylene, hydrophobic, in compliance with ASTM C116.

2.6 CONCRETE MATERIALS

A. Portland Cement

ASTM C150, Type II, unless otherwise acceptable to Engineer. Use only one brand of cement throughout the Project, unless otherwise acceptable to the Engineer. The use of ground granulated blast furnace slag is not allowed.

B. Aggregates

ASTM C33 and as herein specified. Provide aggregates from a single source for all exposed concrete.

Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of adequate strength and durability, may be used when acceptable to the Engineer.

1. Fine Aggregate - Clean, sharp, natural sand free from loam, clay, lumps, or other deleterious substances. Dune sand, bank-run sand and manufactured sand are not acceptable.

2. Coarse Aggregate - Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

a. Crushed stone processed from natural rock or stone.

b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.

c. Maximum Aggregate Size - Not larger than one-fifth of the narrowest dimensions between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear space between individual reinforcing bars or bundles of bars.

3. These limitations may be waived if, in the judgment of the Engineer, workability and methods of consolidation are such that concrete can be placed without honeycomb or voids.

4. In general, it is desired that normal commercial mixes using 1-1/2-inch or 3/4-inch maximum aggregate size be used.

5. Aggregate for exposed aggregate concrete shall consist of selected aggregate of washed clean river gravel in color range of medium to dark in browns and grays; material uniformly sized 5/8-inch to 3/4-inch.

C. Water: Clean, fresh, drinkable.

D. Air Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A.

F. Set-Control Admixtures: ASTM C494, as follows:

1. Type B, Retarding

2. Type C, Accelerating

3. Type D, Water-reducing and Retarding

4. Type E, Water-reducing and Accelerating

Calcium chloride will not be permitted in concrete, unless otherwise authorized in writing by the Engineer.

2.7 RELATED MATERIALS

A. Waterstops

Provide flat, dumbbell type, or centerbulb type waterstops at construction joints and other joints as shown. Size to suit joints or as shown. Provide PVC waterstops complying with Corps of Engineer's CRD-C 572. Waterstops to be Greenstreak 701 or equal. Split face waterstops will not be acceptable under any circumstances.

B. Bituminous and Fiber Joint Filler

Provide resilient and non-extruding type pre-molded bituminous impregnated fiberboard units complying with ASTM D1751, FS HH-F-341, Type 1 and AASHTO M 213. Provide one of the following products:

1. Elastite; Philip Carey/Celotex

2. Flexcell; Celotex Corp.

3. Crane Fiber 1390; W.R. Grace & Co.

4. Fibre; W.R. Meadows, Inc.

5. Tex-Lite; J & P Petroleum Prod. Inc.

6. Sonoflex; Sonneborn/Contech, Inc.

C. Joint Sealing Compound: See Section 07 92 00, Sealants and Caulking

D. Moisture Barrier

Provide moisture barrier cover over all prepared base material. Use only materials that are resistant to decay when tested in accordance with ASTM E154. The moisture barrier consists of heavy Kraft papers laminated together with glass fiber reinforcement and overcoated with black polyethylene on each side. Provide Moistop, St. Regis, or equal.

E. Form Ties (for forms other than wall forms)

Factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. Unless otherwise shown, provide ties so portion remaining within concrete after removal is at least 1-1/2 inches inside concrete. Unless otherwise shown, provide form ties, which will not leave holes larger than 1-inch in diameter in concrete surface.

F. Concrete Curing Materials

Acrylic curing and sealing compound - Water emulsion acrylic curing and sealing compound formulated of acrylic polymers of water-based carrier. W.R. Meadows, Inc. VOCOMP-20 or equal.

G. Epoxy Adhesive

Provide Sikadur-31 Hi-Mod Gel or Sikadur-32 Hi-Mod for application to wire-brushed and prepared existing concrete to be mated to new concrete. Apply per Manufacturer's recommendations.

H. Chemical-Hardener Finish: Provide Hornolith from Tamms Industries or equal.

I. Non-slip Aggregate Finish

Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof and non-glazing, and is unaffected by freezing, moisture and cleaning materials.

J. Non-shrink Grout: See Section 03 60 00, Grouting.

2.8 PROPORTIONING NORMAL CONCRETE

A. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for each class of concrete required, complying with ACI 211.1. All measurements shall be by weight. All concrete admixtures will either be by the same supplier to insure compatibility. If different suppliers are used, a memorandum from EACH admixture supplier will be provided stating the compatibility of their product with the other supplier's products.

B. The slump shall be between 2 inches and 4 inches when tested in accordance with ASTM Specifications C 143. Variations in the slump range may be allowed by the Engineer if admixtures, such as water reducers or superplasticizers, are utilized in the concrete mix. Regardless of the measured slump, the maximum allowable water-cement ratios as specified here-in, shall be strictly adhered to.

C. Compressive Strength, Water and Cement Content

Notwithstanding what has been stated here-before, and unless shown otherwise on the Drawings, the concrete shall meet the following requirements. All concrete except as noted otherwise on the drawings shall have 4,000 pounds per square inch (psi) 28-day compressive strength. The maximum water content per 94-pound sack of cement is 4.5 gallons. The minimum cement content for the 4,000-psi mix is 6.0 sacks (94-pound sack of cement per cubic yard of concrete). Up to a maximum of 15 percent of cementatious material may be fly ash in accordance with ASTM C618. The use ground granulated blast furnace slag is not allowed.

D. Retarding Densifiers

1. All concrete (as defined in 2.9 below) used for wall construction shall also contain DARATARD-17, as manufactured by Grace Const. Products, Cambridge, MA or MBL-82, as manufactured by Master Builders, Cleveland, OH in the amounts recommended by the Additive Manufacturer whenever the air temperature during the pour exceeds 85 degrees Fahrenheit (F).

2. To be considered as equal, any alternate product offered for consideration shall contain no calcium chloride and shall be compatible with air-entrained cements and air-entraining admixtures conforming to the applicable ASTM, AASHTO, ANSI and Federal specifications.

3. Contractor shall certify that admixtures do not contain calcium chlorides or other corrosive materials.

E. Air-Entraining Agents

1. All concrete that that is specified to be air entrained or that may be exposed to freeze/thaw action either during construction or the service life of the structure must be air entrained. Sufficient air-entraining agent shall be used to provide total air content of 5 percent, +/- 1 percent.

2. Air-entraining agents shall meet ASTM C 260, ASTM C 233 and ASTM C 457.

3. The maximum total volumetric air content of the concrete before placement shall be 6 percent plus or minus one percent as determined by ASTM C 173 or ASTM 231.

4. Subject to these Specifications, consideration will be given to the following products: PROTEX “AES,” GRACE “DAREX AEA,” MASTER BUILDERS “MB-AE10,” or SIKA CHEMICAL “AER.”

F. Water Reducing Admixtures

1. In addition to air-entrainment, approved water reducing additives, which do not affect the ultimate performance of any steel in any way, may be added to maintain the maximum water content below that specified herein. Water reducing additives shall conform to ASTM C 494, Type A or D.

2. The use of water reducing additives shall not permit a reduction in the minimum specified cement content or in the specified amount of air-entrainment.

3. Admixtures shall contain no calcium chloride, tri-ethanolamine or fly ash. All admixtures shall be from the same manufacturer.

4. Superplasticizers, if allowed by the Engineer, shall conform to ASTM C 494, Type F or G, batch plant added using second or third generation only.

5. Set control admixtures if allowed by the Engineer, shall conform to ASTM C 494, Type B (retarding) or Type C (accelerating).

G. Fiber reinforcement admixture shall be included in the ready-mix concrete design used for filling and channeling the wet well chambers. Fibers shall be used in strict accordance with the Manufacturer’s directions.

2.9 CONCRETE MIXING

Ready-Mix Concrete - Comply with the requirements of ASTM C94, and as herein specified. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required. When the air temperature is between 85 degrees F and 90 degrees F, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90 degrees F, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 FORMS

A. Design, erect, support, brace, and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formworks so concrete members and structures are of correct size, shape, alignment, elevation, and position.

B. Design formworks to be readily removable without impact shock, or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level, and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required

in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Erect falsework and support; brace and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures.

Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

F. Forms for Exposed Concrete

Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes. Do not use metal cover plates for patching holes or defects in forms. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material, which will produce bow. Assemble forms so they may be readily removed without damage to exposed concrete surfaces. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

Corner Treatment - Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise indicated.

G. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings of forms at inconspicuous locations.

H. Chamfer exposed corners and edges, reveals and drips as shown using wood, metal, PVC or rubber strips fabricated to produce uniform smooth lines and tight edge joints.

I. Provisions for Other Trades - Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such ties. Accurately place and securely support items built into forms.

J. Cleaning and Tightening - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms after concrete placement if required to eliminate mortar leaks.

3.2 PLACING REINFORCEMENT

Detail and place according to ACI Manual SP-66. Unless otherwise noted, minimum cover shall be 1-1/2 inches for No. 5 and smaller bars, 2 inches for No. 6 and larger bars and 3 inches when poured against earth. Unless otherwise noted, bend all horizontals reinforcing a minimum of 2 feet at corners and wall intersections.

A. Clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

B. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

C. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

D. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh plus 2 inches, and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.3 JOINTS

A. Construction Joints - Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the Engineer.

B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Unless otherwise specified, reinforcement shall be lapped in accordance with ACI Standards.

C. Waterstops - Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with Manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.

D. Isolation Joints in Slabs-on-Ground - Construct isolation joints in slabs-on-ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

E. Control Joints in Slabs-on-Ground - Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4-inch wide by one-fifth to one-fourth of the slab depth, unless otherwise shown.

1. Form control joints by inserting a pre-molded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured, remove inserts and clean groove of loose debris.

2. Joint sealant material shall be as specified above.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General - Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs - Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screed strips by the use of strike-off templates or accepted compacting type screeds.

C. Cast in Place Reglets - Place in straight and continuous lines as detailed to enable flashing to be applied continuously without deviation at reglet joints more than 1/8-inch. Miter corners for continuous reglet joint where outside corners occur. At inside corners extend one section 1-inch past corner. Adequately anchor or secure reglets per Manufacturer's instructions prior to pouring and during construction to insure dimensional tolerances and alignment. Vibrate concrete to insure concrete cover adjacent to and around reglet. Visually inspect after pour and patch as required.

3.5 PREPARATION OF FORM SURFACES

Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Thin formcoating compounds only with thinning agent of type, and in amount, and under conditions of the Form-coating Compound Manufacturer's directions. Use dissipating-type form oil at surfaces to receive cement plaster finish. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with Manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.6 CONCRETE PLACEMENT

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work as required. Notify Engineer in time for inspection prior to pouring.

2. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.

3. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

4. Concrete Curbs and Paving - Do not place concrete until subbase is completed and approved by the Engineer as required to provide uniform dampened condition at the time concrete is placed. Moisten subbase as required to provide uniform dampened condition at the time concrete is placed.

B. Place concrete in compliance with the practices and recommendations of ACI 304 and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete, which is being integrated, with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to re-handling or flowing. Do not subject concrete to any procedure, which will cause segregation.

2. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

3. Do not use concrete which becomes non-plastic and unworkable or does not meet the required quality control limits or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the Project Site and dispose of in an acceptable location. Do not use concrete whose allowable mixing time has been exceeded.

C. Concrete Conveying

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods, which will prevent segregation and loss of concrete mix materials.

2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

3. The Contractor shall provide traffic control on the narrow access roads to the work sites.

4. The Contractor shall not wash concrete trucks/chutes/equipment off at the Project Site unless plastic tarps and hay bales are employed to contain the concrete. The Contractor will be required to haul off-site all concrete contaminated soil.

D. Placing Concrete into Forms

1. Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

2. Do not interrupt successive placement; do not permit cold joints to occur.

3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.

4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309, to suit the type of concrete and Project conditions. Vibration of forms and reinforcing will not be permitted.

5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

E. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations using mechanical vibrating equipment so the concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Consolidate concrete placed in beams and girders of supported slabs and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

4. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

F. Bonding

1. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of concrete bonding agent, and clean surfaces of laitance, coatings, loose particles and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and not to leave laitance, loose particles of aggregate or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

a. At joints between footings and walls or columns, and between walls or columns and beams or slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

b. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids; dampen, but do not saturate the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.

c. Use neat cement grout consisting of equal parts Portland cement and fine aggregate by weight and not more than 6 gallons of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16-inch. Deposit fresh concrete before cement grout has attained its initial set.

d. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the Bonding Material Manufacturer.

3. Prepare for bonding of fresh concrete to fully cured hardened concrete or existing concrete by using an epoxy-resin-bonding agent as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the Manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the Manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16-inch thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the Epoxy-resin Manufacturer.

G. Cold Weather Placing

1. Protect all concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.

2. When the air temperature has fallen to or is expected to fall below 40 degrees F, provide adequate means to maintain the temperature in the area where concrete is being placed at either 70 degrees F for 3 days or 50 degrees F for 5 days after placing. Provide temporary housing or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Keep concrete moist. Avoid rapid dry-out of concrete due to over-heating and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40 degrees F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degrees F, and not more than 80 degrees F, at point of placement.

4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

H. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water-soaked burlap if it becomes too hot so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures unless otherwise accepted in mix designs.

3.7 FINISH OF FORMED SURFACES

A. Rough Form Finish

For formed concrete surfaces not exposed to view in the finish work or covered by other construction, unless otherwise shown or specified. This is the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4-inch in height rubbed down or chipped off.

B. Smooth Form Finish

Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view. Or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.

Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

C. Curb Finishes

Curbs shall be screeded off accurately to true lines and planes or warped surfaces as indicated or directed. Finish smooth. Arises shall be true and straight or properly eased where curved

and neatly rounded with approved tool. Smooth trowel finish with corners rounded to 3/4-inch radius.

D. Grout Cleaned Finish (Sacked)

Provide grout cleaned finish to scheduled concrete surfaces which have received smooth form finish treatment, and to all exposed to view interior and exterior building surfaces, typical.

Combine one part Portland cement to 1-1/2 parts fine sand by volume and mix with water to the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

Thoroughly wet concrete surfaces and apply grout immediately to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

E. Related Unformed Surfaces

At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.8 MONOLITHIC SLAB FINISHES

A. Float Finish

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing or sand bed terrazzo, and as otherwise shown on drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill at low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

B. Trowel Finish

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, paint, or other thin-film finish coating system.

2. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Exposed Aggregate Finish

1. Screed to true plane, bullfloat surfaces, provide uniform double troweled finish. After troweling, let set until hard enough to wash without disturbing coarse aggregates. Simultaneously brush and spray with water to expose large aggregate and produce texture to match approved sample. Water cure or keep wet for 25 hours.

2. Scrub surface after 24 hours with a 1-part muriatic acid to 10-part water solution. Rinse thoroughly.

D. Broom Finish (Non-Slip)

1. Apply non-slip, broom finish to exterior concrete platforms, steps and ramps and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finish, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route or in the direction of water flow. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Engineer before application.

E. Chemical-Hardener Finish

1. Apply chemical curing-hardening compound or chemical-hardener to all interior concrete floors which will not receive applied finish materials. Mask adjacent work and surfaces to avoid over spray. Apply liquid chemical-hardener after complete curing and drying of the concrete surface.

2. Dilute the liquid hardener with water and apply in accordance with the Manufacturer's printed directions. Evenly apply each coat and allow for drying between coats in accordance with Manufacturer's printed directions.

3. After the final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

F. Non-slip Aggregate Finish

Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

After completion of float finishing and before starting trowel finish, uniformly spread 25 pounds of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with surface using steel trowel, but do not force the non-slip aggregate particles below surface.

After broadcasting and tamping, apply trowel finish as herein specified. After curing, lightly work the surface with a steel wire brush, or an abrasive stone, and water to expose the non-slip aggregate.

3.9 SCHEDULE OF CONCRETE SURFACE FINISHES

Also see Section 09 90 00, Painting and Coating for protective coating requirements.

	Surface Description	Type	Finish Requirement
A.	Interior Horizontal Slabs	Slab	Trowel Finish
B.	Exterior Horizontal Slabs	Slab	Broom Finish (Non-Slip)
C.	Stair Treads, Platforms and Ramps	Slab	Non-Slip Aggregate
D.	Interior Vertical Surfaces (including Wet Well)	Formed	Smooth Form
E.	Exterior Vertical Surfaces Exposed to View	Formed	Smooth Form

3.10 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 72 hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Curing Methods

Perform curing of concrete by moist curing, by moisture-retaining cover curing, by membrane curing, or by combinations thereof, as herein specified. Provide the curing methods indicated as follows:

1. For concrete floor slabs provide moisture curing, moisture cover curing, or liquid membrane/chemical curing-hardening curing. If liquid membrane curing is used, it must be compatible with concrete hardening compounds to be applied later.

2. For other concrete work, provide moisture curing or moisture cover curing. Do not use liquid membrane or chemical curing-hardening curing on any concrete work to receive any applied finishes.

3. For curing, use only water that is free of impurities, which could etch or discolor exposed, natural concrete surfaces.

4. Provide moisture curing by any of the following methods:

    a. Keeping the surface of the concrete continuously wet by covering with water.

    b. Continuous water-fog spray.

    c. Covering the concrete surface with the specified absorptive cover thoroughly saturated with water and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges with a 4-inch lap over adjacent absorptive covers.

5. Provide moisture-cover curing as follows - Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete placed in the widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

6. Provide liquid membrane curing as follows:

    a. Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply uniformly in a coat continuous operation by power spray equipment in accordance with the Manufacturer's directions. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.

    b. Do not use membrane-curing compounds on surfaces, which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete. Such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

7. Curing Formed Surfaces - Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs, and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

8. Curing Unformed Surfaces

    a. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing, whenever possible.

    b. Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

    c. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise acceptable to the Engineer.

9. Provide liquid curing-hardening compound as follows:

    a. Apply to horizontal surfaces when concrete is dry to touch by means of power spray, hand spray or hair broom in accordance with Manufacturer's directions.

C. Temperature of Concrete during Curing

1. When the atmospheric temperature is 40 degrees F and below, maintain the concrete temperature between 50 degrees F and 70 degrees F continuously throughout the curing period. When necessary, make arrangements before concrete placing for heating, covering, insulation, or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protections complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80 degrees F, and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protections complying with the requirements of ACI 305.

3. Maintain concrete temperature as uniformly as possible and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete, which exceed 5 degrees F in any 1-hour and 50 degrees Ft in any 24-hour period.

D. Protection from Mechanical Injury - During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In - Fill-in holes and openings in concrete structures for the passage of work by other trades, unless otherwise shown or directed, after the work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

B. Curbs - Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations - Provide machine and equipment bases and foundations as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the Manufacturer furnishing the machines and equipment.

3.12 REMOVAL OF SHORES AND FORMS

A. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate re-shoring to safely support the work without excessive stress or deflection.

Keep re-shores in place a minimum of 15 days after placing upper tier, and longer if required, until the concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

B. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulative curing at not less than 50 degrees F for 24 hours after placing concrete. Providing the concrete is sufficiently hard to not be damaged by form removal operations and provided curing and protection operations are maintained.

C. Formwork supporting weight of concrete, such as beam soffits, joints, slabs, and other structural elements, may not be removed in less than 14 days and until concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in place concrete by testing field-cured specimens representative of concrete location or members.

D. Form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

E. Re-Use of Forms

Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use “patched” forms for exposed concrete surfaces, except as acceptable to the Architect.

No forming material will be allowed to be built permanently into exposed visible surfaces.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas

1. Repair and patch defective areas with cement mortar immediately after removal of forms but only when directed by the Engineer.

2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts down to solid concrete but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Engineer.

3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before

proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

B. Repair of Formed Surfaces

1. Repair exposed-to-view formed concrete surfaces that contain defects, which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolt; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01-inch wide, cracks or any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

C. Repair of Unformed Surfaces

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop outs, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so those repairs can be made without damage to adjacent areas.

5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

6. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with a neat cement grout coating or use concrete bonding agent. Place patching

concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

8. For repair of existing unformed surfaces, mechanically remove all lose concrete as required to expose sound aggregate. Clean concrete surfaces to achieve a contaminate free, open textured surface. Square cut or undercut perimeter to minimum depth as specified by the Repair Mortar Manufacturer. Remove all loose concrete around the exposed steel and hand tool or blast clean all portions of rebar with visible rust to near white metal finish. If half of the diameter of the reinforcing steel is exposed, chip out behind the reinforcing to a 1/2-inch minimum depth. Splice new reinforcing steel to existing where corrosion has depleted the cross-section area by 25 percent. Apply a corrosion inhibitor/primer/bonding agent to all exposed rebar and other steel components and to concrete surfaces to be repaired per Manufacturer's requirements, such as Sika Armatec 110. Apply a polymer-modified, cement-based, repair mortar, trowel applied as specified by the Manufacturer, such as Sika MonoTop 615.

9. Repair methods not specified above may be used subject to the acceptance of the Engineer.

3.14 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Contractor will engage a special inspector/testing laboratory to perform all tests and to submit test reports to the Engineer and the Owner.

B. Concrete shall be sampled and tested for quality control during the placement of concrete, as follows:

1. Sampling Fresh Concrete - ASTM C172, except modified for slump to comply with ASTM C94.

2. Slump - ASTM 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.

3. Air Content - ASTM C231, pressure method; one for each set of compressive strength test specimens.

4. Compression Test Specimen - ASTM C31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

5. Concrete Temperature - Test hourly when air temperature is 40 degrees F and below, and when 80 degrees F and above; and each time a set of compression test specimens is made.

6. Compressive Strength Tests - ASTM C39; one set for each 100 cubic yards or fraction thereof, of each concrete class placed in any 1 day or for each 5,000 square feet of surface area placed; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

    a. When the frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

    b. When the total quantity of a given class of concrete is less than 50 cubic yards, the strength tests may be waived by the Engineer if, in the Engineer's judgment, adequate evidence of satisfactory strength is provided.

    c. If required by the building official, perform strength tests of cylinders cured under field conditions. Field cured cylinders shall be taken and molded at the same time and from the same samples as the laboratory cured test cylinders. When the strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

C. Report test results in writing to the Engineer and the Owner on the same day that tests are made. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of Contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day tests and 28-day tests.

D. Additional tests - The testing service will make additional tests of in-place concrete when test results indicate the specified concrete strengths and other characteristics have not been attained in the structure, as directed by the Engineer. The testing service shall conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

END OF SECTION

SECTION 03 60 00 - GROUTING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes all work necessary to form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. Work covered in this Section includes:

1. Grouting
2. Removal of loose and spalling grout and concrete
3. Anchoring, patching, grouting, and sealing

C. Related Sections:

1. Section 03 11 00 – Concrete Work

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Specifications, codes, and standards shall be as specified in Section 03 11 00, Concrete Work and as referred to herein.

B. Commercial Standards:

1. CRD-C 621, Corps of Engineers Specification for Non-Shrink Grout
2. ASTM C109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)”
3. ASTM C531, “Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”
4. ASTM C579, “Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes”
5. ASTM C827, “Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures”

1.3 SUBMITTALS

A. Certified Test Results: Verifying the compressive strength, shrinkage, and expansion requirements specified herein.

B. Manufacturer's Literature: Containing instructions and recommendations on the mixing, handling, placement, and appropriate uses for each type of non-shrink and epoxy grout used in the work.

1.4 QUALITY ASSURANCE

Field Tests

A. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the Engineer to ensure continued compliance with these specifications. The specimens will be made by the Engineer or its representative.

B. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.

C. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of the Contractor.

D. The cost of all laboratory tests on grout shall be borne by the Contractor and the Contractor shall obtain the specimens for testing. The Contractor shall also be charged for the cost of any additional tests and investigation on work performed which does not meet the specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.

PART 2 PRODUCTS

2.1 PREPACKAGED GROUTS

A. Non-shrink grout: This type of grout is to be used wherever grout is required in the Contract Documents unless another type is specifically referenced.

B. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, non-corrosive, non-chloride, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation of each class of non-shrink grout specified herein shall be that recommended by the Manufacturer for the particular application.

C. Class A non-shrink grouts shall have minimum 28-day compressive strength of 5,000 pounds per square inch (psi); shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRDC 621.

D. Class B non-shrink grouts shall have minimum 28-day compressive strength of 5,000 psi and shall meet the requirements of CRD C621.

E. Application

1. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout specified

herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

2. Class B non-shrink grout shall be used or the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

2.2 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.3 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers approved by the Engineer. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the Manufacturer.

PART 3 EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified by the Manufacturer. The finish of the grout surface shall match that of the adjacent concrete.

B. The Manufacturer of Class A non-shrink grout shall provide on-site technical assistance upon request.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

3.2 GROUTING PROCEDURES

Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution of prepackaged grouts shall be done according to the instructions and recommendations of the Manufacturer.

END OF SECTION

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DIVISION 09 - FINISHES

SECTION 09 90 00 - PAINTING AND COATING

PART 1 GENERAL

1.1 THE REQUIREMENT

A. Work under this Section shall include the protective coating of all specified surfaces including all surface preparation, pretreatment, coating application, touch-up of factory coated surfaces, protection of surfaces not to be coated, cleanup, and appurtenant work, all in accordance with the requirements of the Contract Documents.

B. This specification is applicable to coated pipe, steel, concrete, and other surfaces listed in the coating schedule at the end of this section.

C. The Coating System Schedules summarize the surfaces to be coated, the required surface preparation, and the coating systems to be applied. Coating notes on the drawings are used to show exceptions to the schedules, to show or extend the limits of coating systems, or to clarify or show details for application of the coating systems.

D. Related Work Specified in Other Sections -- Shop coatings and/or factory finishes on fabricated or manufactured equipment may be specified in other divisions. Some items with factory finishes, or corrosion resistant finishes may be scheduled or directed to be painted by the Engineer to unify a wall finish or color scheme, at the Engineer's discretion.

E. Exclusions -- Do not coat the following surfaces unless specified or directed elsewhere: Stainless steel, aluminum, copper, brass, bronze, and other corrosion-resistant material (except for valve bodies and piping); Electrical switch-gear and motor control centers having factory finish; Fencing; Multiple coated factory finished baked enamel or porcelain products; Concealed areas such as ducts, piping, conduits, and items specified elsewhere for special linings and coatings.

F. Damaged Factory Finish -- If directed by the Engineer, refinish the entire exposed surfaces of equipment chipped, scratched, or otherwise damaged in shipment or installation.

G. All coating coming in contact with potable water shall be NSF approved.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Comply with the provisions of the following codes, specifications, and standards, except as otherwise shown or specified.

1. "Architectural Specification Manual" by the Painting and Decorating Contractors of America (PDCA), 333 Taylor Avenue North, Seattle, Washington 98109.

2. "Systems and Specifications" - Volume 2 of Steel Structures Painting Council (SSPC).

3. NSF International (NSF) Standard No. 61.

4. NSF International (NSF) Standard No. 600 – Health Effects Evaluation and Criteria for Chemicals in Drinking Water (Effective beginning January 1, 2023)

B. References herein to "NACE" shall mean the published standards of the National Association of Corrosion Engineers, P.O. Box 986, Katy, TX 77450.

C. Pipe Coating Commercial Standards

ANSI/AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
ANSI/AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied.
ANSI/AWWA C205	Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4-inch and Larger - Shop Applied
ANSI/AWWA C209	Cold Applied Tape Coatings for the Exterior of Special Sections, Connections, and Fittings for Steel Pipelines.
ANSI/AWWA C210	Liquid Epoxy Coating for Exterior and Interior of Steel Pipe.
ANSI/AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
ANSI/AWWA C214	Tape Coating systems for the Exterior of Steel Water Pipelines.

D. Federal Specifications

DOD-P-23236A(SH)	Military Specification, Paint Coating Systems, Steel Ship Tank, Fuel and Saltwater Ballast.

1.3 CONTRACTOR SUBMITTALS

A. Coating Materials List -- The Contractor shall provide a coating materials list which indicates the Manufacturer and the coating number, keyed to the coating systems herein. The amount of copies to submit shall be as specified within Section 01 10 00, Summary of Work.

B. Coating Manufacturer's and Applicator Information -- For each coating system to be used the Contractor shall submit, the following listed data.

1. Manufacturer's data sheet for each product used, including statements on the suitability of the material for the intended use.

2. Manufacturer's instructions and recommendations on surface preparation and application.

3. Colors available for each product and each coat.

4. Compatibility of shop and field applied coatings (where applicable).

5. Material safety data sheet (MSDS) for each product used.

6. The Manufacturer’s recommended products and procedures for field coating repairs and field preparation of field cut pipe ends.

7. The name of the proposed coating applicator shop along with certification that the applicator shop is qualified and equipped to apply the coatings systems as specified.

8. Certificate -- Submit Manufacturer's certificate of compliance with the specifications and standards signed by a representative in the Manufacturer's employ.

9. Samples -- Provide painted surface areas at the job for approval of main color selections or submit sample on 12-inch sample of substrate using required finish system at Engineer's discretion.

1.4 QUALITY ASSURANCE

A. Painter Qualifications -- The Painting/Coating Contractor must be capable of performing the various items of work as specified. The Painting/Coating Contractor shall furnish a statement covering experience on similar work, a list of machinery, plant, and other equipment available for the proposed work, and a financial statement, including a complete statement of the Painter/Coating Contractor's financial ability and experience in performing similar painting and coating work. The Painting/Coating Contractor shall have a minimum of 5 years practical experience and a successful history in the application of the specified products to concrete/steel surfaces. Upon request, the Painting/Coating Contractor shall substantiate this requirement by furnishing a list of references, which shall include jobs of similar nature.

B. The Contractor shall give the Engineer a minimum of 3 days advance notice of the start of any field surface preparation work of coating application work, and a minimum of 7 days advance notice of the start of any shop surface preparation work.

C. All such work shall be performed only in the presence of the Engineer unless the Engineer has granted prior approval to perform such work in its absence.

D. Inspection by the Engineer, or the waiver of inspection of any particular portion of the work, shall not relieve the Contractor of its responsibility to perform the work in accordance with these Specifications.

E. Surface Preparation -- Evaluation of blast cleaned surface preparation work will be based upon comparison of the blasted surfaces with the standard samples available from the NACE, using NACE standard TM-01-70.

F. Scaffolding shall be erected and moved to locations where requested by the Engineer to facilitate inspection. Additional illumination shall be provided by the Contractor to cover all areas to be inspected.

G. Paint Products -- No request for substitution shall be approved which decreases the film thickness designated or the number of coats to be applied, or which offers a change from the generic type of coating specified. Painting shall be done at such times as the Contractor and Engineer may agree upon in order that dust-free and neat work be obtained. All painting shall be in strict accordance with the Manufacturer's instructions and shall be performed in a manner satisfactory to the Engineer.

H. Manufacturer's Representative -- Require Coating Manufacturer's representative to be at job site when the first day's coating application is in progress and periodically during progress of the work.

I. Labels -- Deliver to the job site in the original sealed containers with Manufacturer's name, product name, type of product, Manufacturer's specification or catalog number or federal specification number, and instructions for reducing where applicable.

J. Colors -- Colors will be selected from Manufacturer's standard colors as reviewed by Engineer and approved by the Owner. Colors for special coatings that are limited in their availability and color selection will be chosen on the basis of Manufacturer's standard colors, provided that the Manufacturer's product line represents a color range comparable to similar products of other manufacturers.

K. Flame Spread -- Provide paint materials which will result in a Class II finish for all coated surfaces in exit corridors, and a Class III finish for all other interior rooms or areas.

L. Film Thickness Testing -- On ferrous metals, the dry film coating thickness shall be measured in accordance with the SSPC "Paint Application Specification No. 2" using a magnetic-type dry film thickness gauge such as Mikrotest model FM, Elcometer model 111/1EZ, or equal. Each coat shall be tested for the correct thickness. No measurements shall be made until at least 8 hours after application of the coating. On non-ferrous metals and other substrates, the coating thicknesses shall be measured at the time of application using wet film gauge readings and destructive film thickness tests.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Deliver in labeled containers as specified above and store in a locked room accessible for inspection. Comply with fire and health regulations.

B. Provide adequate heat and forced mechanical ventilation for health, safety, and drying requirements. Use explosion proof equipment. Provide face masks.

C. Protect adjacent surfaces with suitable masking and drop cloths as required. Remove cloths or waste from the Project daily.

D. Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer. Do not apply coating in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the Coating Manufacturer's printed instructions. Coating application may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the Paint Manufacturer during application and drying periods.

1.6 PROTECTION

A. Follow all safety recommendations of Manufacturer regarding ventilation and danger from explosion or breathing paint fumes or skin exposure, and all applicable O.S.H.A. and other regulations.

B. Protect surface adjacent to work being coated from overspray, drips, or other damage.

1.7 EXTRA STOCK

Provide one gallon of each type and color, fully labeled, at completion of job.

PART 2 PRODUCTS

2.1 GENERAL

A. Definitions -- The terms "paint," "coatings," or "finishes" as used herein, shall include surface treatments, emulsions, enamels, paints, epoxy resins, tape, and all other protective coatings, excepting galvanizing or anodizing, whether used as a pretreatment, primer, intermediate coat, or finish coat. The term "DFT" means minimum dry film thickness.

B. General -- Coating materials shall be sealed in containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, Manufacturer's directions, and name of Manufacturer, all of which shall be plainly legible at the time of use.

C. The Contractor shall use coating materials suitable for the intended use and recommended by their Manufacturer for the intended service.

D. Compatibility -- In any coating system only compatible materials from a single manufacturer shall be used in the work. Particular attention shall be directed to compatibility of primers and finish coats. If necessary, subject to the approval of the Engineer, a barrier coat shall be applied between existing prime coat and subsequent field coats to ensure compatibility.

E. Colors -- All colors and shades of colors of all coatings shall be as selected or specified by the Engineer. Each coat shall be of a slightly different shade, to facilitate inspection of surface coverage of each coat. Finish colors shall be as selected from the Manufacturer's standard color samples by the Engineer. Color pigments shall be lead free.

F. Protective Coating Materials -- Products shall be standard products produced by recognized manufacturers who are regularly engaged in production of such materials for essentially identical service conditions. Where requested, the Contractor shall provide the Engineer with the names of not less than 10 successful applications of the proposed Manufacturer's products demonstrating compliance with this specification requirement.

G. Substitute or "Or-Equal" Submittals -- Unless otherwise specified, materials are from the catalogs of the companies listed herein. Materials by other manufacturers are acceptable provided that they are established as being compatible with and of equal quality to the coatings of the companies listed. The Contractor shall provide satisfactory documentation from the firm manufacturing the proposed substitute or "or equal" material that said material meets the specified requirements and is equivalent or better than the listed materials.

H. The cost of all testing and analyzing of the proposed substitute materials that may be required by the Engineer shall be paid by the Contractor. If the proposed substitution requires changes in the contract work, the Contractor shall bear all such costs involved and the costs of allied trades affected by the substitution.

2.2 INDUSTRIAL COATING SYSTEMS

A. General

Provide and apply the industrial coatings systems which follow as listed in the coating schedule, as required by these specifications, and as directed by the Engineer. Coat all existing and new

exposed interior or exterior surfaces and submerged and intermittently submerged surfaces as indicated, except as specifically excluded in Part 1 of this section or on the drawings or finish schedules. Coating System Numbers listed below shall be used as the Coating System code letter, and shall be used on any coating submittals or correspondence.

B. Industrial coating systems shall be as follows

1. Coating System 100

   a. Location -- Exposed, unprimed, non-galvanized, nonsubmerged metal surfaces, both interior and exterior including piping, and structural steel.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply prime coat and topcoat, 4.0-6.0 mils each coat of Tnemec Series 66-2 Hi-Build Epoxoline, or equal. Color as selected by Owner.

2. Coating System 101

   a. Location -- Exposed metal surfaces, shop primed, both interior and exterior including piping, railings, ladders, steel doors, and any other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Apply shop prime coat 3.0 mils DFT Tnemec Series 90-97 Tneme-Zinc, one coat 4.0 - 6.0 mils DFT Tnemec Series 66 Hi-Build Epoxoline, and 3.0 - 4.0 mils DFT of Tnemec Series 175 Endura Shield, or equal. Color as selected by Owner.

3. Coating System 102

   a. Location -- Unprimed or non-galvanized, continuously or intermittently submerged metal items, both interior and exterior including piping, structural steel, and all other metal items not otherwise specified.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prime, intermediate and topcoat, 4.0-6.0 mils each coat of Tnemec Series 22 / FC22, or equal. Color as selected by Owner.

4. Coating System 103

   a. Location -- Vertical concrete walls, exterior, below finish grade, not exposed to view.

   b. Surface Preparation – Surface should be free of oil, grease, dirt, laitance and loose material. Dry surfaces must be dampened with water and kept damp until application.

   c. Paint System – Apply MasterSeal 610 and 614 waterborne emulsified-asphalt damp proofing compound, or equal. Apply a prime coat of MasterSeal 610 asphalt emulsion, cut 20% by volume with clean water. Allow prime coat to dry tacky to touch and apply one coat of MasterSeal 614 by trowel. Fill in all crevices and grooves, making sure the coating is continuous and free from breaks and pinholes. Carry coating over exposed

top and outside edge of footing. Spread around all joints, grooves, and slots and into all chases, corners, reveals and soffits. Bring the coating to finished grade. All to set and backfill as described.

d. Backfilling – Place backfill at last 24-48 hours after application but within 7 days. Do not rupture or damage the film or displace the coating. Some situations may require protection board.

5. Coating System 104

a. Location – Non-submerged, exposed to view, PVC piping.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply one coat, 4.0-6.0 mils Tnemec Series 66-2 Hi-Build Epoxoline, or equal. Color as selected by Owner.

2.3 SPECIAL PIPE AND SEVERE SERVICE COATING SYSTEMS

A. General

The following coatings are for buried pipe and surfaces used in severe service conditions. The Manufacturers' products listed in this paragraph are materials which satisfy the material descriptions of this paragraph and have a documented successful record for long term submerged or severe service conditions. Proposed substitute products will be considered as indicated within the paragraph entitled " ‘Or-Equal’ Clause” in Section 01 10 00, Summary of Work.

B. Special pipe and severe service coating systems shall be as follows

1. Coating System 200 -- Cement Mortar Coating

a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

b. Surface Preparation - As specified herein.

c. Coating System -- A 1-1/2-inch minimum thickness mortar coating reinforced with 3/4-inch galvanized welded wire fabric shall be provided. The cement mortar shall contain no less than 1-part Type V cement to 3 parts sand. The cement mortar shall be cured by a curing compound meeting the requirements of "Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C 309-81, Type II, white pigmented, or by enclosure in an 8-mil thick polyethylene sheet with all joints and edges lapped by at least 6 inches. At the Engineer's discretion, the hot applied coal tar epoxy coating may be used as the curing membrane for the mortar coating.

2. Coating System 201 -- Hot Applied Coal Tar Epoxy Coating

a. Location -- Exterior surface of concrete pipe and cement-mortar coated pipe and fittings.

b. Surface Preparation -- As specified herein.

c. Coating System -- The hot applied coal tar epoxy shall be a solvent free 100 percent solids coal tar epoxy chemically compatible with hydrating cement and suitable for application on moist surfaces of freshly placed cement mortar or concrete and properly prepared cured surfaces. The coal tar epoxy coating material shall be Amercoat 1972B or equal. The finish coal tar epoxy coating shall have a minimum DFT of 26 mils.

3. Coating System 202 -- Coal-Tar Epoxy Coating System

   a. Location -- Exterior surface of buried steel pipe, fittings, and other ferrous surfaces.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- High build, two-component amine or polyamide cured coal-tar epoxy shall have a solids content of at least 68 percent by volume, suitable as a long-term coating of buried surfaces, and conforming to AWWA C210. Prime coats are for use as a shop primer only. Prime coat shall be omitted when both surface preparation and coating are to be performed in the field. The coal-tar epoxy coating system shall include:

      1) Prime coat (DFT = 1-1/2 mils), Amercoat 83HS, Tnemec P66, or equal.

      2) Finish coats (Two or more, DFT = 18 mils), Amercoat 78 HB, Tnemec 46 H-413, or equal.

      3) Total system DFT = 19-1/2 mils.

4. Coating System 203 -- Fusion Bonded Epoxy

   a. Location -- Ferrous surfaces of sleeve couplings, steel pipe, and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- The coating material shall be a 100 percent powder epoxy applied in accordance with the ANSI/AWWA C213 "AWWA Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines". The coating shall be applied using the fluidized bed process.

      1) Liquid Epoxy -- For field repairs, the use of a liquid epoxy will be permitted, applied in not less than three coats to provide a DFT 16 mils. The liquid epoxy shall be a 100 percent solids epoxy recommended by the Powder Epoxy Manufacturer.

      2) Coating (DFT = 16 mils), Scotchkote 203, or equal.

      3) Total system DFT = 16 mils.

5. Coating System 204 -- Hot, Coal-Tar Enamel

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation - As specified herein

c. Coating System -- Coal-Tar Enamel materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a primer layer, coal-tar enamel layer, coal-tar saturated non-asbestos felt outer wrap, and a finish coat. Total system DFT = 188 mils.

6. Coating System 205 -- Hot Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C203. This system shall consist of a cold-applied liquid primer and heated coal-tar base tape. Total system DFT = 50 mils.

7. Coating System 206 -- Cold Applied Tape

   a. Location -- Exterior surfaces of buried steel pipe and fittings, non-galvanized.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Tape coating materials and procedures shall be in accordance with ANSI/AWWA C209. Prefabricated tape shall be Type II. The system shall consist of a primer layer, inner layer tape of 35 mils, and an outer layer tape of 35 mils. Total system DFT = 70 mils.

8. Coating System 207 -- PVC Tape

   a. Location -- Small galvanized steel pipe and fittings.

   b. Surface Preparation -- As specified herein.

   c. Coating System -- Prior to wrapping pipe with PVC tape, the pipe and fittings shall be primed using a primer recommended by the PVC Tape Manufacturer. After being primed, the pipe shall be wrapped with a 20-mil adhesive PVC tape, half lapped for a total thickness of 40 mils.

9. Coating System 208 -- Mastic

   a. Location -- Pipe and fitting joints, and general buried surface coating repair and touch up.

   b. Surface Preparation - As specified herein.

   c. Coating System -- Mastic shall be a one-part solvent drying heavy bodied thixotropic synthetic elastomeric coating with chemically inert resins and fillers and an average viscosity of 650,000 CPS at 77 degrees Fahrenheit (F), thereby requiring generous applications by hand or trowel. Total coat thickness shall be 30 mils, minimum. Mastic shall be Protecto Wrap 160 H or equal and be fully compatible with pipeline coating systems.

10. Coating System 209 -- Polyethylene Encasement

a. Location -- Ductile iron, steel and concrete cylinder pipe and fittings

b. Surface Preparation -- None required.

c. Coating System -- Except as otherwise specified, application of polyethylene encasement shall be in accordance with ANSI/AWWA C105 using Method C.

11. Coating System 210 – Wax Tape

a. Location – Buried ductile iron and steel pipe fittings and couplings where specified.

b. Surface Preparation – As specified herein

c. Coating System -- Except as otherwise specified, application of wax tape installation shall be in accordance with ANSI/AWWA C217.

12. Coating System 211 – Amine Cured Epoxy

a. Location – Sanitary sewer manhole and wet well interior concrete surfaces where shown.

b. Surface Preparation – Per manufacturer's recommendations.

c. Coating System – Solvent-free 100% solids, ultra-high build two-component epoxy coating system, thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance with high physical strengths and broad range of chemical resistance. Coating shall be meet these requirements:

Parameter	Requirement
Product Type	Amine cured epoxy
Color	Light Blue
Solids Content (vol %)	100
Mix Ratio	3:1
Compressive Strength, psi	18,000
Tensile Strength, psi	7,600
Tensile Elongation, %	1.50
Flexural Modulus, Type D	88
Bond Strength – Concrete	>Tensile Strength of Concrete
Chemical Resistance	
Sever Municipal Sewer	All types of service
Successful Pass	Sanitation District of LA County Coating Evaluation Study or SSPWC 210.2.3.3

d. Coating system shall be applied by a certified applicator of the epoxy coating manufacturer and according to manufacturer specifications.

e. Coating system shall be Raven 405 or approved equal. The coating shall be applied with minimum thickness of 120 mils.

2.4 ARCHITECTURAL COATING SYSTEMS

A. General

"Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or topcoat.

Fungus Control: Submit evidence for all paints attesting the passing of Federal Test Method Standard No. 141, Method 6271.1 showing no fungus growth or other approved test results.

Apply to surfaces under recommended environmental conditions and within the limitations established by the Material Manufacturer. Acrylics require 60 degrees F and above temperature and below 50 percent relative humidity. Apply water-based paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 50 degrees F and 90 degrees F unless otherwise permitted by the Paint Manufacturer's printed instructions.

B. Architectural coating systems shall be as follows

1. Coating System 300

    a. Location -- Vertical, exterior concrete masonry unit walls exposed to view.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Apply prime, intermediate and topcoat, 75 square foot per gallon (ft^2/gal), 100 ft^2/gal and 100 ft^2/gal respectively for each coat of Tnemec Series 156 Envirocrete or equal. Color as selected by Owner.

2. Paint System 301

    a. Location -- Vertical concrete exterior walls and flat concrete exterior roofs and slabs exposed to view.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Apply two coats 6.0-9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or equal. Color as selected by Owner.

3. Paint System 302

    a. Location -- Interior concrete masonry unit walls and interior and exterior wood walls, ceilings, and other wood surfaces not otherwise specified, exposed to view.

    b. Surface Preparation -- As specified herein.

    c. Coating System -- Prime as specified by Coating Manufacturer. Apply two coats 6.0 - 9.0 mils (100 ft^2/gal) each coat, Tnemec Series 156 Envirocrete, or equal. Color as selected by Owner.

4. Paint System 303

a. Location -- Wood surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- As specified herein.

c. Coating System -- Apply an alkyd primer as recommended by the Manufacturer, 2 mils. Apply finish coats (two or more coats 6 mils total) of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Total DFT = 8 mils. Color as selected by Owner.

5. Paint System 304

a. Location -- Interior drywall surfaces not otherwise specified, exposed to view.

b. Surface Preparation - As specified herein.

c. Coating System -- Apply two coats 2.0 - 3.0 mils each coat of single component, water based acrylic latex coating, Tnemec Series 6, Carboline 3350 or equal. Color as selected by Owner.

6. Paint System 305

a. Location -- Exterior brick surfaces not otherwise specified, exposed to view.

b. Surface Preparation -- Surfaces shall be cleaned with a Manufacturer's approved chemical cleaner and power washed. Surfaces shall be completely dry, free from efflorescence, oils, paint, and other contaminants before the coating system is applied. Coating system shall be applied according to the Manufacturer's published recommendations. A Manufacturer's representative shall be present during application of the coating system, if required by the Manufacturer's warranty.

c. Coating System -- Apply two coats of masonry water retardant material. The system shall be clear, non-staining, silane-modified-siloxane, Fabrishield 161, Rainstopper 1500, or equal. The selected coating system shall provide a minimum of a 5-year Manufacturer's warranty.

7. Paint System 306

a. Location -- Exterior siding, trim and related products, all comprised of fiber cement material with a factory installed primer.

b. Surface Preparation -- If cleaning is required, surface shall be cleaned in a manner approved by both the coating system manufacturer and the siding manufacturer. Under no circumstances shall fiber cement siding products be cleaned with high pressure water blasting, sand blasting, or acid washing as these techniques may damage the surface of the fiber cement. Low pressure water spray and a medium-stiff, nonmetallic bristle brush may be used for cleaning fiber cement products. Coating system shall be applied according to the coating system manufacturer's published recommendations. A manufacturer's representative shall be present during application of the coating system, if required by the manufacturer's warranty. Coating system must be applied within 180 days of installation of the factory primed siding

products, or less if the siding product manufacturer's warranty requires painting in less than 180 days.

c. Coating System -- Apply primer coat of high performance acrylic primer/sealer specifically engineered for high-performance protection of exterior, above-grade, cementitious surfaces and fiber cement siding. Apply topcoat of 100% acrylic latex, cross-linked. The system shall Sherwin Williams Loxon Concrete & Masonry Primer/Sealer and Sherwin Williams Emerald Exterior Acrylic, or approved equal. The selected coating system shall provide a minimum of a five-year manufacturer's warranty.

PART 3 EXECUTION

3.1 STORAGE, MIXING, AND THINNING OF MATERIALS

A. Manufacturer's Recommendations -- Unless otherwise specified herein, the Coating Manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting its coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed.

B. All protective coating materials shall be used within the Manufacturer's recommended shelf life.

C. Storage and Mixing -- Coating materials shall be protected from exposure to cold weather, and shall be thoroughly stirred, strained, and kept at a uniform consistency during application. Coatings of different manufacturers shall not be mixed together.

3.2 SURFACE PREPARATION STANDARDS

A. The following referenced surface preparation specifications of the Steel Structures Painting Council shall form a part of this specification.

1. Solvent Cleaning (SSPC-SP1) -- Removal of oil, grease, soil, salts, and other soluble contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam.

2. Hand Tool Cleaning (SSPC-SP2) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by hand chipping, scraping, sanding, and wire brushing.

3. Power Tool Cleaning (SSPC-SP3) -- Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, by power tool chipping, descaling, sanding, wire brushing, and grinding.

4. White Metal Blast Cleaning (SSPC-SP5) -- Removal of all visible rust, oil, grease, soil, dust, mill scale, paint, oxides, corrosion products, and foreign matter by blast cleaning.

5. Commercial Blast Cleaning (SSPC-SP6) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 33 percent of each square inch of surface area.

6. Brush-Off Blast Cleaning (SSPC-SP7) -- Removal of all visible oil, grease, soil, dust, loose mill scale, loose rust, and loose paint.

7. Near-White Blast Cleaning (SSPC-SP10) -- Removal of all visible oil, grease, soil, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except that staining shall be limited to no more than 5 percent of each square inch of surface area.

8. High- and Ultra High- Pressure Water Jetting (SSPC-SP12): Water jetting at high- or ultra-high-pressure to prepare a surface for recoating using pressure above 10,000 pounds per square inch (psi).

9. Surface Preparation of Concrete (SSPC-SP-13) - Surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.

10. Industrial Blast Cleaning (SSPC-SP14): Blast cleaning to remove all visible oil, grease, dust, and dirt, when viewed without magnification

3.3 CORRECTIONS AND CLEANUP

At completion any damaged, de-laminated or defaced coated surfaces shall be touched up, restored, and left in first class condition. Any coated or finished surfaces damaged in fitting or erection shall be restored. If necessary, an entire wall shall be refinished rather than spot finished. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the coating process shall be removed from the site and any spillage, spatter spots or other misplaced coating material shall be removed in a manner which will not damage surfaces. Perform required patching, repair, and cleaning to the satisfaction of the Engineer. Cooperate and coordinate work with the work of other trades in the removal and replacement of hardware, fixtures, covers, switch plates, etc., as required for coating.

3.4 SURFACE PREPARATION

A. General

Prepare all surfaces scheduled to receive new coating systems, as required to provide for adequate bonding of the specified coating system to the substrate material. Request review of prepared surfaces by the Engineer prior to proceeding. For existing coated surfaces, hand wash with cleaner or product recommended by Coating Manufacturer to properly prepare existing surface and provide for bonding of coating specified to follow. Remove any loose, peeling or flaking coating, or mildewed areas. Surface preparation minimums shall be as follows:

1. Exposed metal items, non-submerged, unprimed, non-galvanized both interior and exterior, including piping, structural steel and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP6, "Commercial Blast Cleaning".

2. Exposed metal items, shop primed, both interior and exterior including piping, steel doors, steel ladders to be painted, and railings, and all other metal items not otherwise specified, shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning"; SSPC-SP2, "Hand Tool Cleaning"; and SSPC-SP3, "Power Tool Cleaning" as may be required to remove grease, loose, or peeling or chipped paint.

3. Metal items, unprimed or non-galvanized, continuously or intermittently submerged, both interior and exterior including piping, structural steel, and all other metal items not otherwise specified, shall undergo surface preparation in conformance with SSPC-SP10, "Near-White Blast Cleaning".

4. Stainless Steel – Non-submerged and submerged, exposed piping and fittings, both interior and exterior shall undergo surface preparation in accordance with SSPC-SP1, "Solvent Cleaning".

5. Polyvinyl Chloride (PVC) – Non-submerged, both interior and exterior, process piping and plumbing, shall be lightly sanded prior to application of the specified coating system to follow.

6. Non-submerged Concrete - Clean all concrete surfaces of dust, form oil, curing compounds, or other incompatible matter. Etch and prime if required by Manufacturer for specified coating products to follow. Allow minimum 28-day cure of concrete prior to application of coating systems.

7. Concrete Masonry Units -- Repair all breaks, cracks, and holes with concrete grout. The surface must be free of dirt, dust, loose sand, and other foreign matter. Brush clean. Allow minimum 28-day cure of concrete joint mortar and repair grout prior to application of coatings system.

8. Wood -- Wood surfaces shall be thoroughly cleaned and free of all foreign matter with cracks, nail holes, and other defects properly filled, smoothed, and sandpapered to fine finish. Wipe clean of dust.

9. Preparation of All Existing Coated Surfaces -- Removed rough and defective coating film from material surfaces to be painted. Touch up with approved primer. Clean all greasy or oily surfaces, to be painted, with benzine or mineral spirits or Rodda's Gresof before coating, or as recommended by Manufacturer. For walls, patch existing nicks and gouges, sand to match wall finish.

10. Sewer Manhole and Wet Well Interior Concrete – Clean all concrete surfaces of oils, grease, incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, and other contaminants. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced. Infiltration shall be stopped by using a material which is compatible with the repair materials and is suitable for top-coating with the epoxy coating system. Cementitious repair materials shall be troweled to provide a smooth surface with an average profile equivalent to coarse sandpaper to optimally receive the epoxy coating. No bug holes or honeycomb surfaces should remain. The repair materials shall be allowed to cure according to the manufacturer recommendations. Curing compounds should not be used unless approved for compatibility with the specified epoxy coating system.

3.5 PRIME COATING

A. Exposed Steel -- Prime coat all exposed steel in accordance with SSPC PS 13.01 for epoxy-polyamide coating systems. Prime coats shall be applied following completion of surface preparation requirements as specified in paragraph 3.4.A.1 above.

B. Galvanized Metal -- After surface preparation specified above, prime galvanized metal items receiving paints as specified with Tnemec Series 66 Hi-Build Epoxaline or equal, verifying with Manufacturer before application the compatibility with coatings specified to follow.

C. Shop Primed Metal -- Where indicated on the plans or coating schedule and following the surface preparation procedures specified in paragraph 3.4.A.2 above, the Contractor shall apply intermediate and topcoats of the specified paint system to shop primed metal. The Contractor shall verify with the Manufacturer(s) representative of the item(s) to be painted, before application, the compatibility of shop primers with the specified intermediate and topcoat coating systems.

D. Non-Shop Primed Metal and Piping -- Prime coat all exposed metal and piping, except stainless steel, received at job site following completion of surface preparation requirements as specified in Paragraph 3.4.A.1 above. Prime paint in accordance with SSPC PS No. 13.01 for epoxy-polyamide primers. Epoxy-polyamide primers shall conform to the standards set forth in SSPC Paint Specification No. 22.

E. Cast-In-Place Reinforced Concrete -- After surface preparation specified above, prime coat concrete as specified in the coating schedule found elsewhere in the specifications.

F. Concrete Masonry Units -- After surface preparation specified above, prime coat as specified in the coating schedule found elsewhere in the specifications.

G. Wood Surfaces -- Following surface preparation specified above, prime coat exterior exposed wood surfaces with appropriate coating system as specified in the painting schedule.

3.6 FIELD PRIME

Wherever shop priming has been damaged in transit or during construction, the damaged area shall be cleaned and touched up with field primer specified herein or returned to the shop for resurfacing and re-priming, at the Engineer’s discretion. Metal items delivered to the job site unprimed shall be cleaned and primed as specified herein.

3.7 APPLICATION

A. Thickness -- Apply coatings in strict conformance with the Manufacturer's application instructions. Apply each coat at the rate specified by the Manufacturer to achieve the dry mil thickness specified. If material must be diluted for application by spray gun, build up more coating to achieve the same thickness as undiluted material. Correct apparent deficiency of film thickness by the application of an additional coat.

B. Porous Surfaces -- Apply paint to porous surfaces as required by increasing the number of coats or decreasing the coverage as may be necessary to achieve a durable protective and decorative finish.

C. Blast cleaned ferrous metal surfaces shall be painted before any rusting or other deterioration of the surface occurs. Blast cleaning shall be limited to only those surfaces that can be coated in the same working day.

D. Coatings shall be applied in accordance with the Manufacturer's instructions and recommendations, and this Section, whichever has the most stringent requirements.

E. Special attention shall be given to edges, angles, weld seams, flanges, nuts and bolts, and other places where insufficient film thicknesses are likely to be present. Use stripe coating for these areas.

F. Special attention shall be given to materials which will be joined so closely that proper surface preparation and application are not possible. Such contact surfaces shall be coated prior to assembly or installation.

G. Ventilation -- Adequately ventilate enclosed rooms and spaces during painting and drying periods.

H. Drying Time -- Do not apply next coat of coat until each coat is dry. Test non-metallic surfaces with moisture meter. The Manufacturer's recommended drying time shall mean an interval under normal condition to be increased to allow for adverse weather or drying conditions. Coating Manufacturer's representative shall verify by cure testing, complete cure of coatings systems used for immersion service.

3.8 COATING SCHEDULE

Coating Schedule

Item	Location	Material	Coating System
Piping Coatings[1] (exterior surface of pipe)	Exposed and in Vaults	Ductile Iron	Coating System 101
Piping Coatings	Buried	Ductile Iron	Coating System 209 and Section 33 31 10
Vaults	Exterior (walls below grade)	Concrete	Coating System 103

Notes:

1. Pipe interior coatings (linings) shall be in accordance with applicable utility piping specifications.
2. Coating of exposed valves and couplings to be shop-applied fusion-bonded epoxy Finish coat shall be same coating system as adjacent piping to match in color, unless otherwise directed by the Engineer.
3. If a location and material are not specifically identified in the table, the coating systems specified in Section 2, Products, shall apply to the entire project as noted in the specifications for each coating system.

END OF SECTION

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DIVISION 31 - EARTHWORK

SECTION 31 05 13 - SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes range of soil and subsoil materials intended to be referenced by other sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other sections and on Drawing notes.

B. Section includes:

1. Subsoil materials
2. Topsoil materials

C. Related Sections

1. Section 31 05 16 - Aggregates for Earthwork
2. Section 31 10 00 – Site Clearing
3. Section 31 22 13 - Rough Grading
4. Section 31 23 16 – Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 18 – Rock Removal
7. Section 31 23 23 - Fill
8. Section 31 37 00 - Riprap

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM):

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
2. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
3. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials source.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Furnish materials of each type from same source throughout the Work.

B. Soil Testing:

1. Soil sampling and testing to be completed by an independent laboratory approved by the Engineer.

2. Frequency of testing shall be determined by the Engineer.

3. All soil testing shall be paid for by the Contractor.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by ASTM D698 (AASHTO T99).

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Soil Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 SUBSOIL MATERIALS

A. Subsoil Type S1, Select Native Material:

1. Select earth obtained from on-site excavations approved for use by Engineer.

2. Graded.

3. Free of peat, humus, vegetative matter, organic matter, and rocks larger than 6 inches in diameter.

4. Processed as required to be placed in thickness as prescribed and at the optimum moisture content to obtain level of compaction required by these specifications.

B. Subsoil Type S2, Imported Fill Material:

1. Imported earth approved for use by Engineer.

2. Meeting the requirements of Subsoil Type S1.

2.2 TOPSOIL MATERIALS

A. Topsoil Type TS1, Select Native Topsoil Material:

1. Top 6 - 12 inches of existing soil containing organic matter.

2. Engineer decision shall be final as to determination of what material is topsoil quality.

3. Graded.

4. Free of roots, rocks larger than 1/2-inch subsoil, debris, large weeds, and foreign matter.

a. Screening: Single screened.

B. Topsoil Type TS2, Imported Topsoil Material:

1. Imported borrow.

2. Friable loam.

3. Reasonably free of roots, rocks larger than 1/2-inch, subsoil, debris, large weeds, and foreign matter.

a. Screening: Single screened.

4. Acidity range (pH) of 5-1/2 to 7-1/2.

5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.

2.3 SPOILS

A. All excess material not suitable or not required for backfill and grading shall be hauled off site and disposed of at a location provided by the Contractor and approved by the Engineer.

B. Make arrangements for disposal of the material at no additional cost to the Owner.

C. Landfill permit to be obtained by the Contractor and provided to Engineer prior to commencement of disposal.

2.4 SOURCE QUALITY CONTROL

A. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698 (AASHTO T99).

B. When tests indicate materials do not meet specified requirements, change material, or vary compaction methods and retest. Additional testing shall be completed and paid for by the Contractor with no reimbursement by the Owner.

C. Furnish materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

A. Excavate material of every nature and description to the lines and grades as indicated on the Drawings and/or as required for construction of facilities.

B. Site within clearing limits shall be stripped of topsoil as required to obtain additional topsoil necessary to complete Work indicated in the Drawings or as specified.

C. When practical, do not excavate wet topsoil.

D. Stockpile excavated material meeting requirements for subsoil materials and topsoil materials.

E. Remove excess excavated subsoil and topsoil not intended for reuse from Site.

F. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

3.2 STOCKPILING

A. Stockpile soils at locations shown in the Drawings or at locations as approved by Engineer for redistribution as specified.

1. Site may not have sufficient area to stockpile excavated material that will be required for fill later in the Project. If additional stockpile area is required to complete the Project on schedule, arrange off-site stockpile areas.

2. No additional payments will be made for stockpiling excavated materials off-site.

B. Stockpile in sufficient quantities to meet Project schedule and requirements.

C. Separate differing materials with dividers or stockpile apart to prevent mixing.

D. Prevent intermixing of soil types or contamination.

E. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.

2. Cover stockpiles to minimize the infiltration of water.

F. Stockpile unsuitable and/or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 31 05 16 - AGGREGATES FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes a range of coarse and fine aggregate materials intended to be referenced by other Sections, generally for fill and grading purposes. Materials are indicated by "Type" to assist in referencing from other Sections and in Drawing notes.

B. Section Includes:

1. Coarse aggregate materials
2. Fine aggregate materials

C. Related Sections

1. Section 31 05 13 - Soils for Earthwork
2. Section 31 23 17 - Trenching
3. Section 31 23 19 - Dewatering
4. Section 32 11 23 - Aggregate Base Courses
5. Section 33 11 10 – Water Utility Distribution and Transmission Piping
6. Section 33 31 10 – Sanitary Sewerage Piping
7. Section 33 41 10 – Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses

2. AASHTO T27 - Sieve Analysis of Fine and Coarse Aggregates

3. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

4. AASHTO TP61 - Standard Method of Test for Determining the Percentage of Fracture in Coarse Aggregate

B. ASTM International (ASTM):

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)

4. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

5. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

D. Results of aggregate sieve analysis and standard proctor tests for all granular material.

1.4 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

B. Aggregate Testing:

1. Aggregate sampling and testing to be completed by an independent laboratory approved by the ENGINEER.

2. The frequency of testing shall be determined by the ENGINEER.

3. All aggregate testing shall be paid for by the CONTRACTOR.

C. Compaction Tests:

1. Maximum density at optimum moisture content determined by ASTM D698 (AASHTO T99).

2. In-place density in accordance with Nuclear Testing Method, ASTM D6938.

D. Aggregate Classification: All imported materials shall be classified in accordance with ASTM D2487.

PART 2 PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

A. Coarse Aggregate Type A1, Dense-Graded Aggregate: Crushed rock with ¾-inch-0, 1-inch-0, 1-1/2-inch-0, 2-inch-0 and 2-1/2-inch-0 gradation as shown in the Drawings and meeting the requirements provided below.

1. Grading - Dense-graded base aggregate shall be crushed rock, including sand. Uniformly grade the aggregates from coarse to fine.

2. Sieve analysis shall be determined according to AASHTO T27.

3. The aggregates shall conform to one of the grading requirements Table 31 05 16-A below.

Table 31 05 16-A
Grading Requirements for Dense-Graded Aggregate
Separated Sizes
Percent Passing (by weight)

Sieve Size	2-1/2" - 0	2" - 0	1-1/2" - 0	1" - 0	3/4" - 0
3”	100				
2-1/2”	95 - 100	100			
2”	-	95 - 100	100		
1-1/2"	-	-	95 - 100	100	
1-1/4”	55 - 75	-	-	-	
1”	-	55 - 75	-	90 - 100	100
3/4"	-	-	55 - 75	-	90 - 100
1/2"	-	-	-	55 - 75	-
3/8”	-	-	-	-	55 - 75
1/4"	30 - 45	30 - 45	35 - 50	40 - 55	40 - 60
No. 4*	-	-	-	-	-
No. 10	[1]	[1]	[1]	[1]	[1]

[1] Of the fraction passing the 1/4-inch sieve, 40 percent to 60 percent shall pass the No. 10 sieve.
* Report percent passing sieve when no grading requirements are listed.

B. Coarse Aggregate Type A2, Granular Drain Backfill Material: Crushed or uncrushed rock or gravel as shown in the Drawings.

1. Material shall be clean and free draining.
2. Sieve analysis shall be according to AASHTO T27.
3. Grading: Meeting the gradation requirements provided in Table 31 05 16-B below.

Table 31 05 16-B
Grading Requirements for Granular Drain Backfill Material
Separated Sizes
Percent Passing (by weight)

Sieve Size	Separated Sizes 1-1/2-inch – 3/4-inch	Separated Sizes 3/4-inch – 1/2-inch
2-inch	100	
1-1/2-inch	90 - 100	
1-inch	20 - 55	100
3/4-inch	0 - 15	85 - 100
1/2-inch	-	0 - 15
3/8-inch	0 - 5	-

2.2 SAND

A. Sand: Sand material shall consist of granular material, naturally produced, or produced from crushed gravel, or dredge sand that is reasonably free of organic material, mica, clay, fly ash, and other deleterious material, meeting the gradations of Table 31 05 16-C below.

Table 31 05 16-C
Grading Requirements for Sand
Separated Sizes
Percent Passing (by weight)

Sieve Size	Coarse Sand	Medium Sand	Fine Sand
1-inch	100	100	100
3/8-inch	95 - 100	95 - 100	-
#4	80 - 100	70 - 95	90 - 100
#30	10 - 30	10 - 45	-
#100	-	2 - 10	2 - 10
#200	0 - 8	0 - 7	0 - 4
Sand Equivalent	50 min.	50 min.	50 in.

2.3 SOURCE QUALITY CONTROL

A. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698 (AASHTO T99).

B. Sand - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698 (AASHTO T99).

C. When tests indicate materials do not meet specified requirements, change material and retest. Additional testing shall be completed and paid for by the CONTRACTOR with no reimbursement by the OWNER.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile materials imported to site as shown in the Drawings or at locations as approved by ENGINEER for redistribution as specified.

B. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.

C. Prevent intermixing of aggregate types or contamination.

D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.

1. Grade surface of stockpiles to prevent ponding of water.
2. Cover stockpiles to minimize the infiltration of water.

3.2 STOCKPILE CLEANUP

A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 31 10 00 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes clearing site of incidental paving and curbs, debris, grass, trees, and other plant life in preparation for site or building excavation work.

B. Related Sections:

1. Section 01 56 39 – Temporary Tree and Plant Protection
2. Section 02 41 00 - Demolition
3. Section 31 22 13 - Rough Grading
4. Section 31 23 18 - Rock Removal

1.2 DEFINITIONS

A. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

B. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 12 inches below subgrade.

C. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

D. Limits of Disturbance: Work area boundary as shown on the Plans.

E. Root Wad: Tree stump and root mass including all roots greater than 1-inch diameter.

F. Stripping: Removal of topsoil remaining after applicable scalping is completed.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Clearing, Grubbing, and Stripping Plan: Drawings clearly showing proposed limits to clearing, grubbing, and stripping activities at Site.

C. Certification or disposal permit for landfill and/or waste disposal site.

D. A copy of written permission of private property owners, with copy of fill permit for said private property, as may be required for disposal of materials.

1.4 QUALITY ASSURANCE

A. Existing Conditions: Determine the extent of Work required and limitations before proceeding with Work.

B. Obtain Engineer's approval of staked clearing, grubbing, and stripping limits prior to commencing clearing, grubbing, and stripping.

C. Conform to applicable local, state, and federal codes for environmental requirements and disposal of debris,

1. Burning on Project Site will not be permitted.

2. Use of herbicides will not be permitted.

D. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the Work described in this Section.

E. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of laborers, other persons, and property in the vicinity of the work and requirements of the General Provisions.

PART 2 PRODUCTS

2.1 MATERIALS

A. Existing Materials: All materials, equipment, miscellaneous items, and debris involved, occurring or resulting from demolition, clearing, and grubbing work shall become the property of the Contractor at the place of origin, except as otherwise indicated in the Drawings or specifications.

B. Wound Paint: Emulsified asphalt formulated for use on damaged plant tissues.

PART 3 EXECUTION

3.1 GENERAL

A. Clear, grub, and strip areas needed for waste disposal, borrow, or Site improvements within limits shown in approved Clearing, Grubbing, and Stripping Plan.

B. Remain within the property lines at all times.

C. Do not injure or deface vegetation or structures that are not designated for removal.

3.2 EXAMINATION

A. Verify existing plant life designated to remain is tagged or identified.

B. Identify waste and salvage areas for placing removed materials.

3.3 PREPARATION

A. Carefully coordinate the work of this Section with all other work and construction.

B. Call Oregon Utility Notification Center at 1-800-332-2344, not less than three working days before performing Work.

C. Request underground utilities to be located and marked within and surrounding construction areas.

1. Disconnect or arrange for disconnection of utilities (if any) affected by required work.

2. Keep all active utilities intact and in continuous operations.

D. Prepare Site only after:

1. Erosion and sediment controls are in place.

a. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls and in compliance with Oregon Erosion and Sediment Control Manual and ESC Permits.

2. Tree and vegetation protection is installed.

a. Protect existing site improvements, trees, and shrubs to remain to preclude damage during construction.

b. Follow the provisions set forth in 01 56 39, Temporary Tree and Plant Protection for all temporary tree and plant protection measures.

3. Temporary fencing is installed along the Limits of Disturbance.

4. Notification of utility agencies; disconnect or arrange for disconnection of utilities (if any) affected by required work. Keep all active utilities intact and in continuous operation.

3.4 PROTECTION

A. Utilities: Locate, identify, and protect utilities located by utilities and indicated in the Drawings to remain from damage.

B. Survey control: Protect benchmarks, survey control points, and existing structures from damage or displacement.

C. Preservation and Trimming of Trees, Shrubs, and Other Vegetation:

1. Follow the provisions set forth in 01 56 39, Temporary Tree and Plant Protection.

D. Landscaped Areas:

1. When any portion of the Work crosses private property or landscaped areas, excavate topsoil separately and pile it on the opposite side of the trench from the subsoil.

2. Conduct Work in a manner that will restore original conditions as nearly as practicable.

3. Remove and replace any trees, shrubs, plants, sod, or other vegetative material as needed to complete Work.

4. All shrubs or plants shall be balled by experienced workers, carefully handled and watered, and replaced in their original positions without damage. Sod shall be handled in a similar manner.

5. Wherever sod cannot be saved and restored, the ground must be reseeded and cared for until a stand of grass is reestablished.

6. Plants or shrubs killed or destroyed shall be replaced and paid for by the Contractor.

7. It is the intent of this paragraph that the Contractor shall leave the surface and plantings in substantially the same conditions as before the Work is undertaken.

E. Miscellaneous Site Features: Protect all existing miscellaneous site features from damage by excavating equipment and vehicular traffic, including but not limited to existing structures, fences, mailboxes, sidewalks, paving, and curbs.

F. Repair and Replacement:

1. Damaged items, including but not restricted to those noted above, shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

2. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired at the Contractor's expense.

3.5 LIMITS

A. As follows, but not to extend beyond Limits of Disturbance and within the approved disturbance limits:

1. Excavation: 5 feet beyond top of cut slopes.

2. Trench Excavation: 6 feet from trench centerline, regardless of actual trench width.

3. Fill:

a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.

b. Stripping: 2 feet beyond toe of permanent fill.

4. Structures: 15 feet outside of new structures.

5. Roadways: Clearing, grubbing, scalping, and stripping 5 feet from roadway shoulders.

6. Other Areas: As shown.

B. Remove rubbish, trash, and junk from entire area within the Limits of Disturbance as material is generated. Stockpiling shall not be permitted without written approval of Owner.

3.6 CLEARING AND GRUBBING

A. Clear and grub areas within limits shown in approved Clearing, Grubbing, and Stripping Plan.

B. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with the applicable sections of these Specifications.

C. Clearing:

1. Remove trees, saplings, snags, stumps, shrubs, brush, vines, grasses, weeds, and other vegetative growth within the clearing limits shown in the Drawings, except those trees and shrubs noted to remain in the Drawings or as directed by the Engineer.

2. Clearing shall be performed in such a manner as to remove all evidence of the presence of vegetative growth from the surface of the Project Site and shall be inclusive of sticks and branches of thickness or diameter greater than 3/8-inch and of grasses, weeds, exceeding 12 inches in height except as otherwise indicated.

3. Clear undergrowth and deadwood, without disturbing subsoil.

D. Grubbing: Clear areas required for access to site and execution of Work and remove all stumps, root wads, and roots over 1-inch diameter to the following depths:

1. Future Structures and Building Areas	24 Inches
2. Roads and Parking Areas	18 Inches
3. All other Areas	12 Inches

3.7 TREE REMOVAL

A. Exercise care in cutting, felling, trimming, and handling of those trees shown for removal to prevent damage to neighboring trees and structures to remain.

B. Tree Salvage: As shown on the Plans.

C. No trees may be removed unless approved and permitted by the Engineer.

D. Do not top trees unless otherwise specified or approved by Owner in writing.

E. Refer to Section 01 56 39, Temporary Tree and Plant Protection for tree protection requirements.

3.8 REMOVAL AND DISPOSAL

A. Native vegetation may be mulched and used on Site.

B. Asphalt and Gravel Surfaces:

1. Asphalt, concrete, and gravel surfaces designated for removal shall be done to full depth.

2. Asphalt, concrete, and gravel removed at Site may be reused at Site where shown in the Drawings or following approval of the Engineer.

3. Haul removed asphalt, concrete, and gravel which is unsuitable for reuse or that exceeds quantity required.

C. Remove debris, rock, abandoned piping, and extracted plant life from Site.

D. Remove from the Site all debris, materials, equipment, and items found thereon and materials and debris resulting from the Work, except as otherwise indicated.

1. All existing improvements designated on the Drawings or specified to be removed including but not limited to structures, pipelines, walls, footings, foundations, slabs, pavements, curbs, fencing, and similar structures occurring above, at, or below existing ground surface shall be included in the Work.

2. Unless otherwise specified, any resulting voids shall be thoroughly cracked out for drainage and backfilled with suitable excavated or imported material compacted to the density of the adjacent soil.

E. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.

F. Do not burn or bury materials on site. Leave site in clean condition.

G. Removal: All material resulting from demolition, clearing, and grubbing, and trimming operations shall be removed from the Site and disposed of in a lawful manner. Materials placed on property of private property owners shall be by written permission only.

H. Cleanup: During and upon completion of work, promptly remove all unused tools and equipment, surplus materials, and debris.

I. Adjacent areas shall be returned to their existing condition prior to the start of Work.

3.9 CLEANUP

A. During the time Work is in progress, make every effort to maintain the Site in a neat and orderly condition.

B. All refuse, broken pipe, excess fill material, cribbing, and debris shall be removed as soon as practicable.

C. Should the Work not be maintained in a satisfactory condition, the Owner may cause the work to stop until the cleanup of the Work has been done to the satisfaction of the Engineer.

D. The Work will not be considered complete, or the final payment certificate issued until all rubbish, unused material, or equipment shall have been removed and the premises left in a condition satisfactory to the Owner and the Engineer.

END OF SECTION

SECTION 31 22 13 - ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes rough grading and filling associated with contouring of Site in preparation for building excavation and subsequent site work.

B. Section Includes:

1. Excavating topsoil
2. Excavating subsoil
3. Cutting, grading, filling, and rough contouring of Site

C. Related Sections:

1. Section 01 45 00 - Quality Control
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 10 00 - Site Clearing
5. Section 31 23 16 - Excavation
6. Section 31 23 17 - Trenching
7. Section 31 23 18 - Rock Removal
8. Section 31 23 23 - Fill

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM):

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
3. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
4. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head)

5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Soils for Earthwork: As specified in Section 31 05 13, Soils for Earthwork.

C. Aggregates for Earthwork: As specified in Section 31 05 16, Aggregates for Earthwork.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136, ASTM D2419, and ASTM D2434.

PART 2 PRODUCTS

2.1 MATERIALS

A. Subsoil Fill: Types S1 and S2 as specified in Section 31 05 13, Soils for Earthwork.

B. Topsoil: As specified in Section 31 05 13, Soils for Earthwork.

1. Type TS1, Select Native Topsoil Material, as may be available.

2. TS2, Imported Topsoil Material, as may be required.

C. Structural Fill: Type A1, Dense-Graded Aggregate as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown in the Drawings.

D. Granular Fill: Type A2, Granular Drain Backfill Material as specified in Section 31 05 16, Aggregates for Earthwork. Size of aggregate as shown in the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify survey benchmark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Oregon Utility Notification Center at 1-800-332-2344 not less than 3 working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Notify Engineer of any potential conflicts resulting from utility locations and the Drawings.

3. Notify utility company to remove and relocate utilities, as may be necessary.

B. Identify required lines, levels, contours, and datum.

C. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with the Work of this Section.

3.3 TOPSOIL EXCAVATION

A. Excavate and stockpile topsoil as specified in Section 31 05 13, Soils for Earthwork.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded as shown in the Drawings.

B. When practical, do not excavate wet subsoil. When wet subsoil must be excavated and is to be reused on site for the Work, process wet material to obtain optimum moisture content.

C. Stockpile excavated material in area designated onsite in accordance with Section 31 05 13, Soils for Earthwork.

D. When excavating through roots, perform Work by hand and cut roots with sharp axe.

E. Benching Slopes: Horizontally bench existing slopes greater than 1:2 to key placed fill material to slope to provide firm bearing.

F. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. General:

1. Grading and filling operations shall not take place when weather conditions and moisture content of fill materials prevent the attainment of specified density.

2. Vertical curves or roundings at abrupt changes in slope shall be established as approved by Engineer.

3. Bring all graded areas to a relatively smooth, even grade and slope by blading or dragging. Remove high spots and fill depressions.

B. Fill areas to contours and elevations shown in the Drawings with unfrozen materials.

C. Topsoil Fill:

1. Scarify prepared subgrade to depth of 4 inches immediately prior to placing topsoil.

2. Place topsoil in areas to be seeded to depths indicated in the Drawings, minimum depth of 6 inches.

3. Place topsoil material loose; do not compact, do not place in wet or muddy conditions.

D. Place material in continuous layers as follows:

1. Subsoil Fill: Maximum 8 inches compacted depth.

2. Structural Fill: Maximum 12 inches compacted depth.

3. Granular Fill: Maximum 12 inches compacted depth.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise.

G. Make grade changes gradual. Blend slope into level areas.

H. Repair or replace items indicated in the Drawings to remain which are damaged by excavation or filling. All costs shall be borne by the Contractor.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 from required elevation.

3.7 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with AASHTO T99.

B. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922

2. Moisture Tests: ASTM D3017

C. Frequency and location of testing is dependent upon type of material placed. See Section 01 45 00, Quality Control for testing requirements.

D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

END OF SECTION

SECTION 31 23 16 – EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes excavation required for building foundations, site structures, or under slabs-on-grade or paving. Excavating for utilities outside building is included in Section 31 23 17, Trenching.

B. Section Includes:

1. Excavating for building foundations
2. Excavating for paving, roads, and parking areas
3. Excavating for slabs-on-grade
4. Excavating for site structures
5. Excavating for landscaping

C. Related Sections:

1. Section 01 45 00 - Quality Control
2. Section 02 41 00 - Demolition
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 10 00 - Site Clearing
6. Section 31 22 13 - Rough Grading
7. Section 31 23 17 - Trenching
8. Section 31 23 18 - Rock Removal
9. Section 31 23 19 - Dewatering
10. Section 31 23 23 - Fill
11. Section 31 50 00 - Excavation Support and Protection
12. Section 33 11 10 - Water Utility Distribution and Transmission Piping.
13. Section 33 31 10 – Sanitary Utility Sewerage Piping
14. Section 33 41 10 – Storm Utility Drainage Piping

1.2 DEFINITIONS

A. Common Excavation: All excavation required for Work, regardless of the type, character, composition, or condition of the material encountered. Common Excavation shall further include all debris, junk, broken concrete, and all other material. All excavation shall be classified as Common Excavation, unless provided as Rock for under Section 31 23 18, Rock Removal below.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Concrete Excavation: The removal of pieces of concrete larger than 1 cubic yard in volume that requires drilling, splitting and breaking methods, or a necessitating a trench width increase of 18 inches or more than the width of the preceding 10 feet of trench. Concrete excavation includes materials composed of Portland cement that are not identified other than manholes, structures, sewer pipe, or other appurtenances.

D. Exploratory Excavation: The removal and replacement of material from locations shown on the Drawings, or as directed for the purpose of investigating underground conditions and identifying potential utility conflict between existing and proposed utilities.

E. Overbreak: Material beyond and outside of the slope limits established by the Owner's Representative, which becomes displaced or loosened during excavation and is excavated.

F. Pothole Excavation: Pothole excavation is the removal and replacement of all materials via coring, vacuum extraction, or similar method, not classified as exploratory excavation, for the purposes of locating an underground utility and to investigate underground conditions.

G. Rock Removal: As defined in Section 31 23 18, Rock Removal.

H. Spoils: Excavated materials from Site unsuitable for use as fill or not required for backfill and grading.

I. Unsuitable Materials: See Spoils.

1.3 REFERENCES

A. Local utility standards when working within 24 inches of utility lines.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Excavation support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

1.5 QUALITY ASSURANCE

A. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

B. Provide adequate survey control to avoid unauthorized over-excavation.

C. Weather Limitations:

1. Material excavated when frozen or when air temperature is less than 32 degrees Fahrenheit (F) shall not be used as fill or backfill until material completely thaws.

2. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.6 NOT USED

PART 2 PRODUCTS - Not Used

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to commencing work in this Section, become familiar with site conditions. In the event discrepancies are found, notify the Engineer as to the nature and extent of the differing conditions.

B. Call Oregon Utility Notification Center at 1-800-332-2344 not less than 3 working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

C. Identify required lines, levels, contours, and datum.

D. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with Work in this Section.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

3.3 EXISTING UNDERGROUND UTILITIES

A. Protect active utilities encountered, located or otherwise, and notify persons or agencies owning same.

B. Remove inactive or abandoned utilities from within the project grading limits in accordance with Section 33 11 50, Existing Pipe Abandonment.

C. For sewer and other miscellaneous drainage facilities, fill and plug pipes as follows:

1. General:

   a. Remove all structures to a minimum of 3 feet below subgrade, unless otherwise noted.

   b. Cover top surface of all abandoned structures with two sheets of nonwoven geotextile, extended at least 1-foot beyond the outside walls of the abandoned manhole, sump, or basin.

   c. Plug all abandoned pipes with permanent plugs as specified in Section 33 05 50, Existing Pipe Abandonment.

2. Sumps:

   a. Remove existing sediment, soil, and water. Properly dispose of these materials in accordance with the requirements of these specifications.

   b. Remove top cone and first solid concrete section to a depth of approximately 8 to 10 feet below ground.

   c. Fill sump with CLSM.

   d. Backfill remaining voids for facilities within existing or proposed roadways with approved materials meeting the requirements of Section 32 11 23, Aggregate Base Courses.

3. Salvaging Manhole Frames, Covers, and Grates:

   a. Remove manhole frames, covers, and grates scheduled for salvage and store in approved location.

   b. Frames, grates, and covers meeting Specifications may be salvaged from structures to be adjusted and may be reused in the Work if of suitable size and condition.

   c. Replace, at no additional cost to the Owner, all items damaged or lost by the Contractor with similar items that are comparable in all respects with those they are to replace, and which are adequate for the intended purpose.

   d. Clean salvaged components to be reused of foreign material by methods that will not harm the components.

4. Existing Manhole Frames and Covers: Manhole frames and covers removed by the Contractor are the property of the Owner. Notify the Engineer a minimum of 48 hours before removal to arrange for pickup of the removed frames and covers, if not reused.

3.4 PRESERVATION OF EXISTING IMPROVEMENT

A. Protect adjacent existing structures which may be damaged by excavation work.

1. Conduct operations in such a manner that existing street facilities, utilities, railroad tracks, structures, and other improvements, which are to remain in place, will not be damaged. Furnish and install cribbing and shoring or whatever means necessary to support material around existing facilities, or to support the facilities themselves, and maintain such supports until no longer needed.

2. Open slopes shall not be cut within 5 feet of any existing spread footings unless approved by the Engineer.

3. Do not interfere with 45 degree bearing splay of foundations unless approved by the Engineer

4. Excavated material shall not be placed adjacent to existing or proposed structures.

3.5 EXCAVATION

A. General:

1. Method of excavation shall be the Contractor's option, but care shall be exercised as final grade is approached to leave it in undisturbed condition.

2. If the final grade for supporting structures is disturbed, it shall be restored to requirements of these Specifications and satisfaction of the Engineer at no additional cost to Owner.

3. The Contractor is advised that footings should be poured as soon as possible to minimize unfavorable final grade conditions from developing.

4. Provide all measures to ensure public safety.

B. Control of Water:

1. Provide and maintain equipment to remove and dispose of water during the course of the work of this Section and keep excavations dry and free of frost or ice.

2. Bearing surfaces that become softened by water or frost must be re-excavated to solid bearing at Contractor's expense and backfilled with compacted crushed rock at Contractor's expense.

3. Grade top perimeter of excavation to prevent surface water from draining into excavation.

4. See additional requirements in Section 31 23 19, Dewatering.

C. Frozen Ground: Frost protection shall be provided for all structural excavation work. Foundation work shall not be placed on frozen ground.

D. Excavate material of every nature and description to the lines and grades as indicated in the Drawings and/or as required for construction of the facility.

1. Allow for forms, shoring, working space, granular base, topsoil, and similar items, wherever applicable.

2. Trim excavations to neat lines. Remove loose matter and lumped subsoil.

E. Excavated Materials: Soils excavated at Site will be treated and used as one of two general categories of material as provided below.

1. Fill:

a. Subsoil Type S1, Select Native Fill, as approved for use by Engineer.

2. Spoils:

a. Ensure there is sufficient suitable material available to complete embankments and other required fillings prior to disposing of any excavated materials.

b. Make arrangements for disposal of spoils and include as part of contract work in preparing of project bids.

c. Landfill permit or written permission from private property owner to be obtained by the Contractor and provided to the Engineer.

F. Shoring:

1. As specified in Section 31 50 00, Excavation Support and Protection.

G. Slope existing banks with machine to angle of repose or less until shored.

1. Shape, trim, and finish cut slopes to conform to lines, grades, and cross-sections shown, with proper allowance for topsoil or slope protection, where shown.

2. Protection of excavation side slopes:

a. Use excavation methods that will not shatter or loosen excavation slopes.

b. Where practical, excavate materials without previous loosening and in limited layers or thickness to avoid breaking the material back of the established slope line.

c. Avoid overbreaks. Overbreak is incidental to the Work, except in cases where the Owner's Representative determines that such overbreak was unavoidable.

d. Excavation in rock or rocky cuts:

1) Once completed, thoroughly test the slopes with bars or other approved means to remove all loose, detached, broken, or otherwise unstable material.

2) Remove jutting points. Scale slopes using mine scaling rods or other approved methods to remove loose or overhanging materials and provide a safe, trim, neat, and stable condition.

3) Dispose of the materials removed under this subparagraph in the same manner as other excavated material.

e. Remove all exposed roots, debris, and all stones more than 3 inches in size which are loose or could become loosened.

3. Construct slopes free of all exposed roots.

4. Construct slopes free of unstable rock and loose stones exceeding 3 inches in diameter.

5. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend off-site, outside of easements, outside of rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

6. Trim all surfaces neatly and smoothly.

H. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 17, Trenching and Section 31 23 23, Fill.

I. Notify Engineer of unexpected subsurface conditions.

J. Over-excavation for Unsuitable Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

3. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

K. Rock Removal:

1. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section.

2. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.

3. Concrete removal, as defined herein, shall be treated as Rock Removal.

L. Stockpile excavated material in area(s) designated on or off site in accordance with Section 31 05 13, Soils for Earthwork.

3.6 FIELD QUALITY CONTROL

A. Perform excavation and controlled fill operations in accordance with the requirements of this Section.

B. Coordinate the visual inspection and approval of all bearing surfaces by Engineer before installing subsequent work.

3.7 PROTECTION

A. Prevent displacement or loose soil from falling into excavation; maintain soil stability and store excavated materials at a distance from top of excavation.

B. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 23 17 - TRENCHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the requirements for excavation and backfill of all utilities, including installation of pipe bedding, pipe zone backfill, trench backfill, and related Work as shown on the Drawings and as specified.

B. Section includes:

1. Excavating trenches for pipe, utility vaults, and other utilities.
2. Compacted fill from top of utility bedding to final grades.
3. Trench and utility vault backfilling and compaction.

C. Related Sections:

1. Section 01 45 00 - Quality Control
2. Section 03 11 00 – Concrete Work
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 10 00 - Site Clearing
6. Section 31 22 13 - Rough Grading
7. Section 31 23 16 - Excavation
8. Section 31 23 18 - Rock Removal
9. Section 31 23 23 - Fill
10. Section 31 23 24 - Flowable Fill
11. Section 31 37 00 - Riprap
12. Section 33 11 10 - Water Utility Distribution and Transmission Piping
13. Section 33 31 10 - Sanitary Utility Sewerage Piping: Sanitary sewer piping and bedding
14. Section 33 41 10 - Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

5. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill. Lean cement concrete fill. A self-compacting, cementitious material.

B. Flexible Pipe: For the purposes of these Specifications, tubing between 1/2-inch and 4-inch diameter constructed of polyvinyl chloride (PVC) and high-density polyethylene (HDPE) are considered flexible pipes. HDPE piping 4 inches in diameter and larger is also considered flexible pipe.

C. Geosynthetics: Geotextiles, geogrids, geomembranes, and drainage composite materials.

D. Imported Material: Materials obtained from sources offsite, suitable for specified use.

E. Lift: Loose (uncompacted) layer of material.

F. Obstructions: Items which may be encountered during utility and vault trenching which do not require replacement.

G. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

H. Pipe Bedding: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 6 inches below the bottom outside surface of pipe, conduit, cable, or duct bank to the trench foundation so as to uniformly support the barrel of the pipe.

I. Pipe Zone: Trench backfill zone for full trench width which extends from the bottom outside surface of the pipe to a minimum of 12 inches above the top outside surface of pipe, conduit, cable, or duct bank.

J. Pipe Bedding, Pipe Zone, and Trench Backfill Classifications:

1. Class A: Backfill with suitable native or imported material that is approved to meet the characteristics required for the specific surface loading or other criteria of the backfill zone.

2. Class B: Backfill with imported granular material consisting of gravel or crushed rock meeting the requirements of this Section and Coarse Aggregate Type A1 as specified in Section 31 05 16, Aggregates for Earthwork; typical designated size shall be 1-inch-0 or 3/4-inch-0.

3. Class C: Backfill with Fine Sand, as specified in Section 31 05 16, Aggregates for Earthwork.

4. Class D: Backfill with approved pit run or bar run material, well-graded from coarse to fine; maximum dimension shall be 3 inches.

5. Class E: Backfill with CLSM. See Section 31 23 24, Flowable Fill.

K. Pothole Excavations: Removal and replacement of all materials via coring, vacuum extraction, or similar method for the purposes of locating an underground utility and to investigate underground conditions.

L. Prepared Trench Bottom: The bottom of the trench on which the pipe bedding is to lie, and which provides support for the pipe.

M. Relative Compaction: Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM Standards.

N. Rigid Pipe: For the purposes of these Specifications, pipe constructed of PVC, ductile iron, steel, concrete, and clay pipes are considered rigid pipes.

O. Sewer, Pipes, and Mains: Conduits of circular or other geometric shapes, used to convey liquids or gases, or other material.

P. Trench Backfill: Trench backfill zone for full trench width extending from the top of the pipe zone to pavement base rock, ground surface, or other surface material.

Q. Trench Stabilization: Removal of unsuitable material in the bottom of a trench and replacement with specified material for support of a pipe, main, conduit, structure, or appurtenances.

R. Utility: Any buried pipe, duct, conduit, or cable.

S. Well-Graded: A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Excavation support plan and utility protection plan as specified in Section 31 50 00, Excavation Support and Protection.

C. Product Data:

1. Geotextile fabric, indicating fabric and construction

2. Marking tapes

3. Tracer wire

4. Connectors for tracer wire and/or marking tapes

5. Tracer wire locate boxes

6. Marker balls

7. Locator stations

8. Ground wires

9. Plastic or copper markers for service laterals.

D. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

E. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

F. Concrete: Mix designs in accordance with Submittal requirements of Section 03 11 00, Concrete Work.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.

2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

1.6 NOT USED

1.7 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

B. Coordinate trenching and utility installation work with other work at utility construction location occurring near or adjacent to specified herein.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S1, Select Native Material as specified in Section 31 05 13, Soils for Earthwork.

B. Imported Granular Fill: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 11 00, Concrete Work with compressive strength of 3,000 psi.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Sand: As specified in Section 31 05 16, Aggregates for Earthwork.

F. Trench Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

2.2 MARKING TAPE

A. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.

2. Foil Thickness: Minimum 0.35 mils.

3. Laminate Thickness: Minimum 5 mils.

4. Width: 6 inches.

5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.

6. Joining Clips: Tin or nickel-coated furnished by Tape Manufacturer.

7. Manufacturers and Products:

    a. Reef Industries; Terra Tape, Sentry Line Detectable

    b. Mutual Industries; Detectable Tape

    c. Presco; Detectable Tape

B. Color: In accordance with APWA Uniform Color Code for Temporary Marking of Underground Facilities and as specified in NEMA Z535.1, Safety Color Code.

Color	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines

2.3 ELECTRONIC LOCATING MATERIALS

A. Marker Balls:

1. Exterior Material: High-density polyethylene.

2. Size: Maximum 4-1/2 inches in diameter.

3. Range: Locatable with standard electronic marker locating devices at depths up to 5 feet.

4. Field Type: Spherical RF field regardless of orientation.

5. Contain no floating or movable parts, and no batteries or active components.

6. Color: Provide colored marker balls per Article 2.03.B above.

7. Manufacturer and Product: Omni Marker Model 162 (green), Omni Marker Model 161 (blue), or equal.

B. Tracer Wire:

1. Direct burial No. 12 AWG solid, annealed copper-clad steel (CCS) high strength tracer wire.

2. Tensile Breaking Load: 380-pound average.

3. Jacket:

    a. High molecular weight high-density polyethylene complying with ASTM D1248, 30-volt rating.

    b. Color: Provide in colors per Article 2.03.B above.

4. Manufacturer and Product: Copperhead Industries; LLC, 12 CCS high strength reinforced tracer wire, or equal.

C. Tracer Wire Connectors:

1. Waterproof, corrosion proof and suitable for No. 12 AWG solid core wire.

2. Prefilled with silicone and suitable for use with low-voltage tracer lines of less than 50 volts.

3. Lug Connectors:

a. Waterproof plastic housing that encases the silicone prefilled lug terminals.

b. Manufacturer and Product: King Innovations; DryConnTM Direct Bury Lug or equal.

4. Twist Connectors:

a. Waterproof epoxy-filled packaging that encases the silicone prefilled twist connectors.

b. Manufacturer and Product: 3M Division; DBY Direct Bury Splice Kit 09053 connectors or equal.

D. Ground Wire: No. 12 AWG bare solid copper wire.

E. Locator Station:

1. Test Station:

a. Lexan® polycarbonate.

b. Color: Provide in colors per Article 2.03.B above.

2. Terminals suitable for No. 12 AWG leads.

3. Use single (two lead) locator stations with two terminals, one for ground wire and one for tracer wire, when only one tracer wire is terminated in manhole.

4. Use multi-lead locator stations with the appropriate number of terminals when 2 or more tracer wire leads are terminated in manhole.

5. Manufacturer and Product: Cott Manufacturing Company; FlangeFink® Cathodic Protection Test Station.

2.4 VISUAL IDENTIFICATION MATERIALS

A. Tracer Wire Locate Boxes:

1. Material: Polyolefin.

2. Cover:

a. Color: Provide in colors per Article 2.03.B above.

b. Provide box cover identification marking for facility type such as “Sewer Locate Wire”, as approved by Owner.

c. Locking type with a nominal 6-inch opening.

3. Manufacturer and Product: Carson Industries LLC; L Series Model 708 or equal.

B. Service Lateral Plastic or Copper Markers:

1. Service Lateral Plastic or Copper Markers: Use markers of the type that requires installation to be recessed below grade.

a. Material: Plastic or copper. In new concrete, use "new construction" markers; in existing concrete use "retrofit" markers and use adhesive recommended by the Manufacturer.

b. Plastic Pavement Markers:

1) UV stabilized and fade resistant.

2) Material: Meet or exceed a tensile strength of 3,500 psi, and meet test requirements as outlined in ASTM G53, Standard Practice for Light and Water Exposure of Nonmetallic Material.

3) Color: Provide in color per Article 2.03 B above with the words, "WARNING, BURIED [UTILITY TYPE], Call Before You Dig," molded to the top of marker.

a) Provide wording for specific facility as approved by Owner.

4) Manufacturer and Product: Rhino Marking and Protective Systems; A-TAG pavement markers or equal.

c. Copper Pavement Markers:

1) Material: Copper material chosen by Manufacturer.

2) Diameter: 1-5/32-inch.

3) Wording: Provide facility identification wording stamped on the top such as "Sewer Lateral" as approved by Owner.

4) Manufacturer and Product: Berntsen Concrete Marker; BP2-U or equal.

C. Service Lateral 2-inch by 4-inch Markers:

1. S4S Douglas fir, pressure-treated 2-inch by 4-inch lumber, utility grade or better.

2. Grade stamped by an American Lumber Standards certified inspection agency.

PART 3 EXECUTION

3.1 PREPARATION

A. Call Oregon Utility Notification Center at 1-800-332-2344 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

2. Coordinate with and notify utility companies should it be necessary to remove or relocate facilities.

3. Maintain and protect above and below grade utilities indicated to remain.

B. Identify required lines, levels, contours, and datum locations.

C. Drawings and/or specifications cover and govern replacement and restoration of foreseeable damage.

D. The site of an open cut excavation shall be first cleared of all obstructions preparatory to excavation in accordance with Section 31 10 00, Site Clearing.

E. See Section 31 10 00, Site Clearing for additional requirements in protection of existing utilities, survey control, plant life, and landscaped areas in coordination with Work in this Section.

1. Intent of Drawings and Specifications is that all streets, structures, and utilities be left in condition equal to or better than original condition.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material, which is satisfactory to Owner.

F. Potholing / Exploratory Test Pits: Dig such exploratory test pits and perform potholing as may be necessary in advance of trenching to determine the exact location and elevation of subsurface structures, pipelines, duct banks, conduits, and other obstructions which are likely to be encountered or need to be connected to and shall make acceptable provision for their protection, support, and maintenance of their continued operation.

G. Paved or Surfaced Streets:

1. Wherever paved or surfaced streets are cut, saw wheel, or approved cutting devices shall be used.

2. Width of pavement cut shall be as shown in the Drawings.

3. Any cut or broken pavement shall be removed from site during excavation.

H. Traffic:

1. Maintain street traffic at all times as required by the Drawings and as specified herein.

2. Erect and maintain barricades, warning signs, traffic cones, and other safety devices during construction in accordance with the latest edition of Manual of Uniform Traffic Control Devices (MUTCD), Part 6, to protect the traveling public in any area applicable.

3. Provide flaggers as required during active work in roadway areas.

I. Operations shall be confined to rights-of-way and easements provided. Avoid encroachment on, or damage to, private property or existing utilities unless prior arrangements have been made with copy of said arrangement submitted to Engineer.

3.2 EASEMENTS

A. Where portions of the Work are located on private property, easements and permits will be obtained by the Owner. Easements shall provide for the use of property for construction purposes to the extent indicated on the easements.

B. Copies of these easements and permits will be available from the Owner for inspection by the Contractor. It shall be the Contractor's responsibility to determine the adequacy of the easement obtained in every case.

C. Confine construction operations to within the easement limits or street right-of-way limits or make special arrangements with the property owners for the additional area required and notify the Engineer with a copy of the written approval from property owners of any such conditions.

D. Any damage to private property, either inside or outside the limits of right-of-way or easements provided by the Owner, resulting from Work shall be the responsibility of the Contractor. Before the Engineer will authorize final payment, the Contractor will be required to furnish the Owner with written releases from property owners where the Contractor has obtained special agreements or easements or where the Contractor's operations, for any reason, have not been kept within the construction right-of-way obtained by the Owner.

3.3 PROTECTION

A. Existing Facilities:

1. It is the intent of these specifications that all streets, structure, and utilities be left in a condition equal to or better than original condition at the completion of the Project.

2. Where damage occurs, and cannot be repaired or replaced, the Contractor shall purchase and install new material to the satisfaction to the Engineer.

3. Drawings and/or specifications cover and govern replacement and restoration of foreseeable damage.

B. Removal of Water:

1. As specified in Section 31 23 19, Dewatering.

2. At all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work.

3. Keep all excavations dry until the utilities or vaults to be placed therein are completed. In water bearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation dry as specified.

4. Dispose of water from the Work in a suitable legal manner without damage to adjacent property or structures.

C. Trench Protection:

1. Provide the materials, labor, and equipment necessary to protect trenches at all times.

2. Trench protection shall provide safe working conditions in the trench and protect the Work, existing property, utilities, pavement, etc.

3. The method of protection shall be according to the Contractor's design.

4. The Contractor may elect to use a combination of shoring, overbreak, tunneling, boring, sliding trench shields, or other methods of accomplishing the work provided the method meets the approval of all applicable local, state, and federal safety codes.

5. Damages resulting from improper shoring, improper removal of shoring, or from failure to shore shall be the sole responsibility of the Contractor.

3.4 LINES AND GRADES

A. Trench excavation for piping, utility vaults, and other utilities shall be performed to the alignment and grade as indicated in the Drawings.

B. Where grades are not shown in the Drawings, utilities shall be laid to grade between control elevations shown.

C. Water mains shall be installed with a minimum cover of 36 inches.

D. The Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

E. Changes in the grade and horizontal alignment of the pipeline as shown in the Drawings or as provided elsewhere in the Specifications may be necessary due to unanticipated interferences or other reasons.

1. No additional compensation will be allowed the Contractor for changes in horizontal alignment.

2. No additional compensation will be allowed for changes in grade which require additional depth of trench excavation and backfill up to 2 feet from those shown in the Drawings.

F. Use laser-beam instrument with qualified operator to establish lines and grades.

3.5 OBSTRUCTIONS

A. Obstructions to the construction of the trench, such as tree roots, stumps, abandoned pilings, abandoned buildings and concrete structures, logs, rubbish, and debris of all types shall be removed without additional compensation from the Owner.

B. The Engineer may, if requested by the Contractor or Owner, make changes in the trench alignment to avoid major obstructions if such alignment changes can be made within the

perpetual easement and right-of-way and without adversely affecting the intended function of the facility or increasing costs to the Owner.

3.6 INTERFERING ROADWAYS AND STRUCTURES

A. Remove, replace and/or repair any damage done during trenching activities to fences, buildings, cultivated fields, drainage crossings, and any other properties without additional compensation from the Owner.

1. Replace or repair these structures to a condition as good as or better than their pre-construction condition prior to commencing work in the area.

B. Paved Roadways:

1. Where paved roadways are cut as part of trenching activities, Class D trench backfill will be required to the bottom of pavement base.

2. New pavement shall be equal to or better than the existing paved surface.

3. New surface shall not deviate by more than 1/4-inch from the existing finish elevation.

C. Existing Structures:

1. If existing structures are encountered as part of trenching activities which will prevent construction and are not adequately shown in the Drawings, the Contractor shall notify the Engineer before continuing with the Work.

2. The Engineer may make such field revisions to the utility alignment as necessary to avoid conflict with the existing conditions.

3. The cost of waiting or “down time” during such field revisions shall be borne by the Contractor without additional cost to the Owner or liability to the Engineer.

4. If the Contactor fails to so notify the Engineer when a conflict of this nature is encountered, but proceeds with construction despite this interference, the Contractor shall do so at the Contractor’s own risk with no additional payment.

3.7 TRENCHING

A. Excavate subsoil as required for construction of utilities to elevations shown in the Drawings.

B. Remove boulders and rock up to 1/2 cubic yard measured by volume per the requirements of this Section. Remove larger boulders and rock material as specified in Section 31 23 18, Rock Removal.

C. Open Trench Limit:

1. Do not advance open trench beyond the distance which will be backfilled and compacted the same day.

2. A maximum length of open trench shall not exceed 100 feet at any one time.

3. Temporary resurfacing shall be completed within 300 feet of the associated open trench limit for each main pipe laying operation.

4. Cover or backfill excavations at the end of each day.

5. If the trench is not backfilled at the end of each working day:

    a. Provide means to prevent caving of excavation sides, as necessary, during non-working hours.

    b. Cover the excavation with a system as needed to provide public safety and prevention of entry during non-working hours.

    c. Provide signed and stamped submittal of caving prevention system and cover system.

6. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.

D. Utility Crossings: Avoid horizontal and vertical conflicts with existing utilities.

1. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

2. Vertical clearance between the new pipe and existing utilities shall be 12 inches minimum, unless otherwise noted on the Drawings.

3. Where existing utility lines are damaged or broken during trenching activities, the utility shall be repaired or replaced. For water or sewer bearing lines, care being taken to insure a smooth flow line and absolutely no leakage at the new joints.

4. All expenses involved in the repair or replacement of leaking or broken utility lines that have occurred due to the Contractor's operations shall be borne by the Contractor, and the amount thereof shall be absorbed in the unit prices of its bid.

E. Water Lines Crossing Sewer Lines: Whenever water lines cross sewer lines, the Contractor shall comply with local Health Department requirements.

1. Wherever possible, the bottom of the water line shall be 18 inches or more above the top of sewer pipe. One full length of the water line pipe shall be centered at the crossing.

2. For clearances less than 1-1/2 feet, the Contractor shall replace the existing sewer pipe with ductile iron or PVC of equal size, centered at the utility crossing, or shall encase existing sewer pipe with concrete for a minimum of 10 feet on both sides of crossing, as directed by the Engineer, at no additional cost to the Owner.

F. Excavate trenches to width and depth as indicated on Drawings. No additional payment will be provided for trenching activities beyond dimensions shown in the Drawings.

1. Excavation for trenches in which pipelines are to be installed shall provide adequate space for workers to place and joint the pipe properly and safely, but in every case the trench shall be kept to a minimum width.

2. The width of the pipe trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench shall not exceed 12 inches on either side of the pipe.

3. Excavation for utility vaults and other structures shall be wide enough to provide 18 inches between the structure surface and the sides of the excavation.

4. For pipe or utility vaults to have bedding material, excavate to a depth of 6 inches below the bottom of the pipe or utility vault. Care shall be taken not to excavate below depths required.

5. If over digging occurs, the trench bottom shall be filled to grade with compacted bedding material.

G. Remove water or materials that interfere with Work.

1. The trench at all times shall be kept free from water to facilitate fine grading, the proper laying and joining of pipe, and prevention of damage to completed joints.

2. Adequate pumping equipment shall be provided to handle and dispose of the water without damage to adjacent property.

3. Water in the trench shall not be allowed to flow through the pipe while construction work is in progress unless special permission to do so has been given by the Engineer.

4. An adequate screen shall be provided to prevent the entrance of objectionable material into the pipe.

5. Remove and dispose of existing abandoned sewer pipe, structures, and other facilities as necessary to construct the improvements.

   a. Where the excavation activities require the removal of portions of an abandoned pipeline, masonry plugs shall be installed in the open ends of the pipe, unless otherwise noted in the Drawings or by the Engineer.

   b. Coordinate with Engineer prior to plugging.

   c. For plugs less than 36 inches in diameter, 8-inch-deep masonry units shall be used. For plugs in larger pipelines, 12-inch-deep masonry units shall be used.

6. The costs associated with the removal of water and materials noted above will be considered incidental to trench excavation and backfill.

H. Do not interfere with 45 degree bearing splay of foundations.

I. Over-excavation for Unsuitable Trench Foundation Conditions:

1. Cross-sectional dimensions and depths of excavations shown in the Drawings shall be subject to such changes as may be found necessary by the Engineer to secure foundations free from soft, weathered, shattered, and loose material or other objectionable materials.

2. Unsuitable materials shall be removed and replaced only as directed in writing by Engineer.

3. Unsuitable materials encountered shall be removed and replaced with Coarse Aggregate Type A1, 2-1/2-inch – 0 gradation, as specified in Table 31 05 16-A of Section 31 05 16, Aggregates for Earthwork. All material placed shall be compacted to 95 percent of maximum dry density.

4. Install nonwoven geotextile under trench stabilization material, over the soft or yielding excavated surface.

    a. Install the nonwoven geotextile ahead of placement of the trench stabilization material, continuously along the excavation bottom and centered on the pipe centerline.

    b. Use nonwoven geotextile width equal to the pipe diameter plus 2 feet.

    c. Place laps or splices in the geotextile in the direction of the pipe laying.

J. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

K. Excavated material shall be placed at locations and in such a manner that it does not create a hazard to pedestrian or vehicular traffic or interfere with the function of existing drainage facilities or system operation.

L. Remove excess subsoil not intended for reuse from site.

M. Stockpile excavated material in area designated on site in accordance with Section 31 05 13, Soils for Earthwork.

3.8 TUNNELING

A. In lieu of open cut trenching as specified above, the Contractor may utilize tunnel methods for installation of pipe where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks, and other structures.

1. The Engineer must approve tunneling methods prior to utility installation.

2. Where tunneling is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks, and other surface improvements whose replacement is avoided by the tunneling method.

3.9 NOT USED

3.10 COMPACTION

A. Testing will be required to show specified densities of compacted backfill are being achieved by the Contractor's compaction methods.

B. Moisture Control:

1. Moisture condition backfill material to within 2 percent of optimum moisture content required for compaction throughout each lift of the fill.

2. Add moisture to granular backfill by sprinkling during compaction operation.

3. Compaction by ponding or jetting is not permitted.

C. Compact all materials and areas that are not accessible for in-place density testing, as determined by the Engineer, in place by whatever equipment and method is practicable or specified, and as approved by the Engineer.

1. Perform compaction at such moisture content as is required to produce well-filled, dense, and firm material in place that will show no appreciable deflection or reaction under the compacting equipment.

3.11 BEDDING

A. All utility vaults, potable water pipe 4-inch nominal diameter and over, all steel pipe, all concrete sewer pipe, all plastic pipe, all pipe under existing or future structures or roadways, and any and all utilities at a depth greater than 6 feet shall be laid in pipe bedding material.

B. Unless otherwise noted in the Drawings, pipe, or conduit of less than 4-inch diameter, outside structure lines and at a depth of less than 6 feet shall be bedded in native material properly shaped as specified below, all as detailed on the Drawings.

C. Compacted bedding material shall be placed the full width of the excavated trench to a depth as shown on the trench detail included in the Drawings.

1. In lieu of a detail, the depth shall be 6 inches.

D. Spread the bedding smoothly over entire width of trench to the proper grade so that the pipe is uniformly supported along the barrel.

E. Hand grade and compact each lift to provide a firm, unyielding surface along the entire pipe length. For rigid pipe, compact to at least 90 percent relative compaction.

F. Excavate bell holes at each joint to permit proper assembly and inspection of the joint.

G. Check grade and correct irregularities in bedding material.

H. Center pipes horizontally in trench width.

3.12 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Place fill material, with the exception of CLSM, in continuous layers and compact in 6- to 8-inch lifts.

1. Prevent pipe from moving either horizontally or vertically during placement and compaction of pipe zone material.

2. Where trenches are under existing or future structures, paved areas, road shoulders, driveways, or sidewalks, or where designated on the Drawings or specified elsewhere in these specifications, the trench backfill shall be Class B or Class E and pipe zone backfill shall be Class B or Class E. Class B backfill shall be compacted to 95 percent of maximum density at optimum moisture content.

3. Where trenches are outside existing or future structures, paved areas, road shoulders, driveways, or sidewalks, or where designated on plans or specified elsewhere, the trench backfill shall be Class A and pipe zone backfill in these areas shall be Class B. For these locations, compaction of Class B backfill shall be to not less than 90 percent of maximum density at optimum moisture content. Class B backfill shall be compacted to not less than 95 percent of maximum density at optimum moisture content.

E. Employ placement method that does not disturb or damage nearby or adjacent foundation perimeter drainage or utilities in trench.

F. Do not use power-driven impact compactors to compact pipe zone material.

G. Backfill Immediately: All trenches and excavations shall be backfilled immediately after pipe or conduit is in approved condition to receive it and shall be carried to completion as rapidly as possible, unless otherwise directed by the Engineer.

H. Under no circumstances shall water be permitted to rise in open trenches after pipe has been placed.

I. Do not allow backfill material to free fall into the trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over the top of pipe.

J. Use hand compactors for compaction until at least 2 feet of backfill is placed over top of pipe. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.

K. Placement of Sand:

1. Place medium sand in lifts not exceeding 8 inches in uncompacted thickness.

2. Compact each lift to a minimum of 95 percent relative compaction prior to placing succeeding lifts.

L. Placement of CLSM:

1. Discharge from truck-mounted drum-type mixer into trench.

2. Place in lifts not exceeding 2 feet in thickness.

3. No compaction of CLSM is allowed.

4. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved, or opened to traffic until permanent surface restoration is completed if it has hardened sufficiently to prevent rutting.

M. New trenching shall not be started when earlier trenches need backfilling, or the surfaces of streets or other areas need to be restored to a safe and proper condition.

N. Do not leave trench open at end of working day.

3.13 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of all buried piping, install 24 inches below finished grade. Coordinate with piping installation drawings.

3.14 ELECTRONIC LOCATING FACILITY INSTALLATION

A. Marker Balls:

1. Install according to Manufacturer's recommendations and as shown or directed and according to the following requirements:

a. Install marker balls directly above the pipe alignment at a depth no less than 3 feet and no more than 4-1/2 feet below final surface grade.

b. Install marker balls during trench backfill operations by placing the marker ball in compacted backfill.

c. Cover marker ball with a minimum of 6 inches of backfill and compact backfill before continuing trench backfill operations.

d. Install markers balls with trenchless pipe installations by core-drilling hole of a minimal diameter needed to allow clearance for placement of marker ball. Backfill with approved trench backfill, pavement base and pavement, as applicable.

2. Water Marker Ball Locations: Install at locations as required by Sewer Marker Ball Locations specified herein.

3. Sewer Marker Ball Locations:

a. Install marker balls directly above connection points, termination points and all fitting locations, and at a minimum spacing of 50 linear feet on sewers with a straight horizontal alignment.

b. Install marker balls at a minimum spacing of 25 lineal feet directly above sewer mains installed on a radius.

c. Install marker balls on new or reconstructed sewer service laterals, directly above the centerline of the end of the lateral at the curb, property line or other end of lateral location, as directed.

d. Install marker balls directly above every alignment change along sewer mains and service laterals.

e. Install marker balls directly above manholes for manholes with buried covers.

B. Tracer Wire and Terminal Appurtenances:

1. Tracer Wire:

    a. Install as shown or directed directly over the pipe centerline and on top of the pipe zone in all sewer trenches, including mainline sewers, service laterals and storm sewer inlet leads.

    b. Connect mainline and service lateral tracer wires using either an approved direct-bury lug connector or direct-bury twist connector.

    c. Extend tracer wire to locator stations in manholes, locator boxes, storm inlets, or other visually identifiable terminal appurtenances, allowing for access with electronic locating equipment, as shown or directed and according to the following requirements:

2. Locator Stations:

    a. Install locator stations as shown within manholes.

    b. Mount locator station to manhole wall within 18 inches of manhole rim with two stainless steel expansion anchors.

    c. Drill a minimum 3/8-inch diameter hole through the manhole wall within 18 inches of the finish grade of the manhole rim.

    d. Extend the tracer wire from the pipe trench in one continuous piece up the outside of the manhole and through the hole and into a locator station and attach to one of the lugs in the locator station.

    e. When multiple tracer wires are terminated in manhole install a multi-lead locator station.

    f. Extend a ground wire from the locator station through a minimum 3/8-inch diameter hole in the manhole wall.

    g. Install ground wire approximately 3 feet deep and extend from the outside manhole wall a minimum of 3 feet horizontally in any direction.

    h. Seal all holes drilled in manhole walls with silicone sealant.

3. Storm Inlet Tracer Wire Termination: Terminate tracer wire inside inlet and directly over storm outlet pipe by placing tracer wire as follows:

    a. Drill a minimum 3/8-inch diameter hole through inlet wall to pass tracer wire through to inside inlet wall.

    b. Seal hole with silicon sealer or material approved by Engineer.

    c. Leave 6 inches of coiled tracer wire along inside of inlet wall approximately 3 inches below the inlet frame and grate or as directed by Engineer.

4. Service Lateral Tracer Wire Termination: Terminate tracer wire at ends of service laterals as shown or directed, as follows:

a. Termination in Tracer Wire Locate Boxes: Extend the tracer wire in one continuous piece up vertically from the pipe trench and into the bottom of the locate box. Leave 18 inches of coiled tracer wire inside locate box.

b. Termination at 2-inch by 4-inch Markers: Extend tracer wire in one continuous piece directly up service lateral 2-inch by 4-inch markers and leave 18 inches of tracer wire wrapped around the exposed top end of 2-inch by 4-inch marker.

3.15 VISUAL IDENTIFICATION FACILITIES

A. Tracer Wire Locate Boxes: Install tracer wire locate boxes directly over service laterals at property line, service boundary, or other location as shown or directed by the Engineer.

B. Service Lateral Plastic or Copper Markers:

1. Install plastic or copper markers in the concrete curb directly over the centerline of the service lateral, as shown or directed by the Engineer.

2. Either plastic or copper markers may be used.

3. If there is not suitable concrete curb for marker placement, then install a lateral cleanout as close to property line as practical at location approved by Engineer.

C. Service Lateral 2-inch by 4-inch Markers:

1. Place a 2-inch by 4-inch marker at the end of each new service lateral not connected to a building sewer.

2. Omit markers only as approved.

3. Block the capped or plugged service lateral end with a wood block against undisturbed earth and install the marker.

4. Extend the marker from the blocked service lateral invert to at least 12 inches above the existing or proposed finish ground surface.

5. Install marker in one piece. No splicing will be accepted.

6. Paint the exposed portion of the marker after its installation with quality quick drying enamel white paint for a storm only sewer and green paint for a sanitary or combined sewer.

7. After the paint has dried, use black, quick drying enamel, and neatly indicate the distance from the ground surface to the top of the service lateral in feet and inches.

8. Do not disturb the position and location of the marker during the backfilling operation.

9. If the marker is broken, moved out of location, or vertical alignment is changed during the backfilling operation, reopen the trench, and replace the marker.

3.16 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Contractor. All testing and reporting shall be the responsibility of the Contractor.

B. Perform laboratory material tests in accordance with ASTM D698 (AASHTO T99).

C. In-place compaction testing of pipeline backfill materials shall be performed at 2-foot elevation increments, one test per 200 lineal feet of pipeline trench as measured along pipe centerline.

1. The Engineer may reduce the frequency when satisfied with method of compaction.

2. The Engineer may direct testing at a higher frequency at no additional cost to the Owner upon failure to obtain specified densities or if the Contractor changes compaction equipment or methods of compaction.

3. The Engineer shall determine all test locations.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922

2. Moisture Tests: ASTM D3017

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

3.17 SURFACE RESTORATION AND CLEANUP

A. Open Trenches: At the end of each workday, all open trenches shall be backfilled and all trenches within streets shall be temporarily paved or covered to the satisfaction of the Engineer and the local permitting agency.

1. Temporary paving shall be replaced with permanent street paving at the completion of construction within street rights-of-way, or sooner, if deemed necessary by the Engineer.

2. No gravel-filled trenches shall be left open within the street right-of-way at the end of the workday.

B. Topsoil:

1. Where trenches cross lawns, garden areas, pastures, cultivated fields, or other areas on which reasonable topsoil conditions exist, remove the topsoil to the specified depth and place the material in a stockpile.

2. Topsoil shall not be mixed with other excavated material.

3. After the trench has been backfilled, the topsoil shall be replaced.

C. Clean up and remove all excess materials, construction materials, debris from construction, etc. Replace or repair any fences, mailboxes, signs, landscaping, or other facilities removed or damaged during construction. Replace all lawns, topsoil, shrubbery, flowers, etc., damaged or

removed during construction. The Contractor shall be responsible for seeing that lawns, shrubs, etc. remain alive and leave premises in condition equal to original condition before construction.

3.18 NOT USED

END OF SECTION

SECTION 31 23 18 - ROCK REMOVAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes removal of subsurface rock during excavation by mechanical method. The use of explosives for rock removal is not permitted for this Project.

B. Section Includes:

1. Removing identified and discovered rock during excavation.

2. Expansive tools to assist rock removal.

C. Related Sections:

1. Section 31 22 13 - Rough Grading

2. Section 31 23 16 - Excavation

3. Section 31 23 17 - Trenching

4. Section 31 23 23 - Fill

1.2 NOT USED

1.3 DEFINITIONS

A. Common Excavation: All excavation required for Work, regardless of the type, character, composition, or condition of the material encountered. All excavation shall be classified as Common Excavation, unless provided for under Rock Removal below.

B. Common Material: All soils, aggregate, debris, junk, broken concrete, and miscellaneous material encountered in Common Excavation, excluding rock as defined below.

C. Rock: Solid mineral material, including boulders, solid bedrock, or ledge rock, with volume in excess of 1/2 cubic yard of solid material which, by actual demonstration, cannot be reasonably excavated with suitable machinery as defined herein. The Engineer may waive the requirements for actual demonstration if the material encountered is well-defined rock.

D. Rock Removal: Removal of rock as defined herein by systematic and continuous drilling, hammering, breaking, splitting, or other methods approved by the Engineer.

E. Suitable Machinery: A track-mounted hydraulic excavator of the 52,800- to 72,500-pound class equipped with a single shank ripper or similar approved equipment.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate proposed method of rock removal.

C. Equipment: Manufacturer information regarding pound class of machinery proposed for rock removal.

D. Survey Report: Submit survey report mapping extent and locations of rock encountered, to be used in calculating total volume of rock removal.

1.5 NOT USED

1.6 PROJECT CONDITIONS

A. Conduct survey of rock uncovered in excavation for structures or trenching for utilities prior to removal of material.

1.7 NOT USED

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify site conditions and note subsurface irregularities affecting Work of this section.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Engineer Approval for Rock Removal:

1. Prior to commencement of rock removal, expose all material anticipated to be rock by removing the common material above it and then notify the Engineer.

2. The Engineer, in association with the Contractor or the Contractor's representative, will measure the amount of material to be removed in an effort to reach a mutually agreeable volume for anticipated rock removal.

3. Prior to commencing the proposed rock removal, the Contractor must receive written approval by the Engineer stating the approximate volume of excepted rock removal to receive payment.

4. During rock removal activities, should it become apparent the previously agreed upon volume of rock removal will be exceeded, notify the Engineer immediately. Should the Contractor proceed with rock removal in excess of the previously agreed upon volume, the Contractor will do so at their own risk and expense.

3.3 ROCK REMOVAL BY MECHANICAL METHOD

A. Excavate and remove rock by mechanical method.

1. Use single shank ripper to fracture rock.

2. Drill holes and use expansive tools and wedges to fracture rock.

B. Cut away rock at bottom of excavation to form level bearing.

C. Remove shaled layers to provide sound and unshattered base for footings and foundations.

D. In utility trenches, excavate to 6 inches below invert elevation of pipe and 24 inches wider than pipe diameter.

E. For vaults and other structures, excavate to the depth necessary to install the structure and to a maximum of 18 inches beyond the outside walls of the vault or structure.

F. Remove excavated materials from site.

G. Correct unauthorized rock removal associated with structural excavations in accordance with backfilling and compacting requirements of Section 31 23 16, Excavation and as directed by Engineer.

H. Correct unauthorized rock removal associated with utility work in accordance with backfilling and compacting requirements of Section 31 23 17, Trenching and as directed by Engineer.

I. If material which would be classified as rock as defined herein is mechanically removed with equipment of a larger size than specified as Suitable Machinery herein, it shall be understood that any added costs for the removal of rock by this method shall be included in the unit price for common excavation and not paid for under this pay item. If material which would be classified as rock as defined herein is mechanically removed without hammering, breaking, or splitting, it will be considered common excavation and not paid for under this pay item. If equipment larger than the suitable machinery as defined herein is brought on the Project Site for the sole purpose of rock removal without hammering, breaking, or splitting, then such excavation will be considered rock removal.

3.4 NOT USED

3.5 FIELD QUALITY CONTROL

A. Request visual inspection of foundation bearing surfaces by Engineer before installing subsequent work.

END OF SECTION

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SECTION 31 23 19 – DEWATERING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes temporary dewatering and surface water control systems for open excavations and utility trenches.

B. Section includes:

1. Dewatering systems.
2. Surface water control systems.
3. System operation and maintenance.
4. Water disposal.

C. Related Sections:

1. Section 31 05 16 - Aggregates for Earthwork
2. Section 31 23 16 - Excavation
3. Section 31 23 17 - Trenching

1.2 SUBMITTALS

A. Dewatering Plan:

1. Descriptions of proposed groundwater and surface water control facilities including, but not limited to, equipment; methods; standby equipment and power supply; pollution control facilities; discharge locations to be utilized; and provisions for immediate temporary water supply as required by this Section.
2. Dewatering plan to include design calculations and drawings indicating the location and size of pumps, well points, temporary pipelines and sediment control systems. Dewatering plan shall be prepared and stamped by a Professional Engineer registered in the State which the project is located and experienced in the design of dewatering systems.
3. Plan to be reviewed by the Engineer prior to the beginning of construction activities requiring dewatering. Review by the Engineer of the design shall not be construed as a detailed analysis of the adequacy of the dewatering system, nor shall any provisions of the above requirements be construed as relieving the Contractor of its overall responsibility and liability for the work.

1.3 DEFINITIONS

A. Dewatering includes the following:

1. Lowering of ground water table and intercepting horizontal water seepage to prevent ground water from entering excavations, trenches, tunnels, and /or shafts.

2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations, trenches, tunnels, and /or shafts.

3. Disposing of removed water.

B. Surface Water Control: Removal of surface water within open excavations.

1.4 QUALITY CONTROL

A. All dewatering operations shall be adequate to assure the integrity of the finished project and shall be the responsibility of the Contractor.

B. Provide all labor, materials, and equipment necessary to dewater trench and structure excavations, in accordance with the requirements of the Contract Documents.

C. Secure all necessary permits to complete the requirements of this Section.

D. Control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

E. Where the critical structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement which may develop.

1. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor.

2. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

PART 2 PRODUCTS

2.1 EQUIPMENT

Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, and other means. Standby pumping equipment shall be maintained on the jobsite.

PART 3 EXECUTION

3.1 DEWATERING

A. Provide all equipment necessary for dewatering.

1. Have on hand, at all times, sufficient pumping equipment and machinery in good working condition.

2. Have available, at all times, competent workers for the operation of the pumping equipment.

3. Adequate standby equipment shall be kept available at all times to insure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering for structures and pipelines shall commence when groundwater is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

C. Site Grading:

1. At all times, site grading shall promote drainage.

2. Surface runoff shall be diverted from excavations.

3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

D. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

E. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with drain rock.

F. Maintain the water level below the bottom of excavation in all work areas where groundwater occurs during excavation construction, backfilling, and up to acceptance.

G. Flotation shall be prevented by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

H. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering and shall be sandpacked and/or other means used to prevent pumping of fine sands or silts from the subsurface. A continual check shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.

I. Dispose of water from the work in a suitable manner without damage to the environment or adjacent property. No water shall be drained into work built or under construction without prior consent of the Engineer. Water shall be filtered using an approved method to remove sand and fine sized soil particles before disposal into any drainage system.

J. The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, pipelines, and sewers.

END OF SECTION

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SECTION 31 23 23 – FILL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes backfilling required at building perimeter and site structures to subgrade elevations, fill under interior and exterior slabs-on-grade or pavement, and fill under landscaped areas. Backfilling for utilities within building proper is included within this section; backfilling for utilities outside building is included in Section 31 23 17, Trenching.

B. Section includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs-on-grade.
4. Fill under paving.
5. Fill for over-excavation.

C. Related Sections:

1. Section 03 11 00 – Concrete Work
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 22 13 - Rough Grading
5. Section 31 23 16 - Excavation
6. Section 31 23 17 - Trenching
7. Section 31 23 24 - Flowable Fill
8. Section 31 25 00 - Erosion and Sediment Controls
9. Section 31 37 00 - Riprap
10. Section 33 11 10 - Water Utility Distribution and Transmission Piping
11. Section 33 31 13 – Sanitary Utility Sewerage Piping
12. Section 33 41 10 - Storm Utility Drainage Piping

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International (ASTM):

1. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance

2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

5. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.3 DEFINITIONS

A. Controlled Low Strength Material (CLSM): Also referred to as Flowable Fill elsewhere in these Specifications. A self-compacted, cementitious material.

B. Imported Material: Materials obtained from sources offsite, suitable for specified use.

C. Lift: Loose (uncompacted) layer of material.

D. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.

2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Imported Materials:

1. Materials Source: Submit name and location of imported fill materials suppliers.

2. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

3. Submit results of aggregate sieve analysis and standard proctor test for granular material.

C. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

1.5 QUALITY ASSURANCE

A. Subsoil and topsoil fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 13, Soils for Earthwork.

B. Aggregate fill materials: In accordance with Quality Assurance requirements stated in Section 31 05 16, Aggregates for Earthwork.

C. CLSM:

1. In-place testing: In accordance with ASTM C403.

2. Compressive testing: In accordance with ASTM D4832.

D. Allowable Tolerances: Final grades shall be plus or minus 0.1-foot.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Subsoil Fill: Type S2, Imported Fill Material, as specified in Section 31 05 13, Soils for Earthwork.

B. Imported Granular Fill: Coarse Aggregate Type A1, Dense-Graded Aggregate with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

C. Concrete:

1. Lean concrete as specified in Section 31 23 24, Flowable Fill, with compressive strength of 100 pounds per square inch (psi).

2. Structural concrete as specified in Section 03 11 00, Concrete Work. Compressive strength as required by the application or as noted in the Drawings.

D. Drain Rock: Coarse Aggregate Type A2, Granular Drain Backfill Material with gradation as shown in the Drawings and specified in Section 31 05 16, Aggregates for Earthwork.

E. Foundation Stabilization Material: Coarse Aggregate Type A1, Dense-Graded Aggregate, 2-1/2-inch - 0 gradation as specified in Section 31 05 16, Aggregates for Earthwork.

PART 3 EXECUTION

3.1 EXAMINATION

A. Prior to Work in this Section, become familiar with Site conditions. In the event discrepancies are found, notify Engineer as to the nature and extent of the differing conditions.

B. Verify sub-drainage, damp-proofing, or waterproofing installation has been inspected.

C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.2 SITE CONDITIONS

A. Quantity Survey: The Contractor shall be responsible for calculations for quantities and volume of cut and fill from existing site grades to finish grades established under this contract as indicated in the Drawings or specified and shall include the cost for all earthwork in the total basic bid.

B. Dust Control: Must meet all federal, state, and local requirements. Protect persons and property from damage and discomfort caused by dust. Water surfaces as necessary and when directed by Engineer to quell dust.

C. Soil Control: Soil shall not be permitted to accumulate on surrounding streets or sidewalks nor to be washed into sewers.

D. See provisions for Work in Section 31 25 00, Erosion and Sediment Controls.

3.3 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Control of Water:

1. Excavated areas shall be kept free of water and frost.

2. Bearing surfaces which become softened by water or frost shall be re-excavated to solid bearing at Contractor's expense and backfilled with compacted crushed rock at Contractor's expense.

3. See Section 31 23 19, Dewatering for additional details.

C. Compact subgrade to density requirements for subsequent backfill materials.

D. Cut out soft areas of subgrade not capable of compaction in place and replace with specified granular fill material. See Article 3.5, Over-excavation for Unsuitable Foundation Conditions in Section 31 23 16, Excavation for additional details.

E. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

F. Subgrade to be approved by Engineer prior to placement of structures and commencement of backfill activities.

G. Do not allow or cause any work performed or installed to be covered up or enclosed prior to required tests and approvals. Should any Work be enclosed or covered up, uncover at Contractor's expense.

3.4 BACKFILLING

A. Backfill areas to contours and elevations shown in the Drawings with unfrozen materials.

B. Do not place materials when weather conditions and/or moisture content prevent attainment of specified density.

C. Maintain optimum moisture content of backfill materials to attain required compaction density.

D. Employ placement method that does not disturb or damage other work.

E. Mechanical tampers permitted in confined areas.

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

G. Foundation Base for Structures:

1. Bring excavation to required subgrade elevation shown in the Drawings.

2. Place foundation base material to required grade shown in the Drawings.

3. Place foundation base material in 6-inch lifts and compact to 95 percent maximum dry density.

4. Pump Station Wet Well:

a. Concrete Footings and Slabs: Place a 18-inch minimum layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, maximum size of 2-1/2-inch and less than 7% passing the No. 200 sieve extending a minimum of 2-feet beyond the horizontal limits of the foundation to required grade under all concrete footings.

5. Foundations established near finished site grades:

a. Place a 12-inch-thick layer of Coarse Aggregate Type A1, Dense-Graded Aggregate, maximum size of 1-1/2-inch and less than 7% passing the No. 200 sieve in the bottom of footing excavations to minimize disturbance of silty foundation soils during wet weather.

b. Lightly compact material with a light-weight hand-operated vibratory plate compactor.

c. To provide uniform support, slabs should be underlain by a minimum 12-inch-thick granular base course consisting of Coarse Aggregate Type A1, Dense-Graded Aggregate, maximum size of 1-1/2-inch and less than 7% passing the No. 200 sieve.

d. The base course material should be installed in a single lift and compacted to at least 95 percent of the maximum dry density. See Drawings for details.

H. Backfill for Structures:

1. Prior to placing backfill, remove forms, temporary construction, and debris below grade.

2. Backfill shall not be placed against poured concrete until 28 days have passed from completion of original concrete pour, unless otherwise approved by Engineer.

3. Heavy compactors and large pieces of construction equipment shall be kept away from any embedded wall a distance of a least 5 feet in order to avoid the build-up of excessive lateral pressures.

a. Over-compaction of fill near walls should be avoided.

4. Compaction within 5 feet of the walls shall be accomplished using hand-operated vibratory plate compactors or tamping units.

5. The maximum particle size of granular material placed against buried structures shall be limited to no greater than 1-1/2-inch diameter.

6. Structural fill backfill material shall be brought up on all sides of the walls and footings in such a manner as to avoid adverse differential lateral earth pressures on the vertical surfaces.

7. Appropriate lift thickness will depend on the type of compaction equipment used and the type of material being placed. All material shall be compacted to at least 95 percent of the standard maximum dry density.

   a. For moderate- to heavy-weight compactors, a maximum loose lift thickness of 12 inches shall be used.

   b. For hand-operated or small compactors, a maximum loose lift thickness of 8 inches shall be used.

8. Particular care must be taken to avoid damage to the pipe connections to the structure.

9. Utility trench backfill within 10 feet of all structural perimeters shall meet the requirements for structural fill.

I. For areas receiving surface structures or existing paved areas to be constructed or replaced, such as roadways, driveways, parking lots, and sidewalks:

1. Place Coarse Aggregate Type A1, Dense-Graded Aggregate, 3/4-inch-0 gradation in 6-inch lifts.

2. Compact with vibratory equipment to 95 percent maximum density, unless otherwise specified or shown in the Drawings.

J. NOT USED

K. Slope grade away from building minimum 2 percent slope for minimum distance of 10 feet, unless noted otherwise in the Drawings.

L. Make gradual grade changes. Blend slope into level areas.

M. Remove surplus backfill materials from Site in accordance with Section 31 23 16, Excavation.

3.5 FIELD QUALITY CONTROL

A. All testing and reporting shall be conducted and completed by an independent laboratory provided by the Contractor. Initial testing will be paid for by the Contractor. Subsequent testing after failure of initial acceptance testing shall be paid by the Contractor.

B. Perform laboratory material tests in accordance with ASTM D698 (AASHTO T99).

C. In-place compaction testing for structural fill material shall be performed at 2-foot elevation increments in the fill material with at a minimum of one test per each 2,500 square feet of material placed. The Engineer shall be provided with the results of each compaction test at the time of testing.

D. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922.

2. Moisture Tests: ASTM D3017.

E. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest at the sole expense of the Contractor.

F. When testing of subgrade is not possible or feasible as detailed above, proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and as may be otherwise required by the Engineer.

3.6 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic.

3.7 NOT USED

END OF SECTION

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SECTION 31 23 24 - FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes flowable lean concrete mix used for structure backfill, utility bedding and backfill and other subgrade Site Work. Applications also include filling abandoned structures and utilities that remain in place.

B. Section Includes:

1. Structure backfill
2. Utility bedding
3. Utility backfill
4. Filling abandoned utilities

C. Related Sections:

1. Section 33 11 50 - Existing Pipe Abandonment
2. Section 31 23 16 - Excavation
3. Section 31 23 17 - Trenching
4. Section 31 23 23 - Fill
5. Section 33 11 10 - Water Utility Distribution and Transmission Piping
6. Section 33 31 10 - Sanitary Utility Sewerage Piping
7. Section 33 41 10 - Storm Utility Drainage Piping

1.2 DEFINITIONS

A. Flowable Fill: Also referred to as Controlled Low Strength Material (CLSM) elsewhere in the Specifications. Lean cement concrete fill.

B. Utility: Any buried pipe, duct, conduit, manhole, tank, or cable.

1.3 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM C33 - Standard Specification for Concrete Aggregates
2. ASTM C94 - Standard Specification for Ready-Mixed Concrete
3. ASTM C150 - Standard Specification for Portland Cement

4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete
5. ASTM C403 - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
6. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete
7. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
8. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
9. ASTM C1040 - Standard Test Methods for Density of Unhardened and Hardened Concrete in Place by Nuclear Methods
10. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

C. Field Quality-Control Submittals:

1. Mix Design:
    a. Furnish flowable fill mix design for each specified strength.
    b. Furnish separate mix designs when admixtures are required for the following:
        1) Flowable fill Work during hot and cold weather.
        2) Air entrained flowable fill Work.
    c. Identify design mix ingredients, proportions, properties, admixtures, and tests.
2. Furnish test results to certify flowable fill mix design properties meet or exceed specified requirements.

D. Delivery Tickets:

1. Furnish duplicate delivery tickets indicating actual materials delivered to Project Site.

1.5 QUALITY ASSURANCE

A. In-place testing of Flowable Fill: In accordance with ASTM C403.

B. Compressive testing of Flowable Fill: In accordance with ASTM D4832.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Minimum Conditions: The following minimum conditions shall be met at time of flowable fill placement.

1. Do not install flowable fill during inclement weather.

2. Ambient temperature must be at least 34 degrees Fahrenheit (F) and rising.

3. Flowable fill shall be at 40 degrees F.

4. Subgrade on which flowable fill is to be placed shall be free of disturbed or soft material, debris, and water.

1.7 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill:

1. Composed of cement, pozzolans, fine aggregate, water, and admixtures.

2. Low cement content.

3. Non-segregating, self-consolidating, free-flowing, and excavatable material which will result in a hardened, dense, non-settling fill.

4. Compressive strength at 28 days of 100 to 200 pounds per square inch (psi), if not otherwise shown in Drawings or specified.

2.2 MATERIALS

A. Portland Cement: ASTM C150, Type I – Normal.

B. Fine Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Air Entrainment: ASTM C260.

B. Chemical Admixture: ASTM C494.

C. Fly Ash: ASTM C618 Class C or F, obtained from residue of electric generating plant using ground or powdered coal.

2.4 MIXES

A. Mix and deliver flowable fill according to ASTM C94, Option C.

B. Flowable Fill Design Mix:

ITEM	PROPERTIES
Cement Content	75 to 100 lb/cu yd
Fly Ash Content	None
Water Content	As specified
Air Entrainment	5 to 35 percent
28-Day Compressive Strength	Maximum 200 psi.
Unit Mass (Wet)	100 to 125 pcf
Temperature, Minimum at Point of Delivery	50 degrees F

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Test and analyze properties of flowable fill design mix and certify results for the following:

1. Design mix proportions by weight of each material.

2. Aggregate: ASTM C33 for material properties and gradation.

3. Properties of plastic flowable fill design mix including:

   a. Temperature

   b. Slump

   c. Air entrainment

   d. Wet unit mass

   e. Yield

   f. Cement factor

4. Properties of hardened flowable fill design mix including:

   a. Compressive strength at 1-day, 7 days, and 28 days. Report compressive strength of each specimen and average specimen compressive strength.

b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:

1. Project designation
2. Date
3. Time
4. Class and quantity of flowable fill
5. Actual batch proportions
6. Free moisture content of aggregate
7. Quantity of water withheld

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavation specified in Section 31 23 16, Excavation and trenching specified in Section 31 23 17, Trenching is complete.

B. Verify utility installation as specified in elsewhere in the specifications is complete and tested before placing flowable fill.

C. Verify excavation is dry and dewatering system is operating, as may be required, prior to placement of flowable fill.

3.2 PREPARATION

A. Support and restrain utilities to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities and foundation drains to prevent intrusion of flowable fill.

3.3 INSTALLATION – FILL, BEDDING, AND BACKFILL

A. Place flowable fill by chute, pumping, or other methods as approved by Engineer.

B. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

C. Place flowable fill evenly on both sides of utilities to maintain alignment.

D. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 INSTALLATION – FILLING ABANDONED UTILITIES

A. As specified in Section 33 11 50, Existing Pipe Abandonment.

3.5 FIELD QUALITY CONTROL

A. Perform inspection and testing according to ASTM C94.

1. Take samples for tests for every 100 cubic yards of flowable fill, or fraction thereof, installed each day.

2. Sample, prepare, and test four compressive strength test cylinders according to ASTM D4832. Test one specimen at 3 days, one at 7 days, and two at 28 days.

3. Measure temperature at point of delivery when samples are prepared.

B. Further construction proceeding upon placed flowable fill will be permitted only after initial set is attained, as measured by ASTM C 403.

1. Perform in place penetration (density) tests using handheld penetrometer to measure penetration resistance of hardened flowable fill.

2. Perform tests at locations as directed by Engineer.

C. Defective Flowable Fill: The Engineer reserves the right to reject all flowable fill failing to meet the following test requirements or flowable fill delivered without the following documentation.

1. Test Requirements:

a. Minimum temperature at point of delivery.

b. Compressive strength requirements for each type of fill.

2. Documentation: Duplicate delivery tickets.

D. No traffic or construction equipment shall be allowed on flowable fill for a least 24 hours after placement.

3.6 CLEANING

A. Remove spilled and excess flowable fill from Project Site.

B. Restore facilities and Site areas damaged or contaminated by flowable fill installation to existing condition before installation.

END OF SECTION

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes shoring and support systems of all types necessary to protect existing utility facilities and new utility facilities.

B. The Contractor is responsible for the selection and design of excavation support systems and the design of utility support systems in conformance with Federal, State, and City requirements and the minimum design criteria specified herein.

C. Temporary shoring is to be installed for protection of the existing trees to remain, structures to remain, buried utilities to remain, adjacent roadways and walkways, and surrounding properties.

D. Care must be taken during the planning and construction of earth support systems to minimize settlements and displacements of the shoring system itself and to surrounding properties.

E. Related Sections:

1. Section 31 23 16, Excavation
2. Section 31 23 17, Trenching
3. Section 31 23 19, Dewatering
4. Section 31 23 23, Fill
5. Section 33 11 10, Water Utility Distribution and Transmission Piping.
6. Section 33 31 10, Sanitary Utility Sewerage Piping.
7. Section 33 41 10, Storm Utility Drainage Piping.

1.2 DESIGN CRITERIA

A. Design excavation support systems and all components to support the earth pressures, unrelieved hydrostatic pressures, utility loads, equipment, traffic, railroad, and construction loads including impact, and other surcharge loads in such manner as will allow the safe and expeditious construction of the permanent structures to minimize ground movement or settlement, and to prevent damage to adjacent structures, roadways, railroads, and utilities.

B. Design support members to resist the maximum loads expected to occur during the excavation and support removal stages.

C. Design system so that water seepage is minimized. Provide dewatering and positive means for preventing sloughing and containing material behind lagging.

D. Design system to prevent sloughing and to contain running sand and silt behind the lagging.

E. Vertical support capacity shall be provided for wall systems and internal bracing elements for loads due to vertical force components and live loads on any portion of the system.

F. Design calculations and shop drawings of all excavation support systems.

1. Calculations and shop drawings shall be made and stamped by a registered Professional Civil or Structural Engineer experienced in the design of excavation support systems in the State of Oregon.

2. Comply with the applicable requirements of OSHA and the Oregon equivalent Structural Specialty Code with respect to excavation and construction.

1.3 SUBMITTALS

A. Section 01 33 00, Submittals - Submittal Procedures: Requirements for submittals.

B. Excavation Support Systems

1. Plans and details for trench and excavation support systems.

a. Calculations and shop drawings shall be made and stamped by an State of Oregon-registered Professional Engineer experienced in the design of excavation support systems and shall comply with the applicable requirements of OSHA and the Oregon equivalent Structural Specialty Code with respect to excavation and construction.

1) Arrangement, size, and details for individual excavation support systems.

2) Construction methods and sequencing to be used for the installation and removal of individual excavation support systems.

b. Provide plans, details, and calculations for Engineer review prior to the beginning of construction activities requiring such systems.

c. Review by the Engineer of the submitted design shall not be construed as a detailed analysis of the adequacy of the support system, nor shall any provisions of the above requirements be construed as relieving overall responsibility and liability for the work.

2. Provide plans, details, and calculations for trench and excavation support systems as required to obtain all necessary construction permits.

3. No excavations shall be started until the submittal review is complete and proper permits are obtained.

C. Excavation Plan

1. Designed to prevent damage to existing and surrounding properties.

D. Contingency Plan

1. Provide alternative procedures to be implemented if the excavation support systems are found to perform unfavorably or if obstructions are encountered in the installation of excavation support systems.

2. Contingency plan is to demonstrate a preparedness to mitigate the effects of movement or settlement.

3. The following minimum requirements for a contingency plan are:

a. Measures to be taken in order to protect existing facilities and neighboring properties from additional settlement or movement.

b. Identification of all material, manpower, equipment, and other items to be available and onsite at all times while excavations and dewatering activities are ongoing and reasonably after the work has been completed.

E. Site Conditions Survey

1. Videotape surveys, photographs, and other data significant in noting the pre-construction conditions of the existing Project Site, as well as the pre-construction conditions of the neighboring properties and their existing structures.

2. Provide to the Owner for record purposes prior to, but not more than 3 weeks before, commencement of any construction activities.

3. A complete set of all photographs and survey data of the post-construction conditions shall be completed and submitted prior to final inspection by the Owner and Engineer.

1.4 QUALITY ASSURANCE

A. Contractor is solely responsible for quality assurance of temporary shoring.

B. At each excavation support system location, provide the following:

1. Continual verification system is planned, executed, and maintained in accordance with applicable codes, regulations, and good construction practice.

2. Systematic observation of suitability of shoring materials.

3. Installation, excavation, settlement, and lateral deflection monitoring.

4. Groundwater control.

5. Adjacent construction activities.

6. Other factors, as necessary.

1.5 CONTRACTOR QUALIFICATIONS

A. The work of this Section shall be done by a firm specializing in this type of work. The firm shall:

1. Regularly and presently perform shoring installation as one of their principal services.

2. Have technical qualifications, experience, training, and facilities to properly install shoring.

3. Provide the services of a supervising engineer, registered in the State, with at least 5 years of experience in the design and construction of shoring walls.

4. A foreman or superintendent experienced in the installation and removal shoring walls shall be present while this work is performed.

1.6 PERMITTING

A. Secure all permits necessary to complete the requirements of this Section.

PART 2 PRODUCTS

2.1 GENERAL

A. Materials and equipment shall be safe and in good condition and shall conform to local, state, and federal codes.

PART 3 EXECUTION

3.1 GENERAL

A. Provide sheeting, shoring, and other protection and support systems wherever required, in accordance with current local, state, and federal laws, codes, and ordinances.

B. The Contractor is solely responsible for excavation protection and worker safety.

C. The Contractor shall be solely responsible for the protection of existing utilities and structures. Under no circumstance shall work threaten the integrity (physical and operational) of these utilities and/or structures.

3.2 EXCAVATION SUPPORT SYSTEMS

A. The excavation support systems shall not disturb the state of soil adjacent to the trench or excavation and below the excavation bottom.

B. Water control measures shall be provided at all times in accordance with the requirements specified in Section 31 23 19, Dewatering.

C. The support system shall extend below the main excavation bottom elevation to a depth adequate to prevent hydrostatic uplift, seepage and piping, and lateral movement and to adequately support applied vertical loads.

D. Damage to existing utilities or structures during installation of excavation support system shall be avoided. If damage occurs, it shall be repaired at no cost to the Owner and to the satisfaction of the utility owner.

E. A company representative from the excavation support system shall be onsite during initial setup of the system. Install excavation support system in strict conformance with the representative's recommendations.

3.3 CONTINGENCY PLAN IMPLEMENTATION

A. Excess movements or settlements: Work shall be stopped immediately and the causes of excess or detrimental movements evaluated if:

1. Damage is noted to existing site features or surrounding properties.

2. Shoring wall movements exceed the limits specified herein or per submitted calculations.

B. Immediately notify the Engineer and begin the implementation of the approved contingency plan to mitigate the effects of settlement or movement occurred.

3.4 REMOVAL OF SUPPORT SYSTEMS

A. Removal of excavation support systems shall be performed in a manner that does not disturb or damage adjacent new or existing structures or utilities.

B. Fill all voids immediately with specified backfill material.

C. All damage to property resulting from removal shall be promptly repaired at no cost to the Owner. The Engineer shall be the sole judge as to the extent and determination of the methods and materials for repair.

3.5 NOT USED

END OF SECTION

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DIVISION 32 – EXTERIOR IMPROVEMENTS

SECTION 32 11 23 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes construction of an aggregate subbase and base course for placement under asphalt or concrete paving, unit paving, or placed and left exposed.

B. Section Includes:

1. Aggregate subbase
2. Aggregate base course

C. Related Sections:

1. Section 31 22 13 - Rough Grading
2. Section 31 23 17 - Trenching
3. Section 31 23 23 - Fill
4. Section 31 37 00 - Riprap
5. Section 31 05 16 - Aggregates for Earthwork
6. Section 32 12 16 - Asphalt Concrete Pavement

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications
2. T11, Standard Method of Test for Materials Finer Than 75μm (No. 200) Sieve in Mineral Aggregates by Washing
3. T27, Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
4. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. ASTM International (ASTM):

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))
2. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

4. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports

5. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

1.3 DEFINITIONS

A. Completed Course: Compacted, unyielding, free from irregularities and standing water, with smooth, tight, even surface, true to grade, line, and cross-section.

B. Completed Lift: Compacted with uniform cross-section thickness.

C. Keystone: Fine aggregate used to aid in binding of loose surface stone.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit data for geotextile fabric and herbicide.

C. Materials Source: Submit name of aggregate materials suppliers.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Furnish each aggregate material from single source throughout the Work.

PART 2 PRODUCTS

2.1 SHOULDER AGGREGATE

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.2 DENSE-GRADED BASE AGGREGATES

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A1, Dense-Graded Aggregate as specified in Section 32 05 16, Aggregates for Earthwork.

2.3 OPEN-GRADED BASE AGGREGATES

A. Of the size shown on the Plans.

B. Coarse Aggregate: Type A2, Granular Drain Backfill Material as specified in Section 32 05 16, Aggregates for Earthwork.

2.4 SOURCE QUALITY CONTROL

A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on test results of installed materials.

C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

2.5 EQUIPMENT

A. Compaction Equipment: Adequate in design and number to provide compaction and to obtain specified density for each layer.

2.6 ACCESSORIES

A. Geotextile Fabric: AASHTO M288; non-woven, polypropylene.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Obtain Engineer's acceptance of subgrade before placing base course or surfacing material.

B. Verify compacted substrate is dry and ready to support paving and imposed loads.

1. Proof roll substrate with equipment approved by the Engineer in minimum two perpendicular passes to identify soft spots.

2. Remove soft substrate and replace with compacted fill as specified in Section 31 23 23.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place base course or surfacing materials in snow or on soft, muddy, or frozen subgrade.

3.3 HAULING AND SPREADING

A. Hauling Materials:

1. Do not haul over surfacing in process of construction.

2. Loads: Of uniform capacity.

3. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

B. Spreading Materials:

1. Distribute material to provide required density, depth, grade, and dimensions with allowance for subsequent lifts.

2. Produce even distribution of material on prepared surface without segregation.

3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

4. Maintain consistent gradation of material. Widely varying gradation will be cause for rejection.

3.4 CONSTRUCTION OF COURSES

A. Untreated Aggregate Base Course:

1. If the required compacted depth of the base course exceeds 6 inches, construct it in two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 6 inches.

2. Completed Course Total Thickness: As shown on the Plans, 8-inch minimum.

3. Spread lift on preceding course to required cross-section. Place each layer in spreads as wide as practical and to the full width of the course before a succeeding layer is placed.

4. Lightly blade and roll surface until thoroughly compacted.

5. Add keystone to achieve compaction and as required when aggregate does not compact readily due to lack of fines or natural cementing properties, as follows:

a. Use 3/4-inch leveling course or surfacing material as keystone.

b. Spread evenly on top of base course, using spreader boxes or chip spreaders.

c. Roll surface until keystone is worked into interstices of base course without excessive displacement.

d. Continue operation until course has become thoroughly keyed, compacted, and will not creep or move under roller.

6. Blade or broom surface to maintain true line, grade, and cross-section.

B. Gravel Surfacing and Leveling Course:

1. Place shoulder aggregates in a single layer, or two or more layers of nearly equal thickness. The maximum compacted thickness of any one layer shall not exceed 9 inches.

2. Spread on preceding course in accordance with cross-section shown.

3. Blade lightly and roll surface until material is thoroughly compacted.

4. Complete Total Thickness: As shown on the Plans, 8-inch minimum.

3.5 ROLLING AND COMPACTION

A. Commence compaction of each layer of base immediately after spreading operations and continue until density of 95 percent of maximum density has been achieved as determined by AASHTO T99.

B. Roll each layer of material until there is no appreciable reaction or yielding under the compactor before succeeding layer is applied.

C. Shape and maintain the surface of each layer during compaction operations. Commence rolling at outer edges and continue toward center; do not roll center of road first.

D. Apply water as needed to obtain specified densities.

E. Place and compact each lift to the required density before succeeding lift is placed.

F. Surface Defects: Remedy by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.

G. Finished surface shall be true to grade and crown before proceeding with surfacing.

3.6 SURFACE TOLERANCES

A. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.

B. Finished Surface of Untreated Aggregate: Within plus or minus 0.04-foot of grade shown at any individual point.

C. Overall Average: Within plus or minus 0.04-foot from crown and grade specified.

3.7 FIELD QUALITY CONTROL

A. Quality control testing shall be performed by an independent testing laboratory provided by the Owner.

B. Refer to table below for minimum sampling and testing requirements for aggregate base course and surfacing. The Owner reserves the right to complete additional testing.

Property	Test Method	Frequency	Sampling Point
Gradation	AASHTO T11 and AASHTO T27	One sample every 500 tons but at least every 4 hours of production	Roadbed after processing
Moisture Density (Maximum Density)	AASHTO T99	One test for every aggregate grading produced	Production output or stockpile
In-Place Density and Moisture Content	AASHTO T310	One for each 500 ton but at least every 10,000 square feet of area	In-place completed, compacted area

3.8 CLEANING

A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate. Restore per Specifications as applicable.

END OF SECTION

SECTION 32 12 16 - ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.1 SCOPE

This section includes the construction of asphalt concrete pavement.

1.2 REFERENCE STANDARDS

A. References herein to "AASHTO" shall mean Association of American State Highway Transportation Officials.

B. Standard Specifications: Where the term "Standard Specifications" is used, such reference shall mean the current edition of the Oregon Department of Transportation (ODOT) Standard Specifications for Highway Construction. Where reference is made to a specific part of the Standard Specifications, such applicable part shall be considered as part of this section of the Specifications. In case of a conflict in the requirements of the Standard Specifications and the requirements stated herein, the requirements herein shall prevail.

1.3 DEFINITIONS

A. Maximum Density Test (MDT): Theoretical maximum density of the bituminous mixture determined by multiplying the theoretical maximum specific gravity, determined by ASTM D2041 (Rice), by 62.4 pounds per cubic foot.

1.4 SUBMITTALS

A. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00640 for aggregate used in aggregate base.

B. Aggregate Qualification Tests: In accordance with Standard Specifications Section 00745 for aggregate used in asphalt concrete.

C. Job mix formula shall be an approved job mix formula. Submit formula, supplier, and product identification to the Engineer 30 days prior to start.

1. Definite percentage for:

    a. Each sieve fraction.

    b. New asphalt cement.

    c. Recycled asphalt pavement.

2. Temperature of completed mix when discharged from mixer.

3. Character and quantity of anti-strip and recycling agents.

1.5 QUALITY ASSURANCE

A. All testing to determine compliance with the specifications shall be performed by an independent testing laboratory contracted by the Contractor and approved by the Engineer. All testing costs shall be borne by the Contractor.

B. A minimum of five nuclear densometer readings shall be taken in random locations within every test area. Each test area shall not exceed 200 tons of asphalt; however, smaller areas may be designated by the Engineer.

C. The surface smoothness of the new asphalt concrete pavement shall be such that when a 10-foot straightedge is laid longitudinally across the paved area in any direction, the new pavement shall not deviate from the straightedge more than 1/8-inch. Surface drainage shall be maintained. Additionally, paving must conform to the design grade and crown and contain no abrupt edges, low or high areas or any other imperfections as determined by the Engineer. Pavement construction not meeting these requirements will be repaired by grinding the existing pavement to a 1-1/2-inch depth and replacing with Level 3, 1/2-inch dense graded Asphaltic Concrete the full width at no cost to Owner.

1.6 PRE-PAVING CONFERENCE

A. Any supervisory personnel of the Contractor and any subcontractors who are to be involved in the paving work shall meet with the Engineer, at a time mutually agreed upon, to discuss methods of accomplishing all phases of the paving work.

B. The Contractor shall be prepared to review the size and type of equipment to be used and the anticipated rate of placement to determine equipment needs.

PART 2 PRODUCTS

2.1 AGGREGATE MATERIAL

A. Aggregate Base for Dense Graded Asphalt Concrete: The aggregate material shall be a clean, well-graded crushed base aggregate conforming to the Standard Specifications. Base course shall be 1-1/2-inch minus aggregate and leveling course shall be 3/4-inch minus aggregate.

2.2 ASPHALT CONCRETE PAVEMENT

A. Dense Graded Hot Mix Asphalt Concrete

1. Use Level 3, 1/2-inch-dense graded, PG 70-22 HMAC. Conform to the requirements as specified in Section 00745 of the Standard Specifications. Conform to the requirements as specified in Section 00745 of the Standard Specification.

2. Asphaltic concrete pavement delivered to the site shall be accompanied by a ticket with the approved "job mix formula" number shown. Loads without tickets identifying the job mix formula will not be accepted.

3. Percent of recycled asphalt pavement used in new asphalt pavement shall not exceed 30 percent. Recycled asphalt pavement may not be used in top wearing course unless otherwise approved by the Engineer.

B. Tack Coat

In accordance with Standard Specifications. Use AR 4000, AC-20 asphalt, or CSS-1 emulsified asphalt C.

C. Seal and Cover Coat

Asphalt material shall be CRS-2 cationic emulsified asphalt. Cover stone shall conform to size 1/4-inch #10 aggregate in the Standard Specifications.

D. Subgrade Geotextile

1. Dense Graded AC Mix-For subgrade separation using dense graded asphalt concrete, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Standard Specifications.

E. Subgrade Stabilization

In the event that unstable materials are encountered during excavation, the additional excavation and installation of geotextile fabric and 12 inches of rock substructure will be required, as directed. Conform to the requirements as specified in Section 00331 of the Standard Specifications. For subgrade separation, use subgrade geotextile with Certification Level B as specified in Section 02320 of the Standard Specifications.

PART 3 EXECUTION

3.1 AGGREGATE PAVEMENT BASE

A. Place pavement base to the depth shown on the plans or as specified in all cases, pavement base shall be compacted to a minimum depth of 6 inches. Bring the top of the pavement base to a smooth, even grade at a distance below finished grade equivalent to the required pavement depth.

B. Compact the pavement base with mechanical vibratory or impact tampers to a density of not less than 95 percent of the maximum density, as determined by AASHTO T-99.

C. Obtain the Engineer's acceptance of the subgrade before beginning construction of the aggregate base course.

D. When, in the judgment of the Engineer, the weather is such that satisfactory results cannot be secured, suspend operations. Place no aggregate base course in snow or in soft, muddy, or frozen subgrade.

E. If the required compacted depth of aggregate base course exceeds 6 inches, construct in two or more lifts of approximately equal thickness. Maximum compacted thickness of any one lift shall not exceed 6 inches. Compact each layer to the specified density before a succeeding lift is placed.

3.2 ASPHALT CONCRETE PAVEMENT

A. Construct asphalt concrete pavement in accordance with Section 00745 of the Standard Specifications.

B. Conform to the requirements for prime coat and tack coat in the Standard Specifications. Tack coat all edges of existing pavement, manhole and clean out frames, inlet boxes, and like items. When rate is not specified, asphalt will be applied at the rate of 0.1-gallon per square yard.

C. Obtain the Engineer's acceptance of the aggregate base course before beginning construction of the asphalt concrete wearing course.

D. Hot mix asphalt shall be placed on dry, prepared surfaces, when air temperature in the shade of 40 degrees Fahrenheit (F) or warmer, unless otherwise authorized by the Engineer.

E. Placing asphalt pavement during rain or other adverse weather conditions will not be permitted unless otherwise authorized by the Engineer, except that asphalt mix in transit at the time these adverse conditions occur may be placed provided it is of proper temperature, the mix has been covered during transit, and it is placed on a foundation free from mud or free-standing water.

F. Correct any defects in material and workmanship, as directed, when determined detrimental by the Engineer. These include segregation of materials, non-uniform texture, and fouled surfaces preventing full bond between successive spreads of mixture. The corrections or replacement of defective material or workmanship shall be at the Contractor's expense.

G. Compact the bituminous mixture to at least 92 percent of the Theoretical Maximum Density.

H. The finished surface of each course of layer of mixture shall be of uniform texture, smooth, and free of defects and shall closely parallel that specified for the top surface finished grade. Remove and replace boils and slicks immediately with suitable materials.

I. The surface of each layer when tested with a Contractor-furnished 10-foot straightedge shall not vary from the testing edge by more than 0.02-foot for underlying courses of pavements and 0.015-foot for finished top courses or wearing courses of pavements. At no point shall the finished top of the wearing course vary more than 0.03-foot from the specified finished grade.

J. Lift thickness shall be as shown on the drawings or specified, but not to exceed 3 inches.

K. Do not place asphalt concrete pavement on emulsified asphalt (tack coat) until the asphalt separates from the water (breaks) but before it loses its tackiness.

L. Asphalt and sand seal edges where new asphalt concrete meets existing pavement.

3.3 FIELD QUALITY CONTROL

A. Job mix will be sampled immediately behind the paving machine.

B. Temperature of the mix will be measured immediately behind the paver.

C. The theoretical maximum specific gravity of the bituminous mixture will be determined in accordance with ASTM D2041.

D. Properties of the job mix will be measured using ASTM D2041.

E. Density of the compacted job mix will be measured in accordance with ASTM D2922.

3.4 ADJUSTMENT OF EXISTING MANHOLE COVERS AND VALVE BOXES

Prior to placing asphalt concrete pavement, the Contractor shall make all necessary adjustments to existing manhole frames and covers, and valve box covers to ensure that the tops of the manhole covers or valve box lids are flush with the finished grade of the adjoining pavement or ground surface, and that valve boxes and PVC pipes are centered and plumb over operating nut valve.

END OF SECTION

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SECTION 32 91 13 - SOIL PREPARATION

PART 1 GENERAL

1.1 SUMMARY

A. Furnish labor, material and equipment required for placement and amendment of topsoils for areas to be planted, and the establishment of finish grades as shown on the Drawings and as specified herein.

B. Coordinate work with installation of other site work including earthwork, irrigation, seeding, and planting.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of amended topsoil soil.

B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Amended Topsoil: Native or imported topsoil or surface soil modified with organic soil amendments and organic fertilizers.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

E. Topsoil: See Part 2 – Products.

1.3 SUBMITTALS

A. Product Data. Include Material Safety Data Sheets (MSDS) where applicable: For the following:

1. Organic Fertilizers, including application rates.
2. Organic Soil Amendments.

B. Samples for Verification: For the following:

1. 1/2 cubic foot compost.

2. 1/2 cubic foot of each imported topsoil. Furnish one sample from each site from which soil is to be furnished.

C. Product Certificates: For each type of manufactured product, signed by product manufacturer, and complying with the following:

1. Manufacturer’s certified analysis for standard products.

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

D. Qualification Data: For testing agencies.

E. Material Test Reports:

1. Soil Fertility and Agricultural Suitability Analyses and Recommendations Reports for the following:

a. Existing on-site topsoil: From three typical locations as selected by Owner's Representative, minimum 30 days prior to beginning soil preparation work.

b. Imported topsoil: Minimum 30 days prior to beginning soil preparation work.

c. Amended topsoils: Provide soil analyses and results for soil samples taken from 3 typical locations as selected by Owner's Representative, minimum 7 days after soil preparation work has been completed and prior to installing plants.

2. Compost Analysis: Provide analysis for one representative sample of compost minimum 30 days prior to compost being delivered to Project Site and an analysis for one representative sample of compost delivered to the Project Site.

3. Soil Compaction Test: Provide results of soil compaction tests minimum of 7 days prior to planting and seeding.

F. Delivery Slips: Provide delivery slips as proof of shipment of specified materials.

1.4 QUALITY ASSURANCE

A. Soil Fertility and Agricultural Suitability-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

1. Acceptable Soil Testing Laboratories are:

a. A & L Western Agricultural Laboratories, (503) 968-9225.
b. Western Laboratories, Inc, (800) 658-3858.

B. Soil Analyses: Furnish soil analyses by a qualified soil-testing laboratory stating:

1. Soil Composition: USDA particle size analysis indicating percentages of sand, silt and clay, and percent organic matter.

2. Macro and micronutrient fertility tests as determined by pH, salinity, nitrate nitrogen, ammonium nitrogen, phosphate phosphorous potassium, calcium, magnesium, soluble copper, zinc, manganese, iron, saturation extract boron and sodium analyses.

3. Sodium Absorption Ratio (SAR).

4. Recommendations by the soil testing lab for fertilizer and soil amendments in pounds per 1,000 square foot or tons per acre, as necessary to correct soil deficiencies.

C. Compost Testing Laboratory Qualifications: An independent laboratory, with the experience and capability to conduct the testing indicated following U.S. Composting Council Seal of Testing Assurance (STA) procedures, or equivalent.

1. Acceptable STA Compost Testing Laboratories are:

a. A & L Western Agricultural Laboratories, (503) 968-9225.
b. Control Laboratories, (831) 724-5422.

D. Compost Analysis: Provide documentation from supplier that compost has reached a monitored temperature of 140 degrees Fahrenheit for at least one week. Engage an independent soil testing laboratory to test representative sample(s) of compost and furnish compost analysis report for the following parameters:

1. Percent organic matter, percent moisture, percent inerts (foreign matter), pH, soluble salts, and particle size.

2. Nutrient content, including: Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), and Magnesium (Mg) and Sulfur (S).

3. Trace Metals, including: Arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Lead (Pb), Mercury (Hg), Nickel (Ni), and Zinc (Zn).

4. Maturity Indicator. Provide bio-assay results. Provide Carbon-Nitrogen ratio.

5. Stability Indicator: Provide respiration test results.

E. Request inspection and allow observation by Owner’s Representative of prepared soils before planting.

F. Soil Compaction Testing: Furnish soil compaction standard tests per ASTM 698. Request inspection and allow observation by Owner's Representative of prepared soils before planting.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver packaged materials in manufacturer's unopened containers fully identified by name, brand, type, weight and analysis.

B. Store and handle packaged materials to prevent damage and intrusion of foreign matter.

C. Store stockpiled topsoil in area designated by Owner’s Representative. Provide erosion control measures for stockpiled topsoil on site to prevent contamination of the soil. Refer to 31 23 16, Excavation for control of dust and erosion.

1.6 SOIL AMENDMENT BID QUANTITIES

A. Bid quantities and types of soil amendments shall be based upon those listed in this Section. Types of amendments required and quantities shall be adjusted as necessary based upon

actual results of soil fertility and agricultural suitability analyses and recommendations for on-site topsoils.

B. For bidding purposed only, calculate the following amounts per 6-inch lift of topsoil over 1000 square-feet of landscape area:

1. 25 lbs. Gypsum (Calcium sulfate)
2. 35 lbs. Calcium carbonate limestone
3. 35 lbs. Dolomite limestone
4. 6 cu-yds Compost

1.7 SITE CONDITIONS

A. Topsoil placement and soil preparation shall not take place during periods where saturated soil or surface water is present in work areas.

B. Work shall not take place when temperature is less than 32 degrees Fahrenheit, or when frozen soil exists on site.

1.8 COORDINATION

A. Coordinate soil preparation 32 91 13, Soil Preparation such that topsoil, soil amendments and fertilizers are incorporated into ground fill areas in specified lifts to specified depths below finish grade for both planting areas and lawn areas. Topsoils shall be amended per recommendations of the Soils Testing Laboratory.

B. Coordinate work with installation of other site work, including irrigation, seeding, and planting.

PART 2 PRODUCTS

2.1 TOPSOIL

A. Topsoil Definition: ASTM D 5268; natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles, conforming to USDA classification for Loam or Sandy Loam; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inches in any dimension; and free of weeds, roots, and other deleterious materials, with the following physical properties:

1. Organic Matter: 6 percent minimum.

2. Sodium Adsorption Ratio (SAR): less than 6.0.

3. Saturation Extract concentration for Boron: less than 1.0

4. pH range of from 6 to 8 (plus 0, minus 0.5).

5. Saturation Extract Conductivity: less than 4.0 dS/m @ 25 degrees Celsius as determined in a saturation extract.

6. Non-soil components: less than 1 percent by volume.

7. Heavy metal concentrations: below the USDA per year load limit.

8. Minimal weed seed.

    a. If regenerative noxious weeds (including, but not limited to, quack grass, nutsedge grass, and horsetail) are present in the soil, all resultant growth including roots shall be removed throughout one-year period after acceptance of work at no additional cost to Owner.

B. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth. Ensure no contamination of the soils occurs during earthwork and grading, and that the soil remains friable and free of debris.

1. Import Topsoil: Supplement on-site topsoil with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.2 ORGANIC SOIL AMENDMENTS

A. Compost: Well-decomposed, commercially manufactured, stable, and weed-free organic matter from agricultural, food, biosolids, or yard debris sources; pH range of 5.5 to 8.0; 100 percent passing through 3/4-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and shall conform as follows:

1. Tested, at minimum, every six months for noxious weeds.

2. Organic matter source (feedstock): Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

3. Organic Matter Content: 60 to 80 percent of dry weight as determined by ash method.

4. Moisture Content: 35 to 55 percent by weight

5. Free of refuse (less than 1 percent by dry weight), plastics, contaminants or any material toxic to plant growth.

6. Processed to meet U.S. Composting Council's Seal of Testing Assurance Program, or equivalent.

7. Carbon to Nitrogen Ratio: 40 to 1 or lower.

8. Composted for a minimum of 9 months and reach a monitored temperature of 140 degrees Fahrenheit for at least one week.

2.3 FERTILIZER

A. Organic fertilizer composition and rate to be determined and adjusted based upon soil analysis report. For bidding purposes, assume: Walts Organic Fertilizer, Organic Garden Blend 6-2-5, or approved equal.

1. Application rate @ 20 pounds per 1000 square feet in all planting beds and seeded areas.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water- insoluble nitrogen, phosphorus, and potassium derived from natural organic sources in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

PART 3 EXECUTION

3.1 EXAMINATION OF SITE CONDITIONS

A. Examine for site conditions that will adversely affect execution, permanence, quality of work, and survival of plant material and grasses.

B. Verify that subgrades and slopes of lawn and planting areas are acceptable to Owner's Representative prior to commencing work of this Section.

C. Should the Contractor find any discrepancies between the Drawings and the physical conditions, inform the Owner's Representative immediately for clarification.

D. Begin Work required under this Section only after conditions are satisfactory.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and existing lawns and exterior plants from damage caused by soil preparation operations.

B. Prepare soils at a time when moisture conditions will permit proper cultivation.

C. Remove stones over 1-inch diameter, sticks, roots, mortar, concrete, rubbish, debris, and all materials harmful to plant life, and legally dispose of them off Owner's property.

D. Remove as required to eradicate noxious weed growth and roots.

1. Achieve complete removal of all weeds within all areas receiving new plantings and lawn areas.

2. In planting beds, kill achieved by working soil is permissible for annual non-noxious broad-leaf type weeds.

E. Locate and securely mark or flag irrigation sprinkler heads, area drains, catch basins, clean outs, manholes, valve boxes, and other site improvements not extending above finish grade. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways in accordance with 31 23 16, Excavation.

3.3 SOIL PREPARATION FOR PLANTING AREAS

A. This article pertains to those shrub bed areas where mass plantings of trees, shrubs and ground cover plants are scheduled.

B. Prepare subgrades by excavating and removing soil, rock and other construction material to 12 inches below finish grade. Cross-rip subgrades to depth of 6 inches prior to placing topsoil.

C. Place topsoil to depth as noted on Plant Legend then place compost, soil amendments, and fertilizers as recommended in Agricultural Soil Suitability Report per 1,000 square feet and rototill thoroughly to a depth of 8 inches. Place remainder of topsoil, compost, soil amendments, and fertilizers as recommended in Agricultural Soil Suitability Report per 1,000 square feet and rototill thoroughly to a depth of 8 inches, allowing for compaction, natural settlement, and depth of specified mulch.

1. It is the Contractor’s option to set up a facility on-site for the preparation and amendment of topsoils, instead of preparing and amending the topsoils in place as indicated in the paragraph above.

2. Set up facility in location as directed by Owner's Representative.

D. Water lightly and allow planting mix to settle. Add additional material at mixture indicated in paragraph above to bring soil level to grades shown on the Drawings with allowance at pavement edges for mulch placement. Provide compaction to 85 percent relative density.

E. Meet lines, grades and elevations shown, after light rolling and natural settlement. Fine grade shrub and ground cover areas to smooth even surface with loose, uniformly fine texture. Rake and drag shrub and ground cover areas to remove ridges and fill depressions to obtain firmness and finish grades preparatory to receiving planting.

F. Remove stones over 1/2-inch in any dimension and sticks, roots, rubbish and other extraneous matter.

3.4 SOIL PREPARATION FOR PLANTING PITS OF TREES

A. This article pertains to tree planting when occurring on an individual basis.

1. Backfill Mix: Prepare backfill mix and place in planting pits as shown and specified.

2. Grade smooth to elevations shown.

3.5 SOIL PREPARATION UNDER EXISTING TREES

A. Remove vegetation not indicated to remain beneath canopy of existing trees. Take care not to disturb roots of existing trees.

B. Lightly rake areas and add amended topsoil to meet proposed grades.

3.6 FINE GRADING

A. Finish grade after full settlement including mulch, shall be 1 inch below tops of curbs, walks, or existing grades in shrub areas and 3/4 inch lower in lawn areas.

B. Slope all areas to prevent puddling and drain surface water toward catch basins, drains, curbs, or off-site as shown on Drawings.

C. Soil in all areas shall be thoroughly settled, with a smooth surface free of humps and hollows, and shall be firm enough to resist undesirable impressions when stepped upon.

D. Use levels, screens, drags, or any other equipment necessary to establish and verify grades and surfaces.

E. Finish grade lawn, grass and planting areas to smooth, even surface with loose, uniformly fine texture.

F. Roll, rake, and drag lawn areas, remove ridges and fill depressions with amended topsoil to obtain firmness and finish grades as indicated.

G. Notify Owner’s Representative 36 hours in advance to review fine grading of lawn, grass and planting areas. Finish grades shall be prepared to the satisfaction of the Owner's Representative prior to planting.

3.7 CLEAN-UP

A. Clean up excess materials and debris from project site upon completion of work or sooner if directed by the Owner's Representative.

B. Leave in neat and tidy condition daily.

3.8 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner’s property.

END OF SECTION

SECTION 32 91 21 - FINISH GRADING AND SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil Preparation
2. Weed control
3. Fertilizing
4. Seeding
5. Mulching
6. Hydroseeding
7. Hydromulching
8. Erosion Control Blanket
9. Maintenance and Establishment Period

B. Related Sections:

1. Section 31 05 13 - Soils for Earthwork
2. Section 31 23 17 - Trenching

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM C602 - Standard Specification for Agricultural Liming Materials.
2. 7 USC 1551-1611 - Federal Seed Act.

1.3 DEFINITIONS

A. Certified Seed: A grass or legume seed named variety that has been reviewed and accepted into the State Certified Seed program. Currently certified seed is individually sold in bags with a Certification Tag.

B. Pure Live Seed (PLS): Is a measure used to describe the percentage of a quantity of seed that will germinate. PLS is obtained by multiplying the purity percentage by the percentage of total viable seed, then dividing by 100.

C. Establishment Period: A period when planting work has been performed and initially accepted, and there is a contract requirement to care for the planted areas in some way until the period ends.

D. Sensitive Areas: Defined areas such as wetlands, natural water and riparian resources, special environmental zones, or where certain activities are restricted such as the use of chemicals.

E. Weeds: Vegetative species other than specified species to be established in given area.

F. Invasive Plants: Any species that appears on the State of Oregon or Clatsop County current noxious weed list, plus known problem species including phalaris arundinacea, mentha pulegium, holcus lanatus, anthoxanthum odoratum. The last crop plants (if listed as non-native on United States Department of Agriculture (USDA) Plants Database) are considered invasive if it comprises more than 15 percent in any newly established vegetation.

G. Weed Control: Removal and prevent regrowth of specified weeds, weed parts, and weed seeds from area within the Project limit.

1.4 SUBMITTALS

A. Product Data: Submit data for seed mix, mulch, tackifier, erosion control blanket, soil amendment materials, pesticides, herbicides, and other accessories. The product should meet or exceeds all product requirements specified herein.

B. Grass Seeds Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1. Certification of seed analysis, germination rate, and inoculation. Include the year of production and date of packaging. Certify that each lot of seed has been tested by a testing laboratory certified in seed testing within 12 months of delivery date. Also include:

    a. Name and address of laboratory
    b. Date of test
    c. Lot number for each seed certified
    d. Test Results: Name, percentages of purity and of germination, and weed content for each seed mix.

C. Operation and Maintenance Data: Include maintenance instructions and weed control.

1.5 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

B. Pesticide shall not be used in this Project.

1.6 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum 3 years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 2 years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Deliver tackifier sealed containers showing weight, chemical analysis, and name of manufacturer.

1.8 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement for 12 months from Date of Substantial Completion. Grass shall be well established and exhibits vigorous growing condition.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Suppliers:

1. Sunmark Seeds, Portland, OR
2. PT Lawn Seed, Portland, OR
3. NaturesSeed.com
4. Approved equal

B. Seed Mixes: The following are the functional categories of seed mixes that may be included on projects (a category may have multiple functions on a Project Site):

1. Temporary Seeding - To provide short-term erosion control of disturbed soils and slopes that are not at finished grade, and which will be exposed for 2 months or longer before being disturbed again, until permanent seeding is performed, or all potential for erosion is removed.

2. Permanent Seeding - The final seeding or only seeding performed for erosion control.

3. Lawn Seeding - Seeding for areas where finished turf appearance is desired.

4. Wildflower Seeding - Seeding to develop growth of wildflowers. The seed mix will typically contain grass or other plant seed to provide erosion control.

5. Plant Seeding - Seeding which typically includes more than just grass species, such as seeds of woody or herbaceous plants.

6. Water Quality Seeding - For use in water quality facilities such as swales or settling basins.

7. Wetland Seeding - To vegetate existing or constructed wetlands.

8. Native Plant Seeding - Seeding to restore native vegetation.

C. Types of Seed Mixes: Seed mixes, quantities, standards, and other information

1. Water Quality Seed Mix: Water quality facilities NW Native bio-filtration seed mix, salmon-friendly, will perform well in the bottom of drainage swales, storm water retention ponds, and bio-filtration swales. This mixture will range from the continuously wet lowlands, up into the riparian zone, offering erosion control and habitat development.

Botanical Name	Common Name	PLS Lbs. per Acre
Elymus glaucus	Blue Wildrye	20
Festuca rubra rubra	Native Red Fescue	16.5
Deschampsia caespitosa	Tufted Hairgrass	5.2
Glyceria occidentallis	Western Mannagrass	0.9
Beckmania syzigachne	American Sloughgrass	0.9
TOTALS:		43.38

2. Roadside Seed Mix: Erosion control mix for vegetation along roadsides. It is also salt tolerant.

Botanical Name	Common Name	PLS Lbs. per Acre
Hordeum vulgare var Poco	Poco Barley	52.24
Hordeum brachyantherum	Meadow Barley	36.57

Bromus carinatus	California Brome	23.51
Festuca idahoensis romerii	Roemer's Fescue	7.18
Trifolium fragiferum	Strawberry Clover	5.22
Clarkia amonea	Farewell to Spring	1.96
Oenothera elata hookeri	Hooker's Evening Primrose	1.96
Deschampsia cespitosa	Tufted Hairgrass	1.31
Agrostis exerata	Spike Bentgrass	0.65
TOTALS:		130.6

2.2 ACCESSORIES

A. Straw Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Wood and Bark Mulching Material: Chipped wood and bark, sawdust, and ground wood mulch should be free of growth or germination inhibiting ingredients.

C. Compost: Commercially manufactured fine and medium compost materials.

D. Tackifier: Commercial tackifier containing no agent toxic to plant life and exhibits no growth or germination inhibiting factors at one of the following forms:

1. Liquid Stabilizer Emulsion - Tackifier with a base material of liquid containing not less than 55 percent total solids by weight. It should allow exchange of air and moisture to the seeds and have an effective life of 1 year or more.

2. Dry Powder Tackifier - Tackifier base consisting of one or more active hydrocolloids from natural plant sources, which hydrates in water and blends with other slurry materials, and upon application tacks the slurry particles to the Soil surface.

E. Fertilizer: Commercial grade; recommended for grass to eliminate deficiencies of topsoil and suitable for application with equipment designed for that purpose.

1. Deliver fertilizers in separate or mixture containers that have the percentage of total nitrogen, available phosphoric acid, and water-soluble potash (NPK) in the amounts specified. Label each container with a quality compliance certificate.

2. Application rate shall be determined by the soil conditions, as indicated in analysis to determine the proportions of Nitrogen percent, phosphoric acid percent, soluble potash percent.

F. Lime: Not Used.

G. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.

H. Erosion Control Blanket shall be open, flexible, and dimensionally stable network of fully-biodegradable, bonded, interlocking fibers. The blanket shall have a functional longevity of up to 12 months. Blanket fibers shall be turf green color or natural wood/straw color.

I. Pesticides/Herbicide: Not Used.

2.3 SOURCE QUALITY CONTROL – NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify permit requirements before starting work.

B. Planting Season: Plant seeds when growing conditions are conducive to seed germination and quick but thorough establishment of seedlings.

1. Depending on latitude and elevation in the Pacific Northwest, these conditions occur either in mid-August through early October or mid-April to late May.

2. Avoid planting seed during the heat of summer or in late fall to avoid freezes that kill sprouting grass seeds.

C. Weed Control Coordinator – Not Used.

D. Pesticide Applicator – Not Used.

3.2 SOIL PREPARATION

A. Prepare area for seeding in accordance with permits and as required for specified seed mixes.

Remove any matter detrimental or toxic to the growth of plants, including weeds, clods, rocks, or debris.

3.3 WEED CONTROL

A. Do not harm or disturb any vegetation that was planted as proposed on the planting plans. Do not compact soil with heavy equipment.

B. Inspect the Project for new growth of specified weeds at least monthly during the plants growing season and apply weed control measures as appropriate.

1. Inspect the area at least every 30 days after growing season has begun or as directed for continuing control of all vegetation considered as weeds.

2. Provide schedule of weed control measures.

3. Request to use wheeled or tracked construction equipment in sensitive areas.

C. Remove and control weeds according to the following:

1. Verify the weed control methods before proceeding with weed control activities.

2. Remove all specified weeds and ensure that weed seeds or reproducing plant parts such as vines, runners, or rhizomes do not remain or become disbursed during control activities.

3. Place weeds and related materials in an approved container and transport to an approved offsite disposal facility according to applicable laws and regulations.

4. Keep the site weed free including weeds not initially documented.

D. Weed Control at Sensitive Areas - as determined by the ENGINEER:

1. Use only hand or light mechanical weed control methods within 50 feet of sensitive areas.

2. Hand methods include the use of hand tools. Light mechanical methods include the use of hand carried, motorized machinery.

E. Weed Control Corrective Work - If corrective work for areas identified as deficient by the ENGINEER, it should be completed within a 15 Calendar Day period,

3.4 SEEDING

A. Apply Water Quality Seed Mix at rate indicated in Section 2.1.C.1 at all disturbed areas shown in the Drawings.

3.5 HYDROSEEDING AND HYDROMULCHING

A. Mix seeds, fertilizers, mulch, and tackifier with water in specific tank as follows:

1. Hydraulic Equipment should continuously mix and agitates the slurry providing a continuous, non-fluctuating delivery.

2. Provide a uniform distribution of the slurry.

3. Place seed, fertilizer, mulch, and tackifier in the hydroseeder tank no more than 30 minutes prior to application.

B. Hydroseeding operation: Perform hydroseeding according to the following:

1. One-Step Operation - Apply materials in one step only for the following situations:

a. When seeding in conjunction with erosion control matting. Apply seed, fertilizer, and tracer before installing matting.

b. When treating small areas that are 1,500 square feet or less and totaling no more than 0.5 acre, double the amount of seed to compensate for seed suspended above Soil by the mulch.

2. Two-Step Operation – for areas over 0.5 acre, use the two-step method for all hydroseeding/hydromulching operations:

a. Step 1 - Apply seed, fertilizer, and tracer.
b. Step 2 - Apply mulch and tackifier.

C. Seed -Thoroughly mix seeds when more than one kind is to be used.

D. Mulch - Apply at the following rates based on dry fiber weight:

1. Slopes Flatter Than 1V:2H - Apply cellulose fiber that includes a tackifier at a rate of 2,000 pounds per acre.

2. Slopes 1V:2H or Steeper - Apply cellulose fiber that includes a tackifier at a rate of 3,000 pounds per acre.

E. Tackifier for Cellulose Fiber Applications – apply dry tackifier to water tank at the following rates unless the Manufacture recommends a greater rate of application:

1. Slopes Flatter Than 1V:2H - 60 pounds per acre mixed with hydromulch fibers at the rate specified.

2. Slopes of 1V:2H or Steeper - 100 pounds per acre mixed with hydromulch fibers at the rate specified.

3.6 MECHANICAL SEEDING

A. Seeding, fertilizing, and covering: The following may be used to stabilize small, disturbed areas that are 1,500 square feet or less and totaling no more than 0.5 acre:

1. Seeds and fertilizer - Seed the disturbed area with the seed mix at the specified rate by mechanical spreader.

2. Cover - Cover seeded areas with one of the following:

    a. Straw mulch at a rate of 100 pounds per 1,000 square feet. Spread the mulch uniformly approximately 2 inches deep, in loose condition, which requires roughly 2-1/2 tons per acre of dry mulch. Do not use straw mulch on slopes of 1V:1.5H or steeper.

    b. Bark mulch spread uniformly at an approximate depth of 1/2-inch. Use well-decomposed mulch for seed mulching. Do not use bark mulch on slopes of 1V:1.5H or steeper.

    c. Suitable open-weave, biodegradable erosion control matting installed according to Manufacturer's instructions.

3.7 SEEDING OVER MULCHED AREAS

A. If an area has been previously mulched for erosion control or temporary seed and mulch is present on the soil surface, double the pound rate for each seed type used. Apply seed and fertilizer hydraulically or mechanically and add a green dye to the mixture to visibly aid uniform application. Upon approval, fertilizer and seed may only be applied after mulching if one of the following conditions apply:

    1. Mulch is punched into the soil by mechanized means. Avoid heavy equipment that may compact the soil. Roll seeded area with roller not exceeding 112 pounds/linear foot.

    2. Mulch that is held down with netting or like material

    3. Mulch is removed prior to seeding.

3.8 WORK QUALITY

A. After application, apply water with fine spray immediately after each area has been hydroseeded Apply water with fine spray immediately after each area has been mulched.

B. Drift - Prevent drift and displacement of seed and fertilizer regardless of equipment and methods used.

C. Displacement - Prevent seed, fertilizer, and mulch from falling or drifting onto other areas where grass is detrimental. Remove material that falls on plants, roadways, gravel shoulders, structures, and other surfaces where material is not specified.

D. Damage - Prevent damage to prepared areas and to completed fertilizer, seed, and mulch work. Replace all material that becomes displaced before acceptance of the work.

3.9 MAINTENANCE

A. Control growth of weeds.

B. Weed Control - Remove specified weeds prior to plants going to seed and keep weed control and seeded areas "Weed Free" throughout the Establishment Period.

C. Immediately reseed areas showing bare spots.

D. Repair washouts or gullies.

E. Protect seeded areas with warning signs during maintenance period.

F. Ensure that each seeded area has a uniform, healthy and weed-free stand of grass or other seeded plants growing at the end of the Establishment Period. The minimum living plant coverage standards for acceptance of seeding in a planted area are as follows:

1. Temporary Seeding:

    a. West of the Cascades - 70 percent coverage of ground surface.
    b. East of the Cascades - 30 percent coverage of ground surface.

2. Permanent Seeding:

    a. West of the Cascades - 90 percent coverage of ground surface.
    b. East of the Cascades - 30 percent coverage of ground surface.

3. Wetland Seeding - 70 percent coverage of ground surface.

4. Water Quality Seeding - 100 percent of ground surface.

G. Protection - Protect seeded areas from trespass and other hazards of damage. Use protective fences and signs at no additional cost to the OWNER. Obtain approval of protective methods used.

H. Fertilizing and Watering - Apply fertilizer according to grass and soil requirements. Apply water according to good horticultural practice under the prevailing conditions, as required to promote a healthy stand of plants. Obtain water at no additional cost to the OWNER.

I. Mowing – If mowing is required, do the first mowing of grass when soil is firm enough to prevent rutting and grass is about 3 inches tall. After mowing, leave grass that is approximately 2 inches tall. At each subsequent mowing, leave about 1-1/2 inches of growth. After the second mowing, grass clippings may be left in place upon written approval.

J. Repair and Restore - Repair and restore soil grades and re-seed damaged, settled, or unproductive areas to the specified conditions of this Section at no additional cost to the OWNER.

K. Finishing and Cleaning Up Cleanup - Remove weeds, trash, debris, stones, and other extraneous matter from seeded areas as directed and dispose of.

END OF SECTION

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SECTION 32 93 00 - PLANTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Furnishing all labor, materials and equipment for installation of landscape planting as shown on the drawings and as specified.

B. Related Sections include the following:

1. Section 32 91 13, Soil Preparation
2. Section 32 92 21, Finish Grade and Seeding

1.3 DEFINITIONS

A. The following publications, referred to thereafter by basic designation only, form a part of this specification to the extent indicated by references:

1. STANDARDIZED PLANT NAMES, 1942 Edition, published by J. Horace McFarland Company.

2. FLORA OF THE PACIFIC NORTHWEST; by Hitchcock and Cronquist, latest edition,

3. Federal Standard for Fertilizers - Mixed, Commercial: FS0-F-241D

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1, latest edition, for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum-laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1, latest edition.

C. Balled and Potted Stock: Exterior plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1, latest edition, for type and size of plant required.

D. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1, latest edition, for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during

shipping and be sized according to ANSI Z60.1, latest edition, for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1, latest edition, for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Groundcover: Low woody or herbaceous plants generally less than 24 inches high at maturity or per jurisdictional definition.

I. Healthy (Plants): Plants that are growing in a condition that expresses leaf size, crown density, color, and with annual growth rates typical of the species and cultivar's horticultural description, adjusted for the planting site conditions, drainage and weather conditions.

J. Kinked root: A root within the root package that bends more than 90 degrees.

K. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

L. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.4 SUBMITTALS

A. Submit certifications, or samples of material requested for substitution.

B. A maximum of 1 month after the Contractor receives the authorization to proceed, the Contractor shall submit to the Owner's Representative, copies of all nursery invoices for plant materials to be used on site. The copies must indicate source of supply by name, address and phone number, order invoice number, and size and quantity for each species or variety ordered.

C. Inspection certificates:

1. All plant material shall meet requirements of State and Federal laws with respect to inspection for plant diseases and infestation.

2. Inspection certificates required by law shall accompany each shipment of plant materials and be submitted to the Owner's Representative.

1.5 QUALITY ASSURANCE

A. Work and material supplied shall comply with applicable requirements of the United States Department of Agriculture (USDA).

B. The Contractor shall protect all materials, at all times during handling, shipping and storage, from extreme weather conditions, wind, drying of roots or root ball injury.

1. Store fertilizers in a dry place and protect from intrusion of moisture.

2. Deliver plants at the time of planting, and handle with proper horticultural practice.

C. Plant materials showing damage from handling, shipping or during planting shall be rejected by the Owner's Representative and shall be replaced by the Contractor at their expense.

D. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in the latest edition of ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Owner's Representative, who will tag plants at their place of growth before they are prepared for transplanting.

E. Tree and Shrub Measurements: Measure according to ANSI Z60.1, latest edition, with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

F. Observation: Owner's Representative may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Owner's Representative retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site and replace.

G. Store fertilizers in a dry place and protect from intrusion of moisture.

H. Planting

1. All landscaping work shall be done under the supervision of a Contractor currently licensed in landscape construction, under respective jurisdictions, and having a minimum of two years of experience in landscape construction. All work shall be done in accordance with proper horticultural practices and hereinafter described.

2. Installer's Personnel Certifications: Certified Landscape Technician, CLT-Exterior or Certified Ornamental Landscape Professional, COLP.

I. Herbicide Application

1. Application of herbicides for weed control as may be required shall be made only by an applicator currently licensed under this state's law.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver exterior plants freshly dug.

B. Do not prune trees and shrubs before delivery, except as approved by Owner's Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to

destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock. Soak roots in water for two hours if dried out.

2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS AND COORDINATION

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Planting Season: West of Cascade Mountains, September 1 – May 15, unless otherwise specified; container grown materials located in irrigated areas may be planted at other times depending upon written approval by Owner's Representative.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions are between 35- and 80-degrees Fahrenheit and soil conditions are not saturated.

C. Coordination with seeded, plugged and sodded areas: Plant trees and shrubs after finish grades are established and before seeding, plugging and sodding designated areas, unless otherwise acceptable to Owner's Representative.

1. When planting trees and shrubs after seeding, plugging and sodding, protect these areas and promptly repair damage caused by the planting operations.

D. The Contractor shall coordinate planting work with soil preparation.

1.8 PLANT MATERIALS SUBSTITUTION

A. Plants, not specifically named in the plant list, will not be accepted unless specifically accepted in writing by the Owner's Representative.

B. Substitutes proposed for approval, in each case, shall possess the same essential characteristics as the kind of plant actually specified in regard to appearance, ultimate height, shape, and habit of growth, general soil, and other environmental requirements.

1.9 WARRANTY

A. The establishment and warranty periods for all types of plantings shall be initiated upon the Owner's Representative acceptance of the work and for the period of time listed below.

B. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

C. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

D. General: The contractor shall provide a warranty for the vibrant and healthy survival of 100% of the trees through the warranty period. The contractor shall provide a warranty for the vibrant and healthy survival of 100% of the shrubs, vines and ornamental grasses through the warranty period. The contractor shall provide a warranty for the vibrant and healthy survival of 100% of the ground covers, biennials and perennials through the warranty period. The contractor shall replace all plants that have died, are dying or are not demonstrating vibrant and healthy growth, as determined by the Owner's Representative, immediately upon discovery by the contractor or direction from the Owner's Representative within the same period as the initial installation. The warranty shall be extended 12 months as originally specified for those plants which are replaced, beginning form the date of replacement. The replaced plants shall be of the same species and size as originally specified. Such replacement shall be made in the same manner as specified for the original plantings, and at no extra cost to the Owner. The replacement will be for one time as long as the contractor meets the requirements of these specifications and as reviewed by the Owner's Representative.

E. Warranty Guarantee

1. The contractor shall provide a financial instrument as a warranty guarantee in the amount of 100 percent of the contract amount (including all labor, equipment and materials). Acceptable instruments for the warranty guarantee are as follows:

    a. A warranty guarantee incorporated with the performance guarantee
    b. A warranty maintenance bond.
    c. Cash deposit with the Owner.

PART 2 PRODUCTS

2.1 TREES, SHRUBS AND GROUNDCOVER

A. General species, variety, quantity, size and condition of plant will be provided as indicated on the drawings.

Plant material shall be supplied, but not limited to form and conditions defined as follows:

Rhizome:	Section of root or stolon
Propagules:	Section of stem
Bulb:	Single bulb mass
Plug:	Rooted Cutting
Aquatic container:	Water filled container for floating plants

Seedling:	Rooted tree or shrub
Tubeling:	Rooted tree or shrub in single tube
Bare Root:	Shrub or tree with soil removed from root mass
Cutting:	Stem cut from parent stock
Ball and Burlap:	Tree or shrub with excavated root ball wrapped and tied
Container:	Standard pot or bag, per ANSI standard sizing.

B. Nomenclature shall conform to "Standardized Plant Names."

C. Quality definitions, grading tolerances, and caliper to height ratios no less than minimum specified in ANSI Z60.1.

D. Plant material shall be healthy nursery stock, well branched, full foliated when in leaf, free from disease, injury, insects, all weeds and weed roots.

E. Cold storage plants shall not be permitted.

F. Plant materials shall be nursery-grown unless otherwise specified. Nursery-grown plants shall have been growing continuously in licensed nurseries for the following minimum number of growing seasons:

Plant Materials	Time in Nursery
Evergreens and conifers	Two growing seasons
Deciduous	One growing season
Groundcover and Vines	One growing season

G. Balled and burlapped (B&B) stock shall be furnished with natural ball.

H. Potted and container stock shall be well rooted, vigorous enough to ensure survival and exhibit healthy growth.

I. Container stock shall have been growing in its container for a minimum of six (6) months and a maximum of two (2) years, with roots filling the containers but not showing evidence of being or having been root bound.

J. Trees: Provide untapped, straight, single-leader trees.

K. Plant materials shall be free from disease, insects, disfiguring knots, sun scale, injuries, bark abrasion, evidence of improper pruning and other objectionable disfigurements.

L. Trees and shrubs shall have all developed branching system; shrubs shall have full foliage and shall not be leggy.

M. Thin, weak, leggy, or misshapen plants will be rejected by the Owner's Representative.

N. Labels: The correct horticultural name, size and caliper and/or other data, as specified in the Plant Material List, written on durable labels in weather-resistant ink, shall be securely attached to all individually shipped plants and to each box, bundle, bale and container of plant

materials. Labels shall remain on representative plant materials until final acceptance of planting. Labels shall be affixed in such a manner that will not girdle the plant materials.

O. The species (botanical and common names), size, manner in which the plants are furnished, and spacing of the required plant materials, are noted on the planting plan.

P. The quantities of plant materials shall be as determined by the Contractor in accordance with the specified spacing, or location on plan. Surplus or shortages of plant quantities shall be the responsibility of the Contractor.

2.2 TREE STABILIZATION MATERIALS

A. Stakes and Guys:

1. Upright and Guy Stakes: Rough-sawn, sound, new softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.

2. Retain one of first two subparagraphs below.

3. Flexible Ties: Wide rubber or elastic bands or straps of length required to reach stakes.

2.3 WATER

A. Water shall be suitable for irrigation, free from oil, acid, alkali, salt or other substances harmful to plant life.

2.4 MULCHES

A. Fir and/or hemlock bark, 1-inch minus size with less than 30% bark finer than 1/4-inch size. Sawdust and wood shavings will not be acceptable.

2.5 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA C2, with waterborne preservative for soil and freshwater use, acceptable to authorities having jurisdiction, and containing no arsenic; including ammoniacal copper arsenate, ammoniacal copper zinc arsenate, and chromated copper arsenate.

B. Root Barrier: Black, molded, modular panels manufactured with 50 percent recycled polyethylene plastic with ultraviolet inhibitors, 85 mils thick, with vertical root deflecting ribs protruding 3/4 inch out from panel, and each panel 24 inches high and wide.

C. Anti-desiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

D. Burlap: Non-synthetic, biodegradable.

E. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb. of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb. of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 EXECUTION

3.1 INITIAL INSPECTION OF PLANT MATERIAL

A. All plant materials must be inspected by the Owner's Representative before planting. All plant material shall be free from insects, diseases, and injuries and sizing shall be equal to or exceeding measurements specified. Transport and handle all materials in strict accordance with proper horticultural standards. The Contractor shall provide plants with habit and growth that is normal, sound, healthy and vigorous.

B. All plant materials not meeting specification requirements shall be rejected.

C. All native plants shall be nursery stock except hardwood cuttings. Nursery stock shall be grown from propagules or seed collected from western Oregon or western Washington sources only. Plants from off-site collection sources shall not be allowed, unless otherwise approved by the Owner's Representative.

D. Hardwood cuttings, as identified on the plant list, shall be taken from healthy, vigorous, one to three-year old, plants grown in full sunlight and obtained from the respective watershed identified by the Owner's Representative. Cuttings shall be from 1 to 2 feet in length and between ¼ and ¾ inches in diameter, as shown on plans. Each piece shall contain a minimum of two dormant buds per foot of length. Period of collection shall be at dormancy and at the optimum time per proper horticultural standards for cutting establishment.

3.2 PLANT BED PREPARATION

A. Prepare plant beds as directed in Section 32 91 13, Soil Preparation.

3.3 PLANT LAYOUT AND INSPECTION

A. Layout of major planting areas as indicated on the plans are approximate only, and the locations and identity of all trees, shrubs, ground covers and other plantings shall be outlined in the field by the Contractor, subject to review and approval by the Owner's Representative.

B. Inspection: The Contractor shall notify the Owner's Representative forty-eight (48) hours prior to beginning any planting. The Owner's Representative may adjust plant material location to meet field conditions. Planting shall not occur until the Owner's Representative has approved the location and layout of all plant beds.

3.4 TREES, SHRUBS, GROUNDCOVER AND OTHER PLANTINGS

A. Plant trees and shrubs upright and adjust to set best appearance or relationship to adjacent plants and structures. Shrubs and groundcovers shall be planted one half the distance from curbs, sidewalks, buildings and other objects, as specified in the spacing requirements.

Native Plant material shall be planted with regard to condition specified on plan, per, but not limited to the following:

Rhizome:	Cut into soil surface within 2 inches of surface
Propagule:	Cut into soil surface within 2 inches of surface
Bulb:	Set into soil 4 inches- 6 inches deep; point up
Plug:	Placed into soil at size of root mass
Aquatic container:	Dispersed into open water surface
Seedling:	Cut into soil as deep as root mass, compacted
Tubeling:	Cut into soil as deep as root mass, compacted
Bare Root:	Placed into plant pit sufficient for root mass, compacted
Cutting:	Dibble into soil per cutting installation detail on plan
Ball and Burlap:	Placed into plant pit twice the size of root ball, compacted
Container:	Placed into plant pit twice the size of container

B. Planting dates:

1. Planting of burlapped and container stock: Feb.15 - May 15, Oct. 1-Nov. 15.

C. Excavation for planting

1. Stockpile all excavated topsoil for planting operations.

2. In digging pits for trees, the contractor shall separate sod, topsoil suitable for backfill, and subsoil, and shall dispose of the sod, rocks and unsuitable material off-site.

3. Diameter or minimum width of planting pit or trenches shall be as shown on the drawings.

4. If standing water is encountered during excavation of the planting pits, the Contractor shall notify the Owner's Representative who will determine the corrective drainage measures required.

5. If underground obstructions or rocks are encountered in excavation of planting areas making it impossible to plant materials as shown on the contract documents, an alternate location for the planting shall be selected by the Owner's Representative.

6. Excess excavated topsoil shall be used to form saucers around plants as detailed. Soil not required or suitable for the above usage shall be properly disposed of off the project site.

7. Root crown to be visible before tree is set. Remove top of root ball media to locate if needed.

8. Burlap, twine and metal basket to be cut and removed entirely down to base of rootball after tree is set (material on bottom can remain). If rootball is unstable or breaking, only remove the top 12" of burlap.

9. Staking to remain no more than two years unless Owner's Representative directs longer staking period. Maintain 2" strap slack around trunk.

D. Cutting: Cut off cleanly all broken or frayed roots, smaller than 1/2 inch caliper.

E. Prior to completing backfilling, the upper two-thirds of the plant pit shall be flooded with the plant starter solution. Allow solution to soak away. Finish filling holes to finish grade and lightly compact soil around root ball.

F. Placement and compaction: Place and compact backfill soil mixture carefully to avoid injury to roots; fill all voids.

3.5 SHRUBS AND GROUNDCOVER PLANTING BED GRADES

A. Establish finish grades and slopes in accordance with finish grades as specified.

3.6 MULCHING

A. Mulch all shrubs and ground cover planting beds with a 2 inch layer of mulch material within two (2) days after planting. Cover entire bed areas; apply evenly. A 2 inch layer of mulch material shall be applied to saucer areas of trees and shrubs located outside of planting beds.

3.7 TREE STABILIZATION

A. Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension shown on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.

2. Use two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees above 12 feet high.

3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways unless otherwise shown on Drawings. Length shall be 6’each side of tree center (12’ total length).

3.9 ANTIDESICCANT

A. The application of the antidesiccant shall be prior to transplanting as a spray or during planting as a dip. The antidesiccant shall not be applied if rain is anticipated in one hour or less. If not previously applied, the Contractor shall, within 24 hours of completing backfilling, spray all evergreen and leafed-out deciduous plants with the antidesiccant thoroughly covering all leaves. The solution shall be mixed according to manufacturer's specifications.

3.10 PRUNING

A. Pruning shall be done at or after the time of planting in accordance with proper horticultural practice.

B. Pruning shall be limited to the minimum necessary to remove injured twigs and branches and to compensate for the loss of roots during transplanting but shall never exceed one-half of the branching structure.

1. Crossed or rubbing branches shall be removed providing the natural shape of the tree is preserved.

2. All cuts shall be made flush with the parent stem leaving no stubs. Pruning cuts shall be made in a manner to favor the earliest possible covering of the wound by callus growth. Cuts that produce large wounds and weaken the tree will not be acceptable. Evergreens shall not be pruned except to remove injured branches and/or double leaders. The use of pole shears and/or hedge shears for pruning deciduous and evergreen trees will not be permitted. All trimmings and other debris left over from the planting operations shall be collected and disposed of legally off the site.

C. With the permission of the Owner's Representative, pruning may be done before delivery of plants, but not before plants have been inspected and accepted.

3.11 CLEANUP

A. Keep premises free from accumulation of debris.

B. At completion of each area of work, remove all debris, equipment and surplus materials

END OF SECTION

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DIVISION 33 - UTILITIES

SECTION 33 05 50 - EXISTING PIPE ABANDONMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the removal of existing buried piping and abandonment in place of existing buried piping.

B. Section includes:

1. Pipe removal.

2. In-place abandonment of pipe.

C. Related Sections:

1. Section 03 60 00, Grouting.

2. Section 31 23 16, Excavation.

3. Section 31 23 17, Trenching.

4. Section 31 23 19, Dewatering.

5. Section 31 23 23, Fill.

6. Section 31 23 24, Flowable Fill.

1.2 SUBMITTALS

A. Provide all submittals in accordance with Section 01 33 00, Submittal Procedures.

B. Piping Abandonment Plan:

1. Identify locations specified for pipe abandonment.

2. Provide method to be utilized to abandon the pipe, including whether the pipe will be left in place or removed in its entirety.

C. Non-Shrink Grout: Product data in accordance with Section 03 60 00, Grouting.

D. CLSM: Mix designs in accordance with Submittal requirements of Section 31 23 24, Flowable Fill.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Permits: The Contractor is responsible for obtaining all necessary permits required for completion of the work described herein.

B. Protection of Persons and Property: Meet all federal, state, and local safety requirements for the protection of workmen, other persons, and property in the vicinity of the work and requirements of the General Provisions.

1.4 PROTECTION OF EXISTING WORK

A. Carefully examine the Contract Documents to determine the extent of the work of this Section.

B. Carefully coordinate the work of this Section with all other work and construction.

C. Take all necessary precautions to prevent damage to existing facilities or utilities which are to remain in place and be responsible for any damages to existing facilities or utilities, which are caused by the operations.

1.5 REPAIR OF DAMAGE

A. Work procedures shall provide for safe conduct of the work; careful removal and disposition of materials and equipment; protection of facilities, utilities and property which are to remain undisturbed; coordination with existing facilities and utilities to remain in service.

B. Any damage to existing facilities or utilities to remain as caused by the Contractor's operations shall be repaired to acceptance of Engineer.

C. Damaged items shall be repaired or replaced with new materials as required to restore damaged items or surfaces to a condition equal to and matching that existing prior to damage or start of work of this contract.

1.6 EXISTING CONDITIONS

A. If the pipe material contains any hazardous materials, such as asbestos, requiring special handling upon removal, it is the responsibility of the Contractor to remove and dispose of the material in accordance with all applicable federal, state, and local regulations.

PART 2 PRODUCTS

2.1 OWNERSHIP OF EXISTING MATERIALS

A. All materials, equipment, miscellaneous items, and debris involved, occurring, or resulting from pipe removal work shall become the property of the Contractor at the place of origin, unless otherwise specified in the Drawings or by the Engineer.

2.2 CONTROLLED LOW STRENGTH MATERIAL

A. As specified in Section 31 23 24, Flowable Fill.

PART 3 EXECUTION

3.1 PIPE REMOVAL

A. Where identified on the Drawings, remove, and dispose of all pipe material and associated appurtenances.

1. All fire hydrants, air release valves service lines and appurtenances being abandoned shall be removed to 36 inches below finished grade.

2. Existing service line appurtenances, including valve and meter boxes, shall be removed to 36 inches below finished grade.

B. All exposed ends of pipes and fittings to remain in service shall be capped or plugged with an appropriate ductile iron blind flange, cap or plug and restrained.

1. A pipe shall be considered in service if it is possible to flood the pipe with water by opening valves in the water system.

C. All excavation and backfilling associated with pipe removal shall be performed in accordance with 31 23 17, Trenching.

3.2 IN-PLACE ABANDONMENT OF PIPING

A. Where identified on the Drawings, abandon pipe in place.

B. All exposed ends of pipes being abandoned in place shall be cut and plugged with a minimum of two (2) feet of non-shrink grout.

C. Prior to placing grout, roughen interior pipe surface and apply epoxy bonding agent.

3.3 FILLING PIPE WITH CLSM

A. Where identified on the Plans, pipes to be abandoned-in-place shall be filled with CLSM.

B. CLSM shall be placed in a manner to ensure complete filling of the pipe, leaving no cavities or voids.

C. Install hot taps, saddles, fill lines and appurtenances as necessary for pumping CLSM from the surface into the pipe being filled.

D. CLSM shall be pumped up grade from fill lines rigidly connected to the pipes being filled.

E. Placement of CLSM by free flowing (non-pumped) methods will not be acceptable.

F. Fill lines shall be located at elevations lower than the pipe being filled.

G. As the CLSM is being placed, use other fill lines as view ports to ensure complete filling of the pipes.

H. Relocate pumping equipment as necessary to complete filling of the pipes.

I. Excavate and cut access holes in the pipes as necessary to complete filling operations.

J. Perform pipe filling operations in a manner to eliminate all air pockets.

K. Submit volume calculations for CLSM placed in each filled segment of piping to verify that pipelines have been completely filled.

3.4 CLEANUP

A. During and upon completion of work of this Section, promptly remove all unused tools and equipment, surplus materials, and debris.

B. Adjacent areas shall be returned to their existing condition prior to the start of work.

END OF SECTION

SECTION 33 05 64 - PRECAST CONCRETE VALVE VAULTS AND METER BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete valve vaults.
2. Precast concrete meter boxes.

B. Related Section:

1. Section 05 50 00, Metal Fabrications
2. Section 31 05 16, Aggregates for Earthwork
3. Section 31 23 16, Excavation
4. Section 31 23 23, Fill
5. Section 33 11 10, Water Utility Distribution and Transmission Piping
6. Section 33 31 10, Sanitary Utility Sewerage Piping
7. Section 33 41 10, Storm Utility Drainage Piping

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
3. ASTM A536 - Standard Specification for Ductile Iron Castings.
4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
5. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
6. ASTM C33 - Standard Specification for Concrete Aggregates.
7. ASTM C150 - Standard Specification for Portland Cement.
8. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
9. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

10. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.

11. ASTM C890 - Standard Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures.

12. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

13. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

14. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).

15. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).

16. ASTM D4104 - Standard Test Method (Analytical Procedure) for Determining Transmissivity of Nonleaky Confined Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Tests).

17. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 COORDINATION

A. Coordinate Work with utilities within construction area.

B. The drawings identify precast vaults and meter boxes by Manufacturer and model number. This information is provided for dimensional information only. Provide precast items in accordance with the requirements of this Section.

1.4 NOT USED

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on valve vaults and meter boxes.

C. Shop Drawings for Precast Concrete Valve Vaults:

1. Indicate plan, location, and inverts of connecting piping.

2. All interior and exterior dimensions.

3. Location and type of lifting inserts, connection embeds, and joints.

4. Details of reinforcement.

5. Covers or hatches.

6. Ladders and grating.

D. Manufacturer's Certificate: Certify that precast concrete valve vaults and meter boxes meet or exceed ASTM standards and specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations and inverts of buried pipe, components, and connections.

1.7 QUALITY ASSURANCE

A. Perform Work according to standards identified in Article 1.2 herein.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Transport and handle precast concrete units with equipment designed to protect units from damage.

C. Storage:

1. Store precast concrete valve vaults and meter boxes according to Manufacturer instructions.

2. Do not place concrete units in position to cause overstress, warping, or twisting.

PART 2 PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Performance and Design Criteria:

1. Watertight, Precast, Reinforced, Air-Entrained Concrete Structures:

a. Manufactured to conform to ASTM C913.

2. Loading:

a. Design to ASTM C890-A16 / AASHTO HS20 live loading and installation conditions.

b. Where vaults are below grade, a dead load of 125 pounds per cubic foot shall be added for the soil.

c. Lateral loads:

1) Static: 105 x Depth of fill per square foot (psf) triangular equivalent fluid pressure plus a surcharge of an additional 3 feet of soil depth in areas subject to vehicular traffic (assume traffic load in all areas, unless indicated otherwise by the Contract Documents).

2) Seismic acceleration: UBC Zone 3 requirements (I = 1.25) where I = importance factor, I = 1.25, but not less than 0.20 grams (g) acting on structure mass. Seismic loading need not be considered simultaneously with traffic surcharge.

3. Minimum 28-Day Compressive Strength: 3,000 pounds per square inch (psi).

4. Honeycombed or re-tempered concrete is not permitted.

5. No knockouts shall be cast into vault walls. All pipe penetrations shall be pre-formed or core-drilled at the required locations.

6. Accessories: Accessories such as ladders, floor grates at sumps, and other features shall be provided as shown on the Drawings.

7. Size: Vault dimensions shall be as required by the Drawings.

2.2 PRECAST CONCRETE VALVES AND METER BOXES

A. Manufacturers:

1. Manufacturer shall be Oldcastle Precast Inc. or approved equal.

B. Valve Vault and Meter Box Frames and Covers:

1. Cast Iron Castings:

a. ASTM A48, Class 30 or better.

b. Free of bubbles, sand, air holes, and other imperfections.

C. Access Steps:

1. Steel reinforced formed polypropylene:

a. ASTM C478

b. Reinforced rod: ASTM A615, Grade 60, 1/2-inch diameter

2. Aluminum: ASTM B221, Alloy 6061-T6

3. Width: Minimum 12 inches

4. Spacing: 12 inches on center vertically.

2.3 ACCESS HATCHES AND LIDS

A. Unless noted otherwise elsewhere in the Contract Documents, vaults shall have concrete top slabs with access openings as shown on the Drawings.

B. Vault Manufacturer shall provide the access hatches per the requirements of Section 05 50 00, Metal Fabrications.

C. Lids shall have lifting holes.

D. When leveling bolts are used to set the vault top sections, ensure the load from the top slab is transferred through grout to the vault walls so that the load is not carried by the leveling bolts.

2.4 MATERIALS

A. Portland Cement:

1. ASTM C150, Type II

B. Coarse Aggregates:

1. ASTM C33

2. Graded 1 inch to No. 4 sieve

C. Sand:

1. ASTM C33

2. Fineness Modulus: 2.35

D. Water:

1. Potable.

2. Clean and free of injurious amounts of acids, alkalis, salts, organic materials, and substances incompatible with concrete or steel.

E. Air-Entraining Admixtures: ASTM C260

F. Reinforcing Steel:

1. Deformed Bars: ASTM A615, Grade 40 minimum

2. Welded Wire Fabric: ASTM A185

G. Gaskets:

1. Rubber gaskets: ASTM C443

H. Joint Sealant:

1. ASTM C990

I. Bedding:

1. Aggregate Bedding Material: Fill Type A1 as specified in Section 31 05 16, Aggregates for Earthwork. Size as shown in the Drawings.

2.5 FABRICATION

A. Fabricate precast reinforced concrete structures according to ASTM C913, to dimensions indicated on Drawings, and to specified design criteria.

B. Vaults may be formed with separate top and bottom slabs.

C. Walls shall be cast so that all sides are continuous at corners and their full length with no block-outs or knockouts.

D. Horizontal joints may be provided so that walls can be placed in horizontal segments.

E. All horizontal joints shall be keyed to prevent offsets and shall be provided with a watertight gasket.

F. Finish:

1. Formed surfaces shall be smooth and uniform with no fins, bulges, or other irregularities.

2. Any void greater in width than 1/2-inch or deeper than 3/8-inch shall be repaired.

3. Unformed interior slab surfaces shall have a smooth steel trowel finish.

4. Unformed exterior slab surfaces shall have a light broom finish applied to a steel trowel finish.

2.6 MIXES

A. Design concrete mix to produce required concrete strength, air-entrainment, watertight properties, and loading requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping connections, sizes, locations, and inverts are as indicated on Drawings.

3.2 PREPARATION

A. Ream pipe ends and remove burrs.

B. Remove scale and dirt from components before assembly.

C. Establish invert elevations for each component in system.

D. Hand trim excavation to suit valve vaults and meter boxes; remove stones, roots, and other obstructions.

3.3 INSTALLATION

A. Vaults/Meter and Bedding:

1. Excavate as specified in Section 31 23 16, Excavation for Work of this Section.

2. Hand trim excavation for accurate placement of vaults and meter boxes to elevations indicated.

3. Place bedding material level in one continuous layer to a minimum compacted depth of 6 inches.

4. Compact bedding material to 95 percent maximum density.

5. Bases for precast concrete structures shall be set level so that bedding material fully and uniformly supports them in true alignment with uniform bearing throughout full perimeter. Do not level bases by wedging gravel under the edges.

6. Backfill around sides of vaults and meter boxes as required by the Drawings.

B. Connect piping.

3.4 FIELD QUALITY CONTROL

A. Request examination of subgrade by Engineer prior to placing aggregate base under precast materials.

B. Compaction Testing: In accordance with Field Quality Control requirements of Section 31 23 23, Fill.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

D. Frequency of Compaction Tests: In accordance with Section 01 45 00, Quality Control.

END OF SECTION

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SECTION 33 11 10 - WATER UTILITY DISTRIBUTION AND TRANSMISSION PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Work under this Section applies to furnishing and installation of pipe materials, fittings, and appurtenances normally encountered with water distribution and transmission systems, including potable water and fire water systems.

B. Section includes:

1. Pipe and fittings
2. Flexible couplings
3. Flanged coupling adapters
4. Insulating flanged joints
5. Tapping sleeves and valves
6. Flexible expansion joints
7. Bedding and cover materials

C. Related Requirements:

1. General

a. Furnish and install all piping systems shown and specified in accordance with the requirements of the Contract Documents.

b. Each buried piping system shall be complete, with all necessary fittings, valves, accessories, lining and coating, testing, excavation, backfill and encasement, to provide a functional installation.

c. Piping layouts shown in the Drawings are intended to define the general layout, configuration, and routing for pipe, as well as the size and type of piping to be installed. The piping plans are not pipe construction or fabrication drawings.

d. The Contractor shall cause the Supplier of pipes, valves, fittings, and appurtenances to coordinate piping installation such that all equipment is compatible and is capable of achieving the performance requirements specified in the Contract Documents.

e. It is the Contractor's responsibility to develop the details necessary to construct all piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, valves, gaskets, fittings, appurtenances etc., for a complete and functional system.

D. Related Sections:

1. Section 03 11 00 - Concrete Work
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 16 - Excavation
5. Section 31 23 17 - Trenching
6. Section 31 23 23 - Fill
7. Section 31 23 24 - Flowable Fill
8. Section 33 05 64 - Precast Concrete Valve Vaults and Meter Boxes
9. Section 33 12 13 - Water Service Connections
10. Section 33 12 16 - Water Utility Distribution and Transmission Valves
11. Section 33 12 19 - Fire Hydrants
12. Section 33 13 00 - Testing and Disinfecting of Water Utility Piping

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop

B. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2. ASME B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy, and other Special Alloys
3. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
4. ASME B31.10 - Standards of Pressure Piping

C. ASTM International (ASTM):

1. ASTM A36 - Standard Specification for Carbon Structural Steel
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
3. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
4. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength

5. ASTM A536, Standard Specification for Ductile Iron Castings.

6. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3))

7. ASTM D1598 - Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

8. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

9. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

10. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)

11. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

12. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

13. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

D. American Water Works Association (AWWA):

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems

3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings

4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges

6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast

7. AWWA C153 - Ductile-Iron Compact Fittings

8. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe

9. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

10. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

11. AWWA C606 - Grooved and Shouldered Joints

12. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm), for Water Transmission and Distribution

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves

F. NSF International (NSF):

1. NSF Standard 61 - Drinking Water System Components – Health Effects

2. NSF Standard 372 - Drinking Water System Components – Lead Content

3. NSF 600 – Health Effects Evaluation and Criteria for Chemicals in Drinking Water

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, restrained joint systems, and accessories.

C. Shop Drawings: Indicate piping layout, including piping specialties.

1. Layout Schedule for applicable segments of proposed transmission main alignment. Schedule shall include layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, pipe supports, and any special provisions required for assembly.

D. Lining and coating data.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer’s handling, delivery, storage, and installation requirements.

G. Field Quality-Control Submittals:

1. Pipeline hydrostatic testing plan.

2. Indicate results of Contractor-furnished tests and inspections.

H. Preconstruction Photographs:

1. Submit digital files of colored photographs of Work areas and material storage areas.

1.4 CLOSEOUT SUBMITTALS

A. As-Built Drawings:

1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Materials:

1. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

2. All material of a like kind shall be provided from a single manufacturer unless otherwise approved by the Owner's Representative.

3. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage, and handling.

B. Markings:

1. Pipes and Fittings: Mark each pipe and fitting at plant. Include date of manufacture, Manufacturer's identification, specification standard, inside diameter of pipe, dimension ratio as applicable, pipe class as applicable, pipe number for laying purposes as applicable, and other information required for type of pipe.

2. Bolting materials (washers, nuts, and bolts) shall be marked with material type.

C. Testing:

1. Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards.

1.6 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. In accordance with Manufacturer's written recommendations and as specified in these Contract Documents.

B. Pipe, specials, and fittings delivered to Project Site in damaged condition will not be accepted.

C. Storage:

1. Store and support pipe securely to prevent accidental rolling and to avoid contact with mud, water, or other deleterious materials.

2. Pipe and fittings shall not be stored on rocks, gravel, or other hard material that might damage pipe. This includes storage area and along pipe trench.

3. Do not store materials in direct sunlight.

4. Gaskets: Do not allow contact with oils, fuels, petroleum, or solvents.

D. Handling:

1. Pipe and appurtenances shall be handled in accordance with Manufacturer's recommendations or requirements contained in this section or subsequent sections dealing with the specific pipe material, whichever is more stringent.

2. Pipe shall be handled with proper equipment in a manner to prevent distortion or damage. Use of hooks, chains, wire ropes, or clamps that could damage pipe, damage coating or lining, or kink and bend pipe ends is not permitted.

3. Use heavy canvas, or nylon slings of suitable strength for lifting and supporting materials.

4. Lifting pipe during unloading or lifting into trench shall be done using two slings placed at quarter point of pipe section. Pipe may be lifted using one sling near center of pipe, provided pipe is guided to prevent uncontrolled swinging and no damage will result to pipe or harm to workers. Slings shall bear uniformly against pipe.

E. Pipe Plugs:

Provide and install a cap or plug on each end of pipe during transportation and onsite storage to protect linings and coatings from debris. Install watertight plug-in end of installed pipe at the end of the workday. Under no circumstances shall materials be dropped or dumped into the trench.

PART 2 PRODUCTS

2.1 WATER PIPING

A. General

1. All piping materials and specials shall meet the specifications of this Section and of the appropriate AWWA Standard Specifications. In the case of conflict, the more stringent specifications shall apply.

2. All coatings and materials specified herein which may come in contact with potable water shall conform to National Sanitation Foundation (NSF) Standard 61, 372 and 600.

3. Minimum Pressure Ratings: Unless otherwise specified herein or shown in the Drawings, the minimum working pressure rating of all water works materials specified herein shall be 1-1/2 times the operating pressure or 150 pounds per square inch (psi) minimum.

4. Gaskets:

a. Material: Styrene Butadiene Rubber (SBR) composition.

B. Ductile Iron Pipe:

1. Centrifugally cast, conforming to AWWA Standard C151.

2. Coating: Asphaltic exterior coating in accordance with AWWA Standard C151.

3. Pipe Mortar Lining: Shop-applied NSF 61 cement mortar lining, smoothed finish, complying with AWWA C104.

4. Pipe Thickness Class:

a. Comply with AWWA C151.

b. Class 52, unless shown to be greater in the Plans.

1) The Contractor shall be aware ductile iron piping with thickness class greater than Class 52 may have long fabrication and supplier lead times. The Contractor shall be responsible for coordinating product submittal and delivery times accordingly such as not to delay construction.

5. NOT USED

6. Polyethylene Encasement:

a. Comply with AWWA C105.

b. Polyethylene film shall be minimum 8-mil thick virgin linear low-density polyethylene (LLDPE).

c. Secure in place with 10-mil polyethylene tape

d. V-BIO Enhance Polyethylene Film shall be minimum 9-mil thick and provided where specified or shown on plans.

7. Joints:

a. Joint types shall be provided as identified in the Drawings and as required for the application.

b. Mechanical Joints:

1) Comply with AWWA C111.

c. Push-on Joints:

1) Comply with AWWA C111.

2) Manufacturers, without exception:

a) Tyton Joint by American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, and Pacific States Cast Iron Pipe.

b) Fastite Joint by American Cast Iron Pipe Company.

d. Restrained Joints:

1) Joint restraint for pipe shall be accomplished with an integral lock mechanism, except as may be otherwise specified.

a) Any such system shall be a manufacturer's standard proprietary design, shall be as recommended by the Manufacturer for the application, and shall be performance proven.

2) Restraining components:

a) Ductile iron complying with AWWA C110 and/or C153, with the exception of a manufacturer's proprietary design dimensions.

b) Push-on joints for such fittings shall comply with AWWA C111.

3) Deflection:

a) The maximum pipe deflection shall not exceed one-half of the Manufacturer's stated joint deflection allowance.

4) Manufacturers:

a) For pipe larger than 12"

(1) "TR Flex", United States Pipe and Foundry Company.

(2) "Flex-Ring", American Cast Iron Pipe Company.

b) For pipe 12" and smaller

(1) "Field-Lok", United States Pipe and Foundry Company.

(2) "Fast Grip", American Cast Iron Pipe Company.

(3) "TR Flex", United States Pipe and Foundry Company.

(4) "Flex-Ring", American Cast Iron Pipe Company.

c) For all pipe sizes

(1) Wedge-type Restraint System – "MEGALUG", EBBA Iron, Inc. or equal.

(a) Where any restrained joint system requires the use of a wedge-type mechanical restraint gland for restraint, the glands shall be provided in quantities as may be required and shall be considered incidental to the joint restraint system.

(b) Wedge-type mechanical restraining glands shall not be used to restrain the plain end of plain end ductile iron or cast-iron fittings.

5) "Foster Adaptor", Infact Corporation

a) Where specified, mechanical joint (MJ) valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of ductile iron conforming to ASTM A536, 65-45-12.

b) The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe.

c) The device shall come complete with all accessories, including standard styrene butadiene rubber (SBR) MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and weathering steel (Corten) bolts conforming to AWWA C111/A21.11 and ASTM A242.

d) Nuts for 3 through 12-inch sizes shall be SAE Grade 5 steel with black oxide coating. Nuts for 14-inch and larger adaptors shall be heavy hex Corten steel conforming to ASTM A242.

e) MJ positive restraining device shall be supplied with NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550.

f) The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves and shall be Infact Corporation FOSTER ADAPTOR or equal.

e. Flanged Joints:

1) Flat faced, complying with AWWA C111 and C115, unless otherwise specified.

2) Bolt hole drilling according to ASME/ANSI B16.1, Class 125, or ASME/ANSI B16.1, Class 250, where specified. Flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown.

3) The Contractor shall coordinate with pipe, valve, and fitting suppliers to make certain mating pipe, valve, and fitting flanges match in bolt pattern.

4) Pressure rating of flange joints shall not exceed the rating of the pipe or fitting of which they are a part, and the maximum pressure rating of the joint shall be 250 psi.

5) Flange joint connections shall not be exposed to test pressures greater than 1-1/2 times their rated working pressure.

6) Threaded flanges:

a) Ductile iron pipe spools with threaded flanges shall conform to AWWA C115.

b) Installed only on pipe with a minimum Class 53 wall thickness.

7) Buried flanges:

a) Flanged connections shall not be buried unless shown as such on the Drawings.

b) Buried flanges shall be wrapped with 2 layers of 10-mil tape along edges of flanges.

8) Gaskets:

a) Full faced, composed of synthetic rubber and 1/8-inch-thick conforming to ASME B21.1 and AWWA C111.

b) Ring gaskets will be permitted only where specifically noted in the Drawings and Specifications.

c) Gaskets for flanged joints shall be as follows:

(1) Pipe sizes between 6-inch and 24-inch diameter, service pressures of 150 psi or greater shall be Garlock 3760-U or equal.

(2) Pipe sizes 4-inch diameter and under, service pressures of 150 psi or greater shall be Garlock GYLON 3505 or equal.

(3) All pipe sizes with service pressures of 150 psi or less shall be Garlock 98206 or equal.

d) Gaskets for insulating flanged joints shall be as follows:

(1) Full faced, conform to ANSI 16.21.

(2) Material: Non-asbestos.

(3) Suitable for operating and test pressures of the pipe system.

(4) Manufacturer:

(a) Garlock GYLON 3505-or equal.

C. PVC:

1. All PVC pressure pipe shall be manufactured with an integral bell design capable of receiving an elastomeric gasket.

2. All PVC pressure pipe shall be dimensionally compatible with standard cast/ductile iron fittings produced according to AWWA C110 or AWWA C153, as applicable.

3. Deflection:

a. PVC pressure pipe may be deflected both horizontally and vertically at the joints after assembly.

b. Deflection by bending of the pipe rather than at the joints is not allowed.

c. The maximum pipe deflection shall not exceed one half of the Manufacturer's stated joint deflection allowance.

4. Joints:

a. Solvent-cement couplings are not permitted.

5. Gaskets: Comply with ASTM F477.

6. Size: 4-inch through 12-inch diameter

a. Comply with AWWA C900, DR 14, Class 305, unless shown otherwise in the Drawings or specified elsewhere.

7. Size: 14-inch through 48-inch diameter

a. Comply with AWWA C900, DR 18, Class 235, unless shown otherwise in the Drawings or specified elsewhere.

8. Restrained Joints:

a. For push-on pipe joint at pipe bells:

1) Material:

a) Body: Ductile iron. Comply with ASTM A536.

b) Bell Restraint Systems: Corten steel tie rods.

2) Coatings: Shop-applied liquid epoxy.

3) Construction:

a) A split serrated ring shall be used behind the pipe bell. A split serrated ring shall also be used to grip the pipe and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring.

b) System shall be designed for a minimum 2 to 1 safety factor.

4) Manufacturers:

a) 4-inch through 12-inch diameter: EBAA Iron, Inc. - Series 1900 Bell Restraint Harness.

b) 14-inch through 48-inch diameter: EBAA Iron, Inc. - Series 2800 Bell Restraint Harness.

b. At mechanical joint fittings:

1) Material: Ductile iron. Comply with ASTM A536.

2) Coatings: Shop-applied liquid epoxy.

3) Construction:

a) Restraint accomplished by a restraint device consisting of a follower gland utilizing multiple gripping wedges.

b) The restraint system shall have a sufficient number of fastening bolts to connect the ring to the mechanical joint.

c) System shall be designed for a minimum 2 to 1 safety factor.

4) Fasteners:

a) T-bolts and nuts: High strength, low alloy steel.

b) Comply with AWWA C111.

5) Manufacturers:

a) EBAA Iron, Inc. - MEGALUG, Series 2000PV

b) Romac Industries, Inc. – 470 Series Pipe Restraining System

2.2 FITTINGS

A. Material: Ductile iron, complying with AWWA Standard C110.

1. Fittings conforming to AWWA C153 may be substituted in lieu of AWWA C110 fittings.

B. Fittings used for joining ductile iron and PVC pipe shall be of the type, size, and strength designated on the Plans, elsewhere in the specifications.

1. Fittings shall be mechanical joint, push-on type, flanged or plain-end as required and shown on the Drawings.

2. All restraint systems and flanged fittings shall be provided with bolts and gaskets as specified herein.

C. Pressure ratings: As specified for joining pipe above and as shown on the Drawings.

D. Coating and Lining:

1. Asphaltic exterior coating in accordance with AWWA Standard C110.

2. Cement Mortar Lining: Comply with AWWA C104.

3. Wax Tape Coating System (Field Coating): Petrolatum wax tape coating system where specified or shown on drawings:

a. General: Apply a wax tape coating system generally per AWWA C217 and consists of three parts: surface primer, wax-tape, and outer covering. All three parts shall be the product of the same manufacturer.

b. The primer shall be a blend of petrolatum, plasticizer, and corrosion inhibitors having a paste like consistency. It shall have a pour point of 100-degrees F to 110-degrees F and a flash point of 350-degrees. Use Trenton Wax-Tape Primer or approved equal.

c. The wax-tape shall consist of a synthetic-fiber felt, saturated with a blend of high melt microcrystalline wax, solvents, and corrosion inhibitors, forming a tape coating that is easily formable over irregular surfaces and which firms up after application. The tape shall have a saturant pour point between 125-degrees F and 130-degrees F and a dielectric strength equal to a minimum of 100-volts per mil. Tape thickness shall be 50-mils to 90-mils in 6-inch-wide rolls. Use Trenton No. 1 wax-tape or equal.

d. The outer covering shall consist of two layers of a plastic wrapper at total of one 150 gauge or three 50 gauge wound together as a single sheet. The plastic wrapper material shall consist of clear polyvinylidene chloride, high cling membranes wound together as a single sheet. Use Trenton Poly-Ply or approved equal.

E. Following information cast upon fittings:

1. Manufacturer's identification.

2. Country of manufacture.

3. Pressure rating.

4. For bends, number of degrees and/or fractions of a circle.

F. Owner may require additional metallurgical documentation or other certifications.

2.3 NUTS, BOLTS, AND WASHERS

A. All bolts shall have heavy hex head with heavy hex nuts.

B. For operating pressures greater than 150 psi:

1. Bolts: Steel alloy composition. Comply with ASTM A193.

2. Nuts: Comply with ASTM A194, Grade 2H.

3. Washers: Comply with ASTM F436.

C. For operation pressures of 150 psi or less:

1. Bolts: Low-carbon steel composition. Comply with ASTM A307, Grade B.

2. Nuts: Comply with ASTM A563A, Heavy Hex.

3. Washers: Comply with ASTM F844.

D. Higher-strength bolts with higher torque values as specified above for operation pressures greater than 150 psi shall not be used for assembly of flange joints including gray-iron flanges.

2.4 FLEXIBLE COUPLINGS

A. General

1. All flexible couplings shall be constructed to inside diameters that properly fit the connecting pipes.

2. The Contractor shall be responsible for selecting sleeve lengths appropriate to the application, subject to review and approval of the Engineer, recognizing that longer sleeves allow for larger deflections and may ease installation.

B. Flexible Couplings:

1. Description:

a. Comply with AWWA C219.

b. Type: Bolted, sleeved.

c. Configuration: Straight, transition, or reducing as shown in the Drawings.

d. Center rings and end rings: Ductile iron. Comply with ASTM A536.

e. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

f. Bolts and nuts: High strength low alloy steel. Comply with AWWA C111.

g. Lining and coating: Factory-applied fusion bonded epoxy.

h. Working pressure: Up to 260 psi.

2. Manufacturers:

a. For 2-inch to 24-inch diameter:

1) Romac Industries, Inc. – Style 501 or equal.

b. For 12-inch diameter and larger:

1) Romac Industries, Inc. – 400 Series or equal.

C. Insulating Flexible Couplings:

1. The Contractor shall be responsible for selecting couplings appropriate to the application, subject to review and approval of the Engineer, recognizing that different pipe materials will require specific sizing and material selection for couplings.

2. Description:

a. Comply with Flexible Coupling specifications above.

b. Insulating Boot: Ethylene propylene diene monomer (EPDM) compounded for water service. Comply with ASTM D2000.

3. Manufacturers:

a. For 4-inch to 14-inch diameter:

1) Romac Industries, Inc. – Style IC501 or equal.

b. For 12-inch to 96-inch diameter:

1) Romac Industries, Inc. – Style IC400 or equal.

D. Restrained Flexible Couplings:

1. Description:

a. Body: Steel. Comply with ASTM A36.

b. Restrained gland: Ductile iron. Comply with ASTM A536, Grade 65-45-12.

c. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

d. Bolts and nuts: All-thread rod, at a minimum complying with ASTM A193 Grade B7. Nuts per ASTM A194 Grade 2H.

e. Lining and coating: Factory-applied fusion bonded epoxy.

f. Working pressure: 250 psi. Test pressure: 400 psi.

2. Manufacturers:

a. Romac Industries, Inc. – Style 400RG

b. EBAA Iron – 3800 MEGA-COUPLING

2.5 FLANGED COUPLING ADAPTERS

A. Flanged Coupling Adapters:

1. All flanged coupling adapters shall be constructed to diameters that properly fit the connecting plain end pipe and the flanged fitting.

2. Description:

a. Comply with AWWA C219.

b. Flange: AWWA Class D Steel Ring Flange, compatible with ANSI Class 125 and 150 bolt circles.

c. End ring and body:

1) Steel. Comply with ASTM A36.

2) Ductile iron. Comply with ASTM A536, Grade 65-45-12.

d. Flange: Compatible with ANSI Class 125 and 150 bolt circles.

e. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

f. Bolts and nuts: High strength low alloy steel bolts and nuts. Comply with AWWA C111 composition requirements.

g. Lining and coating: Factory-applied fusion bonded epoxy.

h. Working pressure rating: Equal to the maximum rating of the flange.

3. Manufacturers:

a. Romac Industries, Inc.

1) Style FCA501

a) For 3-inch to 16-inch diameter.

2) Style FC400.

a) For 12-inch to 96-inch diameter.

B. Restrained Flanged Coupling Adapters:

1. Description:

a. Gland and flange body: Ductile iron. Comply with ASTM A536.

b. Flange: Compatible with ANSI Class 125 and 150 bolt circles.

c. Gaskets: Virgin styrene butadiene rubber (SBR) compounded for water service. Comply with ASTM D2000.

d. Restraining bolts and lugs: Ductile iron. Comply with ASTM A536.

e. T-bolts, Bolts, and nuts: High strength low alloy steel. Comply with AWWA C111 composition requirements.

f. Lining and coating: Factory-applied fusion bonded epoxy.

2. Manufacturers:

a. Romac Industries, Inc. – RFCA Restrained Flanged Coupling Adapters.

b. EBAA Iron – MEGAFLANGE Restrained Flange Adapter.

2.6 TAPPING SLEEVES AND VALVES

A. Tapping Sleeves:

1. Description:

a. Type: Dual compression.

b. Material:

1) Body: Stainless steel, Type 304.

2) Flanged outlet: Stainless steel, Type 304.

c. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 150, and MSS SP-60.

d. Outlet Gasket:

e. Provide with Type 304 stainless steel test plug.

f. Nuts, bolts, and washers: Stainless steel, Type 304.

2. Manufacturers:

a. Romac Industries, Inc. – Model STS 420

b. JMC Industries, Inc.

B. Tapping Valves:

1. Resilient wedge gate valves specified in Section 40 05 61, Gate Valves.

2.7 FLEXIBLE EXPANSION JOINTS

A. Description

1. Installed at locations indicated in the Drawings.

2. End connections: As shown in the Drawings.

3. Material: Ductile iron, AWWA C153.

4. Working pressure: 350 psi, minimum.

5. Construction:

a. An expansion joint designed and cast as an integral part of a double ball and socket type flexible joint.

b. Manufactured of ductile iron, conforming to requirements of AWWA C153 and ASTM A536.

c. Deflection: Minimum of 15 degrees deflection per ball.

d. Expansion:

1) 12-inch diameter and under: 8-inch.

2) Greater than 12-inch diameter: 16 inches.

e. The flexible expansion joint unit shall not impart a thrust force while under internal pressure.

f. Each flexible expansion joint shall be hydrostatically tested to the Manufacturer's published pressure rating prior to shipment.

g. Lining: All interior "wetted" parts shall be shop-lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be holiday tested with a 1500-volt spark test conforming to said specification.

h. Coating: Coal tar epoxy.

6. Quality Assurance: Hydrostatically tested to Manufacturer's published pressure rating prior to shipment.

7. Appropriately sized polyethylene sleeves, meeting AWWA C105 requirements, shall be included for direct bury applications.

B. Manufacturers

1. EBAA Iron, Inc. – Flex-Tend or equal. Force Balanced Flex-Tend where specified or shown on plans.

2.8 UNDERGROUND PIPE MARKERS

A. As specified in Section 31 23 17, Trenching.

2.9 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in the Drawings.

2. Type: reinforced, air entrained as shown in the Drawings.

3. Compressive Strength: Minimum 3,000 psi at 28 days.

4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in the Drawings.

2.10 BEDDING AND COVER MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

a. Material type varies by location, as shown in the Drawings.

b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

c. Subsoil Type S1 or S2, as specified in Section 31 05 13, Soils for Earthwork.

2.11 NOT USED

2.12 ACCESSORIES

A. Concrete for Thrust Restraints: As specified in the Drawings.

B. Manhole and Cover: As specified in Section 33 05 13- Manholes and in the Drawings.

C. Miscellaneous Steel Rods, Bolt, Lugs, and Brackets:

1. Comply with ASTM A36 or ASTM A307.

2. Grade A carbon steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that existing utility water main size, location, and invert are as indicated on Drawings.

3.2 PREPARATION

A. Preconstruction Site Photos:

1. Take photographs along centerline of proposed pipe trench; minimum one photograph for each 100 feet of pipe trench.

2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

3. Include Project name, date taken, and sequential number of each photograph in physical log or CD.

B. Inspection:

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects.

2. No piping or related materials shall be laid that is known to be defective. Any defective piece installed shall be removed and replaced with a new pipe section in a manner satisfactory to the Engineer at the Contractor's expense.

3. Defective material shall be marked and removed from the job site before the end of the day.

C. Pipe Cutting:

1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.

3. Grind edges smooth with beveled end for push-on connections.

4. Prior to assembly of field cut pipe, the reference mark shall be re-established with a pencil or crayon. The location of the reference mark at the proper distance from the bevel end shall be in accordance with the Manufacturer's recommendations.

D. Remove scale and dirt on inside and outside before assembly. Cleaning of each pipe or fitting shall be accomplished by swabbing out, brushing out, blowing out with compressed air, or washing to remove all foreign matter.

E. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Bedding:

1. Excavation:

a. Excavate pipe trench as specified in Section 31 23 17, Trenching for Work of this Section.

b. All pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

c. Remove large stones or other hard matter which could damage pipe or impede consistent pipe bedding backfilling or compaction.

d. Trench base shall be inspected prior to placement of pipe.

e. Hand trim excavation for accurate placement of pipe to elevations as indicated on Drawings.

2. Dewater excavation as specified in Section 31 23 19, Dewatering to maintain dry conditions and to preserve final grades at bottom of excavation.

3. Provide sheeting and shoring as specified in Section 31 23 17, Trenching.

4. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth and compact to 95 percent of maximum density.

B. Piping:

1. Install pipe according to AWWA C600 for ductile iron piping. Install according to AWWA C605 for PVC piping.

2. Handle and assemble pipe according to Manufacturer instructions and as indicated on Drawings.

3. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

4. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.

5. Sanitary Sewer Separation:

a. Install new water lines and appurtenances in compliance with local and state regulations governing the horizontal and vertical separations between water and sewer facilities.

b. Variance:

1) If a variance is proposed due to requested design revisions or if an existing facility has been installed at a different location or elevation than indicated on the Plans, submit written proposal for review and approval by the Engineer.

2) Include the reason for the variance, type of material and condition of the sewer line, location of the water and sewer facilities, horizontal and vertical skin-to-skin clearances and corrective measures proposed.

3) Each variance will be considered on a case-by-case basis.

4) Review Time: Allow a minimum of 5 working days review and response to each proposal.

6. Install ductile iron fittings according to AWWA C600.

7. Joints:

   a. Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining.

   b. Lubricants, primers, adhesives, etc. shall be used as recommended by the Pipe or Joint Manufacturer's specifications.

   c. The jointing materials or factory-fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint.

   d. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing.

   e. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

8. Flanged Joints: Not to be used in underground installations except within structures, unless shown otherwise in the Drawings.

9. Deflection:

   a. PVC pressure pipe may be deflected both horizontally and vertically at the joints after assembly.

   b. Deflection by bending of the pipe rather than at the joints is not allowed.

   c. The maximum pipe deflection shall not exceed one-half of the Manufacturer's stated joint deflection allowance.

   d. Set a laser, string line, or other approved alignment guide along the centerline of previously installed pipe to the point where pipe joint deflection is required. The approved alignment guide shall extend to the end of the proposed subsequent pipe length. A measurement will be taken from the alignment guide to the centerline of the subsequent pipe length to determine the amount of pipe joint deflection proposed. Measured deflection shall not exceed the specified allowable deflection for the purposes of aligning the pipe.

10. Install pipe and fittings to the line and grade specified on the Drawings, with joints centered, pipe properly supported and restrained against movement, and all valve stems plumb. Re-lay pipe that is out of alignment or grade.

11. High Points:

    a. Install pipe with no high points, unless otherwise shown in the Drawings.

    b. If unforeseen field conditions arise that necessitate high points, install air release valves as directed by Engineer.

12. Bearing:

    a. Install pipe to have bearing along entire length of pipe.

    b. Excavate bell holes to permit proper joint installation where necessary or as directed by Engineer.

    c. Do not lay pipe in wet or frozen trench.

13. Prevent foreign material from entering pipe during placement.

14. Install pipe to allow for expansion and contraction without stressing pipe or joints.

15. Close pipe openings with watertight plugs during Work stoppages.

16. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

17. Install access fittings to permit disinfection of water system performed under Section 33 13 00 – Testing and Disinfecting of Water Utility Piping.

18. Cover:

    a. Establish elevations of buried piping with not less than 36 inches of cover.

    b. Measure depth of cover from final surface grade to top of pipe barrel.

19. Pipe Markers:

    a. Install as specified in Section 31 23 17, Trenching.

C. Tapping Sleeves and Valves:

1. As indicated on Drawings and according to Manufacturer instructions.

D. Polyethylene Encasement:

1. Encase piping in polyethylene where indicated on Drawings to prevent contact with surrounding backfill material.

2. Comply with AWWA C105.

3. Encasement shall be two (2) layers of 8 mil polyethylene encasement, V-bio, by US Pipe.

E. Thrust Restraints:

1. Provide valves, tees, bends, caps, and plugs with concrete thrust blocks at locations shown in the Drawings and as required to facilitate testing of lines.

2. Pour concrete thrust blocks against undisturbed earth.

3. Locate thrust blocks to ensure that pipe and fitting joints will be accessible for repair.

4. Provide thrust restraint bearing area on subsoil as shown in details within the Drawings.

5. Install tie rods, clamps, setscrew retainer glands, or restrained joints.

6. Protect metal-restrained joint components against corrosion with polyethylene film or wax tape as specified herein.

7. Avoid encasing mechanical and flanged joints in concrete. Provide clearance between concrete and mechanical and flange joints to allow future bolt removal.

F. Backfilling:

1. Backfill of piping systems shall be as specified in Section 31 23 17, Trenching.

G. Testing and Disinfection of Potable Water Piping System:

1. In accordance with AWWA C600 (for ductile iron piping), AWWA C605 (for PVC piping), AWWA C651 and as specified in Section 33 13 00, Testing and Disinfecting of Water Utility Piping.

2. All chlorinated water used in disinfection of the water main shall either be discharged through an approved connection to a public sanitary sewer system or shall be dechlorinated to limits acceptable by the Oregon Department of Health (DOH) and as required by project permits prior to discharge into any storm drainage system or open drainage way.

3. No chlorinated water shall be discharged into a storm drainage system or open drainage way without a dechlorination under a plan meeting DOH's requirements.

3.4 FIELD QUALITY CONTROL

A. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

END OF SECTION

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SECTION 33 12 13 - WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section includes pipe materials, fittings, valves, meters and backflow preventers encountered with service connections 2 inches in diameter and smaller from the main to a water meter.

B. Section Includes:

1. Pipe and fittings for 2- inch diameter and smaller water service connections.
2. Corporation stop assemblies.
3. Curb stop assemblies.
4. Meter setting equipment.
5. Water meters.
6. Backflow preventers.
7. Underground pipe markers.
8. Precast concrete vaults.
9. Bedding and cover materials.

C. Related Requirements:

1. Section 03 11 00 – Concrete Work
2. Section 31 05 13 - Soils for Earthwork
3. Section 31 05 16 - Aggregates for Earthwork
4. Section 31 23 17 - Trenching
5. Section 31 23 23 - Fill
6. Section 33 05 64 - Precast Concrete Valve Vaults and Meter Boxes
7. Section 33 13 00 - Testing and Disinfecting of Utility Piping

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. American Society of Mechanical Engineers:

1. ASME B16.15 - Cast Bronze Threaded Fittings.

C. American Society of Sanitary Engineering:

1. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

2. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.

2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

4. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.

5. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

6. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

7. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

8. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

9. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

11. ASTM F876 – Standard Specification for Crosslinked Polyethylene (PEX) Tubing

12. ASTM F2023 – Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water

13. ASTM F2080 – Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe

14. ASTM F2657 - Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing

E. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:

1. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

2. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.

3. AWWA C701 – Cold-Water Meters – Turbine Type, for Customer Service.

4. AWWA C702 – Cold-Water Meters – Compound Type.

5. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.

6. AWWA C800 - Underground Service Line Valves and Fittings.

7. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.

8. AWWA C904 – Crosslinked Polyethylene (PEX) Pressure Tubing, 1/2 In. Through 3 In., for Water Service.

9. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

G. National Sanitation Foundation International:

1. NSF/ANSI Standard 14 – Plastic Piping System Components and Related Materials

2. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects

3. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

H. Plastic Pipe Institute (PPI) Technical Report 3 (TR-3):

1. Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), Minimum Required Strength (MRS) Ratings, and Categorized Required Strength (CRS) for Thermoplastic Piping Materials or Pipe.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventer, and accessories.

C. Shop Drawings: Indicate details showing meter boxes, vaults and accessories.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of piping mains, connections, thrust restraints, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 QUALITY ASSURANCE

A. Perform Work according to City of Warrenton standards.

B. Unless otherwise noted, all water works materials provided shall be new, of first class quality and shall be made by reputable manufacturers.

C. All material of like kind shall be provided from a single manufacturer unless otherwise approved by the Engineer.

D. All material shall be carefully handled and installed in good working order free from defect in manufacture, storage and handling.

E. Where an item is to be used but does not have its quality specified herein, it shall be equal to that specified in the appropriate American Water Works Association (AWWA) Standard Specification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store products and materials off ground and under protective coverings and away from walls.

C. Exercise care in handling precast concrete products to avoid chipping, cracking, and breakage.

PART 2 PRODUCTS

2.1 GENERAL

A. Service line material shall conform to the latest version of AWWA C800 and as follows:

1. Minimum working pressure rating of all service line material shall be 150 psi.

2. All water works materials provided shall be rated for the test pressures indicated for the water main and as specified in Section 33 13 00, Testing and Disinfection of Water Utility Pipelines.

B. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 WATER PIPING AND FITTINGS

A. Copper Tubing:

1. Comply with ASTM B88.

2. Type K, annealed, seamless.

3. Fittings: Cast bronze alloys, threaded. Conform to ASTM B584, meeting "lead free" requirements above, and ASME B16.15.

a. Mechanical surfaces shall have a 100% machine finish with no gaps or low spots due to insufficient parent material.

b. All fittings shall either be stamped or embossed with the manufacturer's name.

c. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

d. Manufacturers:

1) Ford.
2) Mueller.

4. Joints: Compression.

B. Crosslinked Polyethylene (PEX) Tubing

1. Piping

a. All pipe shall be crosslinked polyethylene manufactured using the high-pressure peroxide method of crosslinking (known as PEXa). Pipe shall conform and be third-party certified to AWWA C904, ASTM F876, NSF/ANSI 14 and NSF/ANSI 61.

b. Pipe shall be rated for continuous operation of 100 psi gauge pressure at 180°F temperature, and 160 psi gauge pressure at 73.4°F temperature as defined in AWWA C904.

c. Pipe shall be rated for continuous operation at 200 psi gauge pressure at 73°F temperature when evaluated using a 0.63 design factor (see item 20 for details).

d. Pipe shall be listed by PPI to standard TR-3 as Standard Grade.

e. Pipe to be tested for resistance to hot chlorinated water in accordance with ASTM F2023. Pipe to have a minimum Class 3 chlorine resistance rating when evaluated to F876 and tested in accordance with F2023.

f. PEXa pipe shall be listed with a material designation code of "3306" per the ASTM F876 standard and PPI TR-3.

g. Pipe to have a co-extruded UV Shield made from UV-resistant polyethylene, color blue. Pipe to have minimum recommended UV exposure time of 12 months when tested in accordance with ASTM F2657 and evaluated in accordance with ASTM F876.

h. Pipe shall be manufactured in a facility whose quality management system is certified according to ISO 9001.

i. Bend Radius: The minimum bend radius for cold bending of PEXa pipe shall be not more than five (5) times the outside diameter.

2. Fittings

a. Compression joint fittings shall be manufactured in accordance with AWWA C800. Fittings must meet the pressure requirements of the PEX pipe at 73°F when used with stainless steel or plastic inserts.

b. Cold-expansion compression-sleeve fittings shall be in accordance with ASTM F2080.

3. Manufacturers:

a. PEX tubing shall be MUNICIPEX® as manufactured by REHAU Construction, LLC, or approved equal.

2.3 CORPORATION STOP ASSEMBLIES

A. Corporation Stops:

1. Body: Bronze alloy.

2. Valve Type: Ball.

3. Direct Tapping: Corporation stops for direct tapping shall have AWWA tapered thread inlet and outlet connections compatible with service piping specified.

4. Less Than or Equal to 1-Inch Diameter:

   a. Inlets: AWWA tapered thread or male iron pipe thread.

   b. Outlets: Connections compatible with either copper or polyethylene tubing.

   c. Thread patterns for the saddle outlet and corporation stop inlet shall be compatible for proper installation.

5. Greater Than 1-Inch Diameter:

   a. Inlets: Male iron pipe thread.
   b. Outlets: Connections compatible with connecting service pipes.

B. Service Saddles:

1. Material: Ductile iron with stainless steel straps.

2. Coating: Epoxy or nylon.

3. For Services Less Than or Equal to 1-Inch Diameter:

   a. Single strap.
   b. AWWA “CC” tapered thread.

4. For Services Greater Than 1-Inch Diameter:

   a. Double strap.
   b. Female pipe thread outlet.

5. Designed to hold pressures in excess of pipe working pressure.

6. Saddles used on PVC shall be formed for PVC pipe and shall have flat, stainless steel straps.

C. Manufacturers:

1. Mueller.
2. Or approved equal.

2.4 CURB STOP ASSEMBLIES

A. Curb Stops:

1. Body: Bronze alloy. Comply with ASME B16.15.

2. Valve Type: Ball.

3. Sealing: Positive pressure.

B. Manufacturers:

1. Mueller.
2. Or approved equal.

2.5 METER SETTING EQUIPMENT

A. Description:

1. Height: 12 inches.

2. Material: Copper.

3. Construction:

a. Angle meter stop with drilled padlock wing.

b. Angle check valve.

c. Inlets and Outlets: Horizontal setting, with matching couplings, fittings, and stops.

4. Furnish test valves.

5. For services 1-inch and smaller:

a. Meters saddle nuts for installation and removal of meter.

6. For services greater than 1-inch:

a. Equip with a locking bypass.

B. Manufacturers:

1. Ford.
2. Mueller.

2.6 WATER METERS

A. Supplied by Owner.

2.7 BACKFLOW PREVENTERS

A. As specified in Section 40 05 13, Common Work Results for Process Piping.

2.8 UNDERGROUND PIPE MARKERS

A. As specified in Section 33 11 10, Water Utility Distribution Piping.

2.9 METER BOXES

A. Supplied by Owner.

2.10 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

a. Material type varies by location, as shown in the Drawings.

b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

c. Subsoil Type S1, as specified in Section 31 05 13, Soils for Earthwork.

PART 3 EXECUTION

3.1 GENERAL

A. All service lines shall be installed continuous, without joints or splices, complete from the new water main (insulating corporation stop) to the new meter location or as otherwise shown.

B. Install service pipelines perpendicular to the main, unless shown otherwise.

3.2 INSTALLATION

A. Construct the depth of trench for service connection piping to provide a minimum of 30 inches of cover over the top of the pipe, unless otherwise shown.

B. Excavation, backfill and surface restoration shall be performed in accordance with provisions stated in Section 31 23 17, Trenching.

C. Do not damage the main in any way during the service installation.

D. Water Main Tap

1. All direct service taps shall be made with a drilling and tapping machine intended for use on ductile iron pipe as manufactured by Mueller or approved equal. Hand held equipment is not allowed. Coupons shall be removed from pipe.

    a. The drilling and tapping machine shall have alignment tool guides and a placement strap.

2. Direct threaded taps shall engage a minimum of four (4) full threads.

3. Direct taps shall require the use of two (2) layers of 3 mil tetrafluoroethylene (TFE) tape on the threads of the corporation stop. Liquid TFE will not be allowed.

4. Direct taps for 1-inch diameter services are allowed only on mains that are 6 inches in diameter or larger.

5. Service saddles are required on water mains 4 inches in diameter and larger and for all services taps larger than 1-inch diameter.

6. Install corporation stop at a 45-degree angle from the cross section vertical axis of the water main being tapped, unless otherwise shown on the Plans.

7. Install swing joint on all 2-inch diameter services.

E. Piping

1. Cut service pipes using tools specifically designed to leave a smooth, even, and square end on the material being cut.

2. Ream cut ends to the full inside diameter of the pipe.

3. Clean pipe ends to a sound, smooth finish prior to using compression connections which seal to the outside surface of the pipe.

F. Water Meters:

1. Install positive displacement meters according to AWWA M6 and as shown in the Drawings.

G. Backflow Preventers:

1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.

2. Testing and Installation Requirements: Comply with local water company requirements and plumbing codes.

H. Service Connections:

1. Install water service according to details in the Drawings.

2. Install water meters and backflow preventer in precast concrete meter boxes located on Site as specified in Section 33 05 17, Precast Concrete Valve Vaults and Meter Boxes

3. Locate meter boxes as shown in the Drawings. Final location to be determined in the field by Engineer.

I. Service Renewal:

1. Install service line and angle meter stop from the water main to the inside of existing meter box location.

2. Where service renewals are to be connected to existing meters, stub up and terminate service run at angle meter stop where shown.

3. Where no meter is to be installed, place angle meter stop at 18 inches from face of curb with 12 inches to the springline in an approved box.

4. Owner will connect all service lines at the new meters or to existing service piping as shown.

5. Adjust meter box to finished grade after the service piping has been installed and surface has been restored to the satisfaction of the Engineer.

J. Trenchless Installation:

1. All water service installations under existing pavement, curbs, sidewalks or other surface improvements may be installed by trenchless construction techniques at Contractor option where ground conditions are favorable and such methods will not disturb foundations under curbs, sidewalks and other structures.

2. The Owner's Representative must approve all trenchless installation methods.

3. Where trenchless pipe installation is used, payment for the pipe installation will be made for the equivalent trench excavation and backfill as if the open cut method was used. Payment will not be made for surface restoration including pavement, curbs, sidewalks and other surface improvements whose replacement is avoided by use of a trenchless method, such as tunneling.

3.3 NOT USED

3.4 FLUSHING AND DISINFECTION

A. Flush and disinfect all service connections and appurtenances in accordance with Section 33 13 00, Testing and Disinfection of Water Utility Distribution Pipelines.

3.5 FIELD QUALITY CONTROL

A. Pressure test water distribution system according to AWWA C600 and Section 33 11 10, Water Utility Distribution Piping.

B. Compaction Testing for Bedding: See Section 33 11 10, Water Utility Distribution Piping for compaction testing requirements. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

SECTION 33 12 16 - WATER UTILITY DISTRIBUTION AND TRANSMISSION VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes valves and valve boxes for installation with buried water distribution and transmission main, including fire hydrants and tapping sleeves.

B. Section Includes:

1. Valves.
2. Valve boxes.
3. Valve operator extensions.

C. Related Sections:

1. Section 03 11 00 – Concrete Work
2. Section 33 11 10 - Water Utility Distribution and Transmission Piping
3. Section 33 12 13 - Water Service Connections
4. Section 33 12 19 - Fire Hydrants
5. Section 33 13 00 - Testing and Disinfecting of Water Utility Piping
6. Section 40 05 51.15 – Gate Valves
7. Section 40 05 51.18 – Butterfly Valves

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250
2. ASME B16.5 - Pipe Flanges and Flanged Fittings, Steel Nickel Alloy, and other Special Alloys
3. ASME 1.20.1 - General Purpose Pipe Threads (Inch)

B. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. Through 72 In.
2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service
3. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants
4. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

5. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings

C. ASTM International (ASTM):

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings

2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications

D. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects

2. NSF 372 - Drinking Water System Components - Lead Content

1.3 COORDINATION

A. The Contractor shall cause the Supplier of valves to coordinate installation such that all pipes, valves, fittings, appurtenances, and equipment are compatible and capable of achieving the performance requirements specified in the Contract Documents.

B. Coordinate Work of this Section with City of Warrenton Department of Public Works standards and utilities within construction area.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit Manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

E. Lining and coating data.

F. Valve Labeling: Schedule of valves to be labeled indicating in each case the valve location and the proposed labeling for the valve.

G. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

H. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

I. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Operation and Maintenance Data: Submit information for valves.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Tools: Furnish one tee wrench of required length to Owner.

1.7 QUALITY ASSURANCE

A. Cast Manufacturer's name, maximum working pressure, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, American National Standards Institute (ANSI), ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

E. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves and accessories for shipment according to applicable AWWA standards.

B. Seal valve and ends to prevent entry of foreign matter.

C. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

D. Storage:

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

E. Handle products carefully to prevent damage to interior or exterior surfaces.

F. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT WEDGE GATE VALVES

A. As specified in Section 40 05 51.16, Gate Valves.

B. Connecting Hardware:

1. As specified in Article 2.3, Nuts, Bolts and Washers of Section 33 11 10, Water Utility Distribution and Transmission Piping.

C. Gaskets:

1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution and Transmission Piping.

2.3 DOUBLE-DISC GATE VALVES - NOT USED

2.4 SOLID WEDGE, METAL-SEATED GATE VALVES - NOT USED

2.5 RUBBER-SEATED BUTTERFLY VALVES

A. As specified in Section 40 05 51.18, Butterfly Valves.

B. Operation:

1. All buried valves shall be provided with 2-inch square operating nuts.

C. Connecting Hardware:

1. As specified in Article 2.3, Nuts, Bolts and Washers of Section 33 11 10, Water Utility Distribution and Transmission Piping.

D. Gaskets:

1. As required for the end connection types specified in Section 33 11 10, Water Utility Distribution and Transmission Piping.

2.6 ACTUATORS

A. Unless otherwise indicated, all valves shall be furnished with manual actuators.

B. Actuators shall be sized for the valve design pressure in accordance with AWWA C504.

C. All gear-assisted valves that are buried and submerged shall have the actuators hermetically sealed and grease-packed.

D. All valves 6 inches to 30 inches in diameter may have traveling-nut actuators, worm-gear actuators, spur- or bevel-gear actuators, as appropriate for each valve.

2.7 VALVE BOXES

A. Provide all buried valves with valve boxes, covers and risers.

B. Valve Boxes:

1. Materials: Cast iron.

2. Construction:

a. Walls not less than 3/16-inch thick at any point.

b. Internal diameter not less than 5 inches.

3. Type: Two-piece extension.

4. Manufacturers:

a. Olympic Foundry.

b. Brooks Products.

C. Covers:

1. Construction:

a. Prevents dislodging and rotation from traffic.

b. Allows a hand-held pry bar to be applied for easy removal.

2. Materials: Cast iron.

3. Lid Inscription: W.

4. Manufacturers: Matching that of valve box.

D. Riser:

1. Polyvinyl Chloride (PVC) Pipe:

a. ASTM D3034, SDR 35 PVC.

b. White, Schedule 40, 8-inch diameter.

c. Length as shown on details in the Drawings.

2.8 VALVE OPERATOR EXTENSIONS

A. As shown in the Drawings.

B. Provide operator extensions to a maximum of 12 inches below grade where depth to valve exceeds 36 inches. Provide with a 2-inch square operating nut and rock guard as shown on the Drawings.

2.9 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type as specified in Section 03 11 00 – Concrete Work.

PART 3 EXECUTION

3.1 PREPARATION

A. Conduct operations to not interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.

B. Identify required lines, levels, contours, and datum locations.

C. Locate, identify, and protect from damage utilities to remain.

D. Access:

1. All valves shall be installed to provide easy access for operation, removal, and maintenance.

2. Avoid conflicts between valve operators and above grade construction such as structural members or handrails.

E. Valve Accessories:

1. Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly.

2. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.2 INSTALLATION

A. General:

1. All valves, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the Manufacturer's written instructions and as shown in the Drawings and as specified herein.

2. Valves shall be firmly supported to avoid undue stresses on the pipe.

3. Stem extensions shall be braced at no greater than 10 feet intervals and be provided with double universal joints to allow for misalignment, where applicable.

B. Perform trench excavation, backfilling, and compaction as specified in Section 33 11 10, Water Utility Distribution and Transmission Piping.

C. Install valves in conjunction with pipe laying.

D. Set valves plumb.

E. Provide buried valves with valve boxes installed flush with finished grade.

1. Valves installed out of paved or otherwise hard-surfaced areas shall be set in a concrete pad at finished grade.

2. Concrete valve box pads shall be 18 inches square and be not less than 6 inches thick.

F. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfection of Water Utility Piping.

3.3 FIELD QUALITY CONTROL

A. Pressure test valving for water distribution system according to AWWA C600 and in accordance with Section 33 13 00, Testing and Disinfection of Water Utility Piping.

B. Field Testing of Valves:

1. All valves 24-inch diameter or larger, and all in-line transmission main valves, shall be pressure and leakage tested at the Site and shall pass the field testing prior to installation.

2. Valves shall be tested at 1.5 times normal operating pressure, 150 pounds per square inch (psi) minimum.

3. No valve shall be accepted for installation that fails to pass the field pressure test. Any valves failing field pressure tests shall be replaced by the CONTRACTOR at no additional cost to the OWNER.

4. ENGINEER shall witness field testing.

3.4 NOT USED

END OF SECTION

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SECTION 33 12 19 - FIRE HYDRANTS

PART 1 GENERAL

1.1 SUMMARY

A. This Section addresses dry-barrel fire hydrants used in water supply service.

B. Section includes:

1. Fire hydrants used in water main installations.

C. Related Sections:

1. Section 03 11 00 – Concrete Work
2. Section 31 05 16 - Aggregates for Earthwork
3. Section 31 23 17 - Trenching
4. Section 33 13 00 – Testing and Disinfection of Water Utility Piping

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C502 - Dry-Barrel Fire Hydrants
2. AWWA C550 - Protective Interior Coatings for Valves and Hydrants
3. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

B. National Fire Protection Association (NFPA):

1. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants

1.3 COORDINATION

A. All hydrants supplied for the Project shall be of like kind from a single manufacturer.

1.4 SUBMITTALS

A. Section 01 33 00, Submittal Procedures: Requirements for submittals.

B. Product Data: Submit Manufacturer's latest published literature, including illustrations, installation and maintenance instructions, and parts lists.

C. Shop Drawings: Submit description of proposed installation.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of fire hydrants and service valves.

B. Operation and Maintenance Data: Submit data for hydrants.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare hydrants and accessories for shipment according to AWWA standards.

B. Seal hydrant and ends to prevent entry of foreign matter.

C. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

D. Storage:

1. Store materials in areas protected from weather, moisture, or potential damage.

2. Do not store materials directly on ground.

E. Handle materials in a way that prevents damage to interior and exterior surfaces.

PART 2 PRODUCTS

2.1 FIRE HYDRANTS

A. Manufacturers:

1. Mueller Company, Super Centurion 250 Model A-423, or approved equal.

B. Dry-Barrel Breakaway Type:

1. Comply with AWWA C502.

2. Body: Cast iron.

3. Valve: Compression type.

4. Burial Depth: As indicated on Drawings.

5. Inlet Connection Size: 6 inches.

6. Valve Opening: 5-1/4 inches in diameter.

7. End Connections: Mechanical joint or bell end.

8. Bolts and Nuts: Galvanized steel.

9. Interior Coating: Comply with AWWA C550.

10. Direction of Opening: Counterclockwise unless otherwise indicated.

C. Hose Connections:

1. One 4-1/2-inch diameter pumper, two 2-1/2-inch diameter hose nozzles.

2. Obtain thread type and size from local fire department.

3. Attach nozzle caps by separate chains.

D. Finishes:

1. Primer and two coats of enamel.

2. Color: R-1317, Safety Yellow.

2.2 NSF INTERNATIONAL (NSF) REQUIREMENTS

A. All fire hydrants must be NSF/ANSI Standard 61 certified and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.

2.3 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type as specified in Section 03 11 00, Concrete Work.

B. Aggregate: Aggregate for hydrant drainage as specified in Section 31 05 16, Aggregates for Earthwork.

2.4 OUT OF SERVICE COVERS/OUT OF SERVICE RINGS

A. Provide orange plastic bag with reflective tape, or red plastic hydrant out of service rings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify location and size of hydrants from Drawings. Final location of hydrants to be determined by Engineer in the field.

B. Obtain clarification and directions from Engineer prior to execution of Work.

C. If installing a hydrant on an existing water system, verify invert elevation of existing piping is as indicated on Drawings prior to excavation and installation of fire hydrant.

3.2 PREPARATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures, utilities, and landscape in immediate or adjacent areas.

B. Identify required lines, levels, contours, and datum locations.

C. Locate, identify, and protect from damage utilities to remain.

D. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Owner and Engineer not less than 48 hours in advance of proposed utility interruption.

2. Do not proceed without written permission from Engineer.

3. Only District staff shall operate valves in existing system.

3.3 INSTALLATION

A. Perform trench excavation, backfilling, and compaction as specified in Section 31 23 17, Trenching.

B. Install pier support block and drainage gravel for fire hydrants; do not block drain hole.

1. Place drainage gravel around the pier block and bottom of hydrant to 6 inches above the hydrant drain opening.

2. Place textile fabric to cover drain rock prior to placement of backfill.

3. Setting shall allow the hydrant barrel to drain into drainage gravel at base of hydrant.

C. Set fire hydrants plumb with pumper nozzle facing roadway.

D. Set fire hydrants with centerline of pumper nozzle 18 inches above finished grade, and with safety flange not more than 6 inches nor less than 2 inches above grade. Install hydrant extensions where required and as approved.

E. Paint hydrants according to color scheme of local authorities having jurisdiction. Touch up paint after hydrant installation and testing.

F. After hydrostatic testing, flush hydrants, and check for proper drainage.

G. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfection of Water Utility Piping.

3.4 FIELD QUALITY CONTROL

A. Pressure test water distribution system according to AWWA C600 and Section 33 11 10, Water Utility Distribution and Transmission Piping, Field Quality Control.

3.5 CONCRETE HYDRANT PADS

A. When hydrant is place within sidewalks, form and pour-in-place 36-inch by 36-inch by 6-inch, 4,000 pounds per square inch (psi) concrete pad around the hydrant after the hydrant has been installed and set to grade.

B. Center hydrant pad on the hydrant. Set hydrant pad so top of pad is flush with surrounding surface, or as directed by the Engineer.

C. Hydrant pads may be adjusted to reach the back of curb if the hydrant pad is no less than 1-foot in any one direction.

3.6 OUT-OF-SERVICE HYDRANT PADS

A. To indicate that the fire hydrant is NOT operational, secure reflective tape, an orange plastic bag over the entire hydrant assembly or an approved out-of-service cover.

B. An out-of-service ring may also be used in addition to the bag or cover in case of removal of the cover.

C. Maintain the plastic bag up until the waterline is accepted by the Owner.

END OF SECTION

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SECTION 33 13 00 - TESTING AND DISINFECTION OF WATER UTILITY PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes hydrostatic pressure testing, disinfection, and purity testing of potable water systems piping, fittings, valves, and domestic water services.

B. Section Includes:

1. Pressure testing and disinfection of potable water distribution and transmission piping systems and appurtenances.

2. Testing and reporting of results.

C. Related Sections:

1. Section 33 11 10 - Water Utility Distribution and Transmission Piping

2. Section 33 12 16 - Water Utility Distribution and Transmission Valves

3. Section 33 12 19 - Fire Hydrants

4. Section 33 12 13 - Water Service Connections

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA B300 - Hypochlorites

2. AWWA B301 - Liquid Chlorine

3. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances

4. AWWA C605 - Underground Installation of PVC and PVCO Pressure Pipe and Fittings

5. AWWA C651 - Disinfecting Water Mains

6. AWWA C655 - Field Dechlorination

1.3 SUBMITTALS

A. Section 01 33 00 –Submittals Procedures: Requirements for submittals.

B. Product Data: Submit procedures, proposed chemicals, and treatment levels.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Pipeline Testing and Disinfection Plan: To be submitted for review and approval by the Engineer a minimum of 1 month before testing is to start. As a minimum, the plan shall include the following:

1. Testing schedule.
2. Hydrostatic Testing Plan:
    a. Narrative of the proposed process.
    b. Proposed equipment to be used.
    c. Disposal location for excess water used to fill mains.
3. Disinfection Plan:
    a. Narrative of the proposed process.
    b. Proposed chemicals and equipment (including list of all pumps and meters) to be used.
    c. Calculations for the amount of chlorine required to achieve required chlorine residual levels.
    d. Proposed method of mixing, injecting, and distributing of chlorine solution throughout all portions of the new water system facilities.
    e. Proposed plan for testing chlorine levels throughout the length of pipeline.
4. Proposed testing locations.
5. Proposed plan for water conveyance, including flow rates.
6. Proposed plan for water control.
7. Proposed plan for water disposal, including flow rates. Include proposed plan for dechlorination of disinfection water, including discharge points.
8. Proposed measures to be incorporated in the Project to minimize erosion while discharging water from the pipeline.

1.4 CLOSEOUT SUBMITTALS

A. Disinfection Report:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Name of person collecting samples.
5. Initial and 24-hour disinfectant residuals in treated water in parts-per million (ppm) for each outlet tested.
6. Date and time of flushing start and completion.
7. Disinfectant residual after flushing in ppm for each outlet tested.

1.5 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. All test equipment, chemicals for chlorination, temporary valves, bulkheads, or other water control equipment and materials shall be determined and furnished by the Contractor subject to the Engineer's review. No materials shall be used which would be injurious to the construction or its future functions.

B. All temporary thrust restraint and equipment and facilities required for hydrostatic testing will be considered incidental.

C. As a minimum, furnish the following equipment and materials for the testing:

Amount	Description
2	Graduated containers approved by the Engineer.
1	Hydraulic pump approved by the Engineer with hoses, valves, and fittings as needed and required for the testing and disinfection of the facilities.
1	High range chlorine test kit, as approved by Engineer, with digital readout. Range of detection shall be between 5 and 200 ppm. Accuracy of 3 percent.
2	Pressure gauges with pressure range at least 120 percent greater than the required maximum test pressure with graduations in 2 pounds per square inch (psi) increments. Gauges shall have been calibrated with 90 days of pressure testing.

2.2 DISINFECTION CHEMICALS

A. Chemicals:

1. Hypochlorite: Comply with AWWA B300.

2. Liquid chlorine: Comply with AWWA B301.

2.3 DECHLORINATION CHEMICALS

A. Chemicals:

1. Comply with AWWA C655.

PART 3 EXECUTION

3.1 HYDROSTATIC TESTING OF WATER PIPING

A. Make all necessary provisions for conveying water to the points of use and for the disposal of test water.

B. No section of the pipeline shall be hydrostatically tested until backfill has been placed, compacted, and passed required density testing and all field-placed concrete or mortar has attained full strength.

1. At the Contractor's option, early strength concrete may be used when the full-strength requirements conflict with schedule requirements.

2. All such substitutions and installations shall be approved by the Engineer prior to installation.

C. Provide 72-hour notification to the Engineer and Owner prior to conducting hydrostatic testing.

1. Provide coordination and scheduling required for the Owner and Engineer to witness and provide necessary labor for operating Owner's existing system during hydrostatic testing and disinfecting procedures.

2. The Contractor shall not operate any part of the existing water systems.

D. Pipe Filling:

1. Fill pipes slowly from the lowest elevation to highest point along test section with potable water.

2. Take all required precautions to prevent entrapping air in the pipes.

3. Allow for natural absorption of water by the lining of the pipe to occur.

4. Apply specified test pressure by pumping.

E. Testing of Mains:

1. Ductile Iron: In accordance with AWWA C600.

2. Polyvinyl chloride (PVC): In accordance with AWWA C605.

3. General:

a. Tests shall be conducted under a hydrostatic test pressure not less than 1.25 times the stated anticipated maximum sustained working pressure of the pipeline measured at the highest elevation along the test section and not less than 1.5 times the stated working pressure at the lowest elevation of the test section, minimum 150 psi, unless otherwise shown in the Drawings.

b. In no case shall the test pressure exceed the rated working pressure for any joint, thrust restraint, valve, fitting, or other connected appurtenance of the test section.

c. Testing shall be performed by applying the specified test pressure by pumping.

d. Once the test pressure has been attained, the pump shall be valved off.

e. The test will be conducted for a 2-hour period with the allowable leakage not to exceed the value as calculated per the Allowable Leakage formula below.

f. During the test period, there shall be no appreciable or abrupt loss in pressure.

4. Allowable Leakage:

   a. Flanged Joints: Pipe, fittings, and valves with flanged joints shall be completely watertight. No leakage allowed.

   b. Mechanical or Push-on Joints: Pipe, fittings, and valves with rubber gasketed joints shall have a measured loss not to exceed the rate given in the following Allowable Leakage formula:

$$AL = \frac{LD(P)^{1/2}}{148{,}000}$$

      In the above formula:

      AL = Allowable leakage, in gallons per hour
      L = Length of pipe tested, in feet
      D = Nominal diameter of pipe, in inches
      P = Average test pressure during the leakage test, in pounds per square inch.

5. Maintaining Pressure:

   a. During the test period, operate the pump as required to maintain pressure in the pipe within 5 psi of the specified test pressure at all times.

   b. At the end of test period, operate the pump until the specified test pressure is again obtained.

      1) The pump suction shall be in a clean, graduated barrel, or similar device or metered so that the amount of water required to restore the test pressure may be accurately measured.

      2) Sterilize this makeup water by adding chlorine to a concentration of 25 milligrams per liter (mg/L).

   c. The Engineer will determine the quantity of water required to maintain and restore the required pressure at the end of the test period.

   d. Each hour's loss stands on its own and will not be averaged.

6. Defects, Leakage, Failure:

   a. If the test reveals any defects, leakage in excess of the allowable, or failure, furnish all labor, equipment, and materials required to locate and make necessary repairs.

   b. Correct any visible leakage regardless of the allowable leakage specified above.

   c. All leaks shall be repaired in a manner acceptable to the Engineer.

   d. The testing of the line shall be repeated until a test satisfactory to the Engineer has been achieved.

3.2 DISINFECTION OF WATER PIPING

A. Disinfection shall be in accordance with the latest version of AWWA C651 following Engineer's acceptance of hydrostatic testing.

B. Chlorination by means of tablets or powders (calcium hypochlorite) placed in each length of pipe during installation is specifically prohibited.

C. Flush all foreign matter from the pipeline, branches, and services.

1. Provide at no additional cost to the Owner, hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damage to adjacent properties.

2. Flushing velocities shall be at least 2.5 feet per second (fps).

3. For large diameter pipe where it is impractical or impossible to flush the pipe at 2.5 fps velocity, clean the pipe in place from the inside by brushing and sweeping, then flush the line at a lower velocity.

D. Chlorine Application:

1. Fill the test section of main from the lowest elevation and maintain a steady flow rate while injecting the water main with chlorinated water.

2. Flow (bleed) a blow-off, standpipe or hydrant at the water main's high point(s) to allow air to escape and ensure all interior pipe surfaces are wetted.

E. Chlorine Residual:

1. Measure chlorine residual with a high-range chlorine test kit at a point near to the injection point while filling the main.

2. Adjust the dose rate as necessary to maintain the target dose rate.

F. Potable water piping shall be disinfected with a solution containing a minimum 25 ppm and a maximum 50 ppm chlorine.

1. Once the main is completely filled with super-chlorinated water, measure the chlorine residual a minimum of once every 200 feet of main and once for each main branch, 2-inch service, or as directed by the Engineer.

2. The chlorine solution shall remain in the piping system for a period of 24 hours, after which time the sterilizing mixture shall have a strength of at least 10 ppm of chlorine.

3. If check samples fail to produce acceptable results, the disinfection procedure shall be repeated at the expense of the Contractor until satisfactory results are obtained.

G. Flush piping, branches, and services with municipal potable water until the chlorine residual is below 1.5 ppm and approximately the same as the source water.

1. There is no minimum flushing velocity for this step.

H. Disposal of any water containing chlorine shall be performed in accordance with the latest edition of AWWA C651 and C655, and all state or local requirements.

1. Disposal may be made into existing sanitary sewer systems providing approvals are obtained from the respective system owners.

2. Any chlorinated water discharged to open stream channels must be dechlorinated prior to discharge to levels acceptable by Oregon State Department of Environmental Quality.

3.3 DISINFECTION AND TESTING OF WATER MAIN END CONNECTIONS AND TIE-INS

A. Disinfection of potable water piping and appurtenances at end connections and tie-ins to the existing system which are required to remain in service due to restrictions in allowable shutdown time shall be disinfected as described below.

B. Prior to connecting new potable water piping and appurtenances with existing piping and appurtenances, the interior of all new pipe, fittings, valves, and appurtenances shall be swabbed or sprayed with a 1 percent to 5 percent calcium hypochlorite solution.

C. In accordance with AWWA C651, swabbing or spraying of connection piping is allowed only if the total length of piping is equal to or less than one pipe length (18 feet). All runs of new piping over 18 feet in total length will require hydrostatic pressure testing, flushing and disinfection as detailed elsewhere in this Section.

D. Following the disinfection procedures described above, connection of the new piping and appurtenances to the existing water system shall be made.

1. During the system startup, the Engineer and Contractor shall visually inspect all new fittings, piping, valves, and appurtenances for evidence of leakage.

2. Any leakage observed during this period shall be promptly repaired by the Contractor, at Contractor's expense, as required by the Engineer.

3.4 FIELD QUALITY CONTROL

A. Bacteriological Sampling and Testing:

1. The Owner will collect samples after the line is flushed in accordance with the latest edition of AWWA C651. Contractor responsible for payment of testing costs.

a. The locations for sample collection shall be at the sole discretion of the Owner and Engineer.

b. The chlorine residual must be below 1.5 ppm or restored to the level maintained in the Owner's distribution system, when the sample is taken.

2. Bacterial Testing: After completing the chlorination procedure, test the main according to the following:

a. Bacterial Sampling

1) Option A:

a) Take an initial set of samples using sampling site procedures outlined herein.

b) Resample after a minimum of 24 hours' time has elapsed using sampling site procedures outlined herein.

c) Both sets of successive samples must pass for the main to be approved for service.

2) Option B:

a) Allow main to sit for a minimum of 24 hours without any water use.

b) Using sampling site procedures outlined herein, collect two sets of samples a minimum of 15 minutes apart while the sampling taps are left running.

c) Both sets of samples must pass for the main to be approved for service.

3) Allow 24 hours for the test results for each sample set.

b. Sampling Locations

1) The Owner will take one bacteriological sample from the end of the main and on each branch.

2) For long runs of main, at least one sample will be taken for every 1,200 feet of new main and as directed.

c. Sample Testing

1) The Owner will test the sample set for coliform bacteria and publish the test results within 24 hours.

d. Evaluating the Test Results

1) If one or more of the sample set tests positive for coliforms (fails), repeat chlorination and sampling processes specified herein after correcting the cause of the failure and as directed by the Engineer.

2) When two consecutive sample sets test negative (passing)for coliform bacteria, the bacterial testing is complete.

e. Completion of Bacterial Testing

1) Upon completion of bacterial testing, notify the Owner shall notify the Engineer and Contractor in writing that the testing is complete and the main is ready for tie-in.

f. Multiple Positive (Failing) Test Results

1) If sample sets continue to test positive for coliforms, the Engineer will determine how to proceed, up to and including repeating the chlorination procedure or rejecting the pipe.

3. Results of the bacteriological testing shall be satisfactory with the Oregon Health Authority and/or other appropriate regulatory agencies, or disinfection shall be repeated by the Contractor.

B. Optional Sampling and Testing

1. If a pipeline is not promptly returned to service, the situation will be evaluated by the Owner to determine if the water quality may have been impacted and if additional testing as specified herein is warranted.

END OF SECTION

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SECTION 33 41 10 - STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes pipe materials and accessories normally used with gravity storm drainage sewers.

B. Section includes:

1. Storm drainage piping
2. Piping accessories
3. Connection to existing manholes
4. Catch basins and area drains
5. Cleanouts
6. Bedding and cover materials

C. Related Sections:

1. Section 03 11 00 – Concrete Work
2. Section 03 60 00 - Grouting
3. Section 31 05 13 - Soils for Earthwork
4. Section 31 05 16 - Aggregates for Earthwork
5. Section 31 23 16 - Excavation
6. Section 31 23 17 - Trenching
7. Section 31 23 23 - Fill
8. Section 33 30 10.13 - Sewer and Manhole Testing
9. Section 33 05 13 - Manholes

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T99 - Standard Specification for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop.

B. ASTM International (ASTM):

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

4. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

5. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.

6. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

7. ASTM C1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations.

8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

9. ASTM D1784 - Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.

10. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

11. ASTM D2466 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.

12. ASTM D2729 - Standard Specification for Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

13. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

14. ASTM D3034 - Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

15. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

16. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

17. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

18. ASTM F679 - Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

C. American Water Works Association (AWWA):

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

4. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

5. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.

6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

1.3 COORDINATION

A. Notify affected utility companies at least 72 hours prior to construction.

1.4 SUBMITTALS

A. In accordance with Section 01 33 00, Submittal Procedures.

B. Product Data: Submit Manufacturer catalog cuts and other information indicating proposed materials, accessories, details, and construction information.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. The certificate shall be signed by an authorized agent of the Manufacturer.

D. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.

E. Manufacturer Instructions:

1. Indicate special procedures required to install specified products.

2. Submit detailed description of procedures for connecting new storm sewer to existing storm sewer line.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections, manholes, and cleanouts.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer’s original packaging and inspect for damage.

B. Storage:

1. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture, dust, and direct sunlight by storing in clean, dry location remote from construction operations areas.

2. Block individual and stockpiled pipe lengths to prevent moving.

3. Provide additional protection according to Manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 STORM DRAINAGE PIPING

A. Polyvinyl Chloride (PVC) Pipe:

1. Material:

a. Manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454.

b. At locations indicated in the Drawings, pipe shall conform to AWWA C900.

2. Pipe and fittings 4 inches to 15 inches in diameter, non-pressurized:

a. Comply with ASTM D3034, SDR 35.

3. Pipe and fittings 18 inches and larger in diameter, non-pressurized:

a. Comply with ASTM F679, PS46.

b. Pipe shall have a minimum stiffness of 46 pounds per square inch (psi).

4. AWWA C900 Pipe:

a. At locations shown in the Drawings.

b. Four inches to 12 inches in diameter.

c. DR 25.

d. Pipe shall have minimum stiffness of 129 psi.

5. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.

6. Joints:

a. Integral bell push-on type: Comply with ASTM D3212.

b. For use with AWWA C900 pipe: Integral bell push-on type comply with ASTM D3139.

7. Gaskets:

a. Factory installed.

b. Elastomeric gaskets: Comply with ASTM F477.

B. Ductile Iron Pipe:

1. Comply with AWWA C151.

2. Minimum Special Thickness Class: 52.

3. End Connections: Bell and spigot or plain, as shown in the Drawings.

4. Outside Coating:

a. Type: Asphaltic coating, minimum 1-mil uniform thickness.

b. Comply with AWWA C151.

5. Lining:

a. Cement mortar lined.

b. Comply with AWWA C104.

6. Fittings:

a. Material: Ductile iron.

b. Comply with AWWA C153 or AWWA C110.

c. Lining: Cement-mortar lined according to AWWA C104.

7. Coating:

a. Asphaltic exterior coating in accordance with AWWA C151.

8. Joints:

a. Rubber gasket joint devices.

b. Comply with AWWA C111.

C. High Density Polyethylene (HDPE) Pipe:

1. Double wall, ribbed pipe with smooth interior.

2. Solid pipe, perforated pipe, and fittings shall meet the requirements of ASTM F 405 and F 667

3. Pipe 3 inches to 10 inches in diameter: Comply with AASHTO M 252.

4. Pipe 12 inches to 60 inches in diameter: Comply with AASHTO M 294.

5. Joints: Integral bell push-on type.

6. Manufacturers:

    a. ADS, N-12 with ProLink joints, or equal.

D. Acrylonitrile-Butadiene-Styrene (ABS) Pipe:

1. Single walled. Comply with ASTM D2680, SDR 23.5.

2. Perforated.

    a. Three-eighths-inch diameter holes, 3 inches on center.

3. Inside Nominal Diameter: 4 inches.

    a. Minimum Wall Thickness: 0.157 inches.

    b. One row of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.

4. Inside Nominal Diameter: 6 inches.

    a. Minimum Wall Thickness: 0.235 inches.

    b. Two rows of perforations on each side of pipe, approximately 45 degrees above bottom centerline of pipe.

5. Ends:

    a. Style: Bell and spigot.

    b. Type: Solvent sealed.

6. Fittings: ABS.

7. Joints:

    a. Type: Solvent weld.

    b. Comply with ASTM D2235.

E. Reinforced Concrete Pipe:

1. Comply with ASTM C76, Class V, with Wall Type C.

2. Reinforcement: Mesh.

3. End Connections: Bell and spigot.

4. Fittings: Reinforced concrete.

5. Joints:

    a. Rubber compression gasket.

    b. Comply with ASTM C443.

2.2 FLEXIBLE COUPLINGS

A. Description:

1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.

2. Attachment: Two Series 300 stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Description:

1. Material: Ethylene propylene rubber (EPDM).

2. Comply with ASTM C923.

3. Attachment: Stainless-steel clamp and hardware.

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 03 11 00, Concrete Work.

2. Strength: Minimum 3,000 psi at 28 days.

3. Air entrained.

4. Finish: Rough troweled.

B. Concrete Reinforcement: As specified in Section 03 11 00, Concrete Work.

2.5 MANHOLES

A. Description:

1. As specified in Section 33 05 13 - Manholes.

2. Material: Reinforced precast or cast-in-place concrete.

3. Diameter: As shown in the Drawings.

4. Top: Eccentric cone.

5. Frames and Covers: Watertight cast iron.

6. Cover Inscription: “S”.

2.6 CATCH BASINS AND AREA DRAINS

A. Construction:

1. Material: Reinforced precast or cast-in-place concrete pipe sections.

a. Minimum compressive strength of 3,000 psi at 28 days.

b. Precast concrete inlets shall conform to ASTM C913.

2. Joints: Lipped male/female.

3. Nominal Interior Dimensions: As shown in the Drawings.

B. Lids and Frames:

1. Materials: Cast iron.

2. Lid:

a. Removable.

b. Design: Linear grill.

3. Nominal Lid and Frame Size: As shown in the Drawings.

2.7 CLEANOUTS

A. Construction:

1. Per details provided in the Drawings.

B. Lids and Frames:

1. Materials: Cast iron. Meet H-20 load requirement.

2.8 MATERIALS

A. Bedding and Cover:

1. Pipe Bedding: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

2. Pipe Zone Backfill: Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

3. Trench Backfill from Pipe Zone to Finish Grade:

a. Material type varies by location, as shown in the Drawings.

b. Coarse Aggregate Material Type A1, as specified in Section 31 05 16, Aggregates for Earthwork. Aggregate size as shown in the Drawings.

c. Subsoil Type S1 and/or S2, as specified in Section 31 05 13, Soils for Earthwork.

2.9 MIXES

A. Grout: As specified in Section 03 60 00, Grouting.

2.10 ACCESSORIES

A. Underground Pipe Markers: As specified in Section 31 23 17, Trenching.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that trench cut, or excavation base is ready to receive Work.

B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

3.2 PREPARATION

A. Correct over-excavation in accordance with Section 31 23 17, Trenching.

B. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.

C. Protect and support existing sewer lines, utilities, and appurtenances.

D. Utilities:

1. Maintain profiles of utilities.

2. Coordinate with other utilities to eliminate interference.

3. Notify Engineer if crossing conflicts occur.

3.3 INSTALLATION

A. Bedding:

1. Excavate pipe trench as specified in Section 31 23 17, Trenching.

2. Excavate to lines and grades as indicated on Drawings, or as required to accommodate installation of utility.

3. Pipe base shall be observed by Engineer prior to placement of the pipe.

4. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.

5. Provide sheeting and shoring as specified in Section 31 50 00, Excavation Support and Protection.

6. Placement:

a. Place bedding material at trench bottom.

b. Level materials in continuous layer not exceeding 6 inches compacted depth.

c. Compact to 95 percent of the Standard Proctor maximum density by AASHTO T-99.

B. Piping:

1. Install pipe, fittings, and accessories according to standards listed below, and seal joints watertight.

a. PVC, HDPE, ABS: Comply with ASTM D2321.

b. Ductile Iron: Comply with AWWA C600.

c. Reinforced Concrete: Comply with ASTM C1479.

2. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.

3. Lay pipe to slope gradients and line as indicated on Drawings.

4. Variations:

a. Maximum Variation from Indicated Line: 1/32-inch per inch of pipe diameter, but no more than 1/2-inch, providing that such variation does not result in a level or reverse-sloping invert.

b. Maximum Variation from Indicated Grade: 1/32-inch per inch of pipe diameter, but no more than 1/4-inch.

c. Variation in the invert elevation between adjoining ends of pipe, include fittings, shall not exceed 1/64-inch per inch of pipe diameter, or 1/2-inch maximum.

5. Begin at downstream end and progress upstream.

6. Assemble and handle pipe according to Manufacturer's instructions, except as may be modified on Drawings or by Engineer.

7. Make straight field cuts without chipping or cracking pipe.

8. Keep pipe and fittings clean until Work has been completed and accepted by Engineer.

9. Assemble pipe joints in accordance with Manufacturer's recommendations/specifications.

10. Cap open ends during periods of Work stoppage.

11. Lay bell and spigot pipe with bells upstream.

12. Backfill and compact as specified in Section 31 23 17, Trenching.

13. Do not displace or damage pipe when compacting.

14. Pipe Markers: As specified in Section 31 23 17, Trenching.

C. Joints:

1. Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean, and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap.

2. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned.

3. Before the joint is fully "home," the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the Pipe Manufacturer.

4. If the gasket is found not to be in proper position, the pipes shall be separated, and the damaged gasket replaced.

5. The pipe is then forced "home" firmly and fully.

6. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

D. Connection to Existing Manholes:

1. Drilling:

a. Core drill existing manhole to clean opening.

b. Use of pneumatic hammers, chipping guns, and sledgehammers are not permitted.

2. Install watertight neoprene gasket and seal with non-shrink concrete grout.

3. Encasement:

a. Concrete encase new sewer pipe minimum of 24 inches to nearest pipe joint.

b. Use epoxy binder between new and existing concrete.

4. Prevent construction debris from entering existing sewer line when making connection.

E. Manholes:

1. Install manholes as specified in Section 33 05 13, Manholes.

F. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.

2. Use standard fittings of same material and joint type as sewer main.

3. Maintain minimum 5-foot separation distance between wye connection and manhole.

4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.

5. Mount saddles with solvent cement or gasket and secure with metal bands.

6. Lay out holes with template and cut holes with mechanical cutter.

G. Catch Basins

1. Form bottom of excavation clean and smooth, and to indicated elevation.

2. Cast-in-place Concrete Construction:

a. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

b. Level top surface of base pad.

c. Sleeve concrete shaft sections to receive storm sewer pipe sections.

d. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

3. Mount lid and frame level in grout, secured to top cone section to indicated elevation.

H. Backfilling:

1. Backfill around sides and to top of pipe as specified in Section 31 23 23, Fill.

2. Maintain optimum moisture content of bedding material as required to attain specified compaction density.

3.4 FIELD QUALITY CONTROL

A. Request inspection by Engineer prior to and immediately after placing bedding.

B. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.

2. Pipe Testing: As specified in Section 33 30 10.13, Sewer and Manhole Testing.

3. Compaction Testing: See Section 31 23 17, Trenching for Compaction Testing requirements for piping trenches.

3.5 PROTECTION

A. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

DIVISION 40 – PROCESS INTERCONNECTIONS

SECTION 40 05 51 – COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes basic materials and methods related to valves commonly used for process systems, including pump stations, utility vaults, and water and wastewater treatment. This Section is to be used in conjunction with 40 05 61, Gate Valves, 40 05 64, Butterfly Valves, and 40 05 78.19, Combination Air Valves for Water Service.

B. Section Includes:

1. Valves.

C. Related Sections

1. Section 03 11 00, Concrete Work
2. Section 33 11 10, Water Utility Distribution and Transmission Piping
3. Section 40 05 00, Common Work Results for Process Interconnections
4. Section 40 05 61, Gate Valves
5. Section 40 05 64, Butterfly Valves
6. Section 40 05 78.19, Combination Air Valves for Water Service

1.2 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. Through 72 In.
2. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
3. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
4. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. ASTM International (ASTM):

1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges and Unions.

D. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Contractor shall be solely responsible to coordinate Work of this Section with piping, equipment, and appurtenances.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:

1. Submit Manufacturer's latest published literature. Include illustrations, installation and maintenance instructions, and parts lists.

2. Submit valve cavitation limits.

3. Submit Manufacturer data for actuator with model number and size indicated.

C. NOT USED

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit installation instructions and special requirements, including storage and handling procedures.

F. Lining and coating data.

G. Valve Labeling Schedule: Indicate valve locations and nametag text.

H. Certification of Valves Larger than 12 inches: Furnish certified copies of hydrostatic factory tests, indicating compliance with applicable standards.

I. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

J. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves and actuators.

B. Operation and Maintenance Data: Submit information for valves.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Parts:

1. Furnish one set of Manufacturer's recommended spare parts.

B. Tools:

1. Furnish special wrenches and other devices required for Owner to maintain equipment.

2. Furnish compatible and appropriately labeled toolbox when requested by Owner.

1.7 QUALITY ASSURANCE

A. Cast Manufacturer's name, pressure rating, size of valve, and year of fabrication into valve body.

B. Valve Testing: Each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

C. Certification: Prior to shipment, submit for all valves over 12 inches in diameter, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc. Valves tested and supplied shall be trackable and traceable by serial number, tagged or otherwise noted on valve, upon arrival to Site.

D. Maintain clearances as indicated on Drawings.

E. Unless otherwise noted, all water works materials provided for the Project shall be new, of first-class quality and shall be made by reputable manufacturers.

F. All material of a like kind shall be provided from a single manufacturer, unless otherwise approved by the Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

1. Store materials in areas protected from weather, moisture, or other potential damage.

2. Do not store materials directly on ground.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.

3. Provide additional protection according to Manufacturer instructions.

D. Handle products carefully to prevent damage to interior or exterior surfaces.

E. All defective or damaged materials shall be replaced with new materials at no cost to the Owner.

1.9 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required and shown in the Drawings.

B. Operation:

1. Open by turning counterclockwise; close by turning clockwise.

2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

C. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.

D. Connecting Nuts and Bolts: Stainless steel.

2.3 RESILIANT-SEATED GATE VALVES

A. As specified in Section 40 05 61, Gate Valves.

2.4 RUBBER-SEATED BUTTERFLY VALVES

A. As specified in Section 40 05 64, Butterfly Valves.

2.5 VALVE ACTUATORS

A. All valves shall be furnished with manual actuators, unless otherwise indicated in the Drawings.

B. Valves in sizes up to and including 4 inches in diameter shall have direct acting lever or handwheel actuators of the Manufacturer's best standard design.

C. Actuators shall be sized for the valve design pressure in accordance with AWWA C504.

D. Provide actuators with position indicators for shutoff valves 6 inches and larger.

E. Comply with AWWA C541 and C542, where applicable.

F. Furnish gear operators for valves 8 inches and larger, and chainwheel operators for valves mounted over 7 feet above floor.

G. Provide gear and power actuators with position indicators.

H. Gear-Assisted Manual Actuators:

1. Provide totally enclosed gears.

2. Maximum Operating Force: 60-pound-force (lbf).

3. Bearings: Permanently lubricated bronze.

4. Packing: Accessible for adjustment without requiring removal of actuator from valve.

I. Handwheel:

1. Furnish permanently attached handwheel for emergency manual operation.

2. Rotation: None during powered operation.

3. Permanently affix directional arrow and cast OPEN or CLOSE on handwheel to indicate appropriate direction to turn handwheel.

4. Maximum Operating Force: 60 lbf.

J. NOT USED

K. NOT USED

L. NOT USED

M. NOT USED

2.6 SOURCE QUALITY CONTROL

A. Testing: Test valves according to Manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system is ready for valve installation.

3.2 PREPARATION

A. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

B. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the Contractor to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

3.3 INSTALLATION

A. Install valves, extensions, and accessories according to Manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts, and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install valves with clearance for installation of insulation and allowing access.

G. Provide access where valves and fittings are not accessible.

H. Comply with Division 40 - Process Interconnections for piping materials applying to various system types.

I. Valve Applications:

1. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.

2. Install shutoff and isolation valves.

3. Isolate equipment, part of systems, or vertical risers as indicated on Drawings.

4. Install valves for throttling, bypass, or manual flow control services as indicated on Drawings.

J. Disinfection of Water Piping System:

1. Flush and disinfect system as specified in Section 33 13 00, Testing and Disinfection of Water Utility Piping.

3.4 FIELD QUALITY CONTROL

A. Valve Field Testing:

1. Test for proper alignment.

2. If specified by valve Section, field test equipment to demonstrate operation without undue leakage, noise, vibration, or overheating.

3. Engineer will witness field testing.

3.5 NOT USED

END OF SECTION

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SECTION 40 05 61 - GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes gate valves for use in buried service, fire hydrant assemblies and combination air release/vacuum valve assemblies. Coordinate with Section 33 12 16, Water Utility Distribution and Transmission Valves.

B. Section Includes:

1. Resilient-seated gate valves.
2. General duty gate valves smaller than 3 inches.

C. Related Sections:

1. Section 33 12 16, Water Utility Distribution and Transmission Valves
2. Section 33 11 10, Water Utility Distribution and Transmission Piping
3. Section 40 05 51, Common Requirements for Process Valves

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association (AWWA):

1. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

2. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service

3. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):

1. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends.
2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

E. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required by Section 33 12 16 - Water Utility Distribution and Transmission Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the “lead free” requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for “lead free”.

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RESILIENT-SEATED GATE VALVES

A. Description:

1. Comply with AWWA C509.

2. Minimum Pressure Rating:

a. Twelve-inch Diameter and Smaller: 200 pounds per square inch (gauge) (psig).
b. Sixteen-inch Diameter and Larger: 150 psig.

3. End Connections: As shown in the Drawings.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125. Comply with AWWA C115 & ASME 16.5.

1) The CONTRACTOR shall coordinate with pipe, valve, and fitting suppliers to make certain pipe, valve, and fitting flanges match in bolt pattern.

4. Gear Actuators: Conforming to AWWA C509 for manual valves.

5. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.

b. All internal and external ferrous surfaces.

c. Do not coat flange faces of valves.

6. Bi-directional flow.

B. Operation:

1. Non-rising stem.

2. Open counterclockwise when viewing the valve from above, unless otherwise indicated in the Drawings.

3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.

4. In-Plant Service Valves: Valves for in-plant or exposed service shall be furnished with handwheel operators, unless otherwise specified in Section 40 05 51, Common Requirements for Process Valves.

C. Materials:

1. Wedge:

a. ASTM A126, cast iron or ASTM A536, ductile iron.
b. Fully encapsulated.

2. Body and Bonnet:

a. ASTM A126, cast iron or ASTM A536, ductile iron.

3. Stem, Stem Nuts, Glands, and Bushings: ASTM B584, bronze.

4. Valve Body Bolting: Stainless steel.

D. Manufacturers:

1. Clow Valve Company.
2. M&H Valve.
3. U.S. Pipe.
4. American Flow Control.
5. Mueller Company.

2.3 DOUBLE-DISC GATE VALVES – NOT USED

2.4 SOLID WEDGE, METAL-SEATED GATE VALVES – NOT USED

2.5 GENERAL-DUTY GATE VALVES - SMALLER THAN 3 INCHES

A. Two inches and Smaller:

1. MSS SP 80, Class 125.
2. Body and Trim: ASTM B584, bronze.
3. Bonnet: Union.
4. Operation: Handwheel.
5. Inside screw with back-seating stem.
6. Wedge Disc: Solid; ASTM B584, bronze.
7. End Connections: Threaded.

B. Two and one-half inches to 3 inches:

1. MSS SP 70, Class 125.
2. Stem: Non-rising.
3. Body: ASTM A126, cast iron.
4. Trim: Bronze.
5. Bonnet: Bolted bonnet.
6. Handwheel, outside screw and yoke.
7. Wedge Disc: Solid, with bronze seat rings.
8. End Connections: ASME B16.1, ASME B16.5, ASME B16.42, flanged.

C. Manufacturers:

1. Stockham, Figure B-103.
2. Nibco, Model T-113.
3. Milwaukee Valve, Model 105.
4. Approved equal.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test gate valves according to AWWA C509.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by Section 33 12 16, Water Utility Distribution and Transmission Valves.
B. Install according to Manufacturer's instructions.
C. Support valves in plastic piping to prevent undue stresses on piping.

END OF SECTION

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SECTION 40 05 64 - BUTTERFLY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes butterfly valves for buried service. Coordinate with Section 33 12 16, Water Utility Distribution and Transmission Valves and Section 40 05 51, Common Requirements for Process Valves.

B. Section Includes:

1. Rubber-seated butterfly valves.

C. Related Sections:

1. Section 33 12 16, Water Utility Distribution and Transmission Valves
2. Section 33 11 10, Water Utility Distribution and Transmission Piping
3. Section 40 05 51, Common Requirements for Process Valves.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME):

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.

2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.

3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

B. ASTM International (ASTM):

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

4. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. American Water Works Association (AWWA):

1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).

2. AWWA C550 - Protecting Interior Coatings for Valves and Hydrants.

D. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects
2. NSF/ANSI Standard 372 - Drinking Water System Components - Lead Content

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
B. As required by Section 33 12 16 - Water Utility Distribution and Transmission Valves.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials in contact with potable water shall conform to ANSI/NSF Standard 61 and meet the "lead free" requirements of the Safe Drinking Water Act amendment, effective January 4, 2014, as per the lead content evaluation procedures outlined in NSF/ANSI Standard 372.1.

1. All fittings shall either be cast or permanently stamped with markings identifying the item as complying with NSF 61 per the requirements of NSF 372 for "lead free".

2. All brass in contact with potable water shall comply with ASTM B584.

2.2 RUBBER-SEATED BUTTERFLY VALVES

A. Description:

1. Comply with AWWA C504, Class 150B.

2. Minimum Pressure Rating:

a. Twelve-inch (300-millimeter) Diameter and Smaller: 200 pounds per square inch (gauge) (psig).

b. Sixteen-inch (400-millimeter) Diameter and Larger: 150 psig.

3. End Connections: As shown in the Drawings.

a. Standard mechanical joint ends comply with ANSI/AWWA C111.

b. Flanged end dimensions and drilling comply with ANSI/ASME B16.1, class 125, unless shown otherwise.

1) The CONTRACTOR shall coordinate with pipe, valve, and fitting suppliers to make certain pipe, valve, and fitting flanges match in bolt pattern.

4. Gear Actuators: Conforming to AWWA C504 for manual valves.

5. Linings and Coatings:

a. Corrosion-resistant fusion bonded epoxy conforming to AWWA C550 and NSF 61.

b. All internal and external ferrous surfaces.

c. Do not coat flange faces of valves.

6. Bubble-tight at the rated pressure for bi-directional flow.

7. Style: Wafer.

8. Shaft: Self-lubricating, sleeve-type bearings. One-piece, through-shaft construction.

a. Valve shafts shall be full size for that portion of the shaft extending through the valve bearings, valve disc, and shaft seal.

b. Any portion of the shaft turned down for any reason shall have fillets with radii equal to the offset to minimize stress concentrations at the junction of the different shaft diameters. The turned down portion of the shaft shall be capable of transmitting the maximum operator torque without exceeding a torsional steel stress of 11,500 pounds per square inch (psi).

9. Seats: Mounted on body for valves 24 inches and smaller; field replaceable (mechanically retained in a machined groove) for valves larger than 24 inches.

10. Packing: Replaceable without dismantling valve.

B. Operation:

1. Open counterclockwise, unless otherwise indicated in the Drawings.

2. Operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between full open and fully closed without creeping or fluttering.

3. Buried Valves: All buried valves shall be provided with 2-inch square operating nuts.

C. Materials:

1. Body: ASTM A126, cast iron or ASTM A536, ductile iron. Integrally cast flanged or mechanical end joints.

2. Shaft: Stainless steel.

3. Disc: ASTM A126, cast iron or ASTM A536, ductile iron.

4. Seats: Resilient, replaceable, Buna-N.

5. Seating Surfaces: Type 316 stainless steel.

6. Bearings:

a. Sleeve: Corrosion-resistant and self-lubricating.

D. Manufacturers:

1. M&H Valve.
2. Henry Pratt Company.
3. Mueller Company.
4. Kennedy Valve Company.
5. Dezurik.

2.3 SOURCE QUALITY CONTROL

A. Testing: Test butterfly valves according to AWWA C504.

PART 3 EXECUTION

3.1 INSTALLATION

A. As required by Section 33 12 16, Water Utility Distribution and Transmission Valves.

B. Install according to Manufacturer's instructions.

END OF SECTION

SECTION 40 05 78.19 – COMBINATION AIR VALVES FOR WATER SERVICE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Combination air valves for water service.

B. Related Sections:

1. Section 09 90 00 - Painting and Coating

2. Section 40 05 51 - Common Requirements for Process Valves

1.2 REFERENCE STANDARDS

A. American Water Works Association:

1. AWWA C512 - Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

B. ASME International:

1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASTM International:

1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

2. ASTM A536 - Standard Specification for Ductile Iron Castings.

D. International Organization for Standardization:

1. ISO 9001 - Quality Management Systems.

E. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.

2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with installation of process piping.

1.4 NOT USED

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit Manufacturer catalog information.

C. Shop Drawings: Indicate materials, dimensions, weights, and end connections in assembly drawings.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit special procedures and setting dimensions.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Manufacturer Reports: Certify that equipment has been installed according to Manufacturer instructions.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of combination air valves.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

B. Manufacturer Quality Management System: Certified to ISO 9001.

C. Perform Work according to City of Warrenton standards.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in Manufacturer's original packaging and inspect for damage.

B. Store materials according to Manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.

3. Provide additional protection according to Manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.

2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Furnish five-year Manufacturer's warranty for combination air valves.

PART 2 PRODUCTS

2.1 COMBINATION AIR VALVES FOR WATER SERVICE

A. Description:

1. Type:

a. Fully automatic, float operated.

b. Body: Double.

2. Comply with AWWA C512.

3. Size: As indicated on Drawings.

4. Suitable for potable water service.

B. Materials:

1. Body and Cover: 316 Stainless Steel or Ductile Iron ASTM A536 Grade 60-40-18.

2. Float, Seat, and Trim: 316 Stainless Steel.

3. Seats: Buna-N.

4. Seals: Buna-N.

C. End Connections:

1. Size 4 Inches and Smaller: Threaded, NPT.

2. Size Larger than 4 Inches: Flanged, ASME B16.5.

D. Manufacturers:

1. DeZurik, APCO AVV-1800/1800K, Dual Body Combination Air Valves, or approved equal.

2.2 INSULATION

A. As indicated on Drawings.

2.3 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09 90 00 - Painting and Coating.

2.4 SOURCE QUALITY CONTROL

A. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.

2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

B. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flanges mate properly.

3.2 PREPARATION

A. Thoroughly clean end connections before installation.

B. Close pipe and equipment openings with caps or plugs during installation.

C. Surface Preparation: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to Manufacturer instructions.

B. Provide access for operation, removal, and maintenance, and to avoid discharge to occupied areas or other equipment.

C. Installation Standards: Install Work according to City of Warrenton standards.

3.4 FIELD QUALITY CONTROL

A. Inspect for interferences and proper supports.

B. Testing:

1. As specified in Section 40 05 51 - Common Requirements for Process Valves.

2. Demonstrate operation without undue noise or vibration.

C. Manufacturer Services: Furnish services of Manufacturer's representative experienced in installation of products furnished under this Section for not less than two days on Site for

installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

D. Equipment Acceptance:

1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

2. Make final adjustments to equipment under direction of Manufacturer's representative.

3. Repair damaged coatings with material equal to original coating.

E. Furnish installation certificate from Equipment Manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.5 CLEANING

A. Keep interior of air release valves clean as installation progresses.

3.6 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION

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SUPPLEMENTARY INFORMATION

1 – GEOTECHNICAL ENGINEERING REPORT

Submitted To: Consor North America, Inc.
1 SW Columbia Street, Suite 1700
Portland, OR 97204
Attn: Andrew Miles

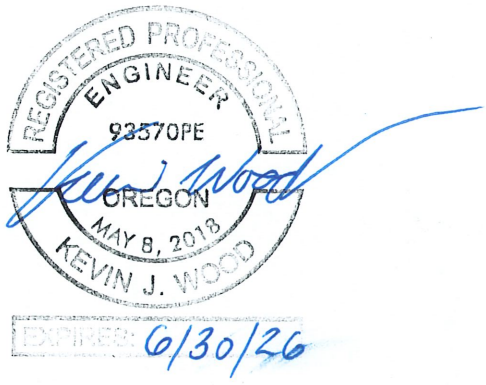
Subject: GEOTECHNICAL ENGINEERING REPORT, HAMMOND TRANSMISSION WATERLINE
CITY OF WARRENTON, WARRENTON, OREGON

Shannon & Wilson, Inc. (Shannon & Wilson) prepared this report and participated in this project as a subconsultant to Consor North America, Inc. (Consor). Our scope of services was specified in a subconsultant agreement with Consor dated September 6, 2023. This report presents the results of our field explorations and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON



Elliott Mecham, PE
Senior Associate | Engineer

Kevin Wood, PE
Senior Engineer

EFD:KJW/aec

CONTENTS

1 Introduction 1
2 Geologic Setting 1
2.1 Regional Geology 1
2.2 Local Geology 2
2.3 Seismic Setting 2
2.3.1 Cascadia Subduction Zone: Mega-Thrust Interface Source 3
2.3.2 Cascadia Subduction Zone: Intraslab Source 3
2.3.3 Shallow Crustal Source 4
2.3.4 Quaternary Faults and Folds 4
3 Exploration Program 5
3.1 Laboratory Testing 5
4 Subsurface Conditions 6
4.1 Geotechnical Units 6
4.2 Groundwater 6
5 Geologic Hazards 7
5.1 Landslide Hazard 7
5.2 Liquefaction 7
5.2.1 Liquefaction Analysis and Liquefaction-Induced Settlement 7
5.2.2 Potential Increased Flotation Effect 8
5.3 Lateral Spreading 9
5.4 Fault Surface Rupture 9
5.5 Seismic Hazard Mitigation 9
6 Pipeline Design Recommendations and Considerations 10
6.1 Bedding, Pipe Zone and Trench Backfill 10
6.1.1 Bedding 10
6.1.2 Pipe Zone 11
6.1.3 Trench Backfill 11
6.2 Uplift Design and Potential Flotation Effects 11
7 Construction Considerations 12

CONTENTS

7.1 Groundwater Control 12
7.1.1 Sump Pumps 13
7.1.2 Wells and Well Points 13
7.1.3 Control of Surface Water 14
7.2 Temporary Pipeline Excavation Stability 14
7.3 Wet Weather Construction 15
8 Limitations 15
9 References 17

Exhibits

Exhibit 2-1: USGS Class A Faults Within an Approximate 20-Mile Radius of the Project Site. 5
Exhibit 4-1: Depth to Groundwater Summary 6
Exhibit 5-1: Summary of Liquefaction-Induced Settlement 8
Exhibit 6-1: Summary of Total and Buoyant Unit Weights 12

Figures

Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan

Appendices

Appendix A: Field Explorations
Appendix B: Laboratory Test Results
Important Information

ACRONYMS

City of Warrenton	the City
Millimeters per year	mm/yr
Cascadia Subduction Zone	CSZ
Magnitude	M
Moment Magnitude	Mw
United States Geological Survey	USGS
Cone Penetration Tests	CPTs
Below ground surface	bgs
Vibrating Wire Piezometer	VWP
Controlled Low Strength Materal	CLSM
Pounds per cubic foot	pcf

ACRONYMS

1 INTRODUCTION

We understand that the City of Warrenton (the City) is planning to install an approximately 10,000 foot long, 18-inch diameter ductile iron waterline. Based on preliminary plans provided to us, the pipeline is planned to have a minimum cover that varies from 30- to 42-inches. Therefore, we anticipate that the pipeline will have an average depth of 4- to 5-feet to invert. However, profiles included in the preliminary plans provided by Consor indicate that the pipeline will be deeper in certain locations along the alignment, but still less than 10-feet to invert.

2 GEOLOGIC SETTING

2.1 Regional Geology

The Oregon Coast Range began as a mid-oceanic volcanic island chain, riding atop the ocean basaltic Kula and Juan de Fuca plates that collided with the North American continental plate during the early Eocene, 55 million years ago (Orr and others, 1992). These volcanic rocks of accreted islands form the backbone of the coastal mountains and are the oldest known rocks in the Coast Range. As the islands were accreted to North America, and the Kula and Juan de Fuca plates on which they were riding were forced beneath the continental plate, a trough was created between the ancestral Cascade Mountains and the accreted volcanic islands. During the Eocene and early Miocene, 55 to 16 million years ago, silt, sand, mud, and volcanic debris were deposited in the forearc basin and onto the subsiding accreted island chain from the landmass to the east. During the Oligocene and early Miocene, deposition over the subsiding accreted islands and the forearc basin continued from increased volcanism in the Western Cascades. During the Miocene, the ocean retreated to the west and the western edge of the North American plate wrinkled and buckled upwards by pressure from the subducting Juan de Fuca plate. Subduction of the Juan de Fuca plate under North America has pushed the Coast Range upwards and created the Coast Range physiographic province, a narrow north-south trending belt of moderately high mountains and coastal headlands, 30 to 60 miles wide and about 200 miles long, typically consisting of Tertiary marine sedimentary and volcanic rocks (Orr and others, 1992).

2.2 Local Geology

Published mapping by Walsh (1987), Niem and Niem (1985) and Schlicker and others (1972) indicates the pipeline alignment is underlain by Quaternary (from 1.8 million years ago to the present) beach sand, dune sand and flood plain alluvium silty clay. Neim and Neim (1985) describe the beach sand as consisting of well sorted, fine- to medium grained quartzo-feldspathic sands and the dune sand as well sorted, fine grained, quartzo-feldspathic sands with cross bedding.

2.3 Seismic Setting

The contemporary tectonics and seismicity of the region are the result of oblique, northeastward subduction at a rate of about 37 millimeters per year (mm/yr) (DeMets and others, 2010) of the Juan de Fuca oceanic plate beneath the North American continental plate (Wells and others, 1998; Wells and Simpson, 2001). This complex tectonic setting produces east-west compressive strain along the Cascadia Subduction Zone (CSZ), as well as northward translation and rotation of the mobile, crustal, Cascadia forearc blocks that span the leading edge of the North American plate (Wells and others, 1998; McCaffrey and others, 2007, 2013). Rotation of the Sierra-Nevada block and expansion of the Basin and Range drive the northward migration and clockwise rotation of the Cascadia forearc blocks (Pezzopane and Weldon, 1993; Wells and others, 1998; Wells and Simpson, 2001). As a result, the southern portion of the forearc, the Oregon Coast block, is impinging on western Washington and northwest Oregon at a rate of about 8 to 12 mm/yr causing crustal shortening in northwest Oregon and western Washington (Wells and others, 1998; Wells and Simpson, 2001; Mazzotti and others, 2002).

The combined effect of margin-normal subduction and margin-parallel shortening produces complex and diverse deformation within the northern edge of the Cascadia forearc and triggers large (greater than magnitude [M] 6), damaging earthquakes from three seismogenic source zones:

- The locked zone of the CSZ fault interface, which produces great mega-thrust earthquakes;
- The deep intraslab portion of the CSZ (i.e., the subducted portion of the Juan de Fuca Plate), the source of Wadati-Benioff zone earthquakes; and
- The overriding North American Plate, where shallow crustal faults rupture.

All three sources potentially produce earthquakes that impact the ground motion hazards at the project site. Offshore, elastic release of strain accumulated in the locked plate interface of the CSZ produces great megathrust earthquakes (greater than M 8.0) occurring at

irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997; Clague, 1997; Goldfinger and others, 2003 and 2012); the most recent rupture occurred in A.D. 1700 (Satake and others, 1996; Atwater and Hemphill-Haley, 1997; Clague, 1997; Yamaguchi and others, 1997; Goldfinger and others, 2003 and 2012).

Onshore, migration and rotation of tectonic blocks produce deformation along shallow faults within the upper part of the crust. At depth, rupture within the subducting slab, referred to as the intraslab, has produced some of the largest recorded earthquakes (M 6.5 to 7) to strike the Pacific Northwest, the northern California Coast, and Western Washington. However, over the past century, intraslab earthquakes have been markedly infrequent in Oregon. The following sections briefly describe the location, characteristics, and seismicity of each of the sources.

2.3.1 Cascadia Subduction Zone: Mega-Thrust Interface Source

CSZ mega-thrust earthquakes originate along the interface between the subducting oceanic plates and the North American plate. Because of the significant uncertainty of the landward extent of a potential rupture surface, estimates of the closest distance between the project and potential rupture surface range from about 5 to 40 horizontal miles. Focal depths for mega-thrust earthquakes are commonly on the order of about 15 to 25 miles. Rupture of the interface could result in earthquakes with moment magnitudes (Mw) on the order of 8.5 to over 9.0, with strong shaking that lasts for several minutes. No large earthquakes have occurred in this zone during historic times (the last 170 years). However, geologic evidence suggests that coastal estuaries have experienced rapid subsidence at various times within the last 2,000 years (Atwater, 1987; Atwater and Hemphill-Haley, 1997) as a result of tectonic movement associated with mega-thrust earthquakes on the CSZ. It appears that ruptures of this zone have occurred at irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997). Based on historical tsunami records in Japan (Satake and others, 1996) the most recent interplate event on the CSZ was a Mw 9 event on January 26, 1700.

2.3.2 Cascadia Subduction Zone: Intraslab Source

CSZ intraslab earthquakes originate from within the subducting oceanic plates as a result of down-dip tensional forces and bending caused by mineralogical and density changes in the plates at depth. These earthquakes typically occur 28 to 37 miles beneath the surface. The nearest seismogenic intraslab portion of the Juan de Fuca plate is approximately 30 to 60 miles below the Portland area. Ludwin and others (1991) estimate that the maximum Mw from this source zone would be about 7.5. Ground shaking produced by intraplate

earthquakes would be less intense and less prolonged in the Portland area than ground motions generated by large subduction zone interface earthquake events. Historic seismicity from this source zone includes the 1949 Mw 6.7 Olympia earthquake, the 1965 Mw 6.7 earthquake between Tacoma and Seattle, and the 2001 Mw 6.8 Nisqually earthquake. While intraslab events have occurred frequently in the Puget Sound area, they are historically rare in Oregon.

2.3.3 Shallow Crustal Source

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within Pacific Northwest, typically within the upper 4 to 19 miles of the continental crust. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at approximate Mw 6.5 to 7.0. Other examples include the 1993 Mw 5.6 Scotts Mill earthquake and the 1993 Mw 6.0 Klamath Falls earthquake.

2.3.4 Quaternary Faults and Folds

Faults and associated folds which demonstrate geological evidence of co-seismic surface deformation during the Quaternary time period in Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

According to the USGS Quaternary Fault and Fold Database (USGS, 2023), there are 5 Class A features, within approximately 20 miles of the project site. Their names, general locations relative to the site, and the time since their most recent deformation are summarized in Exhibit 2-1. The CSZ itself is approximately 6 miles west of the project site, with an average slip rate of approximately 40 millimeters (1.5 inches) per year.

Exhibit 2-1: USGS Class A Faults Within an Approximate 20-Mile Radius of the Project Site

Fault Name	USGS Fault Number	Approximate Length	Approximate Distance and Direction from Project Site[1]	Slip Rate Category[2]	Time Since Last Deformation[3]
Cascadia Fold and Fault Bed	784	301 miles	5.7 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Unnamed Offshore Faults	785	174 miles	9.3 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Willapa Bay Fault Zone	592	23 miles	14.7 miles North	Between 0.2 and 1.0 mm/yr	<750 ka
Nehalem Bank Fault	789	62.8	16.9 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Fault H	790	30.4	17.2 miles SW	Greater than 5.0 mm/yr	< 15 ka

NOTES:

[1] Approximate distance between project site and nearest extent of fault mapped at the ground surface.

[2] mm = millimeters; yr = year.

[3] Ma = "Mega-annum" or million years ago; ka = "Kilo-annum" or one thousand years ago.

3 EXPLORATION PROGRAM

Shannon & Wilson explored subsurface conditions at the project site with six Cone Penetetration Tests (CPTs), designated CPT-1 to CPT-6 and one geotechnical boring designated B-1. The CPT's were completed to depths ranging from 60.4 to 101.5 feet below ground surface (bgs) between January 23 to January 25, 2024. During explorations, a vibrating wire piezometer (VWP) was installed to allow the measurement of groundwater levels in boring B-1.

Approximate locations of the explorations are shown on the Site and Exploration Plan, Figure 2. Details of drilling, sampling procedures, and our log of the materials encountered are presented in Appendix A, Field Explorations.

3.1 Laboratory Testing

Soil samples obtained during our field exploration were transported to our laboratory for further examination. Representative samples were selected for laboratory tests. The laboratory testing program included moisture contents and grain size analyses. Laboratory testing was performed by Shannon & Wilson in accordance with applicable ASTM International (ASTM) standard test procedures. Results of the laboratory testing are presented in Appendix B and are shown on the log of the boring included in Appendix A.

4 SUBSURFACE CONDITIONS

4.1 Geotechnical Units

Shannon & Wilson grouped the materials encountered in our field explorations into two geotechnical units. The soil classifications are presented in the individual boring logs. The geotechnical units are as follows:

- **Fill:** Asphalt and Base Aggregate; and
- **Holocene Beach Sand:** Poorly Graded Sand (SP).

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring log in Appendix A.

4.2 Groundwater

Based on pore water dissipation testing in the CPTs, depth to groundwater was inferred in the CPT locations at the time of testing. Additionally, during explorations, a vibrating wire piezometer was installed to measure the groundwater level in boring B-1. The vibrating wire piezometer was installed to allow for ongoing groundwater level measurements. A summary of groundwater measurements is provided in Exhibit 4-1.

Exhibit 4-1: Depth to Groundwater Summary

Exploration (Method)	Date	Depth of Water (ft)	Approximate Ground Surface Elevation (ft)	Approximate Groundwater Elevation (ft)
B-1	1/23/2024	2.8	11.4	8.6
CPT-1 (PWD_1)	1/25/2024	8.93	14.5	5.6
CPT-2 (PWD_1)	1/24/2024	3.62	9.6	6.0
CPT-3 (PWD_1)	1/24/2024	4.90	13.6	8.7
CPT-4 (PWD_1)	1/24/2024	1.02	10.1	9.1
CPT-5 (PWD_1)	1/25/2024	5.40	11.4	6.0
CPT-6 (PWD_1)	1/23/2024	2.39	12.8	10.4

NOTES:

[1] Measurement inferred from Pore Water Dissipation Test in Cone Penetrometer (PWD)

Groundwater levels should be expected to vary with changes in topography and precipitation. Generally, groundwater highs occur at the end of the wet season in late spring or early summer, and groundwater lows occur towards the end of the dry season in the early to mid-fall.

5 GEOLOGIC HAZARDS

5.1 Landslide Hazard

According to the Oregon Department of Geology and Mineral Industries, no landslides have been mapped along the proposed pipeline alignment. Relative earthquake hazard maps prepared for coastal communities by DOGAMI (IMS-10) indicate that the proposed alignment is in an area of low landslide hazard. Based on the site topography and mapped landslide hazard, we consider the risk of earthquake induced landslides impacting the proposed pipeline to be low.

5.2 Liquefaction

Soil liquefaction is a phenomenon in which excess pore water pressure of loose to medium dense, saturated, granular soils increases during ground shaking to a level near the initial effective stress. The increased excess pore pressure results in a reduction of soil shear strength. The effects of liquefaction typically include lateral spreading, slope instability, and ground settlement.

Soil behavior under seismic loading is the primary factor in determining the susceptibility of soil to liquefaction. Important factors in evaluating soil behavior are relative density, the fines content (percent of soil by weight smaller than 0.075 millimeters, passing the No. 200 sieve), and the plasticity characteristics of the fines. Relative density can be estimated from CPT tip resistances and shear wave velocity measurements that were performed for this project. We completed grain size analyses to evaluate the index parameters of the soils at the site.

5.2.1 Liquefaction Analysis and Liquefaction-Induced Settlement

We evaluated liquefaction potential of the soils based on the boring and CPT results completed for this study. The CPT soundings were evaluated using the computer program CLiq Version 2 by GeoLogismiki, which incorporates the Boulanger and Idriss (2014) method. Our analysis was completed using a peak ground acceleration (PGA_M) of 0.8g and a mean Mw 8.89, based on the total seismic source contribution, according to USGS's Unified Hazard Tool with a 2,475-year return period. Exhibit 5-1 presents a summary of liquefaction induced settlement under the proposed pipeline.

Exhibit 5-1: Summary of Liquefaction-Induced Settlement

Exploration ID	Approximate Pipe Invert Elevation (feet)	Approximate Elevations of Liquefaction Susceptible Soils (feet)	Approximate Total Settlement at Pipe Invert[1] (inch)
CPT-1	6	4 to -46	1.5
CPT-2	6	4 to -51	2.5
CPT-3	6	8.5 to -46.5	3.0
CPT-4	6	8 to -50	2.0
CPT-5	6	6 to -48.5	3.5
CPT-6	6	10 to -47.5	3.0

Liquefaction-induced settlement magnitudes based on CPT soundings were estimated using Boulanger and Idriss (2014).

Soil deposits are not homogeneous; and liquefaction-induced settlement seldom occurs uniformly, even in small, localized areas (Ishihara and Yoshimine 1992), making differential settlements difficult to predict. Based on the available data and considering the range of liquefaction-induced settlement for the borings and CPT soundings along the proposed alignment, it is our qualitative assessment that the average liquefaction-induced differential settlement of the pipeline for the design earthquake ground motions will likely be less than or equal to approximately 1 inch in 500 feet.

We anticipate the estimated settlements could impact the buried pipeline that will be within or above the identified potentially liquefiable layers. Consequently, we recommend the designers of these structures consider the liquefaction-induced settlements.

5.2.2 Potential Increased Flotation Effect

The proposed pipelines within the identified potentially liquefiable soil layers will be subjected to increased buoyance forces beyond those during static conditions due to the dramatic increase in the pore water pressure associated with soil liquefaction.

The assessment of potential flotation of the pipeline from liquefaction involves determining if sufficient resistance to buoyancy forces is provided by the weight of the pipelines and resistance of the surrounding soil to uplift. We recommend the risk for flotation be evaluated during final design based on the specific pipeline and structure embedment within the liquefiable soil. Seismic mitigations for potential pipeline flotation are discussed

in Section 5.5 with additional guidance on the unit weight of various backfill materials and buoyant unit weight of soil in Section 6.2.

5.3 Lateral Spreading

Lateral spreading hazards can exist in areas with mild slopes adjacent to a much steeper slope or vertical face. Lateral spreading failure can occur if soil liquefaction develops during a seismic event and the ground acceleration (inertial force) briefly surpasses the yield acceleration (shear strength) of the liquefied soil. This can cause both the liquefied soil and an overlying non-liquefied crust of soil to displace laterally down mild slopes or towards an embankment face. The displacements are cumulative and permanent in nature.

The proposed pipeline alignment is approximately 750 to greater than 1,000 feet from the nearest free face. Based on the distance to the free face and the presence of existing infrastructure between the site and the Columbia River, the potential for lateral spreading to impact the pipeline is low.

5.4 Fault Surface Rupture

As presented in Exhibit 2-1, the closest mapped fault to the site is mapped approximately 5.7 miles west of the proposed alignment. Consequently, it is our opinion that the risk of surface fault rupture along the alignment is low during a design life of 100 years or less.

5.5 Seismic Hazard Mitigation

Where liquefied soil buoyant forces could cause flotation along the pipeline, mitigation strategies largely consist of protecting the pipeline with weighted pipe, such as encasements, or anchoring the pipeline with special foundation systems. For mitigation of differential settlements, lateral forces, and permanent ground displacements, potential measures consist of the selection of appropriate pipe materials and joints capable of withstanding predicted movements, and the use of specialized earthquake-resistant pipe and joints, as necessary.

Seismic mitigation for flotation of pipelines may include the use of backfilling with Controlled Low Strength Material (CLSM) above the pipeline. If CLSM is used, it will result in additional lateral forces on the pipeline during placement of the CLSM; therefore, we recommend consideration be given to the other methods, or very specific restrictions are placed on lift thickness and allowable time for setup of the CLSM before additional lifts are placed during construction.

6 PIPELINE DESIGN RECOMMENDATIONS AND CONSIDERATIONS

6.1 Bedding, Pipe Zone and Trench Backfill

The following are recommendations for pipe bedding, pipe zone, trench backfill, foundation (subgrade) preparation, and soil stiffness properties for pipe design. The recommendations below are consistent with the City of Warrenton Engineering Design Standards, which follow the 2018 Oregon Standard Specifications for Construction requirements for bedding, pipe zone, and trench backfill.

6.1.1 Bedding

The pipe bedding zone in the trench should be constructed with imported, well-graded, clean crushed rock material suitable for compaction and allowing for flexible joints. The on-site excavation spoils will be predominantly graded sands that are not suitable for use as bedding material. The bedding material should consist of imported, ¾-inch-minus crushed aggregate, as specified in the current Oregon Standard Specification for Construction, Item 00405.12, Bedding. Provided that the subgrade soil is competent, and is not disturbed by the excavation equipment, the minimum thickness of granular bedding below the invert of the pipeline should be 6 inches for 18-inch diameter pipelines in accordance with Oregon Standard Drawing RD300.

In areas where wet, weak, or disturbed subgrade conditions are encountered, the required subgrade stabilization (subgrade overexcavation/replacement) will likely result in thicker pipe bedding. During our explorations, soft clay soils were encountered in the pipe zone in CPT-1, CPT-4 and CPT-6. Additionally, high groundwater is expected at various locations along the alignment. For estimating purposes, in high groundwater areas we recommend planning for installation of a crushed rock drainage layer at a minimum. The crushed rock drainage layer should be at least 12 inches thick and installed below the pipe bedding to facilitate dewatering, such as engineered sump pumping from within this drainage layer to maintain groundwater within this layer. To prevent soils fines from migrating into the drainage layer during sump pumping (described below), we recommend a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent), be placed between the subgrade soils and the bottom of the drainage layer and on the sides of the drainage layer. We recommend that the actual amount of over-excavation and additional work related to the acceptance of the subgrade be determined in the field, observed, and approved by a qualified Owner's Representative.

The drainage layer should be constructed with open, free-draining crushed rock materials with a 1½- to 3/4-inch gradation, conforming to Oregon Standard Specifications for Construction (OSSC 2018, 00430.11). The crushed rock for the working mat/drainage system should also have less than 2 percent by weight passing the No. 200 wet sieve; and 90 percent of particles by weight retained on the U.S. No. 4 sieve should have at least two fractured faces. In areas where the drainage rock described above is used, the material can also serve as the pipe bedding.

If native soil migration or softening of the native subgrade soils is observed during construction, or is a result of construction activities, we recommend a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent), be placed between the subgrade soils and the bedding layer.

6.1.2 Pipe Zone

For the pipe zone material, bedding material specified in OSSC 2018, Item 00405.12, should be used for flexible pipes. In accordance with Oregon Standard Drawing RD300 the pipe zone materials should extend at least 12 inches above the top of an 18-inch pipe, or as determined by the manufacturer or civil engineer. Pipe zone compaction should be at least 90 percent of maximum density, as determined by a proctor, conforming to AASHTO T99.

6.1.3 Trench Backfill

Within roadways, shoulders, and settlement sensitive areas we recommend the use of ¾-inch-minus crushed aggregate, with less than 7 percent by dry weight passing a U.S. Standard No. 200 Sieve, and it should meet OSSC 2024 00405.14 (Class B Backfill). We recommend the backfill be compacted to at least 95 percent of the maximum dry density, as determined by AASHTO T 99 or as recommended by the civil engineer.

In non-settlement sensitive areas Class A Backfill may be used. We recommend the backfill be compacted to at least 90 percent of the maximum dry density, as determined by AASHTO T 99. If native topsoil was present prior to excavation in non-paved areas, then it should be replaced within the upper 12-inches of the adjacent ground surface. The topsoil should be mounded over the trench to allow for settlement.

6.2 Uplift Design and Potential Flotation Effects

The assessment of potential pipeline flotation from liquefaction involves determining if enough resistance to buoyancy forces is provided by the weight of the pipeline and contents, and resistance of the surrounding soil to pipeline uplift. We recommend the risk

for flotation be evaluated based on the specific pipeline embedment within the liquefiable soil. For the discussion on seismic mitigation for flotation, please refer to Section 5.54.6.

For preliminary evaluation purposes, the project structural engineer can evaluate flotation hazards by treating the liquefied soil as a heavy viscous fluid with a unit weight of 95 pounds per cubic foot (pcf). The depth of the fluid can be taken as the distance from the design groundwater elevation to the bottom of the pipeline. Exhibit 6-1 summarizes the total and buoyant unit weights for the various native and imported backfill materials.

Exhibit 6-1: Summary of Total and Buoyant Unit Weights

Material	Total Unit Weight, γ (pcf)	Buoyant Unit Weight, γ' (pcf)
Native Backfill	110	47
Crushed Rock Backfill	130	67
Controlled Low Strength Material (CLSM)	145	83
Liquefied Native Soil	--	95

7 CONSTRUCTION CONSIDERATIONS

7.1 Groundwater Control

We understand that the proposed alignment will typically be installed using open-cut construction methods. In general, the majority of the open cut excavations will be made through graded sands with a portion of the excavation below the water table. In areas where graded sands are present and the excavations are 1 to 3 feet below the water table, we anticipate dewatering can generally be handled by internal sump pumps inside the trench excavation, pumping from within the drainage layer described in Section 6.1.1. In excavations 3 to 12 feet below the water level, an active dewatering system outside the trench should be considered necessary, such as wells or well-points. Wells or well-points mitigate the potential for running soils by reducing pore water pressure buildup in the soil and will also help to stabilize the subgrade especially for excavations that may be near the contact between the fine-grained alluvium gravelly terrace deposits. Running soils could soften, disturb, or weaken the subgrade and could result in long term settlements of the pipeline. Additional details regarding typical external dewatering systems is presented in Section 7.1.2.

Our recommended approach for evaluating the subsurface soil and groundwater conditions prior to performing the excavations is to dig test pits (or perform potholes or install additional observation wells near the proposed alignment) approximately 6 to 8 weeks prior

to the start of excavating. Test pits are likely to provide the most benefit as they will provide relevant information of not only the groundwater depth, but also on the overall stability of the excavation and subgrade conditions. Test pits should be performed to a similar depth as the planned open-cut excavations and at spacings of 400 to 500 feet. The test pits would give further indication of the plasticity of the soil, allowing City representatives and the contractor to visually evaluate the depth and potential adverse effects of groundwater for a particular construction period and to evaluate the potential need for external dewatering systems, for excavation and subgrade instability, and subgrade stabilization depths. If active dewatering is found to be necessary based on the test pit excavations, then we would still recommend supplementing the active dewatering system with internal sump pumps operating within the drainage layer.

We recommend the construction contract documents be prepared in such a way as to accommodate the groundwater control decisions, type of external dewatering systems, and unit price methods of payment during construction.

7.1.1 Sump Pumps

We recommend incorporating a drainage layer into the trench excavation. The sump pumps should be installed at sufficient spacing to keep the groundwater level within the drainage rock layer.. Additional details regarding the recommended drainage layer is discussed in Section 6.1.1.

7.1.2 Wells and Well Points

External dewatering systems, such as wells and well points, should be designed by the Contractor to draw groundwater levels down to below the bottom of the excavations where required during construction. External dewatering will help prevent disturbance and instability of the surrounding soil during excavation and construction of permanent facilities, which would likely lead to constructability issues and short- and long-term settlement.

The contractor should retain the services of a specialized dewatering subcontractor to design and oversee the installation, operation, and removal of the dewatering systems. The type of dewatering system (i.e., vacuum wellpoints and/or dewatering wells) and the spacing and depth of dewatering system components will depend on the contractor's dewatering system design. However, we anticipate, based on the variability of the soils to be dewatered, vacuum well-points may need to be installed on 5- to 6-foot centers. If dewatering wells are selected, we anticipate they may need to be spaced between 20 and 30 feet.

Vacuum well-points or dewatering wells should be developed immediately upon completion using methods such as over-pumping until a visibly clear discharge is achieved and the specific capacity of the wells reaches a minimum level.

Observation wells should be installed close to the trench to measure groundwater depths and to confirm that the target groundwater drawdown has occurred before beginning trench excavation below the groundwater levels. The observation wells should be developed as part of the installation procedure to enable reliable groundwater level measurements to be made. Observation wells installed before the dewatering system can be utilized to observe subsurface soils and static groundwater conditions. However, our recommended approach for evaluating the subsurface conditions ahead of the construction is discussed in Section 7.1.

7.1.3 Control of Surface Water

Surface water should be controlled/redirected so as not to allow it to flow into open excavations. Any water collected, as well as any excavated soil, should be treated and disposed of in a manner meeting local, state, and federal environmental regulations and requirements.

7.2 Temporary Pipeline Excavation Stability

The majority of the trench excavation can be accomplished with a suitably designed trench shield (often referred to as trench boxes), designed or selected by the Contractor, provided the dewatering recommendations prepared in our report are implemented and excavations are less than approximately 10 feet in depth.

Note that while trench boxes are typically used for shallow pipeline installations in the type of soil encountered in our explorations above the groundwater table, they do not provide full-time lateral support for the excavation sidewalls and are typically solely for worker safety. Therefore, excavation sidewalls may still experience sloughing or instability, which could cause damage to existing adjacent infrastructure near the excavation, including adjacent pavement, pipelines or culverts.

If caving, sloughing, or raveling is a potential and/or observed for any excavations, we would recommend that the voids between the sidewalls and the shoring should be immediately backfilled with crushed rock to prevent trench side wall instability and undermining of existing utilities or pavement sections. The voids should be filled with 3/4-inch minus imported crushed rock materials (OSSC, 2018 Item 00405.12) immediately after the trench box is placed to maintain tight contact to the sidewall soils.

We are providing the above information and opinions solely as a service to our client. Under no circumstances should the information provided, and opinions expressed above, be interpreted to mean that Shannon & Wilson is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

7.3 Wet Weather Construction

Excavation and construction operations may expose the on-site soils to inclement weather conditions. The stability of exposed soils may rapidly deteriorate due to a change in moisture content (i.e., wetting or drying) or the action of heavy or repeated construction traffic. Accordingly, excavations should be adequately protected from the elements and from the action of repetitive or heavy construction loadings.

8 LIMITATIONS

The analyses, interpretations, conclusions, and recommendations contained in this report are based on site conditions as they presently exist and further assume that the explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the current explorations. If future phases of work at the site uncover subsurface conditions different from those encountered in these explorations, we should be advised at once so that we can review these encountered conditions and reconsider our interpretations and conclusions, where necessary. If there is a substantial lapse of time between the submission of this report and the start of future phases of work at the site, or if conditions have changed because of natural forces or construction operations at or adjacent to the site, we recommend that we review our report to determine the applicability of the conclusions and recommendations.

Within the limitations of scope, schedule, and budget, the analyses, interpretations, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied. These interpretations and conclusions were based on our understanding of the project as described in this report and the site conditions as observed previously and at the time of our current explorations.

This report was prepared for the exclusive use of Consor, and the City of Warrenton, as covered in this report. During future phases of work involving construction, the data contained in this report should be provided to the contractors for their information, but our

report interpretations, conclusions, and recommendations should not be construed as a warranty of subgrade conditions as included in this report, and should not used as a basis for contractor bidding.

The scope of this report did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air, on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered.

Shannon & Wilson, Inc., has prepared and included, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of this report.

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0 0.5 1 2

Scale in Miles

N

LEGEND

1 Figure 2 Sheet

Hammond Transmission Waterline
Warrenton, Oregon

VICINITY MAP

August 2024 112242

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FIG. 1

Filename: P:\GIS\PDX\112000s\112242_City of Warrenton Hammond\Avmxd\VicinityMap.mxd Date: 2/1/2024 Login: AEH

LEGEND

CPT-1 Designation and Approximate Location of Cone Penetration Test (CPT)

B-1 Designation and Approximate Location of Boring with Vibrating Wire Piezometer

Proposed Alignment

0 375 750 1,500

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Contours were derived from 2010 LiDAR data obtained through DOGAMI.
3. Existing features from file 231023_MB&G ETransmit.dwg, provided by Consor on January 30, 2024.
4. Proposed alignment from file 231023_MB&G ETransmit.dwg, provided by Consor on January 30, 2024.

Hammond Transmission Waterline
Warrenton, Oregon

SITE AND EXPLORATION PLAN

August 2024 112242

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FIG. 2

Filename: P:\GIS\PDX\112000s\112242_City of Warrenton Hammond\Avmxd\SitePlanLS_overview.mxd Date: 2/12/2024 Login: KJW

APPENDIX A: FIELD EXPLORATIONS

Appendix A
Field Explorations

CONTENTS

A.1 General....1
A.2 Drilling....1
A.2.1 Direct Push....1
A.3 Cone Penetration Test (CPT) Results....1
A.3.1 General....1
A.3.2 Cone Penetration Testing....2
A.3.3 CPT Logs....2
A.4 Material Descriptions....2
A.5 Drill Logs....3
A.6 Borehole Installations....3
A.6.1 Vibrating Wire Piezometers....3

Figures

Figure A1: Soil Description and Log Key
Figure A2: Log of Boring B-1
Figure A3: Boring B-1 Photographs

Attachments

CPT Sounding CPT-1
CPT Sounding CPT-2
CPT Sounding CPT-3
CPT Sounding CPT-4
CPT Sounding CPT-5
CPT Sounding CPT-6

APPENDIX A: FIELD EXPLORATIONS

A.1 GENERAL

The geotechnical field exploration program included six cone penetration tests (CPTs), designated CPT-1 to CPT-6 and one geotechnical boring, designated B-1. A vibrating wire piezometer (VWP) was installed in boring B-1. Completed boring locations were measured in the field and are shown on the Site and Exploration Plan, Figure 2. Shannon & Wilson geology and engineering staff were present during the drilling of the geotechnical borings and borehole installations to locate the drilling sites, log the materials encountered, and collect soil samples.

This appendix describes the techniques used to advance and sample the borings and presents logs of the materials encountered.

A.2 DRILLING

One geotechnical boring designated B-1 was completed adjacent to CPT-5. The boring was completed to a depth of 15-feet below ground surface (bgs) with a track-mounted Geoprobe 6622CPT drilling rig operated by Oregon Geotechnical Explorations, Inc. (OGE), of Keizer, Oregon. The approximate locations are shown in the attached Figure 2, Site and Exploration Plan.

A.2.1 Direct Push

The boring CPT-5a was complete using a direct push drilling method where vehicle weight and percussive force are used to advance the drilling rod. Continuous disturbed samples were collected in the boring with a 2-inch plastic sheath. All samples were visually identified and described in the field, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

A.3 CONE PENETRATION TEST (CPT) RESULTS

A.3.1 General

The field exploration program as part of this study included a total of four Cone Penetration Tests (CPTs), designated CPT-1 to CPT-6, performed along the path of the proposed pipeline. The approximate locations are shown in the attached Figure 2, Site and Exploration Plan. The CPTs were completed to a depth of between 60.4 to 101.5 feet bgs and were completed by OGE between January 23, and January 25, 2024.

A.3.2 Cone Penetration Testing

OGE pushed the CPTs using a truck-mounted CPT rig. In some instances, a track-mounted Geoprobe 6622CPT was used to predrill through asphalt layers or gravel. During a CPT, a specialized cone assembly at the end of a steel probe is hydraulically pushed down through the subsurface. The cone assembly contains load cells and associated strain gauges which monitor the deformation of the load cells. One set of load cells deforms with increasing resistance to cone tip penetration. Another set of load cells deforms with increasing frictional resistance encountered on a sleeve on the outside of the assembly.

The cone assembly also contains a piezometer, which measures pore pressure. Pore pressure is useful in estimating soil behavior type because penetration has varying effects on pore pressure, depending on the type of material being penetrated. Data from the strain gauges and from the piezometer is transmitted from the cone assembly back through extension rods to the CPT recording device via a cable. Analysis software using industry-standard calculations then convert the raw data signals from the instruments into tip resistance, skin friction, and pore pressure. The same software applies correlations to the processed data to estimate the soil type and equivalent Standard Penetration Test (SPT) N-value.

A.3.3 CPT Logs

All CPT data was reduced and correlated by OGE. Summary graphic and numeric logs of the CPT data, prepared by OGE, are attached to the end of this appendix. Logs include depth in feet, tip resistance (Qt) in tons per square foot, local friction (Fs) in tons per square foot, friction ratio (Fs/Qt) expressed as a percentage, pore pressure (Pw) in pounds per square inch, estimated soil behavior type, and estimated SPT N-value (N60).

A.4 MATERIAL DESCRIPTIONS

Soil samples were described and identified visually in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Consistency, color, relative moisture, degree of plasticity, and other distinguishing characteristics of the samples were noted. Once transported to Shannon & Wilson, the SPT and hand grab samples from the hand auger were re-examined and the field descriptions, and identifications were modified where necessary. The specific terminology used is defined in the Soil Description and Log Key, Figure A1.

A.5 DRILL LOGS

The summary logs of the borings are presented in the Logs of Borings, Figure A2. Material descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portions of the logs show individual sample intervals, percent recovery, SPT data, and natural moisture content measurements. Material descriptions and geotechnical unit designations are shown in the center of the boring logs, and the right-hand portions provides a graphic log, miscellaneous comments, and a graphic depicting hole installation and backfill details.

A.6 BOREHOLE INSTALLATIONS

A vibrating wire pressure transducer was installed to allow for ongoing measurements of groundwater levels. Installation details are discussed below and shown graphically on the Logs of Borings.

A.6.1 Vibrating Wire Piezometers

A vibrating wire pressure transducer (Geokon model 4500S) was installed in boring B-1 to allow for ongoing groundwater level measurements. A vibrating wire pressure transducer (VWP) measures pressure using a pressure-sensitive diaphragm with a vibrating wire element attached to it. A cable runs from the transducer to the ground surface, where a readout device can be attached. Pressure acting on the outside face of the diaphragm causes it to deflect, which changes the tension of the wire element and the frequency of its vibration. The readout device measures the frequency of the induced vibration, which is converted to pressure, or head of groundwater above the transducer. The vibrating wire pressure transducer was permanently grouted into place in the borehole. The instrument was taped to a measured length of polyvinyl chloride (PVC) pipe to control the depth of installation. Prior to insertion, an initial "zero" reading was taken at "zero" head. With the transducer and PVC pipe in place, the hole was tremie grouted with bentonite cement grout. The cable leading up from the transducer is protected at the surface by a flush-mount monument set in concrete. The VWP installation depth is indicated on the boring log.

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

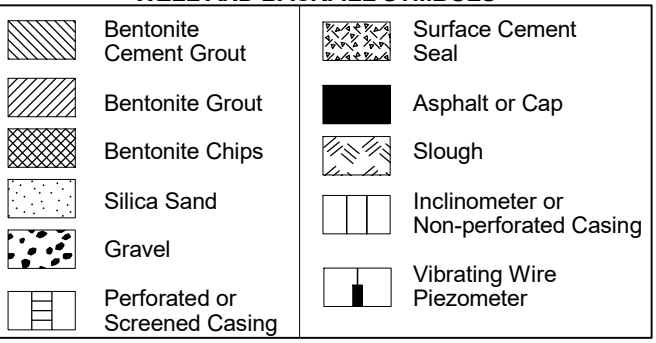
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A1
Sheet 1 of 3

2013 BORING CLASS1 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)
FILL	Placed by humans, both engineered and nonengineered. May include various soil materials and debris.				The Fill graphic symbol is combined with the soil graphic that best represents the observed material

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the *CL-ML* area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.
3. The soil graphics above represent the various USCS identifications (i.e., *GP*, *SM*, etc.) and may be augmented with additional symbology to represent differences within USCS designations. *Sandy Silt (ML)*, for example, may be accompanied by the *ML* soil graphic with sand grains added. Non-USCS materials may be represented by other graphic symbols; see log for descriptions.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

SHANNON & WILSON, INC.
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FIG. A1
Sheet 2 of 3

2013 BORING CLASS2 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

[1]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.
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Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

SHANNON & WILSON, INC.
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FIG. A1
Sheet 3 of 3

2013 BORING CLASS3 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

Total Depth:	*15 ft.*	Northing:	~	Drilling Method:	*Direct Push*	Hole Diam.:	*4" in.*
Top Elevation:	~	Easting:	~	Drilling Company:	*Oregon Geotechnical*	Rod Type:	*N/A*
Vert. Datum:		Station:	~	Drill Rig Equipment:	*Geoprobe 6622CPT*	Hammer Type:	*N/A*
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

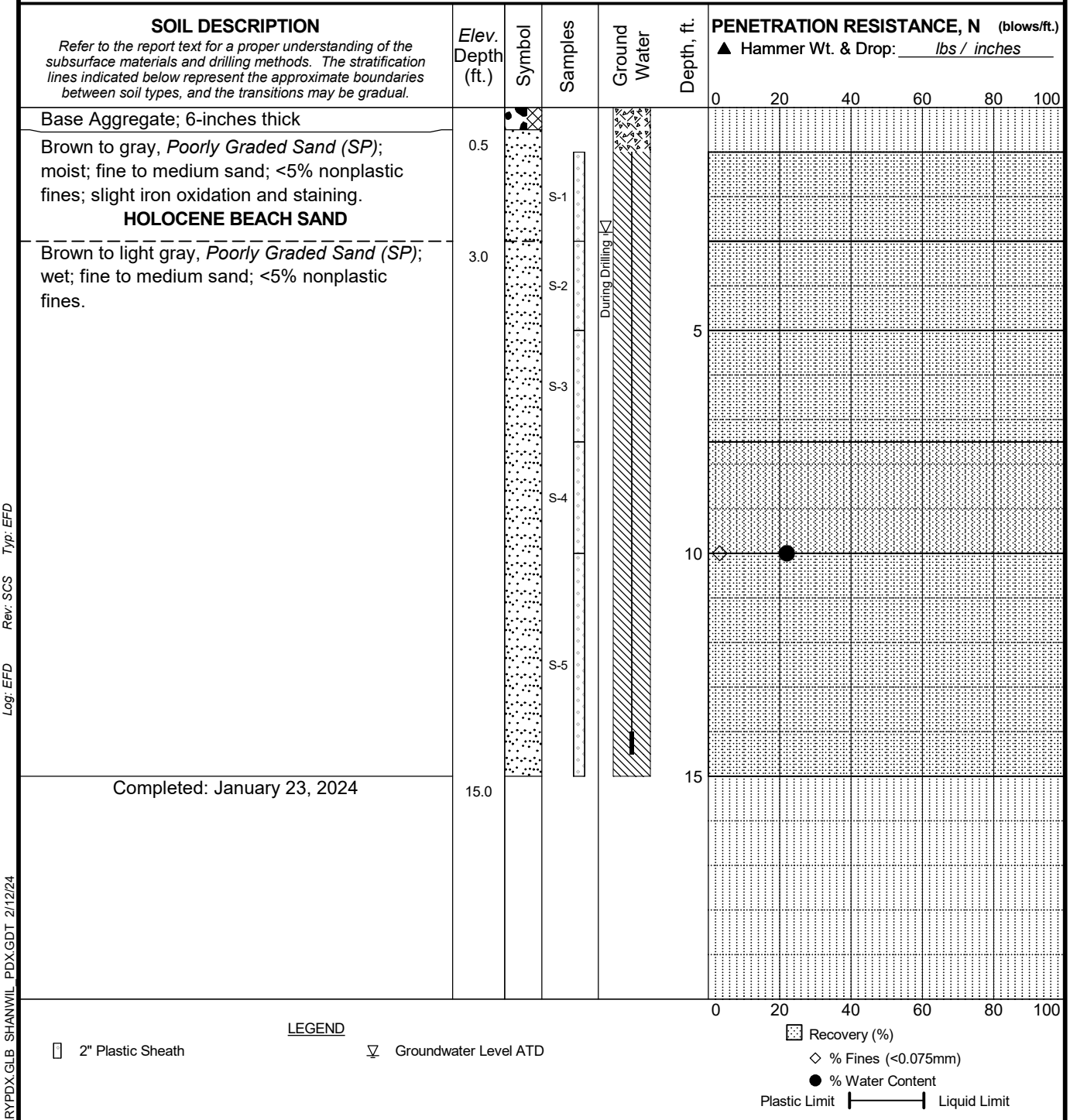
Base Aggregate; 6-inches thick

Brown to gray, *Poorly Graded Sand (SP)*; moist; fine to medium sand; <5% nonplastic fines; slight iron oxidation and staining.

HOLOCENE BEACH SAND

Brown to light gray, *Poorly Graded Sand (SP)*; wet; fine to medium sand; <5% nonplastic fines.

Completed: January 23, 2024



LEGEND

2" Plastic Sheath

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit ——— Liquid Limit

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

LOG OF BORING B-1

August 2024 112242

SHANNON & WILSON

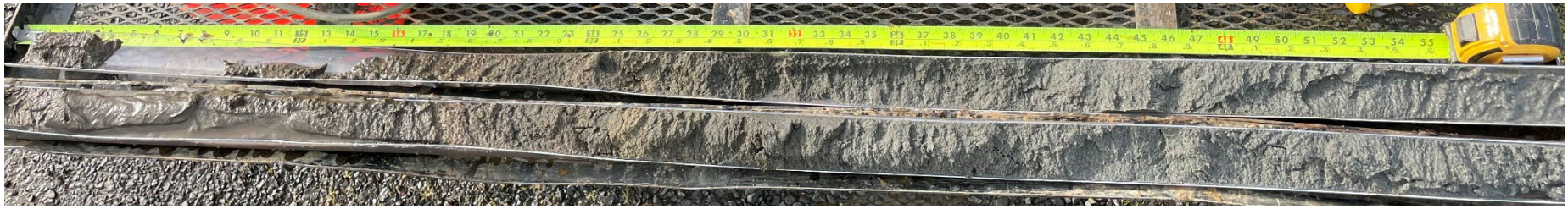
FIG. A2

REV 2

Log: EFD Rev: SCS Typ: EFD

MASTER LOG E 112242.GPJ SW2013LIBRARYPDX.GLB SHANWIL PDX.GDT 2/12/24

Photograph 1: View of B-1, approximately 0-5 feet.



Photograph 2: View of B-1, approximately 5-10 feet.

Photograph 3: View of B-1, approximately 10-15 feet.

Consor North America, Inc.
Hammond Transmission Waterline
Warrenton, Oregon

BORING B-1
GEOPROBE PHOTOGRAPHS

August 2024 112242

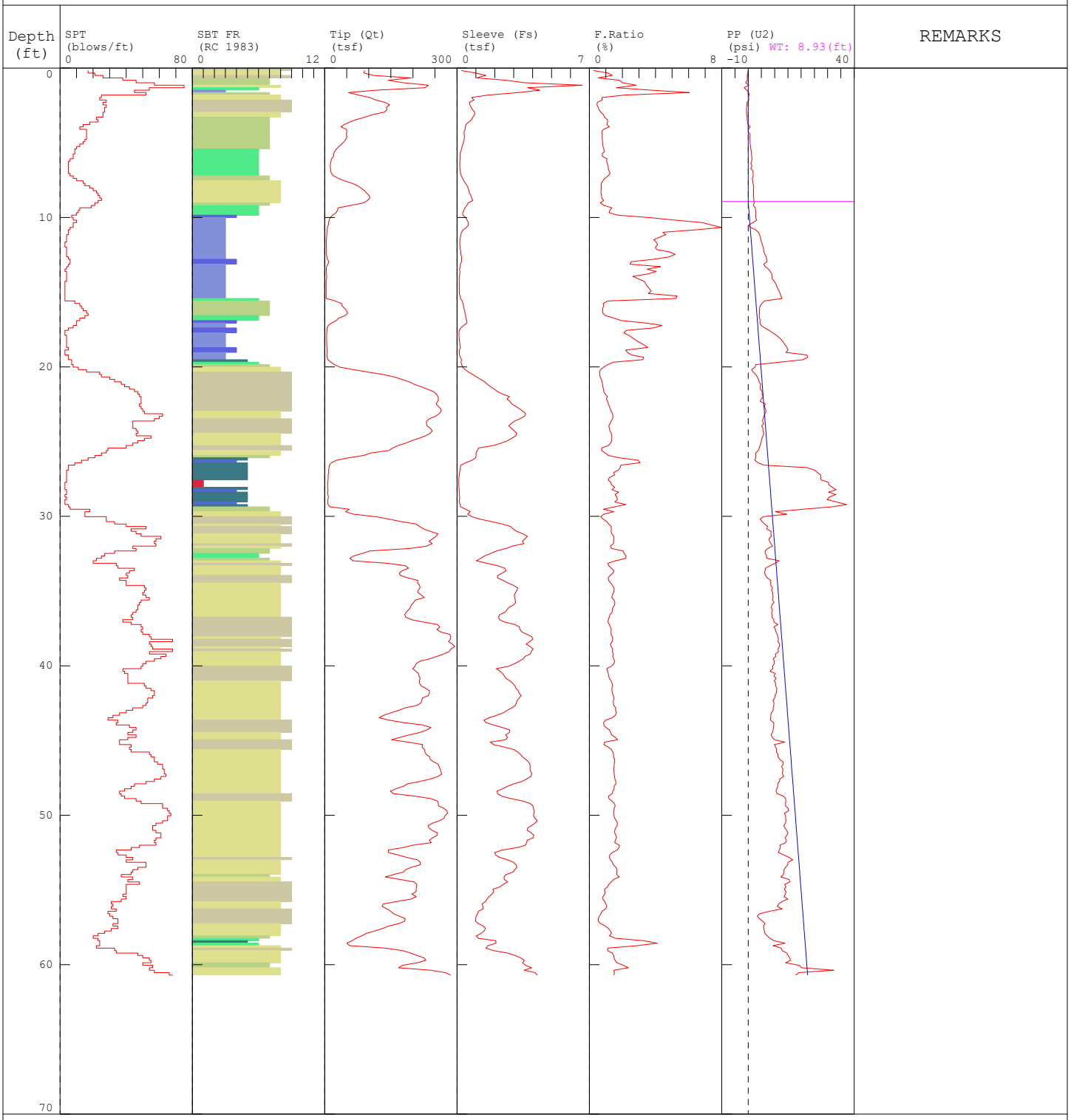
SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A3

FIG. A3

Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM
TOTAL DEPTH: 60.696 ft

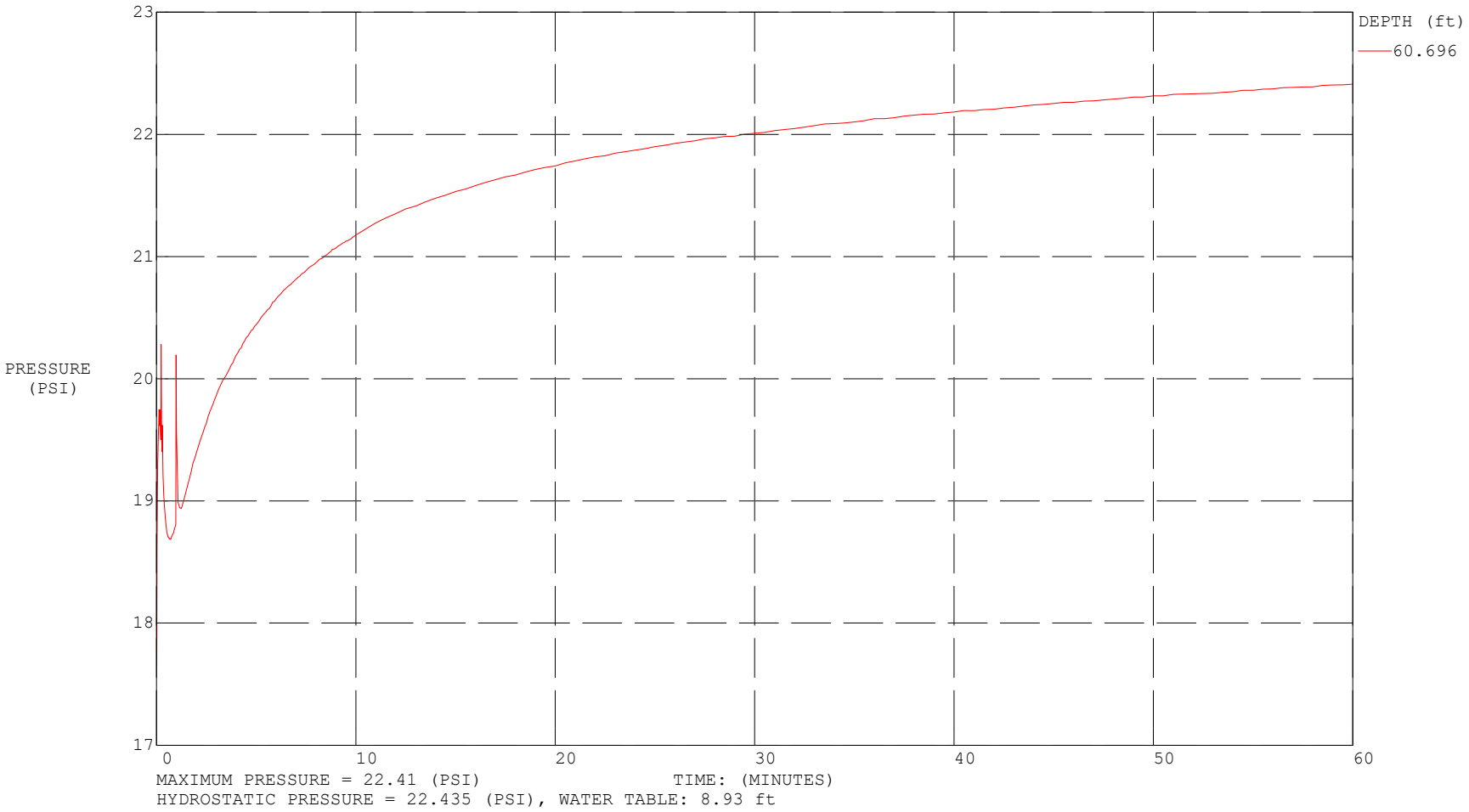


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM



MAXIMUM PRESSURE = 22.41 (PSI)
HYDROSTATIC PRESSURE = 22.435 (PSI), WATER TABLE: 8.93 ft

Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM
TOTAL DEPTH: 60.696 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	89.74	0.2269	0.253	-0.012	17	9	sand
0.328	89.12	0.9957	1.117	-0.086	21	8	sand to silty sand
0.492	110.57	1.5202	1.375	-0.423	26	8	sand to silty sand
0.656	195.98	1.0301	0.526	-0.323	38	9	sand
0.820	143.82	2.5934	1.803	-0.359	46	7	silty sand to sandy silt
0.984	178.16	3.5692	2.003	-0.940	57	7	silty sand to sandy silt
1.148	235.08	6.6073	2.811	0.289	75	7	silty sand to sandy silt
1.312	227.58	3.7311	1.639	-1.559	54	8	sand to silty sand
1.476	116.48	4.3665	3.749	-0.583	45	6	sandy silt to clayey silt
1.640	54.05	3.2614	6.034	0.170	52	3	clay
1.804	76.92	1.6436	2.137	0.383	25	7	silty sand to sandy silt
1.969	102.25	0.7750	0.758	0.074	24	8	sand to silty sand
2.133	115.48	0.8888	0.770	0.258	28	8	sand to silty sand
2.297	136.90	0.6505	0.475	-0.457	26	9	sand
2.461	147.02	0.6750	0.459	-0.509	28	9	sand
2.625	139.57	0.7440	0.533	-0.595	27	9	sand
2.789	141.16	0.8153	0.578	-0.686	27	9	sand
2.953	134.81	0.9317	0.691	-0.643	26	9	sand
3.117	108.05	0.9232	0.854	-0.634	26	8	sand to silty sand
3.281	91.56	0.8276	0.904	-0.402	22	8	sand to silty sand
3.445	70.76	0.7699	1.088	-0.438	23	7	silty sand to sandy silt
3.609	57.10	0.6259	1.096	-0.282	18	7	silty sand to sandy silt
3.773	44.39	0.4680	1.054	-0.115	14	7	silty sand to sandy silt
3.937	37.18	0.4450	1.197	0.772	12	7	silty sand to sandy silt
4.101	49.27	0.4210	0.854	-0.026	16	7	silty sand to sandy silt
4.265	50.05	0.3717	0.743	-0.069	16	7	silty sand to sandy silt
4.429	48.62	0.3758	0.773	0.701	16	7	silty sand to sandy silt
4.593	50.46	0.3857	0.765	0.583	16	7	silty sand to sandy silt
4.757	47.73	0.3731	0.782	0.636	15	7	silty sand to sandy silt
4.921	43.91	0.3484	0.793	0.660	14	7	silty sand to sandy silt
5.085	38.74	0.3123	0.806	0.734	12	7	silty sand to sandy silt
5.249	32.13	0.2640	0.822	0.870	10	7	silty sand to sandy silt
5.413	26.75	0.2308	0.863	0.973	9	7	silty sand to sandy silt
5.577	22.57	0.2043	0.905	1.155	9	6	sandy silt to clayey silt
5.741	20.03	0.1545	0.771	1.248	8	6	sandy silt to clayey silt
5.906	20.13	0.1582	0.786	1.284	8	6	sandy silt to clayey silt
6.070	15.16	0.1598	1.054	1.425	6	6	sandy silt to clayey silt
6.234	14.24	0.1483	1.041	1.294	5	6	sandy silt to clayey silt
6.398	13.01	0.1411	1.085	0.988	5	6	sandy silt to clayey silt
6.562	12.77	0.1428	1.118	1.397	5	6	sandy silt to clayey silt
6.726	13.06	0.1494	1.144	0.959	5	6	sandy silt to clayey silt
6.890	13.84	0.1652	1.194	1.851	5	6	sandy silt to clayey silt
7.054	14.94	0.1865	1.248	1.851	6	6	sandy silt to clayey silt
7.218	20.02	0.2253	1.125	1.870	8	6	sandy silt to clayey silt
7.382	31.12	0.2894	0.930	1.533	10	7	silty sand to sandy silt
7.546	44.23	0.3618	0.818	1.700	14	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	62.06	0.4428	0.714	1.770	15	8	sand to silty sand
7.874	74.51	0.5335	0.716	2.021	18	8	sand to silty sand
8.038	82.11	0.5908	0.720	1.975	20	8	sand to silty sand
8.202	89.93	0.6272	0.697	2.006	22	8	sand to silty sand
8.366	94.90	0.6591	0.695	1.999	23	8	sand to silty sand
8.530	100.57	0.7319	0.728	1.992	24	8	sand to silty sand
8.694	102.44	0.7718	0.753	2.059	25	8	sand to silty sand
8.858	97.27	0.8366	0.860	2.155	23	8	sand to silty sand
9.022	87.05	0.5738	0.659	2.195	21	8	sand to silty sand
9.186	58.89	0.5214	0.885	1.944	19	7	silty sand to sandy silt
9.350	30.25	0.4113	1.359	2.657	12	6	sandy silt to clayey silt
9.514	29.24	0.3646	1.247	2.774	11	6	sandy silt to clayey silt
9.678	25.65	0.3045	1.187	2.881	10	6	sandy silt to clayey silt
9.843	17.87	0.3021	1.691	2.800	7	6	sandy silt to clayey silt
10.007	12.33	0.4511	3.660	2.829	8	4	silty clay to clay
10.171	10.24	0.5287	5.163	3.161	10	3	clay
10.335	8.78	0.5977	6.811	1.832	8	3	clay
10.499	8.16	0.6016	7.375	0.165	8	3	clay
10.663	6.23	0.4973	7.982	1.000	6	3	clay
10.827	5.17	0.3338	6.453	2.788	5	3	clay
10.991	5.21	0.2317	4.444	3.905	5	3	clay
11.155	4.57	0.2106	4.610	4.268	4	3	clay
11.319	4.19	0.1773	4.231	4.596	4	3	clay
11.483	3.87	0.1508	3.895	4.742	4	3	clay
11.647	3.49	0.1408	4.033	4.998	3	3	clay
11.811	3.50	0.1442	4.125	5.342	3	3	clay
11.975	3.87	0.1548	3.996	5.557	4	3	clay
12.139	4.05	0.1644	4.057	5.796	4	3	clay
12.303	4.05	0.1965	4.846	5.942	4	3	clay
12.467	3.84	0.1989	5.183	6.291	4	3	clay
12.631	5.09	0.2453	4.820	6.806	5	3	clay
12.795	5.94	0.2328	3.920	6.990	6	3	clay
12.959	9.38	0.2365	2.522	7.081	6	4	silty clay to clay
13.123	7.20	0.1770	2.458	5.871	5	4	silty clay to clay
13.287	4.06	0.1742	4.290	6.409	4	3	clay
13.451	3.64	0.1271	3.496	7.647	3	3	clay
13.615	3.78	0.1526	4.041	8.343	4	3	clay
13.780	3.98	0.1405	3.534	8.876	4	3	clay
13.944	4.51	0.1181	2.621	8.984	4	3	clay
14.108	3.92	0.1160	2.958	9.068	4	3	clay
14.272	3.43	0.1134	3.305	9.821	3	3	clay
14.436	3.45	0.1175	3.403	10.393	3	3	clay
14.600	3.34	0.1168	3.493	10.780	3	3	clay
14.764	3.31	0.1203	3.635	11.172	3	3	clay
14.928	3.32	0.1238	3.724	11.593	3	3	clay
15.092	3.34	0.1192	3.568	12.028	3	3	clay
15.256	3.07	0.1626	5.298	12.294	3	3	clay
15.420	3.52	0.1842	5.226	12.791	3	3	clay
15.584	24.00	0.2685	1.119	6.115	9	6	sandy silt to clayey silt
15.748	37.67	0.3146	0.835	5.156	12	7	silty sand to sandy silt
15.912	39.47	0.3418	0.866	4.488	13	7	silty sand to sandy silt
16.076	45.22	0.3609	0.798	4.249	14	7	silty sand to sandy silt
16.240	49.62	0.3972	0.801	4.237	16	7	silty sand to sandy silt
16.404	52.02	0.4209	0.809	4.223	17	7	silty sand to sandy silt
16.568	46.63	0.4510	0.967	4.130	15	7	silty sand to sandy silt
16.732	31.35	0.4628	1.476	4.259	12	6	sandy silt to clayey silt
16.896	26.08	0.5041	1.933	4.431	10	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	15.30	0.5253	3.432	4.398	10	4	silty clay to clay
17.224	8.01	0.3510	4.381	4.842	8	3	clay
17.388	5.40	0.2095	3.876	6.253	5	3	clay
17.552	5.10	0.1138	2.232	7.906	3	4	silty clay to clay
17.717	4.73	0.0982	2.078	9.285	3	4	silty clay to clay
17.881	4.15	0.0982	2.366	10.613	4	3	clay
18.045	4.17	0.1083	2.594	11.758	4	3	clay
18.209	4.27	0.1200	2.809	12.631	4	3	clay
18.373	4.40	0.1342	3.048	13.355	4	3	clay
18.537	4.52	0.1502	3.320	13.984	4	3	clay
18.701	5.03	0.1770	3.523	14.608	5	3	clay
18.865	5.36	0.1177	2.194	14.977	3	4	silty clay to clay
19.029	5.22	0.1201	2.300	14.257	3	4	silty clay to clay
19.193	4.93	0.1258	2.552	22.220	5	3	clay
19.357	5.32	0.1746	3.282	22.473	5	3	clay
19.521	7.29	0.2351	3.222	20.709	7	3	clay
19.685	14.14	0.2048	1.448	11.842	7	5	clayey silt to silty clay
19.849	21.91	0.2399	1.095	2.862	8	6	sandy silt to clayey silt
20.013	34.34	0.2958	0.861	2.585	11	7	silty sand to sandy silt
20.177	64.97	0.4277	0.658	1.291	16	8	sand to silty sand
20.341	98.91	0.6071	0.614	1.880	24	8	sand to silty sand
20.505	132.42	0.8279	0.625	2.800	25	9	sand
20.669	157.68	1.0261	0.651	3.374	30	9	sand
20.833	174.27	1.2434	0.713	3.891	33	9	sand
20.997	191.51	1.4575	0.761	4.111	37	9	sand
21.161	202.71	1.6066	0.793	4.682	39	9	sand
21.325	218.65	1.7759	0.812	4.575	42	9	sand
21.490	233.09	1.9757	0.848	4.582	45	9	sand
21.654	246.52	2.1390	0.868	5.301	47	9	sand
21.818	253.18	2.4030	0.949	5.242	48	9	sand
21.982	256.46	2.7734	1.081	5.605	49	9	sand
22.146	257.66	2.6351	1.023	4.948	49	9	sand
22.310	256.04	2.8054	1.096	4.469	49	9	sand
22.474	252.38	2.8898	1.145	6.406	48	9	sand
22.638	257.57	3.1056	1.206	6.117	49	9	sand
22.802	262.62	3.3028	1.258	6.416	50	9	sand
22.966	264.08	3.4750	1.316	6.736	51	9	sand
23.130	259.14	3.6257	1.399	6.344	62	8	sand to silty sand
23.294	251.63	3.5654	1.417	5.942	60	8	sand to silty sand
23.458	237.20	3.3395	1.408	5.548	57	8	sand to silty sand
23.622	230.94	3.0379	1.315	5.407	44	9	sand
23.786	230.32	2.8720	1.247	5.768	44	9	sand
23.950	232.04	2.7288	1.176	5.074	44	9	sand
24.114	239.70	2.8879	1.205	5.519	46	9	sand
24.278	243.75	3.0223	1.240	5.548	47	9	sand
24.442	239.27	3.1572	1.320	5.904	46	9	sand
24.606	228.23	3.1006	1.359	5.569	55	8	sand to silty sand
24.770	213.70	2.8918	1.353	5.148	51	8	sand to silty sand
24.934	197.05	2.6628	1.351	4.945	47	8	sand to silty sand
25.098	184.39	2.3473	1.273	4.783	44	8	sand to silty sand
25.262	166.52	1.9154	1.150	4.443	40	8	sand to silty sand
25.427	153.97	1.1428	0.742	4.144	29	9	sand
25.591	145.88	1.0699	0.733	3.783	28	9	sand
25.755	104.65	0.9998	0.955	2.791	25	8	sand to silty sand
25.919	88.06	1.0064	1.143	2.865	21	8	sand to silty sand
26.083	54.29	0.9907	1.825	2.795	17	7	silty sand to sandy silt
26.247	26.56	0.7829	2.948	2.528	13	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	14.74	0.4492	3.048	3.702	9	4	silty clay to clay
26.575	10.80	0.2049	1.898	5.883	5	5	clayey silt to silty clay
26.739	9.59	0.1781	1.858	22.189	5	5	clayey silt to silty clay
26.903	8.90	0.1557	1.749	24.991	4	5	clayey silt to silty clay
27.067	8.94	0.1305	1.460	26.163	4	5	clayey silt to silty clay
27.231	7.93	0.1217	1.535	27.335	4	5	clayey silt to silty clay
27.395	7.74	0.0939	1.213	27.363	4	5	clayey silt to silty clay
27.559	7.69	0.0869	1.129	27.490	4	5	clayey silt to silty clay
27.723	6.94	0.0892	1.285	30.317	3	1	sensitive fine grained
27.887	6.75	0.0903	1.338	30.429	3	1	sensitive fine grained
28.051	6.51	0.0987	1.517	31.670	3	1	sensitive fine grained
28.215	7.58	0.1035	1.365	33.201	4	5	clayey silt to silty clay
28.379	6.81	0.1196	1.757	30.348	4	4	silty clay to clay
28.543	7.05	0.1090	1.546	33.036	3	5	clayey silt to silty clay
28.707	8.24	0.1359	1.650	30.635	4	5	clayey silt to silty clay
28.871	7.29	0.1233	1.692	29.783	3	5	clayey silt to silty clay
29.035	6.91	0.1061	1.536	33.392	3	5	clayey silt to silty clay
29.199	7.66	0.1675	2.186	37.108	5	4	silty clay to clay
29.364	12.12	0.1840	1.518	31.457	6	5	clayey silt to silty clay
29.528	55.08	0.4634	0.841	20.799	18	7	silty sand to sandy silt
29.692	47.32	0.6948	1.468	10.261	15	7	silty sand to sandy silt
29.856	64.74	0.5626	0.869	14.479	15	8	sand to silty sand
30.020	115.81	0.7883	0.681	5.691	28	8	sand to silty sand
30.184	146.01	1.2195	0.835	4.522	28	9	sand
30.348	174.28	1.8278	1.049	5.268	33	9	sand
30.512	206.90	2.3858	1.153	6.141	40	9	sand
30.676	215.21	2.8314	1.316	7.317	52	8	sand to silty sand
30.840	223.72	2.9551	1.321	6.983	43	9	sand
31.004	238.98	3.1509	1.318	8.640	46	9	sand
31.168	256.38	3.4826	1.358	8.549	49	9	sand
31.332	252.74	3.7198	1.472	8.728	61	8	sand to silty sand
31.496	244.09	3.5905	1.471	7.803	58	8	sand to silty sand
31.660	236.66	3.4550	1.460	8.037	57	8	sand to silty sand
31.824	243.52	3.5304	1.450	8.630	58	8	sand to silty sand
31.988	230.98	2.9207	1.264	9.120	44	9	sand
32.152	192.76	2.5806	1.339	7.411	46	8	sand to silty sand
32.316	102.27	2.0828	2.037	6.373	33	7	silty sand to sandy silt
32.480	85.07	1.7788	2.091	6.413	27	7	silty sand to sandy silt
32.644	65.78	1.4575	2.216	6.940	25	6	sandy silt to clayey silt
32.808	57.12	1.2507	2.190	6.985	22	6	sandy silt to clayey silt
32.972	63.81	1.0243	1.605	11.610	20	7	silty sand to sandy silt
33.136	141.20	1.5747	1.115	10.228	34	8	sand to silty sand
33.301	183.43	2.1387	1.166	8.171	35	9	sand
33.465	189.97	2.5189	1.326	6.502	45	8	sand to silty sand
33.629	175.96	2.5896	1.472	6.366	42	8	sand to silty sand
33.793	169.03	2.3973	1.418	6.158	40	8	sand to silty sand
33.957	171.13	2.1415	1.251	6.574	41	8	sand to silty sand
34.121	188.88	2.1442	1.135	7.179	36	9	sand
34.285	210.90	2.4316	1.153	8.491	40	9	sand
34.449	210.34	2.6842	1.276	8.448	40	9	sand
34.613	214.95	2.9763	1.385	8.527	51	8	sand to silty sand
34.777	216.12	3.2033	1.482	9.111	52	8	sand to silty sand
34.941	212.03	3.1701	1.495	8.798	51	8	sand to silty sand
35.105	210.76	3.0891	1.466	9.254	50	8	sand to silty sand
35.269	218.82	3.0287	1.384	9.290	52	8	sand to silty sand
35.433	225.90	3.0522	1.351	9.352	54	8	sand to silty sand
35.597	205.60	3.0733	1.495	9.228	49	8	sand to silty sand

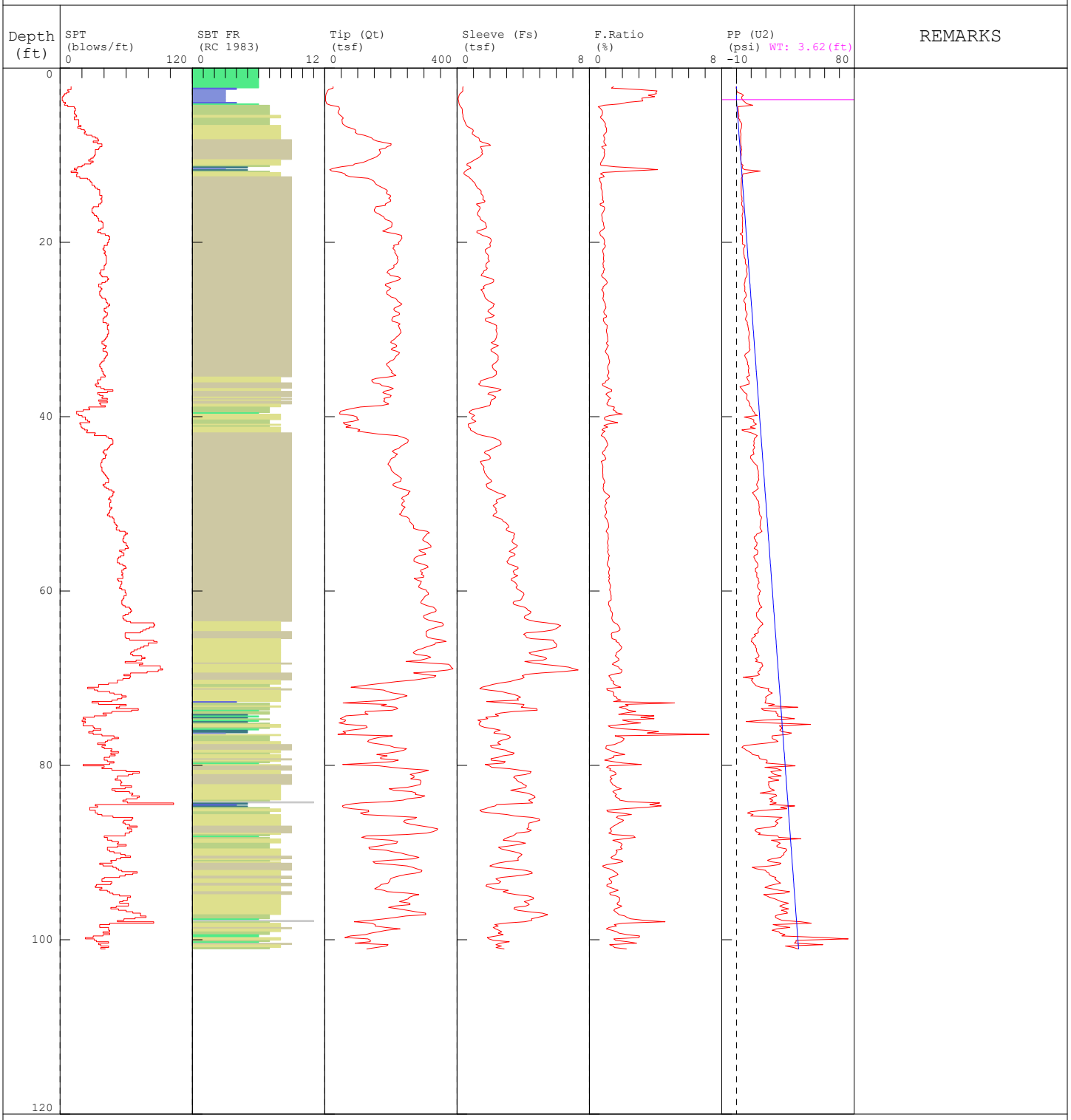
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	201.32	3.0961	1.538	9.704	48	8	sand to silty sand
35.925	196.42	2.9824	1.518	8.905	47	8	sand to silty sand
36.089	194.24	2.7536	1.418	8.683	47	8	sand to silty sand
36.253	190.17	2.6439	1.390	9.116	46	8	sand to silty sand
36.417	184.66	2.5308	1.370	8.850	44	8	sand to silty sand
36.581	181.09	2.2535	1.244	8.965	43	8	sand to silty sand
36.745	183.76	2.1952	1.195	8.900	44	8	sand to silty sand
36.909	196.35	2.2419	1.142	9.666	38	9	sand
37.073	224.98	2.5243	1.122	9.689	43	9	sand
37.238	255.58	3.0635	1.199	11.151	49	9	sand
37.402	260.70	3.2952	1.264	9.711	50	9	sand
37.566	254.41	3.3276	1.308	10.249	49	9	sand
37.730	262.21	3.4283	1.307	10.464	50	9	sand
37.894	283.59	3.6920	1.302	10.974	54	9	sand
38.058	285.80	3.9604	1.386	11.134	55	9	sand
38.222	284.71	3.9990	1.405	11.368	68	8	sand to silty sand
38.386	280.48	3.8417	1.370	11.208	54	9	sand
38.550	289.27	3.6555	1.264	11.856	55	9	sand
38.714	294.55	3.8721	1.315	11.729	56	9	sand
38.878	285.75	4.0213	1.407	11.268	68	8	sand to silty sand
39.042	282.16	3.9180	1.389	11.392	54	9	sand
39.206	269.15	3.8714	1.438	10.256	64	8	sand to silty sand
39.370	254.24	3.5926	1.413	10.402	61	8	sand to silty sand
39.534	238.59	3.4923	1.464	9.388	57	8	sand to silty sand
39.698	215.61	3.2854	1.524	9.857	52	8	sand to silty sand
39.862	206.83	3.0373	1.469	9.809	50	8	sand to silty sand
40.026	204.83	2.7258	1.331	9.171	49	8	sand to silty sand
40.190	199.56	2.0750	1.040	9.290	38	9	sand
40.354	206.14	2.2641	1.098	8.195	39	9	sand
40.518	212.39	2.4105	1.135	10.182	41	9	sand
40.682	213.71	2.4999	1.170	9.718	41	9	sand
40.846	216.30	2.5854	1.195	10.469	41	9	sand
41.011	214.55	2.8007	1.305	9.883	41	9	sand
41.175	215.02	2.9502	1.372	10.294	51	8	sand to silty sand
41.339	218.54	3.0575	1.399	10.366	52	8	sand to silty sand
41.503	228.85	3.1108	1.359	10.732	55	8	sand to silty sand
41.667	237.01	3.2291	1.362	10.713	57	8	sand to silty sand
41.831	237.18	3.2859	1.385	10.593	57	8	sand to silty sand
41.995	234.35	3.3896	1.446	10.096	56	8	sand to silty sand
42.159	221.28	3.2820	1.483	10.005	53	8	sand to silty sand
42.323	219.89	3.1768	1.445	9.314	53	8	sand to silty sand
42.487	218.26	3.1402	1.439	9.723	52	8	sand to silty sand
42.651	208.70	3.0770	1.474	9.627	50	8	sand to silty sand
42.815	182.93	2.8955	1.583	9.381	44	8	sand to silty sand
42.979	167.90	2.6532	1.580	9.419	40	8	sand to silty sand
43.143	149.85	2.4453	1.632	8.754	36	8	sand to silty sand
43.307	133.89	2.0902	1.561	8.542	32	8	sand to silty sand
43.471	123.09	1.6960	1.378	8.484	29	8	sand to silty sand
43.635	145.47	1.4303	0.983	8.374	35	8	sand to silty sand
43.799	178.45	1.5298	0.857	9.565	34	9	sand
43.963	221.58	1.9226	0.868	9.654	42	9	sand
44.127	240.90	2.3811	0.988	9.532	46	9	sand
44.291	231.62	2.7877	1.204	9.383	44	9	sand
44.455	215.88	2.7681	1.282	9.147	41	9	sand
44.619	191.79	2.5691	1.340	8.666	46	8	sand to silty sand
44.783	170.23	2.6629	1.564	9.075	41	8	sand to silty sand
44.948	151.43	2.5706	1.698	10.000	36	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	188.51	1.7501	0.928	13.779	36	9	sand
45.276	222.01	1.9338	0.871	9.874	43	9	sand
45.440	220.79	2.4860	1.126	10.369	42	9	sand
45.604	226.29	3.0005	1.326	10.691	43	9	sand
45.768	227.35	3.2163	1.415	10.617	54	8	sand to silty sand
45.932	230.09	3.3528	1.457	11.246	55	8	sand to silty sand
46.096	238.32	3.4594	1.452	11.210	57	8	sand to silty sand
46.260	239.16	3.6342	1.520	11.866	57	8	sand to silty sand
46.424	246.83	3.7773	1.530	13.119	59	8	sand to silty sand
46.588	257.08	3.8512	1.498	13.226	62	8	sand to silty sand
46.752	259.20	3.8642	1.491	12.614	62	8	sand to silty sand
46.916	261.71	3.8571	1.474	13.102	63	8	sand to silty sand
47.080	263.11	3.8982	1.482	12.939	63	8	sand to silty sand
47.244	265.28	3.9613	1.493	12.944	64	8	sand to silty sand
47.408	256.76	3.8944	1.517	13.379	61	8	sand to silty sand
47.572	239.86	3.6837	1.536	11.925	57	8	sand to silty sand
47.736	215.82	3.4312	1.590	11.768	52	8	sand to silty sand
47.900	187.92	3.0031	1.598	11.105	45	8	sand to silty sand
48.064	178.31	2.6619	1.493	11.155	43	8	sand to silty sand
48.228	161.19	2.4013	1.490	10.813	39	8	sand to silty sand
48.392	149.06	2.1058	1.413	10.469	36	8	sand to silty sand
48.556	155.44	2.1410	1.377	10.902	37	8	sand to silty sand
48.720	203.85	2.3517	1.154	13.279	39	9	sand
48.885	240.41	2.8421	1.182	14.116	46	9	sand
49.049	255.84	3.4864	1.363	14.209	49	9	sand
49.213	257.34	3.8766	1.506	14.099	62	8	sand to silty sand
49.377	257.92	4.0113	1.555	14.132	62	8	sand to silty sand
49.541	269.75	4.0361	1.496	15.072	65	8	sand to silty sand
49.705	276.98	4.0884	1.476	15.240	66	8	sand to silty sand
49.869	278.28	4.0662	1.461	13.688	67	8	sand to silty sand
50.033	272.83	4.0394	1.481	14.077	65	8	sand to silty sand
50.197	270.19	4.1171	1.524	14.137	65	8	sand to silty sand
50.361	260.47	4.2392	1.628	14.242	62	8	sand to silty sand
50.525	244.32	4.1276	1.689	14.118	58	8	sand to silty sand
50.689	234.79	3.9386	1.678	13.420	56	8	sand to silty sand
50.853	235.83	3.7330	1.583	13.812	56	8	sand to silty sand
51.017	243.56	3.7192	1.527	14.465	58	8	sand to silty sand
51.181	255.83	3.9240	1.534	15.001	61	8	sand to silty sand
51.345	254.62	4.0579	1.594	14.537	61	8	sand to silty sand
51.509	244.06	4.0181	1.646	13.869	58	8	sand to silty sand
51.673	237.13	3.7101	1.565	14.417	57	8	sand to silty sand
51.837	241.50	3.6788	1.523	14.089	58	8	sand to silty sand
52.001	200.05	3.6208	1.810	11.992	48	8	sand to silty sand
52.165	178.16	3.1929	1.792	12.141	43	8	sand to silty sand
52.329	143.78	2.4036	1.672	11.727	34	8	sand to silty sand
52.493	144.36	1.9988	1.385	11.337	35	8	sand to silty sand
52.657	166.49	2.0371	1.224	13.508	40	8	sand to silty sand
52.822	185.51	2.2394	1.207	15.474	44	8	sand to silty sand
52.986	210.02	2.6620	1.267	16.775	40	9	sand
53.150	216.66	2.9939	1.382	15.008	52	8	sand to silty sand
53.314	216.28	3.1149	1.440	14.891	52	8	sand to silty sand
53.478	196.50	3.1647	1.611	14.089	47	8	sand to silty sand
53.642	183.09	3.0520	1.667	13.544	44	8	sand to silty sand
53.806	178.37	2.9554	1.657	13.496	43	8	sand to silty sand
53.970	156.64	2.5981	1.659	13.267	37	8	sand to silty sand
54.134	137.63	2.4795	1.802	12.341	44	7	silty sand to sandy silt
54.298	171.01	2.4948	1.459	15.474	41	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	202.46	2.6782	1.323	15.651	48	8	sand to silty sand
54.626	208.78	2.4396	1.169	13.748	40	9	sand
54.790	208.01	2.2687	1.091	14.233	40	9	sand
54.954	207.39	1.8952	0.914	13.606	40	9	sand
55.118	207.19	1.9453	0.939	14.364	40	9	sand
55.282	197.80	1.8445	0.933	13.987	38	9	sand
55.446	207.57	1.6913	0.815	13.525	40	9	sand
55.610	195.43	1.5883	0.813	14.898	37	9	sand
55.774	162.94	1.5019	0.922	12.755	31	9	sand
55.938	132.53	1.3226	0.998	11.392	32	8	sand to silty sand
56.102	130.01	1.3650	1.050	10.954	31	8	sand to silty sand
56.266	140.70	1.3765	0.978	12.734	34	8	sand to silty sand
56.430	149.97	1.1347	0.757	8.102	29	9	sand
56.594	155.70	1.0791	0.693	4.285	30	9	sand
56.759	169.33	1.0071	0.595	3.362	32	9	sand
56.923	182.53	0.9836	0.539	4.256	35	9	sand
57.087	181.08	0.9723	0.537	5.335	35	9	sand
57.251	167.74	1.1143	0.664	6.330	32	9	sand
57.415	145.53	1.3970	0.960	5.756	35	8	sand to silty sand
57.579	131.05	1.5034	1.147	5.906	31	8	sand to silty sand
57.743	112.91	1.4243	1.261	6.062	27	8	sand to silty sand
57.907	94.92	1.2690	1.337	6.299	23	8	sand to silty sand
58.071	83.56	1.0138	1.213	7.097	20	8	sand to silty sand
58.235	70.85	1.1206	1.582	8.202	23	7	silty sand to sandy silt
58.399	62.31	2.0403	3.274	9.735	24	6	sandy silt to clayey silt
58.563	50.47	2.0626	4.087	13.948	24	5	clayey silt to silty clay
58.727	56.19	1.6336	2.907	9.441	22	6	sandy silt to clayey silt
58.891	138.33	1.5295	1.106	12.401	33	8	sand to silty sand
59.055	176.60	1.9363	1.096	12.839	34	9	sand
59.219	194.93	2.6797	1.375	14.592	47	8	sand to silty sand
59.383	209.04	3.0705	1.469	15.044	50	8	sand to silty sand
59.547	224.90	3.3524	1.491	15.672	54	8	sand to silty sand
59.711	229.13	3.5492	1.549	15.945	55	8	sand to silty sand
59.875	209.82	3.4729	1.655	14.183	50	8	sand to silty sand
60.039	176.44	3.6247	2.054	19.202	56	7	silty sand to sandy silt
60.203	167.74	3.9391	2.348	20.182	54	7	silty sand to sandy silt
60.367	239.94	3.5456	1.478	32.321	57	8	sand to silty sand
60.532	273.66	4.1311	1.510	19.169	66	8	sand to silty sand
60.696	285.33	4.2311	1.483	17.880	68	8	sand to silty sand

Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM
TOTAL DEPTH: 101.050 ft

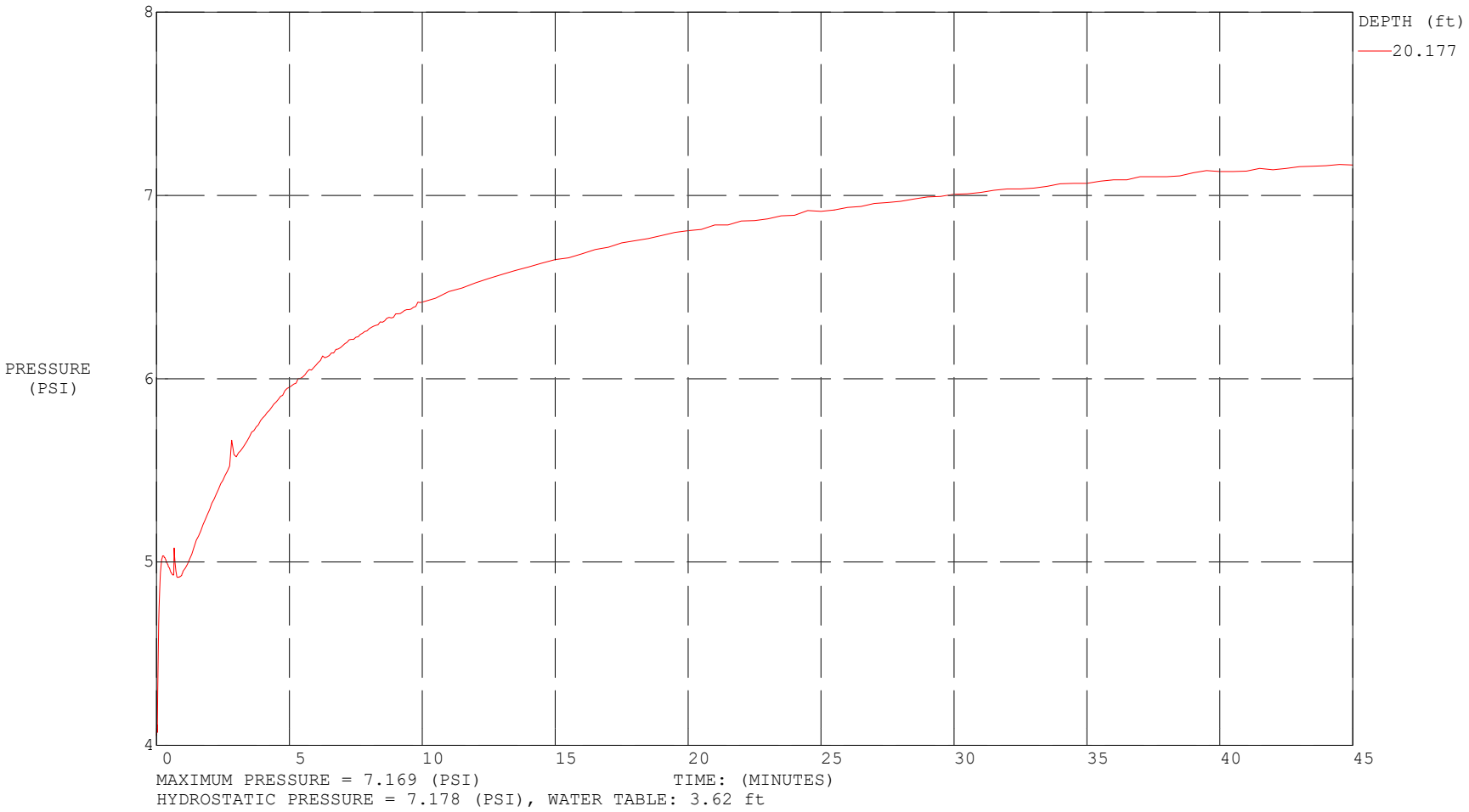


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM



MAXIMUM PRESSURE = 7.169 (PSI)
HYDROSTATIC PRESSURE = 7.178 (PSI), WATER TABLE: 3.62 ft

Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM
TOTAL DEPTH: 101.050 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
2.133	24.89	0.3601	1.447	-0.122	10	6	sandy silt to clayey silt
2.297	25.28	0.3368	1.332	-0.210	10	6	sandy silt to clayey silt
2.461	11.37	0.3432	3.019	0.127	7	4	silty clay to clay
2.625	8.55	0.3494	4.089	0.213	8	3	clay
2.789	6.63	0.2664	4.016	0.744	6	3	clay
2.953	4.34	0.1757	4.044	3.321	4	3	clay
3.117	3.30	0.1175	3.566	4.673	3	3	clay
3.281	2.60	0.1025	3.938	3.683	2	3	clay
3.445	2.30	0.0731	3.175	3.522	2	3	clay
3.609	2.29	0.0730	3.185	3.891	2	3	clay
3.773	2.86	0.0924	3.226	4.711	3	3	clay
3.937	4.70	0.1073	2.281	5.957	5	3	clay
4.101	6.11	0.1169	1.915	7.054	4	4	silty clay to clay
4.265	17.48	0.1560	0.892	11.029	7	6	sandy silt to clayey silt
4.429	41.62	0.2174	0.522	0.997	13	7	silty sand to sandy silt
4.593	44.31	0.2854	0.644	1.004	14	7	silty sand to sandy silt
4.757	44.26	0.3182	0.719	1.179	14	7	silty sand to sandy silt
4.921	41.85	0.3236	0.773	1.296	13	7	silty sand to sandy silt
5.085	39.82	0.3164	0.795	1.483	13	7	silty sand to sandy silt
5.249	42.62	0.3332	0.782	1.552	14	7	silty sand to sandy silt
5.413	46.61	0.3565	0.765	1.631	15	7	silty sand to sandy silt
5.577	52.43	0.3515	0.670	1.693	13	8	sand to silty sand
5.741	55.99	0.3862	0.690	1.229	13	8	sand to silty sand
5.906	51.71	0.4195	0.811	2.257	17	7	silty sand to sandy silt
6.070	52.68	0.4525	0.859	2.169	17	7	silty sand to sandy silt
6.234	52.90	0.4918	0.930	3.068	17	7	silty sand to sandy silt
6.398	54.17	0.5250	0.969	3.525	17	7	silty sand to sandy silt
6.562	59.49	0.5637	0.948	3.491	19	7	silty sand to sandy silt
6.726	65.94	0.6442	0.977	3.422	16	8	sand to silty sand
6.890	79.16	0.8176	1.033	3.312	19	8	sand to silty sand
7.054	91.87	0.9446	1.028	2.848	22	8	sand to silty sand
7.218	94.27	0.9830	1.043	2.599	23	8	sand to silty sand
7.382	91.64	0.9302	1.015	2.731	22	8	sand to silty sand
7.546	98.33	0.9092	0.925	3.011	24	8	sand to silty sand
7.710	119.12	1.0205	0.857	3.008	29	8	sand to silty sand
7.874	133.04	1.1652	0.876	2.800	32	8	sand to silty sand
8.038	142.52	1.3135	0.922	2.901	34	8	sand to silty sand
8.202	146.88	1.3501	0.919	2.795	35	8	sand to silty sand
8.366	157.45	1.3648	0.867	2.783	30	9	sand
8.530	177.67	1.5551	0.875	2.843	34	9	sand
8.694	200.63	1.8871	0.941	2.927	38	9	sand
8.858	199.76	2.0321	1.017	2.951	38	9	sand
9.022	188.55	1.4091	0.747	3.345	36	9	sand
9.186	183.37	1.4500	0.791	3.226	35	9	sand
9.350	164.72	1.4933	0.907	3.518	32	9	sand
9.514	166.47	1.5170	0.911	3.288	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
9.678	168.37	1.4881	0.884	3.039	32	9	sand
9.843	167.04	1.5476	0.926	3.343	32	9	sand
10.007	162.50	1.4641	0.901	3.264	31	9	sand
10.171	156.63	1.3786	0.880	3.008	30	9	sand
10.335	147.47	1.2595	0.854	2.996	28	9	sand
10.499	135.17	1.0806	0.799	2.958	26	9	sand
10.663	125.67	0.9410	0.749	3.073	30	8	sand to silty sand
10.827	115.47	0.7952	0.689	3.202	28	8	sand to silty sand
10.991	90.49	0.6014	0.665	3.336	22	8	sand to silty sand
11.155	85.50	0.5869	0.686	4.558	20	8	sand to silty sand
11.319	50.10	0.7894	1.576	3.891	16	7	silty sand to sandy silt
11.483	27.06	0.8337	3.081	4.027	13	5	clayey silt to silty clay
11.647	15.29	0.6304	4.121	5.471	15	3	clay
11.811	21.50	0.5056	2.352	16.170	10	5	clayey silt to silty clay
11.975	50.17	0.4208	0.839	9.728	16	7	silty sand to sandy silt
12.139	60.80	0.4093	0.673	4.410	15	8	sand to silty sand
12.303	63.68	0.5328	0.837	3.974	15	8	sand to silty sand
12.467	77.14	0.6905	0.895	4.010	18	8	sand to silty sand
12.631	130.51	0.7802	0.598	3.302	25	9	sand
12.795	140.29	0.8831	0.630	3.326	27	9	sand
12.959	148.39	0.9491	0.640	3.367	28	9	sand
13.123	150.56	1.0338	0.687	3.252	29	9	sand
13.287	153.86	1.1022	0.716	3.137	29	9	sand
13.451	160.36	1.1297	0.704	3.128	31	9	sand
13.615	168.95	1.1849	0.701	3.161	32	9	sand
13.780	177.07	1.2356	0.698	3.154	34	9	sand
13.944	185.90	1.3749	0.740	3.168	36	9	sand
14.108	189.83	1.4579	0.768	3.180	36	9	sand
14.272	186.01	1.4549	0.782	3.226	36	9	sand
14.436	187.45	1.4446	0.771	3.204	36	9	sand
14.600	198.28	1.5451	0.779	3.307	38	9	sand
14.764	198.88	1.5870	0.798	3.618	38	9	sand
14.928	193.36	1.5738	0.814	3.723	37	9	sand
15.092	199.06	1.5559	0.782	3.580	38	9	sand
15.256	199.69	1.6896	0.846	3.850	38	9	sand
15.420	191.20	1.6267	0.851	3.546	37	9	sand
15.584	183.57	1.1748	0.640	3.501	35	9	sand
15.748	182.98	1.2354	0.675	3.692	35	9	sand
15.912	154.56	1.3722	0.888	4.273	30	9	sand
16.076	152.51	1.3960	0.915	4.338	29	9	sand
16.240	149.88	1.3523	0.902	4.288	29	9	sand
16.404	150.04	1.2999	0.866	4.400	29	9	sand
16.568	154.34	1.2493	0.809	4.309	30	9	sand
16.732	163.26	1.2300	0.753	3.993	31	9	sand
16.896	170.51	1.2614	0.740	3.836	33	9	sand
17.060	177.99	1.3612	0.765	3.888	34	9	sand
17.224	180.37	1.4004	0.776	4.108	35	9	sand
17.388	184.60	1.4112	0.764	4.149	35	9	sand
17.552	197.49	1.5545	0.787	4.201	38	9	sand
17.717	203.13	1.7018	0.838	3.934	39	9	sand
17.881	203.44	1.7351	0.853	3.989	39	9	sand
18.045	202.82	1.7462	0.861	3.950	39	9	sand
18.209	202.27	1.7848	0.882	4.115	39	9	sand
18.373	193.74	1.7490	0.903	4.201	37	9	sand
18.537	184.99	1.5028	0.812	4.048	35	9	sand
18.701	175.08	1.1950	0.683	4.041	34	9	sand
18.865	192.57	1.1940	0.620	3.979	37	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
19.029	215.66	1.3846	0.642	2.461	41	9	sand
19.193	231.63	1.5345	0.662	3.926	44	9	sand
19.357	232.63	1.8069	0.777	4.010	45	9	sand
19.521	233.51	2.0100	0.861	4.025	45	9	sand
19.685	230.26	2.0533	0.892	4.099	44	9	sand
19.849	227.18	2.0646	0.909	4.106	44	9	sand
20.013	222.37	2.0213	0.909	4.237	43	9	sand
20.177	224.64	1.9732	0.878	4.041	43	9	sand
20.341	208.55	2.0094	0.964	5.816	40	9	sand
20.505	210.02	2.0016	0.953	5.567	40	9	sand
20.669	205.91	1.8297	0.889	4.895	39	9	sand
20.833	210.17	1.6992	0.809	4.773	40	9	sand
20.997	212.60	1.7098	0.804	4.814	41	9	sand
21.161	211.41	1.7322	0.819	4.897	40	9	sand
21.325	215.27	1.8172	0.844	4.962	41	9	sand
21.490	217.04	1.8924	0.872	5.213	42	9	sand
21.654	220.94	1.8891	0.855	5.285	42	9	sand
21.818	218.81	1.8616	0.851	5.584	42	9	sand
21.982	221.49	1.8924	0.854	5.990	42	9	sand
22.146	220.30	1.9592	0.889	5.976	42	9	sand
22.310	219.47	1.8285	0.833	6.079	42	9	sand
22.474	216.38	1.7533	0.810	6.160	41	9	sand
22.638	208.41	1.7482	0.839	7.095	40	9	sand
22.802	210.08	1.7337	0.825	7.296	40	9	sand
22.966	206.89	1.8264	0.883	7.076	40	9	sand
23.130	195.12	1.7762	0.910	6.688	37	9	sand
23.294	191.26	1.6060	0.840	6.751	37	9	sand
23.458	187.84	1.5907	0.847	7.105	36	9	sand
23.622	195.38	1.4985	0.767	7.293	37	9	sand
23.786	198.33	1.4456	0.729	7.114	38	9	sand
23.950	222.40	1.7141	0.771	6.777	43	9	sand
24.114	229.10	2.0147	0.879	6.112	44	9	sand
24.278	226.07	2.2094	0.977	5.794	43	9	sand
24.442	212.83	2.2187	1.042	5.801	41	9	sand
24.606	199.84	2.1563	1.079	5.617	38	9	sand
24.770	184.16	1.9001	1.032	5.227	35	9	sand
24.934	183.34	1.6773	0.915	5.361	35	9	sand
25.098	192.46	1.5798	0.821	5.749	37	9	sand
25.262	198.81	1.6423	0.826	5.694	38	9	sand
25.427	195.79	1.4360	0.733	5.758	37	9	sand
25.591	188.22	1.5198	0.807	5.462	36	9	sand
25.755	186.35	1.5669	0.841	6.189	36	9	sand
25.919	187.95	1.6299	0.867	6.502	36	9	sand
26.083	195.02	1.6421	0.842	6.621	37	9	sand
26.247	200.04	1.6822	0.841	6.366	38	9	sand
26.411	213.47	1.7161	0.804	5.660	41	9	sand
26.575	217.88	1.8252	0.838	5.115	42	9	sand
26.739	220.74	1.9286	0.874	4.926	42	9	sand
26.903	226.51	2.0901	0.923	5.615	43	9	sand
27.067	233.40	2.2572	0.967	6.184	45	9	sand
27.231	227.87	2.1912	0.962	5.950	44	9	sand
27.395	218.04	2.1790	0.999	6.016	42	9	sand
27.559	209.63	2.0629	0.984	6.043	40	9	sand
27.723	208.78	1.9178	0.919	6.045	40	9	sand
27.887	213.56	1.8605	0.871	6.404	41	9	sand
28.051	224.04	1.9494	0.870	6.973	43	9	sand
28.215	226.64	2.0666	0.912	7.210	43	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
28.379	221.32	2.2498	1.017	7.057	42	9	sand
28.543	206.71	2.1388	1.035	6.557	40	9	sand
28.707	204.01	1.7388	0.852	6.208	39	9	sand
28.871	202.90	1.7055	0.841	6.136	39	9	sand
29.035	203.74	1.7449	0.856	7.016	39	9	sand
29.199	219.44	1.9989	0.911	7.403	42	9	sand
29.364	227.87	2.2183	0.974	7.317	44	9	sand
29.528	222.26	2.3900	1.075	7.755	43	9	sand
29.692	224.67	2.3777	1.058	7.817	43	9	sand
29.856	226.09	2.4022	1.062	8.001	43	9	sand
30.020	228.45	2.3472	1.027	8.087	44	9	sand
30.184	229.31	2.3684	1.033	8.408	44	9	sand
30.348	230.51	2.3987	1.041	8.707	44	9	sand
30.512	226.25	2.4229	1.071	8.683	43	9	sand
30.676	223.41	2.3935	1.071	8.489	43	9	sand
30.840	217.13	2.3812	1.097	8.310	42	9	sand
31.004	213.16	2.3533	1.104	8.312	41	9	sand
31.168	208.49	2.3049	1.105	8.525	40	9	sand
31.332	200.84	2.2501	1.120	8.482	38	9	sand
31.496	199.67	2.0649	1.034	8.757	38	9	sand
31.660	211.05	2.2022	1.043	8.642	40	9	sand
31.824	217.59	2.4973	1.148	8.867	42	9	sand
31.988	216.09	2.3488	1.087	8.649	41	9	sand
32.152	203.09	2.1276	1.048	8.857	39	9	sand
32.316	201.70	2.0399	1.011	9.247	39	9	sand
32.480	216.77	2.0772	0.958	8.549	42	9	sand
32.644	225.91	2.2308	0.987	7.552	43	9	sand
32.808	223.75	2.3636	1.056	6.110	43	9	sand
32.972	217.36	2.4715	1.137	5.550	42	9	sand
33.136	213.93	2.4898	1.164	5.856	41	9	sand
33.301	211.15	2.4717	1.171	6.485	40	9	sand
33.465	208.26	2.4831	1.192	7.064	40	9	sand
33.629	197.82	2.4158	1.221	7.303	38	9	sand
33.793	192.02	2.3265	1.212	7.681	37	9	sand
33.957	186.28	2.2016	1.182	7.363	36	9	sand
34.121	188.13	2.1211	1.127	8.102	36	9	sand
34.285	192.87	2.1399	1.109	8.181	37	9	sand
34.449	196.21	2.1767	1.109	8.420	38	9	sand
34.613	199.37	2.2374	1.122	8.061	38	9	sand
34.777	203.56	2.3716	1.165	7.996	39	9	sand
34.941	201.86	2.3655	1.172	8.319	39	9	sand
35.105	208.40	2.3897	1.147	8.518	40	9	sand
35.269	215.15	2.3101	1.074	8.876	41	9	sand
35.433	192.59	2.1502	1.116	6.971	37	9	sand
35.597	155.72	1.8668	1.199	7.267	37	8	sand to silty sand
35.761	142.25	1.5956	1.122	7.678	34	8	sand to silty sand
35.925	142.53	1.4005	0.983	8.499	34	8	sand to silty sand
36.089	147.83	1.4145	0.957	8.432	35	8	sand to silty sand
36.253	166.97	1.2986	0.778	8.659	32	9	sand
36.417	173.04	1.4099	0.815	5.048	33	9	sand
36.581	193.36	1.8823	0.973	2.332	37	9	sand
36.745	207.27	2.4614	1.188	3.312	40	9	sand
36.909	198.47	2.6572	1.339	4.041	48	8	sand to silty sand
37.073	180.11	2.4164	1.342	4.756	43	8	sand to silty sand
37.238	175.48	1.9572	1.115	5.710	34	9	sand
37.402	188.47	1.8608	0.987	7.081	36	9	sand
37.566	201.07	2.1723	1.080	7.136	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
37.730	198.39	2.3433	1.181	6.999	38	9	sand
37.894	179.10	2.2896	1.278	6.796	43	8	sand to silty sand
38.058	181.08	2.0755	1.146	7.298	35	9	sand
38.222	178.16	2.0529	1.152	8.250	43	8	sand to silty sand
38.386	186.00	2.0084	1.080	8.625	36	9	sand
38.550	193.17	2.0234	1.047	9.068	37	9	sand
38.714	171.51	1.9641	1.145	8.793	41	8	sand to silty sand
38.878	107.86	1.6263	1.508	9.852	26	8	sand to silty sand
39.042	84.10	1.2591	1.497	10.275	27	7	silty sand to sandy silt
39.206	64.24	0.9194	1.431	10.904	21	7	silty sand to sandy silt
39.370	48.15	0.7701	1.599	11.368	15	7	silty sand to sandy silt
39.534	45.50	0.7293	1.603	12.239	15	7	silty sand to sandy silt
39.698	45.44	0.9034	1.988	12.411	17	6	sandy silt to clayey silt
39.862	84.93	1.0556	1.243	14.085	20	8	sand to silty sand
40.026	97.94	0.9223	0.942	5.225	23	8	sand to silty sand
40.190	97.50	0.8748	0.897	9.623	23	8	sand to silty sand
40.354	102.90	0.9734	0.946	11.820	25	8	sand to silty sand
40.518	85.50	1.1403	1.334	11.746	27	7	silty sand to sandy silt
40.682	55.88	0.9601	1.718	11.909	18	7	silty sand to sandy silt
40.846	60.70	0.6717	1.107	13.530	19	7	silty sand to sandy silt
41.011	78.72	0.6827	0.867	11.634	19	8	sand to silty sand
41.175	64.05	0.7034	1.098	9.405	20	7	silty sand to sandy silt
41.339	93.83	0.8066	0.860	12.829	22	8	sand to silty sand
41.503	106.32	0.8101	0.762	3.683	25	8	sand to silty sand
41.667	99.55	0.9375	0.942	5.593	24	8	sand to silty sand
41.831	133.67	1.0997	0.823	9.874	32	8	sand to silty sand
41.995	164.32	1.2516	0.762	12.318	31	9	sand
42.159	219.14	1.5616	0.713	14.087	42	9	sand
42.323	232.27	2.0016	0.862	13.377	44	9	sand
42.487	245.59	2.3082	0.940	12.246	47	9	sand
42.651	252.23	2.4959	0.989	12.160	48	9	sand
42.815	252.10	2.6233	1.041	11.777	48	9	sand
42.979	249.87	2.6592	1.064	11.980	48	9	sand
43.143	240.49	2.6595	1.106	11.894	46	9	sand
43.307	234.07	2.5459	1.088	11.500	45	9	sand
43.471	227.72	2.3139	1.016	12.308	44	9	sand
43.635	223.79	2.1659	0.968	12.083	43	9	sand
43.799	210.82	1.9847	0.941	11.292	40	9	sand
43.963	204.00	1.7070	0.837	11.380	39	9	sand
44.127	210.15	1.6511	0.786	11.581	40	9	sand
44.291	219.74	1.7769	0.809	11.885	42	9	sand
44.455	214.12	1.9487	0.910	9.869	41	9	sand
44.619	212.63	2.0028	0.942	9.568	41	9	sand
44.783	201.81	2.0101	0.996	9.608	39	9	sand
44.948	198.50	1.8979	0.956	10.579	38	9	sand
45.112	197.00	1.4104	0.716	11.155	38	9	sand
45.276	193.70	1.4397	0.743	11.887	37	9	sand
45.440	190.95	1.4907	0.781	12.920	37	9	sand
45.604	195.09	1.5671	0.803	14.008	37	9	sand
45.768	199.04	1.6273	0.818	13.972	38	9	sand
45.932	200.13	1.6110	0.805	14.192	38	9	sand
46.096	200.97	1.6130	0.803	14.611	38	9	sand
46.260	204.45	1.6495	0.807	14.843	39	9	sand
46.424	208.91	1.6646	0.797	14.802	40	9	sand
46.588	214.15	1.7396	0.812	14.910	41	9	sand
46.752	221.15	1.7883	0.809	15.034	42	9	sand
46.916	226.74	1.8446	0.814	14.809	43	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
47.080	231.94	1.9313	0.833	15.067	44	9	sand
47.244	230.06	2.0437	0.888	15.166	44	9	sand
47.408	229.10	2.0974	0.915	14.417	44	9	sand
47.572	214.65	1.9801	0.922	14.190	41	9	sand
47.736	206.04	1.7572	0.853	13.649	39	9	sand
47.900	206.57	1.7786	0.861	13.867	40	9	sand
48.064	216.71	1.8051	0.833	14.443	42	9	sand
48.228	228.36	1.8973	0.831	14.769	44	9	sand
48.392	246.14	2.1117	0.858	13.638	47	9	sand
48.556	258.34	2.2684	0.878	12.375	49	9	sand
48.720	253.16	2.4451	0.966	10.926	48	9	sand
48.885	252.98	2.7354	1.081	11.660	48	9	sand
49.049	245.06	2.9367	1.198	12.349	47	9	sand
49.213	235.95	2.8342	1.201	13.241	45	9	sand
49.377	232.16	2.5652	1.105	13.506	44	9	sand
49.541	238.46	2.3873	1.001	14.073	46	9	sand
49.705	240.97	2.3575	0.978	15.084	46	9	sand
49.869	234.78	2.4410	1.040	15.005	45	9	sand
50.033	233.04	2.3014	0.988	15.299	45	9	sand
50.197	233.50	2.1808	0.934	15.276	45	9	sand
50.361	243.04	2.2624	0.931	15.555	47	9	sand
50.525	238.41	2.3596	0.990	15.266	46	9	sand
50.689	235.55	2.3292	0.989	15.328	45	9	sand
50.853	232.88	2.3986	1.030	15.381	45	9	sand
51.017	232.02	2.3852	1.028	15.644	44	9	sand
51.181	226.08	2.2394	0.990	15.723	43	9	sand
51.345	233.95	2.1684	0.927	16.101	45	9	sand
51.509	248.81	2.3418	0.941	17.086	48	9	sand
51.673	254.67	2.6137	1.026	16.942	49	9	sand
51.837	256.28	2.7390	1.069	16.619	49	9	sand
52.001	256.35	2.7920	1.089	16.258	49	9	sand
52.165	260.24	2.9595	1.137	16.196	50	9	sand
52.329	264.42	3.0382	1.149	16.335	51	9	sand
52.493	268.95	3.1045	1.154	16.153	52	9	sand
52.657	268.05	3.1360	1.170	15.959	51	9	sand
52.822	268.79	2.9960	1.115	16.132	51	9	sand
52.986	283.42	2.9660	1.046	16.710	54	9	sand
53.150	309.60	3.1112	1.005	17.442	59	9	sand
53.314	316.29	3.4226	1.082	15.821	61	9	sand
53.478	308.31	3.4861	1.131	13.654	59	9	sand
53.642	304.32	3.4213	1.124	13.298	58	9	sand
53.806	301.31	3.4353	1.140	11.997	58	9	sand
53.970	296.97	3.4120	1.149	12.057	57	9	sand
54.134	296.16	3.3411	1.128	13.013	57	9	sand
54.298	301.97	3.3178	1.099	13.047	58	9	sand
54.462	311.37	3.3724	1.083	13.958	60	9	sand
54.626	315.81	3.5170	1.114	13.831	60	9	sand
54.790	320.46	3.6457	1.138	13.664	61	9	sand
54.954	321.41	3.5846	1.115	12.595	62	9	sand
55.118	308.00	3.4372	1.116	11.999	59	9	sand
55.282	284.45	3.2711	1.150	14.142	54	9	sand
55.446	289.81	3.1533	1.088	14.429	56	9	sand
55.610	301.81	3.3747	1.118	14.312	58	9	sand
55.774	305.34	3.5106	1.150	14.207	58	9	sand
55.938	285.07	3.4493	1.210	12.093	55	9	sand
56.102	275.46	3.2043	1.163	11.787	53	9	sand
56.266	270.25	3.1413	1.162	12.332	52	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
56.430	269.44	3.1014	1.151	12.676	52	9	sand
56.594	269.86	3.0066	1.114	13.238	52	9	sand
56.759	281.69	3.0475	1.082	14.058	54	9	sand
56.923	296.38	3.1693	1.069	14.561	57	9	sand
57.087	309.55	3.4327	1.109	14.439	59	9	sand
57.251	312.60	3.6807	1.177	14.297	60	9	sand
57.415	302.48	3.6893	1.220	12.877	58	9	sand
57.579	290.43	3.4827	1.199	12.879	56	9	sand
57.743	289.83	3.3876	1.169	12.863	56	9	sand
57.907	296.16	3.4373	1.161	13.941	57	9	sand
58.071	292.21	3.4462	1.179	13.814	56	9	sand
58.235	299.58	3.6611	1.222	13.779	57	9	sand
58.399	298.68	3.4724	1.163	13.877	57	9	sand
58.563	270.26	3.2941	1.219	14.979	52	9	sand
58.727	279.23	3.2727	1.172	14.726	53	9	sand
58.891	292.16	3.4066	1.166	15.170	56	9	sand
59.055	290.43	3.5368	1.218	15.417	56	9	sand
59.219	288.38	3.5940	1.246	14.515	55	9	sand
59.383	284.97	3.6453	1.279	14.288	55	9	sand
59.547	283.74	3.5626	1.256	14.405	54	9	sand
59.711	291.93	3.6101	1.237	14.874	56	9	sand
59.875	306.23	3.7334	1.219	15.790	59	9	sand
60.039	308.49	3.8804	1.258	16.285	59	9	sand
60.203	313.00	4.0153	1.283	15.455	60	9	sand
60.367	313.28	4.0456	1.291	15.594	60	9	sand
60.532	305.15	4.0046	1.312	14.584	58	9	sand
60.696	300.98	3.9324	1.307	14.639	58	9	sand
60.860	298.44	3.9132	1.311	14.855	57	9	sand
61.024	294.43	3.8510	1.308	14.960	56	9	sand
61.188	291.42	3.4426	1.181	15.125	56	9	sand
61.352	290.41	3.3812	1.164	15.543	56	9	sand
61.516	299.37	3.4393	1.149	15.692	57	9	sand
61.680	309.78	3.6952	1.193	16.239	59	9	sand
61.844	328.58	4.0769	1.241	17.356	63	9	sand
62.008	332.89	4.2111	1.265	15.541	64	9	sand
62.172	337.09	4.2653	1.265	15.259	65	9	sand
62.336	335.69	4.4558	1.327	14.788	64	9	sand
62.500	321.62	4.4476	1.383	13.432	62	9	sand
62.664	310.14	4.3212	1.393	13.690	59	9	sand
62.828	299.28	4.1148	1.375	13.561	57	9	sand
62.992	298.63	4.0547	1.358	13.853	57	9	sand
63.156	302.94	4.1052	1.355	14.546	58	9	sand
63.320	313.14	4.3386	1.386	15.610	60	9	sand
63.484	332.98	4.7482	1.426	16.196	64	9	sand
63.648	355.12	5.4218	1.527	17.547	85	8	sand to silty sand
63.812	358.70	6.0746	1.693	17.944	86	8	sand to silty sand
63.976	357.13	6.2576	1.752	16.655	85	8	sand to silty sand
64.140	339.53	6.1258	1.804	15.823	81	8	sand to silty sand
64.304	324.91	5.9911	1.844	14.998	78	8	sand to silty sand
64.469	313.86	5.7788	1.841	14.486	75	8	sand to silty sand
64.633	306.40	5.1975	1.696	14.888	73	8	sand to silty sand
64.797	306.51	4.1764	1.363	14.747	59	9	sand
64.961	306.29	4.0228	1.313	12.069	59	9	sand
65.125	306.35	4.1456	1.353	13.059	59	9	sand
65.289	311.91	4.1901	1.343	11.705	60	9	sand
65.453	326.53	4.4738	1.370	10.369	63	9	sand
65.617	355.88	5.8147	1.634	10.519	85	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
65.781	366.72	5.8487	1.595	9.938	88	8	sand to silty sand
65.945	334.27	5.9339	1.775	11.495	80	8	sand to silty sand
66.109	332.72	6.0126	1.807	11.791	80	8	sand to silty sand
66.273	319.12	6.0106	1.884	13.021	76	8	sand to silty sand
66.437	305.36	5.9827	1.959	12.906	73	8	sand to silty sand
66.601	293.07	5.6171	1.917	13.707	70	8	sand to silty sand
66.765	280.06	5.2075	1.859	13.621	67	8	sand to silty sand
66.929	270.99	4.6656	1.722	13.733	65	8	sand to silty sand
67.093	267.57	4.3552	1.628	14.185	64	8	sand to silty sand
67.257	276.70	4.4866	1.621	14.769	66	8	sand to silty sand
67.421	308.89	4.8468	1.569	15.371	74	8	sand to silty sand
67.585	320.33	5.3162	1.660	14.778	77	8	sand to silty sand
67.749	308.20	5.4122	1.756	12.860	74	8	sand to silty sand
67.913	290.05	5.2025	1.794	14.317	69	8	sand to silty sand
68.077	245.45	4.0838	1.664	13.016	59	8	sand to silty sand
68.241	311.91	4.5444	1.457	17.322	75	8	sand to silty sand
68.406	374.73	5.2056	1.389	17.382	72	9	sand
68.570	380.45	6.1143	1.607	17.966	91	8	sand to silty sand
68.734	381.69	6.7447	1.767	17.050	91	8	sand to silty sand
68.898	387.87	7.0397	1.815	15.797	93	8	sand to silty sand
69.062	372.31	7.3236	1.967	16.211	89	8	sand to silty sand
69.226	329.95	6.4529	1.956	14.735	79	8	sand to silty sand
69.390	268.58	5.1069	1.901	14.556	64	8	sand to silty sand
69.554	301.01	4.1655	1.384	15.735	58	9	sand
69.718	335.97	3.9358	1.171	14.051	64	9	sand
69.882	330.04	4.0613	1.231	4.524	63	9	sand
70.046	299.29	3.9302	1.313	11.239	57	9	sand
70.210	270.33	3.5263	1.304	10.094	52	9	sand
70.374	218.88	3.2064	1.465	10.873	52	8	sand to silty sand
70.538	182.20	2.6046	1.430	11.536	44	8	sand to silty sand
70.702	144.86	2.1707	1.499	12.509	35	8	sand to silty sand
70.866	110.24	1.8451	1.674	13.384	35	7	silty sand to sandy silt
71.030	79.28	1.5005	1.893	16.332	25	7	silty sand to sandy silt
71.194	131.26	1.3717	1.045	22.050	31	8	sand to silty sand
71.358	178.20	1.9167	1.076	21.505	34	9	sand
71.522	188.45	2.6643	1.414	22.256	45	8	sand to silty sand
71.686	206.22	3.0387	1.473	24.310	49	8	sand to silty sand
71.850	234.97	3.4142	1.453	22.617	56	8	sand to silty sand
72.014	248.80	3.6814	1.480	20.960	60	8	sand to silty sand
72.178	232.63	3.8388	1.650	19.745	56	8	sand to silty sand
72.343	218.44	3.6300	1.662	20.058	52	8	sand to silty sand
72.507	195.43	3.7199	1.904	19.860	47	8	sand to silty sand
72.671	122.19	1.7825	1.459	19.805	29	8	sand to silty sand
72.835	55.49	2.8509	5.138	19.274	35	4	silty clay to clay
72.999	186.78	4.0455	2.166	25.807	60	7	silty sand to sandy silt
73.163	170.69	4.0014	2.344	21.756	54	7	silty sand to sandy silt
73.327	214.84	3.8738	1.803	41.644	51	8	sand to silty sand
73.491	220.95	4.8090	2.177	16.775	71	7	silty sand to sandy silt
73.655	204.64	4.8408	2.366	18.454	65	7	silty sand to sandy silt
73.819	122.61	3.4314	2.799	26.988	47	6	sandy silt to clayey silt
73.983	121.95	2.6330	2.159	27.012	39	7	silty sand to sandy silt
74.147	131.02	2.3091	1.762	28.353	42	7	silty sand to sandy silt
74.311	64.02	2.4993	3.904	27.827	31	5	clayey silt to silty clay
74.475	55.97	1.7387	3.106	31.687	21	6	sandy silt to clayey silt
74.639	47.50	1.8567	3.909	39.432	23	5	clayey silt to silty clay
74.803	62.74	1.2583	2.005	18.549	20	7	silty sand to sandy silt
74.967	60.86	1.4560	2.392	6.641	23	6	sandy silt to clayey silt

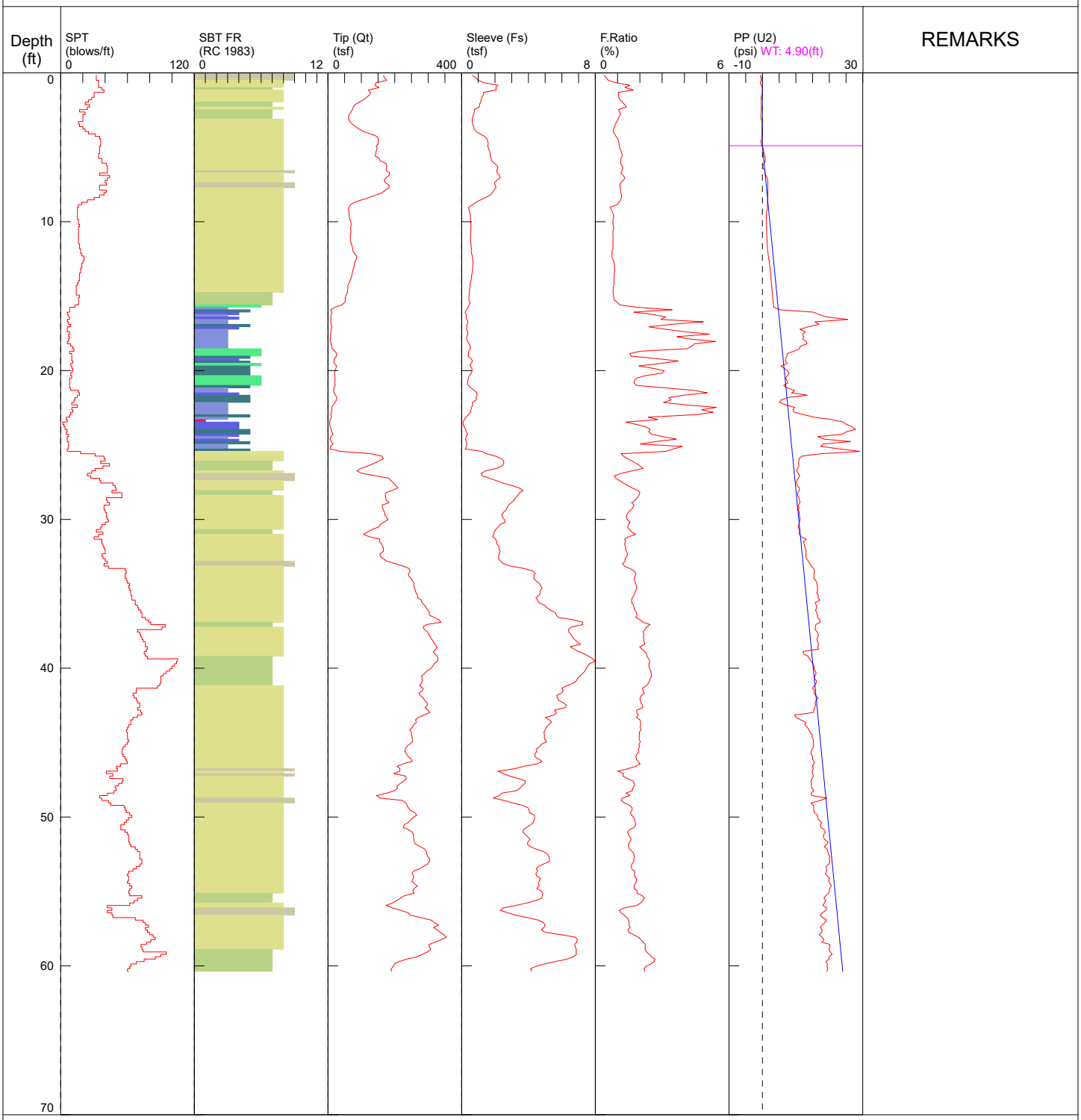
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
75.131	43.26	1.3439	3.106	22.787	21	5	clayey silt to silty clay
75.295	65.47	1.3309	2.033	50.346	21	7	silty sand to sandy silt
75.459	125.36	1.4177	1.131	29.152	30	8	sand to silty sand
75.623	128.48	1.6586	1.291	30.671	31	8	sand to silty sand
75.787	115.11	2.2052	1.916	30.706	37	7	silty sand to sandy silt
75.951	78.62	2.6074	3.317	29.329	30	6	sandy silt to clayey silt
76.115	55.04	2.3024	4.183	30.759	26	5	clayey silt to silty clay
76.280	63.54	2.2190	3.492	37.283	30	5	clayey silt to silty clay
76.444	39.58	2.8618	7.231	34.585	38	3	clay
76.608	204.74	3.1661	1.546	24.341	49	8	sand to silty sand
76.772	165.91	3.2243	1.943	24.090	53	7	silty sand to sandy silt
76.936	147.36	3.0947	2.100	24.472	47	7	silty sand to sandy silt
77.100	133.58	2.7390	2.050	26.921	43	7	silty sand to sandy silt
77.264	129.37	2.5199	1.948	28.294	41	7	silty sand to sandy silt
77.428	143.28	2.4562	1.714	20.919	34	8	sand to silty sand
77.592	172.97	2.6313	1.521	11.648	41	8	sand to silty sand
77.756	197.19	2.0119	1.020	4.842	38	9	sand
77.920	210.23	2.0991	0.999	3.663	40	9	sand
78.084	247.39	2.4442	0.988	5.400	47	9	sand
78.248	239.57	2.9627	1.237	6.633	46	9	sand
78.412	221.66	3.0706	1.385	8.587	53	8	sand to silty sand
78.576	194.11	3.4467	1.776	10.012	46	8	sand to silty sand
78.740	157.19	3.3561	2.135	10.871	50	7	silty sand to sandy silt
78.904	188.79	2.7673	1.466	15.223	45	8	sand to silty sand
79.068	169.12	2.4925	1.474	15.232	40	8	sand to silty sand
79.232	168.55	2.0506	1.217	15.794	40	8	sand to silty sand
79.396	222.45	2.0586	0.925	20.761	43	9	sand
79.560	205.11	2.9050	1.416	20.850	49	8	sand to silty sand
79.724	140.07	2.8212	2.014	19.974	45	7	silty sand to sandy silt
79.888	54.12	1.7020	3.145	32.242	21	6	sandy silt to clayey silt
80.052	165.38	1.9625	1.187	39.939	40	8	sand to silty sand
80.217	200.67	2.0859	1.039	19.367	38	9	sand
80.381	246.06	3.1492	1.280	27.531	47	9	sand
80.545	314.00	3.8411	1.223	30.640	60	9	sand
80.709	298.86	4.4732	1.497	23.363	72	8	sand to silty sand
80.873	275.87	4.4192	1.602	24.523	66	8	sand to silty sand
81.037	258.26	4.1407	1.603	25.977	62	8	sand to silty sand
81.201	269.91	3.5170	1.303	30.405	52	9	sand
81.365	269.77	3.4142	1.266	21.684	52	9	sand
81.529	259.74	3.5619	1.371	24.458	50	9	sand
81.693	289.06	3.5948	1.244	28.717	55	9	sand
81.857	290.91	3.7311	1.283	21.710	56	9	sand
82.021	289.52	3.9050	1.349	22.048	55	9	sand
82.185	288.55	4.0388	1.400	21.756	55	9	sand
82.349	271.61	4.1924	1.544	22.002	65	8	sand to silty sand
82.513	248.36	4.1432	1.668	22.335	59	8	sand to silty sand
82.677	194.70	3.7429	1.922	23.368	47	8	sand to silty sand
82.841	208.28	3.2410	1.556	25.845	50	8	sand to silty sand
83.005	262.59	3.7012	1.410	22.308	63	8	sand to silty sand
83.169	276.22	4.2212	1.528	16.024	66	8	sand to silty sand
83.333	273.59	4.4757	1.636	26.672	65	8	sand to silty sand
83.497	302.74	4.6720	1.543	27.402	72	8	sand to silty sand
83.661	291.07	4.7155	1.620	24.810	70	8	sand to silty sand
83.825	250.18	4.5297	1.811	22.275	60	8	sand to silty sand
83.990	237.05	4.3298	1.827	24.630	57	8	sand to silty sand
84.154	189.57	4.4721	2.359	23.121	61	7	silty sand to sandy silt
84.318	107.42	4.5603	4.245	27.041	103	11	very stiff fine grained (*)

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
84.482	65.85	2.3993	3.644	22.710	32	5	clayey silt to silty clay
84.646	53.29	2.3110	4.337	39.604	34	4	silty clay to clay
84.810	56.44	1.9310	3.422	29.984	27	5	clayey silt to silty clay
84.974	83.30	1.7145	2.058	34.179	27	7	silty sand to sandy silt
85.138	131.85	1.3786	1.046	19.116	32	8	sand to silty sand
85.302	132.90	1.4838	1.116	9.673	32	8	sand to silty sand
85.466	107.74	2.0784	1.929	7.413	34	7	silty sand to sandy silt
85.630	118.42	3.0067	2.539	11.299	38	7	silty sand to sandy silt
85.794	201.51	3.4890	1.731	9.603	48	8	sand to silty sand
85.958	277.59	4.5097	1.625	30.924	66	8	sand to silty sand
86.122	270.43	4.9478	1.830	29.037	65	8	sand to silty sand
86.286	242.16	4.9990	2.064	27.361	58	8	sand to silty sand
86.450	238.11	4.7032	1.975	26.342	57	8	sand to silty sand
86.614	245.74	4.3435	1.768	28.098	59	8	sand to silty sand
86.778	264.35	4.3349	1.640	27.088	63	8	sand to silty sand
86.942	294.42	4.3092	1.464	26.483	70	8	sand to silty sand
87.106	319.47	4.3311	1.356	21.756	61	9	sand
87.270	341.24	4.2195	1.237	13.843	65	9	sand
87.434	338.58	4.4844	1.324	12.420	65	9	sand
87.598	327.05	4.3254	1.323	13.444	63	9	sand
87.762	307.69	3.5987	1.170	16.246	59	9	sand
87.927	245.32	3.5030	1.428	14.797	59	8	sand to silty sand
88.091	126.21	3.3630	2.665	28.071	40	7	silty sand to sandy silt
88.255	111.54	3.0844	2.765	28.758	43	6	sandy silt to clayey silt
88.419	135.44	2.8782	2.125	43.875	43	7	silty sand to sandy silt
88.583	198.28	2.7857	1.405	23.698	47	8	sand to silty sand
88.747	220.67	3.6581	1.658	27.285	53	8	sand to silty sand
88.911	216.81	4.1411	1.910	29.793	52	8	sand to silty sand
89.075	189.33	3.7492	1.980	28.547	60	7	silty sand to sandy silt
89.239	163.17	3.1247	1.915	27.234	52	7	silty sand to sandy silt
89.403	133.42	2.5057	1.878	28.160	43	7	silty sand to sandy silt
89.567	134.77	2.6650	1.977	33.672	43	7	silty sand to sandy silt
89.731	186.07	3.0085	1.617	34.229	45	8	sand to silty sand
89.895	204.23	3.4307	1.680	33.136	49	8	sand to silty sand
90.059	231.50	3.7574	1.623	32.132	55	8	sand to silty sand
90.223	246.61	3.9275	1.593	32.297	59	8	sand to silty sand
90.387	267.42	3.8326	1.433	30.855	64	8	sand to silty sand
90.551	284.97	3.7017	1.299	30.068	55	9	sand
90.715	267.12	3.6756	1.376	23.977	51	9	sand
90.879	191.53	3.7001	1.932	21.050	46	8	sand to silty sand
91.043	146.07	2.9457	2.017	23.236	47	7	silty sand to sandy silt
91.207	152.03	2.4629	1.620	30.135	36	8	sand to silty sand
91.371	204.20	2.1856	1.070	29.109	39	9	sand
91.535	249.39	1.9766	0.793	22.433	48	9	sand
91.699	266.22	2.3645	0.888	10.711	51	9	sand
91.864	278.61	3.3491	1.202	13.681	53	9	sand
92.028	293.60	4.1303	1.407	19.656	56	9	sand
92.192	292.42	4.4656	1.527	20.271	70	8	sand to silty sand
92.356	273.92	4.5503	1.661	22.110	66	8	sand to silty sand
92.520	245.65	4.2381	1.725	22.196	59	8	sand to silty sand
92.684	224.12	3.5288	1.575	23.805	54	8	sand to silty sand
92.848	208.01	2.6644	1.281	26.775	40	9	sand
93.012	198.56	2.3424	1.180	26.027	38	9	sand
93.340	194.94	2.6371	1.353	28.408	47	8	sand to silty sand
93.504	191.13	2.5402	1.329	30.003	46	8	sand to silty sand
93.668	170.13	1.8004	1.058	25.539	33	9	sand
93.832	165.99	1.7426	1.050	21.727	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
93.996	158.41	2.0007	1.263	19.267	38	8	sand to silty sand
94.160	150.75	2.2535	1.495	24.049	36	8	sand to silty sand
94.324	178.31	3.0882	1.732	29.140	43	8	sand to silty sand
94.488	189.54	2.7900	1.472	36.075	45	8	sand to silty sand
94.652	251.29	3.0644	1.219	32.634	48	9	sand
94.816	284.29	3.5733	1.257	18.492	54	9	sand
94.980	265.82	4.3085	1.621	20.723	64	8	sand to silty sand
95.144	255.04	4.6013	1.804	22.710	61	8	sand to silty sand
95.308	252.81	4.6239	1.829	26.053	61	8	sand to silty sand
95.472	237.30	4.3142	1.818	28.456	57	8	sand to silty sand
95.636	226.44	4.0563	1.791	30.599	54	8	sand to silty sand
95.801	257.20	4.2859	1.666	35.350	62	8	sand to silty sand
95.965	257.55	4.3585	1.692	31.957	62	8	sand to silty sand
96.129	211.81	4.1569	1.963	29.353	51	8	sand to silty sand
96.293	193.02	3.4748	1.800	31.630	46	8	sand to silty sand
96.457	222.97	3.4378	1.542	35.436	53	8	sand to silty sand
96.621	249.17	3.6636	1.470	30.491	60	8	sand to silty sand
96.785	274.67	4.3268	1.575	33.956	66	8	sand to silty sand
96.949	305.06	5.1497	1.688	34.717	73	8	sand to silty sand
97.113	305.21	5.4763	1.794	28.315	73	8	sand to silty sand
97.277	245.24	5.2357	2.135	26.378	78	7	silty sand to sandy silt
97.441	212.34	4.8516	2.285	26.546	68	7	silty sand to sandy silt
97.605	181.03	4.4981	2.485	28.346	58	7	silty sand to sandy silt
97.769	136.89	4.5284	3.308	30.931	52	6	sandy silt to clayey silt
97.933	89.21	4.0792	4.572	43.897	85	11	very stiff fine grained (*)
98.097	141.36	2.8489	2.015	50.793	45	7	silty sand to sandy silt
98.261	152.43	2.2860	1.500	24.879	36	8	sand to silty sand
98.425	152.26	2.4825	1.630	29.635	36	8	sand to silty sand
98.589	184.08	2.1807	1.185	36.381	44	8	sand to silty sand
98.753	227.80	2.3278	1.022	27.258	44	9	sand
98.917	186.88	2.5255	1.351	24.245	45	8	sand to silty sand
99.081	162.18	2.6931	1.661	28.793	39	8	sand to silty sand
99.245	140.02	2.4901	1.778	29.547	45	7	silty sand to sandy silt
99.409	122.86	2.7851	2.267	32.952	39	7	silty sand to sandy silt
99.573	78.07	2.3676	3.033	30.836	30	6	sandy silt to clayey silt
99.738	60.68	1.8222	3.003	57.936	23	6	sandy silt to clayey silt
99.902	130.58	1.9307	1.479	75.880	31	8	sand to silty sand
100.066	138.23	2.1892	1.584	40.441	33	8	sand to silty sand
100.230	137.36	3.1589	2.300	40.461	44	7	silty sand to sandy silt
100.394	91.89	2.6164	2.847	39.478	35	6	sandy silt to clayey silt
100.558	191.62	2.3387	1.221	58.740	37	9	sand
100.722	185.82	2.6744	1.439	33.265	44	8	sand to silty sand
100.886	155.06	2.3506	1.516	38.933	37	8	sand to silty sand
101.050	127.01	2.8407	2.237	41.821	41	7	silty sand to sandy silt

Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 11:21:35 AM
TOTAL DEPTH: 60.367 ft



*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

CONE ID: DDG1661
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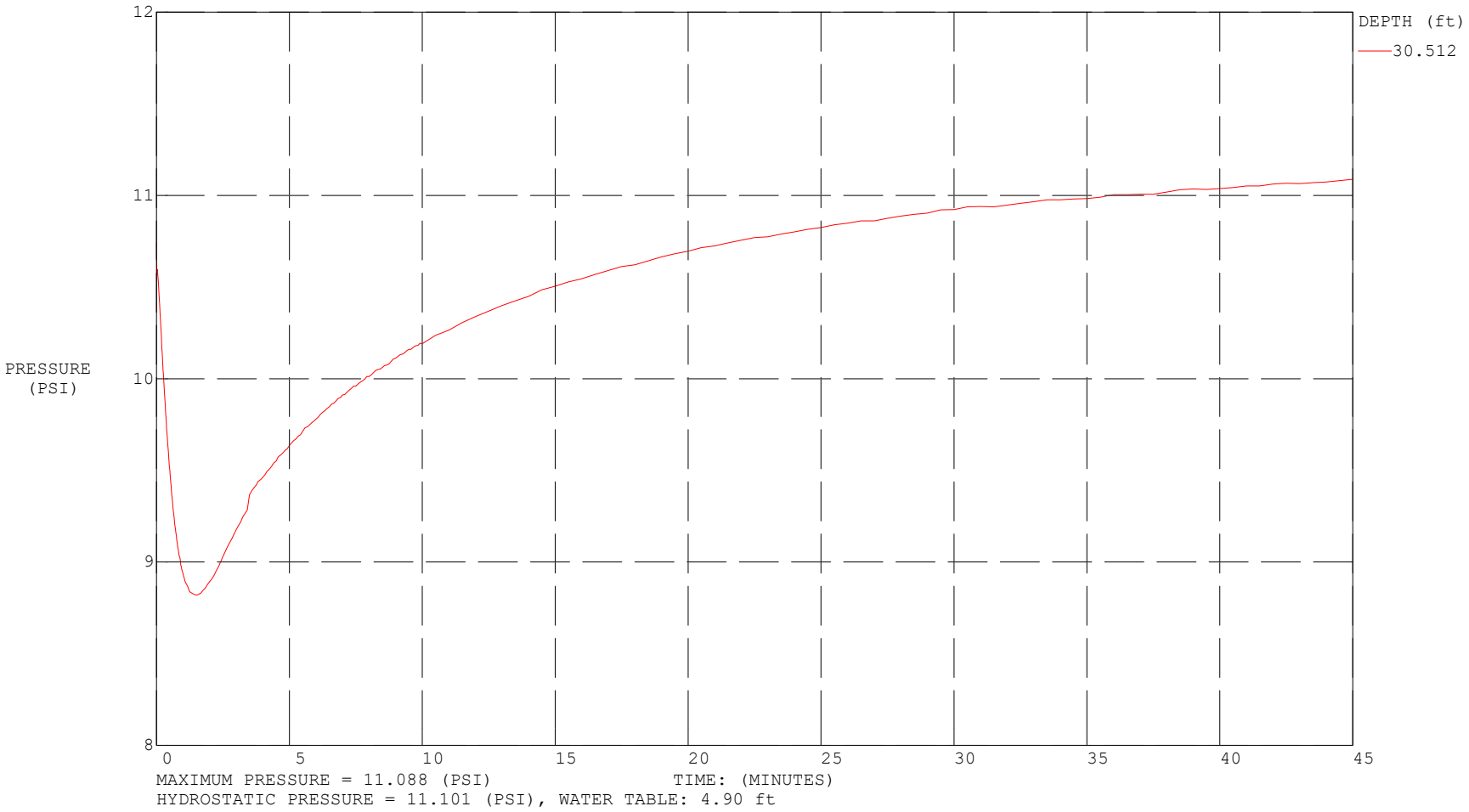


Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 11:21:35 AM
TOTAL DEPTH: 60.367 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	166.36	0.6465	0.389	-0.627	32	9	sand
0.328	168.35	0.8514	0.506	-0.440	32	9	sand
0.492	175.85	1.0048	0.571	-0.416	34	9	sand
0.656	144.08	1.3177	0.915	-0.691	34	8	sand to silty sand
0.820	140.48	2.1659	1.542	-0.435	34	8	sand to silty sand
0.984	152.67	2.0412	1.337	-0.062	37	8	sand to silty sand
1.148	121.37	2.0721	1.707	-0.088	39	7	silty sand to sandy silt
1.312	127.18	1.3137	1.033	-0.065	30	8	sand to silty sand
1.476	124.55	1.2901	1.036	-0.167	30	8	sand to silty sand
1.640	115.44	1.2097	1.048	-0.404	28	8	sand to silty sand
1.804	106.42	1.1763	1.105	-0.373	25	8	sand to silty sand
1.969	93.55	1.1295	1.207	-0.359	22	8	sand to silty sand
2.133	80.77	1.0662	1.320	-0.330	26	7	silty sand to sandy silt
2.297	75.52	1.0477	1.387	-0.342	24	7	silty sand to sandy silt
2.461	72.88	0.7628	1.047	-0.342	17	8	sand to silty sand
2.625	69.46	0.7543	1.086	-0.368	22	7	silty sand to sandy silt
2.789	63.19	0.7111	1.125	-0.462	20	7	silty sand to sandy silt
2.953	61.82	0.6612	1.070	-0.445	20	7	silty sand to sandy silt
3.117	61.91	0.6343	1.025	-0.423	20	7	silty sand to sandy silt
3.281	64.84	0.6234	0.961	-0.182	16	8	sand to silty sand
3.445	72.66	0.6538	0.900	-0.117	17	8	sand to silty sand
3.609	83.23	0.7143	0.858	-0.187	20	8	sand to silty sand
3.773	92.98	0.7543	0.811	-0.201	22	8	sand to silty sand
3.937	105.87	0.8567	0.809	-0.203	25	8	sand to silty sand
4.101	127.80	1.0991	0.860	-0.198	31	8	sand to silty sand
4.265	146.54	1.3701	0.935	-0.179	35	8	sand to silty sand
4.429	150.62	1.5150	1.006	-0.167	36	8	sand to silty sand
4.593	149.91	1.5672	1.045	-0.567	36	8	sand to silty sand
4.757	150.06	1.5867	1.057	-0.387	36	8	sand to silty sand
4.921	144.39	1.5695	1.087	-0.265	35	8	sand to silty sand
5.085	146.86	1.6115	1.097	0.265	35	8	sand to silty sand
5.249	144.59	1.6704	1.155	0.263	35	8	sand to silty sand
5.413	143.10	1.6989	1.187	0.526	34	8	sand to silty sand
5.577	141.04	1.7066	1.210	0.737	34	8	sand to silty sand
5.741	152.72	1.7587	1.152	0.830	37	8	sand to silty sand
5.906	156.20	1.7894	1.146	0.801	37	8	sand to silty sand
6.070	172.28	1.9453	1.129	0.567	41	8	sand to silty sand
6.234	176.55	2.1255	1.204	0.055	42	8	sand to silty sand
6.398	174.42	2.1695	1.244	0.143	42	8	sand to silty sand
6.562	174.37	2.0944	1.201	0.765	42	8	sand to silty sand
6.726	185.27	2.1187	1.144	0.758	35	9	sand
6.890	182.16	2.2728	1.248	1.038	44	8	sand to silty sand
7.054	173.51	2.2929	1.321	1.370	42	8	sand to silty sand
7.218	167.91	2.1079	1.255	1.554	40	8	sand to silty sand
7.382	172.82	1.9662	1.138	1.588	41	8	sand to silty sand
7.546	183.08	2.0011	1.093	1.607	35	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	182.90	2.0570	1.125	1.609	35	9	sand
7.874	171.52	1.9334	1.127	1.583	41	8	sand to silty sand
8.038	163.01	1.8466	1.133	1.631	39	8	sand to silty sand
8.202	144.21	1.7067	1.183	1.631	35	8	sand to silty sand
8.366	123.39	1.4537	1.178	1.593	30	8	sand to silty sand
8.530	101.32	1.1424	1.128	1.542	24	8	sand to silty sand
8.694	79.30	0.8409	1.060	1.483	19	8	sand to silty sand
8.858	67.29	0.6586	0.979	1.468	16	8	sand to silty sand
9.022	62.98	0.4154	0.660	1.471	15	8	sand to silty sand
9.186	61.60	0.4364	0.709	1.468	15	8	sand to silty sand
9.350	63.28	0.4830	0.763	1.198	15	8	sand to silty sand
9.514	62.86	0.5062	0.805	1.184	15	8	sand to silty sand
9.678	63.54	0.5182	0.816	1.172	15	8	sand to silty sand
9.843	65.84	0.5207	0.791	1.179	16	8	sand to silty sand
10.007	67.85	0.5331	0.786	1.193	16	8	sand to silty sand
10.171	69.34	0.5500	0.793	1.203	17	8	sand to silty sand
10.335	68.10	0.5590	0.821	1.205	16	8	sand to silty sand
10.499	67.73	0.5476	0.808	1.215	16	8	sand to silty sand
10.663	68.71	0.5404	0.786	1.236	16	8	sand to silty sand
10.827	67.99	0.5367	0.789	1.272	16	8	sand to silty sand
10.991	66.71	0.5259	0.788	1.306	16	8	sand to silty sand
11.155	66.52	0.5280	0.794	1.346	16	8	sand to silty sand
11.319	67.86	0.5332	0.786	1.382	16	8	sand to silty sand
11.483	69.51	0.5473	0.787	1.420	17	8	sand to silty sand
11.647	72.41	0.5714	0.789	1.473	17	8	sand to silty sand
11.811	74.15	0.5864	0.791	1.530	18	8	sand to silty sand
11.975	75.15	0.5657	0.753	1.593	18	8	sand to silty sand
12.139	79.32	0.5982	0.754	1.681	19	8	sand to silty sand
12.303	86.40	0.6401	0.741	1.774	21	8	sand to silty sand
12.467	85.79	0.6472	0.754	1.832	21	8	sand to silty sand
12.631	82.09	0.6839	0.833	2.028	20	8	sand to silty sand
12.795	79.24	0.6627	0.836	2.107	19	8	sand to silty sand
12.959	78.27	0.6738	0.861	2.195	19	8	sand to silty sand
13.123	77.24	0.6641	0.860	2.272	18	8	sand to silty sand
13.287	73.86	0.6408	0.868	2.343	18	8	sand to silty sand
13.451	72.57	0.6174	0.851	2.410	17	8	sand to silty sand
13.615	71.05	0.5971	0.840	2.470	17	8	sand to silty sand
13.780	69.29	0.5774	0.833	2.525	17	8	sand to silty sand
13.944	66.48	0.5539	0.833	2.602	16	8	sand to silty sand
14.108	63.16	0.5282	0.836	2.664	15	8	sand to silty sand
14.272	59.94	0.4992	0.833	2.731	14	8	sand to silty sand
14.436	59.73	0.4776	0.800	2.812	14	8	sand to silty sand
14.600	58.37	0.4674	0.801	2.870	14	8	sand to silty sand
14.764	57.79	0.4564	0.790	2.948	14	8	sand to silty sand
14.928	54.31	0.4429	0.816	3.013	17	7	silty sand to sandy silt
15.092	51.63	0.4266	0.826	3.082	16	7	silty sand to sandy silt
15.256	51.65	0.4318	0.836	3.149	16	7	silty sand to sandy silt
15.420	50.65	0.5067	1.000	3.228	16	7	silty sand to sandy silt
15.584	41.76	0.4544	1.088	3.317	13	7	silty sand to sandy silt
15.748	20.70	0.3875	1.872	3.429	8	6	sandy silt to clayey silt
15.912	8.49	0.2923	3.445	5.194	8	3	clay
16.076	11.53	0.1992	1.727	15.366	6	5	clayey silt to silty clay
16.240	10.35	0.2693	2.602	16.899	7	4	silty clay to clay
16.404	8.31	0.2615	3.148	19.271	8	3	clay
16.568	10.17	0.2992	2.942	25.553	6	4	silty clay to clay
16.732	7.73	0.3745	4.844	15.694	7	3	clay
16.896	9.51	0.3229	3.397	16.882	9	3	clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	12.30	0.2963	2.410	13.678	6	5	clayey silt to silty clay
17.224	9.42	0.2960	3.141	11.203	6	4	silty clay to clay
17.388	8.70	0.3498	4.021	12.853	8	3	clay
17.552	7.40	0.3783	5.112	12.054	7	3	clay
17.717	7.90	0.2894	3.664	12.310	8	3	clay
17.881	6.91	0.2926	4.236	12.078	7	3	clay
18.045	6.69	0.3613	5.404	13.066	6	3	clay
18.209	9.92	0.4410	4.447	13.343	9	3	clay
18.373	11.73	0.5073	4.327	11.229	11	3	clay
18.537	12.61	0.5180	4.108	11.053	12	3	clay
18.701	20.99	0.4202	2.002	9.434	8	6	sandy silt to clayey silt
18.865	26.10	0.4033	1.545	7.391	10	6	sandy silt to clayey silt
19.029	24.95	0.4007	1.606	7.325	10	6	sandy silt to clayey silt
19.193	20.29	0.5528	2.725	6.961	10	5	clayey silt to silty clay
19.357	17.38	0.6487	3.732	6.853	11	4	silty clay to clay
19.521	19.00	0.5569	2.931	7.516	9	5	clayey silt to silty clay
19.685	25.66	0.5026	1.959	5.478	10	6	sandy silt to clayey silt
19.849	23.48	0.6060	2.581	6.523	11	5	clayey silt to silty clay
20.013	20.11	0.6226	3.096	7.463	10	5	clayey silt to silty clay
20.177	19.35	0.5792	2.993	8.054	9	5	clayey silt to silty clay
20.341	20.49	0.4594	2.242	7.454	10	5	clayey silt to silty clay
20.505	21.41	0.3979	1.859	6.918	8	6	sandy silt to clayey silt
20.669	21.19	0.3731	1.761	7.272	8	6	sandy silt to clayey silt
20.833	20.14	0.3481	1.729	7.611	8	6	sandy silt to clayey silt
20.997	21.30	0.3929	1.845	6.358	8	6	sandy silt to clayey silt
21.161	17.77	0.5629	3.168	7.387	9	5	clayey silt to silty clay
21.325	16.96	0.7471	4.406	9.596	16	3	clay
21.490	18.03	0.9048	5.019	8.740	17	3	clay
21.654	23.05	0.9142	3.967	13.425	15	4	silty clay to clay
21.818	26.19	0.8635	3.296	7.585	13	5	clayey silt to silty clay
21.982	25.62	0.8722	3.404	5.536	12	5	clayey silt to silty clay
22.146	20.78	0.6363	3.061	5.086	10	5	clayey silt to silty clay
22.310	16.13	0.6570	4.072	6.995	15	3	clay
22.474	10.89	0.5922	5.436	9.685	10	3	clay
22.638	11.78	0.5626	4.775	9.161	11	3	clay
22.802	9.91	0.5238	5.286	9.563	9	3	clay
22.966	8.66	0.3893	4.498	12.399	8	3	clay
23.130	10.50	0.2489	2.370	15.474	5	5	clayey silt to silty clay
23.294	5.90	0.1649	2.793	20.610	6	3	clay
23.458	5.10	0.0700	1.371	24.178	2	1	sensitive fine grained
23.622	5.11	0.0945	1.851	25.168	3	4	silty clay to clay
23.786	6.56	0.1483	2.261	26.785	4	4	silty clay to clay
23.950	9.85	0.2419	2.456	27.866	6	4	silty clay to clay
24.114	11.03	0.2641	2.395	25.192	5	5	clayey silt to silty clay
24.278	14.56	0.3659	2.513	23.832	7	5	clayey silt to silty clay
24.442	8.69	0.2649	3.048	16.560	6	4	silty clay to clay
24.606	6.23	0.2262	3.629	18.470	6	3	clay
24.770	10.54	0.2865	2.718	26.460	7	4	silty clay to clay
24.934	14.58	0.2947	2.021	18.147	7	5	clayey silt to silty clay
25.098	7.22	0.2817	3.901	17.476	7	3	clay
25.262	6.17	0.2164	3.507	23.227	6	3	clay
25.427	37.61	1.1954	3.179	29.210	18	5	clayey silt to silty clay
25.591	128.00	1.4844	1.160	17.456	31	8	sand to silty sand
25.755	161.37	2.0301	1.258	11.842	39	8	sand to silty sand
25.919	165.69	2.3692	1.430	10.938	40	8	sand to silty sand
26.083	152.03	2.5144	1.654	10.950	36	8	sand to silty sand
26.247	136.41	2.5235	1.850	10.804	44	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	119.56	2.4032	2.010	10.940	38	7	silty sand to sandy silt
26.575	98.01	2.0928	2.135	10.503	31	7	silty sand to sandy silt
26.739	86.93	1.4379	1.654	10.218	28	7	silty sand to sandy silt
26.903	100.90	1.1810	1.170	10.708	24	8	sand to silty sand
27.067	143.30	1.2205	0.852	11.158	27	9	sand
27.231	181.67	1.6659	0.917	10.732	35	9	sand
27.395	188.92	2.0646	1.093	10.254	36	9	sand
27.559	196.03	2.4579	1.254	10.216	47	8	sand to silty sand
27.723	203.25	2.9712	1.462	10.354	49	8	sand to silty sand
27.887	209.16	3.4434	1.646	11.014	50	8	sand to silty sand
28.051	191.32	3.6586	1.912	10.988	46	8	sand to silty sand
28.215	173.64	3.4666	1.996	10.481	55	7	silty sand to sandy silt
28.379	171.60	3.3507	1.953	10.538	55	7	silty sand to sandy silt
28.543	172.78	3.2461	1.879	10.909	41	8	sand to silty sand
28.707	174.88	3.1297	1.790	11.069	42	8	sand to silty sand
28.871	182.65	2.9709	1.626	11.261	44	8	sand to silty sand
29.035	162.44	2.8142	1.732	10.701	39	8	sand to silty sand
29.199	162.55	2.7299	1.679	10.919	39	8	sand to silty sand
29.364	165.61	2.6615	1.607	10.749	40	8	sand to silty sand
29.528	169.27	2.5036	1.479	10.995	41	8	sand to silty sand
29.692	169.97	2.4051	1.415	10.983	41	8	sand to silty sand
29.856	175.97	2.4382	1.386	11.139	42	8	sand to silty sand
30.020	179.67	2.5694	1.430	11.241	43	8	sand to silty sand
30.184	166.79	2.6057	1.562	11.086	40	8	sand to silty sand
30.348	156.49	2.3181	1.481	10.885	37	8	sand to silty sand
30.512	151.19	2.1762	1.439	10.727	36	8	sand to silty sand
30.676	131.85	2.0349	1.543	11.096	32	8	sand to silty sand
30.840	118.95	1.9426	1.633	11.100	38	7	silty sand to sandy silt
31.004	105.93	1.9148	1.808	11.029	34	7	silty sand to sandy silt
31.168	124.19	1.8461	1.487	11.540	30	8	sand to silty sand
31.332	155.08	2.0387	1.315	13.128	37	8	sand to silty sand
31.496	153.63	2.0952	1.364	12.260	37	8	sand to silty sand
31.660	160.71	2.1066	1.311	12.454	38	8	sand to silty sand
31.824	163.80	2.2251	1.358	12.643	39	8	sand to silty sand
31.988	166.20	2.2505	1.354	12.944	40	8	sand to silty sand
32.152	165.74	2.3165	1.398	13.092	40	8	sand to silty sand
32.316	155.06	2.2402	1.445	13.013	37	8	sand to silty sand
32.480	156.68	2.2188	1.416	12.978	38	8	sand to silty sand
32.644	165.34	2.2000	1.331	13.138	40	8	sand to silty sand
32.808	176.32	2.3478	1.332	13.807	42	8	sand to silty sand
32.972	201.91	2.4812	1.229	14.168	39	9	sand
33.136	224.33	2.9101	1.297	14.611	43	9	sand
33.301	241.74	3.7118	1.535	15.252	58	8	sand to silty sand
33.465	245.63	4.2469	1.729	15.622	59	8	sand to silty sand
33.629	242.12	4.3999	1.817	15.493	58	8	sand to silty sand
33.793	241.16	4.3145	1.789	15.342	58	8	sand to silty sand
33.957	248.02	4.3169	1.741	15.407	59	8	sand to silty sand
34.121	252.49	4.4316	1.755	15.986	60	8	sand to silty sand
34.285	257.45	4.6408	1.803	16.249	62	8	sand to silty sand
34.449	256.79	4.7152	1.836	16.423	61	8	sand to silty sand
34.613	258.80	4.8072	1.857	16.454	62	8	sand to silty sand
34.777	261.09	4.7089	1.804	16.505	63	8	sand to silty sand
34.941	263.90	4.6969	1.780	16.208	63	8	sand to silty sand
35.105	267.86	4.6425	1.733	16.772	64	8	sand to silty sand
35.269	268.66	4.4453	1.655	16.555	64	8	sand to silty sand
35.433	279.45	4.5411	1.625	17.184	67	8	sand to silty sand
35.597	281.28	4.6144	1.640	15.790	67	8	sand to silty sand

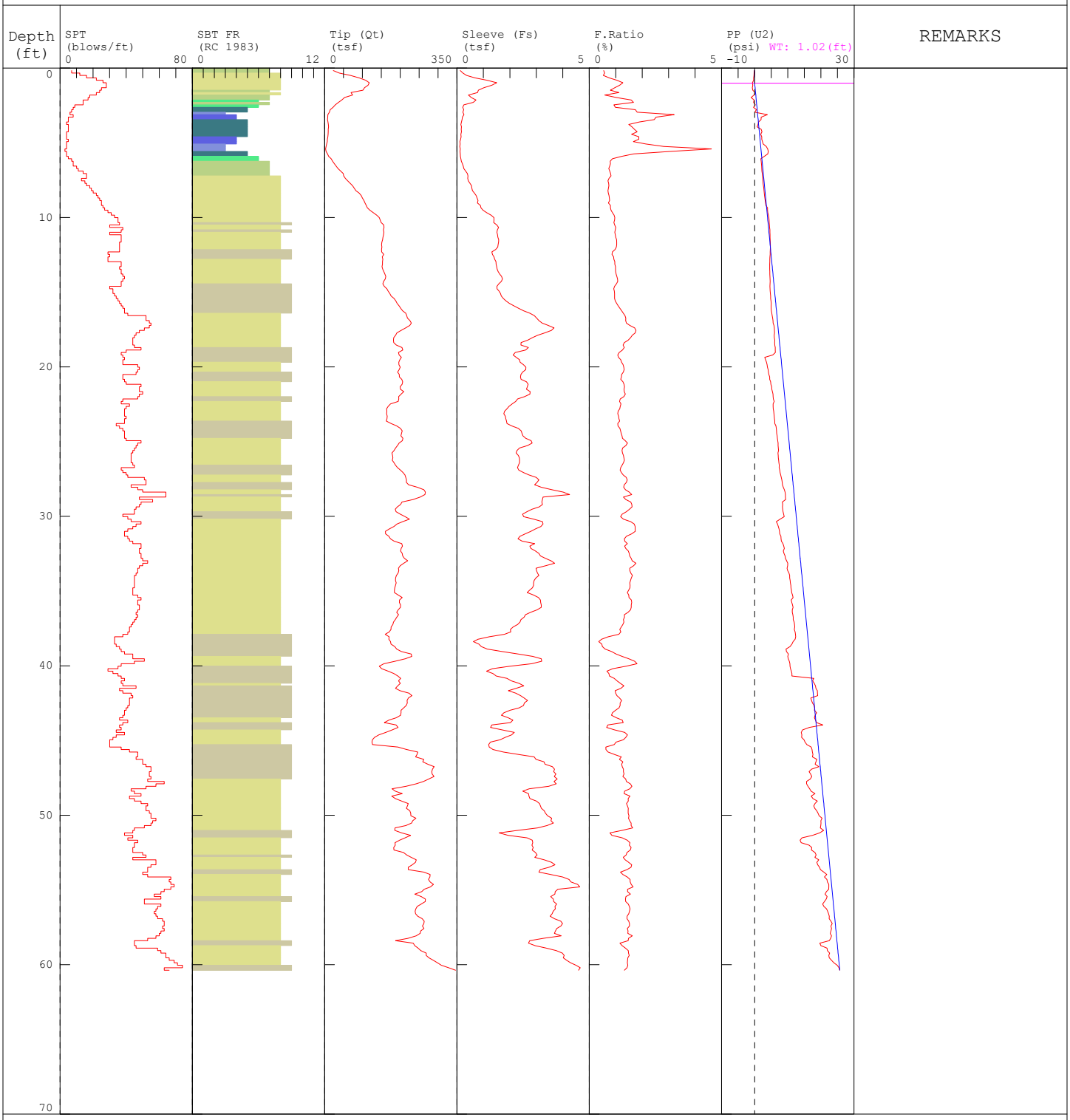
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	288.97	4.9370	1.708	16.101	69	8	sand to silty sand
35.925	293.39	5.1023	1.739	16.261	70	8	sand to silty sand
36.089	299.20	5.2881	1.767	15.885	72	8	sand to silty sand
36.253	303.42	5.5971	1.845	16.156	73	8	sand to silty sand
36.417	302.89	5.6737	1.873	16.512	73	8	sand to silty sand
36.581	317.59	5.7677	1.816	16.509	76	8	sand to silty sand
36.745	331.99	6.6836	2.013	17.093	79	8	sand to silty sand
36.909	337.68	7.2247	2.140	17.212	81	8	sand to silty sand
37.073	294.91	7.2366	2.454	15.969	94	7	silty sand to sandy silt
37.238	284.18	6.5635	2.310	15.830	91	7	silty sand to sandy silt
37.402	288.75	6.3857	2.212	15.751	69	8	sand to silty sand
37.566	298.55	6.4106	2.147	16.344	71	8	sand to silty sand
37.730	300.61	6.5379	2.175	16.732	72	8	sand to silty sand
37.894	306.10	6.6282	2.165	16.641	73	8	sand to silty sand
38.058	310.53	6.7457	2.172	16.323	74	8	sand to silty sand
38.222	316.03	6.9249	2.191	16.486	76	8	sand to silty sand
38.386	319.22	7.1040	2.225	16.856	76	8	sand to silty sand
38.550	325.90	6.4859	1.990	16.529	78	8	sand to silty sand
38.714	323.10	6.7266	2.082	16.782	77	8	sand to silty sand
38.878	315.01	6.9759	2.214	12.186	75	8	sand to silty sand
39.042	319.02	7.3359	2.300	12.401	76	8	sand to silty sand
39.206	327.86	7.6039	2.319	13.657	78	8	sand to silty sand
39.370	328.46	7.8642	2.394	14.089	105	7	silty sand to sandy silt
39.534	327.32	7.9929	2.442	14.596	104	7	silty sand to sandy silt
39.698	318.01	7.6422	2.403	15.056	102	7	silty sand to sandy silt
39.862	313.42	7.5422	2.406	15.479	100	7	silty sand to sandy silt
40.026	307.47	7.4587	2.426	15.498	98	7	silty sand to sandy silt
40.190	296.16	7.3802	2.492	15.804	95	7	silty sand to sandy silt
40.354	288.92	7.2287	2.502	16.079	92	7	silty sand to sandy silt
40.518	280.41	7.1012	2.532	15.665	90	7	silty sand to sandy silt
40.682	281.37	6.9357	2.465	15.500	90	7	silty sand to sandy silt
40.846	282.42	6.8666	2.431	16.167	90	7	silty sand to sandy silt
41.011	279.91	6.6667	2.382	16.024	89	7	silty sand to sandy silt
41.175	273.66	6.2708	2.291	15.558	87	7	silty sand to sandy silt
41.339	284.56	6.0107	2.112	15.029	68	8	sand to silty sand
41.503	283.33	6.0787	2.145	15.491	68	8	sand to silty sand
41.667	272.00	5.9820	2.199	15.407	65	8	sand to silty sand
41.831	275.56	5.6839	2.063	15.947	66	8	sand to silty sand
41.995	284.83	5.7286	2.011	16.660	68	8	sand to silty sand
42.159	289.32	5.8139	2.009	16.029	69	8	sand to silty sand
42.323	296.78	6.0998	2.055	15.749	71	8	sand to silty sand
42.487	297.85	6.2642	2.103	15.955	71	8	sand to silty sand
42.651	290.26	6.2005	2.136	15.496	69	8	sand to silty sand
42.815	298.94	5.5437	1.854	15.402	72	8	sand to silty sand
42.979	305.03	5.6632	1.857	15.225	73	8	sand to silty sand
43.143	287.78	5.5468	1.927	9.572	69	8	sand to silty sand
43.307	270.08	5.0074	1.854	10.094	65	8	sand to silty sand
43.471	262.21	5.2489	2.002	11.447	63	8	sand to silty sand
43.635	264.49	5.3703	2.030	13.056	63	8	sand to silty sand
43.799	256.28	5.2005	2.029	12.638	61	8	sand to silty sand
43.963	252.55	5.0710	2.008	13.374	60	8	sand to silty sand
44.127	244.62	5.0056	2.046	13.893	59	8	sand to silty sand
44.291	249.36	4.9278	1.976	14.242	60	8	sand to silty sand
44.455	250.17	4.9541	1.980	14.852	60	8	sand to silty sand
44.619	251.51	4.9445	1.966	14.788	60	8	sand to silty sand
44.783	252.86	4.9696	1.965	15.237	61	8	sand to silty sand
44.948	252.01	5.0869	2.019	15.216	60	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	244.19	4.7676	1.952	15.209	58	8	sand to silty sand
45.276	234.37	4.6630	1.990	15.302	56	8	sand to silty sand
45.440	231.39	4.4483	1.922	14.828	55	8	sand to silty sand
45.604	230.29	4.4873	1.948	14.580	55	8	sand to silty sand
45.768	235.53	4.3918	1.865	14.544	56	8	sand to silty sand
45.932	240.43	4.3839	1.823	15.060	58	8	sand to silty sand
46.096	248.45	4.5852	1.846	14.960	59	8	sand to silty sand
46.260	252.07	4.8012	1.905	15.469	60	8	sand to silty sand
46.424	226.40	4.5501	2.010	15.405	54	8	sand to silty sand
46.588	207.04	3.7380	1.805	14.969	50	8	sand to silty sand
46.752	215.03	3.1862	1.482	15.213	51	8	sand to silty sand
46.916	214.65	2.1787	1.015	14.881	41	9	sand
47.080	196.93	2.4918	1.265	15.063	47	8	sand to silty sand
47.244	231.85	2.8677	1.237	15.259	44	9	sand
47.408	234.58	3.4009	1.450	14.816	56	8	sand to silty sand
47.572	227.76	3.8213	1.678	14.520	55	8	sand to silty sand
47.736	216.44	3.7914	1.752	14.596	52	8	sand to silty sand
47.900	206.47	3.6110	1.749	14.687	49	8	sand to silty sand
48.064	208.04	3.4922	1.679	14.845	50	8	sand to silty sand
48.228	198.89	3.2856	1.652	15.383	48	8	sand to silty sand
48.392	176.37	2.4265	1.376	14.544	42	8	sand to silty sand
48.556	145.15	2.2501	1.550	14.699	35	8	sand to silty sand
48.720	156.21	1.8903	1.210	19.235	37	8	sand to silty sand
48.885	222.16	2.5396	1.143	17.358	43	9	sand
49.049	232.88	3.0451	1.308	14.549	45	9	sand
49.213	236.29	3.6158	1.530	15.244	57	8	sand to silty sand
49.377	240.85	3.9808	1.653	15.366	58	8	sand to silty sand
49.541	246.04	4.0354	1.640	15.314	59	8	sand to silty sand
49.705	260.09	4.0725	1.566	15.517	62	8	sand to silty sand
49.869	265.63	4.3398	1.634	16.445	64	8	sand to silty sand
50.033	254.69	4.3678	1.715	16.519	61	8	sand to silty sand
50.197	246.88	4.3318	1.755	16.871	59	8	sand to silty sand
50.361	239.85	4.2968	1.791	17.633	57	8	sand to silty sand
50.525	227.57	4.1313	1.815	17.303	54	8	sand to silty sand
50.689	225.01	3.8976	1.732	17.528	54	8	sand to silty sand
50.853	241.20	3.6903	1.530	18.497	58	8	sand to silty sand
51.017	252.20	3.6552	1.449	18.831	60	8	sand to silty sand
51.181	255.75	3.8177	1.493	18.281	61	8	sand to silty sand
51.345	255.85	3.9718	1.552	18.272	61	8	sand to silty sand
51.509	256.25	4.0983	1.599	18.633	61	8	sand to silty sand
51.673	258.28	3.9611	1.534	19.613	62	8	sand to silty sand
51.837	262.91	3.9386	1.498	19.290	63	8	sand to silty sand
52.001	277.92	4.1239	1.484	18.506	67	8	sand to silty sand
52.165	289.97	4.4769	1.544	19.379	69	8	sand to silty sand
52.329	295.01	4.9204	1.668	19.580	71	8	sand to silty sand
52.493	295.66	5.1318	1.736	19.740	71	8	sand to silty sand
52.657	298.32	5.2248	1.751	20.180	71	8	sand to silty sand
52.822	304.52	5.2537	1.725	19.977	73	8	sand to silty sand
52.986	303.42	5.2472	1.729	20.173	73	8	sand to silty sand
53.150	298.49	4.9105	1.645	19.857	71	8	sand to silty sand
53.314	286.05	4.5838	1.602	19.080	68	8	sand to silty sand
53.478	273.00	4.4527	1.631	19.121	65	8	sand to silty sand
53.642	255.85	4.5510	1.779	19.216	61	8	sand to silty sand
53.806	251.28	4.4381	1.766	18.805	60	8	sand to silty sand
53.970	256.31	4.4987	1.755	19.475	61	8	sand to silty sand
54.134	255.00	4.7182	1.850	20.108	61	8	sand to silty sand
54.298	250.91	4.6331	1.847	19.805	60	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	257.53	4.6066	1.789	20.168	62	8	sand to silty sand
54.626	267.70	4.6424	1.734	20.625	64	8	sand to silty sand
54.790	257.93	4.4864	1.739	20.108	62	8	sand to silty sand
54.954	253.77	4.7426	1.869	20.072	61	8	sand to silty sand
55.118	257.85	4.8526	1.882	19.714	62	8	sand to silty sand
55.282	228.26	4.8223	2.113	18.927	73	7	silty sand to sandy silt
55.446	217.43	4.7931	2.204	18.384	69	7	silty sand to sandy silt
55.610	206.43	4.4177	2.140	18.879	66	7	silty sand to sandy silt
55.774	193.09	3.9338	2.037	18.532	62	7	silty sand to sandy silt
55.938	173.63	3.2339	1.863	18.081	42	8	sand to silty sand
56.102	192.04	2.4985	1.301	19.216	46	8	sand to silty sand
56.266	217.85	2.3268	1.068	19.030	42	9	sand
56.430	239.36	2.7475	1.148	17.896	46	9	sand
56.594	247.34	3.2363	1.308	17.349	47	9	sand
56.759	278.30	3.9404	1.416	18.128	67	8	sand to silty sand
56.923	308.82	4.5943	1.488	19.149	74	8	sand to silty sand
57.087	319.01	4.8767	1.529	18.688	76	8	sand to silty sand
57.251	330.58	4.9847	1.508	17.832	79	8	sand to silty sand
57.415	316.10	4.9279	1.559	17.337	76	8	sand to silty sand
57.579	326.52	4.7663	1.460	17.865	78	8	sand to silty sand
57.743	335.52	5.0062	1.492	17.748	80	8	sand to silty sand
57.907	346.29	5.9616	1.722	17.026	83	8	sand to silty sand
58.071	354.16	6.8117	1.923	17.801	85	8	sand to silty sand
58.235	338.99	6.9235	2.042	18.391	81	8	sand to silty sand
58.399	321.17	6.8939	2.146	17.794	77	8	sand to silty sand
58.563	302.10	6.7599	2.238	20.178	72	8	sand to silty sand
58.727	303.78	6.8036	2.240	20.089	73	8	sand to silty sand
58.891	307.71	6.8627	2.230	19.915	74	8	sand to silty sand
59.055	297.51	6.8462	2.301	20.321	95	7	silty sand to sandy silt
59.219	282.71	6.8614	2.427	20.833	90	7	silty sand to sandy silt
59.383	266.56	6.7018	2.514	19.962	85	7	silty sand to sandy silt
59.547	236.37	6.3205	2.674	19.929	75	7	silty sand to sandy silt
59.711	212.63	5.6084	2.638	19.011	68	7	silty sand to sandy silt
59.875	198.69	4.9535	2.493	19.427	63	7	silty sand to sandy silt
60.039	195.46	4.4156	2.259	19.336	62	7	silty sand to sandy silt
60.203	189.18	4.1211	2.178	19.551	60	7	silty sand to sandy silt
60.367	189.63	4.1911	2.210	19.257	61	7	silty sand to sandy silt

Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM
TOTAL DEPTH: 60.367 ft

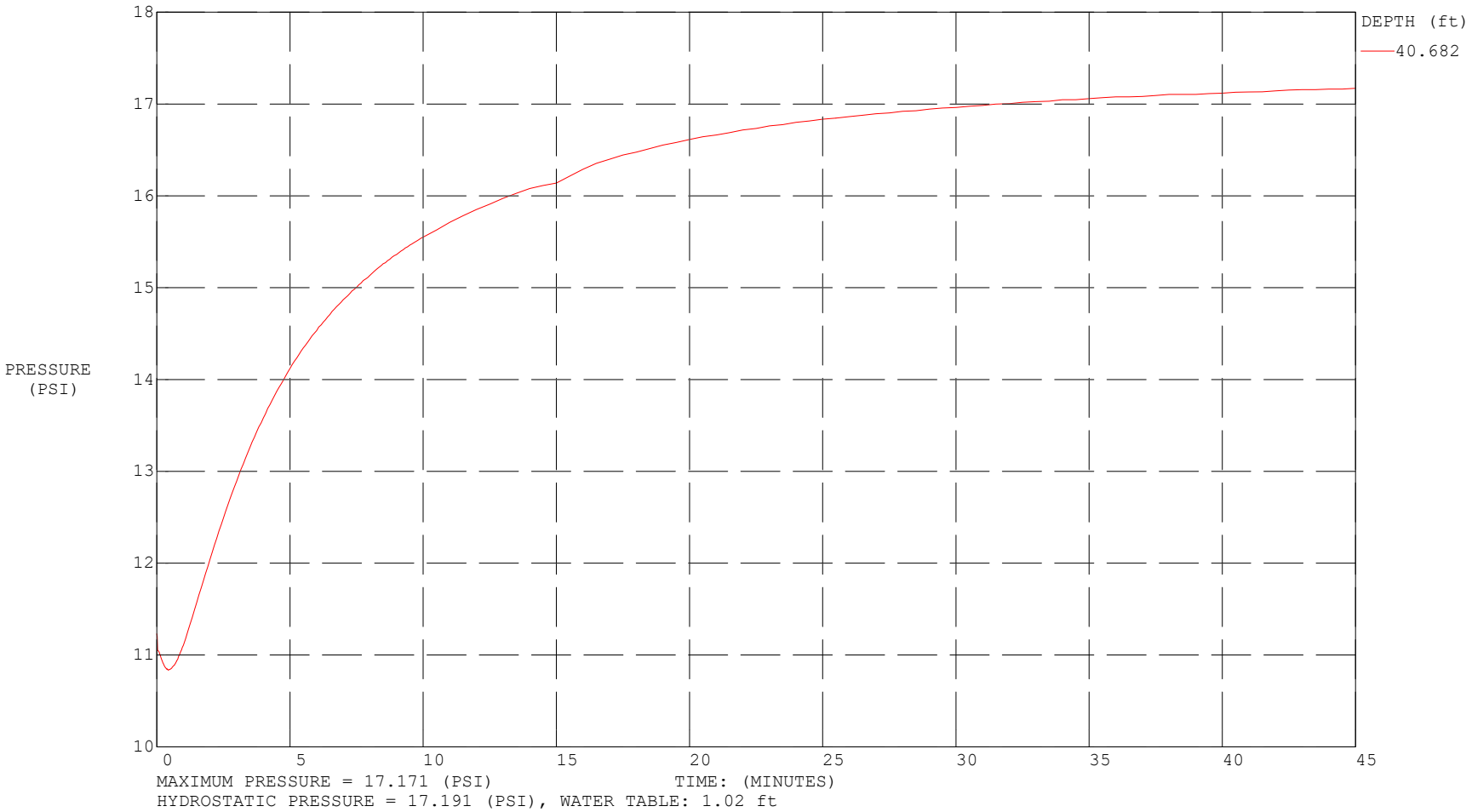


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM



Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM
TOTAL DEPTH: 60.367 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	23.05	0.1251	0.543	-0.124	7	7	silty sand to sandy silt
0.328	38.47	0.2228	0.579	-0.208	12	7	silty sand to sandy silt
0.492	68.16	0.3600	0.528	-0.237	16	8	sand to silty sand
0.656	91.46	0.6863	0.750	-0.332	22	8	sand to silty sand
0.820	108.65	1.1379	1.047	-0.328	26	8	sand to silty sand
0.984	118.18	1.5001	1.269	-0.684	28	8	sand to silty sand
1.148	114.90	1.3189	1.148	-0.576	28	8	sand to silty sand
1.312	105.35	1.0148	0.963	-0.746	25	8	sand to silty sand
1.476	101.28	0.8067	0.796	-0.595	24	8	sand to silty sand
1.640	69.73	0.7793	1.118	0.062	22	7	silty sand to sandy silt
1.804	73.67	0.4327	0.587	-0.244	18	8	sand to silty sand
1.969	52.63	0.5385	1.023	-1.074	17	7	silty sand to sandy silt
2.133	45.22	0.7179	1.588	-0.208	14	7	silty sand to sandy silt
2.297	36.75	0.6126	1.667	-0.383	14	6	sandy silt to clayey silt
2.461	28.04	0.2598	0.927	0.206	9	7	silty sand to sandy silt
2.625	22.11	0.2181	0.986	-0.361	8	6	sandy silt to clayey silt
2.789	14.54	0.2532	1.741	0.531	7	5	clayey silt to silty clay
2.953	12.44	0.2252	1.811	0.005	6	5	clayey silt to silty clay
3.117	8.29	0.2658	3.207	3.833	8	3	clay
3.281	8.12	0.2049	2.524	1.944	5	4	silty clay to clay
3.445	7.68	0.1884	2.453	1.906	5	4	silty clay to clay
3.609	8.82	0.1665	1.887	1.169	4	5	clayey silt to silty clay
3.773	9.64	0.1441	1.495	0.980	5	5	clayey silt to silty clay
3.937	10.43	0.1680	1.611	0.689	5	5	clayey silt to silty clay
4.101	9.49	0.1618	1.705	1.949	5	5	clayey silt to silty clay
4.265	9.25	0.1673	1.808	2.226	4	5	clayey silt to silty clay
4.429	9.03	0.1444	1.599	1.837	4	5	clayey silt to silty clay
4.593	8.43	0.1579	1.874	2.147	4	5	clayey silt to silty clay
4.757	7.35	0.1374	1.868	2.159	5	4	silty clay to clay
4.921	6.82	0.1134	1.663	2.363	4	4	silty clay to clay
5.085	5.53	0.1180	2.134	2.561	4	4	silty clay to clay
5.249	3.84	0.1080	2.815	3.498	4	3	clay
5.413	2.62	0.1211	4.613	3.903	3	3	clay
5.577	3.77	0.1156	3.069	4.094	4	3	clay
5.741	7.61	0.1278	1.678	3.960	4	5	clayey silt to silty clay
5.906	10.78	0.1313	1.218	2.893	5	5	clayey silt to silty clay
6.070	17.22	0.1508	0.876	1.844	7	6	sandy silt to clayey silt
6.234	20.95	0.1652	0.788	1.961	8	6	sandy silt to clayey silt
6.398	25.76	0.2051	0.796	2.035	8	7	silty sand to sandy silt
6.562	30.44	0.2345	0.770	2.088	10	7	silty sand to sandy silt
6.726	35.55	0.2622	0.738	2.145	11	7	silty sand to sandy silt
6.890	42.34	0.3266	0.771	2.190	14	7	silty sand to sandy silt
7.054	49.05	0.3950	0.805	2.277	16	7	silty sand to sandy silt
7.218	50.35	0.4117	0.818	2.339	16	7	silty sand to sandy silt
7.382	54.75	0.4075	0.744	2.413	13	8	sand to silty sand
7.546	61.09	0.4298	0.704	2.470	15	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	67.40	0.4907	0.728	2.547	16	8	sand to silty sand
7.874	73.68	0.5459	0.741	2.640	18	8	sand to silty sand
8.038	78.08	0.5630	0.721	2.738	19	8	sand to silty sand
8.202	82.72	0.5833	0.705	2.800	20	8	sand to silty sand
8.366	90.90	0.6534	0.719	2.891	22	8	sand to silty sand
8.530	96.79	0.7212	0.745	2.968	23	8	sand to silty sand
8.694	99.94	0.7607	0.761	3.070	24	8	sand to silty sand
8.858	103.79	0.7968	0.768	3.164	25	8	sand to silty sand
9.022	106.46	0.7696	0.723	3.264	25	8	sand to silty sand
9.186	110.17	0.8839	0.802	3.405	26	8	sand to silty sand
9.350	112.95	0.9033	0.800	3.867	27	8	sand to silty sand
9.514	119.52	0.9837	0.823	3.888	29	8	sand to silty sand
9.678	128.42	1.1213	0.873	3.962	31	8	sand to silty sand
9.843	137.57	1.2898	0.938	4.149	33	8	sand to silty sand
10.007	144.76	1.3961	0.964	4.276	35	8	sand to silty sand
10.171	146.85	1.4016	0.954	4.369	35	8	sand to silty sand
10.335	149.72	1.3898	0.928	4.395	36	8	sand to silty sand
10.499	156.46	1.5050	0.962	4.441	30	9	sand
10.663	156.80	1.5700	1.001	4.510	38	8	sand to silty sand
10.827	155.34	1.5270	0.983	4.579	37	8	sand to silty sand
10.991	156.74	1.5100	0.963	4.603	30	9	sand
11.155	155.95	1.5329	0.983	4.625	37	8	sand to silty sand
11.319	154.28	1.5433	1.000	4.665	37	8	sand to silty sand
11.483	153.17	1.5772	1.030	4.682	37	8	sand to silty sand
11.647	151.43	1.5697	1.037	4.704	36	8	sand to silty sand
11.811	150.33	1.5571	1.036	4.735	36	8	sand to silty sand
11.975	151.31	1.5427	1.020	4.737	36	8	sand to silty sand
12.139	150.25	1.4606	0.972	4.701	36	8	sand to silty sand
12.303	150.94	1.3197	0.874	4.677	29	9	sand
12.467	156.40	1.3409	0.857	4.696	30	9	sand
12.631	152.24	1.3995	0.919	4.601	29	9	sand
12.795	153.86	1.4248	0.926	4.565	29	9	sand
12.959	152.98	1.4729	0.963	4.563	37	8	sand to silty sand
13.123	153.04	1.4774	0.965	4.541	37	8	sand to silty sand
13.287	151.67	1.4996	0.989	4.546	36	8	sand to silty sand
13.451	153.49	1.5180	0.989	4.541	37	8	sand to silty sand
13.615	156.36	1.5560	0.995	4.565	37	8	sand to silty sand
13.780	159.30	1.6117	1.012	4.567	38	8	sand to silty sand
13.944	161.77	1.6829	1.040	4.591	39	8	sand to silty sand
14.108	160.66	1.7190	1.070	4.610	38	8	sand to silty sand
14.272	156.18	1.6801	1.076	4.675	37	8	sand to silty sand
14.436	153.80	1.5830	1.029	4.665	37	8	sand to silty sand
14.600	157.80	1.5079	0.956	4.586	30	9	sand
14.764	164.48	1.5169	0.922	4.634	32	9	sand
14.928	168.12	1.5905	0.946	4.680	32	9	sand
15.092	172.16	1.6405	0.953	4.735	33	9	sand
15.256	175.65	1.6761	0.954	4.797	34	9	sand
15.420	183.39	1.7489	0.954	4.806	35	9	sand
15.584	188.15	1.8524	0.984	4.919	36	9	sand
15.748	191.80	1.9835	1.034	5.012	37	9	sand
15.912	197.08	2.1597	1.096	4.943	38	9	sand
16.076	201.29	2.3287	1.157	4.957	39	9	sand
16.240	206.20	2.5144	1.219	5.034	39	9	sand
16.404	214.58	2.7546	1.284	5.177	41	9	sand
16.568	216.97	2.9220	1.347	5.278	52	8	sand to silty sand
16.732	218.80	3.0124	1.377	5.426	52	8	sand to silty sand
16.896	225.48	3.0942	1.372	5.548	54	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	229.32	3.2163	1.403	5.569	55	8	sand to silty sand
17.224	225.17	3.4480	1.531	5.828	54	8	sand to silty sand
17.388	214.18	3.6682	1.713	5.938	51	8	sand to silty sand
17.552	202.57	3.5720	1.763	5.959	48	8	sand to silty sand
17.717	191.09	3.3190	1.737	5.983	46	8	sand to silty sand
17.881	187.70	3.0520	1.626	5.918	45	8	sand to silty sand
18.045	182.72	2.8435	1.556	5.947	44	8	sand to silty sand
18.209	181.82	2.6696	1.468	6.064	44	8	sand to silty sand
18.373	182.72	2.4217	1.325	6.033	44	8	sand to silty sand
18.537	189.43	2.4165	1.276	6.091	45	8	sand to silty sand
18.701	204.52	2.7007	1.321	6.198	49	8	sand to silty sand
18.865	206.76	2.5946	1.255	6.189	40	9	sand
19.029	195.27	2.2058	1.130	6.270	37	9	sand
19.193	197.08	2.1219	1.077	5.447	38	9	sand
19.357	202.95	2.2372	1.102	3.006	39	9	sand
19.521	198.85	2.3635	1.189	3.278	38	9	sand
19.685	196.30	2.3872	1.216	3.570	38	9	sand
19.849	196.44	2.5097	1.278	3.721	47	8	sand to silty sand
20.013	199.81	2.6043	1.303	3.843	48	8	sand to silty sand
20.177	197.13	2.5998	1.319	4.053	47	8	sand to silty sand
20.341	193.19	2.4803	1.284	4.154	46	8	sand to silty sand
20.505	197.41	2.4145	1.223	4.307	38	9	sand
20.669	197.82	2.3994	1.213	4.543	38	9	sand
20.833	204.08	2.4210	1.186	4.531	39	9	sand
20.997	206.34	2.6235	1.271	4.821	40	9	sand
21.161	204.94	2.6870	1.311	4.902	49	8	sand to silty sand
21.325	199.65	2.6570	1.331	5.132	48	8	sand to silty sand
21.490	200.47	2.6247	1.309	5.194	48	8	sand to silty sand
21.654	209.26	2.7670	1.322	5.373	50	8	sand to silty sand
21.818	202.22	2.7551	1.362	5.521	48	8	sand to silty sand
21.982	195.84	2.5586	1.306	5.572	47	8	sand to silty sand
22.146	196.10	2.2932	1.169	5.639	38	9	sand
22.310	194.29	2.2184	1.142	5.878	37	9	sand
22.474	174.38	2.0867	1.197	5.567	42	8	sand to silty sand
22.638	168.17	1.9648	1.168	5.576	40	8	sand to silty sand
22.802	163.90	1.8864	1.151	5.620	39	8	sand to silty sand
22.966	164.44	1.7969	1.093	5.746	39	8	sand to silty sand
23.130	164.05	1.7673	1.077	5.820	39	8	sand to silty sand
23.294	165.51	1.8297	1.105	5.885	40	8	sand to silty sand
23.458	164.78	1.8469	1.121	5.957	39	8	sand to silty sand
23.622	162.97	1.8717	1.148	6.093	39	8	sand to silty sand
23.786	175.62	1.8922	1.077	6.098	34	9	sand
23.950	190.47	2.0664	1.085	6.423	36	9	sand
24.114	200.33	2.3199	1.158	6.540	38	9	sand
24.278	205.21	2.4283	1.183	6.583	39	9	sand
24.442	203.39	2.4562	1.208	6.645	39	9	sand
24.606	201.83	2.4917	1.235	6.777	39	9	sand
24.770	207.21	2.6003	1.255	6.844	40	9	sand
24.934	205.71	2.7991	1.361	6.961	49	8	sand to silty sand
25.098	196.92	2.8406	1.443	7.081	47	8	sand to silty sand
25.262	192.67	2.6695	1.386	7.069	46	8	sand to silty sand
25.427	187.67	2.3623	1.259	7.140	45	8	sand to silty sand
25.591	183.61	2.2689	1.236	7.215	44	8	sand to silty sand
25.755	178.09	2.2325	1.254	7.035	43	8	sand to silty sand
25.919	179.67	2.3198	1.291	7.102	43	8	sand to silty sand
26.083	180.32	2.3548	1.306	7.148	43	8	sand to silty sand
26.247	178.89	2.3679	1.324	7.258	43	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	183.79	2.3642	1.286	7.310	44	8	sand to silty sand
26.575	187.34	2.3216	1.239	7.430	45	8	sand to silty sand
26.739	192.58	2.2854	1.187	7.401	37	9	sand
26.903	200.38	2.3340	1.165	7.580	38	9	sand
27.067	207.40	2.5136	1.212	7.650	40	9	sand
27.231	212.42	2.7206	1.281	7.827	41	9	sand
27.395	214.58	2.9964	1.396	8.054	51	8	sand to silty sand
27.559	216.22	3.0965	1.432	8.219	52	8	sand to silty sand
27.723	215.93	3.0221	1.400	8.331	52	8	sand to silty sand
27.887	222.05	2.9347	1.322	8.374	43	9	sand
28.051	245.26	3.1840	1.298	8.652	47	9	sand
28.215	262.44	3.5865	1.367	8.977	50	9	sand
28.379	266.24	4.0112	1.507	9.183	64	8	sand to silty sand
28.543	265.25	4.2572	1.605	9.281	64	8	sand to silty sand
28.707	252.85	3.2551	1.287	9.300	48	9	sand
28.871	233.93	3.2276	1.380	9.369	56	8	sand to silty sand
29.035	204.60	3.2052	1.567	8.348	49	8	sand to silty sand
29.199	200.66	3.2289	1.609	8.453	48	8	sand to silty sand
29.364	192.28	3.1100	1.617	8.396	46	8	sand to silty sand
29.528	186.70	2.8369	1.519	8.472	45	8	sand to silty sand
29.692	188.82	2.6429	1.400	8.542	45	8	sand to silty sand
29.856	200.07	2.4779	1.239	8.752	38	9	sand
30.020	212.95	2.5219	1.184	8.939	41	9	sand
30.184	224.45	2.9017	1.293	7.683	43	9	sand
30.348	206.38	3.2295	1.565	6.535	49	8	sand to silty sand
30.512	191.61	3.2524	1.697	6.887	46	8	sand to silty sand
30.676	183.12	3.1713	1.732	7.162	44	8	sand to silty sand
30.840	171.50	2.9692	1.731	7.351	41	8	sand to silty sand
31.004	160.82	2.7908	1.735	7.506	39	8	sand to silty sand
31.168	160.98	2.5793	1.602	7.585	39	8	sand to silty sand
31.332	169.86	2.3820	1.402	7.920	41	8	sand to silty sand
31.496	173.87	2.3041	1.325	7.963	42	8	sand to silty sand
31.660	183.80	2.4612	1.339	8.085	44	8	sand to silty sand
31.824	204.17	2.9328	1.436	8.518	49	8	sand to silty sand
31.988	205.99	2.7495	1.335	8.800	49	8	sand to silty sand
32.152	202.51	2.7957	1.381	8.972	48	8	sand to silty sand
32.316	201.03	2.9635	1.474	8.659	48	8	sand to silty sand
32.480	205.15	3.0965	1.509	8.843	49	8	sand to silty sand
32.644	206.42	3.1528	1.527	9.180	49	8	sand to silty sand
32.808	210.93	3.3341	1.581	9.288	50	8	sand to silty sand
32.972	219.41	3.5536	1.620	9.632	53	8	sand to silty sand
33.136	209.15	3.6911	1.765	9.979	50	8	sand to silty sand
33.301	199.98	3.3497	1.675	9.964	48	8	sand to silty sand
33.465	195.24	2.9886	1.531	9.771	47	8	sand to silty sand
33.629	196.34	3.0040	1.530	9.962	47	8	sand to silty sand
33.793	194.09	3.0416	1.567	10.330	46	8	sand to silty sand
33.957	189.84	3.0957	1.631	10.569	45	8	sand to silty sand
34.121	187.76	2.9855	1.590	10.584	45	8	sand to silty sand
34.285	187.39	2.9142	1.555	10.703	45	8	sand to silty sand
34.449	189.16	2.8948	1.530	10.792	45	8	sand to silty sand
34.613	187.46	2.8919	1.543	10.928	45	8	sand to silty sand
34.777	185.61	2.8468	1.534	10.978	44	8	sand to silty sand
34.941	184.52	2.7437	1.487	11.110	44	8	sand to silty sand
35.105	184.58	2.6535	1.438	11.163	44	8	sand to silty sand
35.269	194.73	2.8967	1.487	11.428	47	8	sand to silty sand
35.433	205.20	3.0777	1.500	11.607	49	8	sand to silty sand
35.597	198.11	3.1521	1.591	11.036	47	8	sand to silty sand

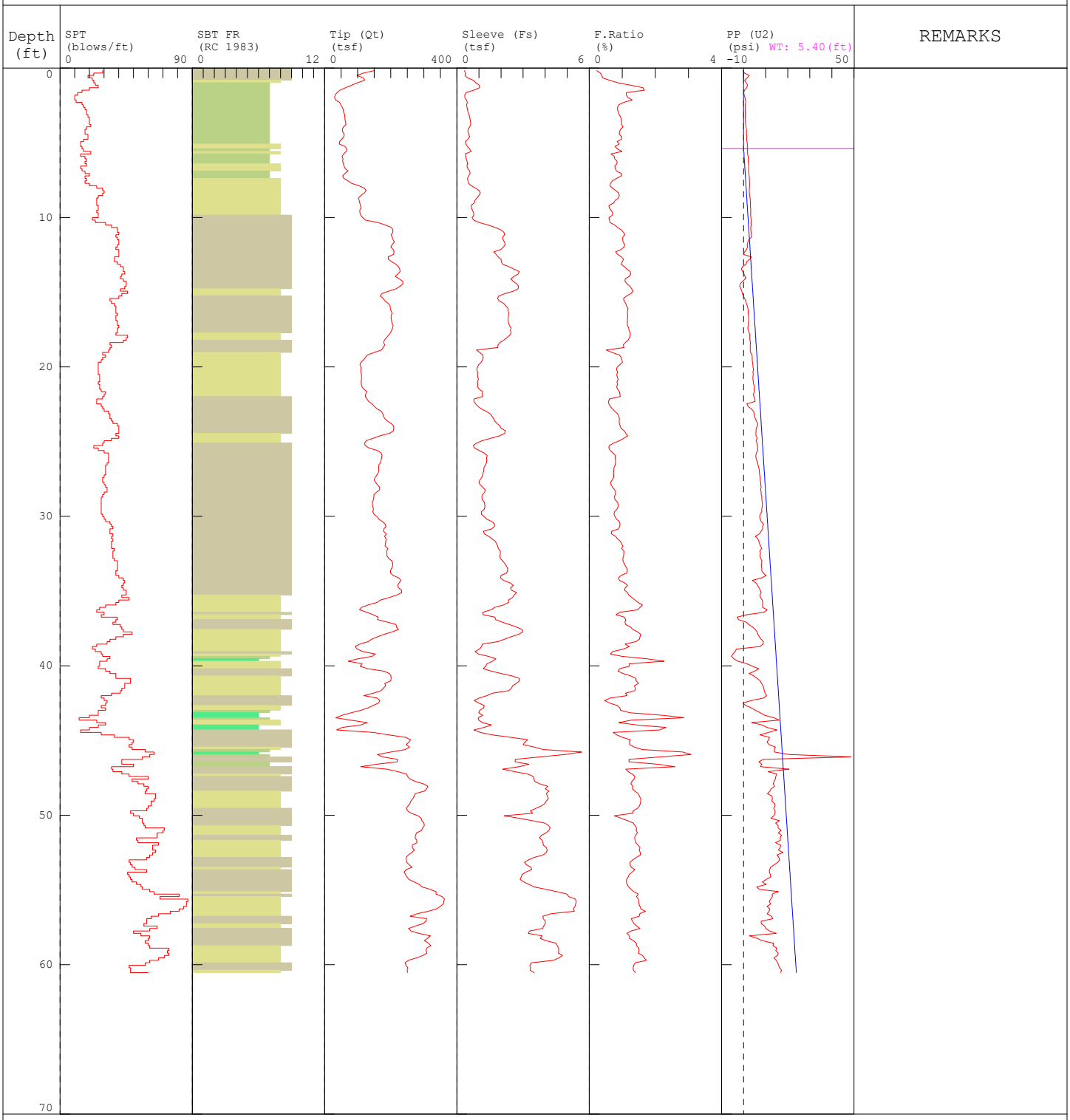
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	197.61	3.1656	1.602	11.196	47	8	sand to silty sand
35.925	200.90	3.1853	1.586	11.454	48	8	sand to silty sand
36.089	200.53	3.1831	1.587	11.583	48	8	sand to silty sand
36.253	194.64	3.0287	1.556	11.368	47	8	sand to silty sand
36.417	190.51	2.7853	1.462	11.342	46	8	sand to silty sand
36.581	195.37	2.5905	1.326	11.538	47	8	sand to silty sand
36.745	190.87	2.5373	1.329	11.653	46	8	sand to silty sand
36.909	186.95	2.4165	1.293	11.648	45	8	sand to silty sand
37.073	181.90	2.3785	1.308	11.923	44	8	sand to silty sand
37.238	180.34	2.2926	1.271	12.050	43	8	sand to silty sand
37.402	175.53	2.1217	1.209	12.102	42	8	sand to silty sand
37.566	175.31	2.0191	1.152	11.961	42	8	sand to silty sand
37.730	170.69	2.0336	1.191	12.217	41	8	sand to silty sand
37.894	160.29	1.7927	1.118	12.318	38	8	sand to silty sand
38.058	170.45	1.2156	0.713	12.404	33	9	sand
38.222	170.04	0.7934	0.467	12.234	33	9	sand
38.386	173.98	0.6215	0.357	11.607	33	9	sand
38.550	175.50	0.8280	0.472	11.244	34	9	sand
38.714	185.63	0.9208	0.496	10.682	36	9	sand
38.878	190.63	1.1444	0.600	9.469	37	9	sand
39.042	203.11	1.7141	0.844	9.608	39	9	sand
39.206	228.83	2.3176	1.013	10.163	44	9	sand
39.370	230.69	2.8622	1.241	9.991	44	9	sand
39.534	213.53	3.1831	1.491	10.127	51	8	sand to silty sand
39.698	186.44	3.2012	1.717	10.448	45	8	sand to silty sand
39.862	156.62	2.8208	1.801	10.629	37	8	sand to silty sand
40.026	144.71	2.0072	1.387	10.672	35	8	sand to silty sand
40.190	150.73	1.3404	0.889	10.818	29	9	sand
40.354	167.92	1.1155	0.664	11.043	32	9	sand
40.518	183.05	1.3595	0.743	11.273	35	9	sand
40.682	193.69	1.4800	0.764	11.225	37	9	sand
40.846	201.12	1.8925	0.941	17.887	39	9	sand
41.011	195.57	2.0548	1.051	17.487	37	9	sand
41.175	200.24	2.3465	1.172	17.990	38	9	sand
41.339	193.32	2.5237	1.305	18.351	46	8	sand to silty sand
41.503	187.43	2.2374	1.194	18.504	36	9	sand
41.667	199.11	1.9428	0.976	18.915	38	9	sand
41.831	223.01	2.2204	0.996	18.965	43	9	sand
41.995	230.87	2.4063	1.042	19.054	44	9	sand
42.159	221.65	2.5362	1.144	16.959	42	9	sand
42.323	218.05	2.6641	1.222	17.181	42	9	sand
42.487	218.72	2.5477	1.165	17.473	42	9	sand
42.651	215.83	2.5159	1.166	17.923	41	9	sand
42.815	209.26	2.3515	1.124	18.136	40	9	sand
42.979	202.08	2.0018	0.991	18.064	39	9	sand
43.143	201.98	1.7706	0.877	18.726	39	9	sand
43.307	200.82	1.6805	0.837	18.253	38	9	sand
43.471	189.55	1.9361	1.021	18.037	36	9	sand
43.635	169.83	2.1092	1.242	18.406	41	8	sand to silty sand
43.799	158.06	2.0220	1.279	18.686	38	8	sand to silty sand
43.963	189.02	1.3196	0.698	20.579	36	9	sand
44.127	194.14	1.2710	0.655	16.497	37	9	sand
44.291	178.64	1.7136	0.959	14.448	34	9	sand
44.455	161.75	2.1677	1.340	14.054	39	8	sand to silty sand
44.619	143.21	2.0618	1.440	14.252	34	8	sand to silty sand
44.783	132.13	1.8251	1.381	14.183	32	8	sand to silty sand
44.948	126.45	1.6332	1.292	14.886	30	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	125.08	1.2648	1.011	15.235	30	8	sand to silty sand
45.276	126.63	1.1951	0.944	15.778	30	8	sand to silty sand
45.440	193.97	1.2157	0.627	17.069	37	9	sand
45.604	217.19	1.3630	0.628	17.337	42	9	sand
45.768	246.35	1.7506	0.711	17.440	47	9	sand
45.932	244.10	2.3330	0.956	17.602	47	9	sand
46.096	240.57	2.9140	1.211	17.440	46	9	sand
46.260	262.07	2.9875	1.140	18.812	50	9	sand
46.424	259.68	3.2869	1.266	18.501	50	9	sand
46.588	272.56	3.3269	1.221	18.253	52	9	sand
46.752	289.49	3.6021	1.244	19.393	55	9	sand
46.916	285.47	3.6865	1.291	17.186	55	9	sand
47.080	283.17	3.6561	1.291	16.450	54	9	sand
47.244	284.37	3.7365	1.314	16.906	54	9	sand
47.408	289.22	3.6765	1.271	17.251	55	9	sand
47.572	275.50	3.7845	1.374	16.832	53	9	sand
47.736	261.44	3.6661	1.402	15.687	63	8	sand to silty sand
47.900	242.21	3.7473	1.547	15.672	58	8	sand to silty sand
48.064	215.18	3.4676	1.612	16.129	52	8	sand to silty sand
48.228	178.18	2.7285	1.531	16.584	43	8	sand to silty sand
48.392	186.65	2.4881	1.333	17.043	45	8	sand to silty sand
48.556	205.15	2.7023	1.317	18.217	49	8	sand to silty sand
48.720	177.42	2.7223	1.534	17.062	42	8	sand to silty sand
48.885	187.06	2.7535	1.472	17.619	45	8	sand to silty sand
49.049	203.63	2.9994	1.473	18.939	49	8	sand to silty sand
49.213	221.29	3.1162	1.408	18.236	53	8	sand to silty sand
49.377	218.93	3.1517	1.440	17.877	52	8	sand to silty sand
49.541	216.15	3.1899	1.476	18.155	52	8	sand to silty sand
49.705	225.13	3.2992	1.465	18.772	54	8	sand to silty sand
49.869	227.90	3.3468	1.469	19.149	55	8	sand to silty sand
50.033	228.07	3.4223	1.501	19.444	55	8	sand to silty sand
50.197	241.41	3.5776	1.482	20.386	58	8	sand to silty sand
50.361	233.11	3.5526	1.524	20.022	56	8	sand to silty sand
50.525	229.90	3.6393	1.583	20.053	55	8	sand to silty sand
50.689	215.00	3.4042	1.583	19.953	51	8	sand to silty sand
50.853	186.00	3.0461	1.638	19.826	45	8	sand to silty sand
51.017	185.61	2.2941	1.236	20.814	44	8	sand to silty sand
51.181	203.48	1.5933	0.783	19.652	39	9	sand
51.345	227.42	1.9366	0.852	17.468	44	9	sand
51.509	212.77	2.6515	1.246	14.286	41	9	sand
51.673	198.24	2.8438	1.435	13.702	47	8	sand to silty sand
51.837	186.02	2.8633	1.539	14.049	45	8	sand to silty sand
52.001	186.83	2.8337	1.517	16.450	45	8	sand to silty sand
52.165	182.59	2.8816	1.578	17.263	44	8	sand to silty sand
52.329	183.17	2.8395	1.550	17.122	44	8	sand to silty sand
52.493	208.81	2.9680	1.421	18.231	50	8	sand to silty sand
52.657	217.21	3.0275	1.394	18.597	52	8	sand to silty sand
52.822	229.01	2.9372	1.283	18.176	44	9	sand
52.986	242.32	3.2961	1.360	19.357	58	8	sand to silty sand
53.150	240.31	3.5727	1.487	18.788	58	8	sand to silty sand
53.314	231.56	3.7035	1.599	19.054	55	8	sand to silty sand
53.478	220.92	3.4758	1.573	19.604	53	8	sand to silty sand
53.642	220.91	3.1455	1.424	19.860	53	8	sand to silty sand
53.806	262.48	3.0974	1.180	20.874	50	9	sand
53.970	278.90	3.5359	1.268	21.777	53	9	sand
54.134	278.30	3.9897	1.434	21.094	67	8	sand to silty sand
54.298	274.76	4.2354	1.541	21.830	66	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	278.75	4.3092	1.546	21.954	67	8	sand to silty sand
54.626	287.63	4.5622	1.586	22.418	69	8	sand to silty sand
54.790	279.98	4.6380	1.657	22.409	67	8	sand to silty sand
54.954	263.28	3.8070	1.446	22.387	63	8	sand to silty sand
55.118	256.61	3.7136	1.447	21.691	61	8	sand to silty sand
55.282	238.68	3.7015	1.551	21.273	57	8	sand to silty sand
55.446	255.71	3.5422	1.385	21.909	61	8	sand to silty sand
55.610	266.25	3.6394	1.367	21.636	51	9	sand
55.774	265.98	3.6575	1.375	21.105	51	9	sand
55.938	255.58	3.7668	1.474	20.565	61	8	sand to silty sand
56.102	245.03	3.7041	1.512	20.883	59	8	sand to silty sand
56.266	241.00	3.7138	1.541	21.708	58	8	sand to silty sand
56.430	239.33	3.6374	1.520	22.040	57	8	sand to silty sand
56.594	240.62	3.5957	1.494	22.349	58	8	sand to silty sand
56.759	246.08	3.5166	1.429	22.559	59	8	sand to silty sand
56.923	258.10	3.6814	1.426	22.509	62	8	sand to silty sand
57.087	263.38	3.9217	1.489	23.021	63	8	sand to silty sand
57.251	262.52	3.9874	1.519	23.451	63	8	sand to silty sand
57.415	258.53	3.9266	1.519	23.040	62	8	sand to silty sand
57.579	262.79	3.7716	1.435	23.241	63	8	sand to silty sand
57.743	253.83	3.7176	1.465	23.026	61	8	sand to silty sand
57.907	252.67	3.6805	1.457	22.810	60	8	sand to silty sand
58.071	242.17	3.9340	1.624	23.250	58	8	sand to silty sand
58.235	220.45	3.2650	1.481	22.985	53	8	sand to silty sand
58.399	187.27	2.7488	1.468	22.567	45	8	sand to silty sand
58.563	234.31	2.7021	1.153	19.695	45	9	sand
58.727	238.30	2.9513	1.238	19.982	46	9	sand
58.891	247.12	3.3760	1.366	21.873	59	8	sand to silty sand
59.055	254.34	3.7530	1.476	21.945	61	8	sand to silty sand
59.219	268.79	3.9794	1.481	22.648	64	8	sand to silty sand
59.383	268.58	4.0498	1.508	22.397	64	8	sand to silty sand
59.547	275.79	4.0179	1.457	22.543	66	8	sand to silty sand
59.711	287.46	4.1483	1.443	23.195	69	8	sand to silty sand
59.875	298.28	4.2919	1.439	23.954	71	8	sand to silty sand
60.039	308.69	4.4973	1.457	24.939	74	8	sand to silty sand
60.203	328.04	4.6612	1.421	25.465	63	9	sand
60.367	346.45	4.5912	1.325	25.678	66	9	sand

Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM
TOTAL DEPTH: 60.532 ft

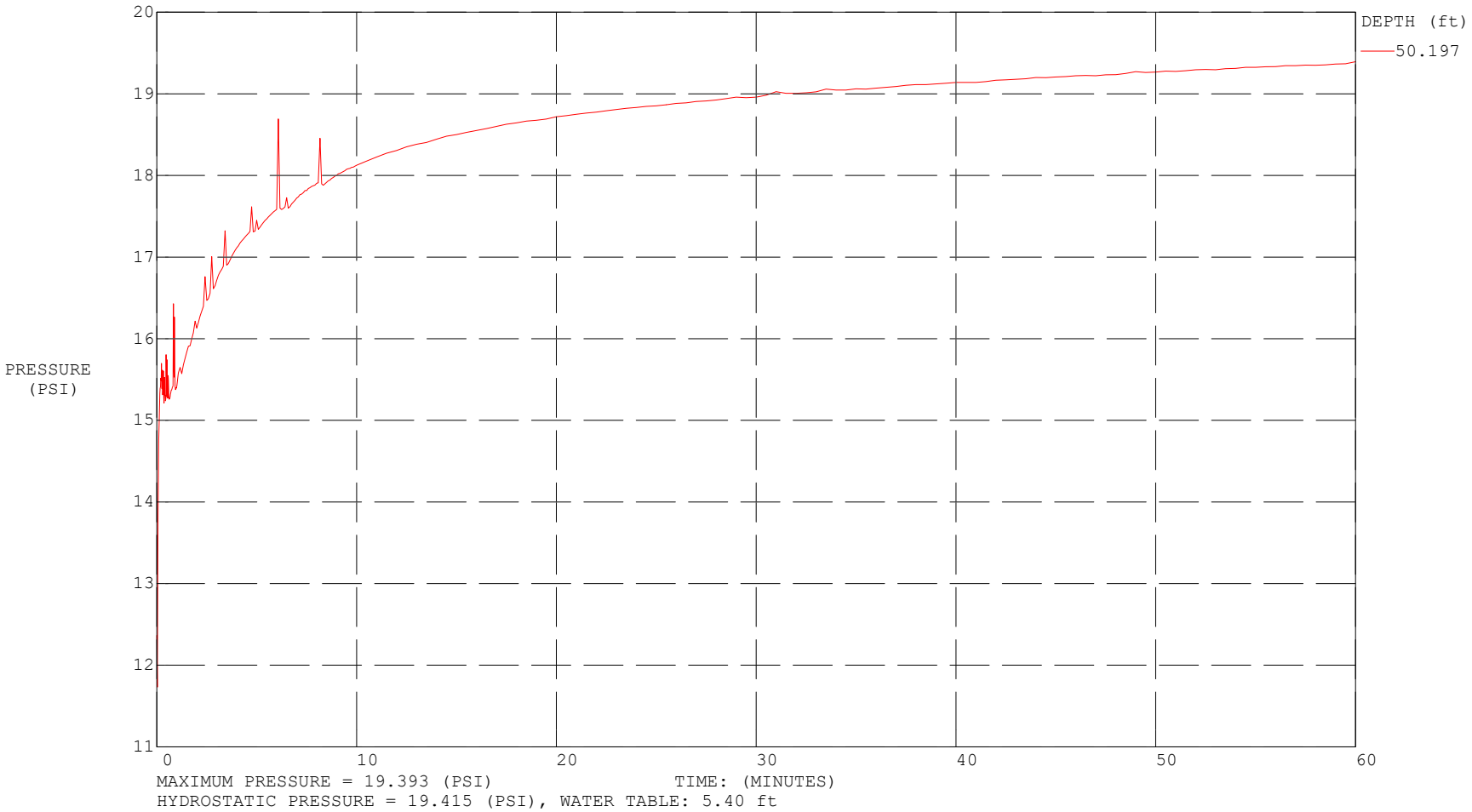


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM



MAXIMUM PRESSURE = 19.393 (PSI)
HYDROSTATIC PRESSURE = 19.415 (PSI), WATER TABLE: 5.40 ft

Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM
TOTAL DEPTH: 60.532 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	150.95	0.3393	0.225	-0.237	29	9	sand
0.328	117.67	0.3914	0.333	0.304	23	9	sand
0.492	97.16	0.3636	0.374	2.535	19	9	sand
0.656	116.76	0.4767	0.408	1.593	22	9	sand
0.820	121.07	0.7446	0.615	0.387	23	9	sand
0.984	99.47	0.8549	0.859	1.131	24	8	sand to silty sand
1.148	81.14	1.0181	1.255	1.805	26	7	silty sand to sandy silt
1.312	63.27	1.0243	1.619	1.349	20	7	silty sand to sandy silt
1.476	46.17	0.7696	1.667	0.354	15	7	silty sand to sandy silt
1.640	37.71	0.4221	1.119	0.050	12	7	silty sand to sandy silt
1.804	31.49	0.3520	1.118	0.251	10	7	silty sand to sandy silt
1.969	30.10	0.3527	1.172	0.591	10	7	silty sand to sandy silt
2.133	33.01	0.4276	1.295	0.827	11	7	silty sand to sandy silt
2.297	45.58	0.4744	1.041	0.902	15	7	silty sand to sandy silt
2.461	48.57	0.4313	0.888	0.710	16	7	silty sand to sandy silt
2.625	53.50	0.4560	0.852	0.820	17	7	silty sand to sandy silt
2.789	55.97	0.4766	0.852	0.787	18	7	silty sand to sandy silt
2.953	57.04	0.4987	0.874	0.734	18	7	silty sand to sandy silt
3.117	60.46	0.5449	0.901	0.784	19	7	silty sand to sandy silt
3.281	61.20	0.5807	0.949	0.670	20	7	silty sand to sandy silt
3.445	61.44	0.5936	0.966	0.847	20	7	silty sand to sandy silt
3.609	63.18	0.6173	0.977	0.820	20	7	silty sand to sandy silt
3.773	64.30	0.6271	0.975	0.890	21	7	silty sand to sandy silt
3.937	56.94	0.5801	1.019	1.035	18	7	silty sand to sandy silt
4.101	53.48	0.5062	0.947	1.198	17	7	silty sand to sandy silt
4.265	54.38	0.4948	0.910	1.289	17	7	silty sand to sandy silt
4.429	59.22	0.5364	0.906	1.279	19	7	silty sand to sandy silt
4.593	58.15	0.5726	0.985	1.428	19	7	silty sand to sandy silt
4.757	51.38	0.4992	0.972	1.365	16	7	silty sand to sandy silt
4.921	44.98	0.3782	0.841	1.471	14	7	silty sand to sandy silt
5.085	44.37	0.4016	0.905	1.640	14	7	silty sand to sandy silt
5.249	61.52	0.4786	0.778	1.640	15	8	sand to silty sand
5.413	67.64	0.5732	0.848	1.652	16	8	sand to silty sand
5.577	65.49	0.6470	0.988	1.746	21	7	silty sand to sandy silt
5.741	57.48	0.3774	0.657	1.815	14	8	sand to silty sand
5.906	52.52	0.3959	0.754	2.045	17	7	silty sand to sandy silt
6.070	55.28	0.4247	0.768	2.133	18	7	silty sand to sandy silt
6.234	54.33	0.4565	0.840	2.068	17	7	silty sand to sandy silt
6.398	57.00	0.4776	0.838	2.181	18	7	silty sand to sandy silt
6.562	58.67	0.4517	0.770	2.267	14	8	sand to silty sand
6.726	62.38	0.4925	0.789	2.260	15	8	sand to silty sand
6.890	70.51	0.5795	0.822	2.224	17	8	sand to silty sand
7.054	61.17	0.5939	0.971	2.355	20	7	silty sand to sandy silt
7.218	54.10	0.5228	0.966	2.480	17	7	silty sand to sandy silt
7.382	57.81	0.4774	0.826	2.607	18	7	silty sand to sandy silt
7.546	70.53	0.4941	0.701	2.642	17	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	81.74	0.5206	0.637	2.654	20	8	sand to silty sand
7.874	103.49	0.6486	0.627	2.695	25	8	sand to silty sand
8.038	119.91	0.8434	0.703	2.535	29	8	sand to silty sand
8.202	125.38	1.0067	0.803	2.499	30	8	sand to silty sand
8.366	119.60	1.0651	0.891	2.563	29	8	sand to silty sand
8.530	109.40	0.9909	0.906	2.685	26	8	sand to silty sand
8.694	102.89	0.9061	0.881	2.905	25	8	sand to silty sand
8.858	104.35	0.8144	0.780	3.008	25	8	sand to silty sand
9.022	106.35	0.7825	0.736	3.035	25	8	sand to silty sand
9.186	108.34	0.6408	0.591	3.008	26	8	sand to silty sand
9.350	109.85	0.6623	0.603	3.075	26	8	sand to silty sand
9.514	106.47	0.6980	0.656	3.209	25	8	sand to silty sand
9.678	106.74	0.7499	0.703	3.195	26	8	sand to silty sand
9.843	109.14	0.7626	0.699	3.090	26	8	sand to silty sand
10.007	115.13	0.6833	0.593	3.281	22	9	sand
10.171	123.41	0.7549	0.612	3.369	24	9	sand
10.335	161.69	1.0179	0.630	3.307	31	9	sand
10.499	183.26	1.3981	0.763	3.393	35	9	sand
10.663	201.61	1.7306	0.858	3.214	39	9	sand
10.827	205.99	1.9869	0.965	3.235	39	9	sand
10.991	206.45	2.1251	1.029	3.403	40	9	sand
11.155	200.83	2.1573	1.074	3.530	38	9	sand
11.319	204.16	2.0641	1.011	3.467	39	9	sand
11.483	206.98	2.0896	1.010	2.406	40	9	sand
11.647	210.57	2.1541	1.023	1.880	40	9	sand
11.811	204.00	2.1852	1.071	1.605	39	9	sand
11.975	200.15	2.1057	1.052	1.767	38	9	sand
12.139	207.32	1.9824	0.956	1.325	40	9	sand
12.303	209.85	1.6713	0.796	0.416	40	9	sand
12.467	208.44	1.7744	0.851	-0.033	40	9	sand
12.631	192.01	1.8659	0.972	3.482	37	9	sand
12.795	192.56	1.9962	1.037	2.738	37	9	sand
12.959	202.39	2.0112	0.994	1.373	39	9	sand
13.123	215.18	2.0633	0.959	1.083	41	9	sand
13.287	223.11	2.3587	1.057	-0.555	43	9	sand
13.451	227.04	2.5855	1.139	-1.002	43	9	sand
13.615	228.16	2.8229	1.237	-0.481	44	9	sand
13.780	220.89	2.7708	1.254	0.160	42	9	sand
13.944	213.64	2.5868	1.211	0.622	41	9	sand
14.108	225.14	2.4407	1.084	0.768	43	9	sand
14.272	235.78	2.5449	1.079	-0.485	45	9	sand
14.436	236.71	2.7106	1.145	-1.571	45	9	sand
14.600	227.62	2.7904	1.226	-1.815	44	9	sand
14.764	215.89	2.7707	1.283	-1.275	41	9	sand
14.928	193.79	2.5651	1.324	-0.811	46	8	sand to silty sand
15.092	173.44	2.1831	1.259	-0.648	42	8	sand to silty sand
15.256	167.93	1.8898	1.125	-0.077	40	8	sand to silty sand
15.420	177.29	1.8355	1.035	0.402	34	9	sand
15.584	181.98	1.9126	1.051	1.004	35	9	sand
15.748	192.54	2.1218	1.102	1.205	37	9	sand
15.912	198.13	2.2177	1.119	1.652	38	9	sand
16.076	198.27	2.3227	1.171	1.923	38	9	sand
16.240	200.48	2.3208	1.158	2.011	38	9	sand
16.404	203.80	2.3416	1.149	1.985	39	9	sand
16.568	200.71	2.3308	1.161	2.207	38	9	sand
16.732	200.74	2.3233	1.157	2.308	38	9	sand
16.896	202.27	2.3246	1.149	2.243	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	203.38	2.3371	1.149	2.128	39	9	sand
17.224	206.89	2.3813	1.151	2.205	40	9	sand
17.388	205.57	2.4462	1.190	1.860	39	9	sand
17.552	202.14	2.4289	1.202	2.169	39	9	sand
17.717	198.78	2.4565	1.236	2.525	38	9	sand
17.881	192.87	2.3904	1.239	2.850	46	8	sand to silty sand
18.045	186.80	2.2626	1.211	2.743	45	8	sand to silty sand
18.209	180.60	2.1196	1.174	2.817	43	8	sand to silty sand
18.373	178.43	1.9473	1.091	3.068	34	9	sand
18.537	181.62	1.8547	1.021	2.956	35	9	sand
18.701	176.77	1.8558	1.050	2.994	34	9	sand
18.865	171.87	0.8830	0.514	2.944	33	9	sand
19.029	149.56	1.0313	0.690	3.156	29	9	sand
19.193	129.39	1.1762	0.909	3.800	31	8	sand to silty sand
19.357	123.20	1.1884	0.965	3.840	29	8	sand to silty sand
19.521	117.75	1.1601	0.985	3.869	28	8	sand to silty sand
19.685	109.89	1.1011	1.002	4.003	26	8	sand to silty sand
19.849	106.54	0.9870	0.926	4.161	26	8	sand to silty sand
20.013	110.05	0.9267	0.842	4.235	26	8	sand to silty sand
20.177	110.13	0.9034	0.820	4.472	26	8	sand to silty sand
20.341	108.86	0.9370	0.861	4.170	26	8	sand to silty sand
20.505	111.65	0.9252	0.829	4.328	27	8	sand to silty sand
20.669	111.17	0.9418	0.847	4.175	27	8	sand to silty sand
20.833	111.71	0.9731	0.871	4.223	27	8	sand to silty sand
20.997	110.20	0.9221	0.837	4.376	26	8	sand to silty sand
21.161	110.70	0.9451	0.854	4.503	27	8	sand to silty sand
21.325	112.91	0.9354	0.828	5.026	27	8	sand to silty sand
21.490	118.16	1.0093	0.854	4.668	28	8	sand to silty sand
21.654	127.61	1.1639	0.912	4.948	31	8	sand to silty sand
21.818	123.94	1.1468	0.925	4.352	30	8	sand to silty sand
21.982	123.04	1.1496	0.934	4.596	29	8	sand to silty sand
22.146	127.98	0.7790	0.609	5.081	25	9	sand
22.310	132.39	0.7678	0.580	5.148	25	9	sand
22.474	143.98	0.8484	0.589	1.449	28	9	sand
22.638	150.43	0.9547	0.635	2.073	29	9	sand
22.802	158.01	1.0925	0.691	3.345	30	9	sand
22.966	171.29	1.3164	0.769	4.505	33	9	sand
23.130	175.98	1.4999	0.852	4.689	34	9	sand
23.294	177.42	1.5861	0.894	4.852	34	9	sand
23.458	182.37	1.6637	0.912	5.325	35	9	sand
23.622	189.36	1.7110	0.904	5.725	36	9	sand
23.786	201.35	1.8243	0.906	6.311	39	9	sand
23.950	208.20	1.9397	0.932	6.244	40	9	sand
24.114	209.12	2.0105	0.961	5.615	40	9	sand
24.278	208.29	2.2021	1.057	5.617	40	9	sand
24.442	195.97	2.1585	1.101	5.483	38	9	sand
24.606	167.24	1.9360	1.158	5.584	40	8	sand to silty sand
24.770	146.64	1.5275	1.042	6.134	35	8	sand to silty sand
24.934	125.89	1.1502	0.914	5.631	30	8	sand to silty sand
25.098	120.93	0.8953	0.740	5.978	29	8	sand to silty sand
25.262	122.03	0.7369	0.604	6.170	23	9	sand
25.427	133.98	0.7904	0.590	6.421	26	9	sand
25.591	159.00	1.0102	0.635	6.368	30	9	sand
25.755	171.01	1.2293	0.719	5.720	33	9	sand
25.919	173.42	1.3664	0.788	5.565	33	9	sand
26.083	172.22	1.3439	0.780	5.584	33	9	sand
26.247	170.35	1.3509	0.793	5.918	33	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	168.34	1.3346	0.793	6.327	32	9	sand
26.575	163.81	1.2854	0.785	6.547	31	9	sand
26.739	163.44	1.2186	0.746	6.856	31	9	sand
26.903	163.85	1.2166	0.742	7.078	31	9	sand
27.067	162.47	1.1866	0.730	7.145	31	9	sand
27.231	157.84	1.1640	0.737	7.234	30	9	sand
27.395	152.78	1.1232	0.735	7.458	29	9	sand
27.559	149.86	1.0399	0.694	7.528	29	9	sand
27.723	154.03	0.9918	0.644	7.657	30	9	sand
27.887	159.73	1.0551	0.661	7.774	31	9	sand
28.051	166.19	1.1670	0.702	7.930	32	9	sand
28.215	166.13	1.2728	0.766	7.657	32	9	sand
28.379	157.28	1.2606	0.801	7.932	30	9	sand
28.543	149.02	1.1592	0.778	7.963	29	9	sand
28.707	148.55	1.1270	0.759	8.279	28	9	sand
28.871	148.09	1.1488	0.776	8.209	28	9	sand
29.035	144.15	1.2320	0.855	8.413	28	9	sand
29.199	144.20	1.2587	0.873	8.532	28	9	sand
29.364	145.92	1.2659	0.868	8.362	28	9	sand
29.528	147.81	1.2360	0.836	8.228	28	9	sand
29.692	145.45	1.1061	0.760	8.207	28	9	sand
29.856	149.00	1.1088	0.744	7.501	29	9	sand
30.020	158.78	1.2321	0.776	7.234	30	9	sand
30.184	163.94	1.3545	0.826	7.516	31	9	sand
30.348	174.93	1.5874	0.907	8.020	34	9	sand
30.512	183.00	1.7012	0.930	8.934	35	9	sand
30.676	185.50	1.6989	0.916	8.601	36	9	sand
30.840	178.95	1.5765	0.881	8.570	34	9	sand
31.004	178.06	1.1963	0.672	7.858	34	9	sand
31.168	186.88	1.2440	0.666	7.205	36	9	sand
31.332	181.27	1.4373	0.793	5.330	35	9	sand
31.496	185.43	1.5821	0.853	6.382	36	9	sand
31.660	184.98	1.7307	0.936	6.868	35	9	sand
31.824	183.79	1.7902	0.974	7.215	35	9	sand
31.988	182.53	1.8498	1.013	7.693	35	9	sand
32.152	191.15	1.8711	0.979	8.118	37	9	sand
32.316	187.64	1.9617	1.045	7.296	36	9	sand
32.480	188.47	1.9668	1.044	7.614	36	9	sand
32.644	188.15	1.9487	1.036	7.442	36	9	sand
32.808	193.32	1.9596	1.014	7.683	37	9	sand
32.972	202.47	2.0652	1.020	8.257	39	9	sand
33.136	205.91	2.1557	1.047	8.140	39	9	sand
33.301	205.46	2.2351	1.088	8.013	39	9	sand
33.465	202.70	2.2955	1.132	8.204	39	9	sand
33.629	198.97	2.2922	1.152	8.188	38	9	sand
33.793	199.07	2.2493	1.130	8.836	38	9	sand
33.957	207.02	1.9923	0.962	10.163	40	9	sand
34.121	224.12	1.9792	0.883	8.202	43	9	sand
34.285	230.51	2.1038	0.913	3.905	44	9	sand
34.449	224.74	2.4074	1.071	5.543	43	9	sand
34.613	220.99	2.5526	1.155	6.303	42	9	sand
34.777	223.35	2.4252	1.086	6.995	43	9	sand
34.941	232.55	2.4760	1.065	7.497	45	9	sand
35.105	233.17	2.7018	1.159	7.937	45	9	sand
35.269	218.43	2.5964	1.189	7.356	42	9	sand
35.433	195.04	2.5137	1.289	7.621	47	8	sand to silty sand
35.597	168.67	2.3334	1.383	8.386	40	8	sand to silty sand

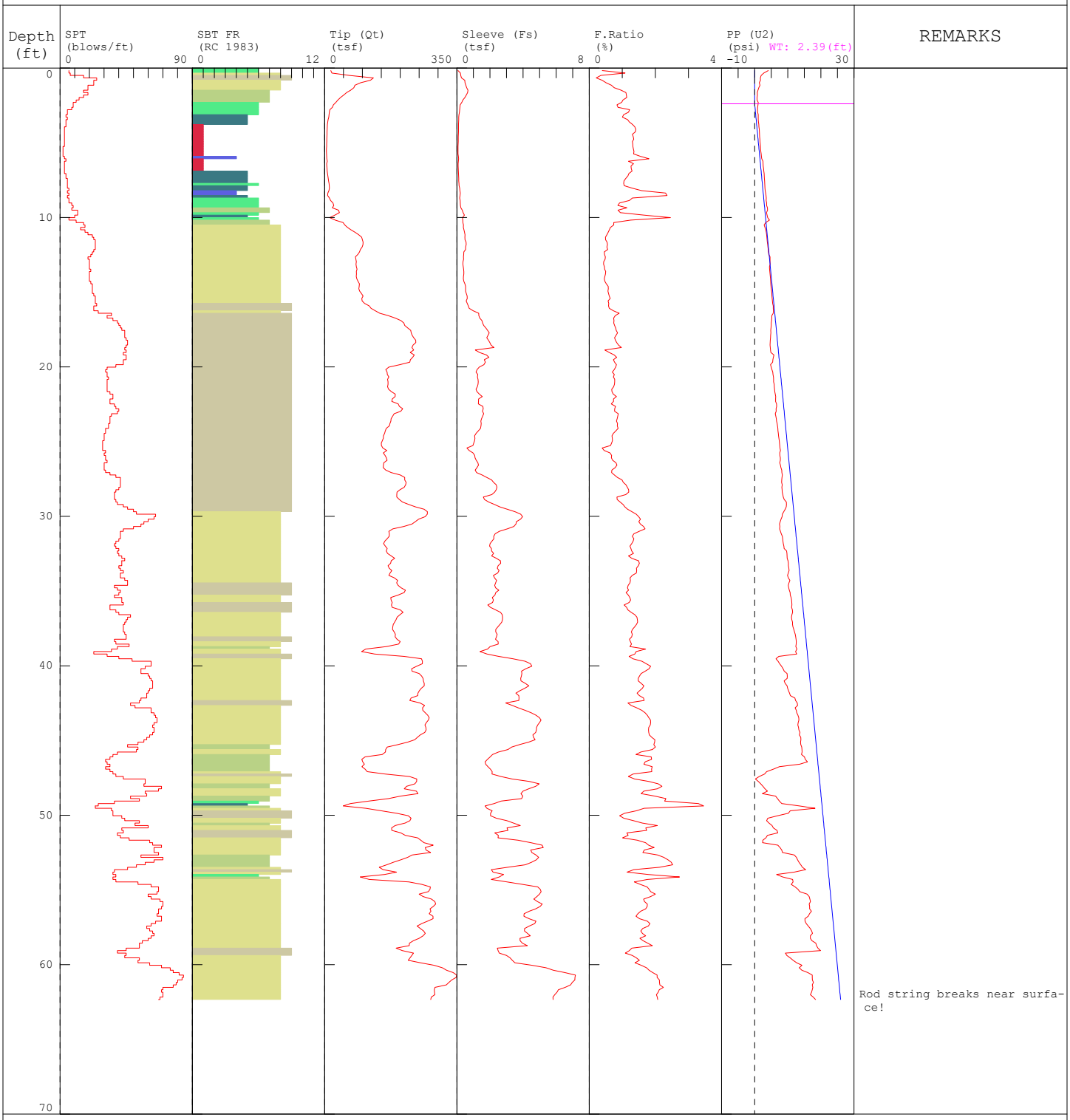
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	158.20	2.3414	1.480	8.587	38	8	sand to silty sand
35.925	131.12	2.1031	1.604	8.570	31	8	sand to silty sand
36.089	111.28	1.7091	1.536	8.599	27	8	sand to silty sand
36.253	105.54	1.5445	1.463	10.668	25	8	sand to silty sand
36.417	127.40	1.1695	0.918	9.111	30	8	sand to silty sand
36.581	146.36	1.1817	0.807	1.547	28	9	sand
36.745	161.99	1.7173	1.060	-2.944	39	8	sand to silty sand
36.909	159.91	1.7587	1.100	-2.375	38	8	sand to silty sand
37.073	189.70	2.0470	1.079	1.172	36	9	sand
37.238	215.88	2.3688	1.097	2.229	41	9	sand
37.402	217.16	2.6953	1.241	4.041	42	9	sand
37.566	223.11	2.9421	1.319	5.194	43	9	sand
37.730	203.85	2.9808	1.462	6.055	49	8	sand to silty sand
37.894	179.76	2.8000	1.558	6.442	43	8	sand to silty sand
38.058	159.61	2.4489	1.534	7.050	38	8	sand to silty sand
38.222	141.74	2.1491	1.516	7.898	34	8	sand to silty sand
38.386	131.59	1.8521	1.408	8.948	32	8	sand to silty sand
38.550	106.42	1.1537	1.084	8.795	25	8	sand to silty sand
38.714	92.18	1.1130	1.207	7.250	22	8	sand to silty sand
38.878	98.67	1.0177	1.031	-3.259	24	8	sand to silty sand
39.042	115.17	0.8191	0.711	-3.922	28	8	sand to silty sand
39.206	153.77	0.9809	0.638	-4.847	29	9	sand
39.370	142.99	1.4291	0.999	-5.550	34	8	sand to silty sand
39.534	101.57	1.7653	1.738	-4.484	32	7	silty sand to sandy silt
39.698	71.42	1.6128	2.258	-2.604	27	6	sandy silt to clayey silt
39.862	113.55	1.3639	1.201	1.471	27	8	sand to silty sand
40.026	106.79	1.2985	1.216	3.938	26	8	sand to silty sand
40.190	129.80	1.1942	0.920	6.908	31	8	sand to silty sand
40.354	179.92	1.5640	0.869	4.979	34	9	sand
40.518	195.84	2.0069	1.025	2.420	38	9	sand
40.682	200.33	2.5215	1.259	4.675	38	9	sand
40.846	200.72	2.8201	1.405	6.095	48	8	sand to silty sand
41.011	199.82	2.8269	1.415	7.518	48	8	sand to silty sand
41.175	181.80	2.7046	1.488	8.111	44	8	sand to silty sand
41.339	184.50	2.5178	1.365	8.757	44	8	sand to silty sand
41.503	177.00	2.4658	1.393	9.111	42	8	sand to silty sand
41.667	170.78	2.3499	1.376	9.348	41	8	sand to silty sand
41.831	147.16	1.6143	1.097	9.704	35	8	sand to silty sand
41.995	118.99	1.3541	1.138	10.328	28	8	sand to silty sand
42.159	158.04	1.0032	0.635	9.068	30	9	sand
42.323	166.64	0.7816	0.469	3.534	32	9	sand
42.487	163.42	0.9824	0.601	-0.342	31	9	sand
42.651	146.53	1.2336	0.842	0.887	28	9	sand
42.815	131.51	1.2170	0.925	3.365	31	8	sand to silty sand
42.979	110.25	1.0381	0.942	5.380	26	8	sand to silty sand
43.143	80.00	0.9879	1.235	7.494	26	7	silty sand to sandy silt
43.307	52.99	1.1694	2.207	9.460	20	6	sandy silt to clayey silt
43.471	33.69	0.9656	2.866	13.779	13	6	sandy silt to clayey silt
43.635	77.33	0.9878	1.277	16.060	25	7	silty sand to sandy silt
43.799	128.37	1.1476	0.894	3.632	31	8	sand to silty sand
43.963	109.36	1.5741	1.439	8.300	26	8	sand to silty sand
44.127	52.93	1.2249	2.314	10.572	20	6	sandy silt to clayey silt
44.291	36.39	0.7745	2.128	15.044	14	6	sandy silt to clayey silt
44.455	146.17	1.0519	0.720	11.330	28	9	sand
44.619	194.13	1.6087	0.829	7.413	37	9	sand
44.783	245.08	2.4584	1.003	11.667	47	9	sand
44.948	259.44	3.2129	1.238	11.318	50	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	254.35	3.0823	1.212	10.534	49	9	sand
45.276	246.72	3.0023	1.217	11.524	47	9	sand
45.440	256.64	3.4938	1.361	14.360	49	9	sand
45.604	244.04	3.9117	1.603	13.881	58	8	sand to silty sand
45.768	199.74	5.6453	2.826	13.939	64	7	silty sand to sandy silt
45.932	159.34	4.8995	3.075	20.625	61	6	sandy silt to clayey silt
46.096	174.89	3.7673	2.154	48.730	56	7	silty sand to sandy silt
46.260	220.49	2.6457	1.200	8.864	42	9	sand
46.424	219.24	2.6339	1.201	6.880	42	9	sand
46.588	157.65	3.2633	2.070	8.123	50	7	silty sand to sandy silt
46.752	108.96	2.8169	2.585	7.633	35	7	silty sand to sandy silt
46.916	187.83	2.0719	1.103	20.551	36	9	sand
47.080	221.31	2.6106	1.180	11.050	42	9	sand
47.244	247.55	3.2037	1.294	15.077	47	9	sand
47.408	250.68	3.4616	1.381	14.549	60	8	sand to silty sand
47.572	257.68	3.4864	1.353	14.372	49	9	sand
47.736	274.58	3.5344	1.287	13.714	53	9	sand
47.900	298.49	3.7523	1.257	13.363	57	9	sand
48.064	312.01	4.1174	1.320	14.008	60	9	sand
48.228	308.10	4.0140	1.303	12.514	59	9	sand
48.392	300.95	4.1627	1.383	11.849	58	9	sand
48.556	273.48	4.0512	1.481	10.787	65	8	sand to silty sand
48.720	270.38	4.1005	1.517	12.889	65	8	sand to silty sand
48.885	266.53	4.1422	1.554	13.052	64	8	sand to silty sand
49.049	260.61	4.0519	1.555	12.736	62	8	sand to silty sand
49.213	257.59	3.9761	1.544	14.027	62	8	sand to silty sand
49.377	252.05	3.8225	1.517	14.254	60	8	sand to silty sand
49.541	246.54	3.5871	1.455	13.652	59	8	sand to silty sand
49.705	250.54	3.3290	1.329	14.211	48	9	sand
49.869	261.92	3.4322	1.310	14.281	50	9	sand
50.033	282.05	2.1462	0.761	13.712	54	9	sand
50.197	291.39	2.8070	0.963	12.384	56	9	sand
50.361	294.22	3.4223	1.163	16.146	56	9	sand
50.525	299.85	3.9792	1.327	14.491	57	9	sand
50.689	301.40	4.1543	1.378	15.608	58	9	sand
50.853	296.44	4.2254	1.425	15.608	71	8	sand to silty sand
51.017	293.07	4.1634	1.421	16.983	70	8	sand to silty sand
51.181	277.45	4.0361	1.455	15.677	66	8	sand to silty sand
51.345	274.67	3.8258	1.393	17.162	66	8	sand to silty sand
51.509	273.51	3.7429	1.368	16.557	52	9	sand
51.673	278.20	3.8631	1.389	16.653	53	9	sand
51.837	278.93	3.9017	1.399	14.470	67	8	sand to silty sand
52.001	264.64	3.9123	1.478	16.799	63	8	sand to silty sand
52.165	264.84	4.0508	1.530	16.581	63	8	sand to silty sand
52.329	271.07	4.0940	1.510	15.756	65	8	sand to silty sand
52.493	263.28	4.0502	1.538	17.784	63	8	sand to silty sand
52.657	252.83	3.9016	1.543	15.106	61	8	sand to silty sand
52.822	246.66	3.5157	1.425	15.916	59	8	sand to silty sand
52.986	246.51	3.2402	1.314	16.220	47	9	sand
53.150	248.15	3.0603	1.233	15.448	48	9	sand
53.314	255.44	3.1570	1.236	13.814	49	9	sand
53.478	263.96	3.3499	1.269	12.186	51	9	sand
53.642	246.39	3.3887	1.375	11.741	59	8	sand to silty sand
53.806	240.37	3.1165	1.297	11.624	46	9	sand
53.970	244.65	2.9510	1.206	12.081	47	9	sand
54.134	248.53	2.9131	1.172	12.236	48	9	sand
54.298	254.88	2.8659	1.124	10.218	49	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	270.56	3.0336	1.121	8.491	52	9	sand
54.626	286.02	3.2676	1.142	10.211	55	9	sand
54.790	294.42	3.4952	1.187	5.926	56	9	sand
54.954	318.56	4.0190	1.262	6.999	61	9	sand
55.118	336.58	4.5227	1.344	15.711	64	9	sand
55.282	336.63	4.9902	1.482	12.927	81	8	sand to silty sand
55.446	354.95	5.0673	1.428	13.004	68	9	sand
55.610	362.08	5.3667	1.482	12.260	87	8	sand to silty sand
55.774	360.24	5.4095	1.502	11.564	86	8	sand to silty sand
55.938	358.67	5.3839	1.501	12.272	86	8	sand to silty sand
56.102	349.30	5.3539	1.533	10.591	84	8	sand to silty sand
56.266	338.60	5.2792	1.559	11.837	81	8	sand to silty sand
56.430	313.70	5.3234	1.697	11.521	75	8	sand to silty sand
56.594	279.47	4.2580	1.524	10.615	67	8	sand to silty sand
56.759	258.63	3.8977	1.507	12.557	62	8	sand to silty sand
56.923	308.23	3.9131	1.270	13.214	59	9	sand
57.087	306.54	4.0051	1.307	7.908	59	9	sand
57.251	297.34	4.0028	1.346	7.973	57	9	sand
57.415	274.75	3.9372	1.433	9.467	66	8	sand to silty sand
57.579	253.47	3.8845	1.533	10.015	61	8	sand to silty sand
57.743	260.77	3.2932	1.263	11.803	50	9	sand
57.907	284.66	3.2331	1.136	14.730	55	9	sand
58.071	319.71	3.8620	1.208	2.638	61	9	sand
58.235	310.79	3.7755	1.215	6.129	60	9	sand
58.399	301.76	4.0348	1.337	8.401	58	9	sand
58.563	314.26	4.4876	1.428	13.434	60	9	sand
58.727	320.46	4.5485	1.419	13.267	61	9	sand
58.891	308.01	4.6094	1.496	15.017	74	8	sand to silty sand
59.055	306.44	4.6106	1.505	14.537	73	8	sand to silty sand
59.219	309.53	4.5973	1.485	15.727	74	8	sand to silty sand
59.383	297.02	4.7801	1.609	15.278	71	8	sand to silty sand
59.547	278.62	4.6254	1.660	13.693	67	8	sand to silty sand
59.711	253.60	4.3776	1.726	14.785	61	8	sand to silty sand
59.875	242.97	3.3812	1.392	15.354	58	8	sand to silty sand
60.039	245.93	3.3030	1.343	15.869	47	9	sand
60.203	251.59	3.3313	1.324	16.244	48	9	sand
60.367	248.85	3.3208	1.334	17.215	48	9	sand
60.532	250.68	3.4909	1.393	16.701	60	8	sand to silty sand

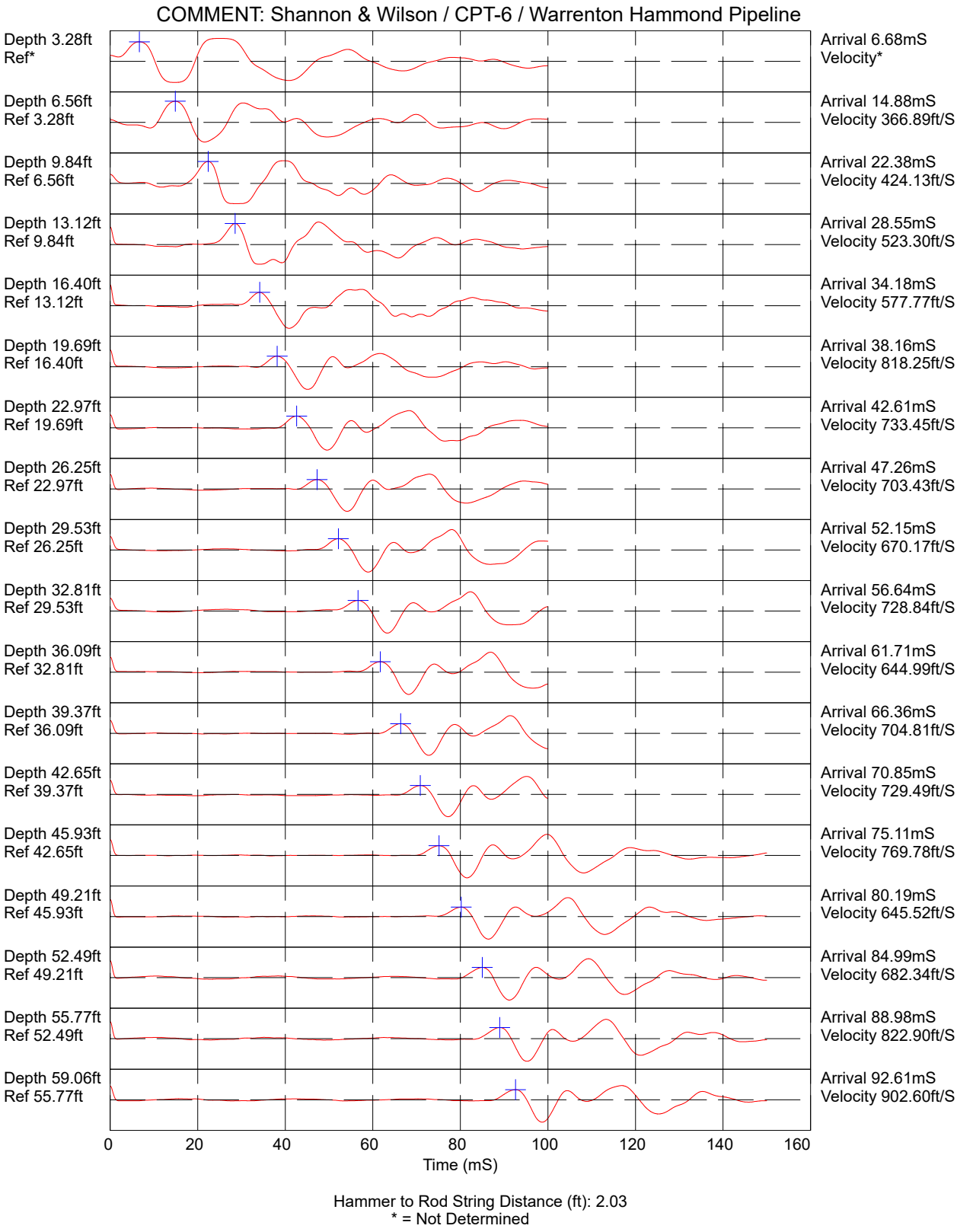
Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM
TOTAL DEPTH: 62.336 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

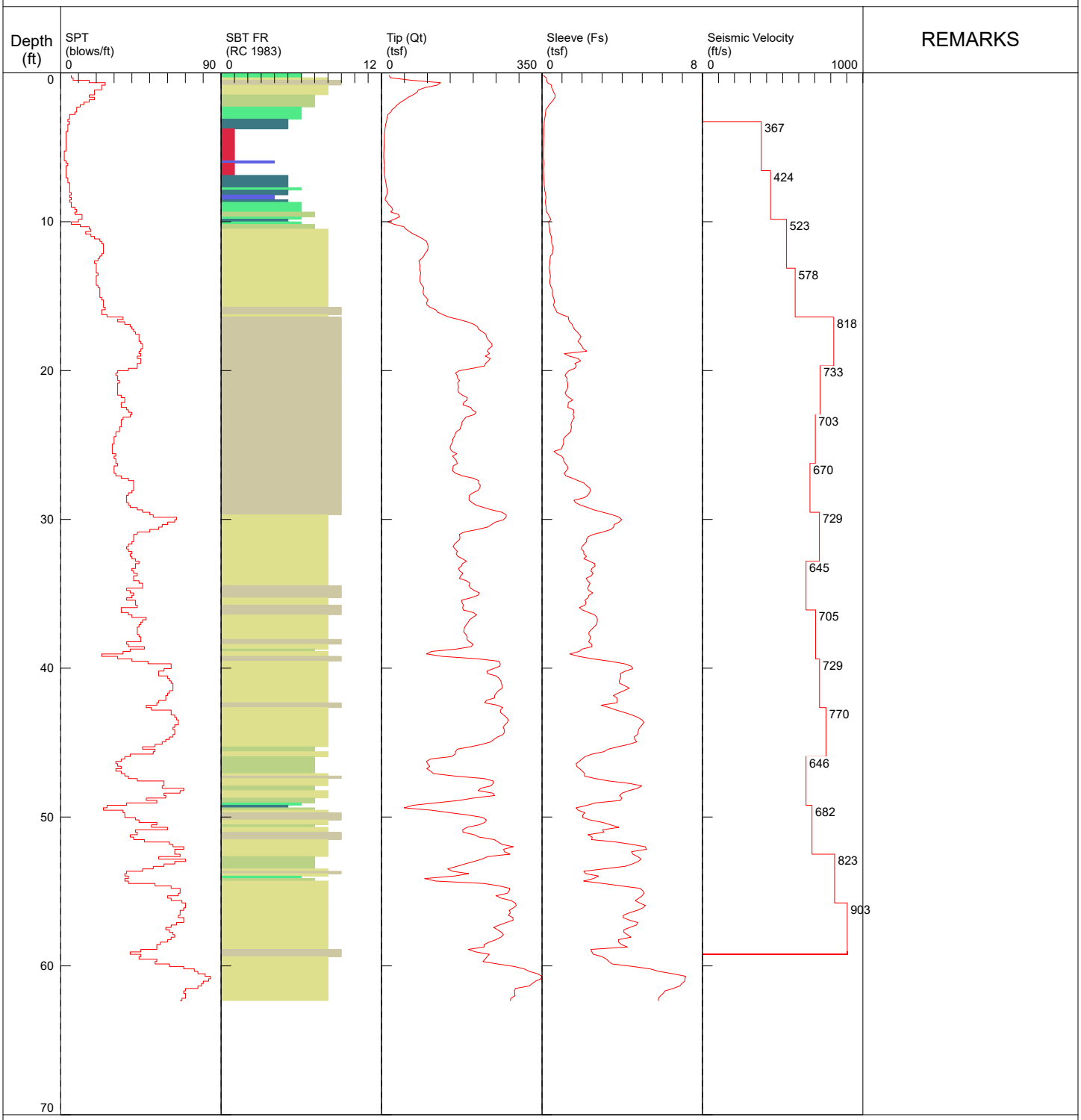
*SBT/SPT CORRELATION: UBC-1983



Hammer to Rod String Distance (ft): 2.03
* = Not Determined

Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM
TOTAL DEPTH: 62.336 ft

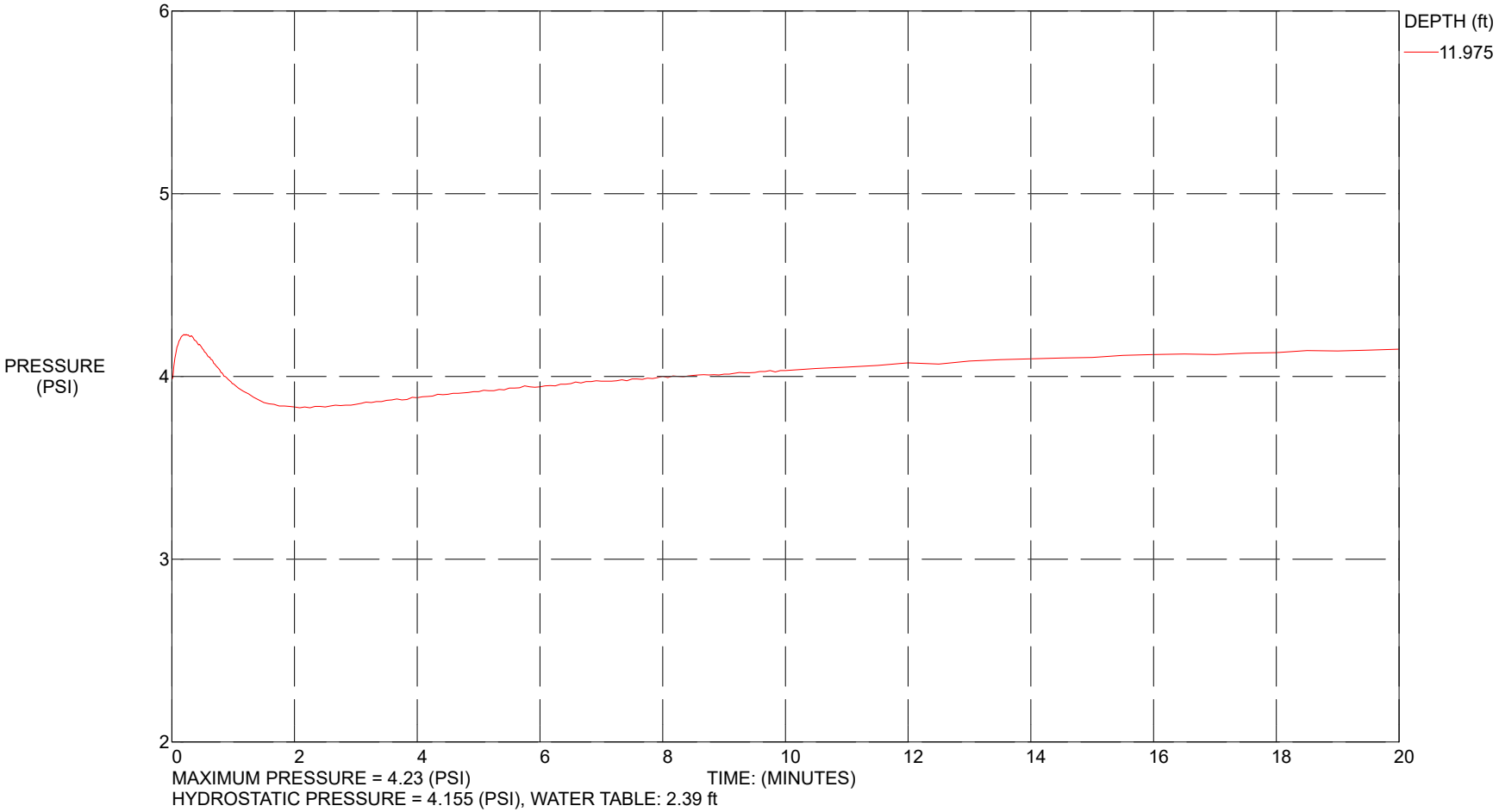


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty clay
6 sandy silt to clayey silt
7 silty sand to sandy silt
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM



Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM
TOTAL DEPTH: 62.336 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	16.47	0.0645	0.392	4.127	6	6	sandy silt to clayey silt
0.328	19.14	0.2067	1.080	2.755	7	6	sandy silt to clayey silt
0.492	65.23	0.2276	0.349	1.980	16	8	sand to silty sand
0.656	128.81	0.2699	0.210	1.695	25	9	sand
0.820	120.86	0.4717	0.390	1.734	23	9	sand
0.984	95.04	0.4819	0.507	1.392	23	8	sand to silty sand
1.148	80.05	0.5352	0.669	1.578	19	8	sand to silty sand
1.312	77.43	0.5833	0.753	1.232	19	8	sand to silty sand
1.476	68.85	0.6610	0.960	0.992	16	8	sand to silty sand
1.640	58.23	0.6453	1.108	0.796	19	7	silty sand to sandy silt
1.804	50.33	0.5635	1.120	0.799	16	7	silty sand to sandy silt
1.969	42.00	0.4755	1.132	0.698	13	7	silty sand to sandy silt
2.133	34.89	0.3551	1.018	0.703	11	7	silty sand to sandy silt
2.297	29.61	0.2894	0.977	1.059	9	7	silty sand to sandy silt
2.461	23.11	0.1924	0.833	0.985	9	6	sandy silt to clayey silt
2.625	20.44	0.1772	0.867	0.906	8	6	sandy silt to clayey silt
2.789	13.69	0.1666	1.217	0.839	5	6	sandy silt to clayey silt
2.953	12.49	0.1482	1.187	0.861	5	6	sandy silt to clayey silt
3.117	11.58	0.1205	1.040	1.052	4	6	sandy silt to clayey silt
3.281	10.87	0.1088	1.001	1.086	5	5	clayey silt to silty clay
3.445	9.19	0.1064	1.158	1.043	4	5	clayey silt to silty clay
3.609	8.16	0.0987	1.210	1.150	4	5	clayey silt to silty clay
3.773	7.39	0.0967	1.309	1.234	4	5	clayey silt to silty clay
3.937	6.96	0.0959	1.377	1.301	3	1	sensitive fine grained
4.101	6.55	0.0922	1.407	1.375	3	1	sensitive fine grained
4.265	6.28	0.0876	1.395	1.432	3	1	sensitive fine grained
4.429	6.21	0.0811	1.306	1.456	3	1	sensitive fine grained
4.593	5.94	0.0789	1.329	1.485	3	1	sensitive fine grained
4.757	5.85	0.0786	1.343	1.547	3	1	sensitive fine grained
4.921	5.73	0.0749	1.305	1.595	3	1	sensitive fine grained
5.085	5.45	0.0716	1.314	1.667	3	1	sensitive fine grained
5.249	5.12	0.0674	1.317	1.722	2	1	sensitive fine grained
5.413	4.80	0.0640	1.332	1.801	2	1	sensitive fine grained
5.577	4.72	0.0637	1.350	1.868	2	1	sensitive fine grained
5.741	4.89	0.0656	1.340	1.944	2	1	sensitive fine grained
5.906	5.34	0.0827	1.548	2.040	3	1	sensitive fine grained
6.070	5.75	0.1037	1.805	2.152	4	4	silty clay to clay
6.234	7.04	0.0834	1.185	2.465	3	1	sensitive fine grained
6.398	5.36	0.0717	1.338	2.528	3	1	sensitive fine grained
6.562	5.86	0.0738	1.260	2.571	3	1	sensitive fine grained
6.726	6.26	0.0794	1.267	2.683	3	1	sensitive fine grained
6.890	6.45	0.0833	1.292	2.752	3	1	sensitive fine grained
7.054	7.48	0.0895	1.196	2.826	4	5	clayey silt to silty clay
7.218	8.52	0.0993	1.166	2.886	4	5	clayey silt to silty clay
7.382	9.45	0.1042	1.103	2.934	5	5	clayey silt to silty clay
7.546	10.44	0.1096	1.050	2.994	5	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	11.36	0.1181	1.040	3.015	5	5	clayey silt to silty clay
7.874	12.28	0.1297	1.056	3.061	5	6	sandy silt to clayey silt
8.038	12.45	0.1620	1.302	3.111	6	5	clayey silt to silty clay
8.202	11.20	0.1777	1.587	3.168	5	5	clayey silt to silty clay
8.366	8.64	0.1993	2.306	3.314	6	4	silty clay to clay
8.530	7.80	0.1833	2.349	3.443	5	4	silty clay to clay
8.694	12.58	0.1640	1.304	3.503	6	5	clayey silt to silty clay
8.858	15.70	0.1904	1.212	3.475	6	6	sandy silt to clayey silt
9.022	22.01	0.2014	0.915	3.599	8	6	sandy silt to clayey silt
9.186	24.29	0.2097	0.863	3.616	9	6	sandy silt to clayey silt
9.350	20.27	0.2297	1.133	3.860	8	6	sandy silt to clayey silt
9.514	36.80	0.3193	0.867	3.874	12	7	silty sand to sandy silt
9.678	39.10	0.3664	0.937	3.561	12	7	silty sand to sandy silt
9.843	26.96	0.4470	1.658	3.740	10	6	sandy silt to clayey silt
10.007	13.58	0.3327	2.451	3.941	6	5	clayey silt to silty clay
10.171	27.85	0.3488	1.252	4.450	11	6	sandy silt to clayey silt
10.335	48.68	0.3592	0.738	3.302	16	7	silty sand to sandy silt
10.499	53.05	0.3912	0.737	2.838	17	7	silty sand to sandy silt
10.663	60.55	0.3883	0.641	3.116	14	8	sand to silty sand
10.827	69.37	0.4209	0.607	3.348	17	8	sand to silty sand
10.991	80.39	0.4605	0.573	3.498	19	8	sand to silty sand
11.155	90.05	0.4814	0.535	3.599	22	8	sand to silty sand
11.319	97.99	0.4783	0.488	3.673	23	8	sand to silty sand
11.483	99.93	0.4901	0.490	3.752	24	8	sand to silty sand
11.647	101.53	0.5453	0.537	3.824	24	8	sand to silty sand
11.811	101.25	0.5549	0.548	3.903	24	8	sand to silty sand
11.975	99.26	0.5260	0.530	3.989	24	8	sand to silty sand
12.139	94.54	0.5252	0.556	4.118	23	8	sand to silty sand
12.303	92.13	0.4178	0.453	4.161	22	8	sand to silty sand
12.467	87.79	0.4066	0.463	4.223	21	8	sand to silty sand
12.631	81.40	0.3961	0.487	4.625	19	8	sand to silty sand
12.795	82.59	0.3969	0.481	4.637	20	8	sand to silty sand
12.959	83.80	0.3653	0.436	4.658	20	8	sand to silty sand
13.123	82.91	0.3584	0.432	4.685	20	8	sand to silty sand
13.287	83.84	0.3815	0.455	4.472	20	8	sand to silty sand
13.451	85.63	0.3987	0.466	4.512	21	8	sand to silty sand
13.615	84.01	0.4179	0.497	4.575	20	8	sand to silty sand
13.780	84.13	0.4099	0.487	4.646	20	8	sand to silty sand
13.944	83.56	0.3935	0.471	4.720	20	8	sand to silty sand
14.108	85.06	0.3846	0.452	4.768	20	8	sand to silty sand
14.272	88.27	0.4161	0.471	4.814	21	8	sand to silty sand
14.436	92.01	0.4736	0.515	4.859	22	8	sand to silty sand
14.600	91.13	0.5223	0.573	4.931	22	8	sand to silty sand
14.764	90.49	0.5198	0.574	5.012	22	8	sand to silty sand
14.928	92.43	0.5192	0.562	5.103	22	8	sand to silty sand
15.092	97.33	0.5663	0.582	5.156	23	8	sand to silty sand
15.256	101.53	0.6112	0.602	5.218	24	8	sand to silty sand
15.420	98.31	0.6204	0.631	5.292	24	8	sand to silty sand
15.584	99.08	0.5600	0.565	5.361	24	8	sand to silty sand
15.748	105.69	0.6224	0.589	5.423	25	8	sand to silty sand
15.912	118.09	0.6874	0.582	5.612	23	9	sand
16.076	122.51	0.7356	0.600	5.610	23	9	sand
16.240	133.96	0.9793	0.731	5.624	26	9	sand
16.404	145.71	1.3136	0.901	5.615	35	8	sand to silty sand
16.568	168.16	1.3230	0.787	5.165	32	9	sand
16.732	186.89	1.3746	0.736	5.160	36	9	sand
16.896	201.64	1.5042	0.746	5.108	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	209.60	1.5491	0.739	5.024	40	9	sand
17.224	211.71	1.6162	0.763	5.005	41	9	sand
17.388	219.74	1.7456	0.794	4.931	42	9	sand
17.552	227.65	1.8521	0.814	4.852	44	9	sand
17.717	228.72	1.9464	0.851	4.885	44	9	sand
17.881	231.52	1.8788	0.812	4.838	44	9	sand
18.045	235.64	1.7981	0.763	4.771	45	9	sand
18.209	240.85	1.9017	0.790	4.728	46	9	sand
18.373	240.96	1.9923	0.827	4.694	46	9	sand
18.537	233.90	2.0603	0.881	4.658	45	9	sand
18.701	230.79	2.2396	0.970	4.704	44	9	sand
18.865	235.47	1.1097	0.471	4.761	45	9	sand
19.029	226.42	1.3662	0.603	4.902	43	9	sand
19.193	237.14	1.7882	0.754	5.818	45	9	sand
19.357	232.66	1.9296	0.829	5.624	45	9	sand
19.521	226.70	1.6479	0.727	5.493	43	9	sand
19.685	225.16	1.7138	0.761	5.414	43	9	sand
19.849	198.73	1.6330	0.822	4.783	38	9	sand
20.013	169.34	1.3469	0.795	4.995	32	9	sand
20.177	161.57	1.2177	0.754	5.223	31	9	sand
20.341	165.15	1.1488	0.696	5.464	32	9	sand
20.505	165.82	1.2555	0.757	5.553	32	9	sand
20.669	170.02	1.2395	0.729	5.653	33	9	sand
20.833	166.15	1.2757	0.768	5.684	32	9	sand
20.997	167.47	1.2859	0.768	5.722	32	9	sand
21.161	167.55	1.2736	0.760	5.861	32	9	sand
21.325	166.51	1.2265	0.737	5.926	32	9	sand
21.490	169.06	1.1500	0.680	6.005	32	9	sand
21.654	176.34	1.2101	0.686	6.091	34	9	sand
21.818	186.88	1.3508	0.723	6.203	36	9	sand
21.982	186.40	1.5323	0.822	6.356	36	9	sand
22.146	179.06	1.3130	0.733	6.323	34	9	sand
22.310	177.65	1.3014	0.733	6.323	34	9	sand
22.474	194.36	1.2926	0.665	6.595	37	9	sand
22.638	197.63	1.5670	0.793	6.641	38	9	sand
22.802	206.33	1.5848	0.768	6.468	40	9	sand
22.966	201.52	1.5425	0.765	6.511	39	9	sand
23.130	183.94	1.6121	0.876	6.198	35	9	sand
23.294	179.82	1.5476	0.861	6.390	34	9	sand
23.458	175.57	1.4811	0.844	6.531	34	9	sand
23.622	175.14	1.4418	0.823	6.612	34	9	sand
23.786	172.46	1.4672	0.851	6.775	33	9	sand
23.950	171.07	1.4496	0.847	6.894	33	9	sand
24.114	162.97	1.4227	0.873	7.009	31	9	sand
24.278	160.57	1.2902	0.804	7.028	31	9	sand
24.442	158.58	1.1581	0.730	7.121	30	9	sand
24.606	155.51	1.0676	0.687	7.224	30	9	sand
24.770	155.04	1.0815	0.698	7.344	30	9	sand
24.934	152.73	1.0678	0.699	7.432	29	9	sand
25.098	149.89	1.0141	0.677	7.490	29	9	sand
25.262	150.03	0.9639	0.642	7.580	29	9	sand
25.427	153.87	0.5991	0.389	7.638	29	9	sand
25.591	164.28	0.7392	0.450	7.776	31	9	sand
25.755	155.02	0.9722	0.627	7.576	30	9	sand
25.919	159.66	1.0738	0.673	7.609	31	9	sand
26.083	163.51	1.0891	0.666	7.762	31	9	sand
26.247	165.17	1.1681	0.707	7.753	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	156.26	1.2625	0.808	7.580	30	9	sand
26.575	155.68	1.2961	0.833	7.793	30	9	sand
26.739	154.90	1.2117	0.782	7.920	30	9	sand
26.903	161.78	1.1044	0.683	8.161	31	9	sand
27.067	176.20	1.1865	0.673	8.228	34	9	sand
27.231	199.99	1.5120	0.756	8.341	38	9	sand
27.395	211.80	1.7966	0.848	8.264	41	9	sand
27.559	211.65	2.0951	0.990	8.183	41	9	sand
27.723	215.45	2.2161	1.029	8.128	41	9	sand
27.887	214.35	2.3725	1.107	8.303	41	9	sand
28.051	210.49	2.4205	1.150	8.212	40	9	sand
28.215	199.31	2.3684	1.188	8.293	38	9	sand
28.379	191.62	2.2811	1.190	8.329	37	9	sand
28.543	190.89	2.1066	1.104	8.487	37	9	sand
28.707	190.81	1.5914	0.834	8.630	37	9	sand
28.871	197.78	1.6678	0.843	8.948	38	9	sand
29.035	205.92	1.9181	0.931	9.556	39	9	sand
29.199	222.83	2.2745	1.021	9.606	43	9	sand
29.364	240.35	2.5847	1.075	9.532	46	9	sand
29.528	262.88	3.0363	1.155	9.211	50	9	sand
29.692	271.92	3.5077	1.290	8.805	52	9	sand
29.856	271.67	3.8524	1.418	8.355	65	8	sand to silty sand
30.020	265.88	3.9684	1.493	8.288	64	8	sand to silty sand
30.184	248.60	3.8422	1.546	7.961	60	8	sand to silty sand
30.348	239.88	3.5954	1.499	7.729	57	8	sand to silty sand
30.512	231.24	3.5687	1.543	7.490	55	8	sand to silty sand
30.676	209.18	3.4351	1.642	7.616	50	8	sand to silty sand
30.840	180.69	3.0455	1.685	7.537	43	8	sand to silty sand
31.004	169.86	2.5591	1.507	7.786	41	8	sand to silty sand
31.168	170.89	2.3027	1.347	8.037	41	8	sand to silty sand
31.332	170.64	2.2224	1.302	8.353	41	8	sand to silty sand
31.496	165.22	2.2251	1.347	8.479	40	8	sand to silty sand
31.660	159.26	2.1123	1.326	8.532	38	8	sand to silty sand
31.824	155.88	1.9988	1.282	8.656	37	8	sand to silty sand
31.988	160.48	1.9706	1.228	8.814	38	8	sand to silty sand
32.152	165.43	2.0784	1.256	8.896	40	8	sand to silty sand
32.316	162.92	2.0916	1.284	9.668	39	8	sand to silty sand
32.480	166.35	2.2183	1.333	9.733	40	8	sand to silty sand
32.644	176.23	2.0896	1.186	9.788	42	8	sand to silty sand
32.808	185.33	2.3766	1.282	9.807	44	8	sand to silty sand
32.972	176.30	2.6212	1.487	10.089	42	8	sand to silty sand
33.136	174.59	2.6456	1.515	10.163	42	8	sand to silty sand
33.301	167.67	2.4861	1.483	10.182	40	8	sand to silty sand
33.465	170.59	2.4345	1.427	10.299	41	8	sand to silty sand
33.629	177.62	2.5462	1.434	10.412	43	8	sand to silty sand
33.793	173.06	2.4584	1.421	10.132	41	8	sand to silty sand
33.957	169.82	2.2003	1.296	9.926	41	8	sand to silty sand
34.121	184.54	2.2752	1.233	10.184	44	8	sand to silty sand
34.285	193.02	2.3961	1.241	10.629	46	8	sand to silty sand
34.449	190.60	2.3371	1.226	10.359	46	8	sand to silty sand
34.613	194.21	2.2785	1.173	10.125	37	9	sand
34.777	202.38	2.3321	1.152	10.297	39	9	sand
34.941	213.58	2.5329	1.186	10.474	41	9	sand
35.105	210.22	2.3382	1.112	10.687	40	9	sand
35.269	194.60	2.2939	1.179	10.768	37	9	sand
35.433	174.79	2.1371	1.223	11.005	42	8	sand to silty sand
35.597	175.68	2.2000	1.252	11.143	42	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	178.62	2.1493	1.203	11.220	43	8	sand to silty sand
35.925	176.75	1.8646	1.055	11.275	34	9	sand
36.089	178.47	2.0165	1.130	11.148	34	9	sand
36.253	199.89	2.3263	1.164	11.371	38	9	sand
36.417	207.42	2.6266	1.266	11.464	40	9	sand
36.581	199.35	2.7416	1.375	11.232	48	8	sand to silty sand
36.745	191.90	2.7596	1.438	11.115	46	8	sand to silty sand
36.909	189.03	2.7493	1.454	11.194	45	8	sand to silty sand
37.073	185.13	2.7081	1.463	11.411	44	8	sand to silty sand
37.238	181.45	2.5911	1.428	11.452	43	8	sand to silty sand
37.402	179.99	2.4632	1.368	11.574	43	8	sand to silty sand
37.566	179.63	2.3432	1.304	11.837	43	8	sand to silty sand
37.730	183.91	2.3398	1.272	12.035	44	8	sand to silty sand
37.894	187.00	2.4307	1.300	12.251	45	8	sand to silty sand
38.058	186.38	2.3905	1.283	12.392	45	8	sand to silty sand
38.222	191.54	2.3268	1.215	12.478	37	9	sand
38.386	199.99	2.4832	1.242	12.571	38	9	sand
38.550	195.45	2.4930	1.276	12.549	47	8	sand to silty sand
38.714	163.25	2.0035	1.227	12.416	39	8	sand to silty sand
38.878	108.73	1.8507	1.702	12.743	35	7	silty sand to sandy silt
39.042	98.11	1.3918	1.419	12.356	23	8	sand to silty sand
39.206	131.92	1.8167	1.377	12.657	32	8	sand to silty sand
39.370	210.17	2.5272	1.202	7.265	40	9	sand
39.534	256.23	3.3844	1.321	6.454	49	9	sand
39.698	258.71	4.1164	1.591	7.064	62	8	sand to silty sand
39.862	258.18	4.4459	1.722	7.535	62	8	sand to silty sand
40.026	243.73	4.5239	1.856	8.109	58	8	sand to silty sand
40.190	230.06	4.1632	1.810	8.554	55	8	sand to silty sand
40.354	231.04	3.8995	1.688	8.943	55	8	sand to silty sand
40.518	250.02	3.9263	1.570	9.773	60	8	sand to silty sand
40.682	256.42	3.8983	1.520	9.857	61	8	sand to silty sand
40.846	260.24	3.8516	1.480	9.811	62	8	sand to silty sand
41.011	261.17	3.8659	1.480	8.886	63	8	sand to silty sand
41.175	263.31	4.1292	1.568	9.221	63	8	sand to silty sand
41.339	263.37	4.3468	1.650	9.764	63	8	sand to silty sand
41.503	255.35	4.0956	1.604	9.967	61	8	sand to silty sand
41.667	250.36	3.8119	1.523	10.232	60	8	sand to silty sand
41.831	246.67	3.5563	1.442	10.553	59	8	sand to silty sand
41.995	246.36	3.7324	1.515	10.789	59	8	sand to silty sand
42.159	228.49	3.7522	1.642	12.167	55	8	sand to silty sand
42.323	225.04	3.7323	1.658	12.382	54	8	sand to silty sand
42.487	252.37	2.9430	1.166	12.846	48	9	sand
42.651	264.37	3.3481	1.266	12.961	51	9	sand
42.815	258.94	3.7075	1.432	12.224	62	8	sand to silty sand
42.979	259.69	4.1151	1.585	12.588	62	8	sand to silty sand
43.143	266.13	4.4842	1.685	12.736	64	8	sand to silty sand
43.307	272.53	4.7809	1.754	13.097	65	8	sand to silty sand
43.471	276.62	4.9871	1.803	13.308	66	8	sand to silty sand
43.635	274.48	5.0796	1.851	13.363	66	8	sand to silty sand
43.799	269.07	4.9925	1.855	13.131	64	8	sand to silty sand
43.963	265.17	4.8870	1.843	13.054	63	8	sand to silty sand
44.127	267.69	4.8095	1.797	13.253	64	8	sand to silty sand
44.291	268.35	4.8001	1.789	13.365	64	8	sand to silty sand
44.455	264.95	4.7593	1.796	13.671	63	8	sand to silty sand
44.619	253.12	4.5878	1.812	13.513	61	8	sand to silty sand
44.783	245.17	4.6285	1.888	13.939	59	8	sand to silty sand
44.948	238.13	4.7249	1.984	13.982	57	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	219.84	4.3389	1.974	13.867	53	8	sand to silty sand
45.276	194.21	3.7882	1.951	13.946	46	8	sand to silty sand
45.440	165.44	3.3087	2.000	14.204	53	7	silty sand to sandy silt
45.604	161.35	3.0796	1.909	14.259	52	7	silty sand to sandy silt
45.768	160.91	2.5064	1.558	14.348	39	8	sand to silty sand
45.932	152.41	2.1513	1.411	14.144	36	8	sand to silty sand
46.096	107.05	2.0069	1.875	15.058	34	7	silty sand to sandy silt
46.260	98.19	1.8478	1.882	15.278	31	7	silty sand to sandy silt
46.424	100.56	1.6991	1.690	15.928	32	7	silty sand to sandy silt
46.588	105.06	1.7320	1.649	13.614	34	7	silty sand to sandy silt
46.752	98.58	1.8729	1.900	7.463	31	7	silty sand to sandy silt
46.916	107.18	2.0172	1.882	5.629	34	7	silty sand to sandy silt
47.080	112.69	2.1299	1.890	3.623	36	7	silty sand to sandy silt
47.244	159.55	2.1164	1.327	2.977	38	8	sand to silty sand
47.408	224.14	2.6526	1.183	1.385	43	9	sand
47.572	243.59	3.3291	1.367	0.225	58	8	sand to silty sand
47.736	243.28	4.3821	1.801	1.102	58	8	sand to silty sand
47.900	238.59	4.9657	2.081	1.817	57	8	sand to silty sand
48.064	216.79	4.7621	2.197	2.499	69	7	silty sand to sandy silt
48.228	210.51	4.3348	2.059	3.101	67	7	silty sand to sandy silt
48.392	242.61	3.9953	1.647	3.855	58	8	sand to silty sand
48.556	246.74	3.8636	1.566	2.288	59	8	sand to silty sand
48.720	200.54	3.9795	1.984	6.335	48	8	sand to silty sand
48.885	168.86	3.9086	2.315	6.896	54	7	silty sand to sandy silt
49.049	116.85	2.6609	2.277	7.444	37	7	silty sand to sandy silt
49.213	68.21	2.2491	3.297	8.169	26	6	sandy silt to clayey silt
49.377	49.14	1.6974	3.454	13.487	24	5	clayey silt to silty clay
49.541	108.73	1.8035	1.659	18.250	35	7	silty sand to sandy silt
49.705	149.68	2.1321	1.424	10.758	36	8	sand to silty sand
49.869	190.21	2.0295	1.067	10.194	36	9	sand
50.033	221.34	2.0335	0.919	6.911	42	9	sand
50.197	228.54	2.3800	1.041	3.955	44	9	sand
50.361	225.47	3.0244	1.341	3.604	54	8	sand to silty sand
50.525	212.78	3.4151	1.605	4.338	51	8	sand to silty sand
50.689	186.42	3.8315	2.055	5.263	60	7	silty sand to sandy silt
50.853	176.95	3.0218	1.708	5.641	42	8	sand to silty sand
51.017	177.71	3.0808	1.734	6.736	43	8	sand to silty sand
51.181	201.58	2.2869	1.134	6.985	39	9	sand
51.345	213.39	2.5010	1.172	3.838	41	9	sand
51.509	245.81	2.4763	1.007	3.367	47	9	sand
51.673	254.27	3.6878	1.450	2.458	61	8	sand to silty sand
51.837	262.68	4.4681	1.701	2.394	63	8	sand to silty sand
52.001	287.15	5.1467	1.792	7.011	69	8	sand to silty sand
52.165	266.18	5.2159	1.960	7.638	64	8	sand to silty sand
52.329	267.89	4.4634	1.666	8.166	64	8	sand to silty sand
52.493	280.15	4.5295	1.617	8.389	67	8	sand to silty sand
52.657	231.41	4.7751	2.064	11.985	55	8	sand to silty sand
52.822	219.39	4.9395	2.251	12.614	70	7	silty sand to sandy silt
52.986	201.51	4.7967	2.380	12.978	64	7	silty sand to sandy silt
53.150	181.51	4.5021	2.480	13.406	58	7	silty sand to sandy silt
53.314	164.19	4.1356	2.519	13.915	52	7	silty sand to sandy silt
53.478	144.27	3.0604	2.121	14.415	46	7	silty sand to sandy silt
53.642	154.64	2.0813	1.346	15.409	37	8	sand to silty sand
53.806	190.28	2.1785	1.145	11.935	36	9	sand
53.970	158.57	2.8186	1.778	6.578	38	8	sand to silty sand
54.134	94.00	2.5603	2.724	8.453	36	6	sandy silt to clayey silt
54.298	118.09	2.0755	1.758	11.488	38	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	222.96	3.0338	1.361	11.593	53	8	sand to silty sand
54.626	257.45	3.9708	1.542	11.021	62	8	sand to silty sand
54.790	279.50	4.8873	1.749	12.229	67	8	sand to silty sand
54.954	278.50	5.0345	1.808	13.095	67	8	sand to silty sand
55.118	274.16	5.0877	1.856	13.606	66	8	sand to silty sand
55.282	249.82	4.9940	1.999	15.835	60	8	sand to silty sand
55.446	260.72	4.8339	1.854	16.478	62	8	sand to silty sand
55.610	282.48	4.6445	1.644	16.686	68	8	sand to silty sand
55.774	291.44	4.8583	1.667	16.875	70	8	sand to silty sand
55.938	293.80	5.1552	1.755	16.464	70	8	sand to silty sand
56.102	287.36	5.0330	1.751	16.591	69	8	sand to silty sand
56.266	278.67	4.7510	1.705	16.610	67	8	sand to silty sand
56.430	281.10	4.3679	1.554	17.155	67	8	sand to silty sand
56.594	276.58	4.0606	1.468	16.581	66	8	sand to silty sand
56.759	286.42	4.0457	1.413	16.191	69	8	sand to silty sand
56.923	287.00	4.3609	1.519	15.187	69	8	sand to silty sand
57.087	272.16	4.7733	1.754	15.240	65	8	sand to silty sand
57.251	256.90	4.7041	1.831	15.598	62	8	sand to silty sand
57.415	244.46	4.3705	1.788	16.172	59	8	sand to silty sand
57.579	253.10	4.0855	1.614	16.801	61	8	sand to silty sand
57.743	261.94	4.0811	1.558	17.222	63	8	sand to silty sand
57.907	266.05	4.2596	1.601	17.466	64	8	sand to silty sand
58.071	260.31	4.4336	1.703	16.847	62	8	sand to silty sand
58.235	249.83	3.8142	1.527	16.832	60	8	sand to silty sand
58.399	234.90	3.8199	1.626	17.294	56	8	sand to silty sand
58.563	224.10	3.9564	1.765	18.482	54	8	sand to silty sand
58.727	223.52	4.2541	1.903	18.686	54	8	sand to silty sand
58.891	189.01	2.4337	1.288	19.097	45	8	sand to silty sand
59.055	205.50	2.4878	1.211	19.893	39	9	sand
59.219	234.92	2.5591	1.089	9.300	45	9	sand
59.383	230.45	2.9983	1.301	9.725	44	9	sand
59.547	225.93	3.2099	1.421	10.703	54	8	sand to silty sand
59.711	220.98	3.3423	1.512	11.631	53	8	sand to silty sand
59.875	253.21	3.4999	1.382	12.693	61	8	sand to silty sand
60.039	289.38	4.5354	1.567	14.264	69	8	sand to silty sand
60.203	311.23	5.3877	1.731	13.465	75	8	sand to silty sand
60.367	322.25	5.8272	1.808	14.245	77	8	sand to silty sand
60.532	340.15	6.5285	1.919	16.084	81	8	sand to silty sand
60.696	349.46	7.1622	2.049	17.416	84	8	sand to silty sand
60.860	347.77	7.1334	2.051	17.409	83	8	sand to silty sand
61.024	336.16	7.1236	2.119	17.430	80	8	sand to silty sand
61.188	328.69	6.9684	2.120	17.770	79	8	sand to silty sand
61.352	321.96	6.8707	2.134	17.416	77	8	sand to silty sand
61.516	291.95	6.5391	2.240	17.578	70	8	sand to silty sand
61.680	289.93	6.1346	2.116	17.411	69	8	sand to silty sand
61.844	290.46	6.0461	2.082	17.179	70	8	sand to silty sand
62.008	291.24	5.9094	2.029	16.835	70	8	sand to silty sand
62.172	282.13	5.8015	2.056	17.657	68	8	sand to silty sand
62.336	280.74	5.8115	2.070	18.387	67	8	sand to silty sand

APPENDIX B: LABORATORY TEST RESULTS

Appendix B

Laboratory Test Results

CONTENTS

B.1 General....1
B.2 Soil Testing....1
B.2.1 Moisture (Natural Water) Content....1
B.2.2 Particle-size Analyses....1

Figures

Figure B1 Grain Size Distribution

APPENDIX B: LABORATORY TEST RESULTS

B.1 GENERAL

Soil samples obtained during the field explorations were described and identified in the field in general accordance with the Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488. The Specific terminology used is defined in the Soil Description and Log Key, Figure A1, Appendix A. The physical characteristics of the collected samples were noted, and field descriptions and identifications were modified, as necessary, in accordance with the terminology presented in Appendix A, Figure A1.

During the review, select soil were collected for further testing. The material descriptions and identifications were refined/revised, as necessary, based on the results of the laboratory tests. The soil testing program included moisture content testing and particle size analysis. Results of the soil testing are presented in Figure B1. All laboratory tests were performed in accordance with applicable ASTM International (ASTM) standards.

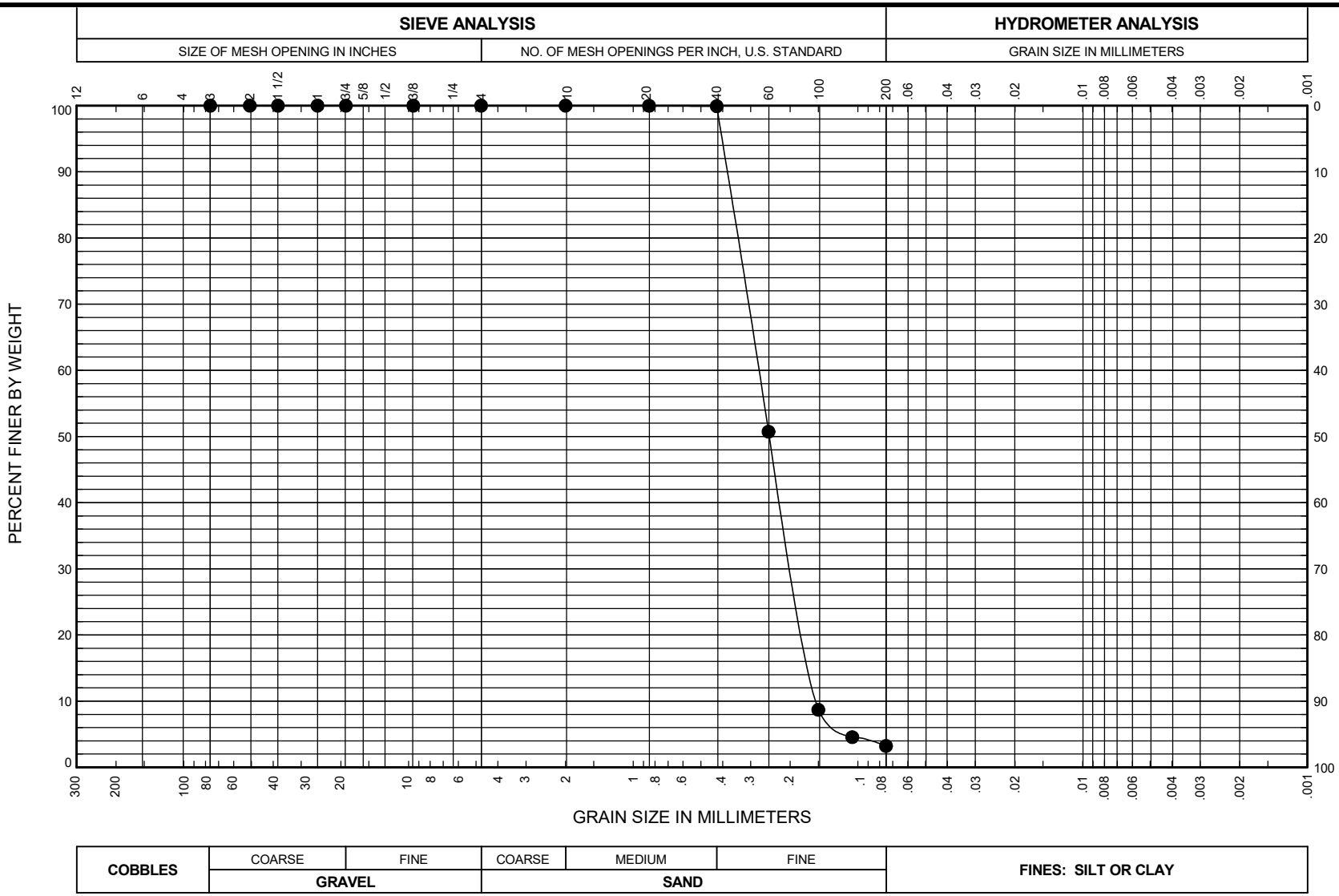
B.2 SOIL TESTING

B.2.1 Moisture (Natural Water) Content

Natural moisture content determinations were performed in accordance with ASTM D2216, on selected soil samples. The natural moisture content is a measure of the amount of moisture in the soil at the time of exploration. It is defined as the ratio of the weight of water to the dry weight of the soil, expressed as a percentage. The results of moisture content determinations are presented on the Logs of Borings in Appendix A.

B.2.2 Particle-size Analyses

Particle-size analyses were conducted on select samples to determine their grain-size distributions. Grain size distributions were determined in accordance with ASTM D6913 D1140, and D422 as applicable. For all samples, a wet sieve analysis was performed to determine the percentage (by weight) of each sample passing the No. 200 (0.075 mm) sieve. Additionally, the material retained on the No. 200 sieve was shaken through a series of sieves to determine the distribution of the plus No. 200 fraction (ASTM 6913). Particle size analyses were performed by Shannon & Wilson. Results of all particle-size analyses are plotted on Figure B1, Grain Size Distribution. The percentage of each sample passing the No. 200 sieve is presented on the Logs of Borings in Appendix A.



NOTES:
1) Sieve analyses were performed in general accordance with ASTM D6913, sieve with hydrometer analyses were performed in general accordance with ASTM D422, and amount finer than #200 sieve analyses were performed in general accordance with ASTM D1140 unless otherwise noted in the report.
2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	GRAVEL %	SAND %	FINES %	NAT. W.C. %	DRY DENSITY PCF
● B-1, S-5	10.0	*SP*	*Poorly Graded Sand*	0	97	3	22	

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

GRAIN SIZE DISTRIBUTION

August 2024 112242

SHANNON & WILSON **FIG. B1**

FIG. B1

GSA MAIN 112242.GPJ SHAN WIL.GDT 2/12/24

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IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

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A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the Geoprofessional Business Association (https://www.geoprofessional.org)

2 – INADVERTENT DISCOVERY PLAN

ARCHAEOLOGICAL AND HUMAN REMAINS INADVERTENT DISCOVERY PLAN (IDP)

PROJECT: Hammond Transmission Waterline Phase 1
PROJECT MANAGER: Twyla Vittetoe, Engineering Technician
LANDOWNER AGENCY: City of Warrenton, Oregon
DATE: 07/31/2024
SHPO CASE NUMBER: 24-0018

This document outlines procedures and protocols to be followed if archaeological objects or features, or human remains are encountered in the course of work. These procedures are intended for circumstances where there is not an expectation or anticipation of encountering cultural resources or human remains. **This is not a replacement for due diligence, robust project design, and consultation with appropriate Native American Tribes**.[1] Prior to undertaking project work, an assessment of the likelihood for disturbance to cultural resources and tribal heritage should be completed. All personnel will be briefed on all procedures and reporting structures before the start of any work.

CONTENTS OF THIS DOCUMENT

A. Procedures for archaeological features and materials
B. Procedures for human remains, burials, funerary objects, sacred objects, and objects of cultural patrimony
C. Roles and responsibilities
D. Contact information
E. Confidentiality statement
F. Procedure flow chart
G. Visual reference guide for archaeology and tribal heritage items

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A. *PROCEDURES FOR INADVERTENT DISCOVERY OF ARCHAEOLOGICAL FEATURES AND MATERIALS (DOES **NOT** INCLUDE HUMAN REMAINS, BURIALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, OR SPIRITUAL OBJECTS)*

It is expected that ALL artifacts, features, structural elements, and other cultural items that are identified will be reported to required project, agency, and Tribal contacts, and accounted for as soon as possible. It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, and appropriate Native American Tribes.

Step 1. Stop work (immediately after discovery)

[1] Appropriate Native American Tribes will be identified by LCIS

If any person believes that they have located an archaeological object[2] or site[3], all work must stop immediately.

Discovery made in field _____(date/time) _____ (initials of discoverer)

Step 2. Secure and protect the area (within first hour after discovery)

Establish a **minimum** 30 meter/100-foot area of protection, or more as necessary, around the find(s). Exclude all vehicle traffic and non-essential foot traffic. Non-ground-disturbing work may continue outside of the area of protection with caution until the situation is assessed by a qualified archaeologist.[4]

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery)

Notify the project manager, agency official (if applicable), and project archaeologist. If there is not an archaeologist on-site, or on retainer for the project, the project manager will contact an Oregon Qualified Archaeologist (which include agency and Tribal archaeologists) to assess the find.

Project Manager contacted _____ (time) _____ (initials of contactor)
Agency Official contacted _____ (time) _____ (initials of contactor)
Project Archaeologist contacted _____ (time) _____ (initials of contactor)

Step 4. Identify and Follow Guidance (timeline variable, as soon as possible)

If the archaeologist determines the find is an archaeological feature or object, or other cultural item or feature, OR if no qualified archaeologist can be contacted within the first hour of discovery, the **State Historic Preservation Office (SHPO) and appropriate Native American Tribes must be contacted,** and their guidance must be followed. SHPO, Native American Tribes, and project and agency personnel will determine in consultation how or if work may continue at the site. If the discovery is determined to *not* be archaeological or a cultural item, you may continue work. This determination should be confirmed in writing to the project manager and agency official.

SHPO contacted _____ (time) _____ (initials of contactor)

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[2] "Archaeological object" means an object that is at least 75 years old (or 50 years if there is a federal nexus), is part of the physical record of an indigenous or other culture found in the state or waters of the state, and is material remains of past human life or activity that are of archaeological significance including, but not limited to, monuments, symbols, tools, facilities, technological by-products and dietary by-products (ORS 358.905).

[3] "Archaeological site" means a geographic locality in Oregon that contains archaeological objects and the contextual associations of the archaeological objects with each other or biotic or geological remains or deposits (ORS 358.905).

[4] Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

Appropriate Native American Tribes[5] _____ (time) _____ (initials of contactor)

B. *PROCEDURES FOR INADVERTENT DISCOVERY OF HUMAN REMAINS*

(INCLUDES HUMAN REMAINS, BURIALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, AND SPIRITUAL OBJECTS)

It is expected that ALL potential human remains, burials, funerary objects, or objects of cultural patrimony that are identified will be reported and accounted for within 3 hours of discovery.[6] It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, OSP and appropriate Native American Tribes.

Step 1: Stop work (immediately after discovery)

If any person believes that they have located human remains[7], ALL work will stop immediately. Any human remains, regardless of antiquity or ethnic origin, will always be treated with dignity and respect.

Step 2. Secure and protect the area (as soon as possible, within c. 10 min)

Secure and protect the area of inadvertent discovery with a **minimum** of 100 meter/300 foot buffer, or more as necessary. The location and other information about the find should be treated as confidential and shared on a **need to know basis only**. Prevent all vehicle traffic and unauthorized foot traffic from entry. Block remains from view and protect them from damage or exposure without touching or disturbing the remains, and leave them in place.

Do not take photographs unless approved by the appropriate Native American Tribes and Oregon Legislative Commission on Indian Services (LCIS), and only for the purpose of identification. **Do not speak to the media or public** or post any information about the find on social media. Non-ground-disturbing work may continue outside of the buffer with caution.[8]

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery) – see contact list below (section D)

1. Project Manager _____ (time) _____ (initials)
2. Agency Official _____ (time) _____ (initials)

[5] ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

[6] Modifications to reporting timelines can be made in consultation with SHPO and Tribes.

[7] Bone may be fragmented, weathered, or otherwise modified to make it difficult to identify, so when in doubt, stop work and call it in.

[8] Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

3. Oregon State Police[9] **DO NOT CALL 911** _____ (time) _____ (initials)
4. State Historic Preservation Office (SHPO) _____ (time) _____ (initials)
5. Commission on Indian Services (LCIS) _____ (time) _____ (initials)
6. Appropriate Native American Tribes[10] _____ (time) _____ (initials)

   Name of Tribe(s) Contacted and Individual(s):

_____
_____
_____
_____

Step 4. Follow guidance (timeline variable, may be up to several days or more)

If the site is determined not to be a crime scene by the Oregon State Police, **do not move anything!** The remains will continue to be *secured in place* along with any associated funerary objects, and protected from weather, water runoff, and shielded from view. Follow all guidance provided by OSP, LCIS, SHPO, and appropriate Native American Tribes.

Continue to maintain the work stoppage within the buffer until a plan is developed and carried out between the Oregon State Police, SHPO, LCIS, and appropriate Native American Tribes and you are directed in writing by the project manager that work may proceed.

C. ROLES AND RESPONSIBILITIES

Person Responsible	**Responsibility**
Contractor/Discoverer will…	Notify the Project Manager Twyla Vittetoe: 503-861-0912
Twyla Vittetoe will…	Notify the Agency Official Greg Shafer: 971-286-2035
Twyla Vittetoe will…	Notify the Contracted Archaeologist Bradley Bowden: 206-898-5781
Twyla Vittetoe will…	Notify the State Agencies (OSP, LCIS, SHPO)
Twyla Vittetoe will…	Notify the Native American Tribes identified by LCIS
Greg Shafer will…	Enforce the work stoppage and buffer

[9] OSP will be responsible for contacting the county or state medical examiner's office as appropriate.
[10] ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

D. *CONTACT INFORMATION*[11]

Agency	Position/Contact	Contact Information
Project Manager	Twyla Vittetoe, Engineering Technician	503-861-0912
Agency Official	Greg Shafer, PE, Public Works Director	971-286-2035
Contracted Archaeologist	Bradley Bowden, Historical Research Associates Inc.	206-898-5781
Legislative Commission on Indian Services (LCIS)	Primary Contact: Dr. Elissa Bullion, State Physical Anthropologist	971-707-1372
	Secondary Contact: LCIS Office	503-986-1067
Oregon State Police (OSP)	Primary Contact: Sgt. Ryan Tague	541-576-4393
	Secondary Contact: Dispatch, northern command[12]	800-442-0776
	Secondary Contact: Dispatch, southern command[13]	800-442-2068
State Historic Preservation Office (SHPO)	Kurt Roedel, MA, RPA, SHPO/ODOT Archaeology Liaison	971-273-8073
	Primary Contact: John Pouley, State Archaeologist	503-480-9164
	Secondary Contact: Jamie French, Asst. State Archaeologist	503-979-7580
Native American Tribes	Confederated Tribes of Grand Ronde • Briece Edwards, Deputy Tribal Historic Preservation Officer • Chrisopher Bailey, Cultural Protection Specialist	503-879-2084 503-879-1675
	Confederated Tribes of Siletz Indians • Buddy Lane, Cultural Resources Manager • Peter Sv-gvs (Black Bear) Hatch, History & Archaeology Specialist	541-444-8230 541-444-8319
	Confederated Tribes of Warm Springs Reservation of Oregon • Bobby Brunoe, THPO & NAGPRA Coordinator • Mars Galloway, Cultural Resources Manager	541-553-2026 541-553-3583

[11] Contact information should be regularly updated for all individuals. Up to date contacts for LCIS, OSP, SHPO, and Native American Tribes can be found on the LCIS cultural resources page: Commission on Indian Services archaeology (oregonlegislature.gov)

[12] Northern command: Benton, Clackamas, Clatsop, Columbia, Crook, Deschutes, Gilliam, Hood River, Jefferson, Klamath, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Sherman, Tillamook, Wasco, Washington, Wheeler, Yamhill

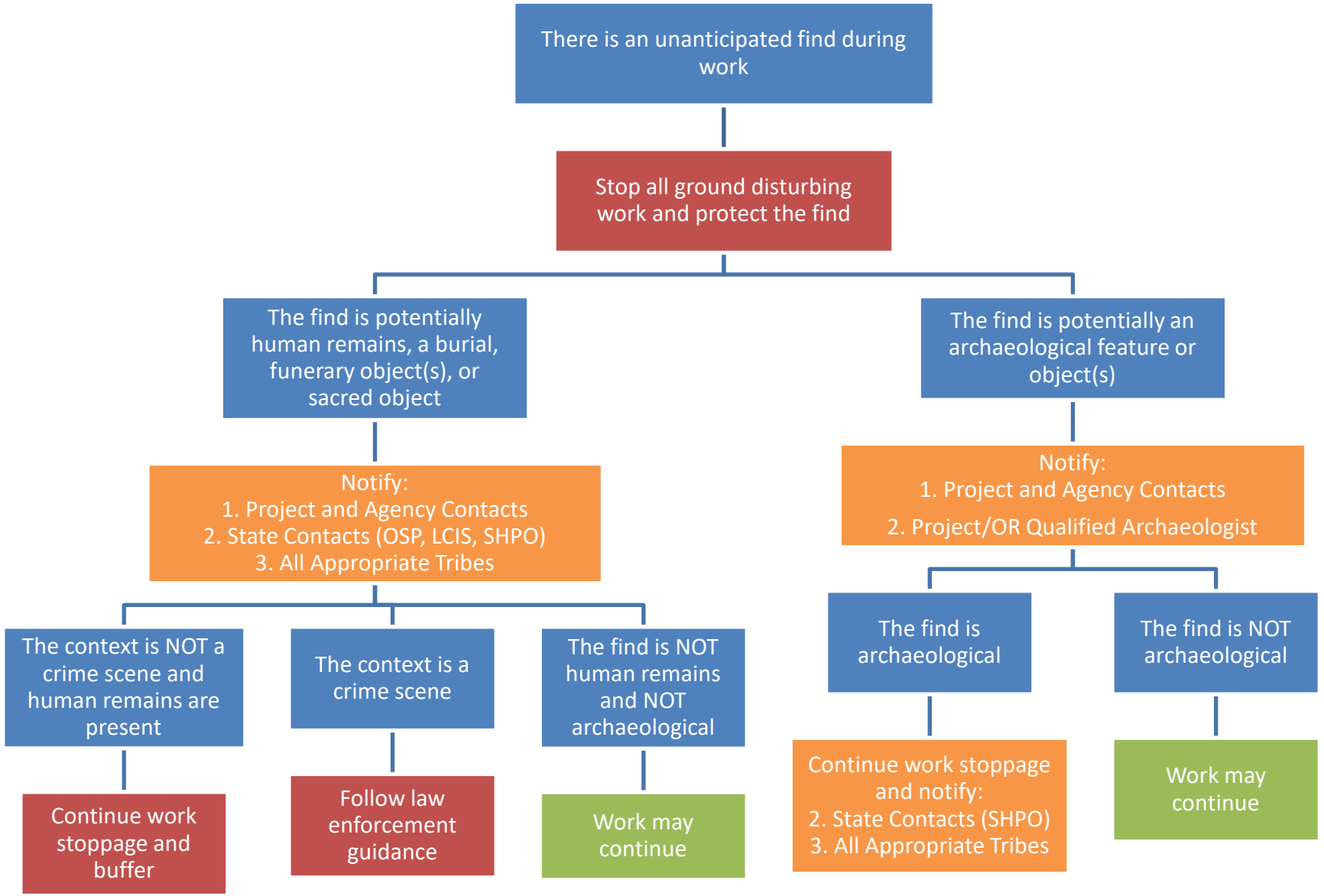
[13] Southern command: Baker, Coos, Curry, Douglas, Grant, Harney, Jackson, Josephine, parts of Klamath, Lake, Malheur, Morrow, Umatilla, Union, and Wallowa

E. CONFIDENTIALITY

The Hammon Transmission Waterline Phase 1 Project and employees shall make their best efforts, in accordance with federal and state law, to ensure that its personnel and contractors keep the discovery confidential. The media, or any third-party member or members of the public are not to be contacted or have information regarding the discovery, and any public or media inquiry is to be reported to the City of Warrenton. Photos shall not be taken except for when authorized by LCIS, SHPO, and Native American Tribes for identification purposes, and no photos will be circulated publicly or on social media. Prior to any release, the responsible agencies and Tribes shall concur on the amount of information, if any, to be released to the public.

To protect fragile, vulnerable, or threatened sites, the National Historic Preservation Act, as amended (Section 304 [16 U.S.C. 470s-3]), and Oregon State law (ORS 192.345(11)) establishes that the location of archaeological sites, both on land and underwater, shall be confidential.

F. *PROCEDURE FLOW CHART*



G. Visual Reference Guide for Archaeology in Oregon (Modify based on region/context)

Lithics and stone tools

Figure 1. Stone flakes

Figure 2. Stone projectile points

Figure 3. Ground stone tools: (left) pestle, (right) net weights,

Basketry/Cordage

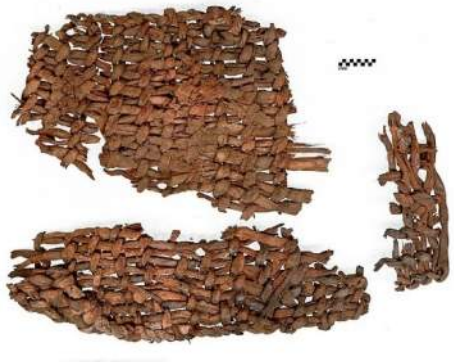


Figure 4. Open diagonal twine basket fragments from Fort Rock Cave (UOMNCH).

Figure 5. Three-strand braid, sagebrush bark from Paisley Caves (UOMNCH).

Shell Middens

Figure 6. Cross section of shell midden.

Figure 7. Dentalium shell beads (UOMNCH).

Figure 8. Glass trade beads, Upper Columbia River (UOMNCH).

Figure 9. Wooden fish weir

Figure 10. Fishing weir.

Figure 11. Close up of fishing weir.

Figure 12. Example of peeled pine.

Figure 13. Arborglyph on aspen tree

Figure 14. Historical glass

Figure 15. Historical metal artifacts

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3 – ODOT Permit No. 01M_41513

Oregon Department of Transportation

APPLICATION AND PERMIT TO OCCUPY OR PERFORM OPERATIONS UPON A STATE HIGHWAY

See Oregon Administrative Rule, Chapter 734, Division 55

PERMIT NUMBER: 01M_41513

CLASS: | KEY#:

GENERAL LOCATION

HIGHWAY NAME AND ROUTE NUMBER: OR-104 / 104 / Fort Stevens

HIGHWAY NUMBER: OR-104

COUNTY: Clatsop

BETWEEN OR NEAR LANDMARKS: From NW 13th St to 7th Ave

HWY. REFERENCE MAP:

DESIGNATED FREEWAY: ☐ YES ☒ NO

IN U.S. FOREST: ☐ YES ☒ NO

APPLICANT NAME AND ADDRESS:
City of Warrenton
45 SW 2nd St
Warrenton OR 97146

PURPOSE OF APPLICATION (TO CONSTRUCT/OPERATE/MAINTAIN)

☐ POLE LINE — TYPE: — MIN. VERT. CLEARANCE:

☐ BURIED CABLE — TYPE:

☒ PIPE LINE — TYPE: Water

☐ NON-COMMERCIAL SIGN AS DESCRIBED BELOW

☐ MISCELLANEOUS OPERATIONS AND/OR FACILITIES AS DESCRIBED BELOW

FOR ODOT USE ONLY

BOND REQUIRED: ☐ YES ☒ NO — REFERENCE: OAR 734-055-0035(2) — AMOUNT OF BOND:

INSURANCE REQUIRED: ☒ YES ☐ NO — REFERENCE: OAR 734-055-0035(1) — SPECIFIED COMP. DATE: 12/31/2025

DETAIL LOCATION OF FACILITY (For more space attach additional sheets)

MILE POINT	TO MILE POINT	ENGINEERS STATION	TO ENGINEERS STATION	SIDE OF HWY OR ANGLE OF CROSSING	DISTANCE FROM CENTER OF PVMT	DISTANCE FROM R/W LINE	BURIED CABLE OR PIPE DEPTH/VERT.	BURIED CABLE OR PIPE SIZE AND KIND	SPAN LENGTH
1.69	1.17	A23+70	A51+47	East/ North	18' to 28'	3' to 25'	42" Cover	18" PVC	2777'
1.17	1.17	A51+47	A51+97	90* Crossing	Crossing	3' to 25'	48" Cover	30" Stl Case/ 18" PVC	50'
1.17	1.17	A51+97	A52+60	South	22'	25'	42" Cover	18" PVC	63'

DESCRIPTION OF DESIRED USE

The Hammond Transmission Waterline Project Phase 1 includes the installation of approximately 4,679 linear feet (LF) of 18-in and smaller diameter water transmission waterline and related system appurtenances (i.e., fittings, valves). Of that amount, about 2,890 LF of pipeline will be installed within ODOT right-of-way along Fort Stevens Hwy (OR-104). The new pipeline will generally parallel existing waterlines within this corridor except for one crossing of OR-104. The new transmission pipeline will have 42-in of cover from top of pipe to the ground surface.

SPECIAL PROVISIONS (FOR ODOT USE ONLY)

TRAFFIC CONTROL REQUIRED

- ☒ YES [OAR 734-055-0025(6)] ☐ NO

OPEN CUTTING OF PAVED OR SURFACED AREAS ALLOWED

- ☒ YES [OAR 734-055-0100(2)] ☐ NO [OAR 734-055-0100(1)]

- **AT LEAST 48 HOURS BEFORE BEGINNING WORK, THE APPLICANT OR HIS CONTRACTOR SHALL NOTIFY THE DISTRICT REPRESENTATIVE** District 1 Office **AT PHONE NO.:** 503-325-7222 **OR EMAIL OR FAX THIS PAGE TO THE DISTRICT OFFICE AT:** ---------- N/A ---------- **. SPECIFY TIME AND DATE WORK IS TO OCCUR.**
- A COPY OF THIS PERMIT AND ALL ATTACHMENTS SHALL BE AVAILABLE AT THE WORK AREA DURING CONSTRUCTION.
- **ATTENTION: Oregon Law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0001 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at (503) 232-1987.**
  CALL BEFORE YOU DIG 1-800-332-2344

COMMENTS (FOR ODOT USE ONLY)

The City shall provide to its contractor the same plans that ODOT approved under this permit.

Applicant to Email TRIP CHECK form in 24 hours prior to any Traffic Control impacting ODOT Highways to: DPCSLMWTOC@odot.state.or.us see attached form.
Notifying the District 1 office 48 hours before work starts and Trip check are two separate actions.
Have your permit in hand as you will need information off of the permit. 503-325-7222

XX

IF THE PROPOSED APPLICATION WILL AFFECT THE LOCAL GOVERNMENT, THE APPLICANT SHALL ACQUIRE THE LOCAL GOVERNMENT OFFICIAL'S SIGNATURE BEFORE ACQUIRING THE DISTRICT MANAGER'S SIGNATURE.

LOCAL GOVERNMENT OFFICIAL SIGNATURE: X [signature] — TITLE: Public Works Director — DATE: 8/7/24

APPLICANT SIGNATURE: X Tanya Miller — APPLICATION DATE: 9/5/2024 — TITLE: City of Warrenton Engineering Technician — TELEPHONE NO.: 503-861-0913

When this application is approved by the Department, the applicant is subject to, accepts and approves the terms and provisions contained and attached, and the terms of Oregon Administrative Rules, Chapter 734, Division 55, which is by this reference made a part of this permit.

DISTRICT MANAGER OR REPRESENTATIVE: Mark Buffington — Mark BUFFINGTON (Dec 23, 2024 12:52 PST) — APPROVAL DATE: 12/23/2024

734-3457 (2/2021)

MILE POINT	TO MILE POINT	ENGINEERS STATION	TO ENGINEERS STATION	SIDE OF HWY OR ANGLE OF CROSSING	DISTANCE FROM CENTER OF PVMT	DISTANCE FROM R/W LINE	BURIED CABLE OR PIPE DEPTH/VERT.	BURIED CABLE OR PIPE SIZE AND KIND	SPAN LENGTH
1.68	1.68	A24+60	A24+60	East	30'	20'		Fire Hydrant	
1.66	1.66	A26+60	A26+60	East	24'	26'		Blow Off Valve	
1.44	1.44	A38+86	A38+86	East/North	26'	4'		Air Release Valve	
1.39	1.39	A40+94	A40+94	East/North	26'	4'		Fire Hydrant	
1.14	1.14	A54+37	A54+37	West/South	80'	20'		Air Release Valve	

Special Provisions:

☒The contractor shall go to the City who is the permit holder with any proposed changes. The City can then bring to ODOT in writing any changes they would like to propose to ODOT. All questions or changes must come to ODOT from the City.

☒The City shall insure that ODOT is supplied with a working cell number of someone who will respond to any issues that may occur after daytime working hours, to address any issue that may arise due to the city's installation. This shall be supplied to ODOT before any work begins.

☒The City and the Contractor shall contact ODOT every Monday to update ODOT with location of work and how the project is progressing.

☒ The applicant shall not work outside the permitted work schedule without prior approval for an exceptional situation. If an unforeseen situation comes up the applicant shall notify the City and ODOT by phone of the situation as soon as possible.

☒No air release valves shall be placed in a ditch section of the Highway Right of Way at any time, specifically, in a shallow ditch / swale line.

☒Only one section of this water line has been pre – approved to be placed under the ditch line between mile point 1.55 by NW 15th ST and 1.68 by NW 13th ST. This line shall not be placed less than 48" below the bottom of the natural ditch line. ODOT shall determine the depth of the natural ditch line. 10" of the top cover shall be ¾" minus.

☒Applicant to email Trip Check 48 hours prior to any work being performed in ODOT's Right of Way. DPCSLMWTOC@odot.state.or.us See the attached form. Applicant to notify the District Office 48 hours before beginning work. These are two separate actions!

☒Please have the permit in hand you will be asked for the application number, who the permit is issued to, who you are, Highway and mile point, Date you would like to start work. What your specified Comp. Date is on

this permit. In the right-hand corner on the face of the permit. specified Comp. Date: That is the last day any work can be done under this permit.

☒Erosion control devices need to be in place and kept in working order at all times during this project.

☒No staging of materials in ODOT's Right of Way.

☒Applicant is responsible for the removal of all contaminated material form ODOT Right of Way, and the proper disposal of the materials and the coast associated with that disposal.

☒ Any damage to ODOT facilities including but not limited to culverts, striping, site posts, signs, asphalt and guardrail shall be repaired by applicant at applicant's expense. Any damage or excavation of asphalt shall require applicant to repair to ODOT's "T-CUT" restoration specifications and the ODOT line to line shall also apply.

☒Applicant to insure no damage occurs to any existing ADA curb ramps or any ADA feathers. If damage occurs the applicant will be required to reconstructs to the current ADA standards at the applicant's expense.

☒In the event of adverse weather or other conditions (ice, snow, excessive rain, or slides resulting from said conditions or traffic or road related incident) ODOT crews reserve the right to stop this permitted activity to perform their necessary maintenance activities or to insure the safety of travelling public.

☒All vaults shall be installed flush to the surface of the ground. No vaults shall be placed in a driveway access in ODOT's Right of Way.

☒Any damage done to a driveway access in ODOT's Right of Way, ODOT will determine the restoration limits.

☒The city shall insure that the contractor they hire to perform this work understands while the plans were created for the complete job this permit is

only written for the phase 1, and a new permit must be applied for by the city for the remainder of this project.

Oregon Department of Transportation

GENERAL PROVISIONS FOR POLELINE, PIPELINE, BURIED CABLE, AND MISCELLANEOUS PERMITS

Revised April 2022

APPLICANT: CITY OF WARRENTON	PERMIT NO.: 01M41513
HIGHWAY: 104 FORT STEVENS	MP: 1.14 - 1.69

These permit provisions are in addition to the requirements described in Oregon Administrative Rule, Chapter 734, Division 55 and may be supplemented by permit special provisions. In the event of a conflict, the Administrative Rule will apply then these provisions followed by any permit special provisions. Unless otherwise specified, all documents referenced are references to the current version, with any revisions or supplements, in place when the work is conducted.

All checked (☒) provisions apply.

WORKSITE

☒ 1. Access control fence must be maintained during permitted work and restored to its original or better condition after permitted work is complete.

☒ 2. The Applicant shall not use state highway right of way to display advertising signs or to display or sell merchandise of any kind.

☒ 3. The stopping and parking of vehicles upon state highway right of way for the maintenance of adjoining property or in furtherance of any business transaction or commercial establishment is prohibited.

☐ 4. All grass and small brush within the work area shall be rotary or flail mowed to ground level prior to the beginning of work to facilitate clean up.

☒ 5. Disturbed areas shall be reseeded with grass native to the area in an appropriate seeding time.

☒ 6. The spreading of mud or debris upon any state highway is prohibited and violation shall be cause for immediate cancellation of the permit. Clean up shall be at the Applicant's expense. The highway shall be cleaned of all dirt and debris at the end of each work day, or more frequently as directed by the District Manager or representative.

☒ 7. Applicant shall replace any landscape vegetation or fences that are damaged or destroyed. Any damage that is not fully restored within 30 days may be replaced by ODOT at the expense of the Applicant. A "plant establishment" shall be understood to be part of the planting work to assure satisfactory growth of planted materials. The plant establishment period will begin when the original planting has been completed and approved. The length of the establishment period will be one calendar year or as defined in the permit Special Provisions.

☐ 8. Applicant shall install and maintain the landscaped area as shown on the attached drawings. Plantings shall be limited to non-invasive, low-growing shrubs, grass or flowers that do not attain sufficient height to obstruct clear vision in any direction. ODOT may remove plantings without liability or loss, injury, or damage of any nature whatsoever if in the future it is determined to be in the public interest to do so.

TRAFFIC

☒ 9. The work area shall be protected in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and the Oregon Temporary Traffic Control Handbook as supplemented or amended by ODOT.

☒ 10. For work requiring traffic control devices to be in place continuously for longer than three days, Applicant shall provide a site specific traffic control plan developed based on the principles of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and ODOT Standards. The traffic control plan may be reviewed by ODOT before work begins. The ODOT review does not relieve the Applicant of responsibility for the accuracy of the traffic control plan.

☒ 11. For permitted utility work, the Applicant shall take measures necessary to maintain the accessibility of the state highway including sidewalks and pedestrian areas by individuals with disabilities to the ODOT Americans with Disability Act (ADA) standard during the course of the work by following the Oregon Temporary Traffic Control Handbook, Section 1.6.

☒ 12. When constructing a new utility service line, Applicant shall ensure that advance notice of any temporary pedestrian route is provided in an accessible format to the public, people with disabilities, and disability organizations to the greatest extent possible. The Notice is to be sent to the organizations on the contact list of Centers for Independent Living at https://www.oregon.gov/odot/Engineering/DOCS_ADA/AOCIL-Contacts.pdf

☒ 13. All damaged or removed highway signs shall be replaced by the Applicant. Installation shall be according to MUTCD and ODOT standards, and shall be completed as soon as possible but no later than the end of the work shift.

☐ 14. No lane restrictions are permitted on the roadway during the hours of darkness, on weekends, or between 6:00 AM and 9:00 AM, or 3:00 PM and 6:00 PM (Monday through Friday) without prior approval by ODOT.

☒ 15. Hours of work shall be _____

Monday - Thursady.

No work on Friday Saturday or Sundays

8:00 am to 4:00pm

No work the day before the day after or the day of a holiday.

DRAINAGE

☐ 16. On-site storm drainage shall be controlled within the permitted property. No blind connections to existing state facilities are allowed.

☒ 17. Excavation shall not be done on ditch slopes. Trench excavation shall either be at ditch bottom or outside ditch area. (Minimum depth at bottom of ditch shall be 36 inches; minimum depth outside of ditch shall be 42 inches).

☒ 18. Only earth or rock shall be used as fill material and shall slope so as not to change or adversely affect existing drainage. Fine grade and seed the finished fill with native grasses to prevent erosion.

☐ 19. A storm drainage study stamped by an Oregon Registered Professional Engineer (PE) is required. The study must meet standards of the National Pollution Discharge Elimination Systems (NPDES) when any of the following conditions apply:

- whenever a four inch pipe is inadequate to serve the developed area,
- development site is one acre or larger in size and directly or indirectly affects state facilities, or
- as directed by the District Manager or representative.

☐ 20. Applicant shall provide on-site retention for storm water runoff that exceeds that of the undeveloped site.

☒ 21. All water discharged to an ODOT drainage system must be treated prior to discharge. All requests for connection to an ODOT storm system must meet any requirements of the National Pollutant Discharge Elimination System (NPDES). This may include local jurisdiction approval of on-site water quality treatment facilities and/or development of an operation and maintenance plan for any on-site water quality treatment facility, as determined by local jurisdiction.

EXCAVATION / CONSTRUCTION

☒ 22. "Oregon Standard Specifications for Construction" and ODOT "Standard Drawings" where applicable and not otherwise superseded by the permit, shall be incorporated for use in the permit; https://www.oregon.gov/odot/engineering/pages/index.aspx. These documents apply only to the extent they provide standards and performance requirements for work to be performed under the permit. In the event of a conflict, the permit provisions will take precedent.

☐ 23. Trench backfill shall be according to the attached typical drawing, marked as Exhibit A.

☒ 24. When open cutting of the highway is allowed, all excavation in paved areas shall be backfilled and the roadway surface patched before the end of each shift.

☒ 25. Steel plates shall be pinned and a temporary cold patch applied to the edges. The Applicant shall be responsible for monitoring and maintenance of temporary patching and steel plating.

☒ 26. Compaction tests shall be required for each open cut per Oregon Standard Specifications for Construction. Compaction tests shall be conducted once for every 300 lineal feet per lift of continuous trench according to the Manual of Field Test Procedures (MFTP), published by ODOT. Percent Compaction shall be at least 95%. Results of compaction test shall be provided upon request of the District Manager or representative at Applicants' expense.

☒ 27. Control Density Fill (CDF) shall be used as surface backfill material in place of crushed rock in open trenches that impact the travel portions of the highway. A ¾"-0, or 1"-0 rock will be used for the aggregate. The amount of cement used shall not exceed 3.0% of the total mixture's weight. Maximum compressed strengths must not exceed 250 pounds per square inch (psi).

☒ 28. Surface restoration shall be a minimum of four inches of hot asphalt-concrete (AC), compacted in two inch lifts, or to match existing pavement depth, whichever is greater. Sand-seal all edges and joints.

☒ 29. Any area of cut or damaged asphalt shall be restored in accordance with the attached "T-Cut Typical Section" drawing. For a period of two years following the patching of the paved surface, Applicant shall be responsible for the condition of the pavement patches, and during that two year period shall repair to District Manager or representative's satisfaction any of the patches which become settled, cracked, broken, or otherwise faulty.

☒ 30. An overlay to seal an open-cut area shall be completed prior to the end of the construction season, or when minimum temperature allows per the Oregon Standard Specification for Construction. The overlay shall be 1.5 inches deep and cover the affected area from edge of pavement to edge of pavement, and taper longitudinally at a fifty feet to one inch (50':1") ratio. Taper may be adjusted by the District Manager as required. For a period of two years following this patching of the paved surface, the Applicant shall be responsible for the condition of said pavement patches, and during that time shall repair to the District Manager or representative's satisfaction any of the patches which become settled, cracked, broken or otherwise faulty.

☒ 31. Highway crossings of utility lines shall be bored, or jacked. Bore pits shall be located behind the ditch line unless otherwise specified in the permit. Unattended pits shall either be protected by a six-foot fence, backfilled, or steel plated and pinned.

☒ 32. Any non-conductive, un-locatable, underground facility shall have a tracer wire or other similar conductive marking tape or device placed the full length of the installed underground facility in compliance with the Oregon Utilities Notification Center rules, OAR Chapter 952.

☒ 33. Trench backfill outside of ditch line may be native soil compacted at optimum moisture in twelve inch layers to not less than 95% relative maximum density.

☒ 34. Native material that is unsatisfactory for compaction shall be disposed of off the work site and granular backfill used.

☒ 35. Trench backfill in rock slope or shoulder shall be crushed 1"-0 or ¾"-0 size rock compacted at optimum moisture in eight-inch layers. Compaction tests shall be conducted according to the Manual of Field Test Procedures (MFTP), published by ODOT. Percent compaction shall be at least 95%maximum density. At the request of the District Manager or representative, results of compaction tests shall be provided to District Manager or representative at Applicant's expense.

☒ 36. Where excavation is on fill slope steeper than a two to one (2:1) ratio, slope protection shall be provided using four-inch size rock laid evenly to a minimum depth of twelve inches.

☒ 37. No more than 300 feet of trench longitudinally along the highway shall be left open at any one time and no trench shall be left in an open condition overnight.

☒ 38. Areas of disturbed cut and fill slopes shall be restored to a condition suitable to the District Manager or representative. Areas of erosion to be inlaid with an acceptable riprap material.

☒ 39. All underground utilities shall be installed with three-foot or more of horizontal clearance from existing or contract plans guardrail posts and attachments.

☒ 40. Any area of cut or damaged concrete shall be restored in accordance with the attached Typical Section-Pipe Section under sidewalk.

☒ 41. Utility markers, pedestals, and vaults shall be placed as near the highway right-of-way line as practical. In no case shall pedestals, vaults, and line markers be located within the area where highway maintenance activities regularly occur including mowing operations, or nearer the pavement edge than any official highway sign in the same general location.

☒ 42. No cable plowing is allowed within the lateral support of the highway asphalt (e.g. at six feet lower than the edge of the asphalt, no plowing within nine feet of the edge of the asphalt).

☐ 43. Review by the ODOT Bridge Engineer is required for all proposed bridge and structure attachments and for any facilities to be installed within sixteen feet of bridge foundations, supports, walls or related elements, or within the influence zone of bridge facilities.

MISCELLANEOUS

☒ 44. Applicant shall be responsible and liable for (1) investigating presence/absence of any legally protected or regulated environmental resource(s) in the action area; (2) determining any and all restrictions or requirements that relate to the proposed actions, and complying with such, including but not limited to those relating to hazardous material(s), water quality constraints, wetlands, archeological or historic resources(s) state and federal threatened or endangered species, etc., (3) complying with all federal, state, and local laws, and obtaining all required and necessary permits and approvals.

☒ 45. If the Applicant impacts a legally protected/regulated resource, Applicant shall be responsible for all costs associated with such impact, including, but not limited to all costs of mitigation and rehabilitation, and shall indemnify, and hold ODOT harmless for such impacts and be responsible and liable to ODOT for any associated costs or claims that ODOT may have.

☒ 46. Plans are reviewed by ODOT in general only and do not relieve the Applicant from completing roadway improvements in a manner satisfactory to ODOT. The District Manager or representative may require field changes. When revisions are made in the field, Applicant is responsible to provide "as built" drawings, within 60 days from completion of roadway improvements, and shall submit them to the District Office issuing the permit.

☒ 47. Applicant shall be responsible for locating and preserving all existing survey monumentation within the work area in accordance with ORS 209.150 and/or 209.155. If monumentation or its accessories are inadvertently or otherwise disturbed or destroyed, Applicant shall be responsible for all costs and coordination associated with its reestablishment by a professional licensed surveyor.

☒ 48. Applicant shall be responsible to restore or replace any curbs or curb ramps damaged by the permitted activity according to ODOT's ADA Standards available at https://www.oregon.gov/ODOT/Engineering/Pages/Accessibility.aspx. Any review or inspection of the curbs or curb ramps conducted by ODOT does not relieve the Applicant of the responsibility to comply with any other aspect of federal, state, and local laws, rules and regulations applicable to the work allowed under the permit including but not limited to the Americans with Disabilities Act of 1990.

☒ 49. When constructing a minor roadway improvement, Applicant shall comply with all federal, state, and local laws, regulations, executive orders and ordinances applicable to the work under this permit, including, without limitation, the provisions of ORS 276.071. If Applicant chooses to assign their permitted responsibilities to a consultant or contractor, Applicant shall inform the consultant or contractor of the requirements of ORS 276.071.

☐ 50. Upon completion of the permitted minor roadway improvement, Applicant shall notify ODOT and request final inspection. If all structures and appurtenances constructed under this permit are found to be in compliance with permit provisions and state standards, ODOT will accept ownership of the permitted structures and appurtenances by written notice to the Applicant.

By this signature Applicant acknowledges that the Applicant is subject to and accepts all checked (☒) provisions (4 pages).

Trip Check Form*

HIGHWAY MAINTENANCE AND CONSTRUCTION WORK – TO BE DONE

Please fill out this form in its entirety (if applicable) and email to

DPCSLMWTOC@odot.state.or.us

Form submitted by:	Contact Phone #:
Construction/Contractor for Project:	
Hwy Route # & Name:	
From MP	To MP

Estimated Length of Delay to the Public

No to min delay ☐	Under 20 mins ☐	~~20 mins-2 hrs ☐~~	~~Closure ☐~~	~~Closure w/Detour ☐~~

Project Dates:

Begin Date:	End Date:
Begin Time:	Completion Time:

Days of the week Traffic Impacted

Mon ☐	Tues ☐	Wed ☐	Thur ☐	~~Fri ☐~~	~~Sat ☐~~	~~Sun ☐~~

Impact to traffic:

Northbound (NB) ☐	Southbound (SB) ☐	Eastbound (EB) ☐	Westbound (WB) ☐

Lanes Affected:

A Lane ☐	B Lane ☐	C Lane ☐	D Lane ☐
On Ramp ☐	Off Ramp ☐	Continuous Turn Lane	

Traffic Control:

Flaggers ☐	Pilot Car ☐	Lane Shift ☐

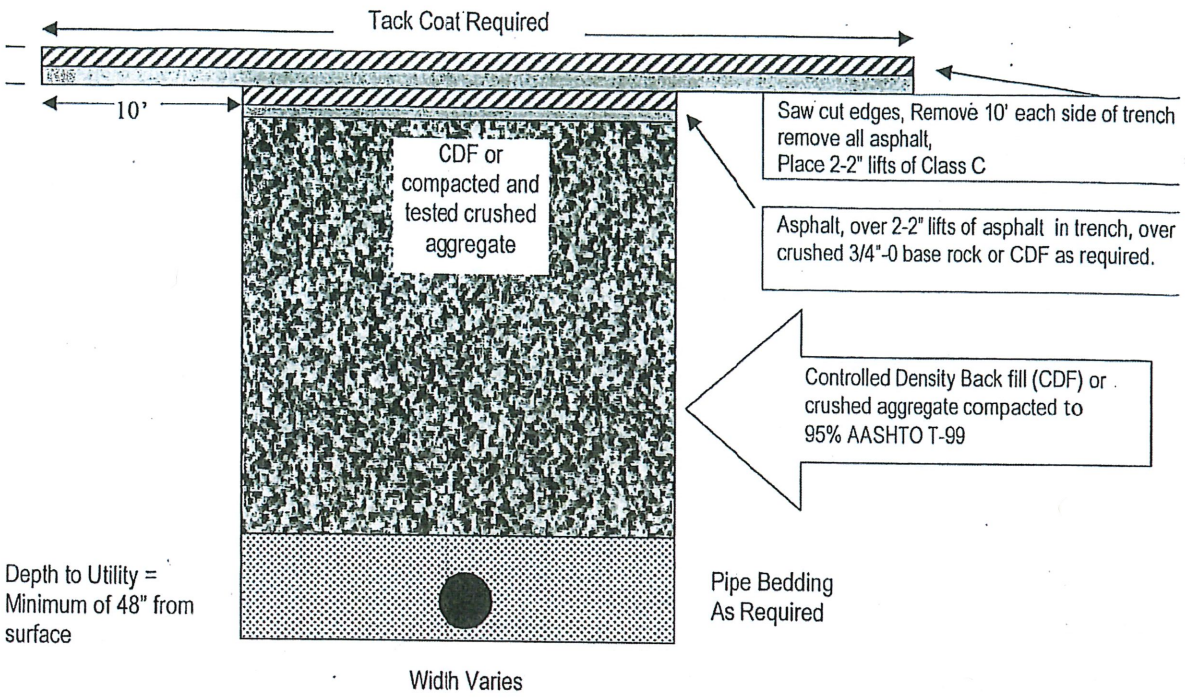
Info to be displayed on TripCheck (Including Detour if applicable)

Contact Information	Cell Phone	Work Phone	Home/Other Phone
On Scene Contact			
24 HR Emergency Contact:			
Contractor:			

Email form to DPCSLMWTOC@odot.state.or.us

Attachment B
T-Cut Typical Section
CDF or Compacted Aggregate Backfill Option

Permit # 01M_41513



Backfill Material:

If Crushed Rock is used:

Place approved compacted crushed aggregate in trench to within 8" of the top of the sub-grade compacted to a minimum of 95% of the maximum density of the material, placed in 12" maximum lifts. Results of compaction tests to be made available to ODOT.

If CDF is used:

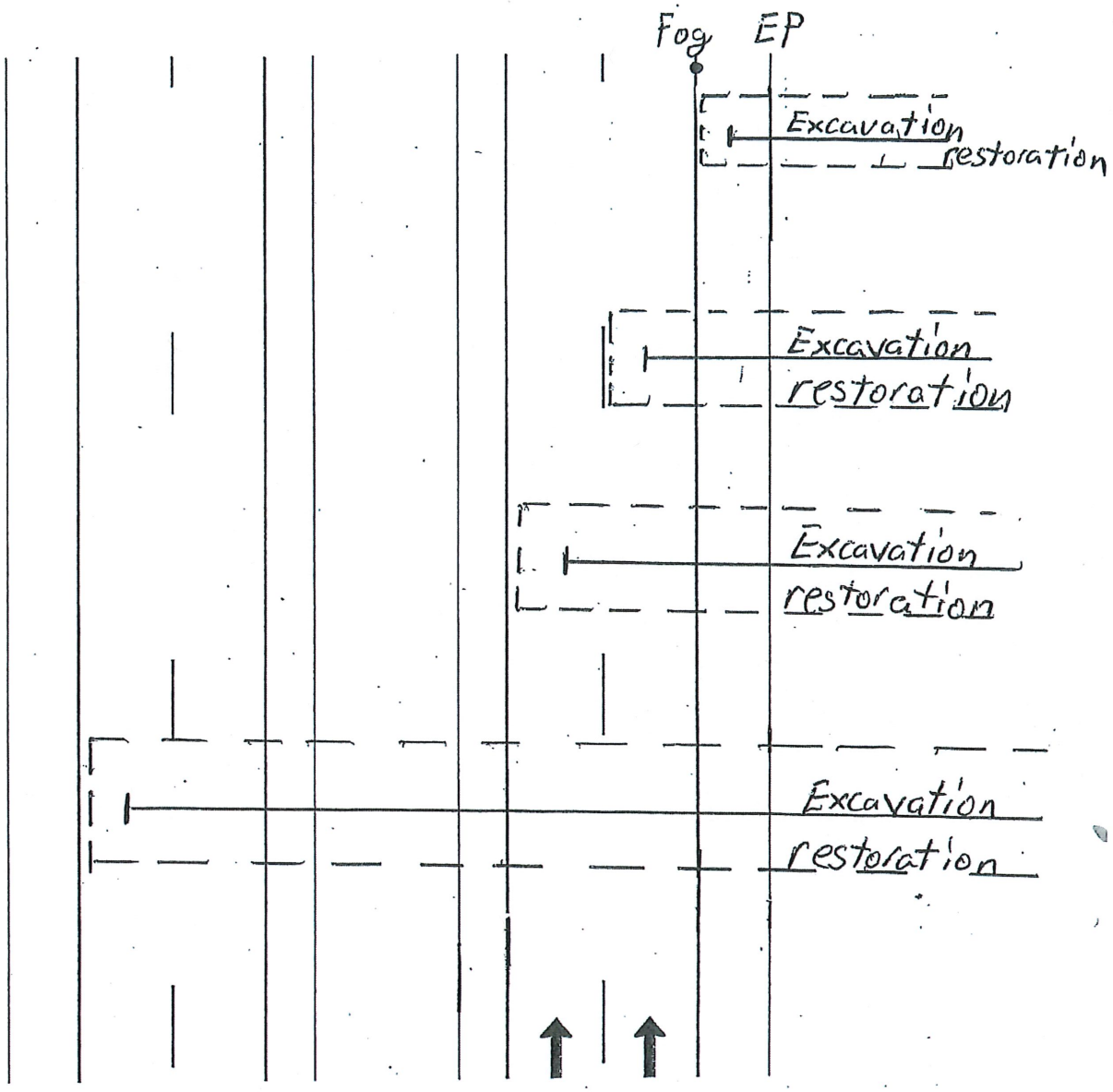
Controlled Density Fill (CDF), consists of ¾" -0 aggregate and an amount of concrete not to exceed 3% of the mixtures total mass. Do not exceed maximum compression strengths of 150 psi. Place approved CDF in trench to 8" below the roadway surface.

Apply an asphalt emulsion tack coat to all asphalt edges and ground surface. Place 2 additional lifts of Asphalt pavement in 2" compacted lifts in the T-Cut surface to grade. Provide a minimum compacted thickness of 4", or the thickness of the removed pavement, whichever is greater.

Cold Patch all cut areas at the end of each workday and maintain the patch. Hot patch damaged area within 7 days.

Restoration of cut asphalt.

A Crossed pavement line must restore to next line.



Any damaged to striping shall be replaced in kind by applicant.

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104
SEVENTH AVE
EIGHTH AVE
CHINOOK ST
TWELFTH AVE
NW 12TH PL
NW 15TH ST
NW 13TH ST
Creek
rtment of Transportation | Oregon Department of Transportation, Geographic Information Services Unit
Oregon Department of Transportation © 2009-2024

Oregon Department of Transportation

Utility Permit Cultural Resource Certification

This form is to be completed and submitted to the Oregon Department of Transportation with the *Application and Permit to Occupy or Perform Operations Upon a State Highway* when ground disturbance (directional boring, cable plowing, trenching, and digging of any kind) is proposed as part of a permit application for installation of a utility line including moving or repositioning existing lines or poles.

Applicant Information		
Applicant Name City of Warrenton		
Address 45 SW 2nd St		
City Warrenton	State OR	Zip 97146
Contact Person Name Twyla Vittetoe	Phone Number 503.861.0912	Email tvittetoe@warrentonoregon.us

Project Location Information		
Highway Name and Route Number OR-104 / 104 / Fort Stevens		
Begin MP 1.17	End MP 1.69	County Clatsop

I represent that this Certification is in support of the *Application and Permit to Occupy or Perform Operations Upon a State Highway* at the above location dated 08/22/2023, submitted to the Oregon Department of Transportation with this Certification.

I am an authorized representative of the Applicant and certify that the Applicant has reached out to the Tribe(s) identified by the Legislative Commission on Indian Services (LCIS) and verified the presence/absence of cultural resources based on information available from the State Historic Preservation Office (SHPO) for a utility installation proposed on state highway right of way that is expected to include ground disturbance (directional boring, cable plowing, trenching, and digging of any kind).

The Tribe(s) was given at least 14 calendar days to respond to the request for feedback on cultural resources in the proposed work area that may be known to the Tribe(s) but not in the SHPO database.

Based on this information, the necessary cultural resource protection clearances and permits have been, or will be, obtained for the proposed work. In addition, it is understood that this does not relieve the Applicant from its responsibility to protect cultural resources. If cultural resources are discovered during the project, work will be stopped and SHPO contacted according to SHPO regulations.

By signing below, I certify that the above statements are true and correct to the best of my knowledge.

Name (Printed)	Signature	Date
Twyla Vittetoe	Twyla Vittetoe	12/15/23

734-5394 (3/2023)

VOLUME II – DRAWINGS

SUBMITTED TO:
Consor North America, Inc.
1 SW Columbia Street, Suite 1700
Portland, OR 97204

BY:
Shannon & Wilson
3990 Collins Way, Suite 100
Lake Oswego, OR, 97035

(503) 210-4750
www.shannonwilson.com

GEOTECHNICAL ENGINEERING REPORT

Hammond Transmission Waterline
City of Warrenton

WARRENTON, OREGON

SHANNON & WILSON

August 2024

Submitted To: Consor North America, Inc.
1 SW Columbia Street, Suite 1700
Portland, OR 97204
Attn: Andrew Miles

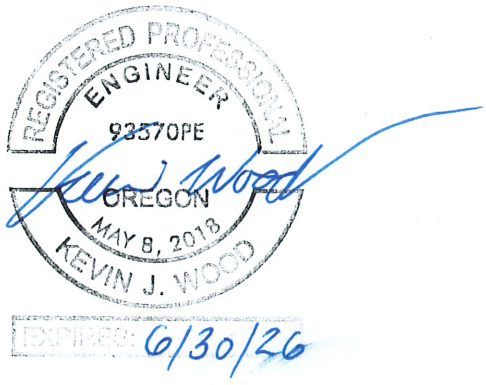
Subject: GEOTECHNICAL ENGINEERING REPORT, HAMMOND TRANSMISSION WATERLINE
CITY OF WARRENTON, WARRENTON, OREGON

Shannon & Wilson, Inc. (Shannon & Wilson) prepared this report and participated in this project as a subconsultant to Consor North America, Inc. (Consor). Our scope of services was specified in a subconsultant agreement with Consor dated September 6, 2023. This report presents the results of our field explorations and was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON



Elliott Mecham, PE
Senior Associate | Engineer

Kevin Wood, PE
Senior Engineer

EFD:KJW/aec

CONTENTS

1 Introduction 1
2 Geologic Setting 1
2.1 Regional Geology 1
2.2 Local Geology 2
2.3 Seismic Setting 2
2.3.1 Cascadia Subduction Zone: Mega-Thrust Interface Source 3
2.3.2 Cascadia Subduction Zone: Intraslab Source 3
2.3.3 Shallow Crustal Source 4
2.3.4 Quaternary Faults and Folds 4
3 Exploration Program 5
3.1 Laboratory Testing 5
4 Subsurface Conditions 6
4.1 Geotechnical Units 6
4.2 Groundwater 6
5 Geologic Hazards 7
5.1 Landslide Hazard 7
5.2 Liquefaction 7
5.2.1 Liquefaction Analysis and Liquefaction-Induced Settlement 7
5.2.2 Potential Increased Flotation Effect 8
5.3 Lateral Spreading 9
5.4 Fault Surface Rupture 9
5.5 Seismic Hazard Mitigation 9
6 Pipeline Design Recommendations and Considerations 10
6.1 Bedding, Pipe Zone and Trench Backfill 10
6.1.1 Bedding 10
6.1.2 Pipe Zone 11
6.1.3 Trench Backfill 11
6.2 Uplift Design and Potential Flotation Effects 11
7 Construction Considerations 12

CONTENTS

7.1 Groundwater Control 12
7.1.1 Sump Pumps 13
7.1.2 Wells and Well Points 13
7.1.3 Control of Surface Water 14
7.2 Temporary Pipeline Excavation Stability 14
7.3 Wet Weather Construction 15
8 Limitations 15
9 References 17

Exhibits

Exhibit 2-1: USGS Class A Faults Within an Approximate 20-Mile Radius of the Project Site. 5
Exhibit 4-1: Depth to Groundwater Summary 6
Exhibit 5-1: Summary of Liquefaction-Induced Settlement 8
Exhibit 6-1: Summary of Total and Buoyant Unit Weights 12

Figures

Figure 1: Vicinity Map
Figure 2: Site and Exploration Plan

Appendices

Appendix A: Field Explorations
Appendix B: Laboratory Test Results
Important Information

ACRONYMS

City of Warrenton	the City
Millimeters per year	mm/yr
Cascadia Subduction Zone	CSZ
Magnitude	M
Moment Magnitude	Mw
United States Geological Survey	USGS
Cone Penetration Tests	CPTs
Below ground surface	bgs
Vibrating Wire Piezometer	VWP
Controlled Low Strength Materal	CLSM
Pounds per cubic foot	pcf

1 INTRODUCTION

We understand that the City of Warrenton (the City) is planning to install an approximately 10,000 foot long, 18-inch diameter ductile iron waterline. Based on preliminary plans provided to us, the pipeline is planned to have a minimum cover that varies from 30- to 42-inches. Therefore, we anticipate that the pipeline will have an average depth of 4- to 5-feet to invert. However, profiles included in the preliminary plans provided by Consor indicate that the pipeline will be deeper in certain locations along the alignment, but still less than 10-feet to invert.

2 GEOLOGIC SETTING

2.1 Regional Geology

The Oregon Coast Range began as a mid-oceanic volcanic island chain, riding atop the ocean basaltic Kula and Juan de Fuca plates that collided with the North American continental plate during the early Eocene, 55 million years ago (Orr and others, 1992). These volcanic rocks of accreted islands form the backbone of the coastal mountains and are the oldest known rocks in the Coast Range. As the islands were accreted to North America, and the Kula and Juan de Fuca plates on which they were riding were forced beneath the continental plate, a trough was created between the ancestral Cascade Mountains and the accreted volcanic islands. During the Eocene and early Miocene, 55 to 16 million years ago, silt, sand, mud, and volcanic debris were deposited in the forearc basin and onto the subsiding accreted island chain from the landmass to the east. During the Oligocene and early Miocene, deposition over the subsiding accreted islands and the forearc basin continued from increased volcanism in the Western Cascades. During the Miocene, the ocean retreated to the west and the western edge of the North American plate wrinkled and buckled upwards by pressure from the subducting Juan de Fuca plate. Subduction of the Juan de Fuca plate under North America has pushed the Coast Range upwards and created the Coast Range physiographic province, a narrow north-south trending belt of moderately high mountains and coastal headlands, 30 to 60 miles wide and about 200 miles long, typically consisting of Tertiary marine sedimentary and volcanic rocks (Orr and others, 1992).

2.2 Local Geology

Published mapping by Walsh (1987), Niem and Niem (1985) and Schlicker and others (1972) indicates the pipeline alignment is underlain by Quaternary (from 1.8 million years ago to the present) beach sand, dune sand and flood plain alluvium silty clay. Neim and Neim (1985) describe the beach sand as consisting of well sorted, fine- to medium grained quartzo-feldspathic sands and the dune sand as well sorted, fine grained, quartzo-feldspathic sands with cross bedding.

2.3 Seismic Setting

The contemporary tectonics and seismicity of the region are the result of oblique, northeastward subduction at a rate of about 37 millimeters per year (mm/yr) (DeMets and others, 2010) of the Juan de Fuca oceanic plate beneath the North American continental plate (Wells and others, 1998; Wells and Simpson, 2001). This complex tectonic setting produces east-west compressive strain along the Cascadia Subduction Zone (CSZ), as well as northward translation and rotation of the mobile, crustal, Cascadia forearc blocks that span the leading edge of the North American plate (Wells and others, 1998; McCaffrey and others, 2007, 2013). Rotation of the Sierra-Nevada block and expansion of the Basin and Range drive the northward migration and clockwise rotation of the Cascadia forearc blocks (Pezzopane and Weldon, 1993; Wells and others, 1998; Wells and Simpson, 2001). As a result, the southern portion of the forearc, the Oregon Coast block, is impinging on western Washington and northwest Oregon at a rate of about 8 to 12 mm/yr causing crustal shortening in northwest Oregon and western Washington (Wells and others, 1998; Wells and Simpson, 2001; Mazzotti and others, 2002).

The combined effect of margin-normal subduction and margin-parallel shortening produces complex and diverse deformation within the northern edge of the Cascadia forearc and triggers large (greater than magnitude [M] 6), damaging earthquakes from three seismogenic source zones:

- The locked zone of the CSZ fault interface, which produces great mega-thrust earthquakes;
- The deep intraslab portion of the CSZ (i.e., the subducted portion of the Juan de Fuca Plate), the source of Wadati-Benioff zone earthquakes; and
- The overriding North American Plate, where shallow crustal faults rupture.

All three sources potentially produce earthquakes that impact the ground motion hazards at the project site. Offshore, elastic release of strain accumulated in the locked plate interface of the CSZ produces great megathrust earthquakes (greater than M 8.0) occurring at

irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997; Clague, 1997; Goldfinger and others, 2003 and 2012); the most recent rupture occurred in A.D. 1700 (Satake and others, 1996; Atwater and Hemphill-Haley, 1997; Clague, 1997; Yamaguchi and others, 1997; Goldfinger and others, 2003 and 2012).

Onshore, migration and rotation of tectonic blocks produce deformation along shallow faults within the upper part of the crust. At depth, rupture within the subducting slab, referred to as the intraslab, has produced some of the largest recorded earthquakes (M 6.5 to 7) to strike the Pacific Northwest, the northern California Coast, and Western Washington. However, over the past century, intraslab earthquakes have been markedly infrequent in Oregon. The following sections briefly describe the location, characteristics, and seismicity of each of the sources.

2.3.1 Cascadia Subduction Zone: Mega-Thrust Interface Source

CSZ mega-thrust earthquakes originate along the interface between the subducting oceanic plates and the North American plate. Because of the significant uncertainty of the landward extent of a potential rupture surface, estimates of the closest distance between the project and potential rupture surface range from about 5 to 40 horizontal miles. Focal depths for mega-thrust earthquakes are commonly on the order of about 15 to 25 miles. Rupture of the interface could result in earthquakes with moment magnitudes (Mw) on the order of 8.5 to over 9.0, with strong shaking that lasts for several minutes. No large earthquakes have occurred in this zone during historic times (the last 170 years). However, geologic evidence suggests that coastal estuaries have experienced rapid subsidence at various times within the last 2,000 years (Atwater, 1987; Atwater and Hemphill-Haley, 1997) as a result of tectonic movement associated with mega-thrust earthquakes on the CSZ. It appears that ruptures of this zone have occurred at irregular intervals that span from about 100 to more than 1,200 years, with an average recurrence interval of about 300 to 500 years (Atwater and Hemphill-Haley, 1997). Based on historical tsunami records in Japan (Satake and others, 1996) the most recent interplate event on the CSZ was a Mw 9 event on January 26, 1700.

2.3.2 Cascadia Subduction Zone: Intraslab Source

CSZ intraslab earthquakes originate from within the subducting oceanic plates as a result of down-dip tensional forces and bending caused by mineralogical and density changes in the plates at depth. These earthquakes typically occur 28 to 37 miles beneath the surface. The nearest seismogenic intraslab portion of the Juan de Fuca plate is approximately 30 to 60 miles below the Portland area. Ludwin and others (1991) estimate that the maximum Mw from this source zone would be about 7.5. Ground shaking produced by intraplate

earthquakes would be less intense and less prolonged in the Portland area than ground motions generated by large subduction zone interface earthquake events. Historic seismicity from this source zone includes the 1949 Mw 6.7 Olympia earthquake, the 1965 Mw 6.7 earthquake between Tacoma and Seattle, and the 2001 Mw 6.8 Nisqually earthquake. While intraslab events have occurred frequently in the Puget Sound area, they are historically rare in Oregon.

2.3.3 Shallow Crustal Source

Shallow crustal earthquakes within the North American Plate have historically occurred in a diffuse pattern within Pacific Northwest, typically within the upper 4 to 19 miles of the continental crust. The largest known crustal earthquake in the Pacific Northwest is the 1872 North Cascades earthquake at approximate Mw 6.5 to 7.0. Other examples include the 1993 Mw 5.6 Scotts Mill earthquake and the 1993 Mw 6.0 Klamath Falls earthquake.

2.3.4 Quaternary Faults and Folds

Faults and associated folds which demonstrate geological evidence of co-seismic surface deformation during the Quaternary time period in Oregon and Washington have been located and characterized by the United States Geological Survey (USGS). The USGS provides approximate fault locations and a detailed summary of available fault information in the USGS Quaternary Fault and Fold Database. The database defines four categories of faults, Class A through D, based on evidence of tectonic movement known or presumed to be associated with large earthquakes during Quaternary time (within the last 2.6 million years). For Class A faults, geologic evidence demonstrates that a tectonic fault exists and that it has likely been active within the Quaternary period. For Class B faults, there is equivocal geologic evidence of Quaternary tectonic deformation, or the fault may not extend deep enough to be considered a source of significant earthquakes. Class C and D faults lack convincing geologic evidence of Quaternary tectonic deformation or have been studied carefully enough to determine that they are not likely to generate significant earthquakes.

According to the USGS Quaternary Fault and Fold Database (USGS, 2023), there are 5 Class A features, within approximately 20 miles of the project site. Their names, general locations relative to the site, and the time since their most recent deformation are summarized in Exhibit 2-1. The CSZ itself is approximately 6 miles west of the project site, with an average slip rate of approximately 40 millimeters (1.5 inches) per year.

Exhibit 2-1: USGS Class A Faults Within an Approximate 20-Mile Radius of the Project Site

Fault Name	USGS Fault Number	Approximate Length	Approximate Distance and Direction from Project Site[1]	Slip Rate Category[2]	Time Since Last Deformation[3]
Cascadia Fold and Fault Bed	784	301 miles	5.7 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Unnamed Offshore Faults	785	174 miles	9.3 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Willapa Bay Fault Zone	592	23 miles	14.7 miles North	Between 0.2 and 1.0 mm/yr	<750 ka
Nehalem Bank Fault	789	62.8	16.9 miles West	Between 1.0 and 5.0 mm/yr	< 15 ka
Fault H	790	30.4	17.2 miles SW	Greater than 5.0 mm/yr	< 15 ka

NOTES:

[1] Approximate distance between project site and nearest extent of fault mapped at the ground surface.

[2] mm = millimeters; yr = year.

[3] Ma = "Mega-annum" or million years ago; ka = "Kilo-annum" or one thousand years ago.

3 EXPLORATION PROGRAM

Shannon & Wilson explored subsurface conditions at the project site with six Cone Penetetration Tests (CPTs), designated CPT-1 to CPT-6 and one geotechnical boring designated B-1. The CPT's were completed to depths ranging from 60.4 to 101.5 feet below ground surface (bgs) between January 23 to January 25, 2024. During explorations, a vibrating wire piezometer (VWP) was installed to allow the measurement of groundwater levels in boring B-1.

Approximate locations of the explorations are shown on the Site and Exploration Plan, Figure 2. Details of drilling, sampling procedures, and our log of the materials encountered are presented in Appendix A, Field Explorations.

3.1 Laboratory Testing

Soil samples obtained during our field exploration were transported to our laboratory for further examination. Representative samples were selected for laboratory tests. The laboratory testing program included moisture contents and grain size analyses. Laboratory testing was performed by Shannon & Wilson in accordance with applicable ASTM International (ASTM) standard test procedures. Results of the laboratory testing are presented in Appendix B and are shown on the log of the boring included in Appendix A.

4 SUBSURFACE CONDITIONS

4.1 Geotechnical Units

Shannon & Wilson grouped the materials encountered in our field explorations into two geotechnical units. The soil classifications are presented in the individual boring logs. The geotechnical units are as follows:

- **Fill:** Asphalt and Base Aggregate; and
- **Holocene Beach Sand:** Poorly Graded Sand (SP).

These geotechnical units were grouped based on their engineering properties, geologic origins, and their distribution in the subsurface. Contacts between the units may be more gradational than shown in the boring log in Appendix A.

4.2 Groundwater

Based on pore water dissipation testing in the CPTs, depth to groundwater was inferred in the CPT locations at the time of testing. Additionally, during explorations, a vibrating wire piezometer was installed to measure the groundwater level in boring B-1. The vibrating wire piezometer was installed to allow for ongoing groundwater level measurements. A summary of groundwater measurements is provided in Exhibit 4-1.

Exhibit 4-1: Depth to Groundwater Summary

Exploration (Method)	Date	Depth of Water (ft)	Approximate Ground Surface Elevation (ft)	Approximate Groundwater Elevation (ft)
B-1	1/23/2024	2.8	11.4	8.6
CPT-1 (PWD_1)	1/25/2024	8.93	14.5	5.6
CPT-2 (PWD_1)	1/24/2024	3.62	9.6	6.0
CPT-3 (PWD_1)	1/24/2024	4.90	13.6	8.7
CPT-4 (PWD_1)	1/24/2024	1.02	10.1	9.1
CPT-5 (PWD_1)	1/25/2024	5.40	11.4	6.0
CPT-6 (PWD_1)	1/23/2024	2.39	12.8	10.4

NOTES:

[1] Measurement inferred from Pore Water Dissipation Test in Cone Penetrometer (PWD)

Groundwater levels should be expected to vary with changes in topography and precipitation. Generally, groundwater highs occur at the end of the wet season in late spring or early summer, and groundwater lows occur towards the end of the dry season in the early to mid-fall.

5 GEOLOGIC HAZARDS

5.1 Landslide Hazard

According to the Oregon Department of Geology and Mineral Industries, no landslides have been mapped along the proposed pipeline alignment. Relative earthquake hazard maps prepared for coastal communities by DOGAMI (IMS-10) indicate that the proposed alignment is in an area of low landslide hazard. Based on the site topography and mapped landslide hazard, we consider the risk of earthquake induced landslides impacting the proposed pipeline to be low.

5.2 Liquefaction

Soil liquefaction is a phenomenon in which excess pore water pressure of loose to medium dense, saturated, granular soils increases during ground shaking to a level near the initial effective stress. The increased excess pore pressure results in a reduction of soil shear strength. The effects of liquefaction typically include lateral spreading, slope instability, and ground settlement.

Soil behavior under seismic loading is the primary factor in determining the susceptibility of soil to liquefaction. Important factors in evaluating soil behavior are relative density, the fines content (percent of soil by weight smaller than 0.075 millimeters, passing the No. 200 sieve), and the plasticity characteristics of the fines. Relative density can be estimated from CPT tip resistances and shear wave velocity measurements that were performed for this project. We completed grain size analyses to evaluate the index parameters of the soils at the site.

5.2.1 Liquefaction Analysis and Liquefaction-Induced Settlement

We evaluated liquefaction potential of the soils based on the boring and CPT results completed for this study. The CPT soundings were evaluated using the computer program CLiq Version 2 by GeoLogismiki, which incorporates the Boulanger and Idriss (2014) method. Our analysis was completed using a peak ground acceleration (PGA_M) of 0.8g and a mean Mw 8.89, based on the total seismic source contribution, according to USGS's Unified Hazard Tool with a 2,475-year return period. Exhibit 5-1 presents a summary of liquefaction induced settlement under the proposed pipeline.

Exhibit 5-1: Summary of Liquefaction-Induced Settlement

Exploration ID	Approximate Pipe Invert Elevation (feet)	Approximate Elevations of Liquefaction Susceptible Soils (feet)	Approximate Total Settlement at Pipe Invert[1] (inch)
CPT-1	6	4 to -46	1.5
CPT-2	6	4 to -51	2.5
CPT-3	6	8.5 to -46.5	3.0
CPT-4	6	8 to -50	2.0
CPT-5	6	6 to -48.5	3.5
CPT-6	6	10 to -47.5	3.0

Liquefaction-induced settlement magnitudes based on CPT soundings were estimated using Boulanger and Idriss (2014).

Soil deposits are not homogeneous; and liquefaction-induced settlement seldom occurs uniformly, even in small, localized areas (Ishihara and Yoshimine 1992), making differential settlements difficult to predict. Based on the available data and considering the range of liquefaction-induced settlement for the borings and CPT soundings along the proposed alignment, it is our qualitative assessment that the average liquefaction-induced differential settlement of the pipeline for the design earthquake ground motions will likely be less than or equal to approximately 1 inch in 500 feet.

We anticipate the estimated settlements could impact the buried pipeline that will be within or above the identified potentially liquefiable layers. Consequently, we recommend the designers of these structures consider the liquefaction-induced settlements.

5.2.2 Potential Increased Flotation Effect

The proposed pipelines within the identified potentially liquefiable soil layers will be subjected to increased buoyance forces beyond those during static conditions due to the dramatic increase in the pore water pressure associated with soil liquefaction.

The assessment of potential flotation of the pipeline from liquefaction involves determining if sufficient resistance to buoyancy forces is provided by the weight of the pipelines and resistance of the surrounding soil to uplift. We recommend the risk for flotation be evaluated during final design based on the specific pipeline and structure embedment within the liquefiable soil. Seismic mitigations for potential pipeline flotation are discussed

in Section 5.5 with additional guidance on the unit weight of various backfill materials and buoyant unit weight of soil in Section 6.2.

5.3 Lateral Spreading

Lateral spreading hazards can exist in areas with mild slopes adjacent to a much steeper slope or vertical face. Lateral spreading failure can occur if soil liquefaction develops during a seismic event and the ground acceleration (inertial force) briefly surpasses the yield acceleration (shear strength) of the liquefied soil. This can cause both the liquefied soil and an overlying non-liquefied crust of soil to displace laterally down mild slopes or towards an embankment face. The displacements are cumulative and permanent in nature.

The proposed pipeline alignment is approximately 750 to greater than 1,000 feet from the nearest free face. Based on the distance to the free face and the presence of existing infrastructure between the site and the Columbia River, the potential for lateral spreading to impact the pipeline is low.

5.4 Fault Surface Rupture

As presented in Exhibit 2-1, the closest mapped fault to the site is mapped approximately 5.7 miles west of the proposed alignment. Consequently, it is our opinion that the risk of surface fault rupture along the alignment is low during a design life of 100 years or less.

5.5 Seismic Hazard Mitigation

Where liquefied soil buoyant forces could cause flotation along the pipeline, mitigation strategies largely consist of protecting the pipeline with weighted pipe, such as encasements, or anchoring the pipeline with special foundation systems. For mitigation of differential settlements, lateral forces, and permanent ground displacements, potential measures consist of the selection of appropriate pipe materials and joints capable of withstanding predicted movements, and the use of specialized earthquake-resistant pipe and joints, as necessary.

Seismic mitigation for flotation of pipelines may include the use of backfilling with Controlled Low Strength Material (CLSM) above the pipeline. If CLSM is used, it will result in additional lateral forces on the pipeline during placement of the CLSM; therefore, we recommend consideration be given to the other methods, or very specific restrictions are placed on lift thickness and allowable time for setup of the CLSM before additional lifts are placed during construction.

6 PIPELINE DESIGN RECOMMENDATIONS AND CONSIDERATIONS

6.1 Bedding, Pipe Zone and Trench Backfill

The following are recommendations for pipe bedding, pipe zone, trench backfill, foundation (subgrade) preparation, and soil stiffness properties for pipe design. The recommendations below are consistent with the City of Warrenton Engineering Design Standards, which follow the 2018 Oregon Standard Specifications for Construction requirements for bedding, pipe zone, and trench backfill.

6.1.1 Bedding

The pipe bedding zone in the trench should be constructed with imported, well-graded, clean crushed rock material suitable for compaction and allowing for flexible joints. The on-site excavation spoils will be predominantly graded sands that are not suitable for use as bedding material. The bedding material should consist of imported, ¾-inch-minus crushed aggregate, as specified in the current Oregon Standard Specification for Construction, Item 00405.12, Bedding. Provided that the subgrade soil is competent, and is not disturbed by the excavation equipment, the minimum thickness of granular bedding below the invert of the pipeline should be 6 inches for 18-inch diameter pipelines in accordance with Oregon Standard Drawing RD300.

In areas where wet, weak, or disturbed subgrade conditions are encountered, the required subgrade stabilization (subgrade overexcavation/replacement) will likely result in thicker pipe bedding. During our explorations, soft clay soils were encountered in the pipe zone in CPT-1, CPT-4 and CPT-6. Additionally, high groundwater is expected at various locations along the alignment. For estimating purposes, in high groundwater areas we recommend planning for installation of a crushed rock drainage layer at a minimum. The crushed rock drainage layer should be at least 12 inches thick and installed below the pipe bedding to facilitate dewatering, such as engineered sump pumping from within this drainage layer to maintain groundwater within this layer. To prevent soils fines from migrating into the drainage layer during sump pumping (described below), we recommend a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent), be placed between the subgrade soils and the bottom of the drainage layer and on the sides of the drainage layer. We recommend that the actual amount of over-excavation and additional work related to the acceptance of the subgrade be determined in the field, observed, and approved by a qualified Owner's Representative.

The drainage layer should be constructed with open, free-draining crushed rock materials with a 1½- to 3/4-inch gradation, conforming to Oregon Standard Specifications for Construction (OSSC 2018, 00430.11). The crushed rock for the working mat/drainage system should also have less than 2 percent by weight passing the No. 200 wet sieve; and 90 percent of particles by weight retained on the U.S. No. 4 sieve should have at least two fractured faces. In areas where the drainage rock described above is used, the material can also serve as the pipe bedding.

If native soil migration or softening of the native subgrade soils is observed during construction, or is a result of construction activities, we recommend a non-woven geotextile such as Mirafi 140N, Amoco Style 4550 (or equivalent), be placed between the subgrade soils and the bedding layer.

6.1.2 Pipe Zone

For the pipe zone material, bedding material specified in OSSC 2018, Item 00405.12, should be used for flexible pipes. In accordance with Oregon Standard Drawing RD300 the pipe zone materials should extend at least 12 inches above the top of an 18-inch pipe, or as determined by the manufacturer or civil engineer. Pipe zone compaction should be at least 90 percent of maximum density, as determined by a proctor, conforming to AASHTO T99.

6.1.3 Trench Backfill

Within roadways, shoulders, and settlement sensitive areas we recommend the use of ¾-inch-minus crushed aggregate, with less than 7 percent by dry weight passing a U.S. Standard No. 200 Sieve, and it should meet OSSC 2024 00405.14 (Class B Backfill). We recommend the backfill be compacted to at least 95 percent of the maximum dry density, as determined by AASHTO T 99 or as recommended by the civil engineer.

In non-settlement sensitive areas Class A Backfill may be used. We recommend the backfill be compacted to at least 90 percent of the maximum dry density, as determined by AASHTO T 99. If native topsoil was present prior to excavation in non-paved areas, then it should be replaced within the upper 12-inches of the adjacent ground surface. The topsoil should be mounded over the trench to allow for settlement.

6.2 Uplift Design and Potential Flotation Effects

The assessment of potential pipeline flotation from liquefaction involves determining if enough resistance to buoyancy forces is provided by the weight of the pipeline and contents, and resistance of the surrounding soil to pipeline uplift. We recommend the risk

for flotation be evaluated based on the specific pipeline embedment within the liquefiable soil. For the discussion on seismic mitigation for flotation, please refer to Section 5.54.6.

For preliminary evaluation purposes, the project structural engineer can evaluate flotation hazards by treating the liquefied soil as a heavy viscous fluid with a unit weight of 95 pounds per cubic foot (pcf). The depth of the fluid can be taken as the distance from the design groundwater elevation to the bottom of the pipeline. Exhibit 6-1 summarizes the total and buoyant unit weights for the various native and imported backfill materials.

Exhibit 6-1: Summary of Total and Buoyant Unit Weights

Material	Total Unit Weight, γ (pcf)	Buoyant Unit Weight, γ' (pcf)
Native Backfill	110	47
Crushed Rock Backfill	130	67
Controlled Low Strength Material (CLSM)	145	83
Liquefied Native Soil	--	95

7 CONSTRUCTION CONSIDERATIONS

7.1 Groundwater Control

We understand that the proposed alignment will typically be installed using open-cut construction methods. In general, the majority of the open cut excavations will be made through graded sands with a portion of the excavation below the water table. In areas where graded sands are present and the excavations are 1 to 3 feet below the water table, we anticipate dewatering can generally be handled by internal sump pumps inside the trench excavation, pumping from within the drainage layer described in Section 6.1.1. In excavations 3 to 12 feet below the water level, an active dewatering system outside the trench should be considered necessary, such as wells or well-points. Wells or well-points mitigate the potential for running soils by reducing pore water pressure buildup in the soil and will also help to stabilize the subgrade especially for excavations that may be near the contact between the fine-grained alluvium gravelly terrace deposits. Running soils could soften, disturb, or weaken the subgrade and could result in long term settlements of the pipeline. Additional details regarding typical external dewatering systems is presented in Section 7.1.2.

Our recommended approach for evaluating the subsurface soil and groundwater conditions prior to performing the excavations is to dig test pits (or perform potholes or install additional observation wells near the proposed alignment) approximately 6 to 8 weeks prior

to the start of excavating. Test pits are likely to provide the most benefit as they will provide relevant information of not only the groundwater depth, but also on the overall stability of the excavation and subgrade conditions. Test pits should be performed to a similar depth as the planned open-cut excavations and at spacings of 400 to 500 feet. The test pits would give further indication of the plasticity of the soil, allowing City representatives and the contractor to visually evaluate the depth and potential adverse effects of groundwater for a particular construction period and to evaluate the potential need for external dewatering systems, for excavation and subgrade instability, and subgrade stabilization depths. If active dewatering is found to be necessary based on the test pit excavations, then we would still recommend supplementing the active dewatering system with internal sump pumps operating within the drainage layer.

We recommend the construction contract documents be prepared in such a way as to accommodate the groundwater control decisions, type of external dewatering systems, and unit price methods of payment during construction.

7.1.1 Sump Pumps

We recommend incorporating a drainage layer into the trench excavation. The sump pumps should be installed at sufficient spacing to keep the groundwater level within the drainage rock layer.. Additional details regarding the recommended drainage layer is discussed in Section 6.1.1.

7.1.2 Wells and Well Points

External dewatering systems, such as wells and well points, should be designed by the Contractor to draw groundwater levels down to below the bottom of the excavations where required during construction. External dewatering will help prevent disturbance and instability of the surrounding soil during excavation and construction of permanent facilities, which would likely lead to constructability issues and short- and long-term settlement.

The contractor should retain the services of a specialized dewatering subcontractor to design and oversee the installation, operation, and removal of the dewatering systems. The type of dewatering system (i.e., vacuum wellpoints and/or dewatering wells) and the spacing and depth of dewatering system components will depend on the contractor's dewatering system design. However, we anticipate, based on the variability of the soils to be dewatered, vacuum well-points may need to be installed on 5- to 6-foot centers. If dewatering wells are selected, we anticipate they may need to be spaced between 20 and 30 feet.

Vacuum well-points or dewatering wells should be developed immediately upon completion using methods such as over-pumping until a visibly clear discharge is achieved and the specific capacity of the wells reaches a minimum level.

Observation wells should be installed close to the trench to measure groundwater depths and to confirm that the target groundwater drawdown has occurred before beginning trench excavation below the groundwater levels. The observation wells should be developed as part of the installation procedure to enable reliable groundwater level measurements to be made. Observation wells installed before the dewatering system can be utilized to observe subsurface soils and static groundwater conditions. However, our recommended approach for evaluating the subsurface conditions ahead of the construction is discussed in Section 7.1.

7.1.3 Control of Surface Water

Surface water should be controlled/redirected so as not to allow it to flow into open excavations. Any water collected, as well as any excavated soil, should be treated and disposed of in a manner meeting local, state, and federal environmental regulations and requirements.

7.2 Temporary Pipeline Excavation Stability

The majority of the trench excavation can be accomplished with a suitably designed trench shield (often referred to as trench boxes), designed or selected by the Contractor, provided the dewatering recommendations prepared in our report are implemented and excavations are less than approximately 10 feet in depth.

Note that while trench boxes are typically used for shallow pipeline installations in the type of soil encountered in our explorations above the groundwater table, they do not provide full-time lateral support for the excavation sidewalls and are typically solely for worker safety. Therefore, excavation sidewalls may still experience sloughing or instability, which could cause damage to existing adjacent infrastructure near the excavation, including adjacent pavement, pipelines or culverts.

If caving, sloughing, or raveling is a potential and/or observed for any excavations, we would recommend that the voids between the sidewalls and the shoring should be immediately backfilled with crushed rock to prevent trench side wall instability and undermining of existing utilities or pavement sections. The voids should be filled with 3/4-inch minus imported crushed rock materials (OSSC, 2018 Item 00405.12) immediately after the trench box is placed to maintain tight contact to the sidewall soils.

We are providing the above information and opinions solely as a service to our client. Under no circumstances should the information provided, and opinions expressed above, be interpreted to mean that Shannon & Wilson is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

7.3 Wet Weather Construction

Excavation and construction operations may expose the on-site soils to inclement weather conditions. The stability of exposed soils may rapidly deteriorate due to a change in moisture content (i.e., wetting or drying) or the action of heavy or repeated construction traffic. Accordingly, excavations should be adequately protected from the elements and from the action of repetitive or heavy construction loadings.

8 LIMITATIONS

The analyses, interpretations, conclusions, and recommendations contained in this report are based on site conditions as they presently exist and further assume that the explorations are representative of the subsurface conditions throughout the site; that is, the subsurface conditions everywhere are not significantly different from those disclosed by the current explorations. If future phases of work at the site uncover subsurface conditions different from those encountered in these explorations, we should be advised at once so that we can review these encountered conditions and reconsider our interpretations and conclusions, where necessary. If there is a substantial lapse of time between the submission of this report and the start of future phases of work at the site, or if conditions have changed because of natural forces or construction operations at or adjacent to the site, we recommend that we review our report to determine the applicability of the conclusions and recommendations.

Within the limitations of scope, schedule, and budget, the analyses, interpretations, conclusions, and recommendations presented in this report were prepared in accordance with generally accepted professional geotechnical engineering principles and practice in this area at the time this report was prepared. We make no other warranty, either express or implied. These interpretations and conclusions were based on our understanding of the project as described in this report and the site conditions as observed previously and at the time of our current explorations.

This report was prepared for the exclusive use of Consor, and the City of Warrenton, as covered in this report. During future phases of work involving construction, the data contained in this report should be provided to the contractors for their information, but our

report interpretations, conclusions, and recommendations should not be construed as a warranty of subgrade conditions as included in this report, and should not used as a basis for contractor bidding.

The scope of this report did not include environmental assessments or evaluations regarding the presence or absence of wetlands, or hazardous or toxic substances in the soil, surface water, groundwater, or air, on or below or around this site, or for the evaluation or disposal of contaminated soils or groundwater should any be encountered.

Shannon & Wilson, Inc., has prepared and included, "Important Information About Your Geotechnical/Environmental Report," to assist you and others in understanding the use and limitations of this report.

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Hammond Transmission Waterline
Warrenton, Oregon

VICINITY MAP

August 2024 112242

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FIG. 1

Filename: P:\GIS\PDX\112000s\112242_City of Warrenton Hammond\Avmxd\VicinityMap.mxd Date: 2/1/2024 Login: AEH

LEGEND

CPT-1 Designation and Approximate Location of Cone Penetration Test (CPT)

B-1 Designation and Approximate Location of Boring with Vibrating Wire Piezometer

Proposed Alignment

0 375 750 1,500

Scale in Feet

NOTES

1. Aerial imagery obtained through Google Maps Satellite.
2. Contours were derived from 2010 LiDAR data obtained through DOGAMI.
3. Existing features from file 231023_MB&G ETransmit.dwg, provided by Consor on January 30, 2024.
4. Proposed alignment from file 231023_MB&G ETransmit.dwg, provided by Consor on January 30, 2024.

Hammond Transmission Waterline
Warrenton, Oregon

SITE AND EXPLORATION PLAN

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GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

Filename: P:\GIS\PDX\112000s\112242_City of Warrenton Hammond\Avmxd\SitePlanLS_overview.mxd Date: 2/12/2024 Login: KJW

APPENDIX A: FIELD EXPLORATIONS

Appendix A
Field Explorations

CONTENTS

A.1 General....1
A.2 Drilling....1
A.2.1 Direct Push....1
A.3 Cone Penetration Test (CPT) Results....1
A.3.1 General....1
A.3.2 Cone Penetration Testing....2
A.3.3 CPT Logs....2
A.4 Material Descriptions....2
A.5 Drill Logs....3
A.6 Borehole Installations....3
A.6.1 Vibrating Wire Piezometers....3

Figures

Figure A1: Soil Description and Log Key
Figure A2: Log of Boring B-1
Figure A3: Boring B-1 Photographs

Attachments

CPT Sounding CPT-1
CPT Sounding CPT-2
CPT Sounding CPT-3
CPT Sounding CPT-4
CPT Sounding CPT-5
CPT Sounding CPT-6

APPENDIX A: FIELD EXPLORATIONS

A.1 GENERAL

The geotechnical field exploration program included six cone penetration tests (CPTs), designated CPT-1 to CPT-6 and one geotechnical boring, designated B-1. A vibrating wire piezometer (VWP) was installed in boring B-1. Completed boring locations were measured in the field and are shown on the Site and Exploration Plan, Figure 2. Shannon & Wilson geology and engineering staff were present during the drilling of the geotechnical borings and borehole installations to locate the drilling sites, log the materials encountered, and collect soil samples.

This appendix describes the techniques used to advance and sample the borings and presents logs of the materials encountered.

A.2 DRILLING

One geotechnical boring designated B-1 was completed adjacent to CPT-5. The boring was completed to a depth of 15-feet below ground surface (bgs) with a track-mounted Geoprobe 6622CPT drilling rig operated by Oregon Geotechnical Explorations, Inc. (OGE), of Keizer, Oregon. The approximate locations are shown in the attached Figure 2, Site and Exploration Plan.

A.2.1 Direct Push

The boring CPT-5a was complete using a direct push drilling method where vehicle weight and percussive force are used to advance the drilling rod. Continuous disturbed samples were collected in the boring with a 2-inch plastic sheath. All samples were visually identified and described in the field, sealed to retain moisture, and returned to our laboratory for additional examination and testing.

A.3 CONE PENETRATION TEST (CPT) RESULTS

A.3.1 General

The field exploration program as part of this study included a total of four Cone Penetration Tests (CPTs), designated CPT-1 to CPT-6, performed along the path of the proposed pipeline. The approximate locations are shown in the attached Figure 2, Site and Exploration Plan. The CPTs were completed to a depth of between 60.4 to 101.5 feet bgs and were completed by OGE between January 23, and January 25, 2024.

A.3.2 Cone Penetration Testing

OGE pushed the CPTs using a truck-mounted CPT rig. In some instances, a track-mounted Geoprobe 6622CPT was used to predrill through asphalt layers or gravel. During a CPT, a specialized cone assembly at the end of a steel probe is hydraulically pushed down through the subsurface. The cone assembly contains load cells and associated strain gauges which monitor the deformation of the load cells. One set of load cells deforms with increasing resistance to cone tip penetration. Another set of load cells deforms with increasing frictional resistance encountered on a sleeve on the outside of the assembly.

The cone assembly also contains a piezometer, which measures pore pressure. Pore pressure is useful in estimating soil behavior type because penetration has varying effects on pore pressure, depending on the type of material being penetrated. Data from the strain gauges and from the piezometer is transmitted from the cone assembly back through extension rods to the CPT recording device via a cable. Analysis software using industry-standard calculations then convert the raw data signals from the instruments into tip resistance, skin friction, and pore pressure. The same software applies correlations to the processed data to estimate the soil type and equivalent Standard Penetration Test (SPT) N-value.

A.3.3 CPT Logs

All CPT data was reduced and correlated by OGE. Summary graphic and numeric logs of the CPT data, prepared by OGE, are attached to the end of this appendix. Logs include depth in feet, tip resistance (Qt) in tons per square foot, local friction (Fs) in tons per square foot, friction ratio (Fs/Qt) expressed as a percentage, pore pressure (Pw) in pounds per square inch, estimated soil behavior type, and estimated SPT N-value (N60).

A.4 MATERIAL DESCRIPTIONS

Soil samples were described and identified visually in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Consistency, color, relative moisture, degree of plasticity, and other distinguishing characteristics of the samples were noted. Once transported to Shannon & Wilson, the SPT and hand grab samples from the hand auger were re-examined and the field descriptions, and identifications were modified where necessary. The specific terminology used is defined in the Soil Description and Log Key, Figure A1.

A.5 DRILL LOGS

The summary logs of the borings are presented in the Logs of Borings, Figure A2. Material descriptions and interfaces on the logs are interpretive, and actual changes may be gradual. The left-hand portions of the logs show individual sample intervals, percent recovery, SPT data, and natural moisture content measurements. Material descriptions and geotechnical unit designations are shown in the center of the boring logs, and the right-hand portions provides a graphic log, miscellaneous comments, and a graphic depicting hole installation and backfill details.

A.6 BOREHOLE INSTALLATIONS

A vibrating wire pressure transducer was installed to allow for ongoing measurements of groundwater levels. Installation details are discussed below and shown graphically on the Logs of Borings.

A.6.1 Vibrating Wire Piezometers

A vibrating wire pressure transducer (Geokon model 4500S) was installed in boring B-1 to allow for ongoing groundwater level measurements. A vibrating wire pressure transducer (VWP) measures pressure using a pressure-sensitive diaphragm with a vibrating wire element attached to it. A cable runs from the transducer to the ground surface, where a readout device can be attached. Pressure acting on the outside face of the diaphragm causes it to deflect, which changes the tension of the wire element and the frequency of its vibration. The readout device measures the frequency of the induced vibration, which is converted to pressure, or head of groundwater above the transducer. The vibrating wire pressure transducer was permanently grouted into place in the borehole. The instrument was taped to a measured length of polyvinyl chloride (PVC) pipe to control the depth of installation. Prior to insertion, an initial "zero" reading was taken at "zero" head. With the transducer and PVC pipe in place, the hole was tremie grouted with bentonite cement grout. The cable leading up from the transducer is protected at the surface by a flush-mount monument set in concrete. The VWP installation depth is indicated on the boring log.

Shannon & Wilson, Inc. (S&W), uses a soil identification system modified from the Unified Soil Classification System (USCS). Elements of the USCS and other definitions are provided on this and the following pages. Soil descriptions are based on visual-manual procedures (ASTM D2488) and laboratory testing procedures (ASTM D2487), if performed.

S&W INORGANIC SOIL CONSTITUENT DEFINITIONS

CONSTITUENT[2]	FINE-GRAINED SOILS (50% or more fines)[1]	COARSE-GRAINED SOILS (less than 50% fines)[1]
Major	***Silt, Lean Clay, Elastic Silt,*** or ***Fat Clay***[3]	***Sand*** or ***Gravel***[4]
Modifying (Secondary) Precedes major constituent	30% or more coarse-grained: ***Sandy*** or ***Gravelly***[4]	More than 12% fine-grained: ***Silty*** or ***Clayey***[3]
Minor Follows major constituent	15% to 30% coarse-grained: ***with Sand*** or ***with Gravel***[4]	5% to 12% fine-grained: ***with Silt*** or ***with Clay***[3]
	30% or more total coarse-grained *and* lesser coarse-grained constituent is 15% or more: ***with Sand*** or ***with Gravel***[5]	15% or more of a second coarse-grained constituent: ***with Sand*** or ***with Gravel***[5]

[1]All percentages are by weight of total specimen passing a 3-inch sieve.
[2]The order of terms is: *Modifying Major with Minor*.
[3]Determined based on behavior.
[4]Determined based on which constituent comprises a larger percentage.
[5]Whichever is the lesser constituent.

MOISTURE CONTENT TERMS

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, from below water table

STANDARD PENETRATION TEST (SPT) SPECIFICATIONS

Hammer:	140 pounds with a 30-inch free fall. Rope on 6- to 10-inch-diam. cathead 2-1/4 rope turns, > 100 rpm
Sampler:	10 to 30 inches long Shoe I.D. = 1.375 inches Barrel I.D. = 1.5 inches Barrel O.D. = 2 inches
N-Value:	Sum blow counts for second and third 6-inch increments. Refusal: 50 blows for 6 inches or less; 10 blows for 0 inches.

NOTE: Penetration resistances (N-values) shown on boring logs are as recorded in the field and have not been corrected for hammer efficiency, overburden, or other factors.

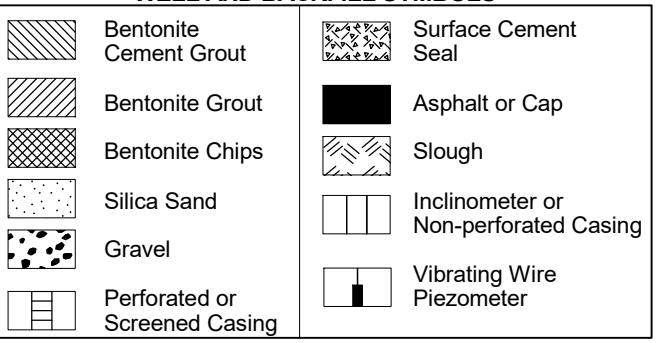
PARTICLE SIZE DEFINITIONS

DESCRIPTION	SIEVE NUMBER AND/OR APPROXIMATE SIZE
FINES	< #200 (0.075 mm = 0.003 in.)
SAND	
Fine	#200 to #40 (0.075 to 0.4 mm; 0.003 to 0.02 in.)
Medium	#40 to #10 (0.4 to 2 mm; 0.02 to 0.08 in.)
Coarse	#10 to #4 (2 to 4.75 mm; 0.08 to 0.187 in.)
GRAVEL	
Fine	#4 to 3/4 in. (4.75 to 19 mm; 0.187 to 0.75 in.)
Coarse	3/4 to 3 in. (19 to 76 mm)
COBBLES	3 to 12 in. (76 to 305 mm)
BOULDERS	> 12 in. (305 mm)

RELATIVE DENSITY / CONSISTENCY

COHESIONLESS SOILS		COHESIVE SOILS	
N, SPT, BLOWS/FT.	RELATIVE DENSITY	N, SPT, BLOWS/FT.	RELATIVE CONSISTENCY
< 4	Very loose	< 2	Very soft
4 - 10	Loose	2 - 4	Soft
10 - 30	Medium dense	4 - 8	Medium stiff
30 - 50	Dense	8 - 15	Stiff
> 50	Very dense	15 - 30	Very stiff
		> 30	Hard

WELL AND BACKFILL SYMBOLS



PERCENTAGES TERMS [1, 2]

Trace	< 5%
Few	5 to 10%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

[1]Gravel, sand, and fines estimated by mass. Other constituents, such as organics, cobbles, and boulders, estimated by volume.

[2]Reprinted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

SHANNON & WILSON, INC.
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FIG. A1
Sheet 1 of 3

2013 BORING_CLASS1 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)
(Modified From USACE Tech Memo 3-357, ASTM D2487, and ASTM D2488)

MAJOR DIVISIONS			GROUP/GRAPHIC SYMBOL		TYPICAL IDENTIFICATIONS
COARSE-GRAINED SOILS *(more than 50% retained on No. 200 sieve)*	Gravels *(more than 50% of coarse fraction retained on No. 4 sieve)*	Gravel *(less than 5% fines)*	GW		Well-Graded Gravel; Well-Graded Gravel with Sand
			GP		Poorly Graded Gravel; Poorly Graded Gravel with Sand
		Silty or Clayey Gravel *(more than 12% fines)*	GM		Silty Gravel; Silty Gravel with Sand
			GC		Clayey Gravel; Clayey Gravel with Sand
	Sands *(50% or more of coarse fraction passes the No. 4 sieve)*	Sand *(less than 5% fines)*	SW		Well-Graded Sand; Well-Graded Sand with Gravel
			SP		Poorly Graded Sand; Poorly Graded Sand with Gravel
		Silty or Clayey Sand *(more than 12% fines)*	SM		Silty Sand; Silty Sand with Gravel
			SC		Clayey Sand; Clayey Sand with Gravel
FINE-GRAINED SOILS *(50% or more passes the No. 200 sieve)*	Silts and Clays *(liquid limit less than 50)*	Inorganic	ML		Silt; Silt with Sand or Gravel; Sandy or Gravelly Silt
			CL		Lean Clay; Lean Clay with Sand or Gravel; Sandy or Gravelly Lean Clay
		Organic	OL		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
	Silts and Clays *(liquid limit 50 or more)*	Inorganic	MH		Elastic Silt; Elastic Silt with Sand or Gravel; Sandy or Gravelly Elastic Silt
			CH		Fat Clay; Fat Clay with Sand or Gravel; Sandy or Gravelly Fat Clay
		Organic	OH		Organic Silt or Clay; Organic Silt or Clay with Sand or Gravel; Sandy or Gravelly Organic Silt or Clay
HIGHLY-ORGANIC SOILS	Primarily organic matter, dark in color, and organic odor		PT		Peat or other highly organic soils (see ASTM D4427)
FILL	Placed by humans, both engineered and nonengineered. May include various soil materials and debris.				The Fill graphic symbol is combined with the soil graphic that best represents the observed material

NOTE: No. 4 size = 4.75 mm = 0.187 in.; No. 200 size = 0.075 mm = 0.003 in.

NOTES

1. Dual symbols *(symbols separated by a hyphen, i.e., SP-SM, Sand with Silt)* are used for soils with between 5% and 12% fines or when the liquid limit and plasticity index values plot in the *CL-ML* area of the plasticity chart.
2. Borderline symbols *(symbols separated by a slash, i.e., CL/ML, Lean Clay to Silt; SP-SM/SM, Sand with Silt to Silty Sand)* indicate that the soil properties are close to the defining boundary between two groups.
3. The soil graphics above represent the various USCS identifications (i.e., *GP*, *SM*, etc.) and may be augmented with additional symbology to represent differences within USCS designations. *Sandy Silt (ML)*, for example, may be accompanied by the *ML* soil graphic with sand grains added. Non-USCS materials may be represented by other graphic symbols; see log for descriptions.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

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FIG. A1
Sheet 2 of 3

2013 BORING CLASS2 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

GRADATION TERMS

Poorly Graded	Narrow range of grain sizes present or, within the range of grain sizes present, one or more sizes are missing (Gap Graded). Meets criteria in ASTM D2487, if tested.
Well-Graded	Full range and even distribution of grain sizes present. Meets criteria in ASTM D2487, if tested.

CEMENTATION TERMS[1]

Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

PLASTICITY[2]

DESCRIPTION	VISUAL-MANUAL CRITERIA	APPROX. PLASITICTY INDEX RANGE
Nonplastic	A 1/8-in. thread cannot be rolled at any water content.	< 4%
Low	A thread can barely be rolled and a lump cannot be formed when drier than the plastic limit.	4 to 10%
Medium	A thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. A lump crumbles when drier than the plastic limit.	10 to 20%
High	It take considerable time rolling and kneading to reach the plastic limit. A thread can be rerolled several times after reaching the plastic limit. A lump can be formed without crumbling when drier than the plastic limit.	> 20%

ADDITIONAL TERMS

Mottled	Irregular patches of different colors.
Bioturbated	Soil disturbance or mixing by plants or animals.
Diamict	Nonsorted sediment; sand and gravel in silt and/or clay matrix.
Cuttings	Material brought to surface by drilling.
Slough	Material that caved from sides of borehole.
Sheared	Disturbed texture, mix of strengths.

PARTICLE ANGULARITY AND SHAPE TERMS[1]

Angular	Sharp edges and unpolished planar surfaces.
Subangular	Similar to angular, but with rounded edges.
Subrounded	Nearly planar sides with well-rounded edges.
Rounded	Smoothly curved sides with no edges.
Flat	Width/thickness ratio > 3.
Elongated	Length/width ratio > 3.

ACRONYMS AND ABBREVIATIONS

ATD	At Time of Drilling
approx.	Approximate/Approximately
Diam.	Diameter
Elev.	Elevation
ft.	Feet
FeO	Iron Oxide
gal.	Gallons
Horiz.	Horizontal
HSA	Hollow Stem Auger
I.D.	Inside Diameter
in.	Inches
lbs.	Pounds
MgO	Magnesium Oxide
mm	Millimeter
MnO	Manganese Oxide
NA	Not Applicable or Not Available
NP	Nonplastic
O.D.	Outside Diameter
OW	Observation Well
pcf	Pounds per Cubic Foot
PID	Photo-Ionization Detector
PMT	Pressuremeter Test
ppm	Parts per Million
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
rpm	Rotations per Minute
SPT	Standard Penetration Test
USCS	Unified Soil Classification System
q_u	Unconfined Compressive Strength
VWP	Vibrating Wire Piezometer
Vert.	Vertical
WOH	Weight of Hammer
WOR	Weight of Rods
Wt.	Weight

STRUCTURE TERMS[1]

Interbedded	Alternating layers of varying material or color with layers at least 1/4-inch thick; singular: bed.
Laminated	Alternating layers of varying material or color with layers less than 1/4-inch thick; singular: lamination.
Fissured	Breaks along definite planes or fractures with little resistance.
Slickensided	Fracture planes appear polished or glossy; sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps that resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay.
Homogeneous	Same color and appearance throughout.

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[2]Adapted, with permission, from ASTM D2488 - 09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), copyright ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. A copy of the complete standard may be obtained from ASTM International, www.astm.org.

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

SOIL DESCRIPTION AND LOG KEY

112242

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FIG. A1
Sheet 3 of 3

2013 BORING CLASS3 110668.GPJ SW2013LIBRARYPDX.GLB SWNEW.GDT 3/20/23

Total Depth:	15 ft.	Northing:	~	Drilling Method:	Direct Push	Hole Diam.:	4" in.
Top Elevation:	~	Easting:	~	Drilling Company:	Oregon Geotechnical	Rod Type:	N/A
Vert. Datum:		Station:	~	Drill Rig Equipment:	Geoprobe 6622CPT	Hammer Type:	N/A
Horiz. Datum:		Offset:	~	Other Comments:			

SOIL DESCRIPTION

Refer to the report text for a proper understanding of the subsurface materials and drilling methods. The stratification lines indicated below represent the approximate boundaries between soil types, and the transitions may be gradual.

Elev. Depth (ft.) | Symbol | Samples | Ground Water | Depth, ft.

PENETRATION RESISTANCE, N (blows/ft.)

▲ Hammer Wt. & Drop: lbs / inches

0 20 40 60 80 100

Base Aggregate; 6-inches thick

0.5

Brown to gray, *Poorly Graded Sand (SP)*; moist; fine to medium sand; <5% nonplastic fines; slight iron oxidation and staining.

HOLOCENE BEACH SAND

3.0

Brown to light gray, *Poorly Graded Sand (SP)*; wet; fine to medium sand; <5% nonplastic fines.

S-1 S-2 S-3 S-4 S-5

During Drilling

5 10 15

Completed: January 23, 2024

15.0

0 20 40 60 80 100

LEGEND

2" Plastic Sheath

Groundwater Level ATD

Recovery (%)

◇ % Fines (<0.075mm)

● % Water Content

Plastic Limit — Liquid Limit

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

NOTES

1. Refer to KEY for explanation of symbols, codes, abbreviations, and definitions.
2. Groundwater level, if indicated above, is for the date specified and may vary.
3. Group symbol is based on visual-manual identification and selected lab testing.
4. The hole location and elevation should be considered approximate.

LOG OF BORING B-1

August 2024 112242

SHANNON & WILSON

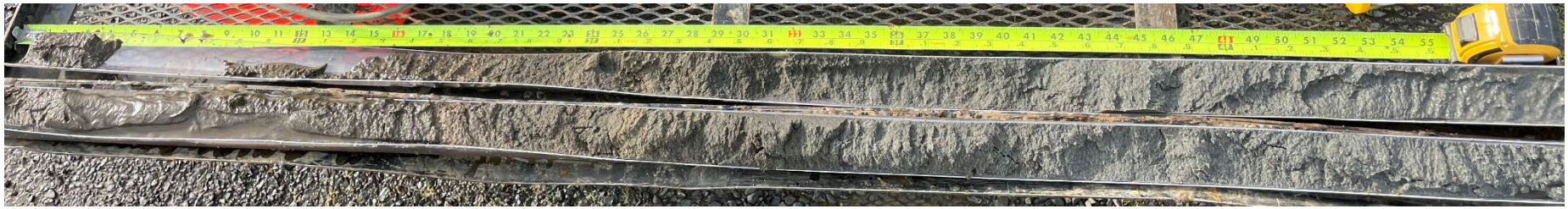
FIG. A2

REV 2

Log: EFD Rev: SCS Typ: EFD

MASTER LOG E 112242.GPJ SW2013LIBRARYPDX.GLB SHANWIL PDX.GDT 2/12/24

Photograph 1: View of B-1, approximately 0-5 feet.



Photograph 2: View of B-1, approximately 5-10 feet.

Photograph 3: View of B-1, approximately 10-15 feet.

FIG. A3

Consor North America, Inc.
Hammond Transmission Waterline
Warrenton, Oregon

BORING B-1
GEOPROBE PHOTOGRAPHS

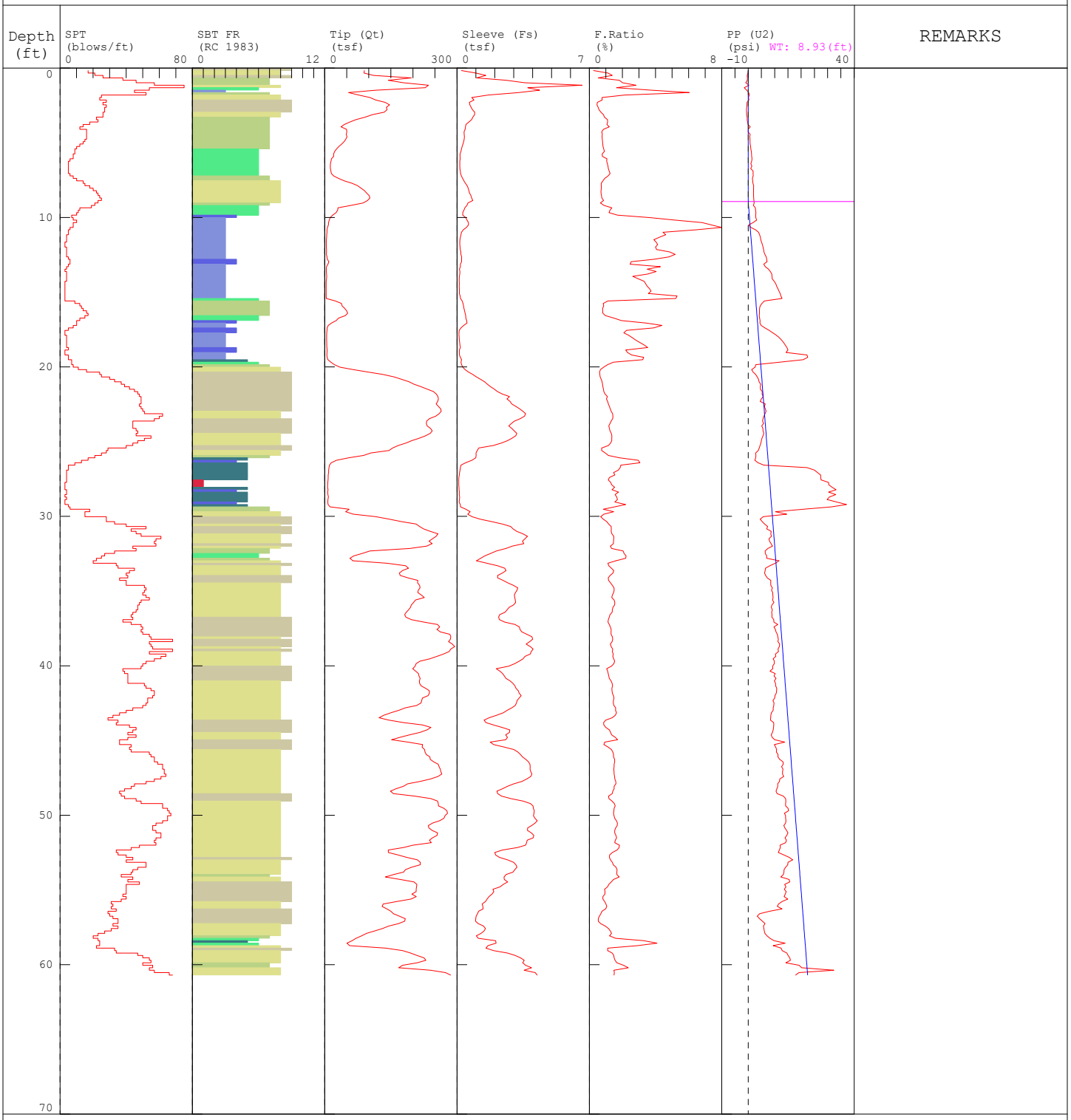
August 2024 112242

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG. A3

Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM
TOTAL DEPTH: 60.696 ft

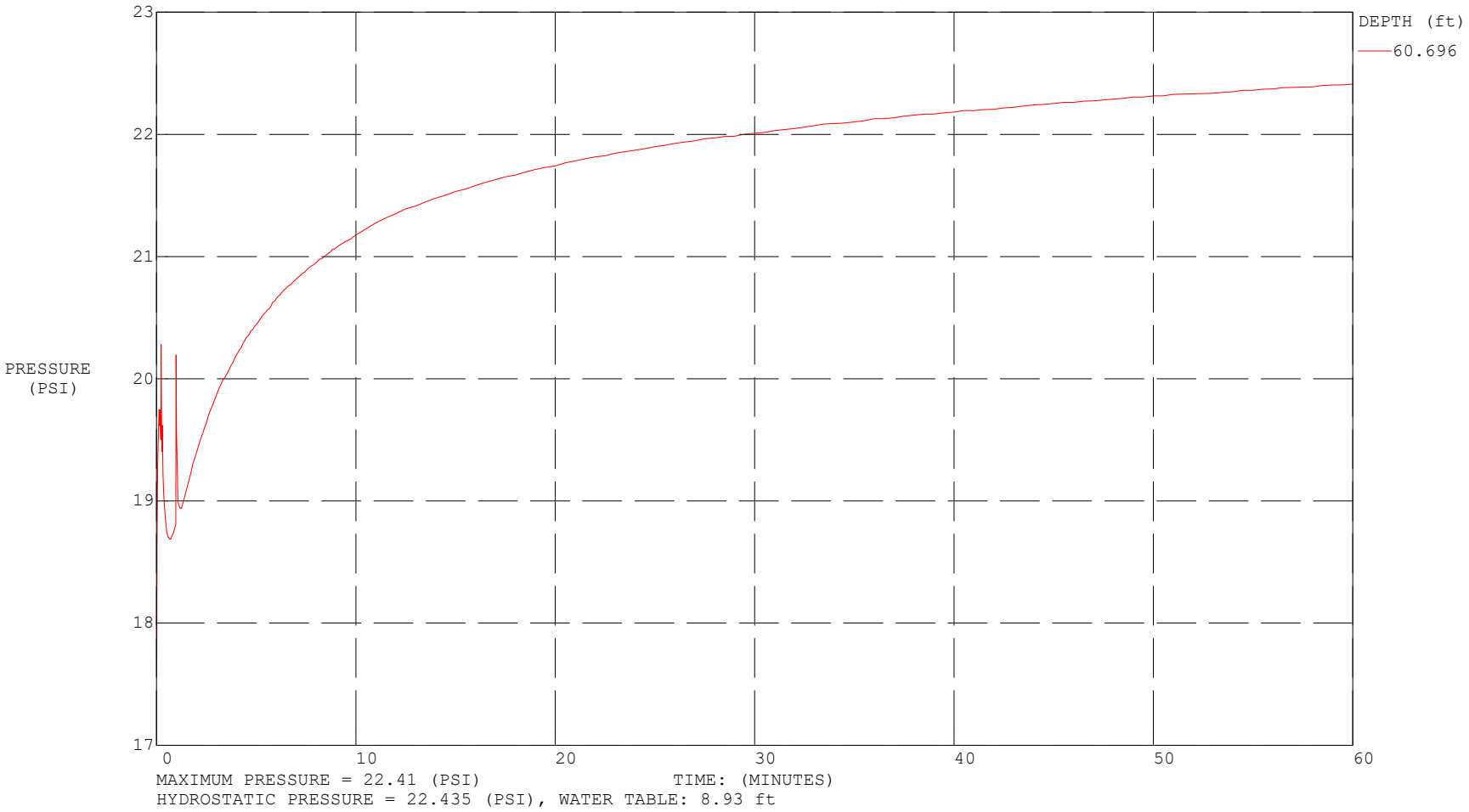


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM



MAXIMUM PRESSURE = 22.41 (PSI)
HYDROSTATIC PRESSURE = 22.435 (PSI), WATER TABLE: 8.93 ft

Shannon & Wilson / CPT-1 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 10:10:54 AM
TOTAL DEPTH: 60.696 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	89.74	0.2269	0.253	-0.012	17	9	sand
0.328	89.12	0.9957	1.117	-0.086	21	8	sand to silty sand
0.492	110.57	1.5202	1.375	-0.423	26	8	sand to silty sand
0.656	195.98	1.0301	0.526	-0.323	38	9	sand
0.820	143.82	2.5934	1.803	-0.359	46	7	silty sand to sandy silt
0.984	178.16	3.5692	2.003	-0.940	57	7	silty sand to sandy silt
1.148	235.08	6.6073	2.811	0.289	75	7	silty sand to sandy silt
1.312	227.58	3.7311	1.639	-1.559	54	8	sand to silty sand
1.476	116.48	4.3665	3.749	-0.583	45	6	sandy silt to clayey silt
1.640	54.05	3.2614	6.034	0.170	52	3	clay
1.804	76.92	1.6436	2.137	0.383	25	7	silty sand to sandy silt
1.969	102.25	0.7750	0.758	0.074	24	8	sand to silty sand
2.133	115.48	0.8888	0.770	0.258	28	8	sand to silty sand
2.297	136.90	0.6505	0.475	-0.457	26	9	sand
2.461	147.02	0.6750	0.459	-0.509	28	9	sand
2.625	139.57	0.7440	0.533	-0.595	27	9	sand
2.789	141.16	0.8153	0.578	-0.686	27	9	sand
2.953	134.81	0.9317	0.691	-0.643	26	9	sand
3.117	108.05	0.9232	0.854	-0.634	26	8	sand to silty sand
3.281	91.56	0.8276	0.904	-0.402	22	8	sand to silty sand
3.445	70.76	0.7699	1.088	-0.438	23	7	silty sand to sandy silt
3.609	57.10	0.6259	1.096	-0.282	18	7	silty sand to sandy silt
3.773	44.39	0.4680	1.054	-0.115	14	7	silty sand to sandy silt
3.937	37.18	0.4450	1.197	0.772	12	7	silty sand to sandy silt
4.101	49.27	0.4210	0.854	-0.026	16	7	silty sand to sandy silt
4.265	50.05	0.3717	0.743	-0.069	16	7	silty sand to sandy silt
4.429	48.62	0.3758	0.773	0.701	16	7	silty sand to sandy silt
4.593	50.46	0.3857	0.765	0.583	16	7	silty sand to sandy silt
4.757	47.73	0.3731	0.782	0.636	15	7	silty sand to sandy silt
4.921	43.91	0.3484	0.793	0.660	14	7	silty sand to sandy silt
5.085	38.74	0.3123	0.806	0.734	12	7	silty sand to sandy silt
5.249	32.13	0.2640	0.822	0.870	10	7	silty sand to sandy silt
5.413	26.75	0.2308	0.863	0.973	9	7	silty sand to sandy silt
5.577	22.57	0.2043	0.905	1.155	9	6	sandy silt to clayey silt
5.741	20.03	0.1545	0.771	1.248	8	6	sandy silt to clayey silt
5.906	20.13	0.1582	0.786	1.284	8	6	sandy silt to clayey silt
6.070	15.16	0.1598	1.054	1.425	6	6	sandy silt to clayey silt
6.234	14.24	0.1483	1.041	1.294	5	6	sandy silt to clayey silt
6.398	13.01	0.1411	1.085	0.988	5	6	sandy silt to clayey silt
6.562	12.77	0.1428	1.118	1.397	5	6	sandy silt to clayey silt
6.726	13.06	0.1494	1.144	0.959	5	6	sandy silt to clayey silt
6.890	13.84	0.1652	1.194	1.851	5	6	sandy silt to clayey silt
7.054	14.94	0.1865	1.248	1.851	6	6	sandy silt to clayey silt
7.218	20.02	0.2253	1.125	1.870	8	6	sandy silt to clayey silt
7.382	31.12	0.2894	0.930	1.533	10	7	silty sand to sandy silt
7.546	44.23	0.3618	0.818	1.700	14	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	62.06	0.4428	0.714	1.770	15	8	sand to silty sand
7.874	74.51	0.5335	0.716	2.021	18	8	sand to silty sand
8.038	82.11	0.5908	0.720	1.975	20	8	sand to silty sand
8.202	89.93	0.6272	0.697	2.006	22	8	sand to silty sand
8.366	94.90	0.6591	0.695	1.999	23	8	sand to silty sand
8.530	100.57	0.7319	0.728	1.992	24	8	sand to silty sand
8.694	102.44	0.7718	0.753	2.059	25	8	sand to silty sand
8.858	97.27	0.8366	0.860	2.155	23	8	sand to silty sand
9.022	87.05	0.5738	0.659	2.195	21	8	sand to silty sand
9.186	58.89	0.5214	0.885	1.944	19	7	silty sand to sandy silt
9.350	30.25	0.4113	1.359	2.657	12	6	sandy silt to clayey silt
9.514	29.24	0.3646	1.247	2.774	11	6	sandy silt to clayey silt
9.678	25.65	0.3045	1.187	2.881	10	6	sandy silt to clayey silt
9.843	17.87	0.3021	1.691	2.800	7	6	sandy silt to clayey silt
10.007	12.33	0.4511	3.660	2.829	8	4	silty clay to clay
10.171	10.24	0.5287	5.163	3.161	10	3	clay
10.335	8.78	0.5977	6.811	1.832	8	3	clay
10.499	8.16	0.6016	7.375	0.165	8	3	clay
10.663	6.23	0.4973	7.982	1.000	6	3	clay
10.827	5.17	0.3338	6.453	2.788	5	3	clay
10.991	5.21	0.2317	4.444	3.905	5	3	clay
11.155	4.57	0.2106	4.610	4.268	4	3	clay
11.319	4.19	0.1773	4.231	4.596	4	3	clay
11.483	3.87	0.1508	3.895	4.742	4	3	clay
11.647	3.49	0.1408	4.033	4.998	3	3	clay
11.811	3.50	0.1442	4.125	5.342	3	3	clay
11.975	3.87	0.1548	3.996	5.557	4	3	clay
12.139	4.05	0.1644	4.057	5.796	4	3	clay
12.303	4.05	0.1965	4.846	5.942	4	3	clay
12.467	3.84	0.1989	5.183	6.291	4	3	clay
12.631	5.09	0.2453	4.820	6.806	5	3	clay
12.795	5.94	0.2328	3.920	6.990	6	3	clay
12.959	9.38	0.2365	2.522	7.081	6	4	silty clay to clay
13.123	7.20	0.1770	2.458	5.871	5	4	silty clay to clay
13.287	4.06	0.1742	4.290	6.409	4	3	clay
13.451	3.64	0.1271	3.496	7.647	3	3	clay
13.615	3.78	0.1526	4.041	8.343	4	3	clay
13.780	3.98	0.1405	3.534	8.876	4	3	clay
13.944	4.51	0.1181	2.621	8.984	4	3	clay
14.108	3.92	0.1160	2.958	9.068	4	3	clay
14.272	3.43	0.1134	3.305	9.821	3	3	clay
14.436	3.45	0.1175	3.403	10.393	3	3	clay
14.600	3.34	0.1168	3.493	10.780	3	3	clay
14.764	3.31	0.1203	3.635	11.172	3	3	clay
14.928	3.32	0.1238	3.724	11.593	3	3	clay
15.092	3.34	0.1192	3.568	12.028	3	3	clay
15.256	3.07	0.1626	5.298	12.294	3	3	clay
15.420	3.52	0.1842	5.226	12.791	3	3	clay
15.584	24.00	0.2685	1.119	6.115	9	6	sandy silt to clayey silt
15.748	37.67	0.3146	0.835	5.156	12	7	silty sand to sandy silt
15.912	39.47	0.3418	0.866	4.488	13	7	silty sand to sandy silt
16.076	45.22	0.3609	0.798	4.249	14	7	silty sand to sandy silt
16.240	49.62	0.3972	0.801	4.237	16	7	silty sand to sandy silt
16.404	52.02	0.4209	0.809	4.223	17	7	silty sand to sandy silt
16.568	46.63	0.4510	0.967	4.130	15	7	silty sand to sandy silt
16.732	31.35	0.4628	1.476	4.259	12	6	sandy silt to clayey silt
16.896	26.08	0.5041	1.933	4.431	10	6	sandy silt to clayey silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	15.30	0.5253	3.432	4.398	10	4	silty clay to clay
17.224	8.01	0.3510	4.381	4.842	8	3	clay
17.388	5.40	0.2095	3.876	6.253	5	3	clay
17.552	5.10	0.1138	2.232	7.906	3	4	silty clay to clay
17.717	4.73	0.0982	2.078	9.285	3	4	silty clay to clay
17.881	4.15	0.0982	2.366	10.613	4	3	clay
18.045	4.17	0.1083	2.594	11.758	4	3	clay
18.209	4.27	0.1200	2.809	12.631	4	3	clay
18.373	4.40	0.1342	3.048	13.355	4	3	clay
18.537	4.52	0.1502	3.320	13.984	4	3	clay
18.701	5.03	0.1770	3.523	14.608	5	3	clay
18.865	5.36	0.1177	2.194	14.977	3	4	silty clay to clay
19.029	5.22	0.1201	2.300	14.257	3	4	silty clay to clay
19.193	4.93	0.1258	2.552	22.220	5	3	clay
19.357	5.32	0.1746	3.282	22.473	5	3	clay
19.521	7.29	0.2351	3.222	20.709	7	3	clay
19.685	14.14	0.2048	1.448	11.842	7	5	clayey silt to silty clay
19.849	21.91	0.2399	1.095	2.862	8	6	sandy silt to clayey silt
20.013	34.34	0.2958	0.861	2.585	11	7	silty sand to sandy silt
20.177	64.97	0.4277	0.658	1.291	16	8	sand to silty sand
20.341	98.91	0.6071	0.614	1.880	24	8	sand to silty sand
20.505	132.42	0.8279	0.625	2.800	25	9	sand
20.669	157.68	1.0261	0.651	3.374	30	9	sand
20.833	174.27	1.2434	0.713	3.891	33	9	sand
20.997	191.51	1.4575	0.761	4.111	37	9	sand
21.161	202.71	1.6066	0.793	4.682	39	9	sand
21.325	218.65	1.7759	0.812	4.575	42	9	sand
21.490	233.09	1.9757	0.848	4.582	45	9	sand
21.654	246.52	2.1390	0.868	5.301	47	9	sand
21.818	253.18	2.4030	0.949	5.242	48	9	sand
21.982	256.46	2.7734	1.081	5.605	49	9	sand
22.146	257.66	2.6351	1.023	4.948	49	9	sand
22.310	256.04	2.8054	1.096	4.469	49	9	sand
22.474	252.38	2.8898	1.145	6.406	48	9	sand
22.638	257.57	3.1056	1.206	6.117	49	9	sand
22.802	262.62	3.3028	1.258	6.416	50	9	sand
22.966	264.08	3.4750	1.316	6.736	51	9	sand
23.130	259.14	3.6257	1.399	6.344	62	8	sand to silty sand
23.294	251.63	3.5654	1.417	5.942	60	8	sand to silty sand
23.458	237.20	3.3395	1.408	5.548	57	8	sand to silty sand
23.622	230.94	3.0379	1.315	5.407	44	9	sand
23.786	230.32	2.8720	1.247	5.768	44	9	sand
23.950	232.04	2.7288	1.176	5.074	44	9	sand
24.114	239.70	2.8879	1.205	5.519	46	9	sand
24.278	243.75	3.0223	1.240	5.548	47	9	sand
24.442	239.27	3.1572	1.320	5.904	46	9	sand
24.606	228.23	3.1006	1.359	5.569	55	8	sand to silty sand
24.770	213.70	2.8918	1.353	5.148	51	8	sand to silty sand
24.934	197.05	2.6628	1.351	4.945	47	8	sand to silty sand
25.098	184.39	2.3473	1.273	4.783	44	8	sand to silty sand
25.262	166.52	1.9154	1.150	4.443	40	8	sand to silty sand
25.427	153.97	1.1428	0.742	4.144	29	9	sand
25.591	145.88	1.0699	0.733	3.783	28	9	sand
25.755	104.65	0.9998	0.955	2.791	25	8	sand to silty sand
25.919	88.06	1.0064	1.143	2.865	21	8	sand to silty sand
26.083	54.29	0.9907	1.825	2.795	17	7	silty sand to sandy silt
26.247	26.56	0.7829	2.948	2.528	13	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	14.74	0.4492	3.048	3.702	9	4	silty clay to clay
26.575	10.80	0.2049	1.898	5.883	5	5	clayey silt to silty clay
26.739	9.59	0.1781	1.858	22.189	5	5	clayey silt to silty clay
26.903	8.90	0.1557	1.749	24.991	4	5	clayey silt to silty clay
27.067	8.94	0.1305	1.460	26.163	4	5	clayey silt to silty clay
27.231	7.93	0.1217	1.535	27.335	4	5	clayey silt to silty clay
27.395	7.74	0.0939	1.213	27.363	4	5	clayey silt to silty clay
27.559	7.69	0.0869	1.129	27.490	4	5	clayey silt to silty clay
27.723	6.94	0.0892	1.285	30.317	3	1	sensitive fine grained
27.887	6.75	0.0903	1.338	30.429	3	1	sensitive fine grained
28.051	6.51	0.0987	1.517	31.670	3	1	sensitive fine grained
28.215	7.58	0.1035	1.365	33.201	4	5	clayey silt to silty clay
28.379	6.81	0.1196	1.757	30.348	4	4	silty clay to clay
28.543	7.05	0.1090	1.546	33.036	3	5	clayey silt to silty clay
28.707	8.24	0.1359	1.650	30.635	4	5	clayey silt to silty clay
28.871	7.29	0.1233	1.692	29.783	3	5	clayey silt to silty clay
29.035	6.91	0.1061	1.536	33.392	3	5	clayey silt to silty clay
29.199	7.66	0.1675	2.186	37.108	5	4	silty clay to clay
29.364	12.12	0.1840	1.518	31.457	6	5	clayey silt to silty clay
29.528	55.08	0.4634	0.841	20.799	18	7	silty sand to sandy silt
29.692	47.32	0.6948	1.468	10.261	15	7	silty sand to sandy silt
29.856	64.74	0.5626	0.869	14.479	15	8	sand to silty sand
30.020	115.81	0.7883	0.681	5.691	28	8	sand to silty sand
30.184	146.01	1.2195	0.835	4.522	28	9	sand
30.348	174.28	1.8278	1.049	5.268	33	9	sand
30.512	206.90	2.3858	1.153	6.141	40	9	sand
30.676	215.21	2.8314	1.316	7.317	52	8	sand to silty sand
30.840	223.72	2.9551	1.321	6.983	43	9	sand
31.004	238.98	3.1509	1.318	8.640	46	9	sand
31.168	256.38	3.4826	1.358	8.549	49	9	sand
31.332	252.74	3.7198	1.472	8.728	61	8	sand to silty sand
31.496	244.09	3.5905	1.471	7.803	58	8	sand to silty sand
31.660	236.66	3.4550	1.460	8.037	57	8	sand to silty sand
31.824	243.52	3.5304	1.450	8.630	58	8	sand to silty sand
31.988	230.98	2.9207	1.264	9.120	44	9	sand
32.152	192.76	2.5806	1.339	7.411	46	8	sand to silty sand
32.316	102.27	2.0828	2.037	6.373	33	7	silty sand to sandy silt
32.480	85.07	1.7788	2.091	6.413	27	7	silty sand to sandy silt
32.644	65.78	1.4575	2.216	6.940	25	6	sandy silt to clayey silt
32.808	57.12	1.2507	2.190	6.985	22	6	sandy silt to clayey silt
32.972	63.81	1.0243	1.605	11.610	20	7	silty sand to sandy silt
33.136	141.20	1.5747	1.115	10.228	34	8	sand to silty sand
33.301	183.43	2.1387	1.166	8.171	35	9	sand
33.465	189.97	2.5189	1.326	6.502	45	8	sand to silty sand
33.629	175.96	2.5896	1.472	6.366	42	8	sand to silty sand
33.793	169.03	2.3973	1.418	6.158	40	8	sand to silty sand
33.957	171.13	2.1415	1.251	6.574	41	8	sand to silty sand
34.121	188.88	2.1442	1.135	7.179	36	9	sand
34.285	210.90	2.4316	1.153	8.491	40	9	sand
34.449	210.34	2.6842	1.276	8.448	40	9	sand
34.613	214.95	2.9763	1.385	8.527	51	8	sand to silty sand
34.777	216.12	3.2033	1.482	9.111	52	8	sand to silty sand
34.941	212.03	3.1701	1.495	8.798	51	8	sand to silty sand
35.105	210.76	3.0891	1.466	9.254	50	8	sand to silty sand
35.269	218.82	3.0287	1.384	9.290	52	8	sand to silty sand
35.433	225.90	3.0522	1.351	9.352	54	8	sand to silty sand
35.597	205.60	3.0733	1.495	9.228	49	8	sand to silty sand

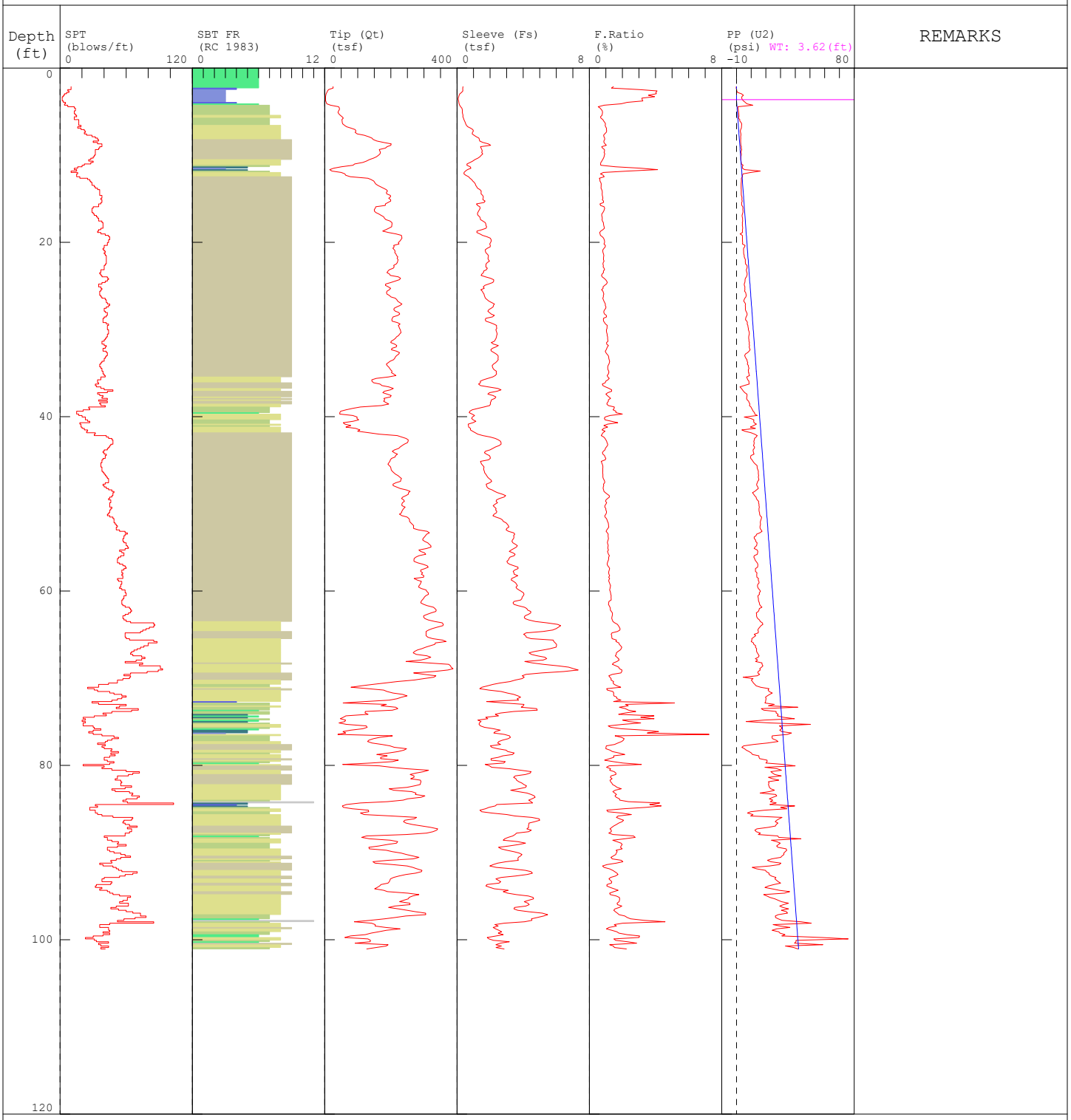
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	201.32	3.0961	1.538	9.704	48	8	sand to silty sand
35.925	196.42	2.9824	1.518	8.905	47	8	sand to silty sand
36.089	194.24	2.7536	1.418	8.683	47	8	sand to silty sand
36.253	190.17	2.6439	1.390	9.116	46	8	sand to silty sand
36.417	184.66	2.5308	1.370	8.850	44	8	sand to silty sand
36.581	181.09	2.2535	1.244	8.965	43	8	sand to silty sand
36.745	183.76	2.1952	1.195	8.900	44	8	sand to silty sand
36.909	196.35	2.2419	1.142	9.666	38	9	sand
37.073	224.98	2.5243	1.122	9.689	43	9	sand
37.238	255.58	3.0635	1.199	11.151	49	9	sand
37.402	260.70	3.2952	1.264	9.711	50	9	sand
37.566	254.41	3.3276	1.308	10.249	49	9	sand
37.730	262.21	3.4283	1.307	10.464	50	9	sand
37.894	283.59	3.6920	1.302	10.974	54	9	sand
38.058	285.80	3.9604	1.386	11.134	55	9	sand
38.222	284.71	3.9990	1.405	11.368	68	8	sand to silty sand
38.386	280.48	3.8417	1.370	11.208	54	9	sand
38.550	289.27	3.6555	1.264	11.856	55	9	sand
38.714	294.55	3.8721	1.315	11.729	56	9	sand
38.878	285.75	4.0213	1.407	11.268	68	8	sand to silty sand
39.042	282.16	3.9180	1.389	11.392	54	9	sand
39.206	269.15	3.8714	1.438	10.256	64	8	sand to silty sand
39.370	254.24	3.5926	1.413	10.402	61	8	sand to silty sand
39.534	238.59	3.4923	1.464	9.388	57	8	sand to silty sand
39.698	215.61	3.2854	1.524	9.857	52	8	sand to silty sand
39.862	206.83	3.0373	1.469	9.809	50	8	sand to silty sand
40.026	204.83	2.7258	1.331	9.171	49	8	sand to silty sand
40.190	199.56	2.0750	1.040	9.290	38	9	sand
40.354	206.14	2.2641	1.098	8.195	39	9	sand
40.518	212.39	2.4105	1.135	10.182	41	9	sand
40.682	213.71	2.4999	1.170	9.718	41	9	sand
40.846	216.30	2.5854	1.195	10.469	41	9	sand
41.011	214.55	2.8007	1.305	9.883	41	9	sand
41.175	215.02	2.9502	1.372	10.294	51	8	sand to silty sand
41.339	218.54	3.0575	1.399	10.366	52	8	sand to silty sand
41.503	228.85	3.1108	1.359	10.732	55	8	sand to silty sand
41.667	237.01	3.2291	1.362	10.713	57	8	sand to silty sand
41.831	237.18	3.2859	1.385	10.593	57	8	sand to silty sand
41.995	234.35	3.3896	1.446	10.096	56	8	sand to silty sand
42.159	221.28	3.2820	1.483	10.005	53	8	sand to silty sand
42.323	219.89	3.1768	1.445	9.314	53	8	sand to silty sand
42.487	218.26	3.1402	1.439	9.723	52	8	sand to silty sand
42.651	208.70	3.0770	1.474	9.627	50	8	sand to silty sand
42.815	182.93	2.8955	1.583	9.381	44	8	sand to silty sand
42.979	167.90	2.6532	1.580	9.419	40	8	sand to silty sand
43.143	149.85	2.4453	1.632	8.754	36	8	sand to silty sand
43.307	133.89	2.0902	1.561	8.542	32	8	sand to silty sand
43.471	123.09	1.6960	1.378	8.484	29	8	sand to silty sand
43.635	145.47	1.4303	0.983	8.374	35	8	sand to silty sand
43.799	178.45	1.5298	0.857	9.565	34	9	sand
43.963	221.58	1.9226	0.868	9.654	42	9	sand
44.127	240.90	2.3811	0.988	9.532	46	9	sand
44.291	231.62	2.7877	1.204	9.383	44	9	sand
44.455	215.88	2.7681	1.282	9.147	41	9	sand
44.619	191.79	2.5691	1.340	8.666	46	8	sand to silty sand
44.783	170.23	2.6629	1.564	9.075	41	8	sand to silty sand
44.948	151.43	2.5706	1.698	10.000	36	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	188.51	1.7501	0.928	13.779	36	9	sand
45.276	222.01	1.9338	0.871	9.874	43	9	sand
45.440	220.79	2.4860	1.126	10.369	42	9	sand
45.604	226.29	3.0005	1.326	10.691	43	9	sand
45.768	227.35	3.2163	1.415	10.617	54	8	sand to silty sand
45.932	230.09	3.3528	1.457	11.246	55	8	sand to silty sand
46.096	238.32	3.4594	1.452	11.210	57	8	sand to silty sand
46.260	239.16	3.6342	1.520	11.866	57	8	sand to silty sand
46.424	246.83	3.7773	1.530	13.119	59	8	sand to silty sand
46.588	257.08	3.8512	1.498	13.226	62	8	sand to silty sand
46.752	259.20	3.8642	1.491	12.614	62	8	sand to silty sand
46.916	261.71	3.8571	1.474	13.102	63	8	sand to silty sand
47.080	263.11	3.8982	1.482	12.939	63	8	sand to silty sand
47.244	265.28	3.9613	1.493	12.944	64	8	sand to silty sand
47.408	256.76	3.8944	1.517	13.379	61	8	sand to silty sand
47.572	239.86	3.6837	1.536	11.925	57	8	sand to silty sand
47.736	215.82	3.4312	1.590	11.768	52	8	sand to silty sand
47.900	187.92	3.0031	1.598	11.105	45	8	sand to silty sand
48.064	178.31	2.6619	1.493	11.155	43	8	sand to silty sand
48.228	161.19	2.4013	1.490	10.813	39	8	sand to silty sand
48.392	149.06	2.1058	1.413	10.469	36	8	sand to silty sand
48.556	155.44	2.1410	1.377	10.902	37	8	sand to silty sand
48.720	203.85	2.3517	1.154	13.279	39	9	sand
48.885	240.41	2.8421	1.182	14.116	46	9	sand
49.049	255.84	3.4864	1.363	14.209	49	9	sand
49.213	257.34	3.8766	1.506	14.099	62	8	sand to silty sand
49.377	257.92	4.0113	1.555	14.132	62	8	sand to silty sand
49.541	269.75	4.0361	1.496	15.072	65	8	sand to silty sand
49.705	276.98	4.0884	1.476	15.240	66	8	sand to silty sand
49.869	278.28	4.0662	1.461	13.688	67	8	sand to silty sand
50.033	272.83	4.0394	1.481	14.077	65	8	sand to silty sand
50.197	270.19	4.1171	1.524	14.137	65	8	sand to silty sand
50.361	260.47	4.2392	1.628	14.242	62	8	sand to silty sand
50.525	244.32	4.1276	1.689	14.118	58	8	sand to silty sand
50.689	234.79	3.9386	1.678	13.420	56	8	sand to silty sand
50.853	235.83	3.7330	1.583	13.812	56	8	sand to silty sand
51.017	243.56	3.7192	1.527	14.465	58	8	sand to silty sand
51.181	255.83	3.9240	1.534	15.001	61	8	sand to silty sand
51.345	254.62	4.0579	1.594	14.537	61	8	sand to silty sand
51.509	244.06	4.0181	1.646	13.869	58	8	sand to silty sand
51.673	237.13	3.7101	1.565	14.417	57	8	sand to silty sand
51.837	241.50	3.6788	1.523	14.089	58	8	sand to silty sand
52.001	200.05	3.6208	1.810	11.992	48	8	sand to silty sand
52.165	178.16	3.1929	1.792	12.141	43	8	sand to silty sand
52.329	143.78	2.4036	1.672	11.727	34	8	sand to silty sand
52.493	144.36	1.9988	1.385	11.337	35	8	sand to silty sand
52.657	166.49	2.0371	1.224	13.508	40	8	sand to silty sand
52.822	185.51	2.2394	1.207	15.474	44	8	sand to silty sand
52.986	210.02	2.6620	1.267	16.775	40	9	sand
53.150	216.66	2.9939	1.382	15.008	52	8	sand to silty sand
53.314	216.28	3.1149	1.440	14.891	52	8	sand to silty sand
53.478	196.50	3.1647	1.611	14.089	47	8	sand to silty sand
53.642	183.09	3.0520	1.667	13.544	44	8	sand to silty sand
53.806	178.37	2.9554	1.657	13.496	43	8	sand to silty sand
53.970	156.64	2.5981	1.659	13.267	37	8	sand to silty sand
54.134	137.63	2.4795	1.802	12.341	44	7	silty sand to sandy silt
54.298	171.01	2.4948	1.459	15.474	41	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	202.46	2.6782	1.323	15.651	48	8	sand to silty sand
54.626	208.78	2.4396	1.169	13.748	40	9	sand
54.790	208.01	2.2687	1.091	14.233	40	9	sand
54.954	207.39	1.8952	0.914	13.606	40	9	sand
55.118	207.19	1.9453	0.939	14.364	40	9	sand
55.282	197.80	1.8445	0.933	13.987	38	9	sand
55.446	207.57	1.6913	0.815	13.525	40	9	sand
55.610	195.43	1.5883	0.813	14.898	37	9	sand
55.774	162.94	1.5019	0.922	12.755	31	9	sand
55.938	132.53	1.3226	0.998	11.392	32	8	sand to silty sand
56.102	130.01	1.3650	1.050	10.954	31	8	sand to silty sand
56.266	140.70	1.3765	0.978	12.734	34	8	sand to silty sand
56.430	149.97	1.1347	0.757	8.102	29	9	sand
56.594	155.70	1.0791	0.693	4.285	30	9	sand
56.759	169.33	1.0071	0.595	3.362	32	9	sand
56.923	182.53	0.9836	0.539	4.256	35	9	sand
57.087	181.08	0.9723	0.537	5.335	35	9	sand
57.251	167.74	1.1143	0.664	6.330	32	9	sand
57.415	145.53	1.3970	0.960	5.756	35	8	sand to silty sand
57.579	131.05	1.5034	1.147	5.906	31	8	sand to silty sand
57.743	112.91	1.4243	1.261	6.062	27	8	sand to silty sand
57.907	94.92	1.2690	1.337	6.299	23	8	sand to silty sand
58.071	83.56	1.0138	1.213	7.097	20	8	sand to silty sand
58.235	70.85	1.1206	1.582	8.202	23	7	silty sand to sandy silt
58.399	62.31	2.0403	3.274	9.735	24	6	sandy silt to clayey silt
58.563	50.47	2.0626	4.087	13.948	24	5	clayey silt to silty clay
58.727	56.19	1.6336	2.907	9.441	22	6	sandy silt to clayey silt
58.891	138.33	1.5295	1.106	12.401	33	8	sand to silty sand
59.055	176.60	1.9363	1.096	12.839	34	9	sand
59.219	194.93	2.6797	1.375	14.592	47	8	sand to silty sand
59.383	209.04	3.0705	1.469	15.044	50	8	sand to silty sand
59.547	224.90	3.3524	1.491	15.672	54	8	sand to silty sand
59.711	229.13	3.5492	1.549	15.945	55	8	sand to silty sand
59.875	209.82	3.4729	1.655	14.183	50	8	sand to silty sand
60.039	176.44	3.6247	2.054	19.202	56	7	silty sand to sandy silt
60.203	167.74	3.9391	2.348	20.182	54	7	silty sand to sandy silt
60.367	239.94	3.5456	1.478	32.321	57	8	sand to silty sand
60.532	273.66	4.1311	1.510	19.169	66	8	sand to silty sand
60.696	285.33	4.2311	1.483	17.880	68	8	sand to silty sand

Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM
TOTAL DEPTH: 101.050 ft

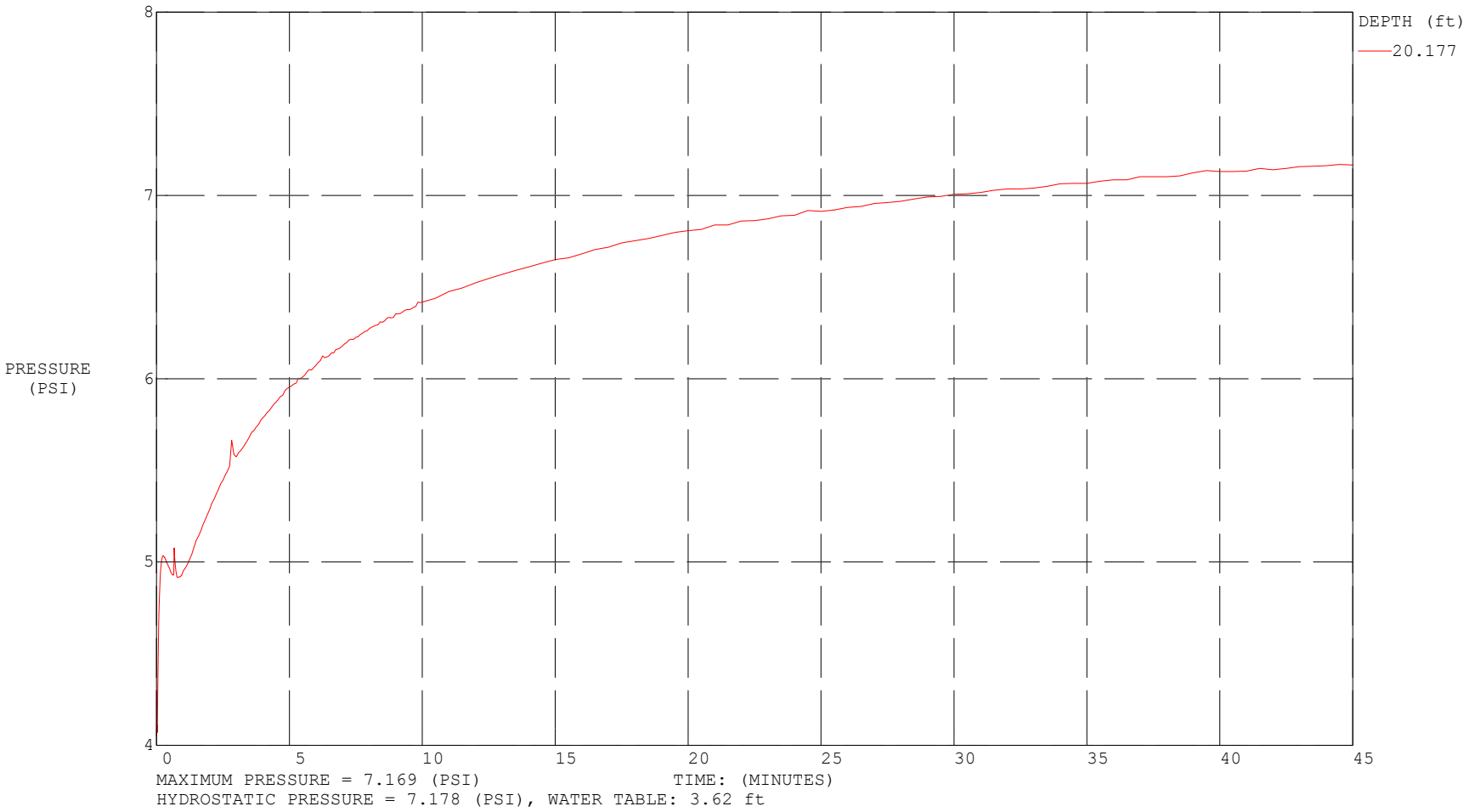


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM



Shannon & Wilson / CPT-2 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 8:55:17 AM
TOTAL DEPTH: 101.050 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
2.133	24.89	0.3601	1.447	-0.122	10	6	sandy silt to clayey silt
2.297	25.28	0.3368	1.332	-0.210	10	6	sandy silt to clayey silt
2.461	11.37	0.3432	3.019	0.127	7	4	silty clay to clay
2.625	8.55	0.3494	4.089	0.213	8	3	clay
2.789	6.63	0.2664	4.016	0.744	6	3	clay
2.953	4.34	0.1757	4.044	3.321	4	3	clay
3.117	3.30	0.1175	3.566	4.673	3	3	clay
3.281	2.60	0.1025	3.938	3.683	2	3	clay
3.445	2.30	0.0731	3.175	3.522	2	3	clay
3.609	2.29	0.0730	3.185	3.891	2	3	clay
3.773	2.86	0.0924	3.226	4.711	3	3	clay
3.937	4.70	0.1073	2.281	5.957	5	3	clay
4.101	6.11	0.1169	1.915	7.054	4	4	silty clay to clay
4.265	17.48	0.1560	0.892	11.029	7	6	sandy silt to clayey silt
4.429	41.62	0.2174	0.522	0.997	13	7	silty sand to sandy silt
4.593	44.31	0.2854	0.644	1.004	14	7	silty sand to sandy silt
4.757	44.26	0.3182	0.719	1.179	14	7	silty sand to sandy silt
4.921	41.85	0.3236	0.773	1.296	13	7	silty sand to sandy silt
5.085	39.82	0.3164	0.795	1.483	13	7	silty sand to sandy silt
5.249	42.62	0.3332	0.782	1.552	14	7	silty sand to sandy silt
5.413	46.61	0.3565	0.765	1.631	15	7	silty sand to sandy silt
5.577	52.43	0.3515	0.670	1.693	13	8	sand to silty sand
5.741	55.99	0.3862	0.690	1.229	13	8	sand to silty sand
5.906	51.71	0.4195	0.811	2.257	17	7	silty sand to sandy silt
6.070	52.68	0.4525	0.859	2.169	17	7	silty sand to sandy silt
6.234	52.90	0.4918	0.930	3.068	17	7	silty sand to sandy silt
6.398	54.17	0.5250	0.969	3.525	17	7	silty sand to sandy silt
6.562	59.49	0.5637	0.948	3.491	19	7	silty sand to sandy silt
6.726	65.94	0.6442	0.977	3.422	16	8	sand to silty sand
6.890	79.16	0.8176	1.033	3.312	19	8	sand to silty sand
7.054	91.87	0.9446	1.028	2.848	22	8	sand to silty sand
7.218	94.27	0.9830	1.043	2.599	23	8	sand to silty sand
7.382	91.64	0.9302	1.015	2.731	22	8	sand to silty sand
7.546	98.33	0.9092	0.925	3.011	24	8	sand to silty sand
7.710	119.12	1.0205	0.857	3.008	29	8	sand to silty sand
7.874	133.04	1.1652	0.876	2.800	32	8	sand to silty sand
8.038	142.52	1.3135	0.922	2.901	34	8	sand to silty sand
8.202	146.88	1.3501	0.919	2.795	35	8	sand to silty sand
8.366	157.45	1.3648	0.867	2.783	30	9	sand
8.530	177.67	1.5551	0.875	2.843	34	9	sand
8.694	200.63	1.8871	0.941	2.927	38	9	sand
8.858	199.76	2.0321	1.017	2.951	38	9	sand
9.022	188.55	1.4091	0.747	3.345	36	9	sand
9.186	183.37	1.4500	0.791	3.226	35	9	sand
9.350	164.72	1.4933	0.907	3.518	32	9	sand
9.514	166.47	1.5170	0.911	3.288	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
9.678	168.37	1.4881	0.884	3.039	32	9	sand
9.843	167.04	1.5476	0.926	3.343	32	9	sand
10.007	162.50	1.4641	0.901	3.264	31	9	sand
10.171	156.63	1.3786	0.880	3.008	30	9	sand
10.335	147.47	1.2595	0.854	2.996	28	9	sand
10.499	135.17	1.0806	0.799	2.958	26	9	sand
10.663	125.67	0.9410	0.749	3.073	30	8	sand to silty sand
10.827	115.47	0.7952	0.689	3.202	28	8	sand to silty sand
10.991	90.49	0.6014	0.665	3.336	22	8	sand to silty sand
11.155	85.50	0.5869	0.686	4.558	20	8	sand to silty sand
11.319	50.10	0.7894	1.576	3.891	16	7	silty sand to sandy silt
11.483	27.06	0.8337	3.081	4.027	13	5	clayey silt to silty clay
11.647	15.29	0.6304	4.121	5.471	15	3	clay
11.811	21.50	0.5056	2.352	16.170	10	5	clayey silt to silty clay
11.975	50.17	0.4208	0.839	9.728	16	7	silty sand to sandy silt
12.139	60.80	0.4093	0.673	4.410	15	8	sand to silty sand
12.303	63.68	0.5328	0.837	3.974	15	8	sand to silty sand
12.467	77.14	0.6905	0.895	4.010	18	8	sand to silty sand
12.631	130.51	0.7802	0.598	3.302	25	9	sand
12.795	140.29	0.8831	0.630	3.326	27	9	sand
12.959	148.39	0.9491	0.640	3.367	28	9	sand
13.123	150.56	1.0338	0.687	3.252	29	9	sand
13.287	153.86	1.1022	0.716	3.137	29	9	sand
13.451	160.36	1.1297	0.704	3.128	31	9	sand
13.615	168.95	1.1849	0.701	3.161	32	9	sand
13.780	177.07	1.2356	0.698	3.154	34	9	sand
13.944	185.90	1.3749	0.740	3.168	36	9	sand
14.108	189.83	1.4579	0.768	3.180	36	9	sand
14.272	186.01	1.4549	0.782	3.226	36	9	sand
14.436	187.45	1.4446	0.771	3.204	36	9	sand
14.600	198.28	1.5451	0.779	3.307	38	9	sand
14.764	198.88	1.5870	0.798	3.618	38	9	sand
14.928	193.36	1.5738	0.814	3.723	37	9	sand
15.092	199.06	1.5559	0.782	3.580	38	9	sand
15.256	199.69	1.6896	0.846	3.850	38	9	sand
15.420	191.20	1.6267	0.851	3.546	37	9	sand
15.584	183.57	1.1748	0.640	3.501	35	9	sand
15.748	182.98	1.2354	0.675	3.692	35	9	sand
15.912	154.56	1.3722	0.888	4.273	30	9	sand
16.076	152.51	1.3960	0.915	4.338	29	9	sand
16.240	149.88	1.3523	0.902	4.288	29	9	sand
16.404	150.04	1.2999	0.866	4.400	29	9	sand
16.568	154.34	1.2493	0.809	4.309	30	9	sand
16.732	163.26	1.2300	0.753	3.993	31	9	sand
16.896	170.51	1.2614	0.740	3.836	33	9	sand
17.060	177.99	1.3612	0.765	3.888	34	9	sand
17.224	180.37	1.4004	0.776	4.108	35	9	sand
17.388	184.60	1.4112	0.764	4.149	35	9	sand
17.552	197.49	1.5545	0.787	4.201	38	9	sand
17.717	203.13	1.7018	0.838	3.934	39	9	sand
17.881	203.44	1.7351	0.853	3.989	39	9	sand
18.045	202.82	1.7462	0.861	3.950	39	9	sand
18.209	202.27	1.7848	0.882	4.115	39	9	sand
18.373	193.74	1.7490	0.903	4.201	37	9	sand
18.537	184.99	1.5028	0.812	4.048	35	9	sand
18.701	175.08	1.1950	0.683	4.041	34	9	sand
18.865	192.57	1.1940	0.620	3.979	37	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
19.029	215.66	1.3846	0.642	2.461	41	9	sand
19.193	231.63	1.5345	0.662	3.926	44	9	sand
19.357	232.63	1.8069	0.777	4.010	45	9	sand
19.521	233.51	2.0100	0.861	4.025	45	9	sand
19.685	230.26	2.0533	0.892	4.099	44	9	sand
19.849	227.18	2.0646	0.909	4.106	44	9	sand
20.013	222.37	2.0213	0.909	4.237	43	9	sand
20.177	224.64	1.9732	0.878	4.041	43	9	sand
20.341	208.55	2.0094	0.964	5.816	40	9	sand
20.505	210.02	2.0016	0.953	5.567	40	9	sand
20.669	205.91	1.8297	0.889	4.895	39	9	sand
20.833	210.17	1.6992	0.809	4.773	40	9	sand
20.997	212.60	1.7098	0.804	4.814	41	9	sand
21.161	211.41	1.7322	0.819	4.897	40	9	sand
21.325	215.27	1.8172	0.844	4.962	41	9	sand
21.490	217.04	1.8924	0.872	5.213	42	9	sand
21.654	220.94	1.8891	0.855	5.285	42	9	sand
21.818	218.81	1.8616	0.851	5.584	42	9	sand
21.982	221.49	1.8924	0.854	5.990	42	9	sand
22.146	220.30	1.9592	0.889	5.976	42	9	sand
22.310	219.47	1.8285	0.833	6.079	42	9	sand
22.474	216.38	1.7533	0.810	6.160	41	9	sand
22.638	208.41	1.7482	0.839	7.095	40	9	sand
22.802	210.08	1.7337	0.825	7.296	40	9	sand
22.966	206.89	1.8264	0.883	7.076	40	9	sand
23.130	195.12	1.7762	0.910	6.688	37	9	sand
23.294	191.26	1.6060	0.840	6.751	37	9	sand
23.458	187.84	1.5907	0.847	7.105	36	9	sand
23.622	195.38	1.4985	0.767	7.293	37	9	sand
23.786	198.33	1.4456	0.729	7.114	38	9	sand
23.950	222.40	1.7141	0.771	6.777	43	9	sand
24.114	229.10	2.0147	0.879	6.112	44	9	sand
24.278	226.07	2.2094	0.977	5.794	43	9	sand
24.442	212.83	2.2187	1.042	5.801	41	9	sand
24.606	199.84	2.1563	1.079	5.617	38	9	sand
24.770	184.16	1.9001	1.032	5.227	35	9	sand
24.934	183.34	1.6773	0.915	5.361	35	9	sand
25.098	192.46	1.5798	0.821	5.749	37	9	sand
25.262	198.81	1.6423	0.826	5.694	38	9	sand
25.427	195.79	1.4360	0.733	5.758	37	9	sand
25.591	188.22	1.5198	0.807	5.462	36	9	sand
25.755	186.35	1.5669	0.841	6.189	36	9	sand
25.919	187.95	1.6299	0.867	6.502	36	9	sand
26.083	195.02	1.6421	0.842	6.621	37	9	sand
26.247	200.04	1.6822	0.841	6.366	38	9	sand
26.411	213.47	1.7161	0.804	5.660	41	9	sand
26.575	217.88	1.8252	0.838	5.115	42	9	sand
26.739	220.74	1.9286	0.874	4.926	42	9	sand
26.903	226.51	2.0901	0.923	5.615	43	9	sand
27.067	233.40	2.2572	0.967	6.184	45	9	sand
27.231	227.87	2.1912	0.962	5.950	44	9	sand
27.395	218.04	2.1790	0.999	6.016	42	9	sand
27.559	209.63	2.0629	0.984	6.043	40	9	sand
27.723	208.78	1.9178	0.919	6.045	40	9	sand
27.887	213.56	1.8605	0.871	6.404	41	9	sand
28.051	224.04	1.9494	0.870	6.973	43	9	sand
28.215	226.64	2.0666	0.912	7.210	43	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
28.379	221.32	2.2498	1.017	7.057	42	9	sand
28.543	206.71	2.1388	1.035	6.557	40	9	sand
28.707	204.01	1.7388	0.852	6.208	39	9	sand
28.871	202.90	1.7055	0.841	6.136	39	9	sand
29.035	203.74	1.7449	0.856	7.016	39	9	sand
29.199	219.44	1.9989	0.911	7.403	42	9	sand
29.364	227.87	2.2183	0.974	7.317	44	9	sand
29.528	222.26	2.3900	1.075	7.755	43	9	sand
29.692	224.67	2.3777	1.058	7.817	43	9	sand
29.856	226.09	2.4022	1.062	8.001	43	9	sand
30.020	228.45	2.3472	1.027	8.087	44	9	sand
30.184	229.31	2.3684	1.033	8.408	44	9	sand
30.348	230.51	2.3987	1.041	8.707	44	9	sand
30.512	226.25	2.4229	1.071	8.683	43	9	sand
30.676	223.41	2.3935	1.071	8.489	43	9	sand
30.840	217.13	2.3812	1.097	8.310	42	9	sand
31.004	213.16	2.3533	1.104	8.312	41	9	sand
31.168	208.49	2.3049	1.105	8.525	40	9	sand
31.332	200.84	2.2501	1.120	8.482	38	9	sand
31.496	199.67	2.0649	1.034	8.757	38	9	sand
31.660	211.05	2.2022	1.043	8.642	40	9	sand
31.824	217.59	2.4973	1.148	8.867	42	9	sand
31.988	216.09	2.3488	1.087	8.649	41	9	sand
32.152	203.09	2.1276	1.048	8.857	39	9	sand
32.316	201.70	2.0399	1.011	9.247	39	9	sand
32.480	216.77	2.0772	0.958	8.549	42	9	sand
32.644	225.91	2.2308	0.987	7.552	43	9	sand
32.808	223.75	2.3636	1.056	6.110	43	9	sand
32.972	217.36	2.4715	1.137	5.550	42	9	sand
33.136	213.93	2.4898	1.164	5.856	41	9	sand
33.301	211.15	2.4717	1.171	6.485	40	9	sand
33.465	208.26	2.4831	1.192	7.064	40	9	sand
33.629	197.82	2.4158	1.221	7.303	38	9	sand
33.793	192.02	2.3265	1.212	7.681	37	9	sand
33.957	186.28	2.2016	1.182	7.363	36	9	sand
34.121	188.13	2.1211	1.127	8.102	36	9	sand
34.285	192.87	2.1399	1.109	8.181	37	9	sand
34.449	196.21	2.1767	1.109	8.420	38	9	sand
34.613	199.37	2.2374	1.122	8.061	38	9	sand
34.777	203.56	2.3716	1.165	7.996	39	9	sand
34.941	201.86	2.3655	1.172	8.319	39	9	sand
35.105	208.40	2.3897	1.147	8.518	40	9	sand
35.269	215.15	2.3101	1.074	8.876	41	9	sand
35.433	192.59	2.1502	1.116	6.971	37	9	sand
35.597	155.72	1.8668	1.199	7.267	37	8	sand to silty sand
35.761	142.25	1.5956	1.122	7.678	34	8	sand to silty sand
35.925	142.53	1.4005	0.983	8.499	34	8	sand to silty sand
36.089	147.83	1.4145	0.957	8.432	35	8	sand to silty sand
36.253	166.97	1.2986	0.778	8.659	32	9	sand
36.417	173.04	1.4099	0.815	5.048	33	9	sand
36.581	193.36	1.8823	0.973	2.332	37	9	sand
36.745	207.27	2.4614	1.188	3.312	40	9	sand
36.909	198.47	2.6572	1.339	4.041	48	8	sand to silty sand
37.073	180.11	2.4164	1.342	4.756	43	8	sand to silty sand
37.238	175.48	1.9572	1.115	5.710	34	9	sand
37.402	188.47	1.8608	0.987	7.081	36	9	sand
37.566	201.07	2.1723	1.080	7.136	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
37.730	198.39	2.3433	1.181	6.999	38	9	sand
37.894	179.10	2.2896	1.278	6.796	43	8	sand to silty sand
38.058	181.08	2.0755	1.146	7.298	35	9	sand
38.222	178.16	2.0529	1.152	8.250	43	8	sand to silty sand
38.386	186.00	2.0084	1.080	8.625	36	9	sand
38.550	193.17	2.0234	1.047	9.068	37	9	sand
38.714	171.51	1.9641	1.145	8.793	41	8	sand to silty sand
38.878	107.86	1.6263	1.508	9.852	26	8	sand to silty sand
39.042	84.10	1.2591	1.497	10.275	27	7	silty sand to sandy silt
39.206	64.24	0.9194	1.431	10.904	21	7	silty sand to sandy silt
39.370	48.15	0.7701	1.599	11.368	15	7	silty sand to sandy silt
39.534	45.50	0.7293	1.603	12.239	15	7	silty sand to sandy silt
39.698	45.44	0.9034	1.988	12.411	17	6	sandy silt to clayey silt
39.862	84.93	1.0556	1.243	14.085	20	8	sand to silty sand
40.026	97.94	0.9223	0.942	5.225	23	8	sand to silty sand
40.190	97.50	0.8748	0.897	9.623	23	8	sand to silty sand
40.354	102.90	0.9734	0.946	11.820	25	8	sand to silty sand
40.518	85.50	1.1403	1.334	11.746	27	7	silty sand to sandy silt
40.682	55.88	0.9601	1.718	11.909	18	7	silty sand to sandy silt
40.846	60.70	0.6717	1.107	13.530	19	7	silty sand to sandy silt
41.011	78.72	0.6827	0.867	11.634	19	8	sand to silty sand
41.175	64.05	0.7034	1.098	9.405	20	7	silty sand to sandy silt
41.339	93.83	0.8066	0.860	12.829	22	8	sand to silty sand
41.503	106.32	0.8101	0.762	3.683	25	8	sand to silty sand
41.667	99.55	0.9375	0.942	5.593	24	8	sand to silty sand
41.831	133.67	1.0997	0.823	9.874	32	8	sand to silty sand
41.995	164.32	1.2516	0.762	12.318	31	9	sand
42.159	219.14	1.5616	0.713	14.087	42	9	sand
42.323	232.27	2.0016	0.862	13.377	44	9	sand
42.487	245.59	2.3082	0.940	12.246	47	9	sand
42.651	252.23	2.4959	0.989	12.160	48	9	sand
42.815	252.10	2.6233	1.041	11.777	48	9	sand
42.979	249.87	2.6592	1.064	11.980	48	9	sand
43.143	240.49	2.6595	1.106	11.894	46	9	sand
43.307	234.07	2.5459	1.088	11.500	45	9	sand
43.471	227.72	2.3139	1.016	12.308	44	9	sand
43.635	223.79	2.1659	0.968	12.083	43	9	sand
43.799	210.82	1.9847	0.941	11.292	40	9	sand
43.963	204.00	1.7070	0.837	11.380	39	9	sand
44.127	210.15	1.6511	0.786	11.581	40	9	sand
44.291	219.74	1.7769	0.809	11.885	42	9	sand
44.455	214.12	1.9487	0.910	9.869	41	9	sand
44.619	212.63	2.0028	0.942	9.568	41	9	sand
44.783	201.81	2.0101	0.996	9.608	39	9	sand
44.948	198.50	1.8979	0.956	10.579	38	9	sand
45.112	197.00	1.4104	0.716	11.155	38	9	sand
45.276	193.70	1.4397	0.743	11.887	37	9	sand
45.440	190.95	1.4907	0.781	12.920	37	9	sand
45.604	195.09	1.5671	0.803	14.008	37	9	sand
45.768	199.04	1.6273	0.818	13.972	38	9	sand
45.932	200.13	1.6110	0.805	14.192	38	9	sand
46.096	200.97	1.6130	0.803	14.611	38	9	sand
46.260	204.45	1.6495	0.807	14.843	39	9	sand
46.424	208.91	1.6646	0.797	14.802	40	9	sand
46.588	214.15	1.7396	0.812	14.910	41	9	sand
46.752	221.15	1.7883	0.809	15.034	42	9	sand
46.916	226.74	1.8446	0.814	14.809	43	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
47.080	231.94	1.9313	0.833	15.067	44	9	sand
47.244	230.06	2.0437	0.888	15.166	44	9	sand
47.408	229.10	2.0974	0.915	14.417	44	9	sand
47.572	214.65	1.9801	0.922	14.190	41	9	sand
47.736	206.04	1.7572	0.853	13.649	39	9	sand
47.900	206.57	1.7786	0.861	13.867	40	9	sand
48.064	216.71	1.8051	0.833	14.443	42	9	sand
48.228	228.36	1.8973	0.831	14.769	44	9	sand
48.392	246.14	2.1117	0.858	13.638	47	9	sand
48.556	258.34	2.2684	0.878	12.375	49	9	sand
48.720	253.16	2.4451	0.966	10.926	48	9	sand
48.885	252.98	2.7354	1.081	11.660	48	9	sand
49.049	245.06	2.9367	1.198	12.349	47	9	sand
49.213	235.95	2.8342	1.201	13.241	45	9	sand
49.377	232.16	2.5652	1.105	13.506	44	9	sand
49.541	238.46	2.3873	1.001	14.073	46	9	sand
49.705	240.97	2.3575	0.978	15.084	46	9	sand
49.869	234.78	2.4410	1.040	15.005	45	9	sand
50.033	233.04	2.3014	0.988	15.299	45	9	sand
50.197	233.50	2.1808	0.934	15.276	45	9	sand
50.361	243.04	2.2624	0.931	15.555	47	9	sand
50.525	238.41	2.3596	0.990	15.266	46	9	sand
50.689	235.55	2.3292	0.989	15.328	45	9	sand
50.853	232.88	2.3986	1.030	15.381	45	9	sand
51.017	232.02	2.3852	1.028	15.644	44	9	sand
51.181	226.08	2.2394	0.990	15.723	43	9	sand
51.345	233.95	2.1684	0.927	16.101	45	9	sand
51.509	248.81	2.3418	0.941	17.086	48	9	sand
51.673	254.67	2.6137	1.026	16.942	49	9	sand
51.837	256.28	2.7390	1.069	16.619	49	9	sand
52.001	256.35	2.7920	1.089	16.258	49	9	sand
52.165	260.24	2.9595	1.137	16.196	50	9	sand
52.329	264.42	3.0382	1.149	16.335	51	9	sand
52.493	268.95	3.1045	1.154	16.153	52	9	sand
52.657	268.05	3.1360	1.170	15.959	51	9	sand
52.822	268.79	2.9960	1.115	16.132	51	9	sand
52.986	283.42	2.9660	1.046	16.710	54	9	sand
53.150	309.60	3.1112	1.005	17.442	59	9	sand
53.314	316.29	3.4226	1.082	15.821	61	9	sand
53.478	308.31	3.4861	1.131	13.654	59	9	sand
53.642	304.32	3.4213	1.124	13.298	58	9	sand
53.806	301.31	3.4353	1.140	11.997	58	9	sand
53.970	296.97	3.4120	1.149	12.057	57	9	sand
54.134	296.16	3.3411	1.128	13.013	57	9	sand
54.298	301.97	3.3178	1.099	13.047	58	9	sand
54.462	311.37	3.3724	1.083	13.958	60	9	sand
54.626	315.81	3.5170	1.114	13.831	60	9	sand
54.790	320.46	3.6457	1.138	13.664	61	9	sand
54.954	321.41	3.5846	1.115	12.595	62	9	sand
55.118	308.00	3.4372	1.116	11.999	59	9	sand
55.282	284.45	3.2711	1.150	14.142	54	9	sand
55.446	289.81	3.1533	1.088	14.429	56	9	sand
55.610	301.81	3.3747	1.118	14.312	58	9	sand
55.774	305.34	3.5106	1.150	14.207	58	9	sand
55.938	285.07	3.4493	1.210	12.093	55	9	sand
56.102	275.46	3.2043	1.163	11.787	53	9	sand
56.266	270.25	3.1413	1.162	12.332	52	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
56.430	269.44	3.1014	1.151	12.676	52	9	sand
56.594	269.86	3.0066	1.114	13.238	52	9	sand
56.759	281.69	3.0475	1.082	14.058	54	9	sand
56.923	296.38	3.1693	1.069	14.561	57	9	sand
57.087	309.55	3.4327	1.109	14.439	59	9	sand
57.251	312.60	3.6807	1.177	14.297	60	9	sand
57.415	302.48	3.6893	1.220	12.877	58	9	sand
57.579	290.43	3.4827	1.199	12.879	56	9	sand
57.743	289.83	3.3876	1.169	12.863	56	9	sand
57.907	296.16	3.4373	1.161	13.941	57	9	sand
58.071	292.21	3.4462	1.179	13.814	56	9	sand
58.235	299.58	3.6611	1.222	13.779	57	9	sand
58.399	298.68	3.4724	1.163	13.877	57	9	sand
58.563	270.26	3.2941	1.219	14.979	52	9	sand
58.727	279.23	3.2727	1.172	14.726	53	9	sand
58.891	292.16	3.4066	1.166	15.170	56	9	sand
59.055	290.43	3.5368	1.218	15.417	56	9	sand
59.219	288.38	3.5940	1.246	14.515	55	9	sand
59.383	284.97	3.6453	1.279	14.288	55	9	sand
59.547	283.74	3.5626	1.256	14.405	54	9	sand
59.711	291.93	3.6101	1.237	14.874	56	9	sand
59.875	306.23	3.7334	1.219	15.790	59	9	sand
60.039	308.49	3.8804	1.258	16.285	59	9	sand
60.203	313.00	4.0153	1.283	15.455	60	9	sand
60.367	313.28	4.0456	1.291	15.594	60	9	sand
60.532	305.15	4.0046	1.312	14.584	58	9	sand
60.696	300.98	3.9324	1.307	14.639	58	9	sand
60.860	298.44	3.9132	1.311	14.855	57	9	sand
61.024	294.43	3.8510	1.308	14.960	56	9	sand
61.188	291.42	3.4426	1.181	15.125	56	9	sand
61.352	290.41	3.3812	1.164	15.543	56	9	sand
61.516	299.37	3.4393	1.149	15.692	57	9	sand
61.680	309.78	3.6952	1.193	16.239	59	9	sand
61.844	328.58	4.0769	1.241	17.356	63	9	sand
62.008	332.89	4.2111	1.265	15.541	64	9	sand
62.172	337.09	4.2653	1.265	15.259	65	9	sand
62.336	335.69	4.4558	1.327	14.788	64	9	sand
62.500	321.62	4.4476	1.383	13.432	62	9	sand
62.664	310.14	4.3212	1.393	13.690	59	9	sand
62.828	299.28	4.1148	1.375	13.561	57	9	sand
62.992	298.63	4.0547	1.358	13.853	57	9	sand
63.156	302.94	4.1052	1.355	14.546	58	9	sand
63.320	313.14	4.3386	1.386	15.610	60	9	sand
63.484	332.98	4.7482	1.426	16.196	64	9	sand
63.648	355.12	5.4218	1.527	17.547	85	8	sand to silty sand
63.812	358.70	6.0746	1.693	17.944	86	8	sand to silty sand
63.976	357.13	6.2576	1.752	16.655	85	8	sand to silty sand
64.140	339.53	6.1258	1.804	15.823	81	8	sand to silty sand
64.304	324.91	5.9911	1.844	14.998	78	8	sand to silty sand
64.469	313.86	5.7788	1.841	14.486	75	8	sand to silty sand
64.633	306.40	5.1975	1.696	14.888	73	8	sand to silty sand
64.797	306.51	4.1764	1.363	14.747	59	9	sand
64.961	306.29	4.0228	1.313	12.069	59	9	sand
65.125	306.35	4.1456	1.353	13.059	59	9	sand
65.289	311.91	4.1901	1.343	11.705	60	9	sand
65.453	326.53	4.4738	1.370	10.369	63	9	sand
65.617	355.88	5.8147	1.634	10.519	85	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
65.781	366.72	5.8487	1.595	9.938	88	8	sand to silty sand
65.945	334.27	5.9339	1.775	11.495	80	8	sand to silty sand
66.109	332.72	6.0126	1.807	11.791	80	8	sand to silty sand
66.273	319.12	6.0106	1.884	13.021	76	8	sand to silty sand
66.437	305.36	5.9827	1.959	12.906	73	8	sand to silty sand
66.601	293.07	5.6171	1.917	13.707	70	8	sand to silty sand
66.765	280.06	5.2075	1.859	13.621	67	8	sand to silty sand
66.929	270.99	4.6656	1.722	13.733	65	8	sand to silty sand
67.093	267.57	4.3552	1.628	14.185	64	8	sand to silty sand
67.257	276.70	4.4866	1.621	14.769	66	8	sand to silty sand
67.421	308.89	4.8468	1.569	15.371	74	8	sand to silty sand
67.585	320.33	5.3162	1.660	14.778	77	8	sand to silty sand
67.749	308.20	5.4122	1.756	12.860	74	8	sand to silty sand
67.913	290.05	5.2025	1.794	14.317	69	8	sand to silty sand
68.077	245.45	4.0838	1.664	13.016	59	8	sand to silty sand
68.241	311.91	4.5444	1.457	17.322	75	8	sand to silty sand
68.406	374.73	5.2056	1.389	17.382	72	9	sand
68.570	380.45	6.1143	1.607	17.966	91	8	sand to silty sand
68.734	381.69	6.7447	1.767	17.050	91	8	sand to silty sand
68.898	387.87	7.0397	1.815	15.797	93	8	sand to silty sand
69.062	372.31	7.3236	1.967	16.211	89	8	sand to silty sand
69.226	329.95	6.4529	1.956	14.735	79	8	sand to silty sand
69.390	268.58	5.1069	1.901	14.556	64	8	sand to silty sand
69.554	301.01	4.1655	1.384	15.735	58	9	sand
69.718	335.97	3.9358	1.171	14.051	64	9	sand
69.882	330.04	4.0613	1.231	4.524	63	9	sand
70.046	299.29	3.9302	1.313	11.239	57	9	sand
70.210	270.33	3.5263	1.304	10.094	52	9	sand
70.374	218.88	3.2064	1.465	10.873	52	8	sand to silty sand
70.538	182.20	2.6046	1.430	11.536	44	8	sand to silty sand
70.702	144.86	2.1707	1.499	12.509	35	8	sand to silty sand
70.866	110.24	1.8451	1.674	13.384	35	7	silty sand to sandy silt
71.030	79.28	1.5005	1.893	16.332	25	7	silty sand to sandy silt
71.194	131.26	1.3717	1.045	22.050	31	8	sand to silty sand
71.358	178.20	1.9167	1.076	21.505	34	9	sand
71.522	188.45	2.6643	1.414	22.256	45	8	sand to silty sand
71.686	206.22	3.0387	1.473	24.310	49	8	sand to silty sand
71.850	234.97	3.4142	1.453	22.617	56	8	sand to silty sand
72.014	248.80	3.6814	1.480	20.960	60	8	sand to silty sand
72.178	232.63	3.8388	1.650	19.745	56	8	sand to silty sand
72.343	218.44	3.6300	1.662	20.058	52	8	sand to silty sand
72.507	195.43	3.7199	1.904	19.860	47	8	sand to silty sand
72.671	122.19	1.7825	1.459	19.805	29	8	sand to silty sand
72.835	55.49	2.8509	5.138	19.274	35	4	silty clay to clay
72.999	186.78	4.0455	2.166	25.807	60	7	silty sand to sandy silt
73.163	170.69	4.0014	2.344	21.756	54	7	silty sand to sandy silt
73.327	214.84	3.8738	1.803	41.644	51	8	sand to silty sand
73.491	220.95	4.8090	2.177	16.775	71	7	silty sand to sandy silt
73.655	204.64	4.8408	2.366	18.454	65	7	silty sand to sandy silt
73.819	122.61	3.4314	2.799	26.988	47	6	sandy silt to clayey silt
73.983	121.95	2.6330	2.159	27.012	39	7	silty sand to sandy silt
74.147	131.02	2.3091	1.762	28.353	42	7	silty sand to sandy silt
74.311	64.02	2.4993	3.904	27.827	31	5	clayey silt to silty clay
74.475	55.97	1.7387	3.106	31.687	21	6	sandy silt to clayey silt
74.639	47.50	1.8567	3.909	39.432	23	5	clayey silt to silty clay
74.803	62.74	1.2583	2.005	18.549	20	7	silty sand to sandy silt
74.967	60.86	1.4560	2.392	6.641	23	6	sandy silt to clayey silt

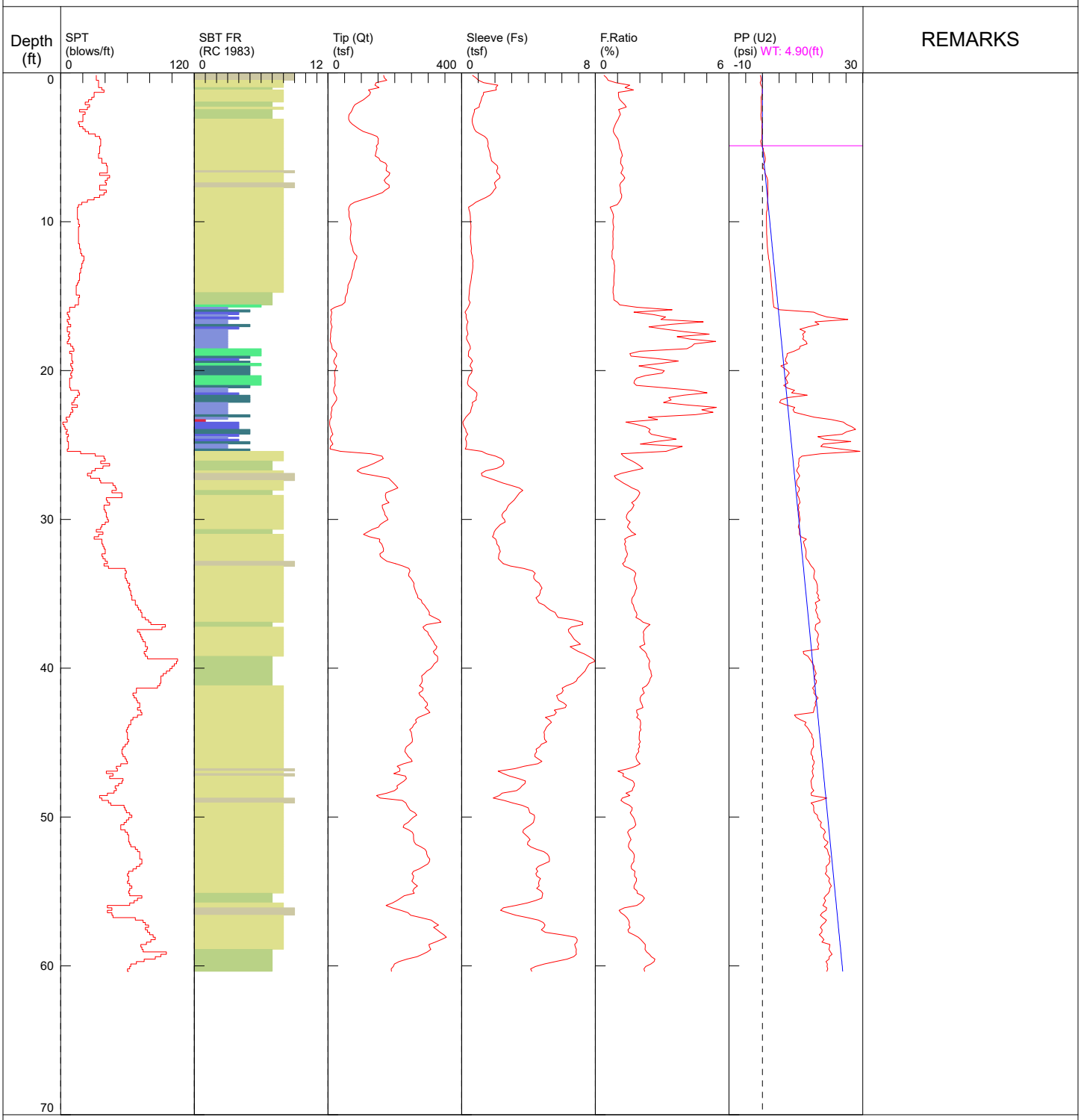
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
75.131	43.26	1.3439	3.106	22.787	21	5	clayey silt to silty clay
75.295	65.47	1.3309	2.033	50.346	21	7	silty sand to sandy silt
75.459	125.36	1.4177	1.131	29.152	30	8	sand to silty sand
75.623	128.48	1.6586	1.291	30.671	31	8	sand to silty sand
75.787	115.11	2.2052	1.916	30.706	37	7	silty sand to sandy silt
75.951	78.62	2.6074	3.317	29.329	30	6	sandy silt to clayey silt
76.115	55.04	2.3024	4.183	30.759	26	5	clayey silt to silty clay
76.280	63.54	2.2190	3.492	37.283	30	5	clayey silt to silty clay
76.444	39.58	2.8618	7.231	34.585	38	3	clay
76.608	204.74	3.1661	1.546	24.341	49	8	sand to silty sand
76.772	165.91	3.2243	1.943	24.090	53	7	silty sand to sandy silt
76.936	147.36	3.0947	2.100	24.472	47	7	silty sand to sandy silt
77.100	133.58	2.7390	2.050	26.921	43	7	silty sand to sandy silt
77.264	129.37	2.5199	1.948	28.294	41	7	silty sand to sandy silt
77.428	143.28	2.4562	1.714	20.919	34	8	sand to silty sand
77.592	172.97	2.6313	1.521	11.648	41	8	sand to silty sand
77.756	197.19	2.0119	1.020	4.842	38	9	sand
77.920	210.23	2.0991	0.999	3.663	40	9	sand
78.084	247.39	2.4442	0.988	5.400	47	9	sand
78.248	239.57	2.9627	1.237	6.633	46	9	sand
78.412	221.66	3.0706	1.385	8.587	53	8	sand to silty sand
78.576	194.11	3.4467	1.776	10.012	46	8	sand to silty sand
78.740	157.19	3.3561	2.135	10.871	50	7	silty sand to sandy silt
78.904	188.79	2.7673	1.466	15.223	45	8	sand to silty sand
79.068	169.12	2.4925	1.474	15.232	40	8	sand to silty sand
79.232	168.55	2.0506	1.217	15.794	40	8	sand to silty sand
79.396	222.45	2.0586	0.925	20.761	43	9	sand
79.560	205.11	2.9050	1.416	20.850	49	8	sand to silty sand
79.724	140.07	2.8212	2.014	19.974	45	7	silty sand to sandy silt
79.888	54.12	1.7020	3.145	32.242	21	6	sandy silt to clayey silt
80.052	165.38	1.9625	1.187	39.939	40	8	sand to silty sand
80.217	200.67	2.0859	1.039	19.367	38	9	sand
80.381	246.06	3.1492	1.280	27.531	47	9	sand
80.545	314.00	3.8411	1.223	30.640	60	9	sand
80.709	298.86	4.4732	1.497	23.363	72	8	sand to silty sand
80.873	275.87	4.4192	1.602	24.523	66	8	sand to silty sand
81.037	258.26	4.1407	1.603	25.977	62	8	sand to silty sand
81.201	269.91	3.5170	1.303	30.405	52	9	sand
81.365	269.77	3.4142	1.266	21.684	52	9	sand
81.529	259.74	3.5619	1.371	24.458	50	9	sand
81.693	289.06	3.5948	1.244	28.717	55	9	sand
81.857	290.91	3.7311	1.283	21.710	56	9	sand
82.021	289.52	3.9050	1.349	22.048	55	9	sand
82.185	288.55	4.0388	1.400	21.756	55	9	sand
82.349	271.61	4.1924	1.544	22.002	65	8	sand to silty sand
82.513	248.36	4.1432	1.668	22.335	59	8	sand to silty sand
82.677	194.70	3.7429	1.922	23.368	47	8	sand to silty sand
82.841	208.28	3.2410	1.556	25.845	50	8	sand to silty sand
83.005	262.59	3.7012	1.410	22.308	63	8	sand to silty sand
83.169	276.22	4.2212	1.528	16.024	66	8	sand to silty sand
83.333	273.59	4.4757	1.636	26.672	65	8	sand to silty sand
83.497	302.74	4.6720	1.543	27.402	72	8	sand to silty sand
83.661	291.07	4.7155	1.620	24.810	70	8	sand to silty sand
83.825	250.18	4.5297	1.811	22.275	60	8	sand to silty sand
83.990	237.05	4.3298	1.827	24.630	57	8	sand to silty sand
84.154	189.57	4.4721	2.359	23.121	61	7	silty sand to sandy silt
84.318	107.42	4.5603	4.245	27.041	103	11	very stiff fine grained (*)

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
84.482	65.85	2.3993	3.644	22.710	32	5	clayey silt to silty clay
84.646	53.29	2.3110	4.337	39.604	34	4	silty clay to clay
84.810	56.44	1.9310	3.422	29.984	27	5	clayey silt to silty clay
84.974	83.30	1.7145	2.058	34.179	27	7	silty sand to sandy silt
85.138	131.85	1.3786	1.046	19.116	32	8	sand to silty sand
85.302	132.90	1.4838	1.116	9.673	32	8	sand to silty sand
85.466	107.74	2.0784	1.929	7.413	34	7	silty sand to sandy silt
85.630	118.42	3.0067	2.539	11.299	38	7	silty sand to sandy silt
85.794	201.51	3.4890	1.731	9.603	48	8	sand to silty sand
85.958	277.59	4.5097	1.625	30.924	66	8	sand to silty sand
86.122	270.43	4.9478	1.830	29.037	65	8	sand to silty sand
86.286	242.16	4.9990	2.064	27.361	58	8	sand to silty sand
86.450	238.11	4.7032	1.975	26.342	57	8	sand to silty sand
86.614	245.74	4.3435	1.768	28.098	59	8	sand to silty sand
86.778	264.35	4.3349	1.640	27.088	63	8	sand to silty sand
86.942	294.42	4.3092	1.464	26.483	70	8	sand to silty sand
87.106	319.47	4.3311	1.356	21.756	61	9	sand
87.270	341.24	4.2195	1.237	13.843	65	9	sand
87.434	338.58	4.4844	1.324	12.420	65	9	sand
87.598	327.05	4.3254	1.323	13.444	63	9	sand
87.762	307.69	3.5987	1.170	16.246	59	9	sand
87.927	245.32	3.5030	1.428	14.797	59	8	sand to silty sand
88.091	126.21	3.3630	2.665	28.071	40	7	silty sand to sandy silt
88.255	111.54	3.0844	2.765	28.758	43	6	sandy silt to clayey silt
88.419	135.44	2.8782	2.125	43.875	43	7	silty sand to sandy silt
88.583	198.28	2.7857	1.405	23.698	47	8	sand to silty sand
88.747	220.67	3.6581	1.658	27.285	53	8	sand to silty sand
88.911	216.81	4.1411	1.910	29.793	52	8	sand to silty sand
89.075	189.33	3.7492	1.980	28.547	60	7	silty sand to sandy silt
89.239	163.17	3.1247	1.915	27.234	52	7	silty sand to sandy silt
89.403	133.42	2.5057	1.878	28.160	43	7	silty sand to sandy silt
89.567	134.77	2.6650	1.977	33.672	43	7	silty sand to sandy silt
89.731	186.07	3.0085	1.617	34.229	45	8	sand to silty sand
89.895	204.23	3.4307	1.680	33.136	49	8	sand to silty sand
90.059	231.50	3.7574	1.623	32.132	55	8	sand to silty sand
90.223	246.61	3.9275	1.593	32.297	59	8	sand to silty sand
90.387	267.42	3.8326	1.433	30.855	64	8	sand to silty sand
90.551	284.97	3.7017	1.299	30.068	55	9	sand
90.715	267.12	3.6756	1.376	23.977	51	9	sand
90.879	191.53	3.7001	1.932	21.050	46	8	sand to silty sand
91.043	146.07	2.9457	2.017	23.236	47	7	silty sand to sandy silt
91.207	152.03	2.4629	1.620	30.135	36	8	sand to silty sand
91.371	204.20	2.1856	1.070	29.109	39	9	sand
91.535	249.39	1.9766	0.793	22.433	48	9	sand
91.699	266.22	2.3645	0.888	10.711	51	9	sand
91.864	278.61	3.3491	1.202	13.681	53	9	sand
92.028	293.60	4.1303	1.407	19.656	56	9	sand
92.192	292.42	4.4656	1.527	20.271	70	8	sand to silty sand
92.356	273.92	4.5503	1.661	22.110	66	8	sand to silty sand
92.520	245.65	4.2381	1.725	22.196	59	8	sand to silty sand
92.684	224.12	3.5288	1.575	23.805	54	8	sand to silty sand
92.848	208.01	2.6644	1.281	26.775	40	9	sand
93.012	198.56	2.3424	1.180	26.027	38	9	sand
93.340	194.94	2.6371	1.353	28.408	47	8	sand to silty sand
93.504	191.13	2.5402	1.329	30.003	46	8	sand to silty sand
93.668	170.13	1.8004	1.058	25.539	33	9	sand
93.832	165.99	1.7426	1.050	21.727	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
93.996	158.41	2.0007	1.263	19.267	38	8	sand to silty sand
94.160	150.75	2.2535	1.495	24.049	36	8	sand to silty sand
94.324	178.31	3.0882	1.732	29.140	43	8	sand to silty sand
94.488	189.54	2.7900	1.472	36.075	45	8	sand to silty sand
94.652	251.29	3.0644	1.219	32.634	48	9	sand
94.816	284.29	3.5733	1.257	18.492	54	9	sand
94.980	265.82	4.3085	1.621	20.723	64	8	sand to silty sand
95.144	255.04	4.6013	1.804	22.710	61	8	sand to silty sand
95.308	252.81	4.6239	1.829	26.053	61	8	sand to silty sand
95.472	237.30	4.3142	1.818	28.456	57	8	sand to silty sand
95.636	226.44	4.0563	1.791	30.599	54	8	sand to silty sand
95.801	257.20	4.2859	1.666	35.350	62	8	sand to silty sand
95.965	257.55	4.3585	1.692	31.957	62	8	sand to silty sand
96.129	211.81	4.1569	1.963	29.353	51	8	sand to silty sand
96.293	193.02	3.4748	1.800	31.630	46	8	sand to silty sand
96.457	222.97	3.4378	1.542	35.436	53	8	sand to silty sand
96.621	249.17	3.6636	1.470	30.491	60	8	sand to silty sand
96.785	274.67	4.3268	1.575	33.956	66	8	sand to silty sand
96.949	305.06	5.1497	1.688	34.717	73	8	sand to silty sand
97.113	305.21	5.4763	1.794	28.315	73	8	sand to silty sand
97.277	245.24	5.2357	2.135	26.378	78	7	silty sand to sandy silt
97.441	212.34	4.8516	2.285	26.546	68	7	silty sand to sandy silt
97.605	181.03	4.4981	2.485	28.346	58	7	silty sand to sandy silt
97.769	136.89	4.5284	3.308	30.931	52	6	sandy silt to clayey silt
97.933	89.21	4.0792	4.572	43.897	85	11	very stiff fine grained (*)
98.097	141.36	2.8489	2.015	50.793	45	7	silty sand to sandy silt
98.261	152.43	2.2860	1.500	24.879	36	8	sand to silty sand
98.425	152.26	2.4825	1.630	29.635	36	8	sand to silty sand
98.589	184.08	2.1807	1.185	36.381	44	8	sand to silty sand
98.753	227.80	2.3278	1.022	27.258	44	9	sand
98.917	186.88	2.5255	1.351	24.245	45	8	sand to silty sand
99.081	162.18	2.6931	1.661	28.793	39	8	sand to silty sand
99.245	140.02	2.4901	1.778	29.547	45	7	silty sand to sandy silt
99.409	122.86	2.7851	2.267	32.952	39	7	silty sand to sandy silt
99.573	78.07	2.3676	3.033	30.836	30	6	sandy silt to clayey silt
99.738	60.68	1.8222	3.003	57.936	23	6	sandy silt to clayey silt
99.902	130.58	1.9307	1.479	75.880	31	8	sand to silty sand
100.066	138.23	2.1892	1.584	40.441	33	8	sand to silty sand
100.230	137.36	3.1589	2.300	40.461	44	7	silty sand to sandy silt
100.394	91.89	2.6164	2.847	39.478	35	6	sandy silt to clayey silt
100.558	191.62	2.3387	1.221	58.740	37	9	sand
100.722	185.82	2.6744	1.439	33.265	44	8	sand to silty sand
100.886	155.06	2.3506	1.516	38.933	37	8	sand to silty sand
101.050	127.01	2.8407	2.237	41.821	41	7	silty sand to sandy silt

Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

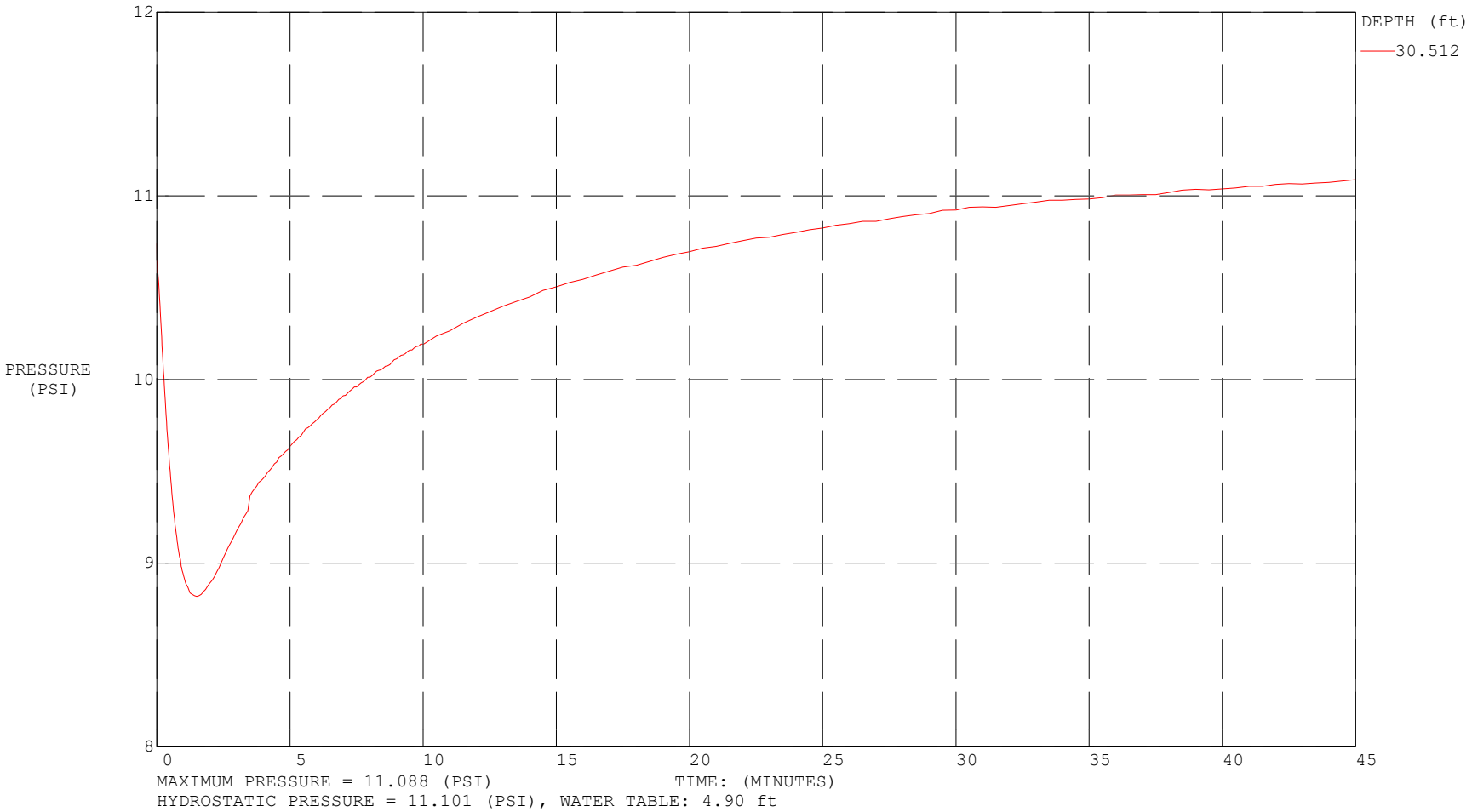
OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 11:21:35 AM
TOTAL DEPTH: 60.367 ft



*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/24/2024 11:21:35 AM



Shannon & Wilson / CPT-3 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 11:21:35 AM
TOTAL DEPTH: 60.367 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	166.36	0.6465	0.389	-0.627	32	9	sand
0.328	168.35	0.8514	0.506	-0.440	32	9	sand
0.492	175.85	1.0048	0.571	-0.416	34	9	sand
0.656	144.08	1.3177	0.915	-0.691	34	8	sand to silty sand
0.820	140.48	2.1659	1.542	-0.435	34	8	sand to silty sand
0.984	152.67	2.0412	1.337	-0.062	37	8	sand to silty sand
1.148	121.37	2.0721	1.707	-0.088	39	7	silty sand to sandy silt
1.312	127.18	1.3137	1.033	-0.065	30	8	sand to silty sand
1.476	124.55	1.2901	1.036	-0.167	30	8	sand to silty sand
1.640	115.44	1.2097	1.048	-0.404	28	8	sand to silty sand
1.804	106.42	1.1763	1.105	-0.373	25	8	sand to silty sand
1.969	93.55	1.1295	1.207	-0.359	22	8	sand to silty sand
2.133	80.77	1.0662	1.320	-0.330	26	7	silty sand to sandy silt
2.297	75.52	1.0477	1.387	-0.342	24	7	silty sand to sandy silt
2.461	72.88	0.7628	1.047	-0.342	17	8	sand to silty sand
2.625	69.46	0.7543	1.086	-0.368	22	7	silty sand to sandy silt
2.789	63.19	0.7111	1.125	-0.462	20	7	silty sand to sandy silt
2.953	61.82	0.6612	1.070	-0.445	20	7	silty sand to sandy silt
3.117	61.91	0.6343	1.025	-0.423	20	7	silty sand to sandy silt
3.281	64.84	0.6234	0.961	-0.182	16	8	sand to silty sand
3.445	72.66	0.6538	0.900	-0.117	17	8	sand to silty sand
3.609	83.23	0.7143	0.858	-0.187	20	8	sand to silty sand
3.773	92.98	0.7543	0.811	-0.201	22	8	sand to silty sand
3.937	105.87	0.8567	0.809	-0.203	25	8	sand to silty sand
4.101	127.80	1.0991	0.860	-0.198	31	8	sand to silty sand
4.265	146.54	1.3701	0.935	-0.179	35	8	sand to silty sand
4.429	150.62	1.5150	1.006	-0.167	36	8	sand to silty sand
4.593	149.91	1.5672	1.045	-0.567	36	8	sand to silty sand
4.757	150.06	1.5867	1.057	-0.387	36	8	sand to silty sand
4.921	144.39	1.5695	1.087	-0.265	35	8	sand to silty sand
5.085	146.86	1.6115	1.097	0.265	35	8	sand to silty sand
5.249	144.59	1.6704	1.155	0.263	35	8	sand to silty sand
5.413	143.10	1.6989	1.187	0.526	34	8	sand to silty sand
5.577	141.04	1.7066	1.210	0.737	34	8	sand to silty sand
5.741	152.72	1.7587	1.152	0.830	37	8	sand to silty sand
5.906	156.20	1.7894	1.146	0.801	37	8	sand to silty sand
6.070	172.28	1.9453	1.129	0.567	41	8	sand to silty sand
6.234	176.55	2.1255	1.204	0.055	42	8	sand to silty sand
6.398	174.42	2.1695	1.244	0.143	42	8	sand to silty sand
6.562	174.37	2.0944	1.201	0.765	42	8	sand to silty sand
6.726	185.27	2.1187	1.144	0.758	35	9	sand
6.890	182.16	2.2728	1.248	1.038	44	8	sand to silty sand
7.054	173.51	2.2929	1.321	1.370	42	8	sand to silty sand
7.218	167.91	2.1079	1.255	1.554	40	8	sand to silty sand
7.382	172.82	1.9662	1.138	1.588	41	8	sand to silty sand
7.546	183.08	2.0011	1.093	1.607	35	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	182.90	2.0570	1.125	1.609	35	9	sand
7.874	171.52	1.9334	1.127	1.583	41	8	sand to silty sand
8.038	163.01	1.8466	1.133	1.631	39	8	sand to silty sand
8.202	144.21	1.7067	1.183	1.631	35	8	sand to silty sand
8.366	123.39	1.4537	1.178	1.593	30	8	sand to silty sand
8.530	101.32	1.1424	1.128	1.542	24	8	sand to silty sand
8.694	79.30	0.8409	1.060	1.483	19	8	sand to silty sand
8.858	67.29	0.6586	0.979	1.468	16	8	sand to silty sand
9.022	62.98	0.4154	0.660	1.471	15	8	sand to silty sand
9.186	61.60	0.4364	0.709	1.468	15	8	sand to silty sand
9.350	63.28	0.4830	0.763	1.198	15	8	sand to silty sand
9.514	62.86	0.5062	0.805	1.184	15	8	sand to silty sand
9.678	63.54	0.5182	0.816	1.172	15	8	sand to silty sand
9.843	65.84	0.5207	0.791	1.179	16	8	sand to silty sand
10.007	67.85	0.5331	0.786	1.193	16	8	sand to silty sand
10.171	69.34	0.5500	0.793	1.203	17	8	sand to silty sand
10.335	68.10	0.5590	0.821	1.205	16	8	sand to silty sand
10.499	67.73	0.5476	0.808	1.215	16	8	sand to silty sand
10.663	68.71	0.5404	0.786	1.236	16	8	sand to silty sand
10.827	67.99	0.5367	0.789	1.272	16	8	sand to silty sand
10.991	66.71	0.5259	0.788	1.306	16	8	sand to silty sand
11.155	66.52	0.5280	0.794	1.346	16	8	sand to silty sand
11.319	67.86	0.5332	0.786	1.382	16	8	sand to silty sand
11.483	69.51	0.5473	0.787	1.420	17	8	sand to silty sand
11.647	72.41	0.5714	0.789	1.473	17	8	sand to silty sand
11.811	74.15	0.5864	0.791	1.530	18	8	sand to silty sand
11.975	75.15	0.5657	0.753	1.593	18	8	sand to silty sand
12.139	79.32	0.5982	0.754	1.681	19	8	sand to silty sand
12.303	86.40	0.6401	0.741	1.774	21	8	sand to silty sand
12.467	85.79	0.6472	0.754	1.832	21	8	sand to silty sand
12.631	82.09	0.6839	0.833	2.028	20	8	sand to silty sand
12.795	79.24	0.6627	0.836	2.107	19	8	sand to silty sand
12.959	78.27	0.6738	0.861	2.195	19	8	sand to silty sand
13.123	77.24	0.6641	0.860	2.272	18	8	sand to silty sand
13.287	73.86	0.6408	0.868	2.343	18	8	sand to silty sand
13.451	72.57	0.6174	0.851	2.410	17	8	sand to silty sand
13.615	71.05	0.5971	0.840	2.470	17	8	sand to silty sand
13.780	69.29	0.5774	0.833	2.525	17	8	sand to silty sand
13.944	66.48	0.5539	0.833	2.602	16	8	sand to silty sand
14.108	63.16	0.5282	0.836	2.664	15	8	sand to silty sand
14.272	59.94	0.4992	0.833	2.731	14	8	sand to silty sand
14.436	59.73	0.4776	0.800	2.812	14	8	sand to silty sand
14.600	58.37	0.4674	0.801	2.870	14	8	sand to silty sand
14.764	57.79	0.4564	0.790	2.948	14	8	sand to silty sand
14.928	54.31	0.4429	0.816	3.013	17	7	silty sand to sandy silt
15.092	51.63	0.4266	0.826	3.082	16	7	silty sand to sandy silt
15.256	51.65	0.4318	0.836	3.149	16	7	silty sand to sandy silt
15.420	50.65	0.5067	1.000	3.228	16	7	silty sand to sandy silt
15.584	41.76	0.4544	1.088	3.317	13	7	silty sand to sandy silt
15.748	20.70	0.3875	1.872	3.429	8	6	sandy silt to clayey silt
15.912	8.49	0.2923	3.445	5.194	8	3	clay
16.076	11.53	0.1992	1.727	15.366	6	5	clayey silt to silty clay
16.240	10.35	0.2693	2.602	16.899	7	4	silty clay to clay
16.404	8.31	0.2615	3.148	19.271	8	3	clay
16.568	10.17	0.2992	2.942	25.553	6	4	silty clay to clay
16.732	7.73	0.3745	4.844	15.694	7	3	clay
16.896	9.51	0.3229	3.397	16.882	9	3	clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	12.30	0.2963	2.410	13.678	6	5	clayey silt to silty clay
17.224	9.42	0.2960	3.141	11.203	6	4	silty clay to clay
17.388	8.70	0.3498	4.021	12.853	8	3	clay
17.552	7.40	0.3783	5.112	12.054	7	3	clay
17.717	7.90	0.2894	3.664	12.310	8	3	clay
17.881	6.91	0.2926	4.236	12.078	7	3	clay
18.045	6.69	0.3613	5.404	13.066	6	3	clay
18.209	9.92	0.4410	4.447	13.343	9	3	clay
18.373	11.73	0.5073	4.327	11.229	11	3	clay
18.537	12.61	0.5180	4.108	11.053	12	3	clay
18.701	20.99	0.4202	2.002	9.434	8	6	sandy silt to clayey silt
18.865	26.10	0.4033	1.545	7.391	10	6	sandy silt to clayey silt
19.029	24.95	0.4007	1.606	7.325	10	6	sandy silt to clayey silt
19.193	20.29	0.5528	2.725	6.961	10	5	clayey silt to silty clay
19.357	17.38	0.6487	3.732	6.853	11	4	silty clay to clay
19.521	19.00	0.5569	2.931	7.516	9	5	clayey silt to silty clay
19.685	25.66	0.5026	1.959	5.478	10	6	sandy silt to clayey silt
19.849	23.48	0.6060	2.581	6.523	11	5	clayey silt to silty clay
20.013	20.11	0.6226	3.096	7.463	10	5	clayey silt to silty clay
20.177	19.35	0.5792	2.993	8.054	9	5	clayey silt to silty clay
20.341	20.49	0.4594	2.242	7.454	10	5	clayey silt to silty clay
20.505	21.41	0.3979	1.859	6.918	8	6	sandy silt to clayey silt
20.669	21.19	0.3731	1.761	7.272	8	6	sandy silt to clayey silt
20.833	20.14	0.3481	1.729	7.611	8	6	sandy silt to clayey silt
20.997	21.30	0.3929	1.845	6.358	8	6	sandy silt to clayey silt
21.161	17.77	0.5629	3.168	7.387	9	5	clayey silt to silty clay
21.325	16.96	0.7471	4.406	9.596	16	3	clay
21.490	18.03	0.9048	5.019	8.740	17	3	clay
21.654	23.05	0.9142	3.967	13.425	15	4	silty clay to clay
21.818	26.19	0.8635	3.296	7.585	13	5	clayey silt to silty clay
21.982	25.62	0.8722	3.404	5.536	12	5	clayey silt to silty clay
22.146	20.78	0.6363	3.061	5.086	10	5	clayey silt to silty clay
22.310	16.13	0.6570	4.072	6.995	15	3	clay
22.474	10.89	0.5922	5.436	9.685	10	3	clay
22.638	11.78	0.5626	4.775	9.161	11	3	clay
22.802	9.91	0.5238	5.286	9.563	9	3	clay
22.966	8.66	0.3893	4.498	12.399	8	3	clay
23.130	10.50	0.2489	2.370	15.474	5	5	clayey silt to silty clay
23.294	5.90	0.1649	2.793	20.610	6	3	clay
23.458	5.10	0.0700	1.371	24.178	2	1	sensitive fine grained
23.622	5.11	0.0945	1.851	25.168	3	4	silty clay to clay
23.786	6.56	0.1483	2.261	26.785	4	4	silty clay to clay
23.950	9.85	0.2419	2.456	27.866	6	4	silty clay to clay
24.114	11.03	0.2641	2.395	25.192	5	5	clayey silt to silty clay
24.278	14.56	0.3659	2.513	23.832	7	5	clayey silt to silty clay
24.442	8.69	0.2649	3.048	16.560	6	4	silty clay to clay
24.606	6.23	0.2262	3.629	18.470	6	3	clay
24.770	10.54	0.2865	2.718	26.460	7	4	silty clay to clay
24.934	14.58	0.2947	2.021	18.147	7	5	clayey silt to silty clay
25.098	7.22	0.2817	3.901	17.476	7	3	clay
25.262	6.17	0.2164	3.507	23.227	6	3	clay
25.427	37.61	1.1954	3.179	29.210	18	5	clayey silt to silty clay
25.591	128.00	1.4844	1.160	17.456	31	8	sand to silty sand
25.755	161.37	2.0301	1.258	11.842	39	8	sand to silty sand
25.919	165.69	2.3692	1.430	10.938	40	8	sand to silty sand
26.083	152.03	2.5144	1.654	10.950	36	8	sand to silty sand
26.247	136.41	2.5235	1.850	10.804	44	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	119.56	2.4032	2.010	10.940	38	7	silty sand to sandy silt
26.575	98.01	2.0928	2.135	10.503	31	7	silty sand to sandy silt
26.739	86.93	1.4379	1.654	10.218	28	7	silty sand to sandy silt
26.903	100.90	1.1810	1.170	10.708	24	8	sand to silty sand
27.067	143.30	1.2205	0.852	11.158	27	9	sand
27.231	181.67	1.6659	0.917	10.732	35	9	sand
27.395	188.92	2.0646	1.093	10.254	36	9	sand
27.559	196.03	2.4579	1.254	10.216	47	8	sand to silty sand
27.723	203.25	2.9712	1.462	10.354	49	8	sand to silty sand
27.887	209.16	3.4434	1.646	11.014	50	8	sand to silty sand
28.051	191.32	3.6586	1.912	10.988	46	8	sand to silty sand
28.215	173.64	3.4666	1.996	10.481	55	7	silty sand to sandy silt
28.379	171.60	3.3507	1.953	10.538	55	7	silty sand to sandy silt
28.543	172.78	3.2461	1.879	10.909	41	8	sand to silty sand
28.707	174.88	3.1297	1.790	11.069	42	8	sand to silty sand
28.871	182.65	2.9709	1.626	11.261	44	8	sand to silty sand
29.035	162.44	2.8142	1.732	10.701	39	8	sand to silty sand
29.199	162.55	2.7299	1.679	10.919	39	8	sand to silty sand
29.364	165.61	2.6615	1.607	10.749	40	8	sand to silty sand
29.528	169.27	2.5036	1.479	10.995	41	8	sand to silty sand
29.692	169.97	2.4051	1.415	10.983	41	8	sand to silty sand
29.856	175.97	2.4382	1.386	11.139	42	8	sand to silty sand
30.020	179.67	2.5694	1.430	11.241	43	8	sand to silty sand
30.184	166.79	2.6057	1.562	11.086	40	8	sand to silty sand
30.348	156.49	2.3181	1.481	10.885	37	8	sand to silty sand
30.512	151.19	2.1762	1.439	10.727	36	8	sand to silty sand
30.676	131.85	2.0349	1.543	11.096	32	8	sand to silty sand
30.840	118.95	1.9426	1.633	11.100	38	7	silty sand to sandy silt
31.004	105.93	1.9148	1.808	11.029	34	7	silty sand to sandy silt
31.168	124.19	1.8461	1.487	11.540	30	8	sand to silty sand
31.332	155.08	2.0387	1.315	13.128	37	8	sand to silty sand
31.496	153.63	2.0952	1.364	12.260	37	8	sand to silty sand
31.660	160.71	2.1066	1.311	12.454	38	8	sand to silty sand
31.824	163.80	2.2251	1.358	12.643	39	8	sand to silty sand
31.988	166.20	2.2505	1.354	12.944	40	8	sand to silty sand
32.152	165.74	2.3165	1.398	13.092	40	8	sand to silty sand
32.316	155.06	2.2402	1.445	13.013	37	8	sand to silty sand
32.480	156.68	2.2188	1.416	12.978	38	8	sand to silty sand
32.644	165.34	2.2000	1.331	13.138	40	8	sand to silty sand
32.808	176.32	2.3478	1.332	13.807	42	8	sand to silty sand
32.972	201.91	2.4812	1.229	14.168	39	9	sand
33.136	224.33	2.9101	1.297	14.611	43	9	sand
33.301	241.74	3.7118	1.535	15.252	58	8	sand to silty sand
33.465	245.63	4.2469	1.729	15.622	59	8	sand to silty sand
33.629	242.12	4.3999	1.817	15.493	58	8	sand to silty sand
33.793	241.16	4.3145	1.789	15.342	58	8	sand to silty sand
33.957	248.02	4.3169	1.741	15.407	59	8	sand to silty sand
34.121	252.49	4.4316	1.755	15.986	60	8	sand to silty sand
34.285	257.45	4.6408	1.803	16.249	62	8	sand to silty sand
34.449	256.79	4.7152	1.836	16.423	61	8	sand to silty sand
34.613	258.80	4.8072	1.857	16.454	62	8	sand to silty sand
34.777	261.09	4.7089	1.804	16.505	63	8	sand to silty sand
34.941	263.90	4.6969	1.780	16.208	63	8	sand to silty sand
35.105	267.86	4.6425	1.733	16.772	64	8	sand to silty sand
35.269	268.66	4.4453	1.655	16.555	64	8	sand to silty sand
35.433	279.45	4.5411	1.625	17.184	67	8	sand to silty sand
35.597	281.28	4.6144	1.640	15.790	67	8	sand to silty sand

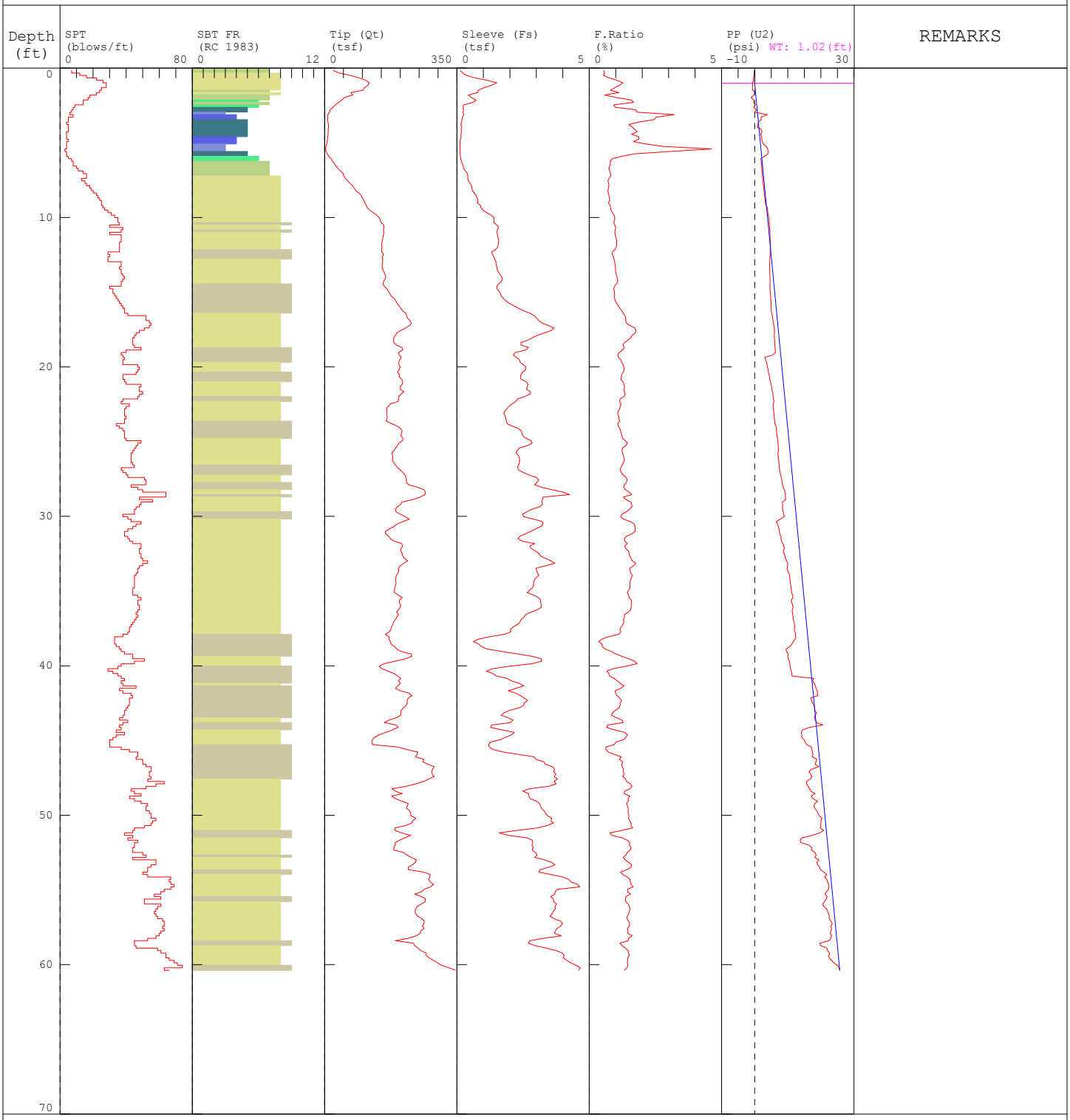
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	288.97	4.9370	1.708	16.101	69	8	sand to silty sand
35.925	293.39	5.1023	1.739	16.261	70	8	sand to silty sand
36.089	299.20	5.2881	1.767	15.885	72	8	sand to silty sand
36.253	303.42	5.5971	1.845	16.156	73	8	sand to silty sand
36.417	302.89	5.6737	1.873	16.512	73	8	sand to silty sand
36.581	317.59	5.7677	1.816	16.509	76	8	sand to silty sand
36.745	331.99	6.6836	2.013	17.093	79	8	sand to silty sand
36.909	337.68	7.2247	2.140	17.212	81	8	sand to silty sand
37.073	294.91	7.2366	2.454	15.969	94	7	silty sand to sandy silt
37.238	284.18	6.5635	2.310	15.830	91	7	silty sand to sandy silt
37.402	288.75	6.3857	2.212	15.751	69	8	sand to silty sand
37.566	298.55	6.4106	2.147	16.344	71	8	sand to silty sand
37.730	300.61	6.5379	2.175	16.732	72	8	sand to silty sand
37.894	306.10	6.6282	2.165	16.641	73	8	sand to silty sand
38.058	310.53	6.7457	2.172	16.323	74	8	sand to silty sand
38.222	316.03	6.9249	2.191	16.486	76	8	sand to silty sand
38.386	319.22	7.1040	2.225	16.856	76	8	sand to silty sand
38.550	325.90	6.4859	1.990	16.529	78	8	sand to silty sand
38.714	323.10	6.7266	2.082	16.782	77	8	sand to silty sand
38.878	315.01	6.9759	2.214	12.186	75	8	sand to silty sand
39.042	319.02	7.3359	2.300	12.401	76	8	sand to silty sand
39.206	327.86	7.6039	2.319	13.657	78	8	sand to silty sand
39.370	328.46	7.8642	2.394	14.089	105	7	silty sand to sandy silt
39.534	327.32	7.9929	2.442	14.596	104	7	silty sand to sandy silt
39.698	318.01	7.6422	2.403	15.056	102	7	silty sand to sandy silt
39.862	313.42	7.5422	2.406	15.479	100	7	silty sand to sandy silt
40.026	307.47	7.4587	2.426	15.498	98	7	silty sand to sandy silt
40.190	296.16	7.3802	2.492	15.804	95	7	silty sand to sandy silt
40.354	288.92	7.2287	2.502	16.079	92	7	silty sand to sandy silt
40.518	280.41	7.1012	2.532	15.665	90	7	silty sand to sandy silt
40.682	281.37	6.9357	2.465	15.500	90	7	silty sand to sandy silt
40.846	282.42	6.8666	2.431	16.167	90	7	silty sand to sandy silt
41.011	279.91	6.6667	2.382	16.024	89	7	silty sand to sandy silt
41.175	273.66	6.2708	2.291	15.558	87	7	silty sand to sandy silt
41.339	284.56	6.0107	2.112	15.029	68	8	sand to silty sand
41.503	283.33	6.0787	2.145	15.491	68	8	sand to silty sand
41.667	272.00	5.9820	2.199	15.407	65	8	sand to silty sand
41.831	275.56	5.6839	2.063	15.947	66	8	sand to silty sand
41.995	284.83	5.7286	2.011	16.660	68	8	sand to silty sand
42.159	289.32	5.8139	2.009	16.029	69	8	sand to silty sand
42.323	296.78	6.0998	2.055	15.749	71	8	sand to silty sand
42.487	297.85	6.2642	2.103	15.955	71	8	sand to silty sand
42.651	290.26	6.2005	2.136	15.496	69	8	sand to silty sand
42.815	298.94	5.5437	1.854	15.402	72	8	sand to silty sand
42.979	305.03	5.6632	1.857	15.225	73	8	sand to silty sand
43.143	287.78	5.5468	1.927	9.572	69	8	sand to silty sand
43.307	270.08	5.0074	1.854	10.094	65	8	sand to silty sand
43.471	262.21	5.2489	2.002	11.447	63	8	sand to silty sand
43.635	264.49	5.3703	2.030	13.056	63	8	sand to silty sand
43.799	256.28	5.2005	2.029	12.638	61	8	sand to silty sand
43.963	252.55	5.0710	2.008	13.374	60	8	sand to silty sand
44.127	244.62	5.0056	2.046	13.893	59	8	sand to silty sand
44.291	249.36	4.9278	1.976	14.242	60	8	sand to silty sand
44.455	250.17	4.9541	1.980	14.852	60	8	sand to silty sand
44.619	251.51	4.9445	1.966	14.788	60	8	sand to silty sand
44.783	252.86	4.9696	1.965	15.237	61	8	sand to silty sand
44.948	252.01	5.0869	2.019	15.216	60	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	244.19	4.7676	1.952	15.209	58	8	sand to silty sand
45.276	234.37	4.6630	1.990	15.302	56	8	sand to silty sand
45.440	231.39	4.4483	1.922	14.828	55	8	sand to silty sand
45.604	230.29	4.4873	1.948	14.580	55	8	sand to silty sand
45.768	235.53	4.3918	1.865	14.544	56	8	sand to silty sand
45.932	240.43	4.3839	1.823	15.060	58	8	sand to silty sand
46.096	248.45	4.5852	1.846	14.960	59	8	sand to silty sand
46.260	252.07	4.8012	1.905	15.469	60	8	sand to silty sand
46.424	226.40	4.5501	2.010	15.405	54	8	sand to silty sand
46.588	207.04	3.7380	1.805	14.969	50	8	sand to silty sand
46.752	215.03	3.1862	1.482	15.213	51	8	sand to silty sand
46.916	214.65	2.1787	1.015	14.881	41	9	sand
47.080	196.93	2.4918	1.265	15.063	47	8	sand to silty sand
47.244	231.85	2.8677	1.237	15.259	44	9	sand
47.408	234.58	3.4009	1.450	14.816	56	8	sand to silty sand
47.572	227.76	3.8213	1.678	14.520	55	8	sand to silty sand
47.736	216.44	3.7914	1.752	14.596	52	8	sand to silty sand
47.900	206.47	3.6110	1.749	14.687	49	8	sand to silty sand
48.064	208.04	3.4922	1.679	14.845	50	8	sand to silty sand
48.228	198.89	3.2856	1.652	15.383	48	8	sand to silty sand
48.392	176.37	2.4265	1.376	14.544	42	8	sand to silty sand
48.556	145.15	2.2501	1.550	14.699	35	8	sand to silty sand
48.720	156.21	1.8903	1.210	19.235	37	8	sand to silty sand
48.885	222.16	2.5396	1.143	17.358	43	9	sand
49.049	232.88	3.0451	1.308	14.549	45	9	sand
49.213	236.29	3.6158	1.530	15.244	57	8	sand to silty sand
49.377	240.85	3.9808	1.653	15.366	58	8	sand to silty sand
49.541	246.04	4.0354	1.640	15.314	59	8	sand to silty sand
49.705	260.09	4.0725	1.566	15.517	62	8	sand to silty sand
49.869	265.63	4.3398	1.634	16.445	64	8	sand to silty sand
50.033	254.69	4.3678	1.715	16.519	61	8	sand to silty sand
50.197	246.88	4.3318	1.755	16.871	59	8	sand to silty sand
50.361	239.85	4.2968	1.791	17.633	57	8	sand to silty sand
50.525	227.57	4.1313	1.815	17.303	54	8	sand to silty sand
50.689	225.01	3.8976	1.732	17.528	54	8	sand to silty sand
50.853	241.20	3.6903	1.530	18.497	58	8	sand to silty sand
51.017	252.20	3.6552	1.449	18.831	60	8	sand to silty sand
51.181	255.75	3.8177	1.493	18.281	61	8	sand to silty sand
51.345	255.85	3.9718	1.552	18.272	61	8	sand to silty sand
51.509	256.25	4.0983	1.599	18.633	61	8	sand to silty sand
51.673	258.28	3.9611	1.534	19.613	62	8	sand to silty sand
51.837	262.91	3.9386	1.498	19.290	63	8	sand to silty sand
52.001	277.92	4.1239	1.484	18.506	67	8	sand to silty sand
52.165	289.97	4.4769	1.544	19.379	69	8	sand to silty sand
52.329	295.01	4.9204	1.668	19.580	71	8	sand to silty sand
52.493	295.66	5.1318	1.736	19.740	71	8	sand to silty sand
52.657	298.32	5.2248	1.751	20.180	71	8	sand to silty sand
52.822	304.52	5.2537	1.725	19.977	73	8	sand to silty sand
52.986	303.42	5.2472	1.729	20.173	73	8	sand to silty sand
53.150	298.49	4.9105	1.645	19.857	71	8	sand to silty sand
53.314	286.05	4.5838	1.602	19.080	68	8	sand to silty sand
53.478	273.00	4.4527	1.631	19.121	65	8	sand to silty sand
53.642	255.85	4.5510	1.779	19.216	61	8	sand to silty sand
53.806	251.28	4.4381	1.766	18.805	60	8	sand to silty sand
53.970	256.31	4.4987	1.755	19.475	61	8	sand to silty sand
54.134	255.00	4.7182	1.850	20.108	61	8	sand to silty sand
54.298	250.91	4.6331	1.847	19.805	60	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	257.53	4.6066	1.789	20.168	62	8	sand to silty sand
54.626	267.70	4.6424	1.734	20.625	64	8	sand to silty sand
54.790	257.93	4.4864	1.739	20.108	62	8	sand to silty sand
54.954	253.77	4.7426	1.869	20.072	61	8	sand to silty sand
55.118	257.85	4.8526	1.882	19.714	62	8	sand to silty sand
55.282	228.26	4.8223	2.113	18.927	73	7	silty sand to sandy silt
55.446	217.43	4.7931	2.204	18.384	69	7	silty sand to sandy silt
55.610	206.43	4.4177	2.140	18.879	66	7	silty sand to sandy silt
55.774	193.09	3.9338	2.037	18.532	62	7	silty sand to sandy silt
55.938	173.63	3.2339	1.863	18.081	42	8	sand to silty sand
56.102	192.04	2.4985	1.301	19.216	46	8	sand to silty sand
56.266	217.85	2.3268	1.068	19.030	42	9	sand
56.430	239.36	2.7475	1.148	17.896	46	9	sand
56.594	247.34	3.2363	1.308	17.349	47	9	sand
56.759	278.30	3.9404	1.416	18.128	67	8	sand to silty sand
56.923	308.82	4.5943	1.488	19.149	74	8	sand to silty sand
57.087	319.01	4.8767	1.529	18.688	76	8	sand to silty sand
57.251	330.58	4.9847	1.508	17.832	79	8	sand to silty sand
57.415	316.10	4.9279	1.559	17.337	76	8	sand to silty sand
57.579	326.52	4.7663	1.460	17.865	78	8	sand to silty sand
57.743	335.52	5.0062	1.492	17.748	80	8	sand to silty sand
57.907	346.29	5.9616	1.722	17.026	83	8	sand to silty sand
58.071	354.16	6.8117	1.923	17.801	85	8	sand to silty sand
58.235	338.99	6.9235	2.042	18.391	81	8	sand to silty sand
58.399	321.17	6.8939	2.146	17.794	77	8	sand to silty sand
58.563	302.10	6.7599	2.238	20.178	72	8	sand to silty sand
58.727	303.78	6.8036	2.240	20.089	73	8	sand to silty sand
58.891	307.71	6.8627	2.230	19.915	74	8	sand to silty sand
59.055	297.51	6.8462	2.301	20.321	95	7	silty sand to sandy silt
59.219	282.71	6.8614	2.427	20.833	90	7	silty sand to sandy silt
59.383	266.56	6.7018	2.514	19.962	85	7	silty sand to sandy silt
59.547	236.37	6.3205	2.674	19.929	75	7	silty sand to sandy silt
59.711	212.63	5.6084	2.638	19.011	68	7	silty sand to sandy silt
59.875	198.69	4.9535	2.493	19.427	63	7	silty sand to sandy silt
60.039	195.46	4.4156	2.259	19.336	62	7	silty sand to sandy silt
60.203	189.18	4.1211	2.178	19.551	60	7	silty sand to sandy silt
60.367	189.63	4.1911	2.210	19.257	61	7	silty sand to sandy silt

Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM
TOTAL DEPTH: 60.367 ft

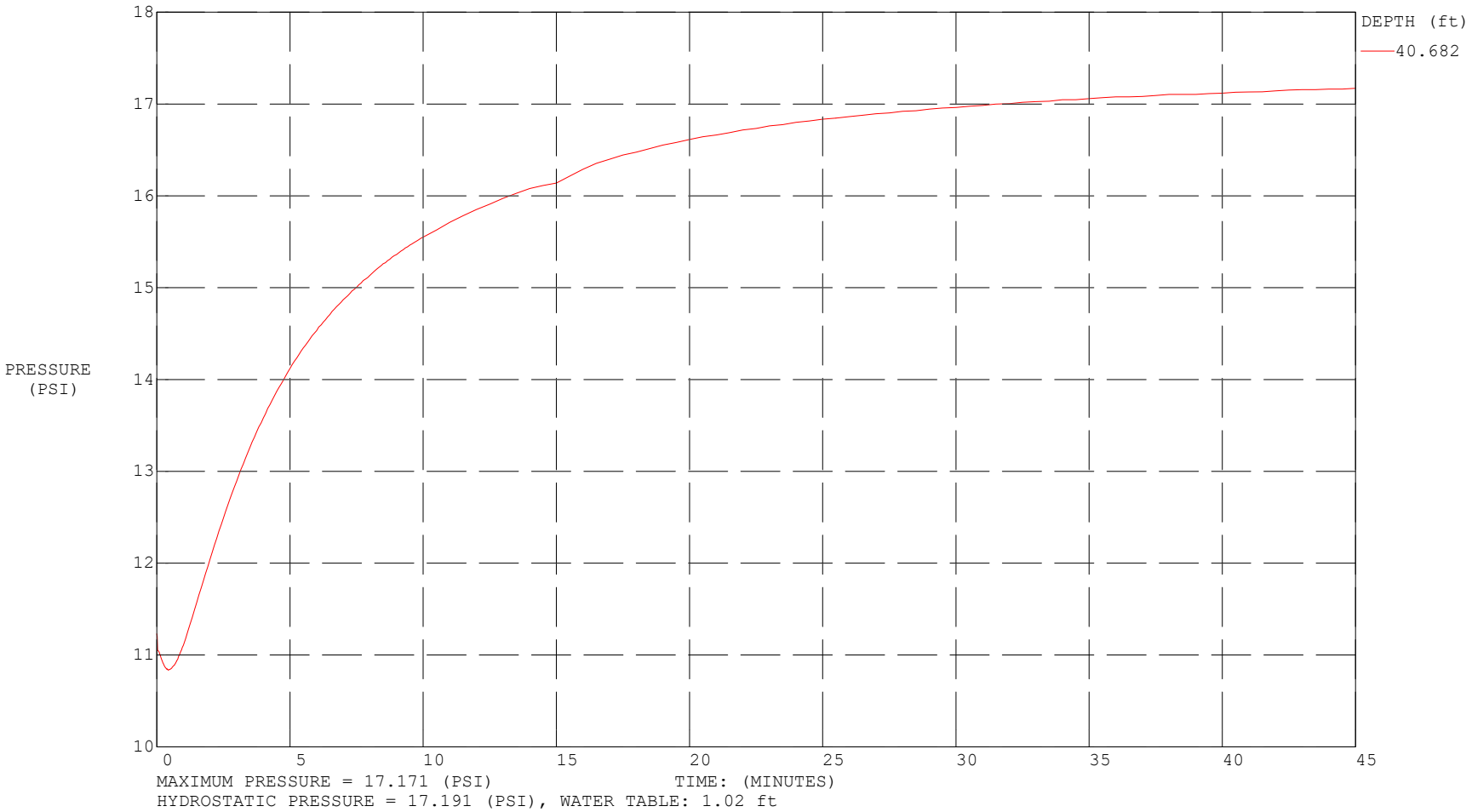


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM



Shannon & Wilson / CPT-4 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/24/2024 1:47:38 PM
TOTAL DEPTH: 60.367 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	23.05	0.1251	0.543	-0.124	7	7	silty sand to sandy silt
0.328	38.47	0.2228	0.579	-0.208	12	7	silty sand to sandy silt
0.492	68.16	0.3600	0.528	-0.237	16	8	sand to silty sand
0.656	91.46	0.6863	0.750	-0.332	22	8	sand to silty sand
0.820	108.65	1.1379	1.047	-0.328	26	8	sand to silty sand
0.984	118.18	1.5001	1.269	-0.684	28	8	sand to silty sand
1.148	114.90	1.3189	1.148	-0.576	28	8	sand to silty sand
1.312	105.35	1.0148	0.963	-0.746	25	8	sand to silty sand
1.476	101.28	0.8067	0.796	-0.595	24	8	sand to silty sand
1.640	69.73	0.7793	1.118	0.062	22	7	silty sand to sandy silt
1.804	73.67	0.4327	0.587	-0.244	18	8	sand to silty sand
1.969	52.63	0.5385	1.023	-1.074	17	7	silty sand to sandy silt
2.133	45.22	0.7179	1.588	-0.208	14	7	silty sand to sandy silt
2.297	36.75	0.6126	1.667	-0.383	14	6	sandy silt to clayey silt
2.461	28.04	0.2598	0.927	0.206	9	7	silty sand to sandy silt
2.625	22.11	0.2181	0.986	-0.361	8	6	sandy silt to clayey silt
2.789	14.54	0.2532	1.741	0.531	7	5	clayey silt to silty clay
2.953	12.44	0.2252	1.811	0.005	6	5	clayey silt to silty clay
3.117	8.29	0.2658	3.207	3.833	8	3	clay
3.281	8.12	0.2049	2.524	1.944	5	4	silty clay to clay
3.445	7.68	0.1884	2.453	1.906	5	4	silty clay to clay
3.609	8.82	0.1665	1.887	1.169	4	5	clayey silt to silty clay
3.773	9.64	0.1441	1.495	0.980	5	5	clayey silt to silty clay
3.937	10.43	0.1680	1.611	0.689	5	5	clayey silt to silty clay
4.101	9.49	0.1618	1.705	1.949	5	5	clayey silt to silty clay
4.265	9.25	0.1673	1.808	2.226	4	5	clayey silt to silty clay
4.429	9.03	0.1444	1.599	1.837	4	5	clayey silt to silty clay
4.593	8.43	0.1579	1.874	2.147	4	5	clayey silt to silty clay
4.757	7.35	0.1374	1.868	2.159	5	4	silty clay to clay
4.921	6.82	0.1134	1.663	2.363	4	4	silty clay to clay
5.085	5.53	0.1180	2.134	2.561	4	4	silty clay to clay
5.249	3.84	0.1080	2.815	3.498	4	3	clay
5.413	2.62	0.1211	4.613	3.903	3	3	clay
5.577	3.77	0.1156	3.069	4.094	4	3	clay
5.741	7.61	0.1278	1.678	3.960	4	5	clayey silt to silty clay
5.906	10.78	0.1313	1.218	2.893	5	5	clayey silt to silty clay
6.070	17.22	0.1508	0.876	1.844	7	6	sandy silt to clayey silt
6.234	20.95	0.1652	0.788	1.961	8	6	sandy silt to clayey silt
6.398	25.76	0.2051	0.796	2.035	8	7	silty sand to sandy silt
6.562	30.44	0.2345	0.770	2.088	10	7	silty sand to sandy silt
6.726	35.55	0.2622	0.738	2.145	11	7	silty sand to sandy silt
6.890	42.34	0.3266	0.771	2.190	14	7	silty sand to sandy silt
7.054	49.05	0.3950	0.805	2.277	16	7	silty sand to sandy silt
7.218	50.35	0.4117	0.818	2.339	16	7	silty sand to sandy silt
7.382	54.75	0.4075	0.744	2.413	13	8	sand to silty sand
7.546	61.09	0.4298	0.704	2.470	15	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	67.40	0.4907	0.728	2.547	16	8	sand to silty sand
7.874	73.68	0.5459	0.741	2.640	18	8	sand to silty sand
8.038	78.08	0.5630	0.721	2.738	19	8	sand to silty sand
8.202	82.72	0.5833	0.705	2.800	20	8	sand to silty sand
8.366	90.90	0.6534	0.719	2.891	22	8	sand to silty sand
8.530	96.79	0.7212	0.745	2.968	23	8	sand to silty sand
8.694	99.94	0.7607	0.761	3.070	24	8	sand to silty sand
8.858	103.79	0.7968	0.768	3.164	25	8	sand to silty sand
9.022	106.46	0.7696	0.723	3.264	25	8	sand to silty sand
9.186	110.17	0.8839	0.802	3.405	26	8	sand to silty sand
9.350	112.95	0.9033	0.800	3.867	27	8	sand to silty sand
9.514	119.52	0.9837	0.823	3.888	29	8	sand to silty sand
9.678	128.42	1.1213	0.873	3.962	31	8	sand to silty sand
9.843	137.57	1.2898	0.938	4.149	33	8	sand to silty sand
10.007	144.76	1.3961	0.964	4.276	35	8	sand to silty sand
10.171	146.85	1.4016	0.954	4.369	35	8	sand to silty sand
10.335	149.72	1.3898	0.928	4.395	36	8	sand to silty sand
10.499	156.46	1.5050	0.962	4.441	30	9	sand
10.663	156.80	1.5700	1.001	4.510	38	8	sand to silty sand
10.827	155.34	1.5270	0.983	4.579	37	8	sand to silty sand
10.991	156.74	1.5100	0.963	4.603	30	9	sand
11.155	155.95	1.5329	0.983	4.625	37	8	sand to silty sand
11.319	154.28	1.5433	1.000	4.665	37	8	sand to silty sand
11.483	153.17	1.5772	1.030	4.682	37	8	sand to silty sand
11.647	151.43	1.5697	1.037	4.704	36	8	sand to silty sand
11.811	150.33	1.5571	1.036	4.735	36	8	sand to silty sand
11.975	151.31	1.5427	1.020	4.737	36	8	sand to silty sand
12.139	150.25	1.4606	0.972	4.701	36	8	sand to silty sand
12.303	150.94	1.3197	0.874	4.677	29	9	sand
12.467	156.40	1.3409	0.857	4.696	30	9	sand
12.631	152.24	1.3995	0.919	4.601	29	9	sand
12.795	153.86	1.4248	0.926	4.565	29	9	sand
12.959	152.98	1.4729	0.963	4.563	37	8	sand to silty sand
13.123	153.04	1.4774	0.965	4.541	37	8	sand to silty sand
13.287	151.67	1.4996	0.989	4.546	36	8	sand to silty sand
13.451	153.49	1.5180	0.989	4.541	37	8	sand to silty sand
13.615	156.36	1.5560	0.995	4.565	37	8	sand to silty sand
13.780	159.30	1.6117	1.012	4.567	38	8	sand to silty sand
13.944	161.77	1.6829	1.040	4.591	39	8	sand to silty sand
14.108	160.66	1.7190	1.070	4.610	38	8	sand to silty sand
14.272	156.18	1.6801	1.076	4.675	37	8	sand to silty sand
14.436	153.80	1.5830	1.029	4.665	37	8	sand to silty sand
14.600	157.80	1.5079	0.956	4.586	30	9	sand
14.764	164.48	1.5169	0.922	4.634	32	9	sand
14.928	168.12	1.5905	0.946	4.680	32	9	sand
15.092	172.16	1.6405	0.953	4.735	33	9	sand
15.256	175.65	1.6761	0.954	4.797	34	9	sand
15.420	183.39	1.7489	0.954	4.806	35	9	sand
15.584	188.15	1.8524	0.984	4.919	36	9	sand
15.748	191.80	1.9835	1.034	5.012	37	9	sand
15.912	197.08	2.1597	1.096	4.943	38	9	sand
16.076	201.29	2.3287	1.157	4.957	39	9	sand
16.240	206.20	2.5144	1.219	5.034	39	9	sand
16.404	214.58	2.7546	1.284	5.177	41	9	sand
16.568	216.97	2.9220	1.347	5.278	52	8	sand to silty sand
16.732	218.80	3.0124	1.377	5.426	52	8	sand to silty sand
16.896	225.48	3.0942	1.372	5.548	54	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	229.32	3.2163	1.403	5.569	55	8	sand to silty sand
17.224	225.17	3.4480	1.531	5.828	54	8	sand to silty sand
17.388	214.18	3.6682	1.713	5.938	51	8	sand to silty sand
17.552	202.57	3.5720	1.763	5.959	48	8	sand to silty sand
17.717	191.09	3.3190	1.737	5.983	46	8	sand to silty sand
17.881	187.70	3.0520	1.626	5.918	45	8	sand to silty sand
18.045	182.72	2.8435	1.556	5.947	44	8	sand to silty sand
18.209	181.82	2.6696	1.468	6.064	44	8	sand to silty sand
18.373	182.72	2.4217	1.325	6.033	44	8	sand to silty sand
18.537	189.43	2.4165	1.276	6.091	45	8	sand to silty sand
18.701	204.52	2.7007	1.321	6.198	49	8	sand to silty sand
18.865	206.76	2.5946	1.255	6.189	40	9	sand
19.029	195.27	2.2058	1.130	6.270	37	9	sand
19.193	197.08	2.1219	1.077	5.447	38	9	sand
19.357	202.95	2.2372	1.102	3.006	39	9	sand
19.521	198.85	2.3635	1.189	3.278	38	9	sand
19.685	196.30	2.3872	1.216	3.570	38	9	sand
19.849	196.44	2.5097	1.278	3.721	47	8	sand to silty sand
20.013	199.81	2.6043	1.303	3.843	48	8	sand to silty sand
20.177	197.13	2.5998	1.319	4.053	47	8	sand to silty sand
20.341	193.19	2.4803	1.284	4.154	46	8	sand to silty sand
20.505	197.41	2.4145	1.223	4.307	38	9	sand
20.669	197.82	2.3994	1.213	4.543	38	9	sand
20.833	204.08	2.4210	1.186	4.531	39	9	sand
20.997	206.34	2.6235	1.271	4.821	40	9	sand
21.161	204.94	2.6870	1.311	4.902	49	8	sand to silty sand
21.325	199.65	2.6570	1.331	5.132	48	8	sand to silty sand
21.490	200.47	2.6247	1.309	5.194	48	8	sand to silty sand
21.654	209.26	2.7670	1.322	5.373	50	8	sand to silty sand
21.818	202.22	2.7551	1.362	5.521	48	8	sand to silty sand
21.982	195.84	2.5586	1.306	5.572	47	8	sand to silty sand
22.146	196.10	2.2932	1.169	5.639	38	9	sand
22.310	194.29	2.2184	1.142	5.878	37	9	sand
22.474	174.38	2.0867	1.197	5.567	42	8	sand to silty sand
22.638	168.17	1.9648	1.168	5.576	40	8	sand to silty sand
22.802	163.90	1.8864	1.151	5.620	39	8	sand to silty sand
22.966	164.44	1.7969	1.093	5.746	39	8	sand to silty sand
23.130	164.05	1.7673	1.077	5.820	39	8	sand to silty sand
23.294	165.51	1.8297	1.105	5.885	40	8	sand to silty sand
23.458	164.78	1.8469	1.121	5.957	39	8	sand to silty sand
23.622	162.97	1.8717	1.148	6.093	39	8	sand to silty sand
23.786	175.62	1.8922	1.077	6.098	34	9	sand
23.950	190.47	2.0664	1.085	6.423	36	9	sand
24.114	200.33	2.3199	1.158	6.540	38	9	sand
24.278	205.21	2.4283	1.183	6.583	39	9	sand
24.442	203.39	2.4562	1.208	6.645	39	9	sand
24.606	201.83	2.4917	1.235	6.777	39	9	sand
24.770	207.21	2.6003	1.255	6.844	40	9	sand
24.934	205.71	2.7991	1.361	6.961	49	8	sand to silty sand
25.098	196.92	2.8406	1.443	7.081	47	8	sand to silty sand
25.262	192.67	2.6695	1.386	7.069	46	8	sand to silty sand
25.427	187.67	2.3623	1.259	7.140	45	8	sand to silty sand
25.591	183.61	2.2689	1.236	7.215	44	8	sand to silty sand
25.755	178.09	2.2325	1.254	7.035	43	8	sand to silty sand
25.919	179.67	2.3198	1.291	7.102	43	8	sand to silty sand
26.083	180.32	2.3548	1.306	7.148	43	8	sand to silty sand
26.247	178.89	2.3679	1.324	7.258	43	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	183.79	2.3642	1.286	7.310	44	8	sand to silty sand
26.575	187.34	2.3216	1.239	7.430	45	8	sand to silty sand
26.739	192.58	2.2854	1.187	7.401	37	9	sand
26.903	200.38	2.3340	1.165	7.580	38	9	sand
27.067	207.40	2.5136	1.212	7.650	40	9	sand
27.231	212.42	2.7206	1.281	7.827	41	9	sand
27.395	214.58	2.9964	1.396	8.054	51	8	sand to silty sand
27.559	216.22	3.0965	1.432	8.219	52	8	sand to silty sand
27.723	215.93	3.0221	1.400	8.331	52	8	sand to silty sand
27.887	222.05	2.9347	1.322	8.374	43	9	sand
28.051	245.26	3.1840	1.298	8.652	47	9	sand
28.215	262.44	3.5865	1.367	8.977	50	9	sand
28.379	266.24	4.0112	1.507	9.183	64	8	sand to silty sand
28.543	265.25	4.2572	1.605	9.281	64	8	sand to silty sand
28.707	252.85	3.2551	1.287	9.300	48	9	sand
28.871	233.93	3.2276	1.380	9.369	56	8	sand to silty sand
29.035	204.60	3.2052	1.567	8.348	49	8	sand to silty sand
29.199	200.66	3.2289	1.609	8.453	48	8	sand to silty sand
29.364	192.28	3.1100	1.617	8.396	46	8	sand to silty sand
29.528	186.70	2.8369	1.519	8.472	45	8	sand to silty sand
29.692	188.82	2.6429	1.400	8.542	45	8	sand to silty sand
29.856	200.07	2.4779	1.239	8.752	38	9	sand
30.020	212.95	2.5219	1.184	8.939	41	9	sand
30.184	224.45	2.9017	1.293	7.683	43	9	sand
30.348	206.38	3.2295	1.565	6.535	49	8	sand to silty sand
30.512	191.61	3.2524	1.697	6.887	46	8	sand to silty sand
30.676	183.12	3.1713	1.732	7.162	44	8	sand to silty sand
30.840	171.50	2.9692	1.731	7.351	41	8	sand to silty sand
31.004	160.82	2.7908	1.735	7.506	39	8	sand to silty sand
31.168	160.98	2.5793	1.602	7.585	39	8	sand to silty sand
31.332	169.86	2.3820	1.402	7.920	41	8	sand to silty sand
31.496	173.87	2.3041	1.325	7.963	42	8	sand to silty sand
31.660	183.80	2.4612	1.339	8.085	44	8	sand to silty sand
31.824	204.17	2.9328	1.436	8.518	49	8	sand to silty sand
31.988	205.99	2.7495	1.335	8.800	49	8	sand to silty sand
32.152	202.51	2.7957	1.381	8.972	48	8	sand to silty sand
32.316	201.03	2.9635	1.474	8.659	48	8	sand to silty sand
32.480	205.15	3.0965	1.509	8.843	49	8	sand to silty sand
32.644	206.42	3.1528	1.527	9.180	49	8	sand to silty sand
32.808	210.93	3.3341	1.581	9.288	50	8	sand to silty sand
32.972	219.41	3.5536	1.620	9.632	53	8	sand to silty sand
33.136	209.15	3.6911	1.765	9.979	50	8	sand to silty sand
33.301	199.98	3.3497	1.675	9.964	48	8	sand to silty sand
33.465	195.24	2.9886	1.531	9.771	47	8	sand to silty sand
33.629	196.34	3.0040	1.530	9.962	47	8	sand to silty sand
33.793	194.09	3.0416	1.567	10.330	46	8	sand to silty sand
33.957	189.84	3.0957	1.631	10.569	45	8	sand to silty sand
34.121	187.76	2.9855	1.590	10.584	45	8	sand to silty sand
34.285	187.39	2.9142	1.555	10.703	45	8	sand to silty sand
34.449	189.16	2.8948	1.530	10.792	45	8	sand to silty sand
34.613	187.46	2.8919	1.543	10.928	45	8	sand to silty sand
34.777	185.61	2.8468	1.534	10.978	44	8	sand to silty sand
34.941	184.52	2.7437	1.487	11.110	44	8	sand to silty sand
35.105	184.58	2.6535	1.438	11.163	44	8	sand to silty sand
35.269	194.73	2.8967	1.487	11.428	47	8	sand to silty sand
35.433	205.20	3.0777	1.500	11.607	49	8	sand to silty sand
35.597	198.11	3.1521	1.591	11.036	47	8	sand to silty sand

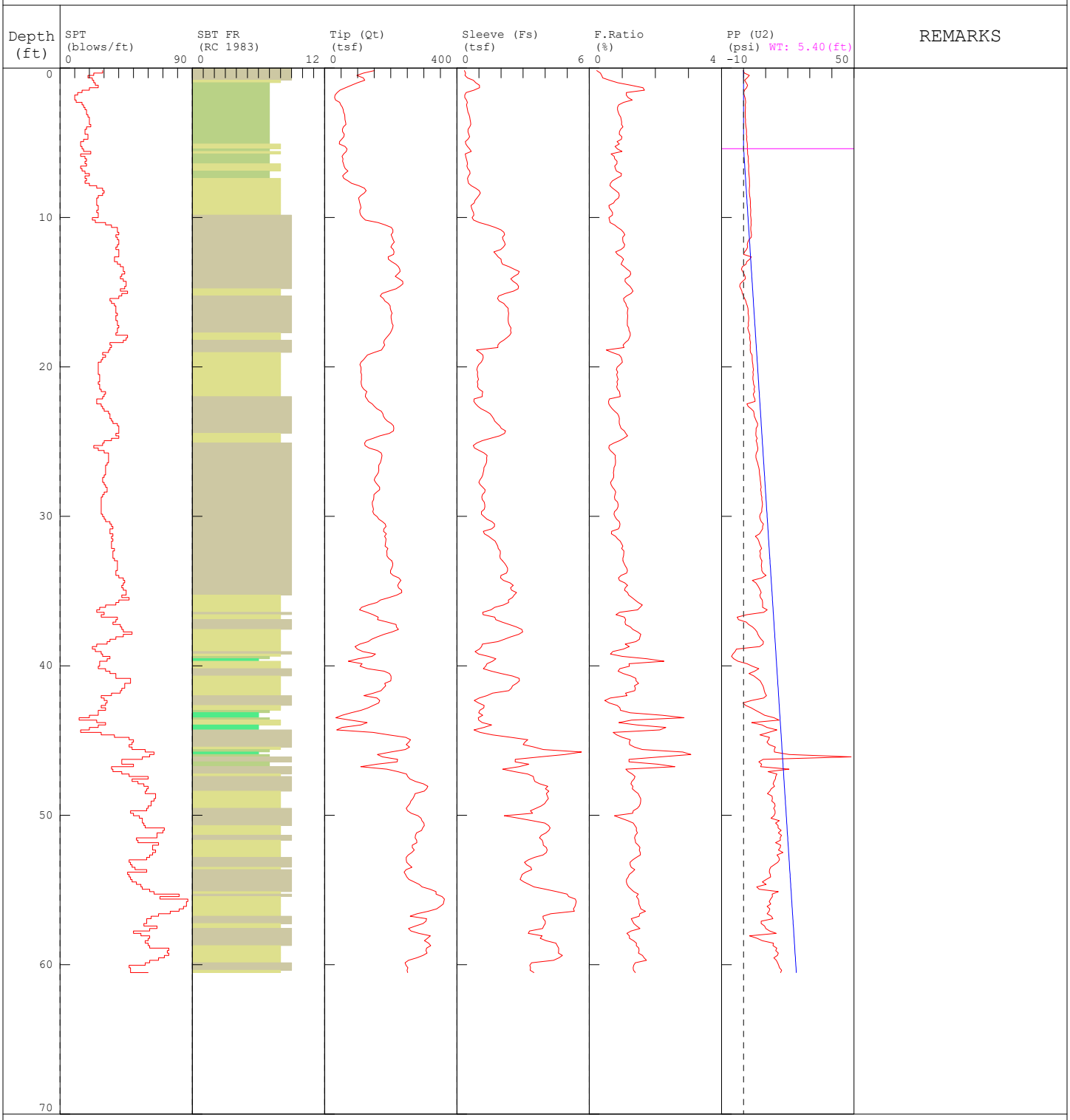
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	197.61	3.1656	1.602	11.196	47	8	sand to silty sand
35.925	200.90	3.1853	1.586	11.454	48	8	sand to silty sand
36.089	200.53	3.1831	1.587	11.583	48	8	sand to silty sand
36.253	194.64	3.0287	1.556	11.368	47	8	sand to silty sand
36.417	190.51	2.7853	1.462	11.342	46	8	sand to silty sand
36.581	195.37	2.5905	1.326	11.538	47	8	sand to silty sand
36.745	190.87	2.5373	1.329	11.653	46	8	sand to silty sand
36.909	186.95	2.4165	1.293	11.648	45	8	sand to silty sand
37.073	181.90	2.3785	1.308	11.923	44	8	sand to silty sand
37.238	180.34	2.2926	1.271	12.050	43	8	sand to silty sand
37.402	175.53	2.1217	1.209	12.102	42	8	sand to silty sand
37.566	175.31	2.0191	1.152	11.961	42	8	sand to silty sand
37.730	170.69	2.0336	1.191	12.217	41	8	sand to silty sand
37.894	160.29	1.7927	1.118	12.318	38	8	sand to silty sand
38.058	170.45	1.2156	0.713	12.404	33	9	sand
38.222	170.04	0.7934	0.467	12.234	33	9	sand
38.386	173.98	0.6215	0.357	11.607	33	9	sand
38.550	175.50	0.8280	0.472	11.244	34	9	sand
38.714	185.63	0.9208	0.496	10.682	36	9	sand
38.878	190.63	1.1444	0.600	9.469	37	9	sand
39.042	203.11	1.7141	0.844	9.608	39	9	sand
39.206	228.83	2.3176	1.013	10.163	44	9	sand
39.370	230.69	2.8622	1.241	9.991	44	9	sand
39.534	213.53	3.1831	1.491	10.127	51	8	sand to silty sand
39.698	186.44	3.2012	1.717	10.448	45	8	sand to silty sand
39.862	156.62	2.8208	1.801	10.629	37	8	sand to silty sand
40.026	144.71	2.0072	1.387	10.672	35	8	sand to silty sand
40.190	150.73	1.3404	0.889	10.818	29	9	sand
40.354	167.92	1.1155	0.664	11.043	32	9	sand
40.518	183.05	1.3595	0.743	11.273	35	9	sand
40.682	193.69	1.4800	0.764	11.225	37	9	sand
40.846	201.12	1.8925	0.941	17.887	39	9	sand
41.011	195.57	2.0548	1.051	17.487	37	9	sand
41.175	200.24	2.3465	1.172	17.990	38	9	sand
41.339	193.32	2.5237	1.305	18.351	46	8	sand to silty sand
41.503	187.43	2.2374	1.194	18.504	36	9	sand
41.667	199.11	1.9428	0.976	18.915	38	9	sand
41.831	223.01	2.2204	0.996	18.965	43	9	sand
41.995	230.87	2.4063	1.042	19.054	44	9	sand
42.159	221.65	2.5362	1.144	16.959	42	9	sand
42.323	218.05	2.6641	1.222	17.181	42	9	sand
42.487	218.72	2.5477	1.165	17.473	42	9	sand
42.651	215.83	2.5159	1.166	17.923	41	9	sand
42.815	209.26	2.3515	1.124	18.136	40	9	sand
42.979	202.08	2.0018	0.991	18.064	39	9	sand
43.143	201.98	1.7706	0.877	18.726	39	9	sand
43.307	200.82	1.6805	0.837	18.253	38	9	sand
43.471	189.55	1.9361	1.021	18.037	36	9	sand
43.635	169.83	2.1092	1.242	18.406	41	8	sand to silty sand
43.799	158.06	2.0220	1.279	18.686	38	8	sand to silty sand
43.963	189.02	1.3196	0.698	20.579	36	9	sand
44.127	194.14	1.2710	0.655	16.497	37	9	sand
44.291	178.64	1.7136	0.959	14.448	34	9	sand
44.455	161.75	2.1677	1.340	14.054	39	8	sand to silty sand
44.619	143.21	2.0618	1.440	14.252	34	8	sand to silty sand
44.783	132.13	1.8251	1.381	14.183	32	8	sand to silty sand
44.948	126.45	1.6332	1.292	14.886	30	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	125.08	1.2648	1.011	15.235	30	8	sand to silty sand
45.276	126.63	1.1951	0.944	15.778	30	8	sand to silty sand
45.440	193.97	1.2157	0.627	17.069	37	9	sand
45.604	217.19	1.3630	0.628	17.337	42	9	sand
45.768	246.35	1.7506	0.711	17.440	47	9	sand
45.932	244.10	2.3330	0.956	17.602	47	9	sand
46.096	240.57	2.9140	1.211	17.440	46	9	sand
46.260	262.07	2.9875	1.140	18.812	50	9	sand
46.424	259.68	3.2869	1.266	18.501	50	9	sand
46.588	272.56	3.3269	1.221	18.253	52	9	sand
46.752	289.49	3.6021	1.244	19.393	55	9	sand
46.916	285.47	3.6865	1.291	17.186	55	9	sand
47.080	283.17	3.6561	1.291	16.450	54	9	sand
47.244	284.37	3.7365	1.314	16.906	54	9	sand
47.408	289.22	3.6765	1.271	17.251	55	9	sand
47.572	275.50	3.7845	1.374	16.832	53	9	sand
47.736	261.44	3.6661	1.402	15.687	63	8	sand to silty sand
47.900	242.21	3.7473	1.547	15.672	58	8	sand to silty sand
48.064	215.18	3.4676	1.612	16.129	52	8	sand to silty sand
48.228	178.18	2.7285	1.531	16.584	43	8	sand to silty sand
48.392	186.65	2.4881	1.333	17.043	45	8	sand to silty sand
48.556	205.15	2.7023	1.317	18.217	49	8	sand to silty sand
48.720	177.42	2.7223	1.534	17.062	42	8	sand to silty sand
48.885	187.06	2.7535	1.472	17.619	45	8	sand to silty sand
49.049	203.63	2.9994	1.473	18.939	49	8	sand to silty sand
49.213	221.29	3.1162	1.408	18.236	53	8	sand to silty sand
49.377	218.93	3.1517	1.440	17.877	52	8	sand to silty sand
49.541	216.15	3.1899	1.476	18.155	52	8	sand to silty sand
49.705	225.13	3.2992	1.465	18.772	54	8	sand to silty sand
49.869	227.90	3.3468	1.469	19.149	55	8	sand to silty sand
50.033	228.07	3.4223	1.501	19.444	55	8	sand to silty sand
50.197	241.41	3.5776	1.482	20.386	58	8	sand to silty sand
50.361	233.11	3.5526	1.524	20.022	56	8	sand to silty sand
50.525	229.90	3.6393	1.583	20.053	55	8	sand to silty sand
50.689	215.00	3.4042	1.583	19.953	51	8	sand to silty sand
50.853	186.00	3.0461	1.638	19.826	45	8	sand to silty sand
51.017	185.61	2.2941	1.236	20.814	44	8	sand to silty sand
51.181	203.48	1.5933	0.783	19.652	39	9	sand
51.345	227.42	1.9366	0.852	17.468	44	9	sand
51.509	212.77	2.6515	1.246	14.286	41	9	sand
51.673	198.24	2.8438	1.435	13.702	47	8	sand to silty sand
51.837	186.02	2.8633	1.539	14.049	45	8	sand to silty sand
52.001	186.83	2.8337	1.517	16.450	45	8	sand to silty sand
52.165	182.59	2.8816	1.578	17.263	44	8	sand to silty sand
52.329	183.17	2.8395	1.550	17.122	44	8	sand to silty sand
52.493	208.81	2.9680	1.421	18.231	50	8	sand to silty sand
52.657	217.21	3.0275	1.394	18.597	52	8	sand to silty sand
52.822	229.01	2.9372	1.283	18.176	44	9	sand
52.986	242.32	3.2961	1.360	19.357	58	8	sand to silty sand
53.150	240.31	3.5727	1.487	18.788	58	8	sand to silty sand
53.314	231.56	3.7035	1.599	19.054	55	8	sand to silty sand
53.478	220.92	3.4758	1.573	19.604	53	8	sand to silty sand
53.642	220.91	3.1455	1.424	19.860	53	8	sand to silty sand
53.806	262.48	3.0974	1.180	20.874	50	9	sand
53.970	278.90	3.5359	1.268	21.777	53	9	sand
54.134	278.30	3.9897	1.434	21.094	67	8	sand to silty sand
54.298	274.76	4.2354	1.541	21.830	66	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	278.75	4.3092	1.546	21.954	67	8	sand to silty sand
54.626	287.63	4.5622	1.586	22.418	69	8	sand to silty sand
54.790	279.98	4.6380	1.657	22.409	67	8	sand to silty sand
54.954	263.28	3.8070	1.446	22.387	63	8	sand to silty sand
55.118	256.61	3.7136	1.447	21.691	61	8	sand to silty sand
55.282	238.68	3.7015	1.551	21.273	57	8	sand to silty sand
55.446	255.71	3.5422	1.385	21.909	61	8	sand to silty sand
55.610	266.25	3.6394	1.367	21.636	51	9	sand
55.774	265.98	3.6575	1.375	21.105	51	9	sand
55.938	255.58	3.7668	1.474	20.565	61	8	sand to silty sand
56.102	245.03	3.7041	1.512	20.883	59	8	sand to silty sand
56.266	241.00	3.7138	1.541	21.708	58	8	sand to silty sand
56.430	239.33	3.6374	1.520	22.040	57	8	sand to silty sand
56.594	240.62	3.5957	1.494	22.349	58	8	sand to silty sand
56.759	246.08	3.5166	1.429	22.559	59	8	sand to silty sand
56.923	258.10	3.6814	1.426	22.509	62	8	sand to silty sand
57.087	263.38	3.9217	1.489	23.021	63	8	sand to silty sand
57.251	262.52	3.9874	1.519	23.451	63	8	sand to silty sand
57.415	258.53	3.9266	1.519	23.040	62	8	sand to silty sand
57.579	262.79	3.7716	1.435	23.241	63	8	sand to silty sand
57.743	253.83	3.7176	1.465	23.026	61	8	sand to silty sand
57.907	252.67	3.6805	1.457	22.810	60	8	sand to silty sand
58.071	242.17	3.9340	1.624	23.250	58	8	sand to silty sand
58.235	220.45	3.2650	1.481	22.985	53	8	sand to silty sand
58.399	187.27	2.7488	1.468	22.567	45	8	sand to silty sand
58.563	234.31	2.7021	1.153	19.695	45	9	sand
58.727	238.30	2.9513	1.238	19.982	46	9	sand
58.891	247.12	3.3760	1.366	21.873	59	8	sand to silty sand
59.055	254.34	3.7530	1.476	21.945	61	8	sand to silty sand
59.219	268.79	3.9794	1.481	22.648	64	8	sand to silty sand
59.383	268.58	4.0498	1.508	22.397	64	8	sand to silty sand
59.547	275.79	4.0179	1.457	22.543	66	8	sand to silty sand
59.711	287.46	4.1483	1.443	23.195	69	8	sand to silty sand
59.875	298.28	4.2919	1.439	23.954	71	8	sand to silty sand
60.039	308.69	4.4973	1.457	24.939	74	8	sand to silty sand
60.203	328.04	4.6612	1.421	25.465	63	9	sand
60.367	346.45	4.5912	1.325	25.678	66	9	sand

Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM
TOTAL DEPTH: 60.532 ft

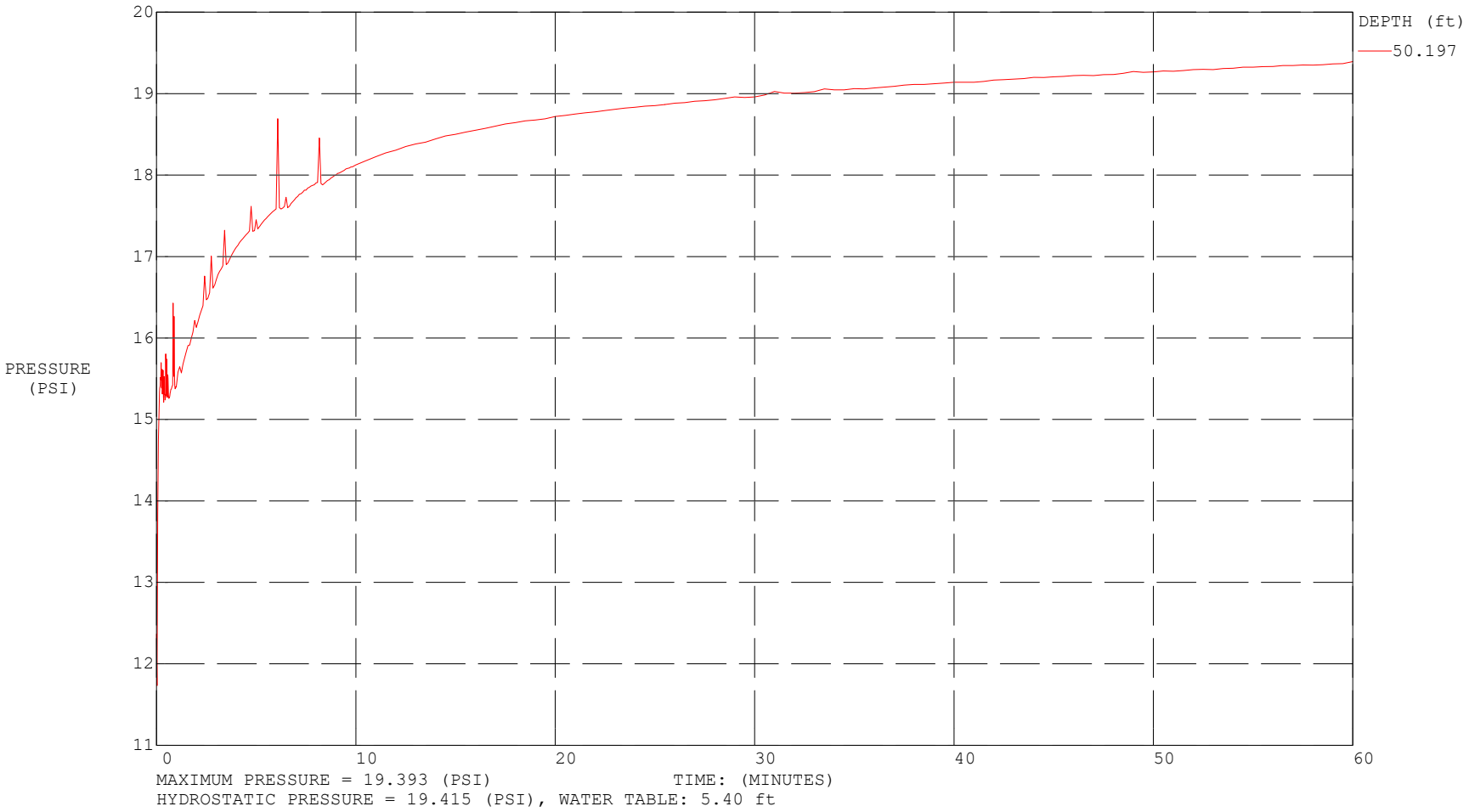


1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM



MAXIMUM PRESSURE = 19.393 (PSI)
HYDROSTATIC PRESSURE = 19.415 (PSI), WATER TABLE: 5.40 ft

Shannon & Wilson / CPT-5 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/25/2024 8:07:00 AM
TOTAL DEPTH: 60.532 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	150.95	0.3393	0.225	-0.237	29	9	sand
0.328	117.67	0.3914	0.333	0.304	23	9	sand
0.492	97.16	0.3636	0.374	2.535	19	9	sand
0.656	116.76	0.4767	0.408	1.593	22	9	sand
0.820	121.07	0.7446	0.615	0.387	23	9	sand
0.984	99.47	0.8549	0.859	1.131	24	8	sand to silty sand
1.148	81.14	1.0181	1.255	1.805	26	7	silty sand to sandy silt
1.312	63.27	1.0243	1.619	1.349	20	7	silty sand to sandy silt
1.476	46.17	0.7696	1.667	0.354	15	7	silty sand to sandy silt
1.640	37.71	0.4221	1.119	0.050	12	7	silty sand to sandy silt
1.804	31.49	0.3520	1.118	0.251	10	7	silty sand to sandy silt
1.969	30.10	0.3527	1.172	0.591	10	7	silty sand to sandy silt
2.133	33.01	0.4276	1.295	0.827	11	7	silty sand to sandy silt
2.297	45.58	0.4744	1.041	0.902	15	7	silty sand to sandy silt
2.461	48.57	0.4313	0.888	0.710	16	7	silty sand to sandy silt
2.625	53.50	0.4560	0.852	0.820	17	7	silty sand to sandy silt
2.789	55.97	0.4766	0.852	0.787	18	7	silty sand to sandy silt
2.953	57.04	0.4987	0.874	0.734	18	7	silty sand to sandy silt
3.117	60.46	0.5449	0.901	0.784	19	7	silty sand to sandy silt
3.281	61.20	0.5807	0.949	0.670	20	7	silty sand to sandy silt
3.445	61.44	0.5936	0.966	0.847	20	7	silty sand to sandy silt
3.609	63.18	0.6173	0.977	0.820	20	7	silty sand to sandy silt
3.773	64.30	0.6271	0.975	0.890	21	7	silty sand to sandy silt
3.937	56.94	0.5801	1.019	1.035	18	7	silty sand to sandy silt
4.101	53.48	0.5062	0.947	1.198	17	7	silty sand to sandy silt
4.265	54.38	0.4948	0.910	1.289	17	7	silty sand to sandy silt
4.429	59.22	0.5364	0.906	1.279	19	7	silty sand to sandy silt
4.593	58.15	0.5726	0.985	1.428	19	7	silty sand to sandy silt
4.757	51.38	0.4992	0.972	1.365	16	7	silty sand to sandy silt
4.921	44.98	0.3782	0.841	1.471	14	7	silty sand to sandy silt
5.085	44.37	0.4016	0.905	1.640	14	7	silty sand to sandy silt
5.249	61.52	0.4786	0.778	1.640	15	8	sand to silty sand
5.413	67.64	0.5732	0.848	1.652	16	8	sand to silty sand
5.577	65.49	0.6470	0.988	1.746	21	7	silty sand to sandy silt
5.741	57.48	0.3774	0.657	1.815	14	8	sand to silty sand
5.906	52.52	0.3959	0.754	2.045	17	7	silty sand to sandy silt
6.070	55.28	0.4247	0.768	2.133	18	7	silty sand to sandy silt
6.234	54.33	0.4565	0.840	2.068	17	7	silty sand to sandy silt
6.398	57.00	0.4776	0.838	2.181	18	7	silty sand to sandy silt
6.562	58.67	0.4517	0.770	2.267	14	8	sand to silty sand
6.726	62.38	0.4925	0.789	2.260	15	8	sand to silty sand
6.890	70.51	0.5795	0.822	2.224	17	8	sand to silty sand
7.054	61.17	0.5939	0.971	2.355	20	7	silty sand to sandy silt
7.218	54.10	0.5228	0.966	2.480	17	7	silty sand to sandy silt
7.382	57.81	0.4774	0.826	2.607	18	7	silty sand to sandy silt
7.546	70.53	0.4941	0.701	2.642	17	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	81.74	0.5206	0.637	2.654	20	8	sand to silty sand
7.874	103.49	0.6486	0.627	2.695	25	8	sand to silty sand
8.038	119.91	0.8434	0.703	2.535	29	8	sand to silty sand
8.202	125.38	1.0067	0.803	2.499	30	8	sand to silty sand
8.366	119.60	1.0651	0.891	2.563	29	8	sand to silty sand
8.530	109.40	0.9909	0.906	2.685	26	8	sand to silty sand
8.694	102.89	0.9061	0.881	2.905	25	8	sand to silty sand
8.858	104.35	0.8144	0.780	3.008	25	8	sand to silty sand
9.022	106.35	0.7825	0.736	3.035	25	8	sand to silty sand
9.186	108.34	0.6408	0.591	3.008	26	8	sand to silty sand
9.350	109.85	0.6623	0.603	3.075	26	8	sand to silty sand
9.514	106.47	0.6980	0.656	3.209	25	8	sand to silty sand
9.678	106.74	0.7499	0.703	3.195	26	8	sand to silty sand
9.843	109.14	0.7626	0.699	3.090	26	8	sand to silty sand
10.007	115.13	0.6833	0.593	3.281	22	9	sand
10.171	123.41	0.7549	0.612	3.369	24	9	sand
10.335	161.69	1.0179	0.630	3.307	31	9	sand
10.499	183.26	1.3981	0.763	3.393	35	9	sand
10.663	201.61	1.7306	0.858	3.214	39	9	sand
10.827	205.99	1.9869	0.965	3.235	39	9	sand
10.991	206.45	2.1251	1.029	3.403	40	9	sand
11.155	200.83	2.1573	1.074	3.530	38	9	sand
11.319	204.16	2.0641	1.011	3.467	39	9	sand
11.483	206.98	2.0896	1.010	2.406	40	9	sand
11.647	210.57	2.1541	1.023	1.880	40	9	sand
11.811	204.00	2.1852	1.071	1.605	39	9	sand
11.975	200.15	2.1057	1.052	1.767	38	9	sand
12.139	207.32	1.9824	0.956	1.325	40	9	sand
12.303	209.85	1.6713	0.796	0.416	40	9	sand
12.467	208.44	1.7744	0.851	-0.033	40	9	sand
12.631	192.01	1.8659	0.972	3.482	37	9	sand
12.795	192.56	1.9962	1.037	2.738	37	9	sand
12.959	202.39	2.0112	0.994	1.373	39	9	sand
13.123	215.18	2.0633	0.959	1.083	41	9	sand
13.287	223.11	2.3587	1.057	-0.555	43	9	sand
13.451	227.04	2.5855	1.139	-1.002	43	9	sand
13.615	228.16	2.8229	1.237	-0.481	44	9	sand
13.780	220.89	2.7708	1.254	0.160	42	9	sand
13.944	213.64	2.5868	1.211	0.622	41	9	sand
14.108	225.14	2.4407	1.084	0.768	43	9	sand
14.272	235.78	2.5449	1.079	-0.485	45	9	sand
14.436	236.71	2.7106	1.145	-1.571	45	9	sand
14.600	227.62	2.7904	1.226	-1.815	44	9	sand
14.764	215.89	2.7707	1.283	-1.275	41	9	sand
14.928	193.79	2.5651	1.324	-0.811	46	8	sand to silty sand
15.092	173.44	2.1831	1.259	-0.648	42	8	sand to silty sand
15.256	167.93	1.8898	1.125	-0.077	40	8	sand to silty sand
15.420	177.29	1.8355	1.035	0.402	34	9	sand
15.584	181.98	1.9126	1.051	1.004	35	9	sand
15.748	192.54	2.1218	1.102	1.205	37	9	sand
15.912	198.13	2.2177	1.119	1.652	38	9	sand
16.076	198.27	2.3227	1.171	1.923	38	9	sand
16.240	200.48	2.3208	1.158	2.011	38	9	sand
16.404	203.80	2.3416	1.149	1.985	39	9	sand
16.568	200.71	2.3308	1.161	2.207	38	9	sand
16.732	200.74	2.3233	1.157	2.308	38	9	sand
16.896	202.27	2.3246	1.149	2.243	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	203.38	2.3371	1.149	2.128	39	9	sand
17.224	206.89	2.3813	1.151	2.205	40	9	sand
17.388	205.57	2.4462	1.190	1.860	39	9	sand
17.552	202.14	2.4289	1.202	2.169	39	9	sand
17.717	198.78	2.4565	1.236	2.525	38	9	sand
17.881	192.87	2.3904	1.239	2.850	46	8	sand to silty sand
18.045	186.80	2.2626	1.211	2.743	45	8	sand to silty sand
18.209	180.60	2.1196	1.174	2.817	43	8	sand to silty sand
18.373	178.43	1.9473	1.091	3.068	34	9	sand
18.537	181.62	1.8547	1.021	2.956	35	9	sand
18.701	176.77	1.8558	1.050	2.994	34	9	sand
18.865	171.87	0.8830	0.514	2.944	33	9	sand
19.029	149.56	1.0313	0.690	3.156	29	9	sand
19.193	129.39	1.1762	0.909	3.800	31	8	sand to silty sand
19.357	123.20	1.1884	0.965	3.840	29	8	sand to silty sand
19.521	117.75	1.1601	0.985	3.869	28	8	sand to silty sand
19.685	109.89	1.1011	1.002	4.003	26	8	sand to silty sand
19.849	106.54	0.9870	0.926	4.161	26	8	sand to silty sand
20.013	110.05	0.9267	0.842	4.235	26	8	sand to silty sand
20.177	110.13	0.9034	0.820	4.472	26	8	sand to silty sand
20.341	108.86	0.9370	0.861	4.170	26	8	sand to silty sand
20.505	111.65	0.9252	0.829	4.328	27	8	sand to silty sand
20.669	111.17	0.9418	0.847	4.175	27	8	sand to silty sand
20.833	111.71	0.9731	0.871	4.223	27	8	sand to silty sand
20.997	110.20	0.9221	0.837	4.376	26	8	sand to silty sand
21.161	110.70	0.9451	0.854	4.503	27	8	sand to silty sand
21.325	112.91	0.9354	0.828	5.026	27	8	sand to silty sand
21.490	118.16	1.0093	0.854	4.668	28	8	sand to silty sand
21.654	127.61	1.1639	0.912	4.948	31	8	sand to silty sand
21.818	123.94	1.1468	0.925	4.352	30	8	sand to silty sand
21.982	123.04	1.1496	0.934	4.596	29	8	sand to silty sand
22.146	127.98	0.7790	0.609	5.081	25	9	sand
22.310	132.39	0.7678	0.580	5.148	25	9	sand
22.474	143.98	0.8484	0.589	1.449	28	9	sand
22.638	150.43	0.9547	0.635	2.073	29	9	sand
22.802	158.01	1.0925	0.691	3.345	30	9	sand
22.966	171.29	1.3164	0.769	4.505	33	9	sand
23.130	175.98	1.4999	0.852	4.689	34	9	sand
23.294	177.42	1.5861	0.894	4.852	34	9	sand
23.458	182.37	1.6637	0.912	5.325	35	9	sand
23.622	189.36	1.7110	0.904	5.725	36	9	sand
23.786	201.35	1.8243	0.906	6.311	39	9	sand
23.950	208.20	1.9397	0.932	6.244	40	9	sand
24.114	209.12	2.0105	0.961	5.615	40	9	sand
24.278	208.29	2.2021	1.057	5.617	40	9	sand
24.442	195.97	2.1585	1.101	5.483	38	9	sand
24.606	167.24	1.9360	1.158	5.584	40	8	sand to silty sand
24.770	146.64	1.5275	1.042	6.134	35	8	sand to silty sand
24.934	125.89	1.1502	0.914	5.631	30	8	sand to silty sand
25.098	120.93	0.8953	0.740	5.978	29	8	sand to silty sand
25.262	122.03	0.7369	0.604	6.170	23	9	sand
25.427	133.98	0.7904	0.590	6.421	26	9	sand
25.591	159.00	1.0102	0.635	6.368	30	9	sand
25.755	171.01	1.2293	0.719	5.720	33	9	sand
25.919	173.42	1.3664	0.788	5.565	33	9	sand
26.083	172.22	1.3439	0.780	5.584	33	9	sand
26.247	170.35	1.3509	0.793	5.918	33	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	168.34	1.3346	0.793	6.327	32	9	sand
26.575	163.81	1.2854	0.785	6.547	31	9	sand
26.739	163.44	1.2186	0.746	6.856	31	9	sand
26.903	163.85	1.2166	0.742	7.078	31	9	sand
27.067	162.47	1.1866	0.730	7.145	31	9	sand
27.231	157.84	1.1640	0.737	7.234	30	9	sand
27.395	152.78	1.1232	0.735	7.458	29	9	sand
27.559	149.86	1.0399	0.694	7.528	29	9	sand
27.723	154.03	0.9918	0.644	7.657	30	9	sand
27.887	159.73	1.0551	0.661	7.774	31	9	sand
28.051	166.19	1.1670	0.702	7.930	32	9	sand
28.215	166.13	1.2728	0.766	7.657	32	9	sand
28.379	157.28	1.2606	0.801	7.932	30	9	sand
28.543	149.02	1.1592	0.778	7.963	29	9	sand
28.707	148.55	1.1270	0.759	8.279	28	9	sand
28.871	148.09	1.1488	0.776	8.209	28	9	sand
29.035	144.15	1.2320	0.855	8.413	28	9	sand
29.199	144.20	1.2587	0.873	8.532	28	9	sand
29.364	145.92	1.2659	0.868	8.362	28	9	sand
29.528	147.81	1.2360	0.836	8.228	28	9	sand
29.692	145.45	1.1061	0.760	8.207	28	9	sand
29.856	149.00	1.1088	0.744	7.501	29	9	sand
30.020	158.78	1.2321	0.776	7.234	30	9	sand
30.184	163.94	1.3545	0.826	7.516	31	9	sand
30.348	174.93	1.5874	0.907	8.020	34	9	sand
30.512	183.00	1.7012	0.930	8.934	35	9	sand
30.676	185.50	1.6989	0.916	8.601	36	9	sand
30.840	178.95	1.5765	0.881	8.570	34	9	sand
31.004	178.06	1.1963	0.672	7.858	34	9	sand
31.168	186.88	1.2440	0.666	7.205	36	9	sand
31.332	181.27	1.4373	0.793	5.330	35	9	sand
31.496	185.43	1.5821	0.853	6.382	36	9	sand
31.660	184.98	1.7307	0.936	6.868	35	9	sand
31.824	183.79	1.7902	0.974	7.215	35	9	sand
31.988	182.53	1.8498	1.013	7.693	35	9	sand
32.152	191.15	1.8711	0.979	8.118	37	9	sand
32.316	187.64	1.9617	1.045	7.296	36	9	sand
32.480	188.47	1.9668	1.044	7.614	36	9	sand
32.644	188.15	1.9487	1.036	7.442	36	9	sand
32.808	193.32	1.9596	1.014	7.683	37	9	sand
32.972	202.47	2.0652	1.020	8.257	39	9	sand
33.136	205.91	2.1557	1.047	8.140	39	9	sand
33.301	205.46	2.2351	1.088	8.013	39	9	sand
33.465	202.70	2.2955	1.132	8.204	39	9	sand
33.629	198.97	2.2922	1.152	8.188	38	9	sand
33.793	199.07	2.2493	1.130	8.836	38	9	sand
33.957	207.02	1.9923	0.962	10.163	40	9	sand
34.121	224.12	1.9792	0.883	8.202	43	9	sand
34.285	230.51	2.1038	0.913	3.905	44	9	sand
34.449	224.74	2.4074	1.071	5.543	43	9	sand
34.613	220.99	2.5526	1.155	6.303	42	9	sand
34.777	223.35	2.4252	1.086	6.995	43	9	sand
34.941	232.55	2.4760	1.065	7.497	45	9	sand
35.105	233.17	2.7018	1.159	7.937	45	9	sand
35.269	218.43	2.5964	1.189	7.356	42	9	sand
35.433	195.04	2.5137	1.289	7.621	47	8	sand to silty sand
35.597	168.67	2.3334	1.383	8.386	40	8	sand to silty sand

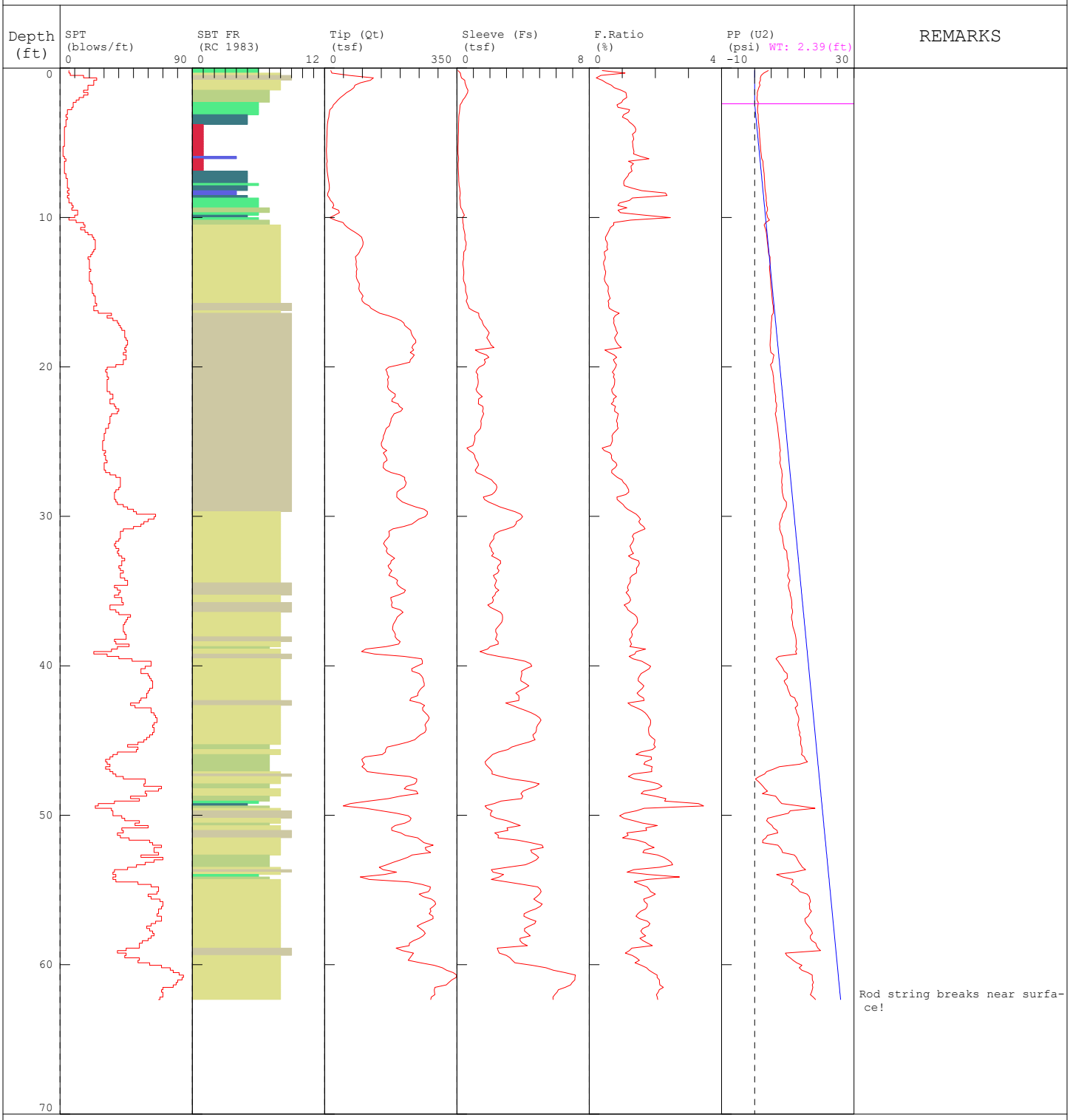
Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	158.20	2.3414	1.480	8.587	38	8	sand to silty sand
35.925	131.12	2.1031	1.604	8.570	31	8	sand to silty sand
36.089	111.28	1.7091	1.536	8.599	27	8	sand to silty sand
36.253	105.54	1.5445	1.463	10.668	25	8	sand to silty sand
36.417	127.40	1.1695	0.918	9.111	30	8	sand to silty sand
36.581	146.36	1.1817	0.807	1.547	28	9	sand
36.745	161.99	1.7173	1.060	-2.944	39	8	sand to silty sand
36.909	159.91	1.7587	1.100	-2.375	38	8	sand to silty sand
37.073	189.70	2.0470	1.079	1.172	36	9	sand
37.238	215.88	2.3688	1.097	2.229	41	9	sand
37.402	217.16	2.6953	1.241	4.041	42	9	sand
37.566	223.11	2.9421	1.319	5.194	43	9	sand
37.730	203.85	2.9808	1.462	6.055	49	8	sand to silty sand
37.894	179.76	2.8000	1.558	6.442	43	8	sand to silty sand
38.058	159.61	2.4489	1.534	7.050	38	8	sand to silty sand
38.222	141.74	2.1491	1.516	7.898	34	8	sand to silty sand
38.386	131.59	1.8521	1.408	8.948	32	8	sand to silty sand
38.550	106.42	1.1537	1.084	8.795	25	8	sand to silty sand
38.714	92.18	1.1130	1.207	7.250	22	8	sand to silty sand
38.878	98.67	1.0177	1.031	-3.259	24	8	sand to silty sand
39.042	115.17	0.8191	0.711	-3.922	28	8	sand to silty sand
39.206	153.77	0.9809	0.638	-4.847	29	9	sand
39.370	142.99	1.4291	0.999	-5.550	34	8	sand to silty sand
39.534	101.57	1.7653	1.738	-4.484	32	7	silty sand to sandy silt
39.698	71.42	1.6128	2.258	-2.604	27	6	sandy silt to clayey silt
39.862	113.55	1.3639	1.201	1.471	27	8	sand to silty sand
40.026	106.79	1.2985	1.216	3.938	26	8	sand to silty sand
40.190	129.80	1.1942	0.920	6.908	31	8	sand to silty sand
40.354	179.92	1.5640	0.869	4.979	34	9	sand
40.518	195.84	2.0069	1.025	2.420	38	9	sand
40.682	200.33	2.5215	1.259	4.675	38	9	sand
40.846	200.72	2.8201	1.405	6.095	48	8	sand to silty sand
41.011	199.82	2.8269	1.415	7.518	48	8	sand to silty sand
41.175	181.80	2.7046	1.488	8.111	44	8	sand to silty sand
41.339	184.50	2.5178	1.365	8.757	44	8	sand to silty sand
41.503	177.00	2.4658	1.393	9.111	42	8	sand to silty sand
41.667	170.78	2.3499	1.376	9.348	41	8	sand to silty sand
41.831	147.16	1.6143	1.097	9.704	35	8	sand to silty sand
41.995	118.99	1.3541	1.138	10.328	28	8	sand to silty sand
42.159	158.04	1.0032	0.635	9.068	30	9	sand
42.323	166.64	0.7816	0.469	3.534	32	9	sand
42.487	163.42	0.9824	0.601	-0.342	31	9	sand
42.651	146.53	1.2336	0.842	0.887	28	9	sand
42.815	131.51	1.2170	0.925	3.365	31	8	sand to silty sand
42.979	110.25	1.0381	0.942	5.380	26	8	sand to silty sand
43.143	80.00	0.9879	1.235	7.494	26	7	silty sand to sandy silt
43.307	52.99	1.1694	2.207	9.460	20	6	sandy silt to clayey silt
43.471	33.69	0.9656	2.866	13.779	13	6	sandy silt to clayey silt
43.635	77.33	0.9878	1.277	16.060	25	7	silty sand to sandy silt
43.799	128.37	1.1476	0.894	3.632	31	8	sand to silty sand
43.963	109.36	1.5741	1.439	8.300	26	8	sand to silty sand
44.127	52.93	1.2249	2.314	10.572	20	6	sandy silt to clayey silt
44.291	36.39	0.7745	2.128	15.044	14	6	sandy silt to clayey silt
44.455	146.17	1.0519	0.720	11.330	28	9	sand
44.619	194.13	1.6087	0.829	7.413	37	9	sand
44.783	245.08	2.4584	1.003	11.667	47	9	sand
44.948	259.44	3.2129	1.238	11.318	50	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	254.35	3.0823	1.212	10.534	49	9	sand
45.276	246.72	3.0023	1.217	11.524	47	9	sand
45.440	256.64	3.4938	1.361	14.360	49	9	sand
45.604	244.04	3.9117	1.603	13.881	58	8	sand to silty sand
45.768	199.74	5.6453	2.826	13.939	64	7	silty sand to sandy silt
45.932	159.34	4.8995	3.075	20.625	61	6	sandy silt to clayey silt
46.096	174.89	3.7673	2.154	48.730	56	7	silty sand to sandy silt
46.260	220.49	2.6457	1.200	8.864	42	9	sand
46.424	219.24	2.6339	1.201	6.880	42	9	sand
46.588	157.65	3.2633	2.070	8.123	50	7	silty sand to sandy silt
46.752	108.96	2.8169	2.585	7.633	35	7	silty sand to sandy silt
46.916	187.83	2.0719	1.103	20.551	36	9	sand
47.080	221.31	2.6106	1.180	11.050	42	9	sand
47.244	247.55	3.2037	1.294	15.077	47	9	sand
47.408	250.68	3.4616	1.381	14.549	60	8	sand to silty sand
47.572	257.68	3.4864	1.353	14.372	49	9	sand
47.736	274.58	3.5344	1.287	13.714	53	9	sand
47.900	298.49	3.7523	1.257	13.363	57	9	sand
48.064	312.01	4.1174	1.320	14.008	60	9	sand
48.228	308.10	4.0140	1.303	12.514	59	9	sand
48.392	300.95	4.1627	1.383	11.849	58	9	sand
48.556	273.48	4.0512	1.481	10.787	65	8	sand to silty sand
48.720	270.38	4.1005	1.517	12.889	65	8	sand to silty sand
48.885	266.53	4.1422	1.554	13.052	64	8	sand to silty sand
49.049	260.61	4.0519	1.555	12.736	62	8	sand to silty sand
49.213	257.59	3.9761	1.544	14.027	62	8	sand to silty sand
49.377	252.05	3.8225	1.517	14.254	60	8	sand to silty sand
49.541	246.54	3.5871	1.455	13.652	59	8	sand to silty sand
49.705	250.54	3.3290	1.329	14.211	48	9	sand
49.869	261.92	3.4322	1.310	14.281	50	9	sand
50.033	282.05	2.1462	0.761	13.712	54	9	sand
50.197	291.39	2.8070	0.963	12.384	56	9	sand
50.361	294.22	3.4223	1.163	16.146	56	9	sand
50.525	299.85	3.9792	1.327	14.491	57	9	sand
50.689	301.40	4.1543	1.378	15.608	58	9	sand
50.853	296.44	4.2254	1.425	15.608	71	8	sand to silty sand
51.017	293.07	4.1634	1.421	16.983	70	8	sand to silty sand
51.181	277.45	4.0361	1.455	15.677	66	8	sand to silty sand
51.345	274.67	3.8258	1.393	17.162	66	8	sand to silty sand
51.509	273.51	3.7429	1.368	16.557	52	9	sand
51.673	278.20	3.8631	1.389	16.653	53	9	sand
51.837	278.93	3.9017	1.399	14.470	67	8	sand to silty sand
52.001	264.64	3.9123	1.478	16.799	63	8	sand to silty sand
52.165	264.84	4.0508	1.530	16.581	63	8	sand to silty sand
52.329	271.07	4.0940	1.510	15.756	65	8	sand to silty sand
52.493	263.28	4.0502	1.538	17.784	63	8	sand to silty sand
52.657	252.83	3.9016	1.543	15.106	61	8	sand to silty sand
52.822	246.66	3.5157	1.425	15.916	59	8	sand to silty sand
52.986	246.51	3.2402	1.314	16.220	47	9	sand
53.150	248.15	3.0603	1.233	15.448	48	9	sand
53.314	255.44	3.1570	1.236	13.814	49	9	sand
53.478	263.96	3.3499	1.269	12.186	51	9	sand
53.642	246.39	3.3887	1.375	11.741	59	8	sand to silty sand
53.806	240.37	3.1165	1.297	11.624	46	9	sand
53.970	244.65	2.9510	1.206	12.081	47	9	sand
54.134	248.53	2.9131	1.172	12.236	48	9	sand
54.298	254.88	2.8659	1.124	10.218	49	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	270.56	3.0336	1.121	8.491	52	9	sand
54.626	286.02	3.2676	1.142	10.211	55	9	sand
54.790	294.42	3.4952	1.187	5.926	56	9	sand
54.954	318.56	4.0190	1.262	6.999	61	9	sand
55.118	336.58	4.5227	1.344	15.711	64	9	sand
55.282	336.63	4.9902	1.482	12.927	81	8	sand to silty sand
55.446	354.95	5.0673	1.428	13.004	68	9	sand
55.610	362.08	5.3667	1.482	12.260	87	8	sand to silty sand
55.774	360.24	5.4095	1.502	11.564	86	8	sand to silty sand
55.938	358.67	5.3839	1.501	12.272	86	8	sand to silty sand
56.102	349.30	5.3539	1.533	10.591	84	8	sand to silty sand
56.266	338.60	5.2792	1.559	11.837	81	8	sand to silty sand
56.430	313.70	5.3234	1.697	11.521	75	8	sand to silty sand
56.594	279.47	4.2580	1.524	10.615	67	8	sand to silty sand
56.759	258.63	3.8977	1.507	12.557	62	8	sand to silty sand
56.923	308.23	3.9131	1.270	13.214	59	9	sand
57.087	306.54	4.0051	1.307	7.908	59	9	sand
57.251	297.34	4.0028	1.346	7.973	57	9	sand
57.415	274.75	3.9372	1.433	9.467	66	8	sand to silty sand
57.579	253.47	3.8845	1.533	10.015	61	8	sand to silty sand
57.743	260.77	3.2932	1.263	11.803	50	9	sand
57.907	284.66	3.2331	1.136	14.730	55	9	sand
58.071	319.71	3.8620	1.208	2.638	61	9	sand
58.235	310.79	3.7755	1.215	6.129	60	9	sand
58.399	301.76	4.0348	1.337	8.401	58	9	sand
58.563	314.26	4.4876	1.428	13.434	60	9	sand
58.727	320.46	4.5485	1.419	13.267	61	9	sand
58.891	308.01	4.6094	1.496	15.017	74	8	sand to silty sand
59.055	306.44	4.6106	1.505	14.537	73	8	sand to silty sand
59.219	309.53	4.5973	1.485	15.727	74	8	sand to silty sand
59.383	297.02	4.7801	1.609	15.278	71	8	sand to silty sand
59.547	278.62	4.6254	1.660	13.693	67	8	sand to silty sand
59.711	253.60	4.3776	1.726	14.785	61	8	sand to silty sand
59.875	242.97	3.3812	1.392	15.354	58	8	sand to silty sand
60.039	245.93	3.3030	1.343	15.869	47	9	sand
60.203	251.59	3.3313	1.324	16.244	48	9	sand
60.367	248.85	3.3208	1.334	17.215	48	9	sand
60.532	250.68	3.4909	1.393	16.701	60	8	sand to silty sand

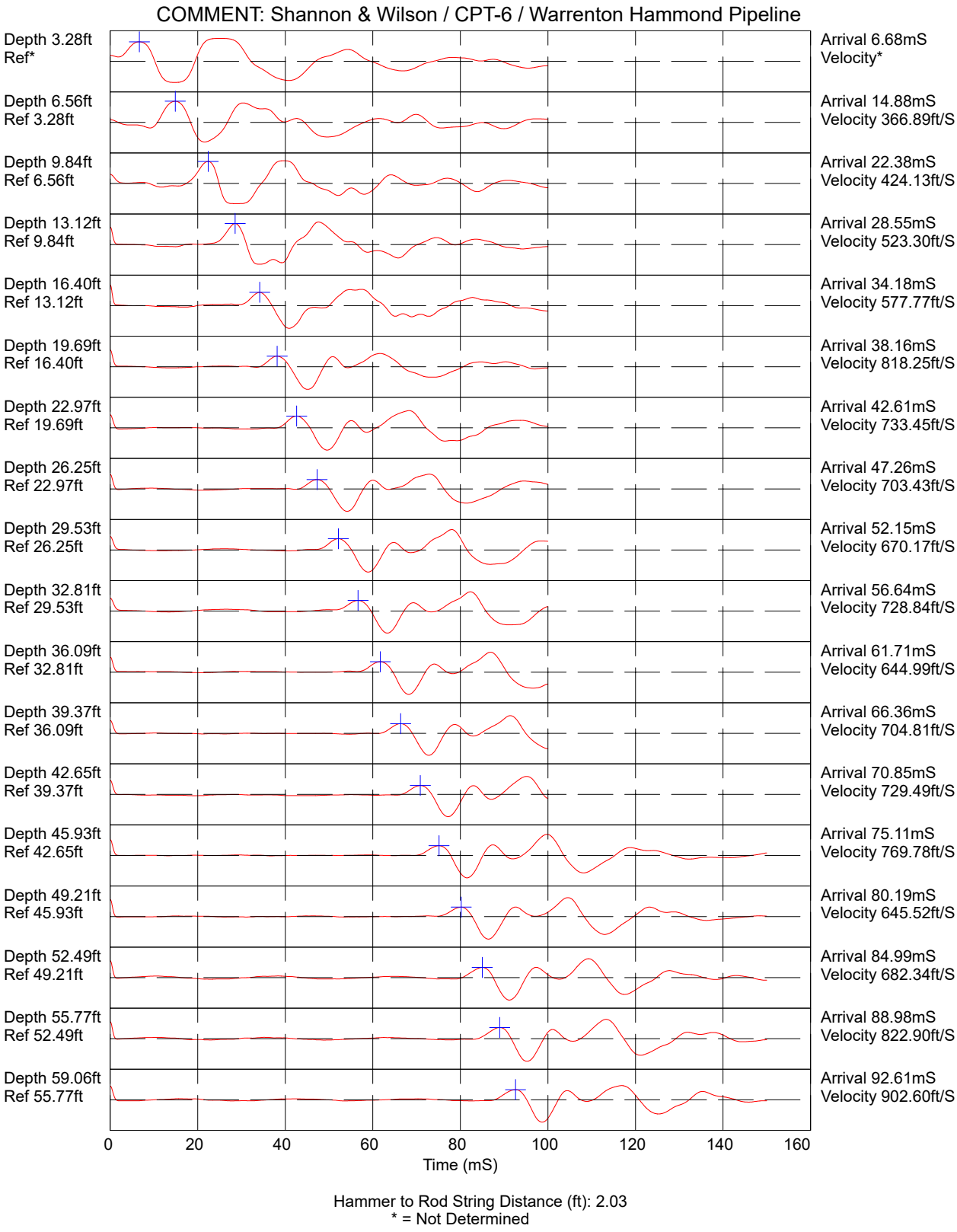
Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM
TOTAL DEPTH: 62.336 ft



1 sensitive fine grained
2 organic material
3 clay
4 silty clay to clay
5 clayey silt to silty cl
6 sandy silt to clayey si
7 silty sand to sandy si
8 sand to silty sand
9 sand
10 gravelly sand to sand
11 very stiff fine grained (*)
12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983



Hammer to Rod String Distance (ft): 2.03
* = Not Determined

Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

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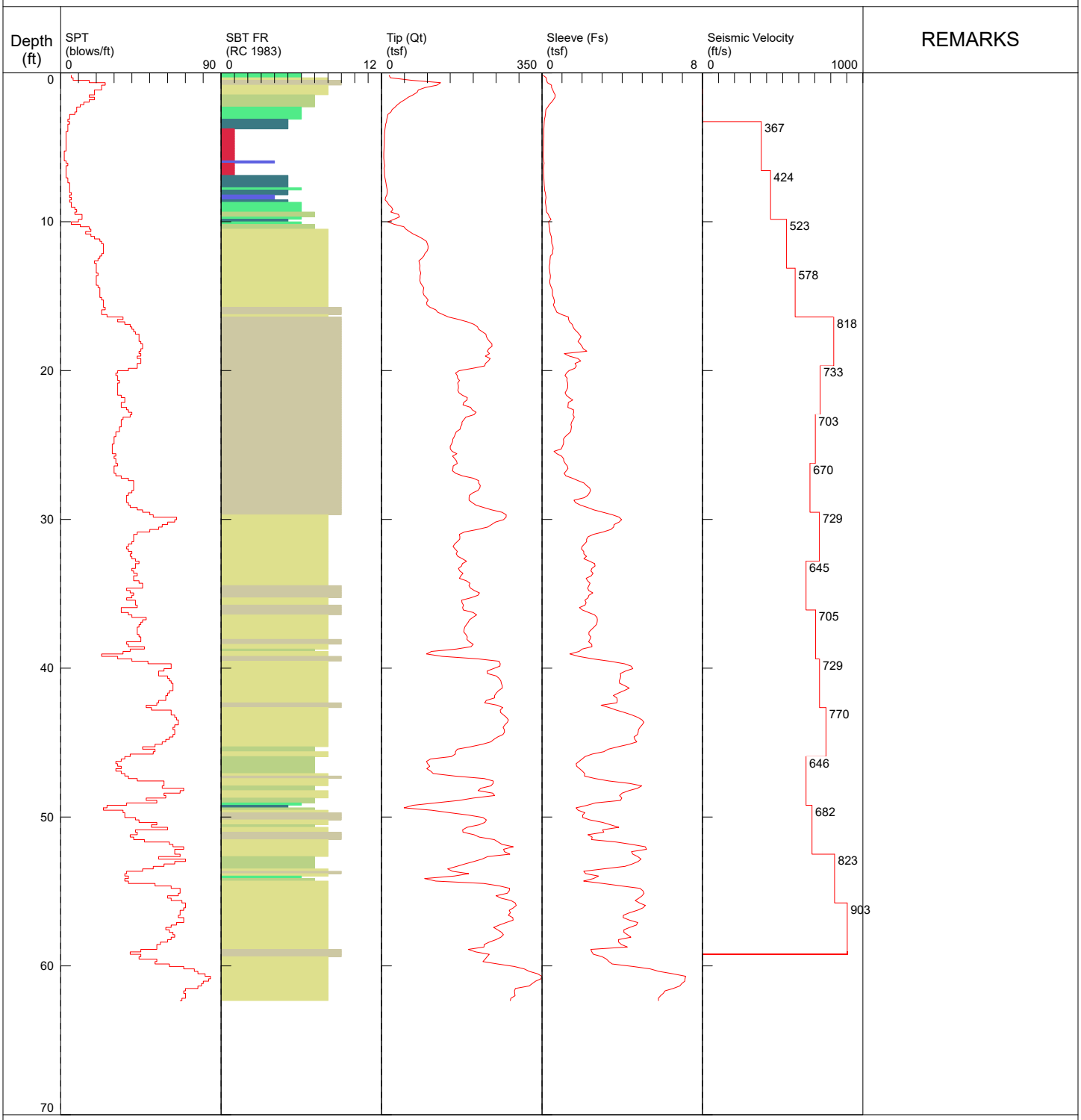

1 sensitive fine grained
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8 sand to silty sand
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*SBT/SPT CORRELATION: UBC-1983

COMMENT: Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

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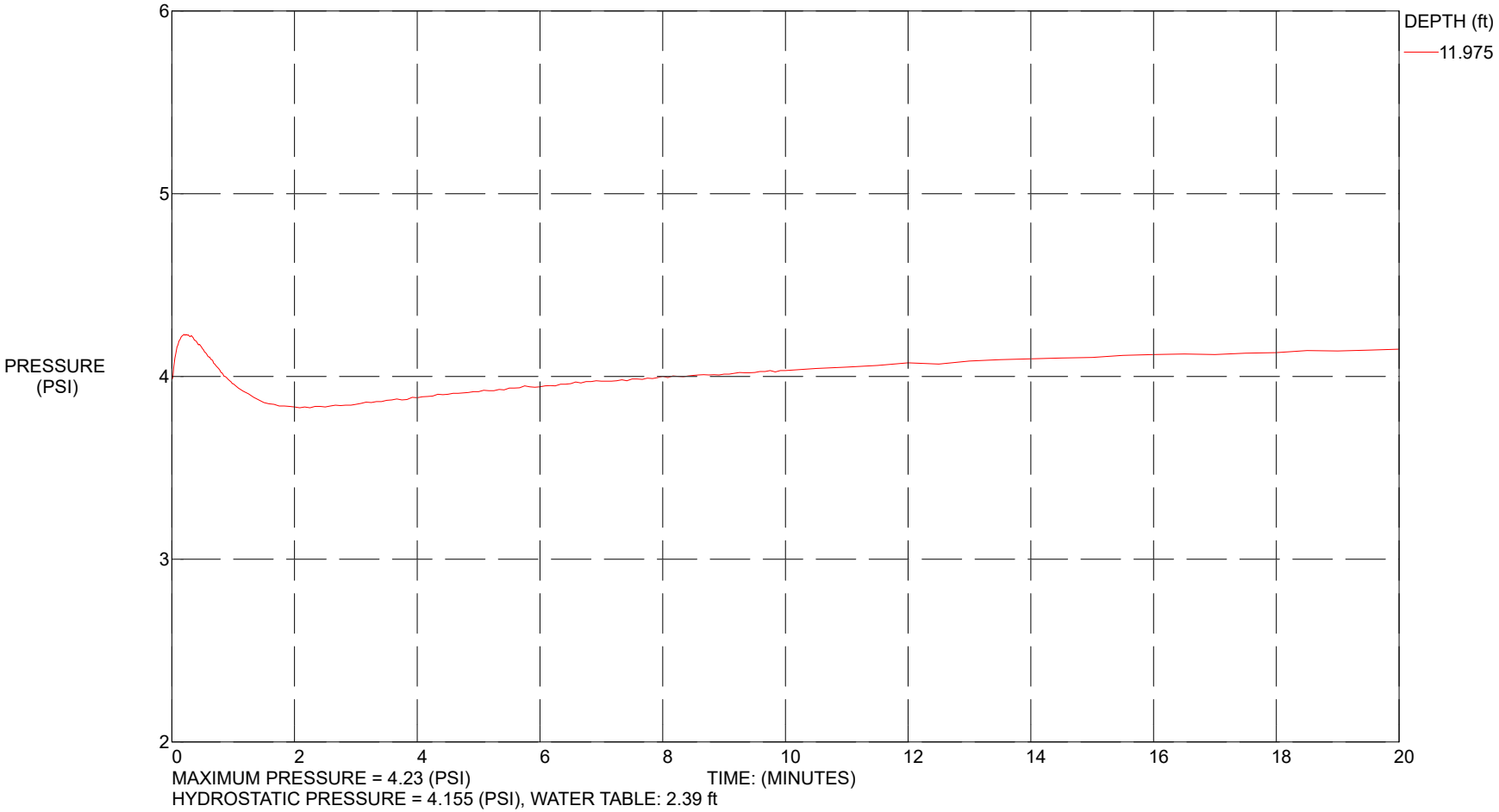


Shannon & Wilson / CPT-6 / Warrenton Hammond Pipeline

OPERATOR: OGE BAK
CONE ID: DDG1661
TEST DATE: 1/23/2024 10:35:38 AM
TOTAL DEPTH: 62.336 ft

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
0.164	16.47	0.0645	0.392	4.127	6	6	sandy silt to clayey silt
0.328	19.14	0.2067	1.080	2.755	7	6	sandy silt to clayey silt
0.492	65.23	0.2276	0.349	1.980	16	8	sand to silty sand
0.656	128.81	0.2699	0.210	1.695	25	9	sand
0.820	120.86	0.4717	0.390	1.734	23	9	sand
0.984	95.04	0.4819	0.507	1.392	23	8	sand to silty sand
1.148	80.05	0.5352	0.669	1.578	19	8	sand to silty sand
1.312	77.43	0.5833	0.753	1.232	19	8	sand to silty sand
1.476	68.85	0.6610	0.960	0.992	16	8	sand to silty sand
1.640	58.23	0.6453	1.108	0.796	19	7	silty sand to sandy silt
1.804	50.33	0.5635	1.120	0.799	16	7	silty sand to sandy silt
1.969	42.00	0.4755	1.132	0.698	13	7	silty sand to sandy silt
2.133	34.89	0.3551	1.018	0.703	11	7	silty sand to sandy silt
2.297	29.61	0.2894	0.977	1.059	9	7	silty sand to sandy silt
2.461	23.11	0.1924	0.833	0.985	9	6	sandy silt to clayey silt
2.625	20.44	0.1772	0.867	0.906	8	6	sandy silt to clayey silt
2.789	13.69	0.1666	1.217	0.839	5	6	sandy silt to clayey silt
2.953	12.49	0.1482	1.187	0.861	5	6	sandy silt to clayey silt
3.117	11.58	0.1205	1.040	1.052	4	6	sandy silt to clayey silt
3.281	10.87	0.1088	1.001	1.086	5	5	clayey silt to silty clay
3.445	9.19	0.1064	1.158	1.043	4	5	clayey silt to silty clay
3.609	8.16	0.0987	1.210	1.150	4	5	clayey silt to silty clay
3.773	7.39	0.0967	1.309	1.234	4	5	clayey silt to silty clay
3.937	6.96	0.0959	1.377	1.301	3	1	sensitive fine grained
4.101	6.55	0.0922	1.407	1.375	3	1	sensitive fine grained
4.265	6.28	0.0876	1.395	1.432	3	1	sensitive fine grained
4.429	6.21	0.0811	1.306	1.456	3	1	sensitive fine grained
4.593	5.94	0.0789	1.329	1.485	3	1	sensitive fine grained
4.757	5.85	0.0786	1.343	1.547	3	1	sensitive fine grained
4.921	5.73	0.0749	1.305	1.595	3	1	sensitive fine grained
5.085	5.45	0.0716	1.314	1.667	3	1	sensitive fine grained
5.249	5.12	0.0674	1.317	1.722	2	1	sensitive fine grained
5.413	4.80	0.0640	1.332	1.801	2	1	sensitive fine grained
5.577	4.72	0.0637	1.350	1.868	2	1	sensitive fine grained
5.741	4.89	0.0656	1.340	1.944	2	1	sensitive fine grained
5.906	5.34	0.0827	1.548	2.040	3	1	sensitive fine grained
6.070	5.75	0.1037	1.805	2.152	4	4	silty clay to clay
6.234	7.04	0.0834	1.185	2.465	3	1	sensitive fine grained
6.398	5.36	0.0717	1.338	2.528	3	1	sensitive fine grained
6.562	5.86	0.0738	1.260	2.571	3	1	sensitive fine grained
6.726	6.26	0.0794	1.267	2.683	3	1	sensitive fine grained
6.890	6.45	0.0833	1.292	2.752	3	1	sensitive fine grained
7.054	7.48	0.0895	1.196	2.826	4	5	clayey silt to silty clay
7.218	8.52	0.0993	1.166	2.886	4	5	clayey silt to silty clay
7.382	9.45	0.1042	1.103	2.934	5	5	clayey silt to silty clay
7.546	10.44	0.1096	1.050	2.994	5	5	clayey silt to silty clay

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
7.710	11.36	0.1181	1.040	3.015	5	5	clayey silt to silty clay
7.874	12.28	0.1297	1.056	3.061	5	6	sandy silt to clayey silt
8.038	12.45	0.1620	1.302	3.111	6	5	clayey silt to silty clay
8.202	11.20	0.1777	1.587	3.168	5	5	clayey silt to silty clay
8.366	8.64	0.1993	2.306	3.314	6	4	silty clay to clay
8.530	7.80	0.1833	2.349	3.443	5	4	silty clay to clay
8.694	12.58	0.1640	1.304	3.503	6	5	clayey silt to silty clay
8.858	15.70	0.1904	1.212	3.475	6	6	sandy silt to clayey silt
9.022	22.01	0.2014	0.915	3.599	8	6	sandy silt to clayey silt
9.186	24.29	0.2097	0.863	3.616	9	6	sandy silt to clayey silt
9.350	20.27	0.2297	1.133	3.860	8	6	sandy silt to clayey silt
9.514	36.80	0.3193	0.867	3.874	12	7	silty sand to sandy silt
9.678	39.10	0.3664	0.937	3.561	12	7	silty sand to sandy silt
9.843	26.96	0.4470	1.658	3.740	10	6	sandy silt to clayey silt
10.007	13.58	0.3327	2.451	3.941	6	5	clayey silt to silty clay
10.171	27.85	0.3488	1.252	4.450	11	6	sandy silt to clayey silt
10.335	48.68	0.3592	0.738	3.302	16	7	silty sand to sandy silt
10.499	53.05	0.3912	0.737	2.838	17	7	silty sand to sandy silt
10.663	60.55	0.3883	0.641	3.116	14	8	sand to silty sand
10.827	69.37	0.4209	0.607	3.348	17	8	sand to silty sand
10.991	80.39	0.4605	0.573	3.498	19	8	sand to silty sand
11.155	90.05	0.4814	0.535	3.599	22	8	sand to silty sand
11.319	97.99	0.4783	0.488	3.673	23	8	sand to silty sand
11.483	99.93	0.4901	0.490	3.752	24	8	sand to silty sand
11.647	101.53	0.5453	0.537	3.824	24	8	sand to silty sand
11.811	101.25	0.5549	0.548	3.903	24	8	sand to silty sand
11.975	99.26	0.5260	0.530	3.989	24	8	sand to silty sand
12.139	94.54	0.5252	0.556	4.118	23	8	sand to silty sand
12.303	92.13	0.4178	0.453	4.161	22	8	sand to silty sand
12.467	87.79	0.4066	0.463	4.223	21	8	sand to silty sand
12.631	81.40	0.3961	0.487	4.625	19	8	sand to silty sand
12.795	82.59	0.3969	0.481	4.637	20	8	sand to silty sand
12.959	83.80	0.3653	0.436	4.658	20	8	sand to silty sand
13.123	82.91	0.3584	0.432	4.685	20	8	sand to silty sand
13.287	83.84	0.3815	0.455	4.472	20	8	sand to silty sand
13.451	85.63	0.3987	0.466	4.512	21	8	sand to silty sand
13.615	84.01	0.4179	0.497	4.575	20	8	sand to silty sand
13.780	84.13	0.4099	0.487	4.646	20	8	sand to silty sand
13.944	83.56	0.3935	0.471	4.720	20	8	sand to silty sand
14.108	85.06	0.3846	0.452	4.768	20	8	sand to silty sand
14.272	88.27	0.4161	0.471	4.814	21	8	sand to silty sand
14.436	92.01	0.4736	0.515	4.859	22	8	sand to silty sand
14.600	91.13	0.5223	0.573	4.931	22	8	sand to silty sand
14.764	90.49	0.5198	0.574	5.012	22	8	sand to silty sand
14.928	92.43	0.5192	0.562	5.103	22	8	sand to silty sand
15.092	97.33	0.5663	0.582	5.156	23	8	sand to silty sand
15.256	101.53	0.6112	0.602	5.218	24	8	sand to silty sand
15.420	98.31	0.6204	0.631	5.292	24	8	sand to silty sand
15.584	99.08	0.5600	0.565	5.361	24	8	sand to silty sand
15.748	105.69	0.6224	0.589	5.423	25	8	sand to silty sand
15.912	118.09	0.6874	0.582	5.612	23	9	sand
16.076	122.51	0.7356	0.600	5.610	23	9	sand
16.240	133.96	0.9793	0.731	5.624	26	9	sand
16.404	145.71	1.3136	0.901	5.615	35	8	sand to silty sand
16.568	168.16	1.3230	0.787	5.165	32	9	sand
16.732	186.89	1.3746	0.736	5.160	36	9	sand
16.896	201.64	1.5042	0.746	5.108	39	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
17.060	209.60	1.5491	0.739	5.024	40	9	sand
17.224	211.71	1.6162	0.763	5.005	41	9	sand
17.388	219.74	1.7456	0.794	4.931	42	9	sand
17.552	227.65	1.8521	0.814	4.852	44	9	sand
17.717	228.72	1.9464	0.851	4.885	44	9	sand
17.881	231.52	1.8788	0.812	4.838	44	9	sand
18.045	235.64	1.7981	0.763	4.771	45	9	sand
18.209	240.85	1.9017	0.790	4.728	46	9	sand
18.373	240.96	1.9923	0.827	4.694	46	9	sand
18.537	233.90	2.0603	0.881	4.658	45	9	sand
18.701	230.79	2.2396	0.970	4.704	44	9	sand
18.865	235.47	1.1097	0.471	4.761	45	9	sand
19.029	226.42	1.3662	0.603	4.902	43	9	sand
19.193	237.14	1.7882	0.754	5.818	45	9	sand
19.357	232.66	1.9296	0.829	5.624	45	9	sand
19.521	226.70	1.6479	0.727	5.493	43	9	sand
19.685	225.16	1.7138	0.761	5.414	43	9	sand
19.849	198.73	1.6330	0.822	4.783	38	9	sand
20.013	169.34	1.3469	0.795	4.995	32	9	sand
20.177	161.57	1.2177	0.754	5.223	31	9	sand
20.341	165.15	1.1488	0.696	5.464	32	9	sand
20.505	165.82	1.2555	0.757	5.553	32	9	sand
20.669	170.02	1.2395	0.729	5.653	33	9	sand
20.833	166.15	1.2757	0.768	5.684	32	9	sand
20.997	167.47	1.2859	0.768	5.722	32	9	sand
21.161	167.55	1.2736	0.760	5.861	32	9	sand
21.325	166.51	1.2265	0.737	5.926	32	9	sand
21.490	169.06	1.1500	0.680	6.005	32	9	sand
21.654	176.34	1.2101	0.686	6.091	34	9	sand
21.818	186.88	1.3508	0.723	6.203	36	9	sand
21.982	186.40	1.5323	0.822	6.356	36	9	sand
22.146	179.06	1.3130	0.733	6.323	34	9	sand
22.310	177.65	1.3014	0.733	6.323	34	9	sand
22.474	194.36	1.2926	0.665	6.595	37	9	sand
22.638	197.63	1.5670	0.793	6.641	38	9	sand
22.802	206.33	1.5848	0.768	6.468	40	9	sand
22.966	201.52	1.5425	0.765	6.511	39	9	sand
23.130	183.94	1.6121	0.876	6.198	35	9	sand
23.294	179.82	1.5476	0.861	6.390	34	9	sand
23.458	175.57	1.4811	0.844	6.531	34	9	sand
23.622	175.14	1.4418	0.823	6.612	34	9	sand
23.786	172.46	1.4672	0.851	6.775	33	9	sand
23.950	171.07	1.4496	0.847	6.894	33	9	sand
24.114	162.97	1.4227	0.873	7.009	31	9	sand
24.278	160.57	1.2902	0.804	7.028	31	9	sand
24.442	158.58	1.1581	0.730	7.121	30	9	sand
24.606	155.51	1.0676	0.687	7.224	30	9	sand
24.770	155.04	1.0815	0.698	7.344	30	9	sand
24.934	152.73	1.0678	0.699	7.432	29	9	sand
25.098	149.89	1.0141	0.677	7.490	29	9	sand
25.262	150.03	0.9639	0.642	7.580	29	9	sand
25.427	153.87	0.5991	0.389	7.638	29	9	sand
25.591	164.28	0.7392	0.450	7.776	31	9	sand
25.755	155.02	0.9722	0.627	7.576	30	9	sand
25.919	159.66	1.0738	0.673	7.609	31	9	sand
26.083	163.51	1.0891	0.666	7.762	31	9	sand
26.247	165.17	1.1681	0.707	7.753	32	9	sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
26.411	156.26	1.2625	0.808	7.580	30	9	sand
26.575	155.68	1.2961	0.833	7.793	30	9	sand
26.739	154.90	1.2117	0.782	7.920	30	9	sand
26.903	161.78	1.1044	0.683	8.161	31	9	sand
27.067	176.20	1.1865	0.673	8.228	34	9	sand
27.231	199.99	1.5120	0.756	8.341	38	9	sand
27.395	211.80	1.7966	0.848	8.264	41	9	sand
27.559	211.65	2.0951	0.990	8.183	41	9	sand
27.723	215.45	2.2161	1.029	8.128	41	9	sand
27.887	214.35	2.3725	1.107	8.303	41	9	sand
28.051	210.49	2.4205	1.150	8.212	40	9	sand
28.215	199.31	2.3684	1.188	8.293	38	9	sand
28.379	191.62	2.2811	1.190	8.329	37	9	sand
28.543	190.89	2.1066	1.104	8.487	37	9	sand
28.707	190.81	1.5914	0.834	8.630	37	9	sand
28.871	197.78	1.6678	0.843	8.948	38	9	sand
29.035	205.92	1.9181	0.931	9.556	39	9	sand
29.199	222.83	2.2745	1.021	9.606	43	9	sand
29.364	240.35	2.5847	1.075	9.532	46	9	sand
29.528	262.88	3.0363	1.155	9.211	50	9	sand
29.692	271.92	3.5077	1.290	8.805	52	9	sand
29.856	271.67	3.8524	1.418	8.355	65	8	sand to silty sand
30.020	265.88	3.9684	1.493	8.288	64	8	sand to silty sand
30.184	248.60	3.8422	1.546	7.961	60	8	sand to silty sand
30.348	239.88	3.5954	1.499	7.729	57	8	sand to silty sand
30.512	231.24	3.5687	1.543	7.490	55	8	sand to silty sand
30.676	209.18	3.4351	1.642	7.616	50	8	sand to silty sand
30.840	180.69	3.0455	1.685	7.537	43	8	sand to silty sand
31.004	169.86	2.5591	1.507	7.786	41	8	sand to silty sand
31.168	170.89	2.3027	1.347	8.037	41	8	sand to silty sand
31.332	170.64	2.2224	1.302	8.353	41	8	sand to silty sand
31.496	165.22	2.2251	1.347	8.479	40	8	sand to silty sand
31.660	159.26	2.1123	1.326	8.532	38	8	sand to silty sand
31.824	155.88	1.9988	1.282	8.656	37	8	sand to silty sand
31.988	160.48	1.9706	1.228	8.814	38	8	sand to silty sand
32.152	165.43	2.0784	1.256	8.896	40	8	sand to silty sand
32.316	162.92	2.0916	1.284	9.668	39	8	sand to silty sand
32.480	166.35	2.2183	1.333	9.733	40	8	sand to silty sand
32.644	176.23	2.0896	1.186	9.788	42	8	sand to silty sand
32.808	185.33	2.3766	1.282	9.807	44	8	sand to silty sand
32.972	176.30	2.6212	1.487	10.089	42	8	sand to silty sand
33.136	174.59	2.6456	1.515	10.163	42	8	sand to silty sand
33.301	167.67	2.4861	1.483	10.182	40	8	sand to silty sand
33.465	170.59	2.4345	1.427	10.299	41	8	sand to silty sand
33.629	177.62	2.5462	1.434	10.412	43	8	sand to silty sand
33.793	173.06	2.4584	1.421	10.132	41	8	sand to silty sand
33.957	169.82	2.2003	1.296	9.926	41	8	sand to silty sand
34.121	184.54	2.2752	1.233	10.184	44	8	sand to silty sand
34.285	193.02	2.3961	1.241	10.629	46	8	sand to silty sand
34.449	190.60	2.3371	1.226	10.359	46	8	sand to silty sand
34.613	194.21	2.2785	1.173	10.125	37	9	sand
34.777	202.38	2.3321	1.152	10.297	39	9	sand
34.941	213.58	2.5329	1.186	10.474	41	9	sand
35.105	210.22	2.3382	1.112	10.687	40	9	sand
35.269	194.60	2.2939	1.179	10.768	37	9	sand
35.433	174.79	2.1371	1.223	11.005	42	8	sand to silty sand
35.597	175.68	2.2000	1.252	11.143	42	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
35.761	178.62	2.1493	1.203	11.220	43	8	sand to silty sand
35.925	176.75	1.8646	1.055	11.275	34	9	sand
36.089	178.47	2.0165	1.130	11.148	34	9	sand
36.253	199.89	2.3263	1.164	11.371	38	9	sand
36.417	207.42	2.6266	1.266	11.464	40	9	sand
36.581	199.35	2.7416	1.375	11.232	48	8	sand to silty sand
36.745	191.90	2.7596	1.438	11.115	46	8	sand to silty sand
36.909	189.03	2.7493	1.454	11.194	45	8	sand to silty sand
37.073	185.13	2.7081	1.463	11.411	44	8	sand to silty sand
37.238	181.45	2.5911	1.428	11.452	43	8	sand to silty sand
37.402	179.99	2.4632	1.368	11.574	43	8	sand to silty sand
37.566	179.63	2.3432	1.304	11.837	43	8	sand to silty sand
37.730	183.91	2.3398	1.272	12.035	44	8	sand to silty sand
37.894	187.00	2.4307	1.300	12.251	45	8	sand to silty sand
38.058	186.38	2.3905	1.283	12.392	45	8	sand to silty sand
38.222	191.54	2.3268	1.215	12.478	37	9	sand
38.386	199.99	2.4832	1.242	12.571	38	9	sand
38.550	195.45	2.4930	1.276	12.549	47	8	sand to silty sand
38.714	163.25	2.0035	1.227	12.416	39	8	sand to silty sand
38.878	108.73	1.8507	1.702	12.743	35	7	silty sand to sandy silt
39.042	98.11	1.3918	1.419	12.356	23	8	sand to silty sand
39.206	131.92	1.8167	1.377	12.657	32	8	sand to silty sand
39.370	210.17	2.5272	1.202	7.265	40	9	sand
39.534	256.23	3.3844	1.321	6.454	49	9	sand
39.698	258.71	4.1164	1.591	7.064	62	8	sand to silty sand
39.862	258.18	4.4459	1.722	7.535	62	8	sand to silty sand
40.026	243.73	4.5239	1.856	8.109	58	8	sand to silty sand
40.190	230.06	4.1632	1.810	8.554	55	8	sand to silty sand
40.354	231.04	3.8995	1.688	8.943	55	8	sand to silty sand
40.518	250.02	3.9263	1.570	9.773	60	8	sand to silty sand
40.682	256.42	3.8983	1.520	9.857	61	8	sand to silty sand
40.846	260.24	3.8516	1.480	9.811	62	8	sand to silty sand
41.011	261.17	3.8659	1.480	8.886	63	8	sand to silty sand
41.175	263.31	4.1292	1.568	9.221	63	8	sand to silty sand
41.339	263.37	4.3468	1.650	9.764	63	8	sand to silty sand
41.503	255.35	4.0956	1.604	9.967	61	8	sand to silty sand
41.667	250.36	3.8119	1.523	10.232	60	8	sand to silty sand
41.831	246.67	3.5563	1.442	10.553	59	8	sand to silty sand
41.995	246.36	3.7324	1.515	10.789	59	8	sand to silty sand
42.159	228.49	3.7522	1.642	12.167	55	8	sand to silty sand
42.323	225.04	3.7323	1.658	12.382	54	8	sand to silty sand
42.487	252.37	2.9430	1.166	12.846	48	9	sand
42.651	264.37	3.3481	1.266	12.961	51	9	sand
42.815	258.94	3.7075	1.432	12.224	62	8	sand to silty sand
42.979	259.69	4.1151	1.585	12.588	62	8	sand to silty sand
43.143	266.13	4.4842	1.685	12.736	64	8	sand to silty sand
43.307	272.53	4.7809	1.754	13.097	65	8	sand to silty sand
43.471	276.62	4.9871	1.803	13.308	66	8	sand to silty sand
43.635	274.48	5.0796	1.851	13.363	66	8	sand to silty sand
43.799	269.07	4.9925	1.855	13.131	64	8	sand to silty sand
43.963	265.17	4.8870	1.843	13.054	63	8	sand to silty sand
44.127	267.69	4.8095	1.797	13.253	64	8	sand to silty sand
44.291	268.35	4.8001	1.789	13.365	64	8	sand to silty sand
44.455	264.95	4.7593	1.796	13.671	63	8	sand to silty sand
44.619	253.12	4.5878	1.812	13.513	61	8	sand to silty sand
44.783	245.17	4.6285	1.888	13.939	59	8	sand to silty sand
44.948	238.13	4.7249	1.984	13.982	57	8	sand to silty sand

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
45.112	219.84	4.3389	1.974	13.867	53	8	sand to silty sand
45.276	194.21	3.7882	1.951	13.946	46	8	sand to silty sand
45.440	165.44	3.3087	2.000	14.204	53	7	silty sand to sandy silt
45.604	161.35	3.0796	1.909	14.259	52	7	silty sand to sandy silt
45.768	160.91	2.5064	1.558	14.348	39	8	sand to silty sand
45.932	152.41	2.1513	1.411	14.144	36	8	sand to silty sand
46.096	107.05	2.0069	1.875	15.058	34	7	silty sand to sandy silt
46.260	98.19	1.8478	1.882	15.278	31	7	silty sand to sandy silt
46.424	100.56	1.6991	1.690	15.928	32	7	silty sand to sandy silt
46.588	105.06	1.7320	1.649	13.614	34	7	silty sand to sandy silt
46.752	98.58	1.8729	1.900	7.463	31	7	silty sand to sandy silt
46.916	107.18	2.0172	1.882	5.629	34	7	silty sand to sandy silt
47.080	112.69	2.1299	1.890	3.623	36	7	silty sand to sandy silt
47.244	159.55	2.1164	1.327	2.977	38	8	sand to silty sand
47.408	224.14	2.6526	1.183	1.385	43	9	sand
47.572	243.59	3.3291	1.367	0.225	58	8	sand to silty sand
47.736	243.28	4.3821	1.801	1.102	58	8	sand to silty sand
47.900	238.59	4.9657	2.081	1.817	57	8	sand to silty sand
48.064	216.79	4.7621	2.197	2.499	69	7	silty sand to sandy silt
48.228	210.51	4.3348	2.059	3.101	67	7	silty sand to sandy silt
48.392	242.61	3.9953	1.647	3.855	58	8	sand to silty sand
48.556	246.74	3.8636	1.566	2.288	59	8	sand to silty sand
48.720	200.54	3.9795	1.984	6.335	48	8	sand to silty sand
48.885	168.86	3.9086	2.315	6.896	54	7	silty sand to sandy silt
49.049	116.85	2.6609	2.277	7.444	37	7	silty sand to sandy silt
49.213	68.21	2.2491	3.297	8.169	26	6	sandy silt to clayey silt
49.377	49.14	1.6974	3.454	13.487	24	5	clayey silt to silty clay
49.541	108.73	1.8035	1.659	18.250	35	7	silty sand to sandy silt
49.705	149.68	2.1321	1.424	10.758	36	8	sand to silty sand
49.869	190.21	2.0295	1.067	10.194	36	9	sand
50.033	221.34	2.0335	0.919	6.911	42	9	sand
50.197	228.54	2.3800	1.041	3.955	44	9	sand
50.361	225.47	3.0244	1.341	3.604	54	8	sand to silty sand
50.525	212.78	3.4151	1.605	4.338	51	8	sand to silty sand
50.689	186.42	3.8315	2.055	5.263	60	7	silty sand to sandy silt
50.853	176.95	3.0218	1.708	5.641	42	8	sand to silty sand
51.017	177.71	3.0808	1.734	6.736	43	8	sand to silty sand
51.181	201.58	2.2869	1.134	6.985	39	9	sand
51.345	213.39	2.5010	1.172	3.838	41	9	sand
51.509	245.81	2.4763	1.007	3.367	47	9	sand
51.673	254.27	3.6878	1.450	2.458	61	8	sand to silty sand
51.837	262.68	4.4681	1.701	2.394	63	8	sand to silty sand
52.001	287.15	5.1467	1.792	7.011	69	8	sand to silty sand
52.165	266.18	5.2159	1.960	7.638	64	8	sand to silty sand
52.329	267.89	4.4634	1.666	8.166	64	8	sand to silty sand
52.493	280.15	4.5295	1.617	8.389	67	8	sand to silty sand
52.657	231.41	4.7751	2.064	11.985	55	8	sand to silty sand
52.822	219.39	4.9395	2.251	12.614	70	7	silty sand to sandy silt
52.986	201.51	4.7967	2.380	12.978	64	7	silty sand to sandy silt
53.150	181.51	4.5021	2.480	13.406	58	7	silty sand to sandy silt
53.314	164.19	4.1356	2.519	13.915	52	7	silty sand to sandy silt
53.478	144.27	3.0604	2.121	14.415	46	7	silty sand to sandy silt
53.642	154.64	2.0813	1.346	15.409	37	8	sand to silty sand
53.806	190.28	2.1785	1.145	11.935	36	9	sand
53.970	158.57	2.8186	1.778	6.578	38	8	sand to silty sand
54.134	94.00	2.5603	2.724	8.453	36	6	sandy silt to clayey silt
54.298	118.09	2.0755	1.758	11.488	38	7	silty sand to sandy silt

Depth ft	Tip (Qt) (tsf)	Sleeve (Fs) (tsf)	F.Ratio (%)	PP (U2) (psi)	SPT (blows/ft)	Zone	Soil Behavior Type UBC-1983
54.462	222.96	3.0338	1.361	11.593	53	8	sand to silty sand
54.626	257.45	3.9708	1.542	11.021	62	8	sand to silty sand
54.790	279.50	4.8873	1.749	12.229	67	8	sand to silty sand
54.954	278.50	5.0345	1.808	13.095	67	8	sand to silty sand
55.118	274.16	5.0877	1.856	13.606	66	8	sand to silty sand
55.282	249.82	4.9940	1.999	15.835	60	8	sand to silty sand
55.446	260.72	4.8339	1.854	16.478	62	8	sand to silty sand
55.610	282.48	4.6445	1.644	16.686	68	8	sand to silty sand
55.774	291.44	4.8583	1.667	16.875	70	8	sand to silty sand
55.938	293.80	5.1552	1.755	16.464	70	8	sand to silty sand
56.102	287.36	5.0330	1.751	16.591	69	8	sand to silty sand
56.266	278.67	4.7510	1.705	16.610	67	8	sand to silty sand
56.430	281.10	4.3679	1.554	17.155	67	8	sand to silty sand
56.594	276.58	4.0606	1.468	16.581	66	8	sand to silty sand
56.759	286.42	4.0457	1.413	16.191	69	8	sand to silty sand
56.923	287.00	4.3609	1.519	15.187	69	8	sand to silty sand
57.087	272.16	4.7733	1.754	15.240	65	8	sand to silty sand
57.251	256.90	4.7041	1.831	15.598	62	8	sand to silty sand
57.415	244.46	4.3705	1.788	16.172	59	8	sand to silty sand
57.579	253.10	4.0855	1.614	16.801	61	8	sand to silty sand
57.743	261.94	4.0811	1.558	17.222	63	8	sand to silty sand
57.907	266.05	4.2596	1.601	17.466	64	8	sand to silty sand
58.071	260.31	4.4336	1.703	16.847	62	8	sand to silty sand
58.235	249.83	3.8142	1.527	16.832	60	8	sand to silty sand
58.399	234.90	3.8199	1.626	17.294	56	8	sand to silty sand
58.563	224.10	3.9564	1.765	18.482	54	8	sand to silty sand
58.727	223.52	4.2541	1.903	18.686	54	8	sand to silty sand
58.891	189.01	2.4337	1.288	19.097	45	8	sand to silty sand
59.055	205.50	2.4878	1.211	19.893	39	9	sand
59.219	234.92	2.5591	1.089	9.300	45	9	sand
59.383	230.45	2.9983	1.301	9.725	44	9	sand
59.547	225.93	3.2099	1.421	10.703	54	8	sand to silty sand
59.711	220.98	3.3423	1.512	11.631	53	8	sand to silty sand
59.875	253.21	3.4999	1.382	12.693	61	8	sand to silty sand
60.039	289.38	4.5354	1.567	14.264	69	8	sand to silty sand
60.203	311.23	5.3877	1.731	13.465	75	8	sand to silty sand
60.367	322.25	5.8272	1.808	14.245	77	8	sand to silty sand
60.532	340.15	6.5285	1.919	16.084	81	8	sand to silty sand
60.696	349.46	7.1622	2.049	17.416	84	8	sand to silty sand
60.860	347.77	7.1334	2.051	17.409	83	8	sand to silty sand
61.024	336.16	7.1236	2.119	17.430	80	8	sand to silty sand
61.188	328.69	6.9684	2.120	17.770	79	8	sand to silty sand
61.352	321.96	6.8707	2.134	17.416	77	8	sand to silty sand
61.516	291.95	6.5391	2.240	17.578	70	8	sand to silty sand
61.680	289.93	6.1346	2.116	17.411	69	8	sand to silty sand
61.844	290.46	6.0461	2.082	17.179	70	8	sand to silty sand
62.008	291.24	5.9094	2.029	16.835	70	8	sand to silty sand
62.172	282.13	5.8015	2.056	17.657	68	8	sand to silty sand
62.336	280.74	5.8115	2.070	18.387	67	8	sand to silty sand

APPENDIX B: LABORATORY TEST RESULTS

Appendix B

Laboratory Test Results

CONTENTS

B.1 General....1
B.2 Soil Testing....1
B.2.1 Moisture (Natural Water) Content....1
B.2.2 Particle-size Analyses....1

Figures

Figure B1 Grain Size Distribution

APPENDIX B: LABORATORY TEST RESULTS

B.1 GENERAL

Soil samples obtained during the field explorations were described and identified in the field in general accordance with the Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488. The Specific terminology used is defined in the Soil Description and Log Key, Figure A1, Appendix A. The physical characteristics of the collected samples were noted, and field descriptions and identifications were modified, as necessary, in accordance with the terminology presented in Appendix A, Figure A1.

During the review, select soil were collected for further testing. The material descriptions and identifications were refined/revised, as necessary, based on the results of the laboratory tests. The soil testing program included moisture content testing and particle size analysis. Results of the soil testing are presented in Figure B1. All laboratory tests were performed in accordance with applicable ASTM International (ASTM) standards.

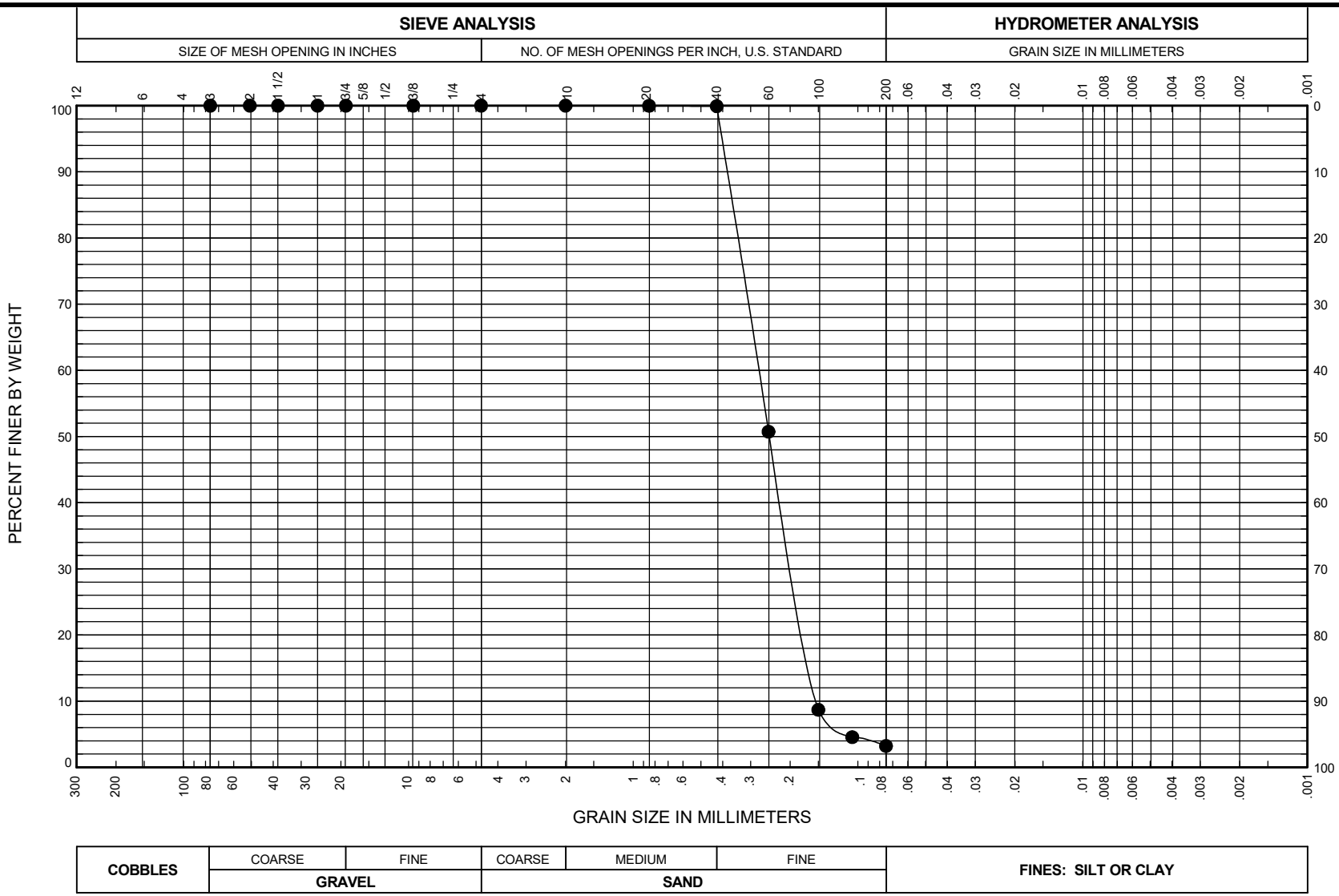
B.2 SOIL TESTING

B.2.1 Moisture (Natural Water) Content

Natural moisture content determinations were performed in accordance with ASTM D2216, on selected soil samples. The natural moisture content is a measure of the amount of moisture in the soil at the time of exploration. It is defined as the ratio of the weight of water to the dry weight of the soil, expressed as a percentage. The results of moisture content determinations are presented on the Logs of Borings in Appendix A.

B.2.2 Particle-size Analyses

Particle-size analyses were conducted on select samples to determine their grain-size distributions. Grain size distributions were determined in accordance with ASTM D6913 D1140, and D422 as applicable. For all samples, a wet sieve analysis was performed to determine the percentage (by weight) of each sample passing the No. 200 (0.075 mm) sieve. Additionally, the material retained on the No. 200 sieve was shaken through a series of sieves to determine the distribution of the plus No. 200 fraction (ASTM 6913). Particle size analyses were performed by Shannon & Wilson. Results of all particle-size analyses are plotted on Figure B1, Grain Size Distribution. The percentage of each sample passing the No. 200 sieve is presented on the Logs of Borings in Appendix A.



NOTES:
1) Sieve analyses were performed in general accordance with ASTM D6913, sieve with hydrometer analyses were performed in general accordance with ASTM D422, and amount finer than #200 sieve analyses were performed in general accordance with ASTM D1140 unless otherwise noted in the report.
2) Group Name and Group Symbol are in accordance with ASTM D2488 and are refined in accordance with ASTM D2487 where appropriate laboratory tests are performed.

BORING AND SAMPLE NO.	DEPTH (feet)	GROUP SYMBOL[2]	GROUP NAME[2]	GRAVEL %	SAND %	FINES %	NAT. W.C. %	DRY DENSITY PCF
● B-1, S-5	10.0	*SP*	*Poorly Graded Sand*	0	97	3	22	

Hammond Transmission Waterline
City of Warrenton
Warrenton, Oregon

GRAIN SIZE DISTRIBUTION

August 2024 112242

SHANNON & WILSON **FIG. B1**

FIG. B1

GSA MAIN 112242.GPJ SHAN WIL.GDT 2/12/24

Important Information

About Your Geotechnical Engineering Report

IMPORTANT INFORMATION

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the Geoprofessional Business Association (https://www.geoprofessional.org)

ARCHAEOLOGICAL AND HUMAN REMAINS INADVERTENT DISCOVERY PLAN (IDP)

PROJECT: Hammond Transmission Waterline Phase 1
PROJECT MANAGER: Twyla Vittetoe, Engineering Technician
LANDOWNER AGENCY: City of Warrenton, Oregon
DATE: 07/31/2024
SHPO CASE NUMBER: 24-0018

This document outlines procedures and protocols to be followed if archaeological objects or features, or human remains are encountered in the course of work. These procedures are intended for circumstances where there is not an expectation or anticipation of encountering cultural resources or human remains. **This is not a replacement for due diligence, robust project design, and consultation with appropriate Native American Tribes**.[1] Prior to undertaking project work, an assessment of the likelihood for disturbance to cultural resources and tribal heritage should be completed. All personnel will be briefed on all procedures and reporting structures before the start of any work.

CONTENTS OF THIS DOCUMENT

A. Procedures for archaeological features and materials
B. Procedures for human remains, burials, funerary objects, sacred objects, and objects of cultural patrimony
C. Roles and responsibilities
D. Contact information
E. Confidentiality statement
F. Procedure flow chart
G. Visual reference guide for archaeology and tribal heritage items

---

A. *PROCEDURES FOR INADVERTENT DISCOVERY OF ARCHAEOLOGICAL FEATURES AND MATERIALS (DOES **NOT** INCLUDE HUMAN REMAINS, BURIALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, OR SPIRITUAL OBJECTS)*

It is expected that ALL artifacts, features, structural elements, and other cultural items that are identified will be reported to required project, agency, and Tribal contacts, and accounted for as soon as possible. It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, and appropriate Native American Tribes.

Step 1. Stop work (immediately after discovery)

[1] Appropriate Native American Tribes will be identified by LCIS

If any person believes that they have located an archaeological object[2] or site[3], all work must stop immediately.

Discovery made in field _____(date/time) _____ (initials of discoverer)

Step 2. Secure and protect the area (within first hour after discovery)

Establish a **minimum** 30 meter/100-foot area of protection, or more as necessary, around the find(s). Exclude all vehicle traffic and non-essential foot traffic. Non-ground-disturbing work may continue outside of the area of protection with caution until the situation is assessed by a qualified archaeologist.[4]

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery)

Notify the project manager, agency official (if applicable), and project archaeologist. If there is not an archaeologist on-site, or on retainer for the project, the project manager will contact an Oregon Qualified Archaeologist (which include agency and Tribal archaeologists) to assess the find.

Project Manager contacted _____ (time) _____ (initials of contactor)
Agency Official contacted _____ (time) _____ (initials of contactor)
Project Archaeologist contacted _____ (time) _____ (initials of contactor)

Step 4. Identify and Follow Guidance (timeline variable, as soon as possible)

If the archaeologist determines the find is an archaeological feature or object, or other cultural item or feature, OR if no qualified archaeologist can be contacted within the first hour of discovery, the **State Historic Preservation Office (SHPO) and appropriate Native American Tribes must be contacted,** and their guidance must be followed. SHPO, Native American Tribes, and project and agency personnel will determine in consultation how or if work may continue at the site. If the discovery is determined to *not* be archaeological or a cultural item, you may continue work. This determination should be confirmed in writing to the project manager and agency official.

SHPO contacted _____ (time) _____ (initials of contactor)

---

[2] "Archaeological object" means an object that is at least 75 years old (or 50 years if there is a federal nexus), is part of the physical record of an indigenous or other culture found in the state or waters of the state, and is material remains of past human life or activity that are of archaeological significance including, but not limited to, monuments, symbols, tools, facilities, technological by-products and dietary by-products (ORS 358.905).

[3] "Archaeological site" means a geographic locality in Oregon that contains archaeological objects and the contextual associations of the archaeological objects with each other or biotic or geological remains or deposits (ORS 358.905).

[4] Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

Appropriate Native American Tribes[5] _____ (time) _____ (initials of contactor)

B. *PROCEDURES FOR INADVERTENT DISCOVERY OF HUMAN REMAINS*

(INCLUDES HUMAN REMAINS, BURIALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, AND SPIRITUAL OBJECTS)

It is expected that ALL potential human remains, burials, funerary objects, or objects of cultural patrimony that are identified will be reported and accounted for within 3 hours of discovery.[6] It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, OSP and appropriate Native American Tribes.

Step 1: Stop work (immediately after discovery)

If any person believes that they have located human remains[7], ALL work will stop immediately. Any human remains, regardless of antiquity or ethnic origin, will always be treated with dignity and respect.

Step 2. Secure and protect the area (as soon as possible, within c. 10 min)

Secure and protect the area of inadvertent discovery with a **minimum** of 100 meter/300 foot buffer, or more as necessary. The location and other information about the find should be treated as confidential and shared on a **need to know basis only**. Prevent all vehicle traffic and unauthorized foot traffic from entry. Block remains from view and protect them from damage or exposure without touching or disturbing the remains, and leave them in place.

Do not take photographs unless approved by the appropriate Native American Tribes and Oregon Legislative Commission on Indian Services (LCIS), and only for the purpose of identification. **Do not speak to the media or public** or post any information about the find on social media. Non-ground-disturbing work may continue outside of the buffer with caution.[8]

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery) – see contact list below (section D)

1. Project Manager _____ (time) _____ (initials)
2. Agency Official _____ (time) _____ (initials)

[5] ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

[6] Modifications to reporting timelines can be made in consultation with SHPO and Tribes.

[7] Bone may be fragmented, weathered, or otherwise modified to make it difficult to identify, so when in doubt, stop work and call it in.

[8] Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

3. Oregon State Police[9] **DO NOT CALL 911** _____ (time) _____ (initials)
4. State Historic Preservation Office (SHPO) _____ (time) _____ (initials)
5. Commission on Indian Services (LCIS) _____ (time) _____ (initials)
6. Appropriate Native American Tribes[10] _____ (time) _____ (initials)

   Name of Tribe(s) Contacted and Individual(s):

_____
_____
_____
_____

Step 4. Follow guidance (timeline variable, may be up to several days or more)

If the site is determined not to be a crime scene by the Oregon State Police, **do not move anything!** The remains will continue to be *secured in place* along with any associated funerary objects, and protected from weather, water runoff, and shielded from view. Follow all guidance provided by OSP, LCIS, SHPO, and appropriate Native American Tribes.

Continue to maintain the work stoppage within the buffer until a plan is developed and carried out between the Oregon State Police, SHPO, LCIS, and appropriate Native American Tribes and you are directed in writing by the project manager that work may proceed.

C. *ROLES AND RESPONSIBILITIES*

Person Responsible	**Responsibility**
Contractor/Discoverer will…	Notify the Project Manager Twyla Vittetoe: 503-861-0912
Twyla Vittetoe will…	Notify the Agency Official Greg Shafer: 971-286-2035
Twyla Vittetoe will…	Notify the Contracted Archaeologist Bradley Bowden: 206-898-5781
Twyla Vittetoe will…	Notify the State Agencies (OSP, LCIS, SHPO)
Twyla Vittetoe will…	Notify the Native American Tribes identified by LCIS
Greg Shafer will…	Enforce the work stoppage and buffer

[9] OSP will be responsible for contacting the county or state medical examiner's office as appropriate.
[10] ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

D. *CONTACT INFORMATION*[11]

Agency	Position/Contact	Contact Information
Project Manager	Twyla Vittetoe, Engineering Technician	503-861-0912
Agency Official	Greg Shafer, PE, Public Works Director	971-286-2035
Contracted Archaeologist	Bradley Bowden, Historical Research Associates Inc.	206-898-5781
Legislative Commission on Indian Services (LCIS)	Primary Contact: Dr. Elissa Bullion, State Physical Anthropologist	971-707-1372
	Secondary Contact: LCIS Office	503-986-1067
Oregon State Police (OSP)	Primary Contact: Sgt. Ryan Tague	541-576-4393
	Secondary Contact: Dispatch, northern command[12]	800-442-0776
	Secondary Contact: Dispatch, southern command[13]	800-442-2068
State Historic Preservation Office (SHPO)	Kurt Roedel, MA, RPA, SHPO/ODOT Archaeology Liaison	971-273-8073
	Primary Contact: John Pouley, State Archaeologist	503-480-9164
	Secondary Contact: Jamie French, Asst. State Archaeologist	503-979-7580
Native American Tribes	Confederated Tribes of Grand Ronde • Briece Edwards, Deputy Tribal Historic Preservation Officer • Chrisopher Bailey, Cultural Protection Specialist	503-879-2084 503-879-1675
	Confederated Tribes of Siletz Indians • Buddy Lane, Cultural Resources Manager • Peter Sv-gvs (Black Bear) Hatch, History & Archaeology Specialist	541-444-8230 541-444-8319
	Confederated Tribes of Warm Springs Reservation of Oregon • Bobby Brunoe, THPO & NAGPRA Coordinator • Mars Galloway, Cultural Resources Manager	541-553-2026 541-553-3583

[11] Contact information should be regularly updated for all individuals. Up to date contacts for LCIS, OSP, SHPO, and Native American Tribes can be found on the LCIS cultural resources page: Commission on Indian Services archaeology (oregonlegislature.gov)

[12] Northern command: Benton, Clackamas, Clatsop, Columbia, Crook, Deschutes, Gilliam, Hood River, Jefferson, Klamath, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Sherman, Tillamook, Wasco, Washington, Wheeler, Yamhill

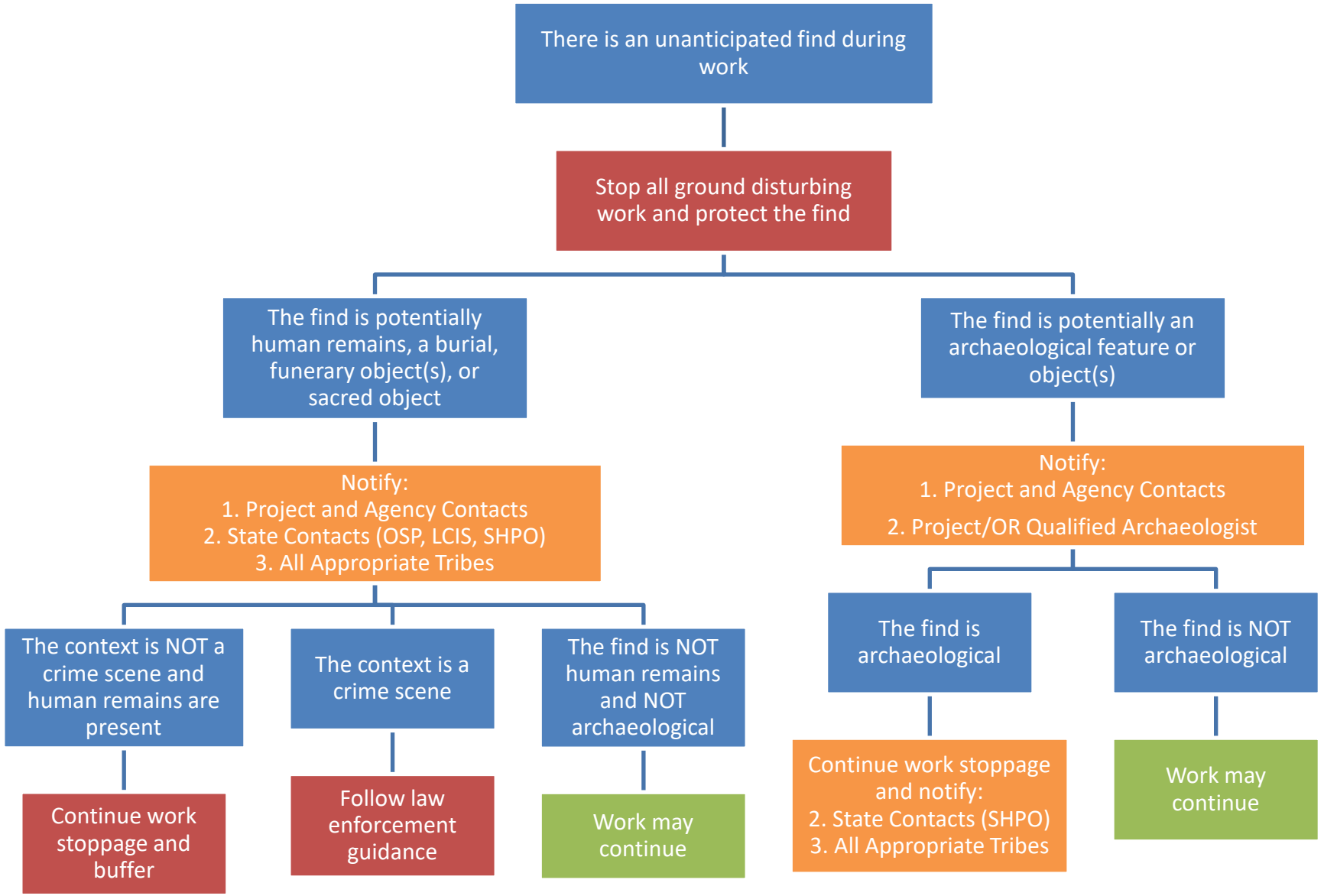
[13] Southern command: Baker, Coos, Curry, Douglas, Grant, Harney, Jackson, Josephine, parts of Klamath, Lake, Malheur, Morrow, Umatilla, Union, and Wallowa

E. CONFIDENTIALITY

The Hammon Transmission Waterline Phase 1 Project and employees shall make their best efforts, in accordance with federal and state law, to ensure that its personnel and contractors keep the discovery confidential. The media, or any third-party member or members of the public are not to be contacted or have information regarding the discovery, and any public or media inquiry is to be reported to the City of Warrenton. Photos shall not be taken except for when authorized by LCIS, SHPO, and Native American Tribes for identification purposes, and no photos will be circulated publicly or on social media. Prior to any release, the responsible agencies and Tribes shall concur on the amount of information, if any, to be released to the public.

To protect fragile, vulnerable, or threatened sites, the National Historic Preservation Act, as amended (Section 304 [16 U.S.C. 470s-3]), and Oregon State law (ORS 192.345(11)) establishes that the location of archaeological sites, both on land and underwater, shall be confidential.

F. *PROCEDURE FLOW CHART*



G. Visual Reference Guide for Archaeology in Oregon (Modify based on region/context)

Lithics and stone tools

Figure 1. Stone flakes

Figure 2. Stone projectile points

Figure 3. Ground stone tools: (left) pestle, (right) net weights,

Basketry/Cordage

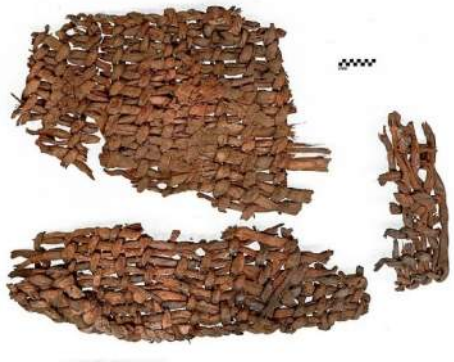


Figure 4. Open diagonal twine basket fragments from Fort Rock Cave (UOMNCH).

Figure 5. Three-strand braid, sagebrush bark from Paisley Caves (UOMNCH).

Shell Middens

Figure 6. Cross section of shell midden.

Figure 7. Dentalium shell beads (UOMNCH).

Figure 8. Glass trade beads, Upper Columbia River (UOMNCH).

Figure 9. Wooden fish weir

Figure 10. Fishing weir.

Figure 11. Close up of fishing weir.

Figure 12. Example of peeled pine.

Figure 13. Arborglyph on aspen tree

Figure 14. Historical glass

Figure 15. Historical metal artifacts

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Oregon Department of Transportation

APPLICATION AND PERMIT TO OCCUPY OR PERFORM OPERATIONS UPON A STATE HIGHWAY

See Oregon Administrative Rule, Chapter 734, Division 55

PERMIT NUMBER: 01M_41513

CLASS: | KEY#:

GENERAL LOCATION

HIGHWAY NAME AND ROUTE NUMBER: OR-104 / 104 / Fort Stevens

HIGHWAY NUMBER: OR-104

COUNTY: Clatsop

BETWEEN OR NEAR LANDMARKS: From NW 13th St to 7th Ave

HWY. REFERENCE MAP:

DESIGNATED FREEWAY: ☐ YES ☒ NO

IN U.S. FOREST: ☐ YES ☒ NO

APPLICANT NAME AND ADDRESS:
City of Warrenton
45 SW 2nd St
Warrenton OR 97146

PURPOSE OF APPLICATION (TO CONSTRUCT/OPERATE/MAINTAIN)

☐ POLE LINE	TYPE	MIN. VERT. CLEARANCE
☐ BURIED CABLE	TYPE	
☒ PIPE LINE	TYPE: Water	

☐ NON-COMMERCIAL SIGN AS DESCRIBED BELOW

☐ MISCELLANEOUS OPERATIONS AND/OR FACILITIES AS DESCRIBED BELOW

FOR ODOT USE ONLY

BOND REQUIRED: ☐ YES ☒ NO	REFERENCE: OAR 734-055 -0035(2)	AMOUNT OF BOND
INSURANCE REQUIRED: ☒ YES ☐ NO	REFERENCE: OAR 734-055 -0035(1)	SPECIFIED COMP. DATE: 12/31/2025

DETAIL LOCATION OF FACILITY (For more space attach additional sheets)

MILE POINT	TO MILE POINT	ENGINEERS STATION	TO ENGINEERS STATION	SIDE OF HWY OR ANGLE OF CROSSING	DISTANCE FROM CENTER OF PVMT	DISTANCE FROM R/W LINE	BURIED CABLE OR PIPE DEPTH/VERT.	BURIED CABLE OR PIPE SIZE AND KIND	SPAN LENGTH
1.69	1.17	A23+70	A51+47	East/ North	18' to 28'	3' to 25'	42" Cover	18" PVC	2777'
1.17	1.17	A51+47	A51+97	90* Crossing	Crossing	3' to 25'	48" Cover	30" Stl Case/ 18" PVC	50'
1.17	1.17	A51+97	A52+60	South	22'	25'	42" Cover	18" PVC	63'

DESCRIPTION OF DESIRED USE

The Hammond Transmission Waterline Project Phase 1 includes the installation of approximately 4,679 linear feet (LF) of 18-in and smaller diameter water transmission waterline and related system appurtenances (i.e., fittings, valves). Of that amount, about 2,890 LF of pipeline will be installed within ODOT right-of-way along Fort Stevens Hwy (OR-104). The new pipeline will generally parallel existing waterlines within this corridor except for one crossing of OR-104. The new transmission pipeline will have 42-in of cover from top of pipe to the ground surface.

SPECIAL PROVISIONS (FOR ODOT USE ONLY)

TRAFFIC CONTROL REQUIRED

- ☒ YES [OAR 734-055-0025(6)] ☐ NO

OPEN CUTTING OF PAVED OR SURFACED AREAS ALLOWED

- ☒ YES [OAR 734-055-0100(2)] ☐ NO [OAR 734-055-0100(1)]

- **AT LEAST 48 HOURS BEFORE BEGINNING WORK, THE APPLICANT OR HIS CONTRACTOR SHALL NOTIFY THE DISTRICT REPRESENTATIVE** District 1 Office **AT PHONE NO.:** 503-325-7222 **OR EMAIL OR FAX THIS PAGE TO THE DISTRICT OFFICE AT:** ---------- N/A ----------. **SPECIFY TIME AND DATE WORK IS TO OCCUR.**
- A COPY OF THIS PERMIT AND ALL ATTACHMENTS SHALL BE AVAILABLE AT THE WORK AREA DURING CONSTRUCTION.
- **ATTENTION: Oregon Law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0001 through OAR 952-001-0090. You may obtain copies of the rules by calling the center at (503) 232-1987.**
  CALL BEFORE YOU DIG 1-800-332-2344

COMMENTS (FOR ODOT USE ONLY)

The City shall provide to its contractor the same plans that ODOT approved under this permit.

Applicant to Email TRIP CHECK form in 24 hours prior to any Traffic Control impacting ODOT Highways to: DPCSLMWTOC@odot.state.or.us see attached form.
Notifying the District 1 office 48 hours before work starts and Trip check are two separate actions.
Have your permit in hand as you will need information off of the permit. 503-325-7222

XX

IF THE PROPOSED APPLICATION WILL AFFECT THE LOCAL GOVERNMENT, THE APPLICANT SHALL ACQUIRE THE LOCAL GOVERNMENT OFFICIAL'S SIGNATURE BEFORE ACQUIRING THE DISTRICT MANAGER'S SIGNATURE.

LOCAL GOVERNMENT OFFICIAL SIGNATURE X		TITLE: Public Works Director	DATE: 8/7/24
APPLICANT SIGNATURE X Tonya Wiltt	APPLICATION DATE: 9/5/2024	TITLE: City of Warrenton Engineering Technician	TELEPHONE NO.: 503-861-0913
When this application is approved by the Department, the applicant is subject to, accepts and approves the terms and provisions contained and attached, and the terms of Oregon Administrative Rules, Chapter 734, Division 55, which is by this reference made a part of this permit.		DISTRICT MANAGER OR REPRESENTATIVE: Mark Buffington (Dec 23, 2024 12:52 PST)	APPROVAL DATE: 12/23/2024

734-3457 (2/2021)

MILE POINT	TO MILE POINT	ENGINEERS STATION	TO ENGINEERS STATION	SIDE OF HWY OR ANGLE OF CROSSING	DISTANCE FROM CENTER OF PVMT	DISTANCE FROM R/W LINE	BURIED CABLE OR PIPE DEPTH/VERT.	BURIED CABLE OR PIPE SIZE AND KIND	SPAN LENGTH
1.68	1.68	A24+60	A24+60	East	30'	20'		Fire Hydrant	
1.66	1.66	A26+60	A26+60	East	24'	26'		Blow Off Valve	
1.44	1.44	A38+86	A38+86	East/North	26'	4'		Air Release Valve	
1.39	1.39	A40+94	A40+94	East/North	26'	4'		Fire Hydrant	
1.14	1.14	A54+37	A54+37	West/South	80'	20'		Air Release Valve	

Special Provisions:

☒The contractor shall go to the City who is the permit holder with any proposed changes. The City can then bring to ODOT in writing any changes they would like to propose to ODOT. All questions or changes must come to ODOT from the City.

☒The City shall insure that ODOT is supplied with a working cell number of someone who will respond to any issues that may occur after daytime working hours, to address any issue that may arise due to the city's installation. This shall be supplied to ODOT before any work begins.

☒The City and the Contractor shall contact ODOT every Monday to update ODOT with location of work and how the project is progressing.

☒ The applicant shall not work outside the permitted work schedule without prior approval for an exceptional situation. If an unforeseen situation comes up the applicant shall notify the City and ODOT by phone of the situation as soon as possible.

☒No air release valves shall be placed in a ditch section of the Highway Right of Way at any time, specifically, in a shallow ditch / swale line.

☒Only one section of this water line has been pre – approved to be placed under the ditch line between mile point 1.55 by NW 15th ST and 1.68 by NW 13th ST. This line shall not be placed less than 48" below the bottom of the natural ditch line. ODOT shall determine the depth of the natural ditch line. 10" of the top cover shall be ¾" minus.

☒Applicant to email Trip Check 48 hours prior to any work being performed in ODOT's Right of Way. DPCSLMWTOC@odot.state.or.us See the attached form. Applicant to notify the District Office 48 hours before beginning work. These are two separate actions!

☒Please have the permit in hand you will be asked for the application number, who the permit is issued to, who you are, Highway and mile point, Date you would like to start work. What your specified Comp. Date is on

this permit. In the right-hand corner on the face of the permit. specified Comp. Date: That is the last day any work can be done under this permit.

☒Erosion control devices need to be in place and kept in working order at all times during this project.

☒No staging of materials in ODOT's Right of Way.

☒Applicant is responsible for the removal of all contaminated material form ODOT Right of Way, and the proper disposal of the materials and the coast associated with that disposal.

☒ Any damage to ODOT facilities including but not limited to culverts, striping, site posts, signs, asphalt and guardrail shall be repaired by applicant at applicant's expense. Any damage or excavation of asphalt shall require applicant to repair to ODOT's "T-CUT" restoration specifications and the ODOT line to line shall also apply.

☒Applicant to insure no damage occurs to any existing ADA curb ramps or any ADA feathers. If damage occurs the applicant will be required to reconstructs to the current ADA standards at the applicant's expense.

☒In the event of adverse weather or other conditions (ice, snow, excessive rain, or slides resulting from said conditions or traffic or road related incident) ODOT crews reserve the right to stop this permitted activity to perform their necessary maintenance activities or to insure the safety of travelling public.

☒All vaults shall be installed flush to the surface of the ground. No vaults shall be placed in a driveway access in ODOT's Right of Way.

☒Any damage done to a driveway access in ODOT's Right of Way, ODOT will determine the restoration limits.

☒The city shall insure that the contractor they hire to perform this work understands while the plans were created for the complete job this permit is

only written for the phase 1, and a new permit must be applied for by the city for the remainder of this project.

Oregon Department of Transportation

GENERAL PROVISIONS FOR POLELINE, PIPELINE, BURIED CABLE, AND MISCELLANEOUS PERMITS

Revised April 2022

APPLICANT: CITY OF WARRENTON	PERMIT NO.: 01M41513
HIGHWAY: 104 FORT STEVENS	MP: 1.14 - 1.69

These permit provisions are in addition to the requirements described in Oregon Administrative Rule, Chapter 734, Division 55 and may be supplemented by permit special provisions. In the event of a conflict, the Administrative Rule will apply then these provisions followed by any permit special provisions. Unless otherwise specified, all documents referenced are references to the current version, with any revisions or supplements, in place when the work is conducted.

All checked (☒) provisions apply.

WORKSITE

☒ 1. Access control fence must be maintained during permitted work and restored to its original or better condition after permitted work is complete.

☒ 2. The Applicant shall not use state highway right of way to display advertising signs or to display or sell merchandise of any kind.

☒ 3. The stopping and parking of vehicles upon state highway right of way for the maintenance of adjoining property or in furtherance of any business transaction or commercial establishment is prohibited.

☐ 4. All grass and small brush within the work area shall be rotary or flail mowed to ground level prior to the beginning of work to facilitate clean up.

☒ 5. Disturbed areas shall be reseeded with grass native to the area in an appropriate seeding time.

☒ 6. The spreading of mud or debris upon any state highway is prohibited and violation shall be cause for immediate cancellation of the permit. Clean up shall be at the Applicant's expense. The highway shall be cleaned of all dirt and debris at the end of each work day, or more frequently as directed by the District Manager or representative.

☒ 7. Applicant shall replace any landscape vegetation or fences that are damaged or destroyed. Any damage that is not fully restored within 30 days may be replaced by ODOT at the expense of the Applicant. A "plant establishment" shall be understood to be part of the planting work to assure satisfactory growth of planted materials. The plant establishment period will begin when the original planting has been completed and approved. The length of the establishment period will be one calendar year or as defined in the permit Special Provisions.

☐ 8. Applicant shall install and maintain the landscaped area as shown on the attached drawings. Plantings shall be limited to non-invasive, low-growing shrubs, grass or flowers that do not attain sufficient height to obstruct clear vision in any direction. ODOT may remove plantings without liability or loss, injury, or damage of any nature whatsoever if in the future it is determined to be in the public interest to do so.

TRAFFIC

☒ 9. The work area shall be protected in accordance with the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), and the Oregon Temporary Traffic Control Handbook as supplemented or amended by ODOT.

☒ 10. For work requiring traffic control devices to be in place continuously for longer than three days, Applicant shall provide a site specific traffic control plan developed based on the principles of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) and ODOT Standards. The traffic control plan may be reviewed by ODOT before work begins. The ODOT review does not relieve the Applicant of responsibility for the accuracy of the traffic control plan.

☒ 11. For permitted utility work, the Applicant shall take measures necessary to maintain the accessibility of the state highway including sidewalks and pedestrian areas by individuals with disabilities to the ODOT Americans with Disability Act (ADA) standard during the course of the work by following the Oregon Temporary Traffic Control Handbook, Section 1.6.

☒ 12. When constructing a new utility service line, Applicant shall ensure that advance notice of any temporary pedestrian route is provided in an accessible format to the public, people with disabilities, and disability organizations to the greatest extent possible. The Notice is to be sent to the organizations on the contact list of Centers for Independent Living at https://www.oregon.gov/odot/Engineering/DOCS_ADA/AOCIL-Contacts.pdf

☒ 13. All damaged or removed highway signs shall be replaced by the Applicant. Installation shall be according to MUTCD and ODOT standards, and shall be completed as soon as possible but no later than the end of the work shift.

☐ 14. No lane restrictions are permitted on the roadway during the hours of darkness, on weekends, or between 6:00 AM and 9:00 AM, or 3:00 PM and 6:00 PM (Monday through Friday) without prior approval by ODOT.

☒ 15. Hours of work shall be _____

Monday - Thursady.

No work on Friday Saturday or Sundays

8:00 am to 4:00pm

No work the day before the day after or the day of a holiday.

DRAINAGE

☐ 16. On-site storm drainage shall be controlled within the permitted property. No blind connections to existing state facilities are allowed.

☒ 17. Excavation shall not be done on ditch slopes. Trench excavation shall either be at ditch bottom or outside ditch area. (Minimum depth at bottom of ditch shall be 36 inches; minimum depth outside of ditch shall be 42 inches).

☒ 18. Only earth or rock shall be used as fill material and shall slope so as not to change or adversely affect existing drainage. Fine grade and seed the finished fill with native grasses to prevent erosion.

☐ 19. A storm drainage study stamped by an Oregon Registered Professional Engineer (PE) is required. The study must meet standards of the National Pollution Discharge Elimination Systems (NPDES) when any of the following conditions apply:

- whenever a four inch pipe is inadequate to serve the developed area,
- development site is one acre or larger in size and directly or indirectly affects state facilities, or
- as directed by the District Manager or representative.

☐ 20. Applicant shall provide on-site retention for storm water runoff that exceeds that of the undeveloped site.

☒ 21. All water discharged to an ODOT drainage system must be treated prior to discharge. All requests for connection to an ODOT storm system must meet any requirements of the National Pollutant Discharge Elimination System (NPDES). This may include local jurisdiction approval of on-site water quality treatment facilities and/or development of an operation and maintenance plan for any on-site water quality treatment facility, as determined by local jurisdiction.

EXCAVATION / CONSTRUCTION

☒ 22. "Oregon Standard Specifications for Construction" and ODOT "Standard Drawings" where applicable and not otherwise superseded by the permit, shall be incorporated for use in the permit; https://www.oregon.gov/odot/engineering/pages/index.aspx. These documents apply only to the extent they provide standards and performance requirements for work to be performed under the permit. In the event of a conflict, the permit provisions will take precedent.

☐ 23. Trench backfill shall be according to the attached typical drawing, marked as Exhibit A.

☒ 24. When open cutting of the highway is allowed, all excavation in paved areas shall be backfilled and the roadway surface patched before the end of each shift.

☒ 25. Steel plates shall be pinned and a temporary cold patch applied to the edges. The Applicant shall be responsible for monitoring and maintenance of temporary patching and steel plating.

☒ 26. Compaction tests shall be required for each open cut per Oregon Standard Specifications for Construction. Compaction tests shall be conducted once for every 300 lineal feet per lift of continuous trench according to the Manual of Field Test Procedures (MFTP), published by ODOT. Percent Compaction shall be at least 95%. Results of compaction test shall be provided upon request of the District Manager or representative at Applicants' expense.

☒ 27. Control Density Fill (CDF) shall be used as surface backfill material in place of crushed rock in open trenches that impact the travel portions of the highway. A ¾"-0, or 1"-0 rock will be used for the aggregate. The amount of cement used shall not exceed 3.0% of the total mixture's weight. Maximum compressed strengths must not exceed 250 pounds per square inch (psi).

☒ 28. Surface restoration shall be a minimum of four inches of hot asphalt-concrete (AC), compacted in two inch lifts, or to match existing pavement depth, whichever is greater. Sand-seal all edges and joints.

☒ 29. Any area of cut or damaged asphalt shall be restored in accordance with the attached "T-Cut Typical Section" drawing. For a period of two years following the patching of the paved surface, Applicant shall be responsible for the condition of the pavement patches, and during that two year period shall repair to District Manager or representative's satisfaction any of the patches which become settled, cracked, broken, or otherwise faulty.

☒ 30. An overlay to seal an open-cut area shall be completed prior to the end of the construction season, or when minimum temperature allows per the Oregon Standard Specification for Construction. The overlay shall be 1.5 inches deep and cover the affected area from edge of pavement to edge of pavement, and taper longitudinally at a fifty feet to one inch (50':1") ratio. Taper may be adjusted by the District Manager as required. For a period of two years following this patching of the paved surface, the Applicant shall be responsible for the condition of said pavement patches, and during that time shall repair to the District Manager or representative's satisfaction any of the patches which become settled, cracked, broken or otherwise faulty.

☒ 31. Highway crossings of utility lines shall be bored, or jacked. Bore pits shall be located behind the ditch line unless otherwise specified in the permit. Unattended pits shall either be protected by a six-foot fence, backfilled, or steel plated and pinned.

☒ 32. Any non-conductive, un-locatable, underground facility shall have a tracer wire or other similar conductive marking tape or device placed the full length of the installed underground facility in compliance with the Oregon Utilities Notification Center rules, OAR Chapter 952.

☒ 33. Trench backfill outside of ditch line may be native soil compacted at optimum moisture in twelve inch layers to not less than 95% relative maximum density.

☒ 34. Native material that is unsatisfactory for compaction shall be disposed of off the work site and granular backfill used.

☒ 35. Trench backfill in rock slope or shoulder shall be crushed 1"-0 or ¾"-0 size rock compacted at optimum moisture in eight-inch layers. Compaction tests shall be conducted according to the Manual of Field Test Procedures (MFTP), published by ODOT. Percent compaction shall be at least 95%maximum density. At the request of the District Manager or representative, results of compaction tests shall be provided to District Manager or representative at Applicant's expense.

☒ 36. Where excavation is on fill slope steeper than a two to one (2:1) ratio, slope protection shall be provided using four-inch size rock laid evenly to a minimum depth of twelve inches.

☒ 37. No more than 300 feet of trench longitudinally along the highway shall be left open at any one time and no trench shall be left in an open condition overnight.

☒ 38. Areas of disturbed cut and fill slopes shall be restored to a condition suitable to the District Manager or representative. Areas of erosion to be inlaid with an acceptable riprap material.

☒ 39. All underground utilities shall be installed with three-foot or more of horizontal clearance from existing or contract plans guardrail posts and attachments.

☒ 40. Any area of cut or damaged concrete shall be restored in accordance with the attached Typical Section-Pipe Section under sidewalk.

☒ 41. Utility markers, pedestals, and vaults shall be placed as near the highway right-of-way line as practical. In no case shall pedestals, vaults, and line markers be located within the area where highway maintenance activities regularly occur including mowing operations, or nearer the pavement edge than any official highway sign in the same general location.

☒ 42. No cable plowing is allowed within the lateral support of the highway asphalt (e.g. at six feet lower than the edge of the asphalt, no plowing within nine feet of the edge of the asphalt).

☐ 43. Review by the ODOT Bridge Engineer is required for all proposed bridge and structure attachments and for any facilities to be installed within sixteen feet of bridge foundations, supports, walls or related elements, or within the influence zone of bridge facilities.

MISCELLANEOUS

☒ 44. Applicant shall be responsible and liable for (1) investigating presence/absence of any legally protected or regulated environmental resource(s) in the action area; (2) determining any and all restrictions or requirements that relate to the proposed actions, and complying with such, including but not limited to those relating to hazardous material(s), water quality constraints, wetlands, archeological or historic resources(s) state and federal threatened or endangered species, etc., (3) complying with all federal, state, and local laws, and obtaining all required and necessary permits and approvals.

☒ 45. If the Applicant impacts a legally protected/regulated resource, Applicant shall be responsible for all costs associated with such impact, including, but not limited to all costs of mitigation and rehabilitation, and shall indemnify, and hold ODOT harmless for such impacts and be responsible and liable to ODOT for any associated costs or claims that ODOT may have.

☒ 46. Plans are reviewed by ODOT in general only and do not relieve the Applicant from completing roadway improvements in a manner satisfactory to ODOT. The District Manager or representative may require field changes. When revisions are made in the field, Applicant is responsible to provide "as built" drawings, within 60 days from completion of roadway improvements, and shall submit them to the District Office issuing the permit.

☒ 47. Applicant shall be responsible for locating and preserving all existing survey monumentation within the work area in accordance with ORS 209.150 and/or 209.155. If monumentation or its accessories are inadvertently or otherwise disturbed or destroyed, Applicant shall be responsible for all costs and coordination associated with its reestablishment by a professional licensed surveyor.

☒ 48. Applicant shall be responsible to restore or replace any curbs or curb ramps damaged by the permitted activity according to ODOT's ADA Standards available at https://www.oregon.gov/ODOT/Engineering/Pages/Accessibility.aspx. Any review or inspection of the curbs or curb ramps conducted by ODOT does not relieve the Applicant of the responsibility to comply with any other aspect of federal, state, and local laws, rules and regulations applicable to the work allowed under the permit including but not limited to the Americans with Disabilities Act of 1990.

☒ 49. When constructing a minor roadway improvement, Applicant shall comply with all federal, state, and local laws, regulations, executive orders and ordinances applicable to the work under this permit, including, without limitation, the provisions of ORS 276.071. If Applicant chooses to assign their permitted responsibilities to a consultant or contractor, Applicant shall inform the consultant or contractor of the requirements of ORS 276.071.

☐ 50. Upon completion of the permitted minor roadway improvement, Applicant shall notify ODOT and request final inspection. If all structures and appurtenances constructed under this permit are found to be in compliance with permit provisions and state standards, ODOT will accept ownership of the permitted structures and appurtenances by written notice to the Applicant.

By this signature Applicant acknowledges that the Applicant is subject to and accepts all checked (☒) provisions (4 pages).

Trip Check Form*

HIGHWAY MAINTENANCE AND CONSTRUCTION WORK – TO BE DONE

Please fill out this form in its entirety (if applicable) and email to

DPCSLMWTOC@odot.state.or.us

Form submitted by:	Contact Phone #:
Construction/Contractor for Project:	
Hwy Route # & Name:	
From MP	To MP

Estimated Length of Delay to the Public

No to min delay ☐	Under 20 mins ☐	~~20 mins-2 hrs ☐~~	~~Closure ☐~~	~~Closure w/Detour ☐~~

Project Dates:

Begin Date:	End Date:
Begin Time:	Completion Time:

Days of the week Traffic Impacted

Mon ☐	Tues ☐	Wed ☐	Thur ☐	~~Fri ☐~~	~~Sat ☐~~	~~Sun ☐~~

Impact to traffic:

Northbound (NB) ☐	Southbound (SB) ☐	Eastbound (EB) ☐	Westbound (WB) ☐

Lanes Affected:

A Lane ☐	B Lane ☐	C Lane ☐	D Lane ☐
On Ramp ☐	Off Ramp ☐	Continuous Turn Lane	

Traffic Control:

Flaggers ☐	Pilot Car ☐	Lane Shift ☐

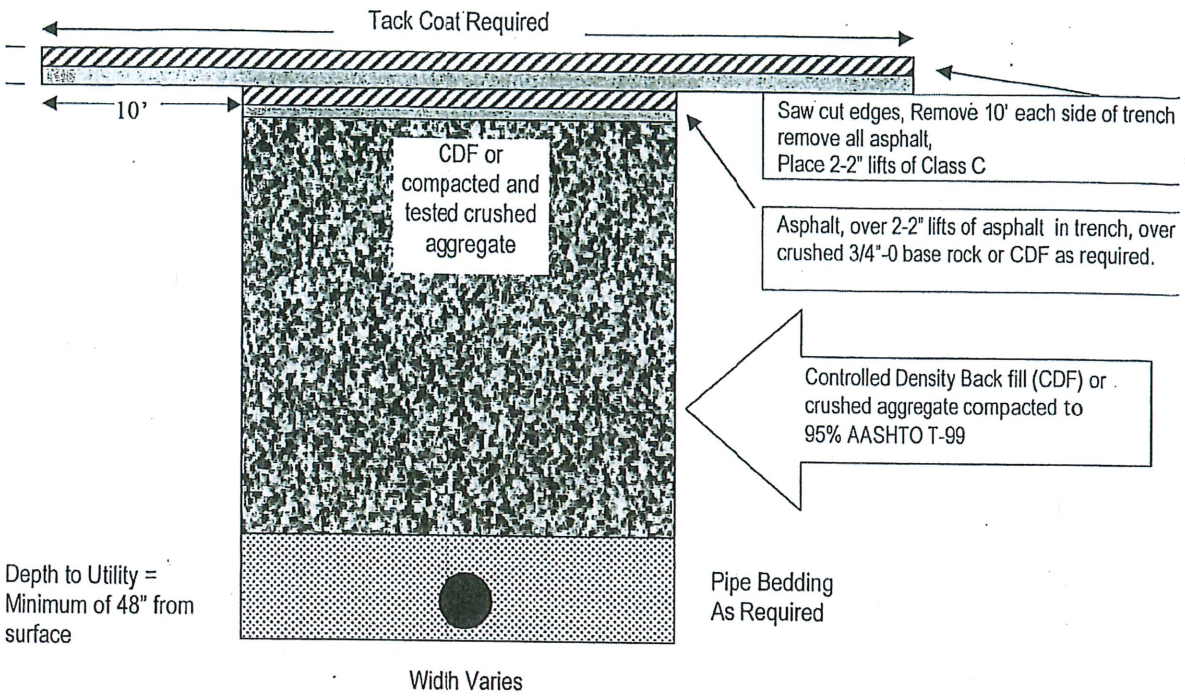
Info to be displayed on TripCheck (Including Detour if applicable)

Contact Information	Cell Phone	Work Phone	Home/Other Phone
On Scene Contact			
24 HR Emergency Contact:			
Contractor:			

Email form to DPCSLMWTOC@odot.state.or.us

Attachment B
T-Cut Typical Section
CDF or Compacted Aggregate Backfill Option

Permit # 01M_41513



Backfill Material:

If Crushed Rock is used:

Place approved compacted crushed aggregate in trench to within 8" of the top of the sub-grade compacted to a minimum of 95% of the maximum density of the material, placed in 12" maximum lifts. Results of compaction tests to be made available to ODOT.

If CDF is used:

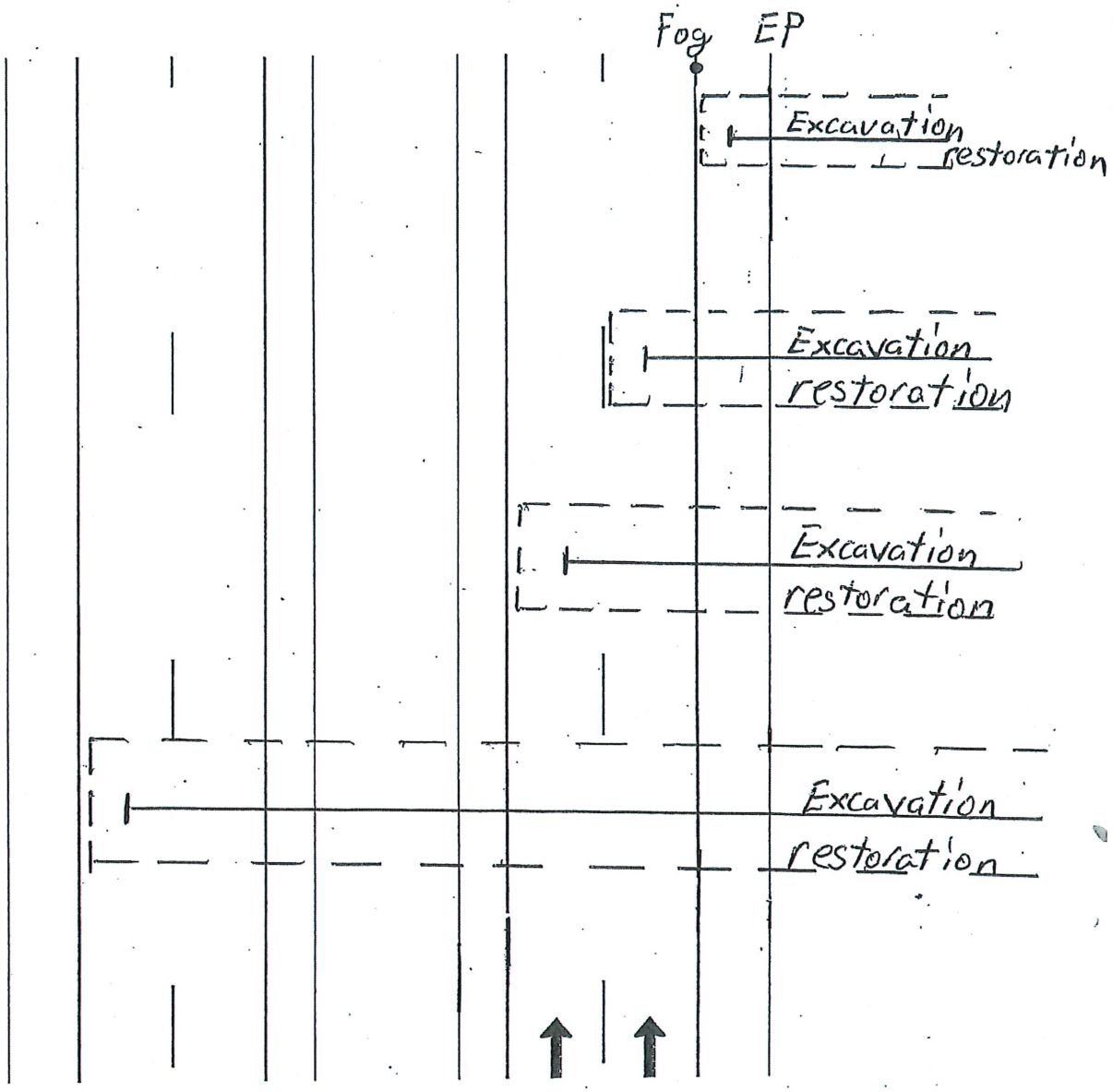
Controlled Density Fill (CDF), consists of ¾" -0 aggregate and an amount of concrete not to exceed 3% of the mixtures total mass. Do not exceed maximum compression strengths of 150 psi. Place approved CDF in trench to 8" below the roadway surface.

Apply an asphalt emulsion tack coat to all asphalt edges and ground surface. Place 2 additional lifts of Asphalt pavement in 2" compacted lifts in the T-Cut surface to grade. Provide a minimum compacted thickness of 4", or the thickness of the removed pavement, whichever is greater.

Cold Patch all cut areas at the end of each workday and maintain the patch. Hot patch damaged area within 7 days.

Restoration of cut asphalt.

A Crossed pavement line must restore to next line.



Any damaged to striping shall be replaced in kind by applicant.

0.87
0.9
0.94
0.97
1
1.02
1.05
1.08
1.1
1.12
1.14
1.16
1.19
1.22
1.25
1.28
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1.81
1.83
1.85
1.87
104
SEVENTH AVE
EIGHTH AVE
CHINOOK ST
TWELFTH AVE
NW 12TH PL
NW 15TH ST
NW 13TH ST
Creek
rtment of Transportation | Oregon Department of Transportation, Geographic Information Services Unit
Oregon Department of Transportation © 2009-2024

Oregon Department of Transportation

Utility Permit Cultural Resource Certification

This form is to be completed and submitted to the Oregon Department of Transportation with the *Application and Permit to Occupy or Perform Operations Upon a State Highway* when ground disturbance (directional boring, cable plowing, trenching, and digging of any kind) is proposed as part of a permit application for installation of a utility line including moving or repositioning existing lines or poles.

Applicant Information		
Applicant Name City of Warrenton		
Address 45 SW 2nd St		
City Warrenton	State OR	Zip 97146
Contact Person Name Twyla Vittetoe	Phone Number 503.861.0912	Email tvittetoe@warrentonoregon.us
Project Location Information		
Highway Name and Route Number OR-104 / 104 / Fort Stevens		
Begin MP 1.17	End MP 1.69	County Clatsop

I represent that this Certification is in support of the *Application and Permit to Occupy or Perform Operations Upon a State Highway* at the above location dated 08/22/2023, submitted to the Oregon Department of Transportation with this Certification.

I am an authorized representative of the Applicant and certify that the Applicant has reached out to the Tribe(s) identified by the Legislative Commission on Indian Services (LCIS) and verified the presence/absence of cultural resources based on information available from the State Historic Preservation Office (SHPO) for a utility installation proposed on state highway right of way that is expected to include ground disturbance (directional boring, cable plowing, trenching, and digging of any kind).

The Tribe(s) was given at least 14 calendar days to respond to the request for feedback on cultural resources in the proposed work area that may be known to the Tribe(s) but not in the SHPO database.

Based on this information, the necessary cultural resource protection clearances and permits have been, or will be, obtained for the proposed work. In addition, it is understood that this does not relieve the Applicant from its responsibility to protect cultural resources. If cultural resources are discovered during the project, work will be stopped and SHPO contacted according to SHPO regulations.

By signing below, I certify that the above statements are true and correct to the best of my knowledge.

Name (Printed)	Signature	Date
Twyla Vittetoe	Twyla Vittetoe	12/15/23

734-5394 (3/2023)

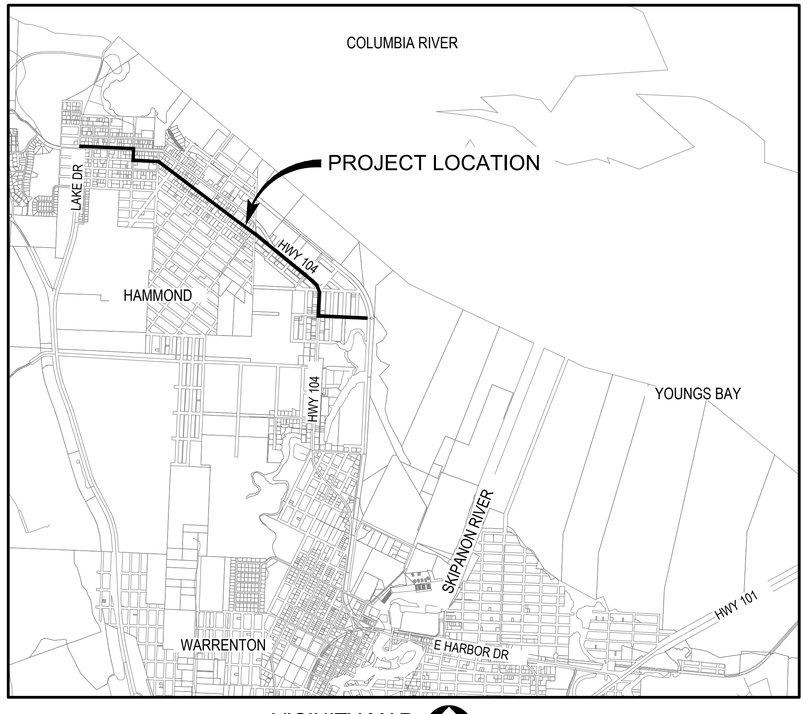
CITY OF WARRENTON

HAMMOND TRANSMISSION WATERLINE PHASE 1

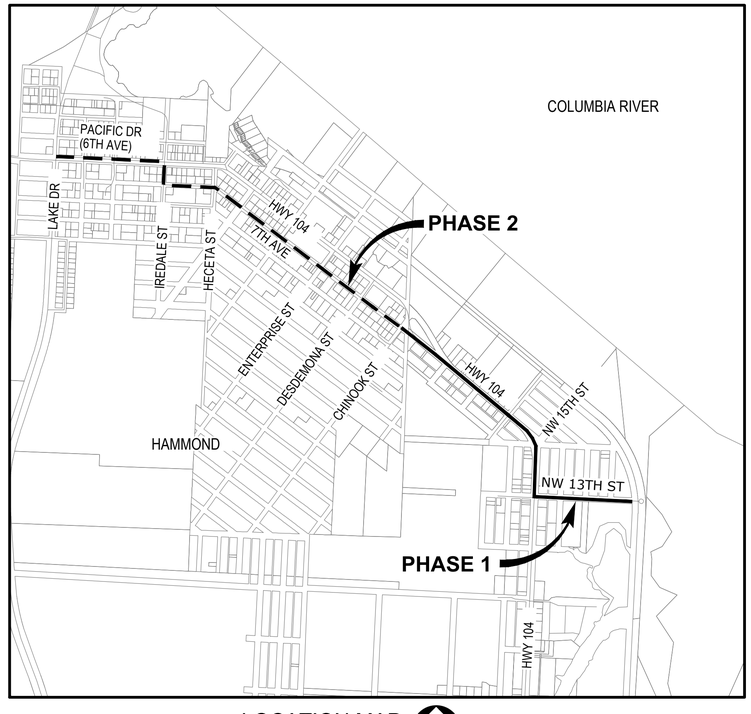
BID SET

PROJECT NO: W231023OR
MARCH 2025

consor
400 E MILL PLAIN BOULEVARD, SUITE 400
VANCOUVER, WASHINGTON 98660
P 360.448.4230



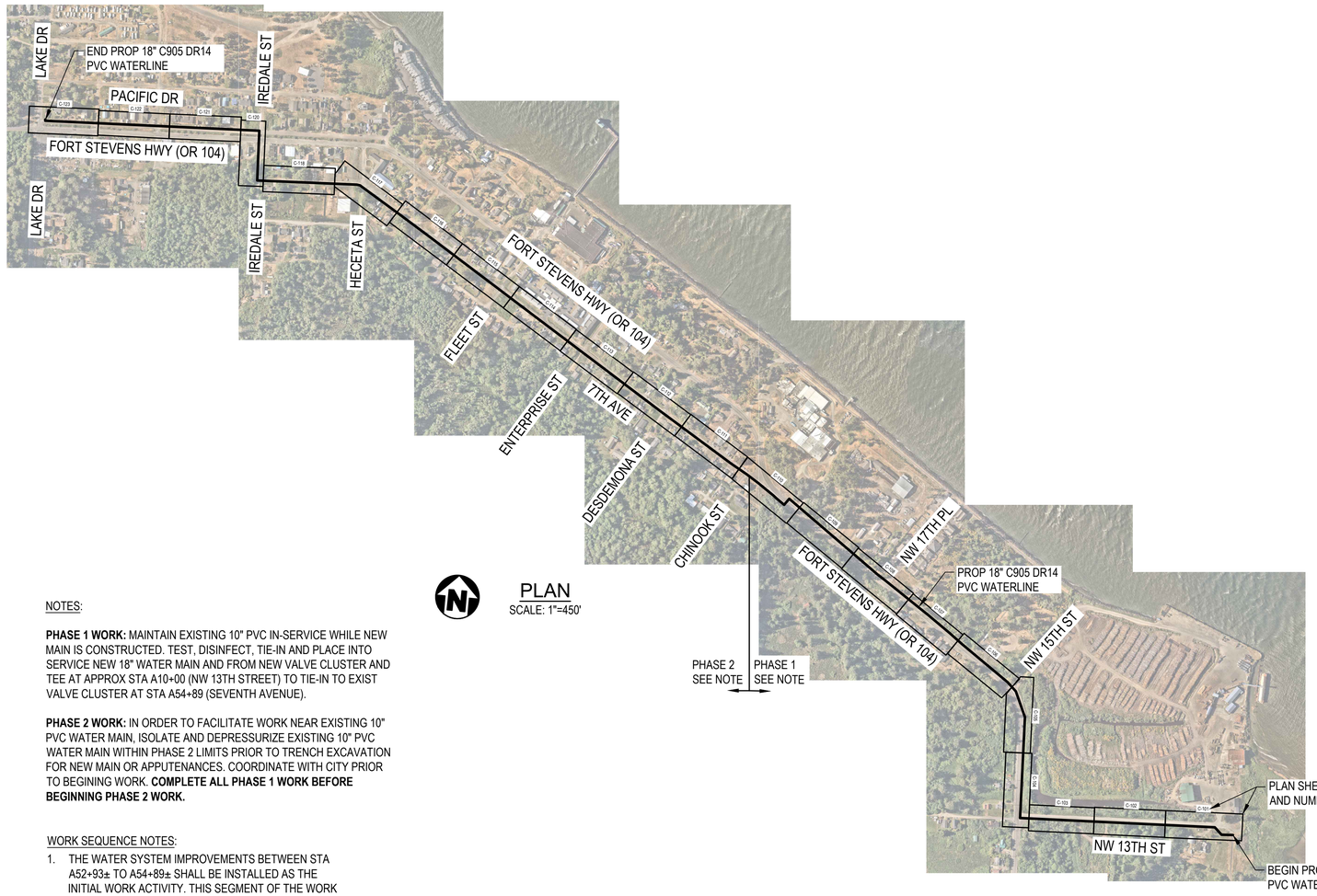
VICINITY MAP
SCALE: 1" = 5000'



LOCATION MAP
SCALE: 1" = 1000'

REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

811
Know what's **below.**
Call before you dig.



PLAN
SCALE: 1"=450'

NOTES:

PHASE 1 WORK: MAINTAIN EXISTING 10" PVC IN-SERVICE WHILE NEW MAIN IS CONSTRUCTED. TEST, DISINFECT, TIE-IN AND PLACE INTO SERVICE NEW 18" WATER MAIN AND FROM NEW VALVE CLUSTER AND TEE AT APPROX STA A10+00 (NW 13TH STREET) TO TIE-IN TO EXIST VALVE CLUSTER AT STA A54+89 (SEVENTH AVENUE).

PHASE 2 WORK: IN ORDER TO FACILITATE WORK NEAR EXISTING 10" PVC WATER MAIN, ISOLATE AND DEPRESSURIZE EXISTING 10" PVC WATER MAIN WITHIN PHASE 2 LIMITS PRIOR TO TRENCH EXCAVATION FOR NEW MAIN OR APPUTENANCES. COORDINATE WITH CITY PRIOR TO BEGINING WORK. **COMPLETE ALL PHASE 1 WORK BEFORE BEGINNING PHASE 2 WORK.**

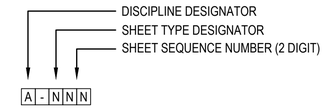
WORK SEQUENCE NOTES:

1. THE WATER SYSTEM IMPROVEMENTS BETWEEN STA A52+93± TO A54+89± SHALL BE INSTALLED AS THE INITIAL WORK ACTIVITY. THIS SEGMENT OF THE WORK REQUIRES ARCHAEOLOGIST MONITORING OF EXCAVATION AND TRENCHING ACTIVITIES. THIS SEGMENT OF WORK SHALL BE INSTALLED, TESTED AND DISINFECTED. THE CUT-OFF VALVES WILL BE CLOSED TO ISOLATE IT FROM THE EXISTING 10-INCH WATER MAIN, THE WATER SHALL BE DRAINED FROM THE PIPE AND A TEMPORARY CAP INSTALLED.
2. UPON COMPLETION OF THE PREVIOUS WORK SEGMENT, THE WATERLINE INSTALLATION SHALL RESUME BEGINNING AT STA A10+00 AND PROCEEDING WEST/NORTH IN STATION ASCENDING ORDER. THE WATER SYSTEM IMPROVEMENTS SHALL BE INSTALLED, TESTED, DISINFECTED AND ACCEPTED IN LOGICAL SEQUENCE.
3. UPON REACHING THE TEMPORARY CAP INSTALLED IN STEP 1, THE TEMPORARY CAP SHALL BE REMOVED, WATERLINE CONNECTED, AND THE PIPE SEGMENT SHALL BE TESTED, DISINFECTED, AND ACCEPTED.
4. REFER TO SECTIONS 00 73 00, SPECIAL PROVISIONS, AND 01 12 16, WORK SEQUENCE, FOR ADDITIONAL INFORMATION.

SHEET INDEX

DWG NAME	DESCRIPTION
GENERAL	
G-000	COVER SHEET
G-001	SHEET INDEX AND KEY MAP
G-002	GENERAL SYMBOLS AND LEGEND
G-003	ABBREVIATIONS
G-004	GENERAL NOTES
CIVIL	
C-001	CIVIL SYMBOLS AND LEGEND
C-101	WATERLINE PLAN & PROFILE - STA A10+00 TO STA A14+60
C-102	WATERLINE PLAN & PROFILE - STA A14+60 TO STA A19+20
C-103	WATERLINE PLAN & PROFILE - STA A19+20 TO STA A23+40
C-104	WATERLINE PLAN & PROFILE - STA A23+40 TO STA A28+00
C-105	WATERLINE PLAN & PROFILE - STA A28+00 TO STA A32+60
C-106	WATERLINE PLAN & PROFILE - STA A32+60 TO STA A37+20
C-107	WATERLINE PLAN & PROFILE - STA A37+20 TO STA A41+80
C-108	WATERLINE PLAN & PROFILE - STA A41+80 TO STA A46+40
C-109	WATERLINE PLAN & PROFILE - STA A46+40 TO STA A51+00
C-110	WATERLINE PLAN & PROFILE - STA A51+00 TO STA A55+60
C-111	WATERLINE PLAN & PROFILE - STA A55+60 TO STA A60+20
C-112	WATERLINE PLAN & PROFILE - STA A60+20 TO STA A64+80
C-113	WATERLINE PLAN & PROFILE - STA A64+80 TO STA A69+40
C-114	WATERLINE PLAN & PROFILE - STA A69+40 TO STA A74+00
C-115	WATERLINE PLAN & PROFILE - STA A74+00 TO STA A78+60
C-116	WATERLINE PLAN & PROFILE - STA A78+60 TO STA A83+20
C-117	WATERLINE PLAN & PROFILE - STA A83+20 TO STA A87+80
C-118	WATERLINE PLAN & PROFILE - STA A87+80 TO STA A92+40
C-119	WATERLINE PLAN & PROFILE - STA A92+40 TO STA A97+20
C-120	WATERLINE PLAN & PROFILE - STA A97+20 TO STA A101+80
C-121	WATERLINE PLAN & PROFILE - STA A101+80 TO STA A106+40
C-122	WATERLINE PLAN & PROFILE - STA A106+40 TO STA A110+00
C-501	DETAILS
C-502	DETAILS
C-503	DETAILS
C-504	DETAILS
C-505	WATER CONNECTION DETAILS
C-506	WATER CONNECTION DETAILS
C-507	WATER CONNECTION DETAILS
C-1001	EROSION CONTROL COVER SHEET
C-1501	EROSION CONTROL DETAILS
C-2101	TRAFFIC CONTROL PLAN
C-2501	TRAFFIC CONTROL DETAILS

SHEET INDEX DESIGNATIONS



DISCIPLINE DESIGNATORS

G	GENERAL
C	CIVIL
L	LANDSCAPE
A	ARCHITECTURAL
S	STRUCTURAL
D	PROCESS
P	PLUMBING
M	MECHANICAL (HVAC)
F	FIRE PROTECTION
E	ELECTRICAL
I	INSTRUMENTATION AND P&IDS

SHEET TYPE DESIGNATORS

0	GENERAL
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE SCALE VIEWS
5	DETAILS
6	SCHEDULES AND DIAGRAMS
7	USER DEFINED
8	USER DEFINED
9	3D REPRESENTATION

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Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION WATERLINE PHASE 1

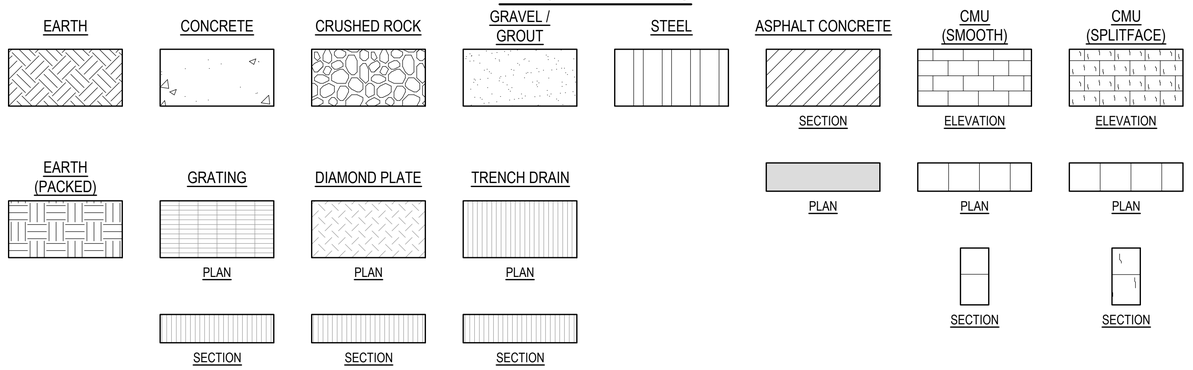
Drawing Title:
GENERAL
SHEET INDEX AND KEY MAP

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	G-001

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_G-001.dwg, Plotted Date: March 4, 2025 1:20 PM By: Andy Miles

HATCH PATTERNS

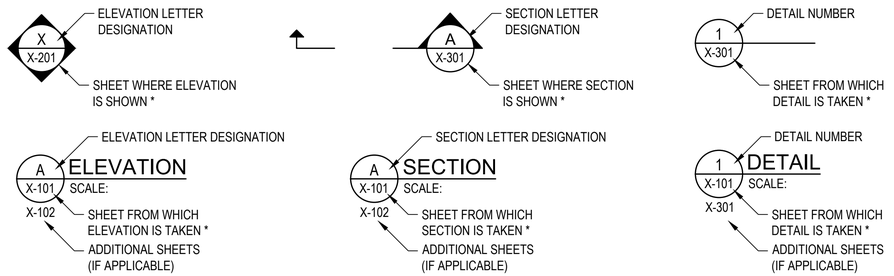


VIEW TITLE DESIGNATIONS

PLAN AND PROFILE

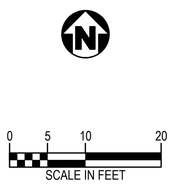
PLAN
SCALE: 1/4"=1'-0"

PROFILE
SCALE: 1"=X' HORIZ, 1"=X' VERT



* NOTE: IF PLAN AND SECTION FOR DETAIL CALL-OUT AND DETAIL ARE SHOWN ON THE SAME DRAWING, DRAWING NUMBER IS REPLACED WITH A DASH.

NORTH ARROW AND SCALE BAR



GENERAL NOTES:

1. THIS IS A STANDARD GENERAL SHEET, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.

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Engineer's Seal:

REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title:
GENERAL
GENERAL SYMBOLS AND LEGEND

Designed By: CAD	CONSOR Project No.: W231023OR
Drawn By: CAD	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: G-002
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_G-002.dwg, Plotted Date: March 4, 2025 1:20 PM By: Andy Miles

@	AT
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS
AB	ANCHOR BOLT
ABAN(D)	ABANDON(ED)
ABS	ACRYLONITRILE BUTADIENE STYRENE
ABV	ABOVE / ALCOHOL BY VOLUME
AC	ASPHALTIC CONCRETE
ACP	ASPHALTIC CONCRETE PAVING
ADJ	ADJUSTABLE
ADJC	ADJACENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHR	ANCHOR
AL	ALUMINUM
ALT	ALTERNATE
AMP	AMPERE
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
APPVD	APPROVED
APWA	AMERICAN PUBLIC WORKS ASSOCIATION
ARCH	ARCHITECTURAL
ARV	AIR RELEASE VALVE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASR	AQUIFER STORAGE & RECOVERY
ASSN	ASSOCIATION
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY FOR TESTING & MATERIALS
ATM	ATMOSPHERE
AUTO	AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWWA	AMERICAN WATER WORKS ASSOCIATION
B&S	BELL & SPIGOT
BC	BOLT CIRCLE
BD	BOARD
BETW	BETWEEN
BF	BOTH FACE
BFD	BACKFLOW PREVENTION DEVICE
BFILL	BACKFILL
BFV	BUTTERFLY VALVE
BHP	BRAKE HORSEPOWER
BKGD	BACKGROUND
BLDG	BUILDING
BLK	BLOCK
BLVD	BOULEVARD
BM	BENCHMARK / BEAM
BMP	BEST MANAGEMENT PRACTICES
BO	BLOW-OFF
BOC	BACK OF CURB
BS	BOTH SIDES
BSMT	BASEMENT
BTF	BOTTOM FACE
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BW	BOTH WAYS
C	CELSIUS
C TO C	CENTER TO CENTER
CALTRANS	CALIFORNIA DEPARTMENT OF TRANSPORTATION
CARV	COMBINATION AIR RELEASE VALVE
CATV	CABLE TELEVISION
CB	CATCH BASIN
CCP	CONCRETE CYLINDER PIPE
CCW	COUNTER CLOCKWISE
CDOT	COLORADO DEPARTMENT OF TRANSPORTATION
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHAN	CHANNEL
CHEM	CHEMICAL
CHFR	CHAMFER
CHKV	CHECK VALVE
CI	CAST IRON
CIP	CAST IRON PIPE
CIPC	CAST IN PLACE CONCRETE
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CL OR C/L	CENTER LINE
CL2	CHLORINE
CLG	CEILING
CLJ	CONTROL JOINT

CLR	CLEAR
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CND	CONDUIT
CO	CLEANOUT
COL	COLUMN
COMB	COMBINATION
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS / CONTINUATION
CONTR	CONTRACT(OR)
COORD	COORDINATE
COP	COPPER
CORP	CORPORATION
CORR	CORRUGATED
CP	CONTROL POINT
CPLG	COUPLING
CPVC	CHLORINATED POLYVINYL CHLORIDE
CR	CRUSHED ROCK
CS	COMBINED SEWER
CSP	CONCRETE SEWER PIPE
CT	COURT
CTR	CENTER
CU	CUBIC
CULV	CULVERT
CV	CONTROL VALVE
CW	CLOCKWISE / COLD WATER
CY	CUBIC YARDS
CYL	CYLINDER LOCK
D	DRAIN
DC	DIRECT CURRENT
DEFL	DEFLECTION
DEQ	DEPARTMENT OF ENVIRONMENTAL QUALITY
DET	DETAIL
DI	DUCTILE IRON
DIA	DIAMETER
DIM	DIMENSION
DIR	DIRECTION
DIST	DISTANCE
DN	DOWN
DR	DRIVE
DS	DOWNSPOUT
DWG	DRAWING
DWL	DOWEL
DWV	DRAIN WASTE AND VENT
DWY	DRIVEWAY
E / ELEC	ELECTRICAL
EA	EACH
ECC	ECCENTRIC
EF	EACH FACE
EL	ELEVATION
ELB	ELBOW
ENCL	ENCLOSURE
EOP	EDGE OF PAVEMENT
EQ	EQUAL
EQL SP	EQUALLY SPACED
EQUIP	EQUIPMENT
ESMT	EASEMENT
EW	EACH WAY
EXC	EXCAVATE
EXIST	EXISTING
EXP	EXPANSION
EXP BT	EXPANSION BOLT
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	FAHRENHEIT
F TO F	FACE TO FACE
FAB	FABRICATE
FB	FLAT BAR
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDN	FOUNDATION
FEXT	FIRE EXTINGUISHER
FF	FINISHED FLOOR / FAR FACE
FGL	FIBERGLASS
FH	FIRE HYDRANT
FIN	FINISH(ED)
FIPT	FEMALE IRON PIPE THREAD
FITG	FITTING
FL	FLOOR LINE
FLEX	FLEXIBLE
FLG	FLANGE

FLL	FLOW LINE
FLR	FLOOR
FM	FORCE MAIN
FO	FIBER OPTIC
FOC	FACE OF CONCRETE
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FRP	FIBERGLASS REINFORCED PLASTIC
FT	FEET / FOOT
FTG	FOOTING
FUT	FUTURE
FXTR	FIXTURE
G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GROOVED COUPLING
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GIP	GALVANIZED IRON PIPE
GJ	GRIP JOINT
GL	GLASS
GLV	GLOBE VALVE
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GALLONS PER SECOND
GR	GRADE
GR LN	GRADE LINE
GRTG	GRATING
GV	GATE VALVE
GRVL	GRAVEL
GYP	GYPSUM
HB	HOSE BIBB
HC	HOLLOW CORE
HDPE	HIGH DENSITY POLYETHYLENE
HDR	HEADER
HDWE	HARDWARE
HGR	HANGER
HGT	HEIGHT
HH	HANDHOLD
HM	HOLLOW METAL
HMAC	HOT MIX ASPHALT CONCRETE
HNDRL	HANDRAIL
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
HORIZ	HORIZONTAL
HP	HIGH PRESSURE / HORSEPOWER
HPG	HIGH PRESSURE GAS
HPT	HIGH POINT
HR	HOUR
HSB	HIGH STRENGTH BOLT
HV	HOSE VALVE
HVAC	HEATING, VENTILATION, AIR CONDITIONING
HWL	HIGH WATER LINE
HWY	HIGHWAY
HYD	HYDRANT
HYDR	HYDRAULIC
I&C	INSTRUMENTATION & CONTROL
IAW	IN ACCORDANCE WITH
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IF	INSIDE FACE
IMPVT	IMPROVEMENT
IN	INCH
INCC	INCLUDE(D)(ING)
INFL	INFLUENT
INJ	INJECTION
INSTL	INSTALLATION / INSTALL
INSUL	INSULATION
INTER	INTERCEPTOR
INTR	INTERIOR
INV	INVERT
IP	IRON PIPE
IPT	IRON PIPE THREAD
IR	IRON ROD
IRRIG	IRRIGATION
ITD	IDAHO TRANSPORTATION DEPARTMENT
JT	JOINT

JUNC	JUNCTION
KPL	KICK PLATE
KVA	KILOVOLT AMPERE
KW	KILOWATT
KWY	KEYWAY
L	LENGTH
LAB	LABORATORY
LAV	LAVATORY
LB	POUND
LF	LINEAR FOOT
LIN	LINEAL
LN	LANE
LOC	LOCATION
LONG	LONGITUDINAL
LP	LOW PRESSURE
LPT	LOW POINT
LRG	LARGE
LS	LONG SLEEVE / LUMP SUM
LT	LEFT
LVL	LEVEL
LWL	LOW WATER LINE
MAN	MANUAL
MAT	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MCP	MASTER CONTROL PANEL
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIN	MINIMUM
MIPT	MALE IRON PIPE THREAD
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MON	MONUMENT / MONOLITHIC
MOT	MOTOR
MP	MILEPOST
MSL	MEAN SEAL LEVEL
MTD	MOUNTED
NA	NOT APPLICABLE
NAVD	NORTH AMERICAN VERTICAL DATUM
NC	NORMALLY CLOSED
NF	NEAR FACE
NIC	NOT IN CONTRACT
NO / NO.	NORMALLY OPEN / NUMBER
NOM	NOMINAL
NORM	NORMAL
NRS	NON-RISING STEM
NTS	NOT TO SCALE
O TO O	OUT TO OUT
OAR	OREGON ADMINISTRATIVE RULES
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OREGON DEPARTMENT OF TRANSPORTATION
OF	OVERFLOW / OUTSIDE FACE
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OVHD	OVERHEAD
P&ID	PROCESS & INSTRUMENTATION DIAGRAM
PC	POINT OF CURVE
PCC	POINT OF COMPOUND CURVE
PCVC	POINT OF CURVATURE ON VERTICAL CURVE
PE	PLAIN END
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PG	PRESSURE GAUGE
PH	PIPE HANGER
PI	POINT OF INTERSECTION
PIVC	POINT OF INTERSECTION ON VERTICAL CURVE
PL OR P/L	PROPERTY LINE / PLATE / PLASTIC
PLBG	PLUMBING
PNL	PANEL
POC	POINT OF CURVATURE

POLY	POLYETHYLENE
PP	POWER POLE / PURPLE PIPE
PRC	POINT OF REVERSE CURVATURE
PRCST	PRECAST
PREP	PREPARATION
PRESS	PRESSURE
PRKG	PARKING
PROP	PROPERTY
PRV	PRESSURE REDUCING VALVE
PS	PUMP STATION
PSIG	POUNDS PER SQUARE INCH GAUGE
PSL	PIPE SLEEVE
PSPT	PIPE SUPPORT
PT	POINT OF TANGENCY
PTVC	POINT OF TANGENCY ON VERTICAL CURVE
PTW	PUMP TO WASTE
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER
PWR	POWER
QTY	QUANTITY
RAD	RADIUS
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD / ROOF DRAIN
RDCR	REDUCER
REF	REFERENCE
REINF	REINFORCE(D)(ING)(MENT)
REQ'D	REQUIRED
RESTR	RESTRAINED
RFCA	RESTRAINED FLANGE COUPLING ADAPTER
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
R/W	RIGHT-OF-WAY
RPBPD	REDUCED PRESSURE BACKFLOW PREVENTION DEVICE
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RST	REINFORCED STEEL
RT	RIGHT
SALV	SALVAGE
SAN	SANITARY
SC	SOLID CORE
SCHED	SCHEDULE
SD	STORM DRAIN
SDL	SADDLE
SDR	STANDARD DIMENSION RATIO
SECT	SECTION
SHLDR	SHOULDER
SHT	SHEET
SIM	SIMILAR
SLP	SLOPE
SLV	SLEEVE
SOLN	SOLUTION
SP	SOIL PIPE / SEWER PIPE
SPCL	SPECIAL
SPEC(S)	SPECIFICATION(S)
SPG	SPACING
SPL	SPOOL
SPRT	SUPPORT
SQ	SQUARE
SQ FT	SQUARE FOOT
SQ IN	SQUARE INCH
SQ YD	SQUARE YARD
SS	SANITARY SEWER
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
STOR	STORAGE
STR	STRAIGHT
STRUCT	STRUCTURE / STRUCTURAL
SUBMG	SUBMERGED
SUCT	SUCTION
SV	SOLENOID VALVE
S/W	SIDEWALK
SWD	SIDEWATER DEPTH
SWGR	SWITCH GEAR
SYMM	SYMMETRICAL
SYS	SYSTEM

T OR TEL	TELEPHONE
T&B	TOP & BOTTOM
TAN	TANGENCY
TB	THRUST BLOCK
TBM	TEMPORARY BENCHMARK
TC	TOP OF CONCRETE / TOP OF CURB
TCE	TEMPORARY CONSTRUCTION EASEMENT
TDH	TOTAL DYNAMIC HEAD
TEMP	TEMPERATURE / TEMPORARY
T&G	TONGUE & GROOVE
THK	THICK / THICKNESS
THRD	THREAD (ED)
THRU	THROUGH
TP	TEST PIT / TOP OF PAVEMENT / TURNING POINT TRANSTRANSITION
TSP	TRI-SODIUM PHOSPHATE
TST	TOP OF STEEL
TW	TOP OF WALL
TYP	TYPICAL
UG	UNDERGROUND
UH	UNIT HEATER
UN	UNION
UON	UNLESS OTHERWISE NOTED
USGS	UNITED STATES GEOLOGIC SURVEY
V	VENT / VOLT
VAC	VACUUM
VB	VACUUM BREAKER
VBOX	VALVE BOX
VC	VERTICAL CURVE
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
VCP	VITRIFIED CLAY PIPE
VTR	VENT THROUGH ROOF
W	WATER
W/	WITH
W/IN	WITHIN
W/O	WITHOUT
W/W	WALL TO WALL
WD	WOOD
WF	WIDE FLANGE
WH	WATER HEATER
WI	WROUGHT IRON
WM	WATER METER
WP	WORKING POINT / WATERPROOFING
WS	WATER SERVICE
WSDOT	WASHINGTON STATE DEPARTMENT OF TRANSPORTATION
WT	WEIGHT
WTP	WATER TREATMENT PLANT
WTRT	WATERTIGHT
WWF	WELDED WIRE FABRIC
WWTF	WASTEWATER TREATMENT FACILITY
WWTP	WASTEWATER TREATMENT PLANT
X SECT	CROSS SECTION
XFMR	TRANSFORMER
YD	YARD DRAIN / YARD
YH	YARD HYDRANT
YR	YEAR
ZN	ZINC

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Consultant:

BID SET

Engineer's Seal:

REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2025
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:

THE CITY OF WARRENTON OREGON

Project Title:

CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:

GENERAL

ABBREVIATIONS

Designed By:	CAD
Drawn By:	CAD
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	G-003

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_G-003.dwg, Plotted Date: March 4, 2025 1:20 PM By: Andy Miles

GENERAL NOTES

1. CONSTRUCTION SHALL CONFORM TO THE OREGON SPECIFICATIONS AND STANDARD DRAWINGS FOR CONSTRUCTION AND AS REVISED BY THE CITY OF WARRENTON. ANY CONDITION NOT DESCRIBED IN THE PERMIT SHALL BE PER SUBMITTED PLANS AND TO ALL APPLICABLE REQUIREMENTS OF APWA, AWWA, DEQ, EPA, DSL, AND ODOT CONSTRUCTION STANDARDS.

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL UTILITY LOCATIONS PRIOR TO CONSTRUCTION AND ARRANGE FOR THE RELOCATION OF ANY IN CONFLICT WITH THE PROPOSED CONSTRUCTION. THE LOCATIONS, DEPTH, AND DESCRIPTION OF EXISTING UTILITIES SHOWN WERE COMPILED FROM AVAILABLE RECORDS AND-OR FIELD SURVEYS. THE CITY OR UTILITY COMPANIES DO NOT GUARANTEE THE ACCURACY OF THE COMPLETENESS OF SUCH RECORDS. ADDITIONAL UTILITIES MAY EXIST WITHIN THE WORK AREA.

3. OREGON LAW REQUIRES THAT THE RULES ADOPTED BY OREGON UTILITY NOTIFICATION CENTER BE FOLLOWED. THOSE RULES ARE SET FORTH IN OAR 952-001-0090. THE CONTRACTOR IS RESPONSIBLE TO CALL 1-800-332-2344 FOR LOCATES PRIOR TO EXCAVATION. AT LEAST TWO (2) BUSINESS DAYS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE OREGON UTILITY NOTIFICATION CENTER OF THE DATE AND LOCATION OF THE PROPOSED CONSTRUCTION, AND THE TYPE OF WORK TO BE PERFORMED. ANY DAMAGE TO CITY OR PRIVATE SERVICES SHALL BE REPAIRED BY THE CONTRACTOR WITH OWN REPAIR MATERIALS.

4. THE CONTRACTOR SHALL MAKE PROVISIONS TO KEEP ALL EXISTING UTILITIES (INCLUDING NON-LOCATABLE) IN SERVICE AND PROTECT THEM DURING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR THE IMMEDIATE NOTIFICATION OF DAMAGE TO UTILITIES AND THE REPAIR OR REPLACEMENT OF DAMAGED UTILITIES USING MATERIALS AND METHODS APPROVED BY THE UTILITY OWNER. NO SERVICE INTERRUPTIONS SHALL BE PERMITTED WITHOUT PRIOR WRITTEN AGREEMENT WITH THE UTILITY OWNER/PROVIDER.

5. THE CONTRACTOR SHALL POTHOLE AND VERIFY LOCATION AND DEPTH OF ALL EXISTING UTILITIES PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR SHALL TAKE ALL NECESSARY FIELD MEASUREMENTS AND OTHERWISE VERIFY ALL DIMENSIONS AND EXISTING CONSTRUCTION CONDITIONS INDICATED AND OR SHOWN ON THE PLANS. SHOULD ANY ERROR OR INCONSISTENCY EXIST, THE CONTRACTOR SHALL NOT PROCEED WITH THE WORK AFFECTED UNTIL REPORTED TO THE DESIGN ENGINEER FOR CLARIFICATION OR CORRECTION.

6. ALL PROJECT ELEMENTS SHALL BE CONSTRUCTED PER APPROVED PROJECT DRAWINGS; SPECIFICATIONS; FEDERAL, STATE AND LOCAL PERMITS.

7. THE CONTRACTOR SHALL KEEP AN APPROVED SET OF PLANS ON THE PROJECT SITE AT ALL TIMES.

8. ALL SURVEY MONUMENTS ON THE PROJECT'S SITE OR THAT MAY BE SUBJECT TO DISTURBANCE WITHIN THE CONSTRUCTION AREA, OR THE CONSTRUCTION OF ANY OFF-SITE IMPROVEMENTS SHALL BE ADEQUATELY REFERENCED AND PROTECTED PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITY. IF THE SURVEY MONUMENTS ARE DISTURBED, MOVED, RELOCATED, OR DESTROYED AS A RESULT OF ANY CONSTRUCTION, THE CONTRACTOR SHALL, AT THEIR COST, RETAIN THE SERVICES OF A REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF OREGON TO RESTORE THE MONUMENT TO ITS ORIGINAL CONDITION AND FILE THE NECESSARY SURVEYS AS REQUIRED BY OREGON STATE LAW.

9. CONTRACTOR SHALL ERECT AND MAINTAIN TEMPORARY TRAFFIC CONTROL PER THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD), PART 6, AND DEVIATIONS TO THE MUTCD AS ADOPTED AND MODIFIED BY ODOT.

10. SHOULD WORK BE IN AN EXISTING PUBLIC RIGHT OF WAY THAT IS OPEN TO TRAFFIC, THE CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN WITH ROW PERMIT TO APPROPRIATE CITY, COUNTY, AND STATE JURISDICTIONAL AUTHORITIES FOR APPROVAL.

11. ANY INSPECTION BY THE CITY, COUNTY, STATE, FEDERAL AGENCY OR DESIGN ENGINEER SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR FROM ANY OBLIGATION TO PERFORM THE WORK IN COMPLIANCE WITH THE APPLICABLE CODES, REGULATIONS, CITY STANDARDS AND PROJECT CONTRACT DOCUMENTS.

12. FINAL LOCATIONS OF ALL NEW FACILITIES SHALL BE FIELD VERIFIED WITH THE CITY'S INSPECTOR AND ENGINEER PRIOR TO CONSTRUCTION.

13. PROVIDE "AS CONSTRUCTED" DRAWINGS TO THE ENGINEER INDICATING ALL CHANGES IN GRADE, ALIGNMENT, FITTINGS AND MATERIALS INSTALLED INSTALLED AND ANY OTHER UTILITIES OR OBSTACLES NOT SO INDICATED ON THESE PLANS.

14. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING CONSTRUCTION SURVEYS. PRIOR TO CONSTRUCTION, FIELD LAYOUT SHALL BE APPROVED BY ENGINEER, SEE CONTRACT DOCUMENTS FOR SURVEY REQUIREMENTS.

15. ALL EXISTING FEATURES INCLUDING BUT NOT LIMITED TO ROADWAYS, STRUCTURES, LOTS, CURBS, SIDEWALKS, FENCES, WALLS, PLANTING, DITCHES, SIGNS, PIPING AND UTILITIES DISTURBED DURING CONSTRUCTION SHALL BE REMOVED AND RESTORED TO AS GOOD OR BETTER THAN EXISTING CONDITION AS DETERMINED BY THE OWNER. CONTRACTOR SHALL REPAIR ALL UTILITY SERVICES DAMAGED DURING CONSTRUCTION AND SUCH REPAIR SHALL BE CONSIDERED INCIDENTAL UNLESS PROVIDED FOR OTHERWISE IN THE SPECIFICATIONS.

WATER SYSTEM NOTES

1. AT THE END OF EACH WORKDAY ALL OPEN TRENCHES SHALL BE BACKFILLED.

2. OPERATION OF WATER VALVES SHALL BE BY CITY OF WARRENTON STAFF ONLY.

3. NO UNDERGROUND WORK SHALL BE "BURIED" UNTIL INSPECTED AND APPROVED BY THE ENGINEER.

4. FINAL LOCATIONS OF ALL VALVE BOXES, FIRE HYDRANTS, AND AIR RELEASE VALVES SHALL BE VERIFIED BY OWNER PRIOR TO CONSTRUCTION.

5. THE USE OF CONCRETE THRUST BLOCKS IS ALLOWED ONLY WHERE SHOWN ON PLANS. REQUIRED THRUST RESTRAINT IN ALL OTHER LOCATIONS WILL BE ACCOMPLISHED WITH APPROVED JOIN RESTRAINT SYSTEM.

6. DEPTH OF INSTALLATION PARALLEL TO ODOT HIGHWAY WILL BE AT A MINIMUM OF 42" TO TOP OF PIPE.

7. CROSSINGS UNDER ODOT HIGHWAY WILL BE A MINIMUM OF 48" TO TOP OF PIPE. CROSSINGS UNDER ODOT HIGHWAY WILL REQUIRE PIPE TO BE PLACED IN CASING.

8. THE CONTRACTOR SHALL CONSTRUCT THE WATER MAIN TO THE MINIMUM DEPTHS OF COVER INDICATED ON THE DRAWINGS FOLLOWING THE EXISTING GROUND CONTOURS. WHERE PIPING INVERTS ARE SHOWN ON THE PIPELINE PROFILES, THE PIPELINE SHALL BE CONSTRUCTED TO THOSE INVERTS, UNLESS OTHERWISE SPECIFIED OR APPROVED BY ENGINEER.

9. COMPLY WITH OAR CHAPTER 333 RULES FOR REQUIRED WATERLINE-SEWERLINE SEPARATION AND CROSSING REQUIREMENTS. IN SPECIFIC LOCATIONS WHERE WATER PIPELINE IS TO BE INSTALLED CROSSING UNDERNEATH EXISTING SANITARY SEWERS, CONTRACTOR SHALL EXPOSE EXISTING SEWERS TO NEAREST JOINTS TO EXAMINE CONDITION AND THEN CONCRETE ENCASE OR REPLACE SECTION OF SEWER PER THE REQUIREMENTS OF OAR 333-061-0050(9)(c)(C) IF IT IS FOUND TO BE LEAKING OR ITS CONDITION IS DETERMINED TO BE UNFAVORABLE BY THE CITY'S INSPECTOR. IF EXISTING SEWER'S CONDITION IS DETERMINED TO BE FAVORABLE, CENTER A FULL STICK OF WATER PIPING AT THE CROSSING ASSURE THAT SEWER IS PROPERLY SUPPORTED DURING AND AFTER BACKFILLING, AND PREPARE A WRITTEN REPORT, ALL PER THE REQUIREMENT'S OF OAR 333. WITH THE CITY APPROVAL, THE CONTRACTOR MAY ALSO ELECT TO CUT AND REPLACE A FULL STICK OF SEWER LATERAL PIPING AT CROSSING REGARDLESS OF PIPING CONDITION TO FACILITATE SHORING PROGRESSION AND WATERLINE INSTALLATION. CONTRACTOR SHALL PROVIDE SEWER BYPASS AS REQUIRED TO FACILITATE THE WORK.

10. NO CONNECTION TO EXISTING MAIN LINES WILL BE ALLOWED WITHOUT FLUSHING, TESTING, DISINFECTION, AND RECEIPT OF SATISFACTORY BACTERIAL TESTS. CONTRACTOR SHALL PROVIDE TEMPORARY BLOW-OFF ASSEMBLIES AT ALL CONNECTIONS TO EXISTING PIPING AS REQUIRED TO FACILITATE TESTING AND DISINFECTION OF NEW PIPELINES.

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Consultant:

BID SET

Engineer's Seal:

REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
GENERAL
GENERAL NOTES

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: G-004
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

TOPOGRAPHIC LEGEND

	EXISTING	PROPOSED
WATERLINE	10"W	12"DI W
ELECTRICITY (UNDERGROUND)	E	E
OVERHEAD UTILITY	OVHD	OVHD
GAS	4"G	4"G
TELEPHONE/TELEMETRY	T	T
CABLE TELEVISION	CATV	CATV
COMMUNICATION	COM	COM
FIBER OPTIC	FO	FO
SANITARY SEWER LINE	8"SS	8"SS
SANITARY SEWER FORCE MAIN	6"SSFM	6"FM
STORM DRAIN	8"SD	8"SD
DRAIN	D	D
CULVERT	18"SD	18"SD
ABANDONED PIPE	10"W (ABAND)	
DEMOLISH/ REMOVE		
DRAINAGE DITCH		
TOP OF SLOPE	TOP	TOP
TOE OF SLOPE	TOE	TOE
CUT		C
FILL		F
BARBWIRE FENCE		
CHAIN LINK FENCE		
WOOD FENCE		
TEMPORARY SILT FENCE		
GUARDRAIL		
ROCK WALL		
TREE/BUSH LINE		
WETLAND		
CENTERLINE		
RIGHT-OF-WAY	R/W	
PROPERTY LINE		
EASEMENT		
EDGE OF PAVEMENT/AC		
EDGE OF GRAVEL		
CURB		
SIDEWALK	S/W	S/W
STRUCTURE OR FACILITY		
CONTOUR MINOR		
CONTOUR MAJOR	200	200

	EXISTING	PROPOSED
MANHOLE	SS SD W C T	SS SD W C T
CLEAN-OUT		
CATCH BASIN/FIELD INLET		
THRUST BLOCK		
VALVE		
AIR INJECTION ASSEMBLY		
BLOW-OFF ASSEMBLY (PERMANENT)		
BLOW-OFF ASSEMBLY (TEMPORARY)		
AIR RELEASE ASSEMBLY		
FIRE HYDRANT ASSEMBLY		
WATER METER		
FIRE DEPARTMENT CONNECTION		
WATER IRRIGATION VALVE	IR	IR
PULL BOX/JUNCTION BOX		
COM RISER		
UTILITY POLE		
GUY WIRE		
LIGHT POST		
STREET LIGHT		
TRANSFORMER		
ELECTRICAL METER	M	
ELECTRICAL CABINET		
GAS METER		
GAS VALVE		
MAILBOX		
SIGN		
TREE DECIDUOUS		
TREE CONIFEROUS		
TREE TO BE REMOVED		
SURFACE ELEVATION	+ 176.63	+ 176.63
WETLAND FLAG		
BENCHMARK		
IRON ROD		
MONUMENT		
BORE/ POTHOLE		
TEST PIT		
BOLLARD		
INLET PROTECTION		

SCHEMATIC	
	WELDED JOINT
	FLANGED JOINT
	GROOVED END JOINT
	MECHANICAL JOINT
	PUSH-ON JOINT (RUBBER GASKET)
	FLANGED COUPLING ADAPTER
	DOUBLE BALL FLEXIBLE EXTENSION COUPLING
	FLEXIBLE COUPLING W/ THRUST RING
	90° BEND UP
	90° BEND DOWN
	TEE UP
	TEE DOWN
	LATERAL UP
	LATERAL DOWN
	CONCENTRIC REDUCER
	ECCENTRIC REDUCER
	UNION
	BLIND FLANGE
	CAP/ PLUG
	LONG SLEEVE
	FLEXIBLE COUPLING
	FITTING (45°)
	STRAINER
	SIGHT GLASS
	PRESSURE GAUGE W/ COCK
	PRESSURE SWITCH W/ COCK
M	METER
SP	SLIP-ON JOINT PIPE
R	RESTRAINED JOINT PIPE

SCHEMATIC	
	BUTTERFLY VALVE
	GATE VALVE
	GLOBE VALVE
	BALL VALVE
	BALANCING VALVE
	PLUG VALVE (TOP)
	PLUG VALVE (SIDE)
	3-WAY PLUG VALVE
	CHECK VALVE
	SWING CHECK VALVE
	DOUBLE CHECK ASSEMBLY
	BALL SWING CHECK
	SILENT CHECK VALVE
	PRESSURE REDUCING VALVE
	ALTITUDE CONTROL VALVE
	SOLENOID VALVE
	RELIEF VALVE
	NEEDLE VALVE
	HOSE VALVE
	REDUCED PRESSURE BACKFLOW PREVENTER W/ GATE VALVES
	HOSE BIBB

GENERAL NOTES:

1. THIS IS A STANDARD CIVIL LEGEND, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2025 ANDREW THOMAS MILES RENEWS 12-31-26

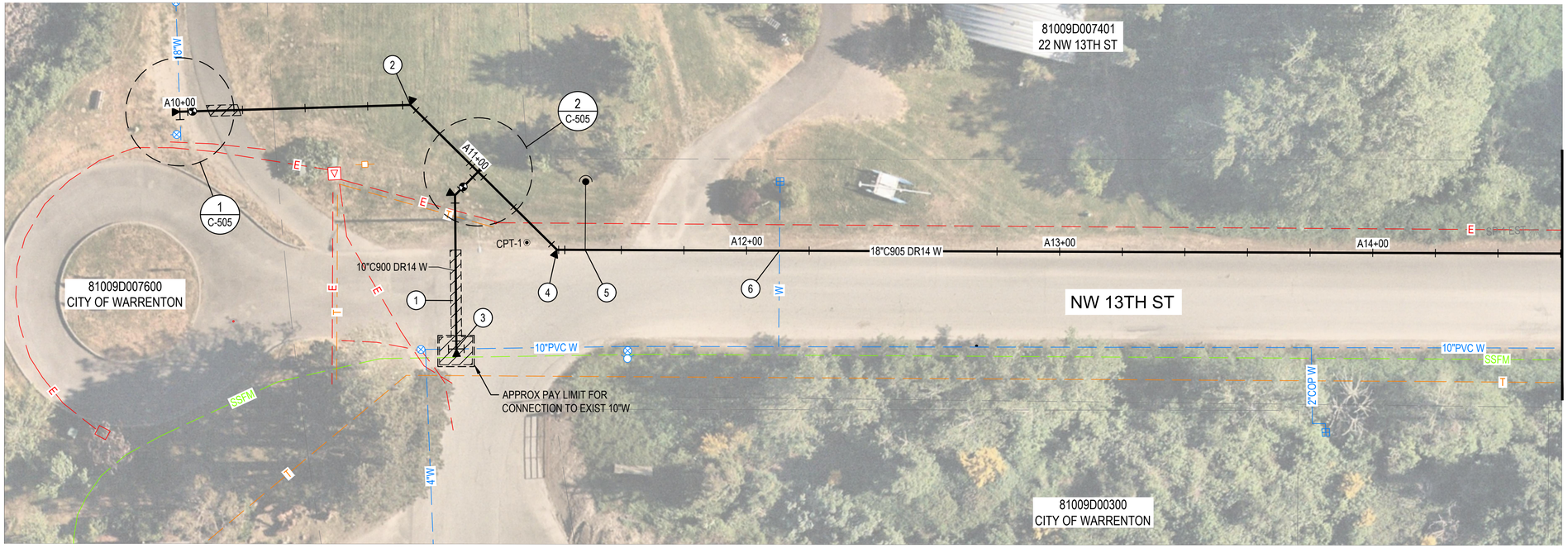
Client / Owner: THE CITY OF WARRENTON OREGON

Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title: CIVIL

CIVIL SYMBOLS AND LEGEND

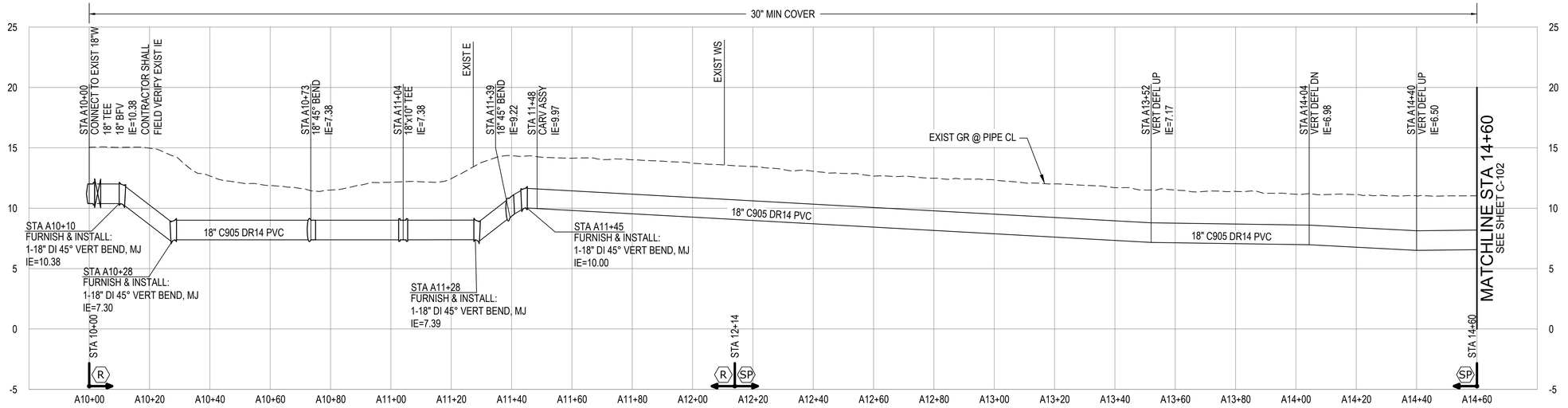
Designed By: CAD	CONSOR Project No.: W231023OR
Drawn By: CAD	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-001
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. AC PVMT RESTORATION
   251 SF THIS SHT
2. STA A10+74
   FURNISH & INSTALL:
   1-18" DI 45° BEND, MJ W/ TB
3. STA A11+39 RT 45'
   FURNISH & INSTALL:
   1-10" DI TEE, MJ W/ TB
   2-10" CPLG
   CONNECT TO EXIST 10" W
4. STA A11+39
   FURNISH & INSTALL:
   1-18" DI 45° BEND, MJ W/ TB
5. STA A11+48
   FURNISH & INSTALL:
   1-CARV ASSY, SEE DET 2, SHT C-502
6. STA A12+11
   ADJUST EXIST WS OVER 18"W



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A10+00 TO STA A14+60

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-101
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

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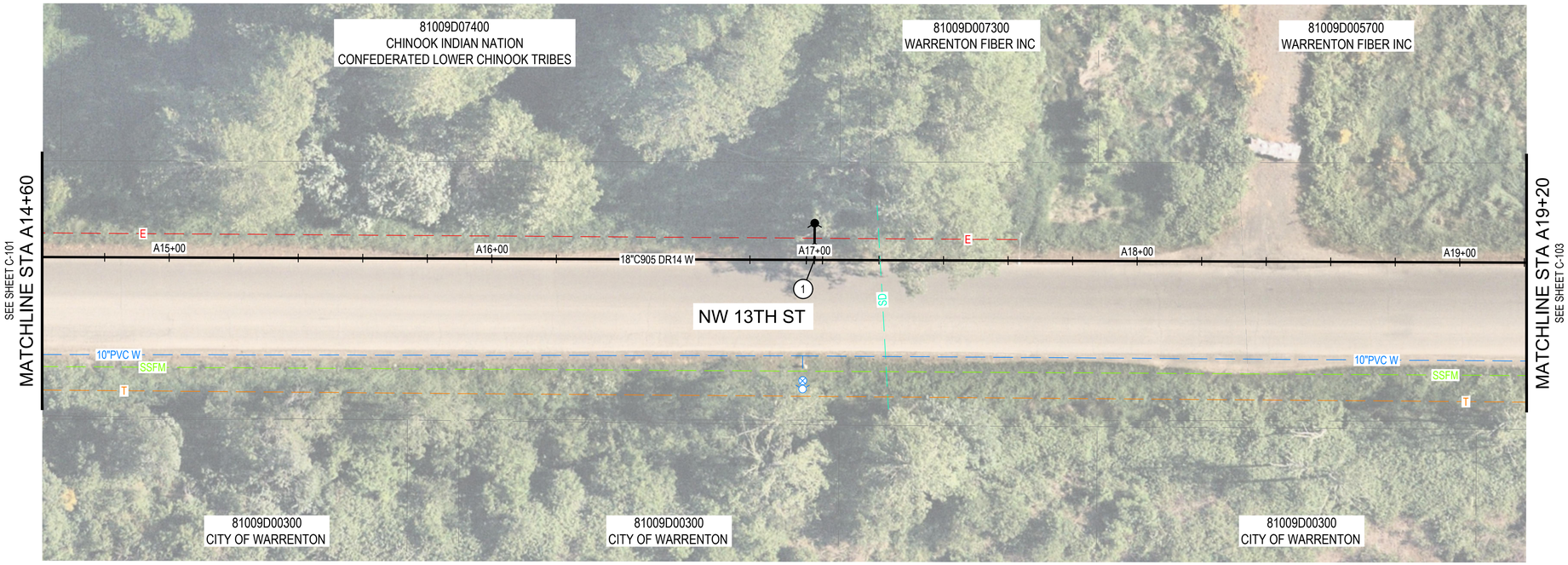
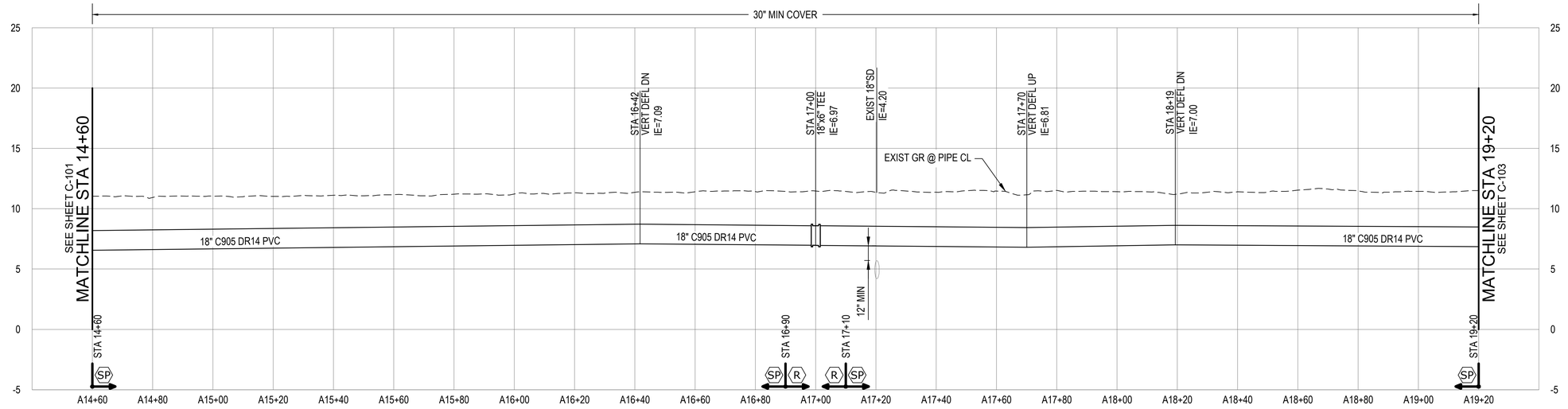


PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A17+00
FURNISH & INSTALL:
1-18"x6" DI TEE, MJ
1-FH ASSY, SEE DET 3, SHT C-503



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A14+60 TO STA A19+20

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-102
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

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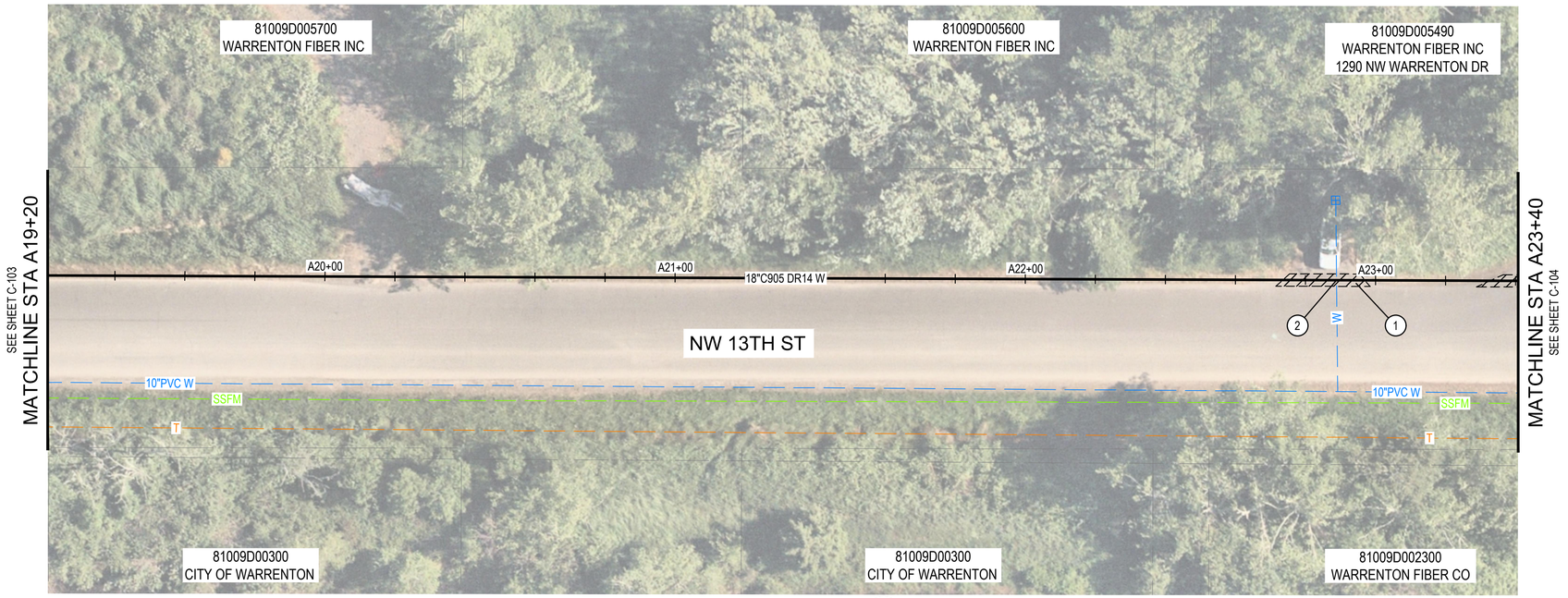
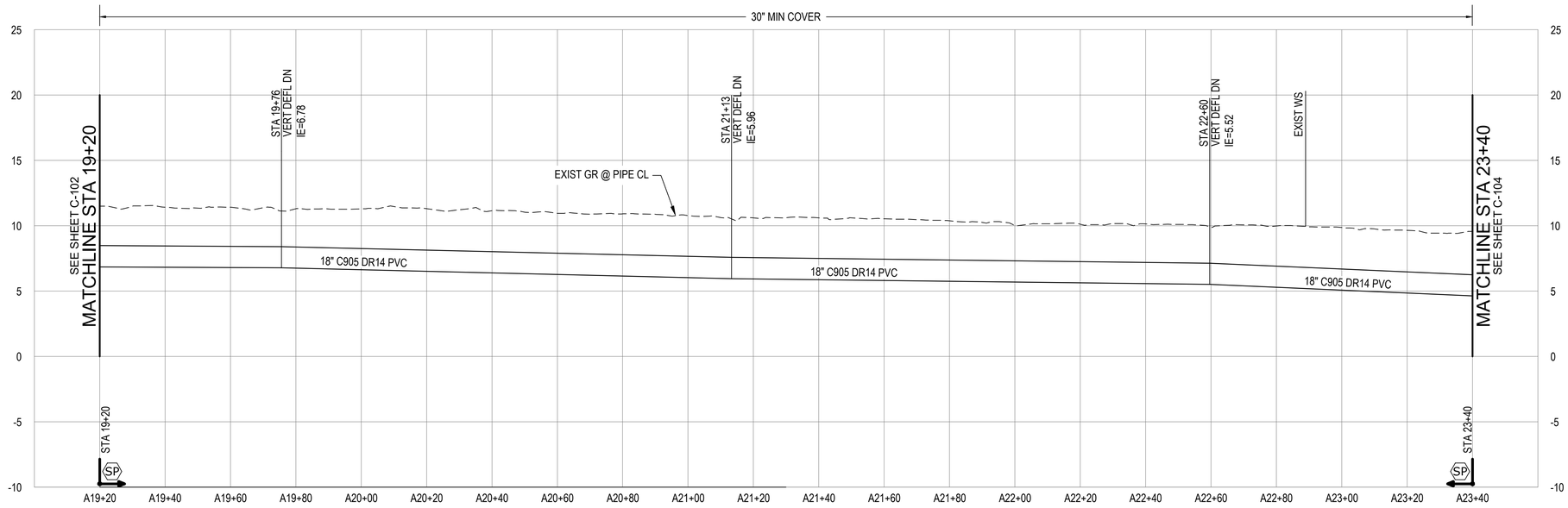


PLAN
SCALE: 1"=20'

KEY NOTES

1. AC PVMT RESTORATION
   110 SF THIS SHT
2. STA A22+89
   ABAND IN PLACE EXIST WS.
   DECOMMISSION WS AT CONNECTION TO
   EXIST 10"W MAIN W/ LOCATE BALL.



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

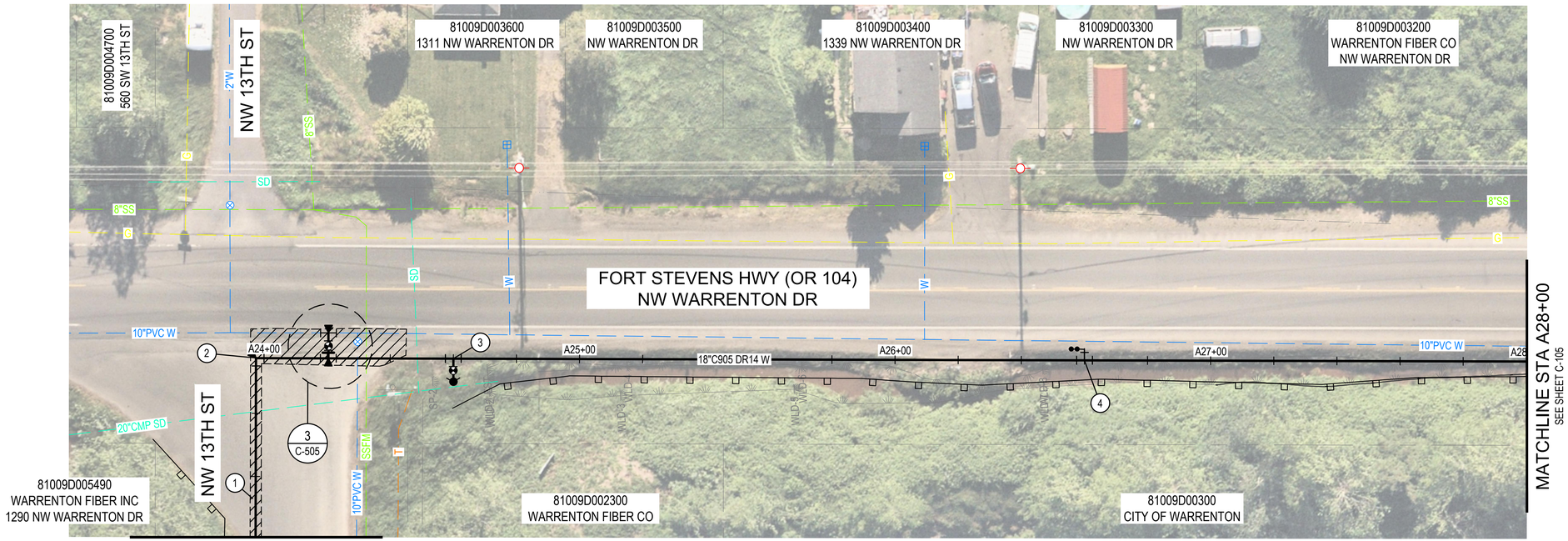
Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A19+20 TO STA A23+40

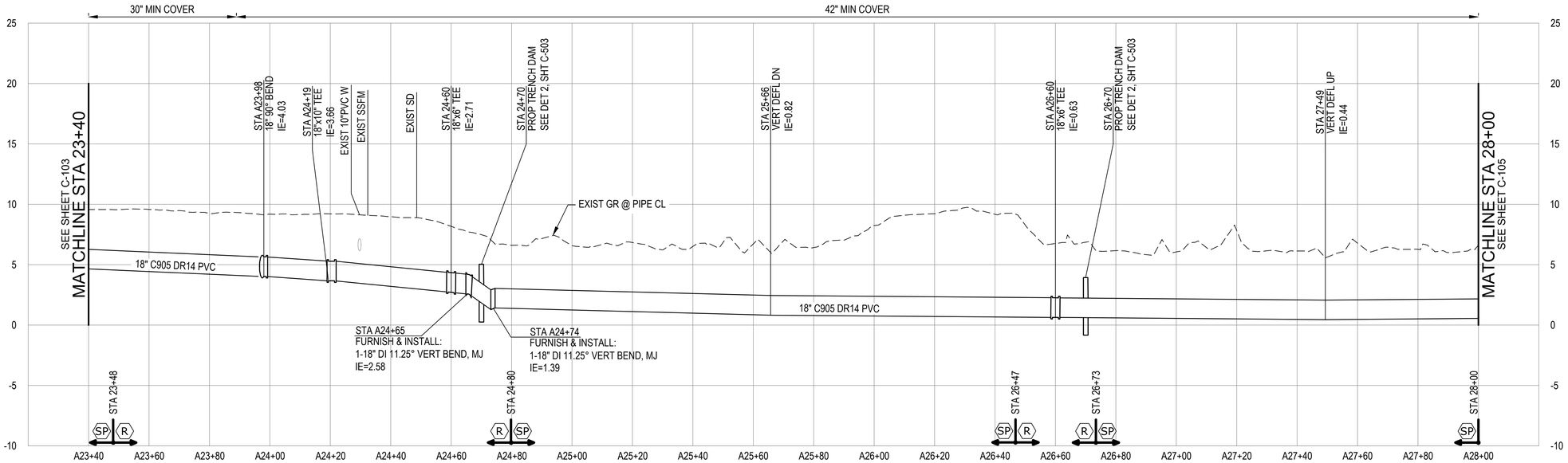
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-103

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_W\W231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-103.dwg, Plotted Date: March 4, 2025 1:25 PM By: Andy Miles



PLAN
SCALE: 1"=20'



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

KEY NOTES

1. AC PVMT RESTORATION
   804 SF THIS SHT
2. STA A23+97
   FURNISH & INSTALL:
   2-18" DI 45° BEND, MJ W/ TB
   ROTATE BENDS AS REQ'D
3. STA A24+60
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
4. STA A26+60
   FURNISH & INSTALL:
   1-BO ASSY, SEE DET 1, SHT C-502

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MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON OREGON

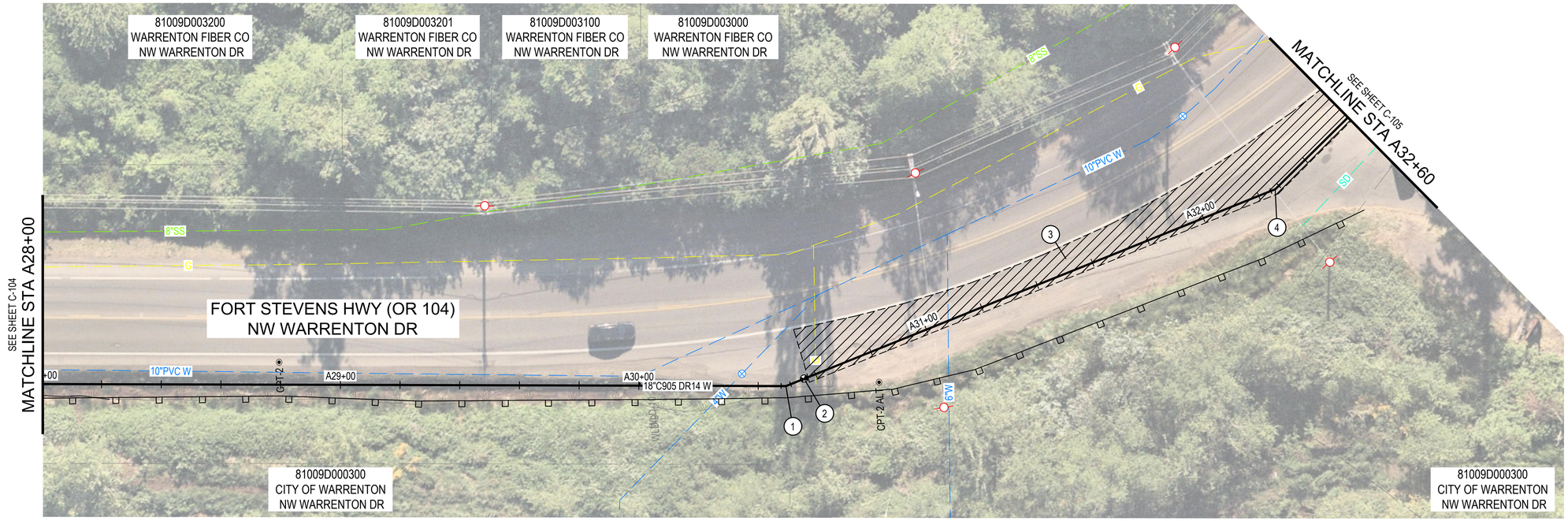
Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A23+40 TO STA A28+00

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM

CONSOR Project No.: W231023OR
Issued On: MARCH 2025
Drawing No.: C-104
0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

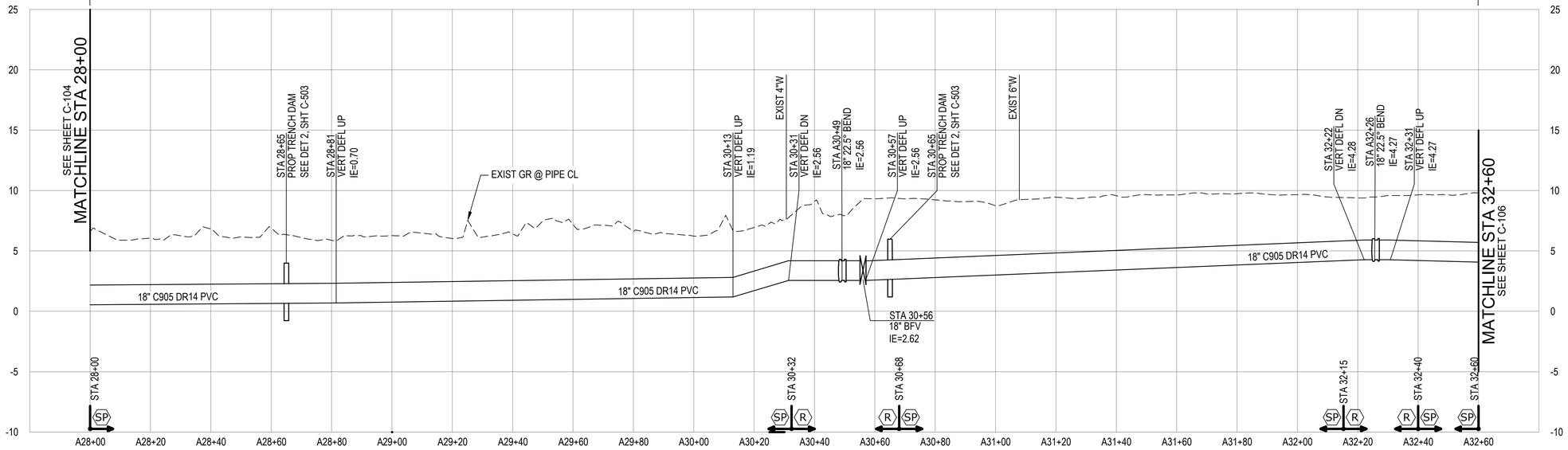
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-104.dwg, Plotted Date: March 4, 2025 1:27 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A30+49
   FURNISH & INSTALL:
   1-18" DI 22.5° BEND, MJ
2. STA A30+56
   FURNISH & INSTALL:
   1-18" BFV, MJ
3. AC PVMT RESTORATION
   2,901 SF THIS SHT
4. STA A32+26
   FURNISH & INSTALL:
   1-18" DI 22.5° BEND, MJ



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Consultant:

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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

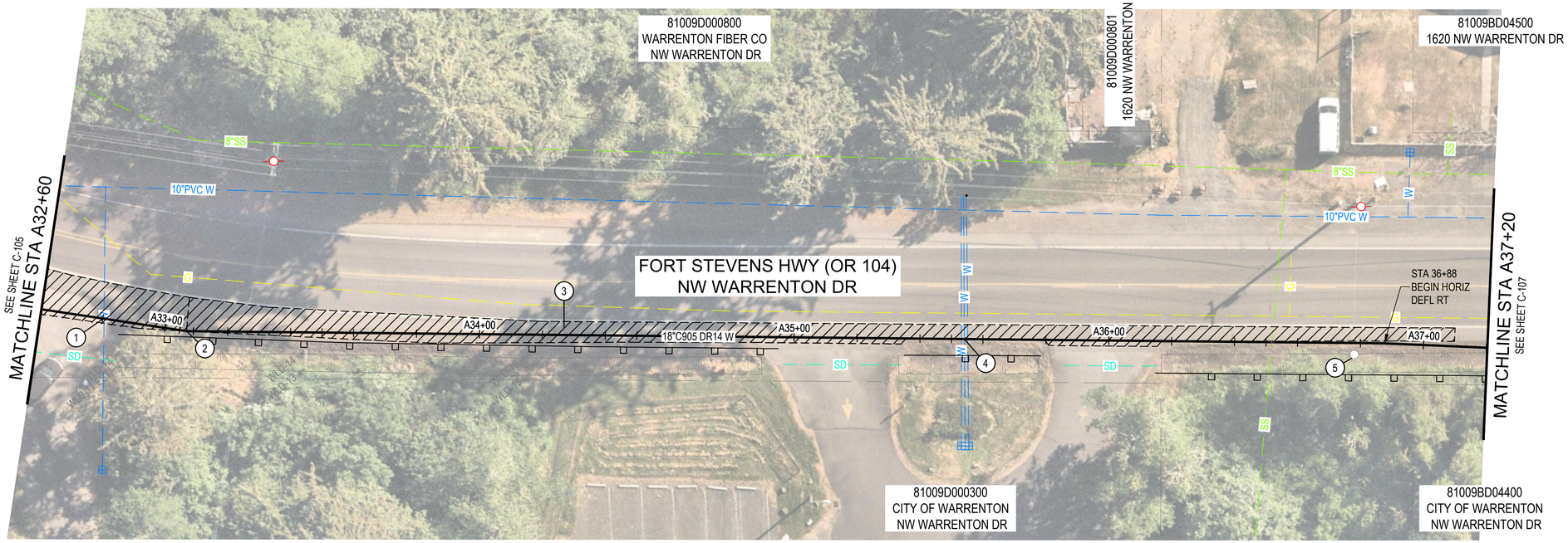
Client / Owner:
THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A28+00 TO STA A32+60

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-105
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

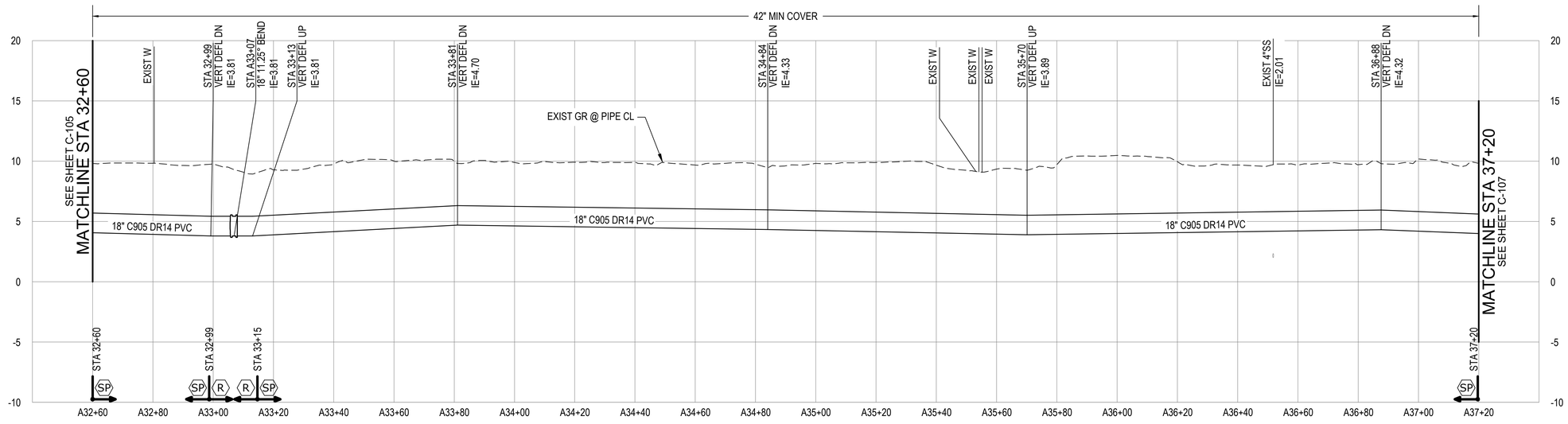
Drawing Path and Name: G:\PDX_Projects\23\Vertical_W\W231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-105.dwg, Plotted Date: March 4, 2025 1:28 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A32+80
   ADJUST EXIST WS OVER 18" W
2. STA A32+80
   1-18" DI 11.25° BEND, MJ
3. AC PVMT REPLACEMENT
   3,041 SF THIS SHT
4. STA A35+54
   DECOMMISSION EXIST WS AT DOG PARK
5. STA A36+78 RT 4'
   PROTECT AND SUPPORT EXIST UTIL POLE



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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REGISTERED PROFESSIONAL ENGINEER
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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

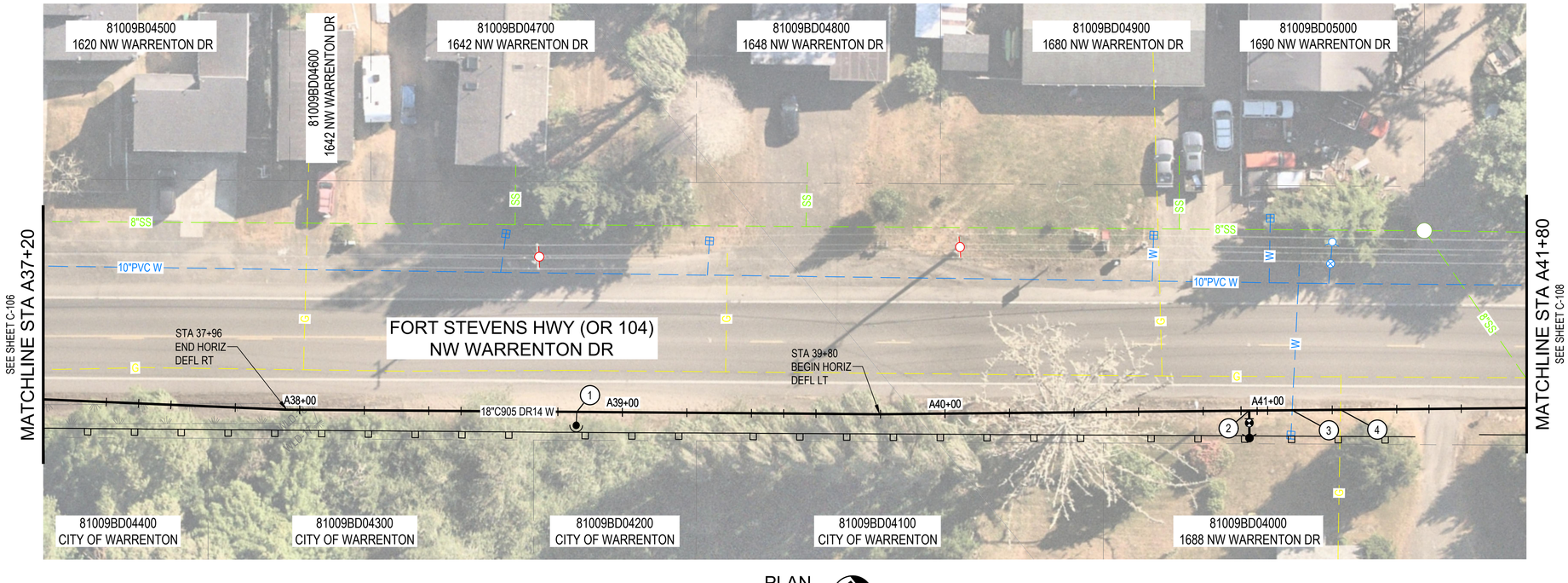
Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A32+60 TO STA A37+20

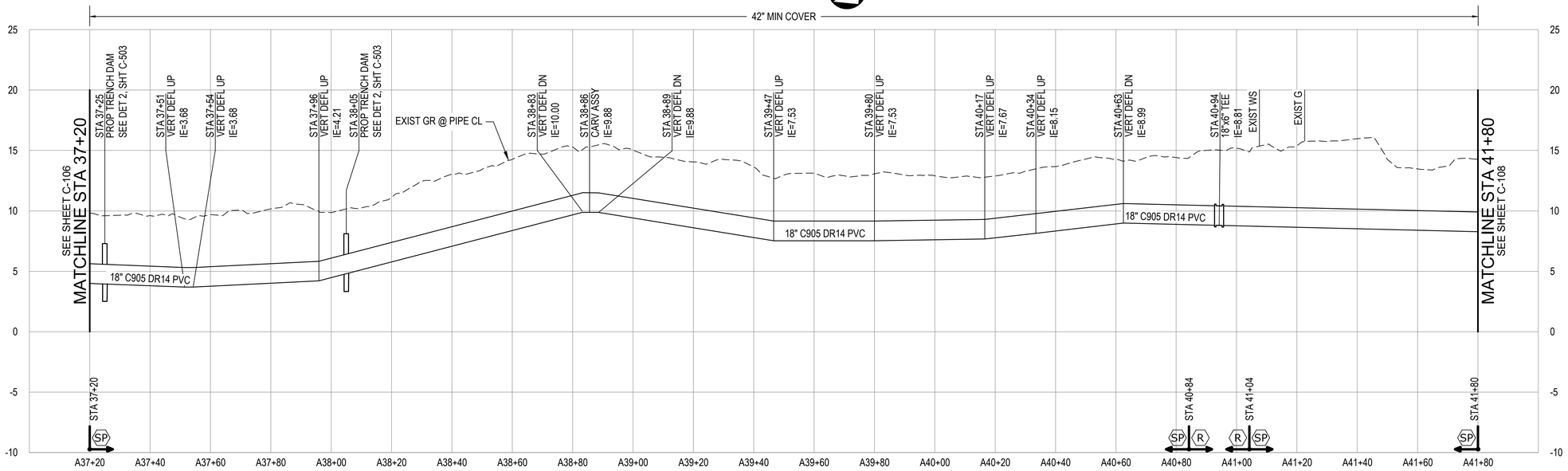
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-106

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-106.dwg, Plotted Date: March 4, 2025 1:30 PM By: Andy Miles



PLAN
SCALE: 1"=20'



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

KEY NOTES

1. STA A38+86
   FURNISH & INSTALL:
   1-CARV ASSY, SEE DET 2, SHT C-502
2. STA A40+94
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
3. STA A41+08
   ADJUST EXIST WS OVER 18" W
4. COORDINATE ADJUSTMENT OF GAS UTILITY W/ NW NATURAL

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Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2025
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

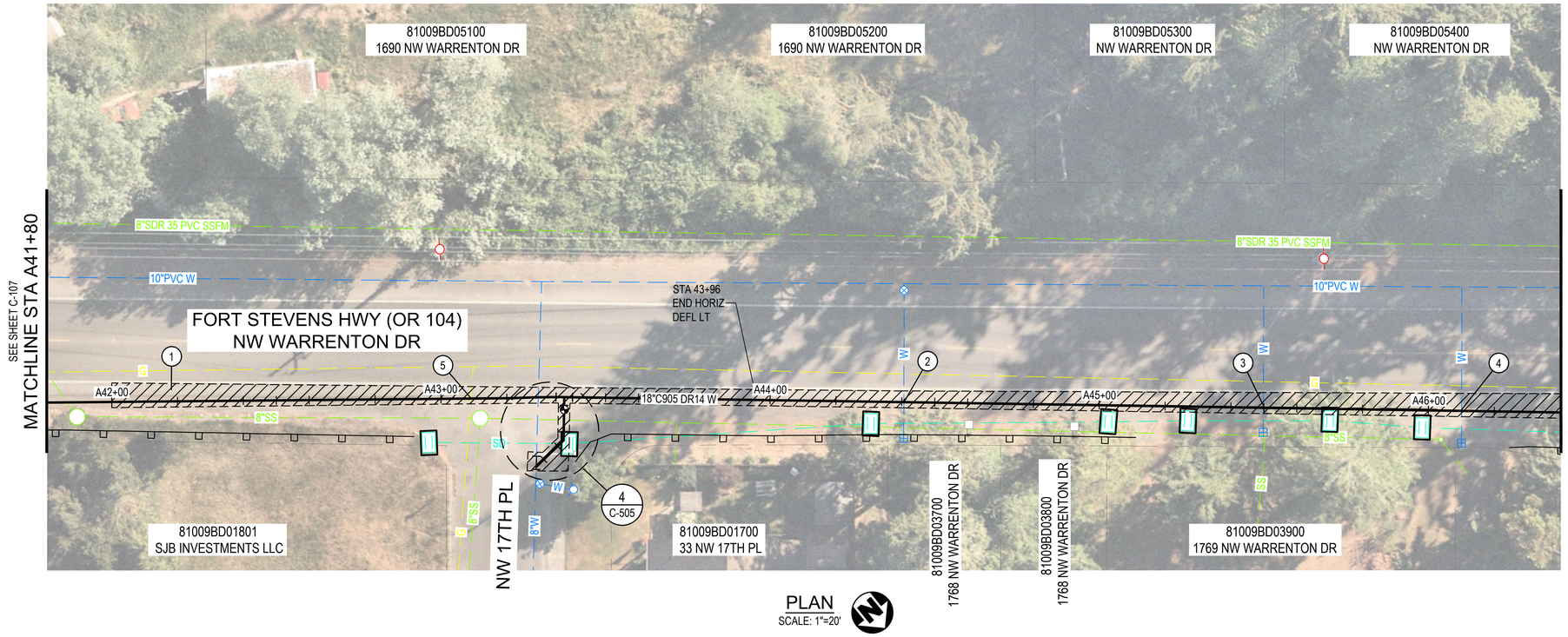
Drawing Title:
CIVIL
PLAN AND PROFILE
STA A37+20 TO STA A41+80

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM

CONSOR Project No.: W231023OR
Issued On: MARCH 2025
Drawing No.: C-107

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-107.dwg, Plotted Date: March 4, 2025 1:32 PM By: Andy Miles



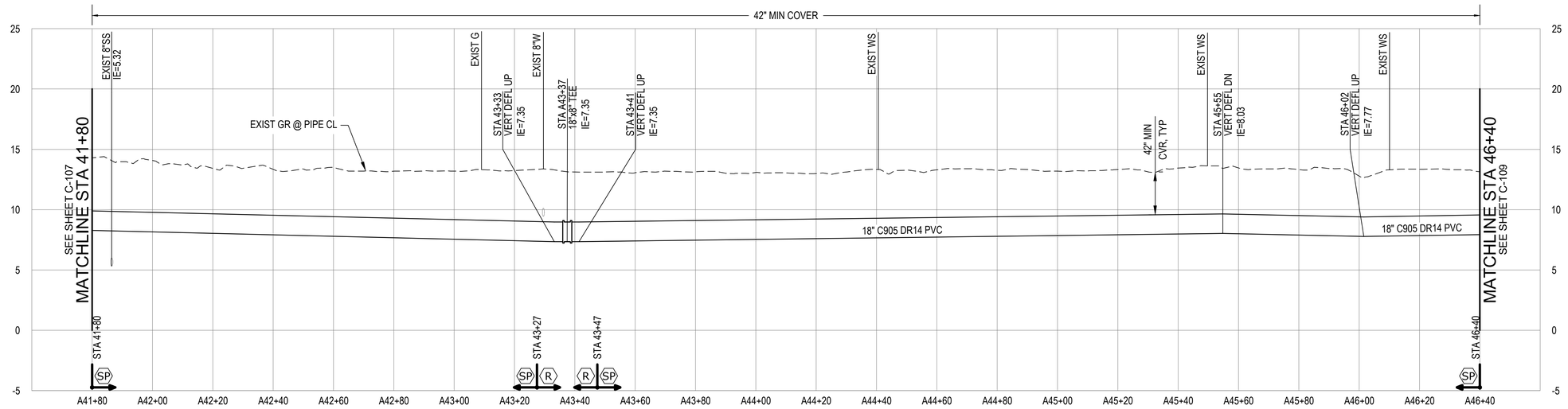
PLAN
SCALE: 1"=20'

KEY NOTES

1. AC PVMT RESTORATION
   2,953 SF THIS SHT
2. STA A44+41
   ADJUST EXIST WS OVER 18" W
3. STA A45+50
   ADJUST EXIST WS OVER 18" W
4. STA A46+10
   ADJUST EXIST WS OVER 18" W
5. COORDINATE ADJUSTMENT OF GAS UTILITY
   W/ NW NATURAL

NOTES:

1. INSTALL TYPE 4 INLET PROTECTION ON EXIST INLETS, SEE SHT C-1501



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Engineer's Seal:
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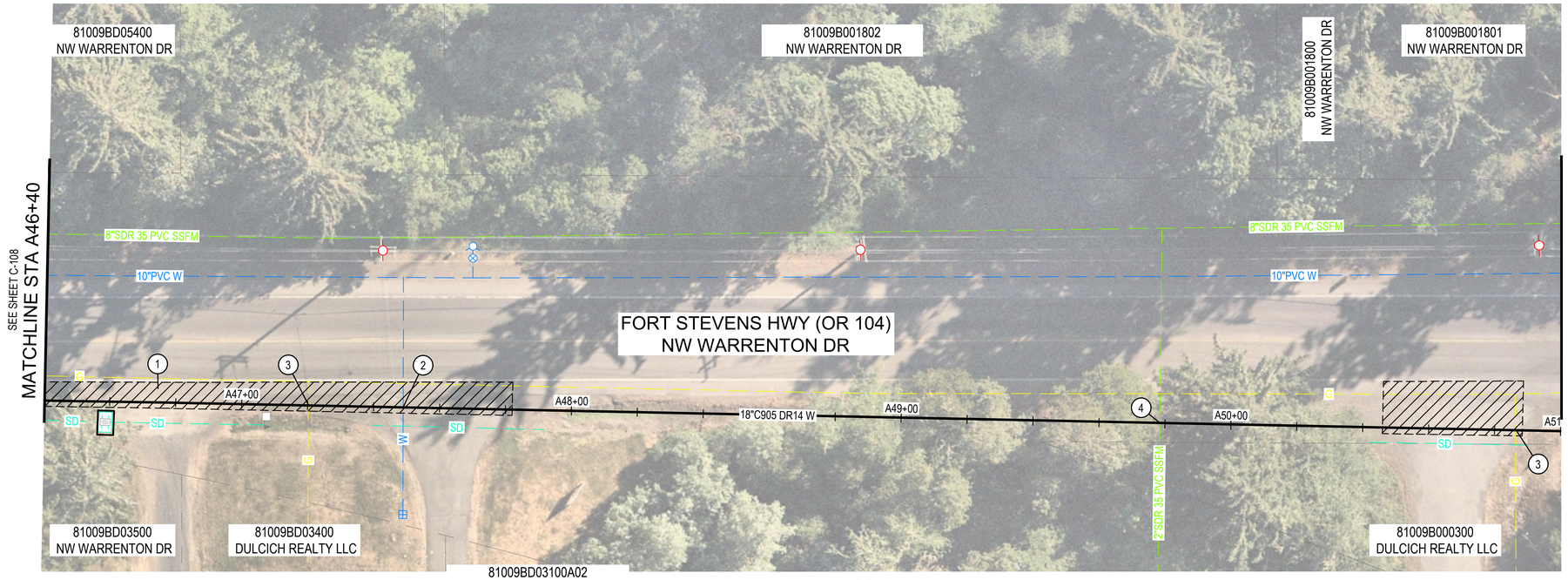
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A41+80 TO STA A46+40

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-108
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



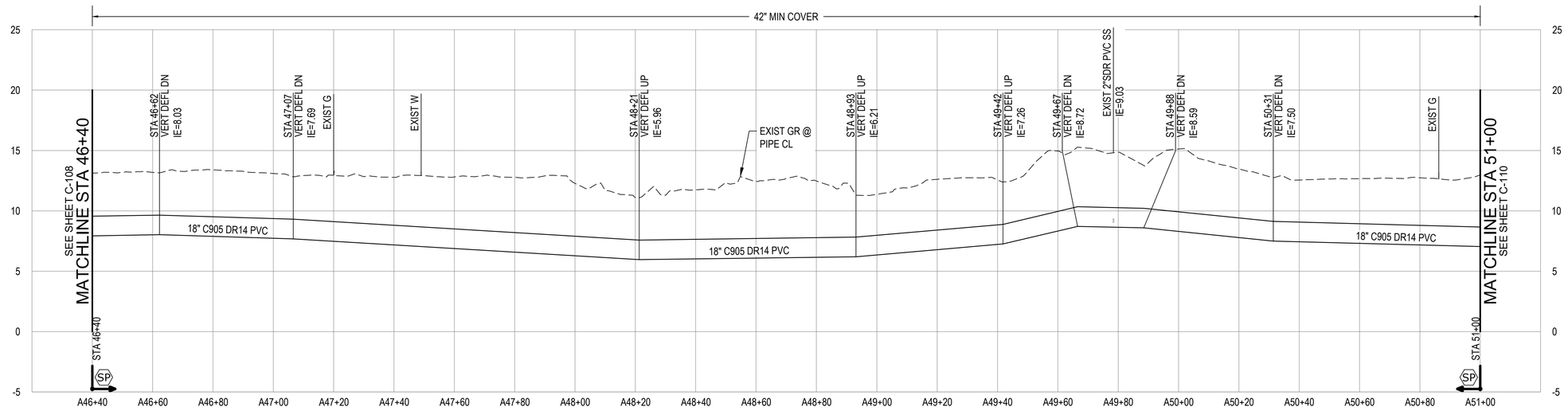
PLAN
SCALE: 1"=20'

KEY NOTES

1. AC PVMT RESTORATION 1,894 SF THIS SHT
2. STA A47+49 ADJUST EXIST WS OVER 18" W
3. COORDINATE ADJUSTMENT OF GAS UTILITY W/ NW NATURAL
4. ADJUST EXIST 2" SSFM 18-IN BELOW NEW 18"W MAIN
5. INLET PROTECTION TYPE 4 OR 7, SEE ODOT STDS RD1010 AND RD1015, SHT C-1501

NOTES:

1. INSTALL TYPE 4 INLET PROTECTION ON EXIST INLETS, SEE SHT C-1501



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Consultant:

BID SET

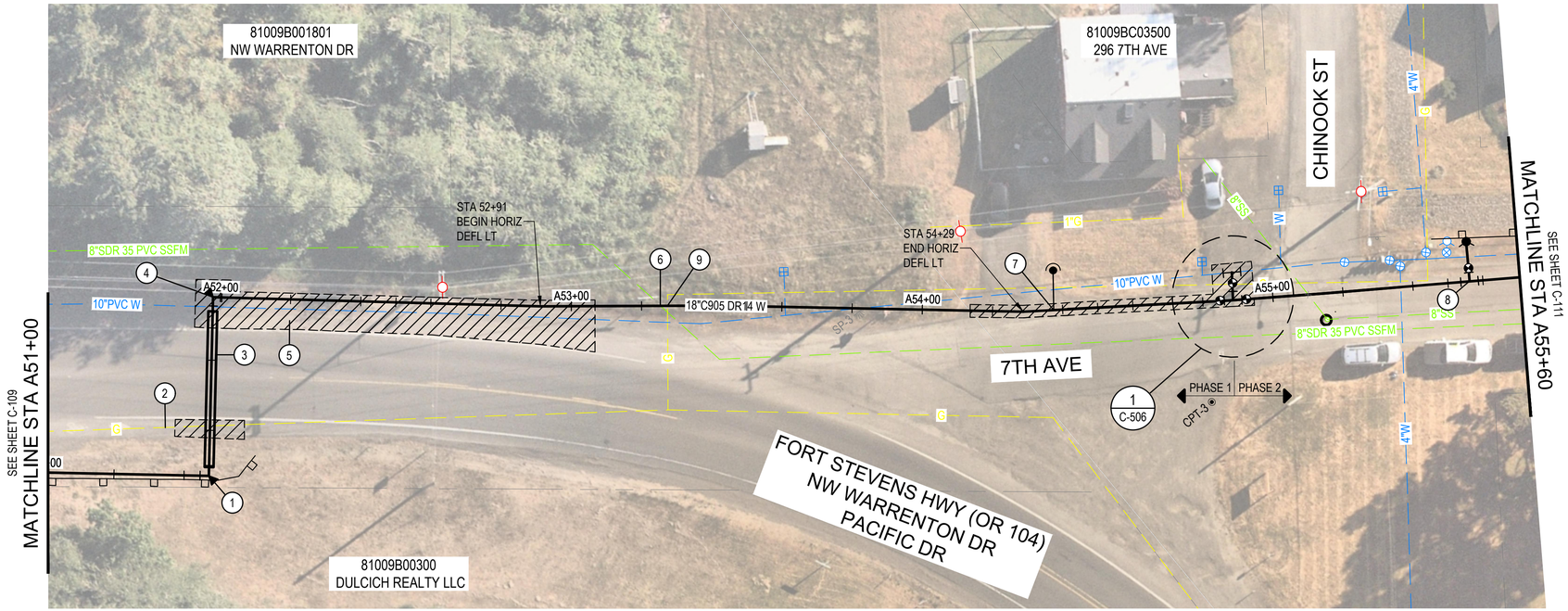
Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER, PE96202, OREGON, MAY 12, 2020, ANDREW THOMAS MILES, RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON

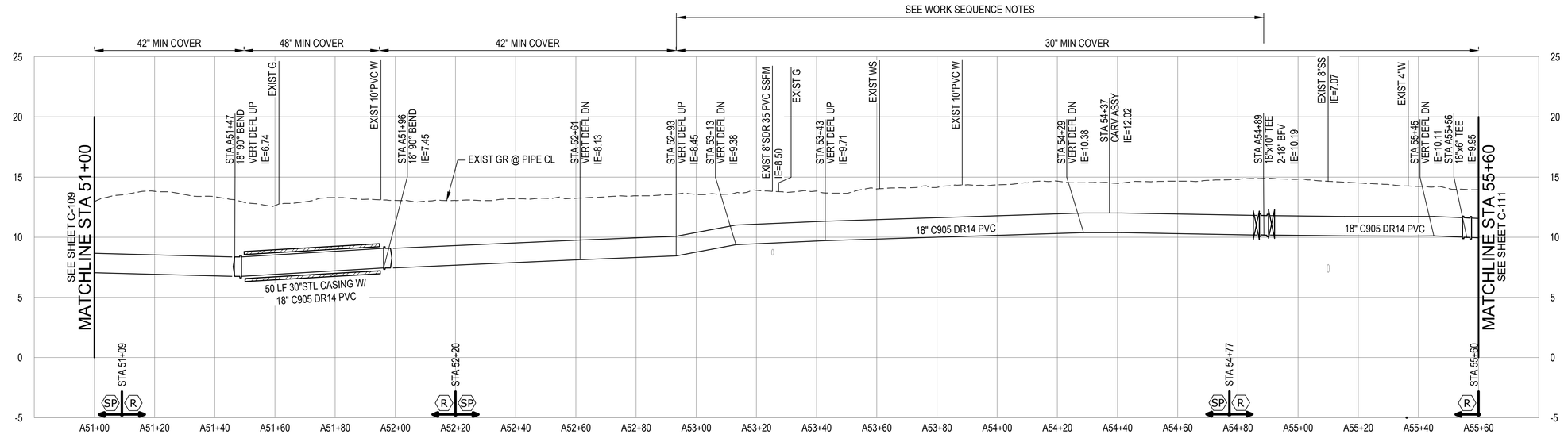
Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A46+40 TO STA A51+00

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-109
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

KEY NOTES

1. STA A51+47
   FURNISH & INSTALL:
   1-18" DI 90° BEND, MJ W/ TB
2. CONTRACTOR SHALL CONTACT NW NATURAL RESOURCE MANAGEMENT CENTER (503-220-2415), 7AM TO 5PM, AND SCHEDULE STAND-BY 24 HOURS BEFORE EXCAVATING WITHIN 5-FT OF EXIST GAS MAIN.
3. FURNISH & INSTALL:
   50 LF-30" STL CASING W/ 18" C905 DR14 PVC W, SEE DET 1, SHT C-503. CENTER STL CASING TO CENTERLINE OF FORT STEVENS HWY.
4. STA A51+98
   FURNISH & INSTALL:
   1-18" DI 90° BEND, MJ W/ TB
5. AC PVMT RESTORATION
   1,955 SF THIS SHT
6. FURNISH & INSTALL:
   20 LF CONC ENCASEMENT OF EXIST 8" SS, SEE DET 2, SHT C-504
7. STA A54+37
   FURNISH & INSTALL:
   1-CARV ASSY, SEE DET 2, SHT C-502
8. STA A55+56
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
9. COORDINATE ADJUSTMENT OF GAS UTILITY W/ NW NATURAL

WORK SEQUENCE NOTES:

1. THE WATER SYSTEM IMPROVEMENTS BETWEEN STA A52+93± TO A54+89± SHALL BE INSTALLED AS THE INITIAL WORK ACTIVITY. THIS SEGMENT OF THE WORK REQUIRES ARCHAEOLOGIST MONITORING OF EXCAVATION AND TRENCHING ACTIVITIES. THIS SEGMENT OF WORK SHALL BE INSTALLED, TESTED AND DISINFECTED. THE CUT-OFF VALVES WILL BE CLOSED TO ISOLATE IT FROM THE EXISTING 10-INCH WATER MAIN. THE WATER SHALL BE DRAINED FROM THE PIPE AND A TEMPORARY CAP INSTALLED.
2. UPON COMPLETION OF THE PREVIOUS WORK SEGMENT, THE WATERLINE INSTALLATION SHALL RESUME BEGINNING AT STA A10+00 AND PROCEEDING WEST/NORTH IN STATION ASCENDING ORDER. THE WATER SYSTEM IMPROVEMENTS SHALL BE INSTALLED, TESTED, DISINFECTED AND ACCEPTED IN LOGICAL SEQUENCE.
3. UPON REACHING THE TEMPORARY CAP INSTALLED IN STEP 1, THE TEMPORARY CAP SHALL BE REMOVED, WATERLINE CONNECTED, AND THE PIPE SEGMENT SHALL BE TESTED, DISINFECTED, AND ACCEPTED.
4. REFER TO SECTIONS 00 73 00, SPECIAL PROVISIONS, AND 01 12 16, WORK SEQUENCE, FOR ADDITIONAL INFORMATION.

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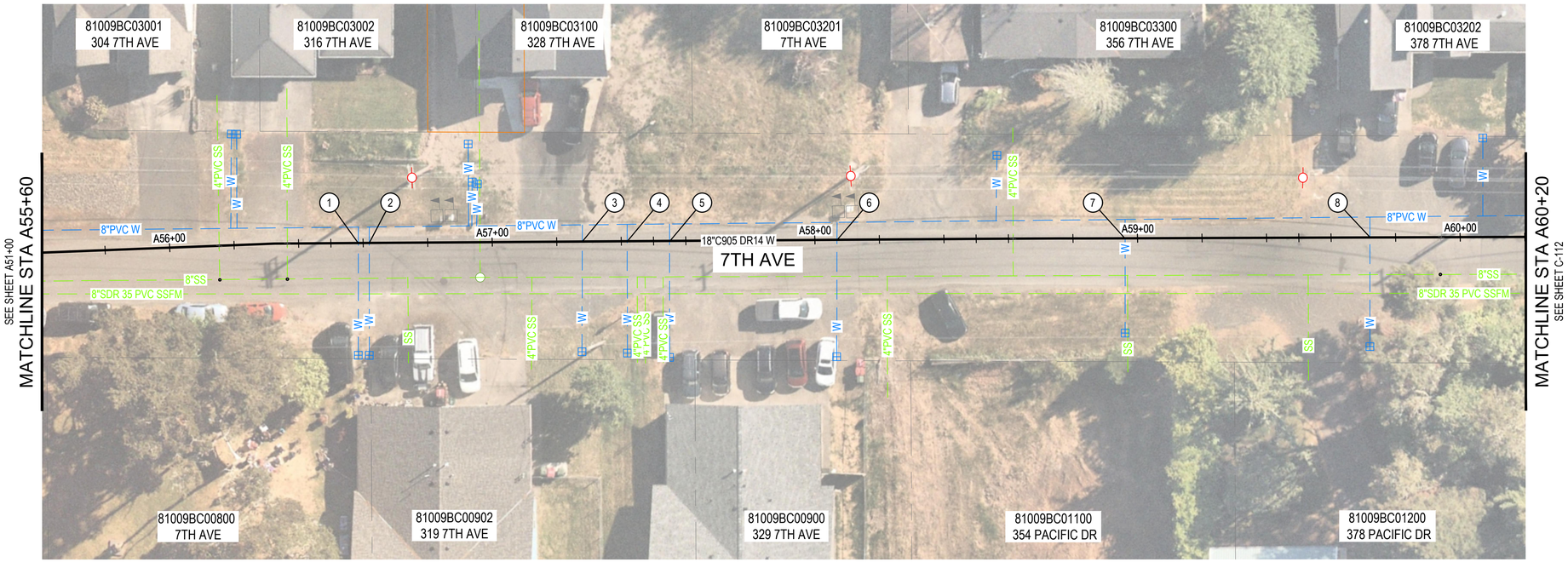
Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A51+00 TO STA A55+60

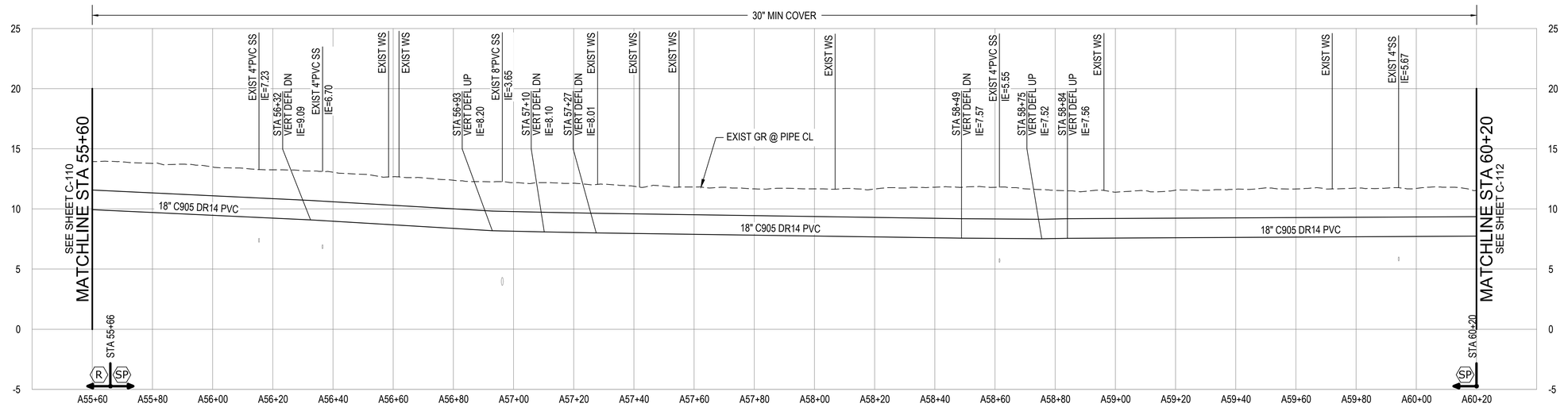
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-110
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A56+58 ADJUST EXIST WS OVER 18" W
2. STA A56+62 ADJUST EXIST WS OVER 18" W
3. STA A57+41 ADJUST EXIST WS OVER 18" W
4. STA A57+41 ADJUST EXIST WS OVER 18" W
5. STA A57+55 ADJUST EXIST WS OVER 18" W
6. STA A58+06 ADJUST EXIST WS OVER 18" W
7. STA A58+96 ADJUST EXIST WS OVER 18" W
8. STA A59+72 ADJUST EXIST WS OVER 18" W



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Consultant:

BID SET

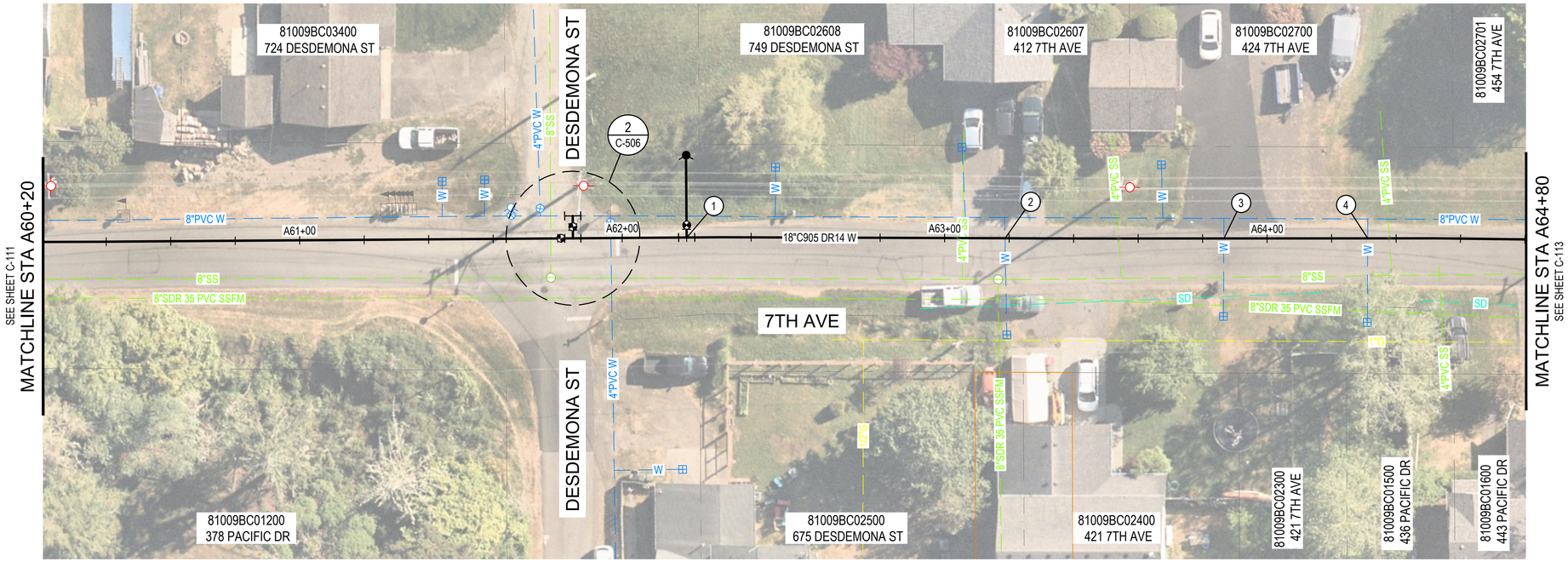
Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2020 ANDREW THOMAS MILES RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title: CIVIL
PLAN AND PROFILE
STA A55+60 TO STA A60+20

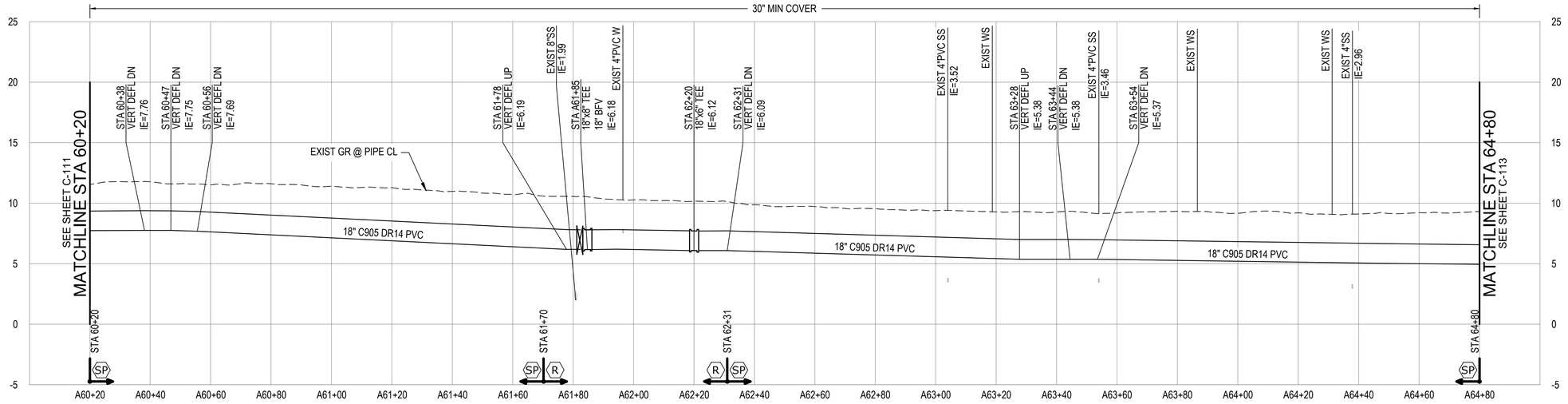
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-111
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A62+20
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
2. STA A63+09
   ADJUST EXIST WS OVER 18" W
3. STA A63+76
   ADJUST EXIST WS OVER 18" W
4. STA A64+21
   ADJUST EXIST WS OVER 18" W



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

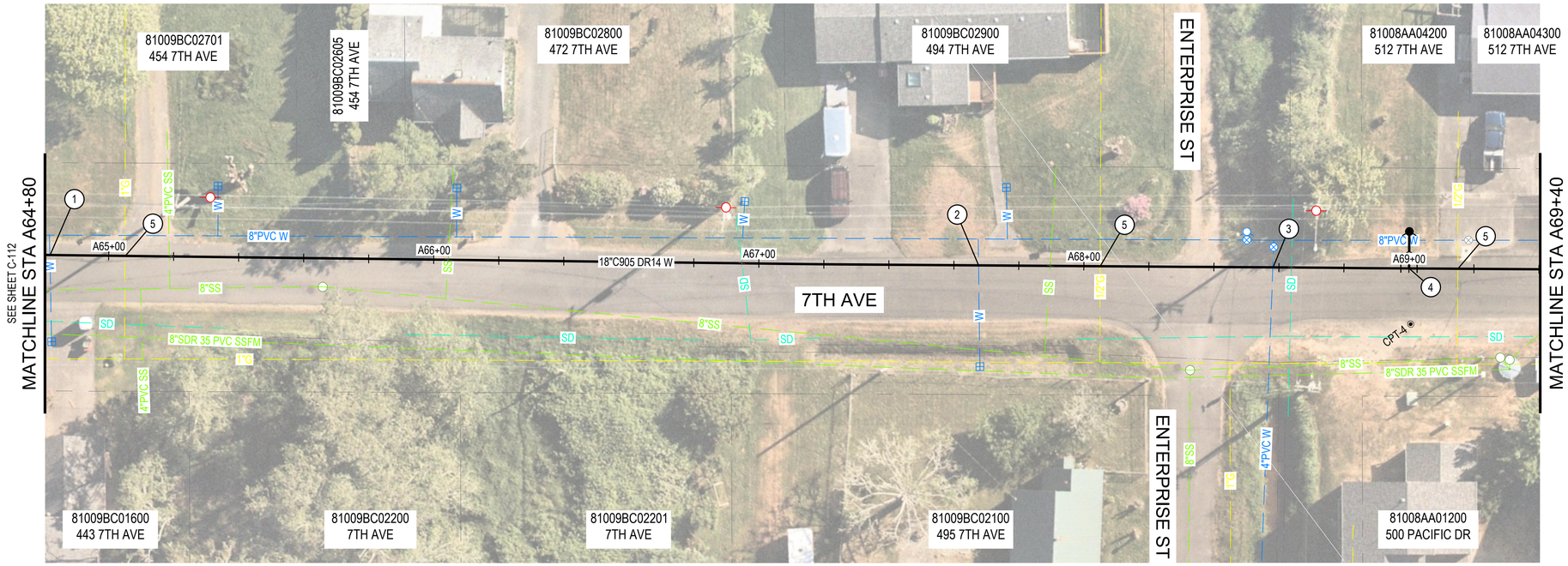
Client / Owner:
THE CITY OF WARRENTON
OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A60+20 TO STA A64+80

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-112
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

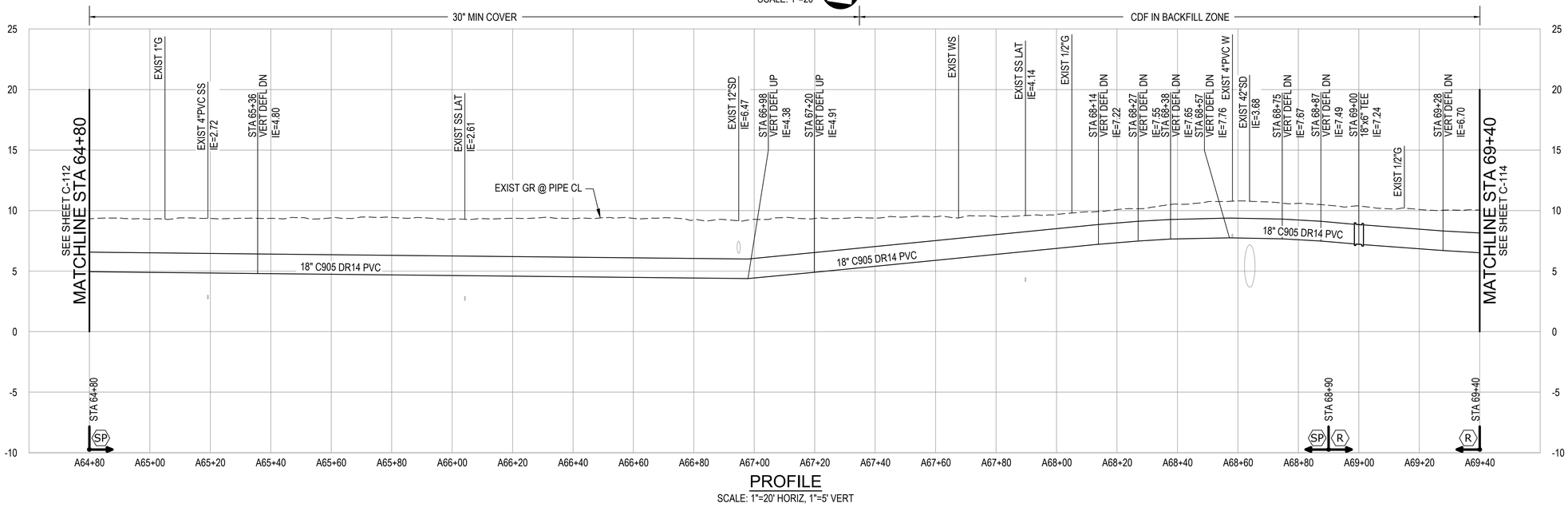
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-112.dwg, Plotted Date: March 4, 2025 1:40 PM By: Andy Miles



KEY NOTES

1. STA A67+57
   ADJUST EXIST WS OVER 18" W
2. STA A68+48
   ADJUST EXIST WS OVER 18" W
3. STA A68+58
   ADJUST EXIST 4"W OVER 18" W
4. STA A69+00
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
5. COORDINATE ADJUSTMENT OF GAS UTILITY WITH NW NATURAL

PLAN
SCALE: 1"=20'



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON
OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A64+80 TO STA A69+40

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-113

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

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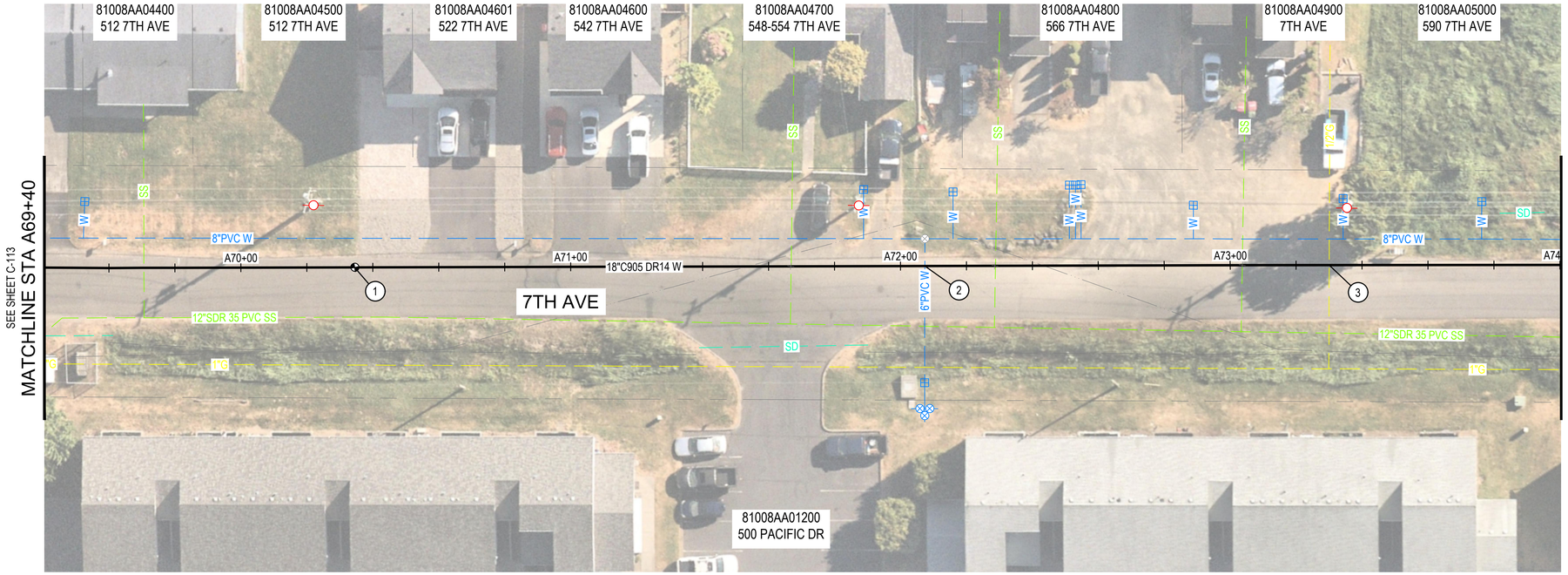
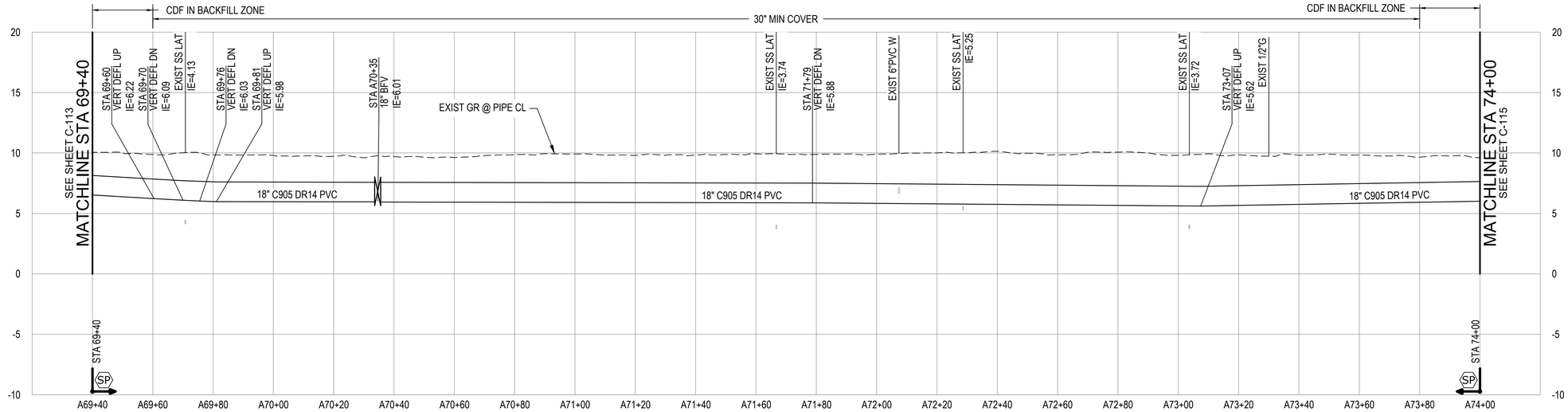


PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A70+35
   FURNISH & INSTALL:
   1-18" BFV, MJ
2. STA A71+97
   REALIGN EXIST 6" W BELOW 18" W
3. COORDINATE ADJUSTMENT OF GAS
   UTILITY WITH NW NATURAL



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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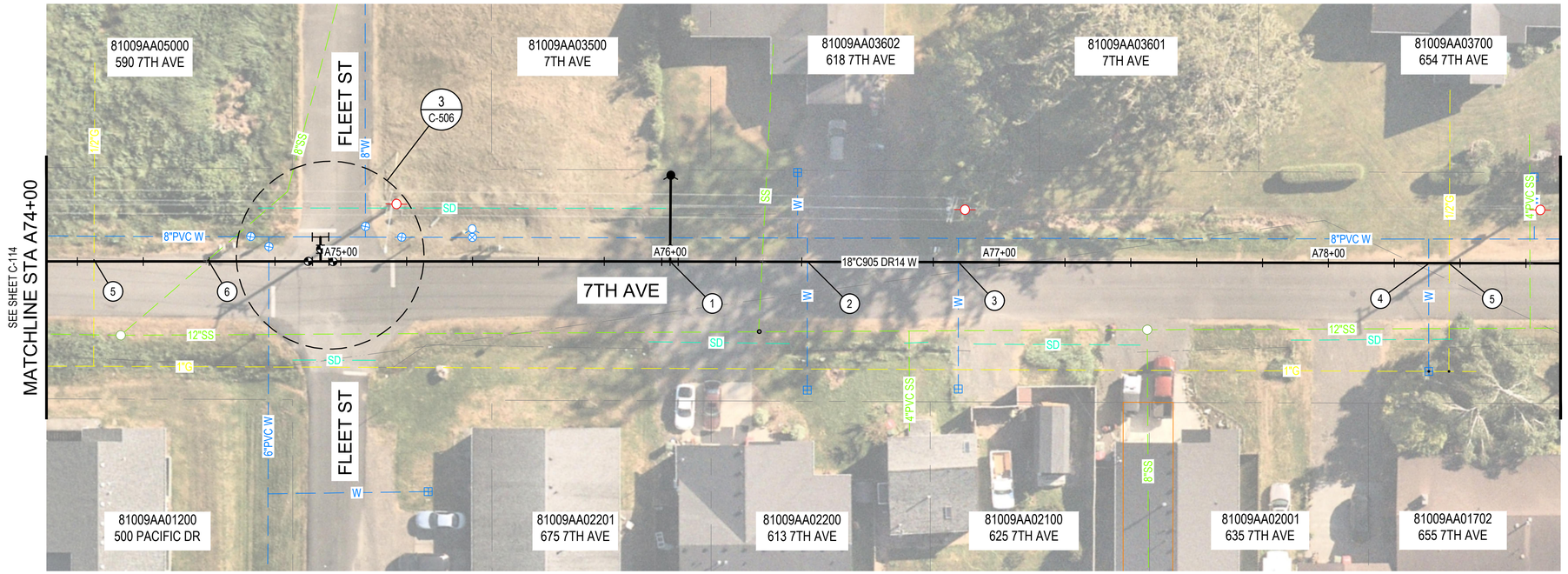
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A69+40 TO STA A74+00

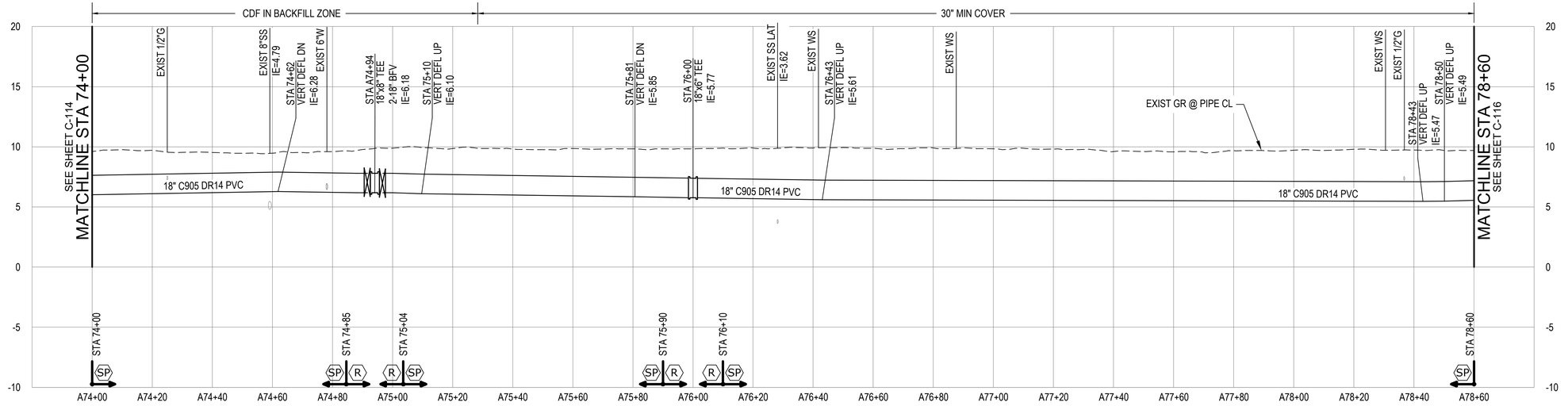
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-114
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A76+00
   FURNISH & INSTALL:
   1-18"x6" DI TEE, MJ
   1-FH ASSY, SEE DET 3, SHT C-503
2. STA A76+41
   ADJUST EXIST WS OVER 18" W
3. STA A76+87
   ADJUST EXIST WS OVER 18" W
4. STA A78+30
   ADJUST EXIST WS OVER 18" W
5. COORDINATE ADJUSTMENT OF GAS UTILITY WITH NW NATURAL
6. 20 LF CONC ENCASEMENT OF EXIST 8" SS, SEE DET 2, SHT C-504



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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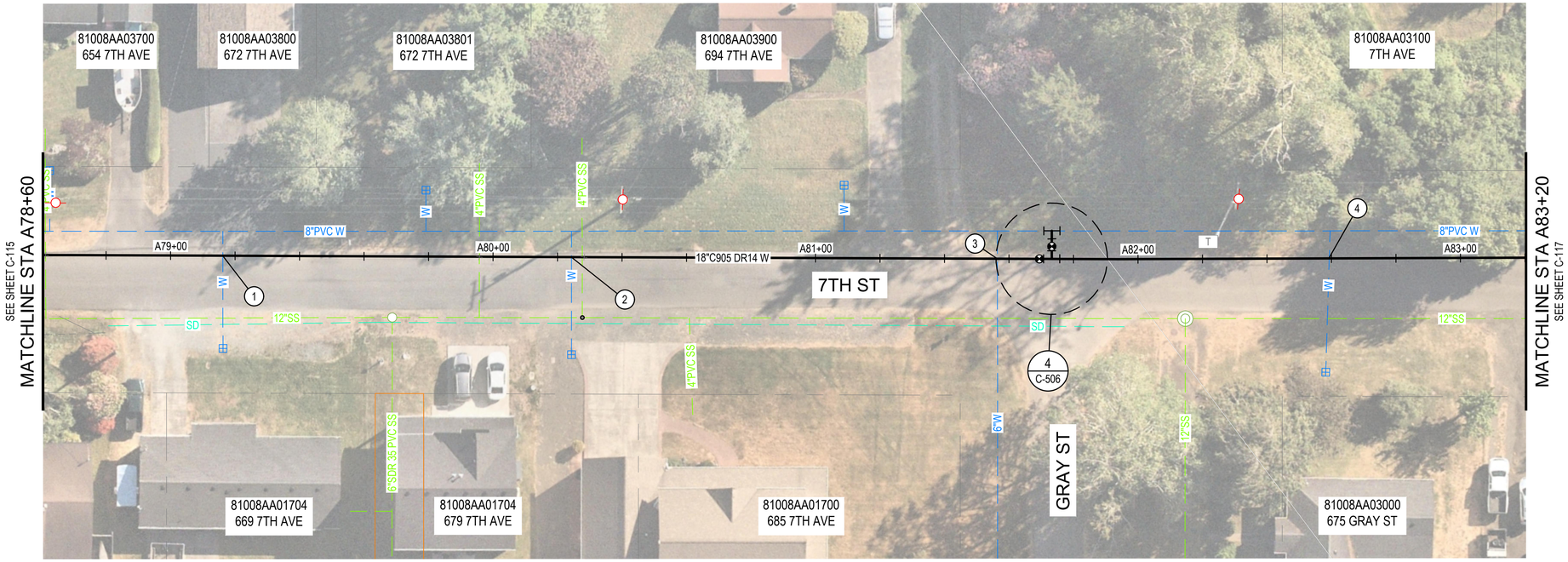
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A74+00 TO STA A78+60

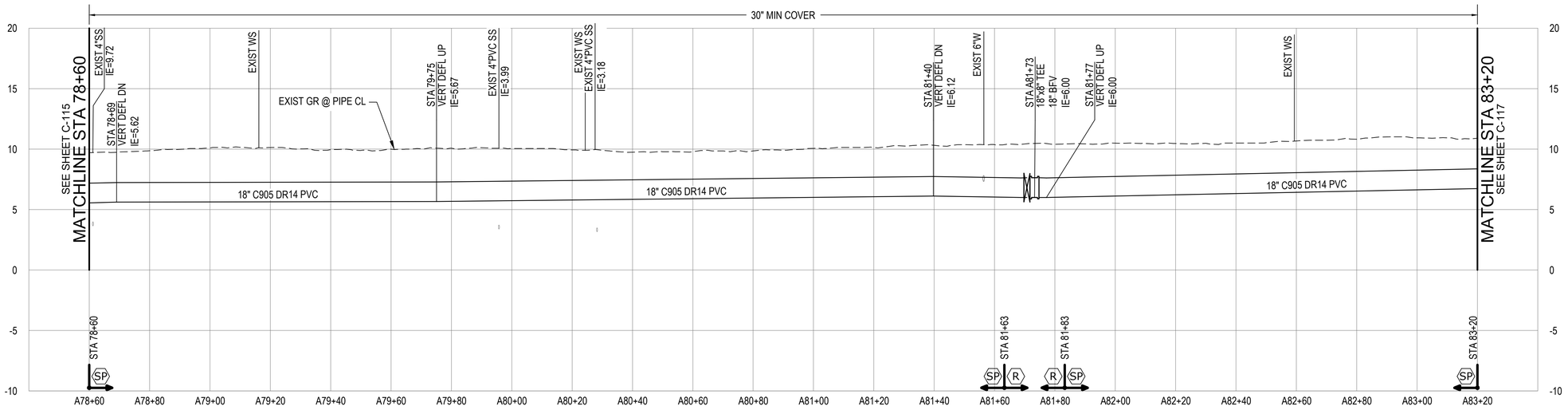
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-115
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A79+16
   ADJUST EXIST WS OVER 18" W
2. STA A80+24
   ADJUST EXIST WS OVER 18" W
3. STA A81+56
   ADJUST EXIST 6"W OVER 18" W
4. STA A82+59
   ADJUST EXIST WS OVER 18" W



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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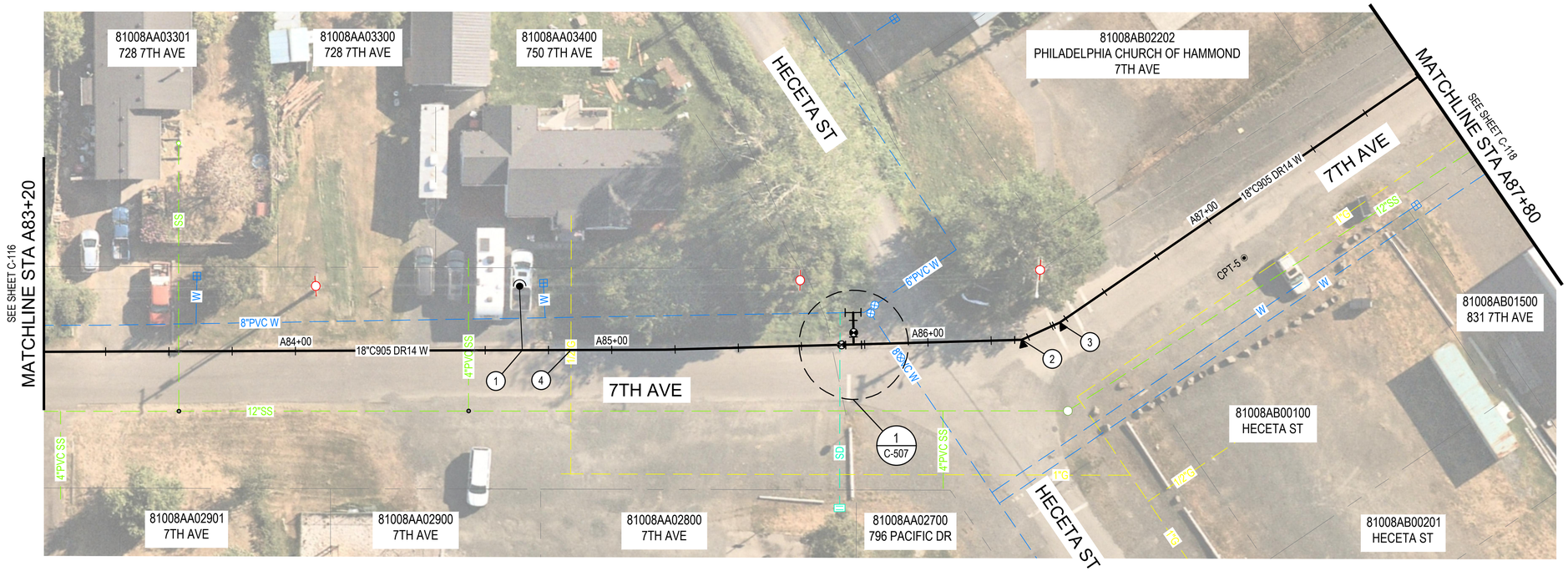
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A78+60 TO STA A83+20

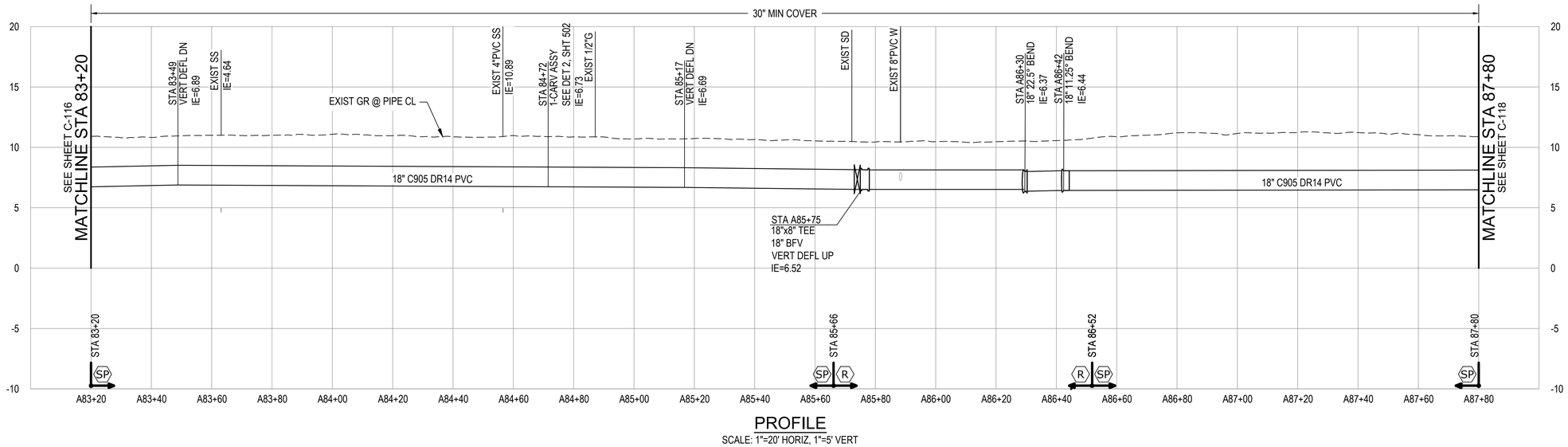
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-116
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA 84+72
   FURNISH & INSTALL:
   1-CARV ASSY, SEE DET 2, SHT C-502
2. STA A86+30
   FURNISH & INSTALL:
   1-18" 22.5° DI BEND, MJ W/ TB
3. STA A86+43
   FURNISH & INSTALL:
   1-18" 11.25° DI BEND, MJ W/ TB
4. COORDINATE ADJUSTMENT OF GAS UTILITY WITH NW NATURAL



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

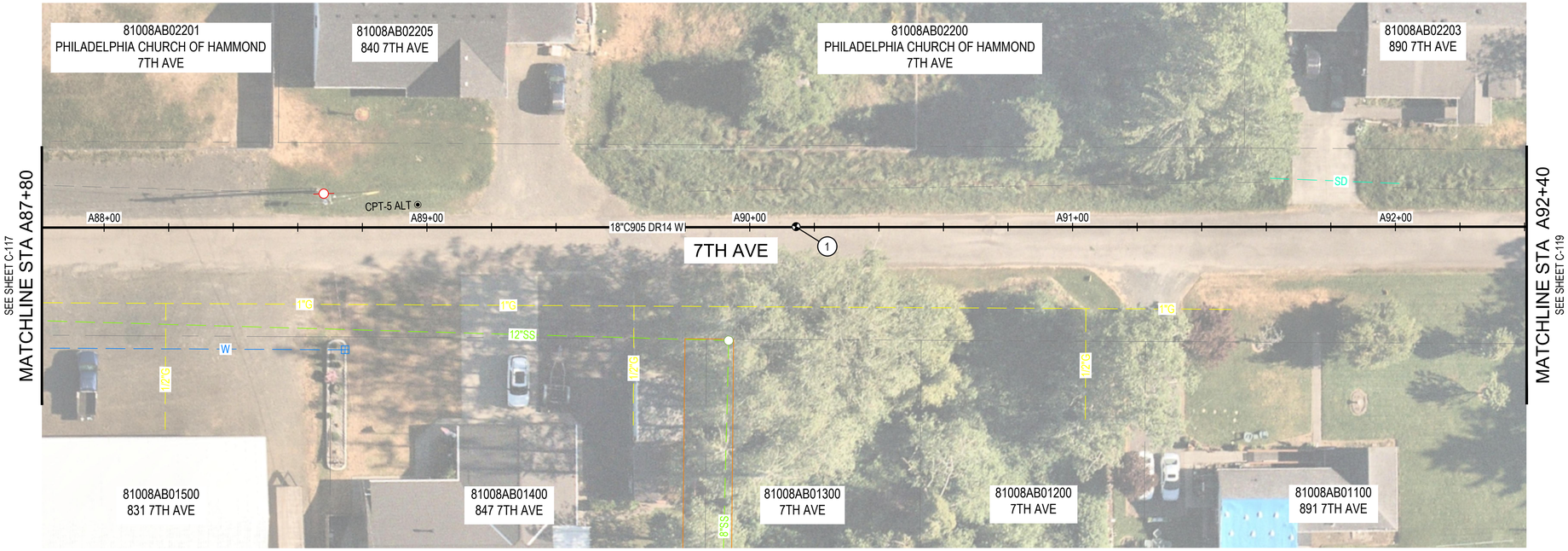
Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A83+20 TO STA A87+80

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-117
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

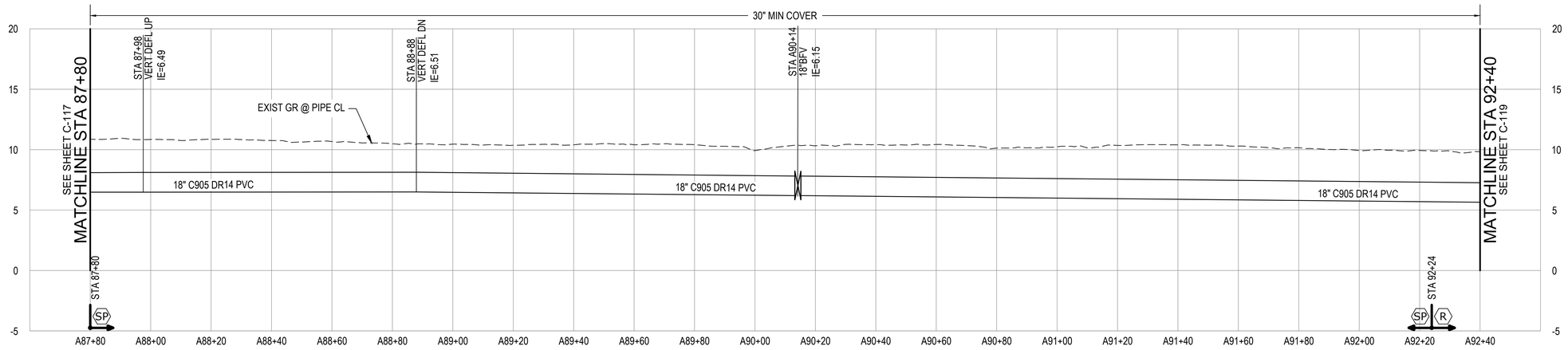
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-117.dwg, Plotted Date: March 4, 2025 1:47 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A90+14
FURNISH & INSTALL:
1-18" BFV, MJ



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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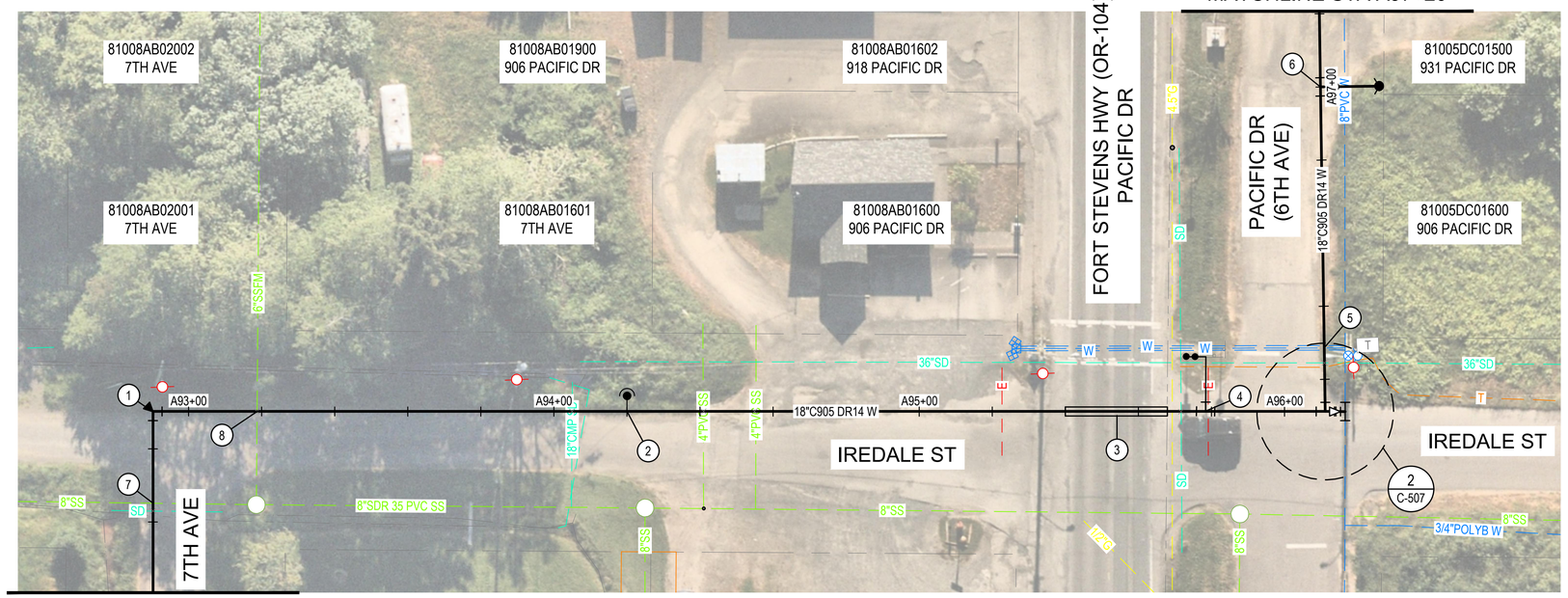
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A87+80 TO STA A92+40

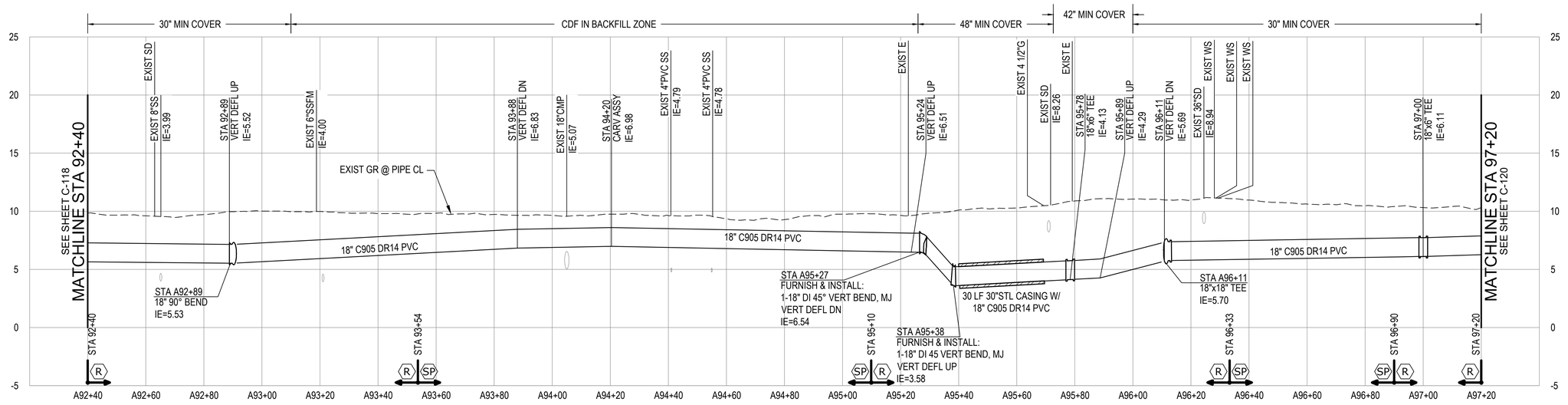
Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-118
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A92+90
   FURNISH & INSTALL:
   2-18" DI 45° BEND, MJ W/ TB
   ROTATE BEND AS REQ'D
2. STA A94+20
   FURNISH & INSTALL:
   1-CARV ASSY, SEE DET 2, SHT C-502
3. FURNISH & INSTALL:
   30 LF-30" STL CASING W/ 18" C905 DR14
   PVC W, SEE DET 1, SHT C-503
4. STA A96+11
   FURNISH & INSTALL:
   1-BO ASSY, SEE DET 1, SHT C-502
5. STA A96+28
   ADJUST EXIST WS OVER 18" W
6. FURNISH & INSTALL:
   STA A97+00
   1-18"x6" DI TEE, MJ
   1- FH ASSY, SEE DET 3, SHT C-503
7. FURNISH & INSTALL:
   20 LF CONC ENCASEMENT OF EXIST 8" SS,
   SEE DET 2, SHT C-504
8. FURNISH & INSTALL:
   20 LF CONC ENCASEMENT OF EXIST 6"
   SSFM, SEE DET 2, SHT C-504



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

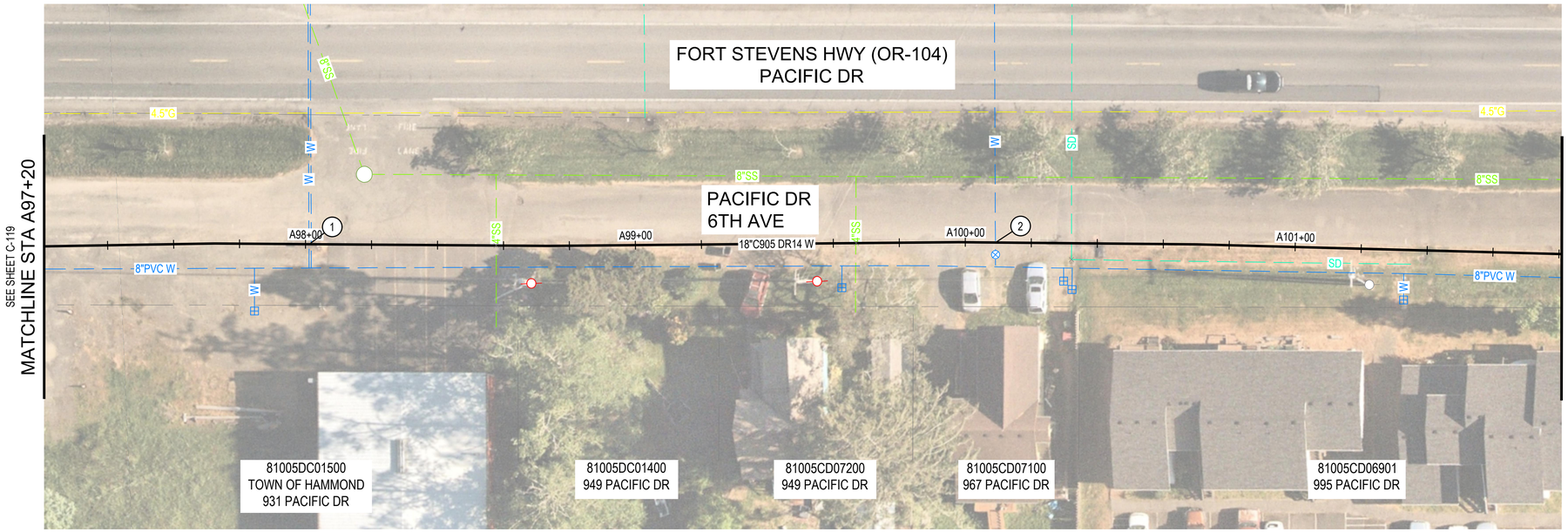
Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A92+40 TO STA A97+20

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-119
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

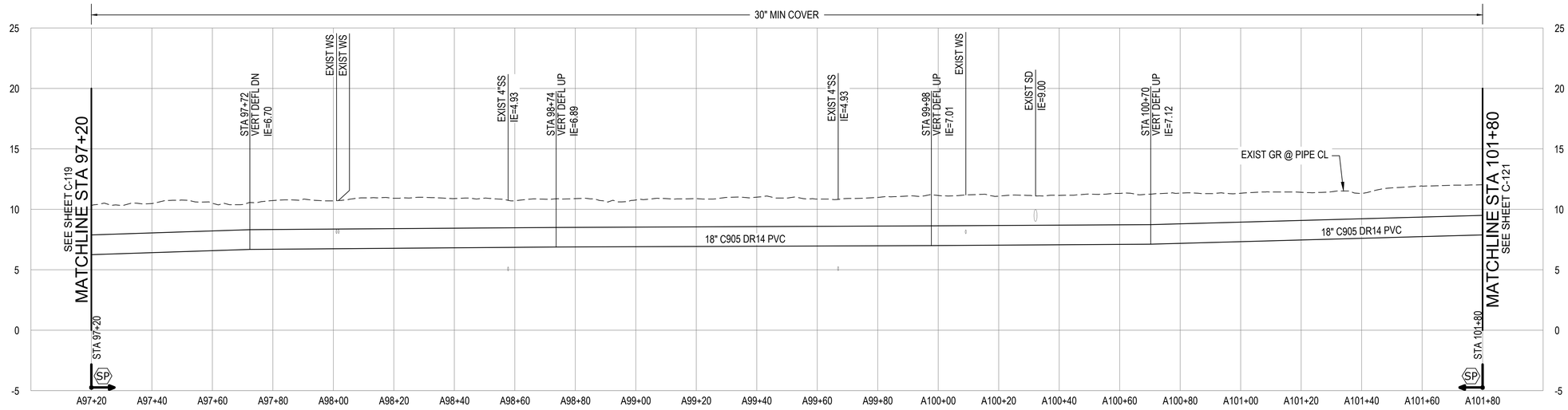
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-119.dwg, Plotted Date: March 4, 2025 1:50 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A98+01
   ADJUST EXIST WS OVER 18" W
2. STA A100+08
   ADJUST EXIST WS OVER 18" W



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

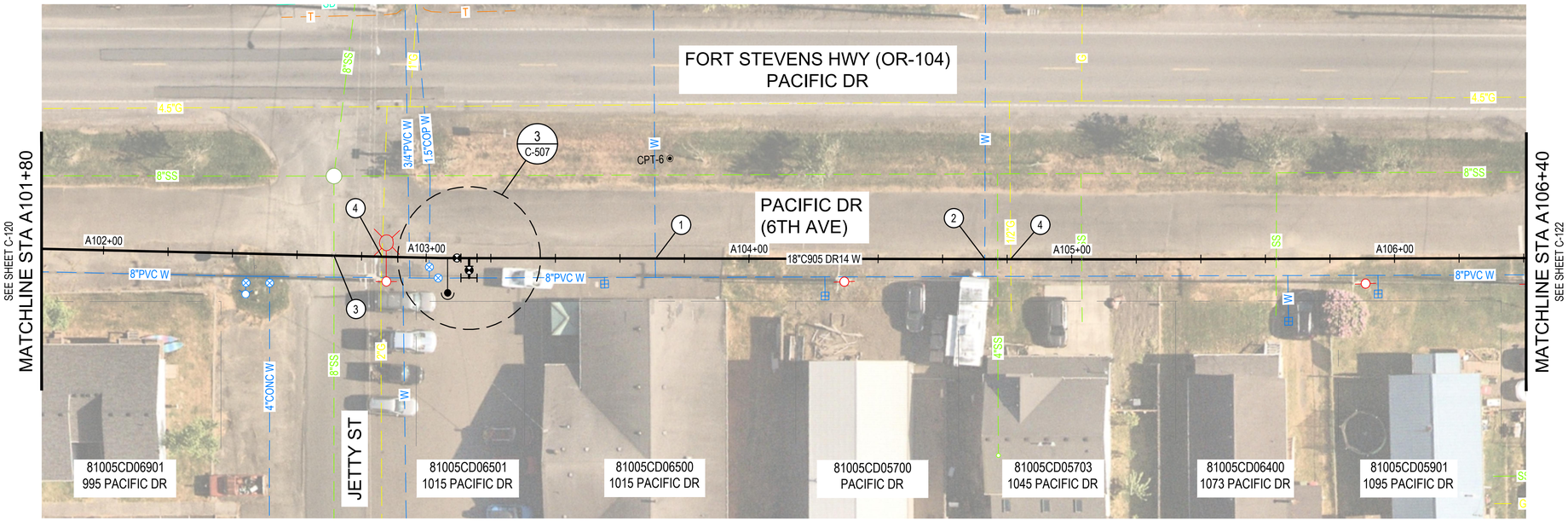
Client / Owner:
THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A97+20 TO STA A101+80

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-120
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

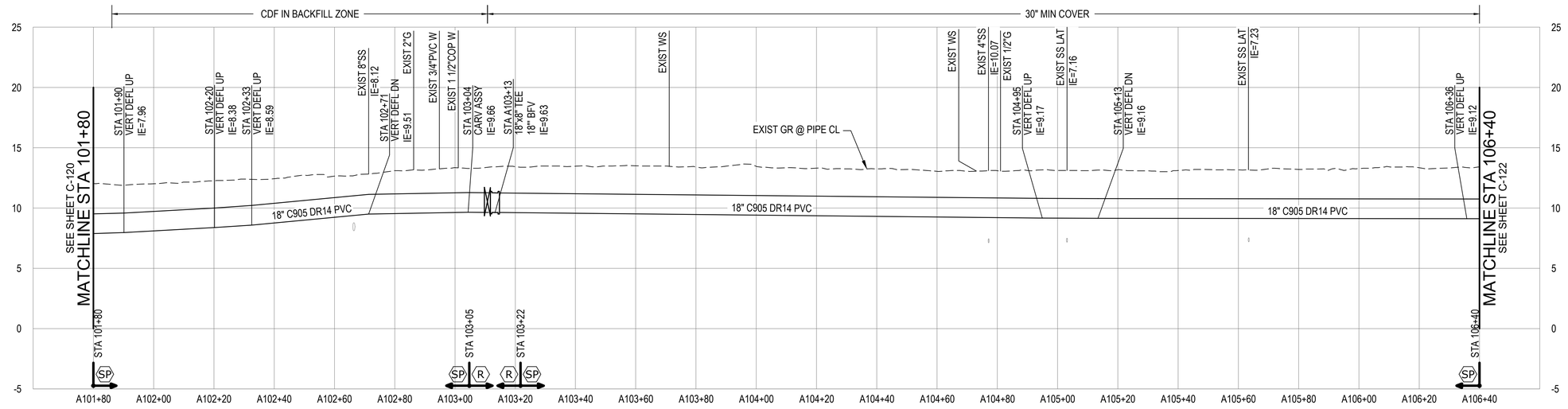
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-120.dwg, Plotted Date: March 4, 2025 1:52 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA 103+71
   ADJUST EXIST WS OVER 18" W
2. STA 104+73
   ADJUST EXIST WS OVER 18" W
3. FURNISH & INSTALL:
   20 LF CONC ENCASEMENT OF EXIST 8" SSFM, SEE DET 2, SHT C-504
4. COORDINATE ADJUSTMENT OF GAS UTILITY WITH NW NATURAL



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON
OREGON

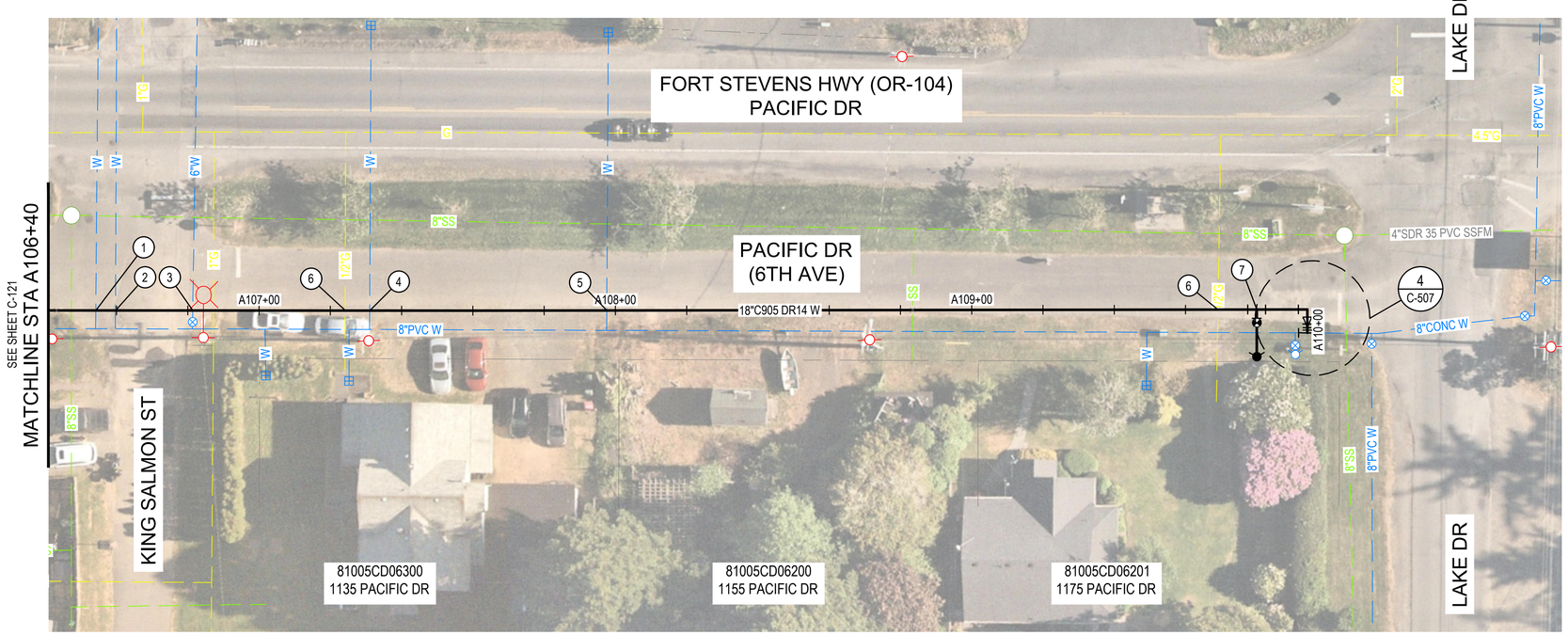
Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE
STA A101+80 TO STA A106+40

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-121

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

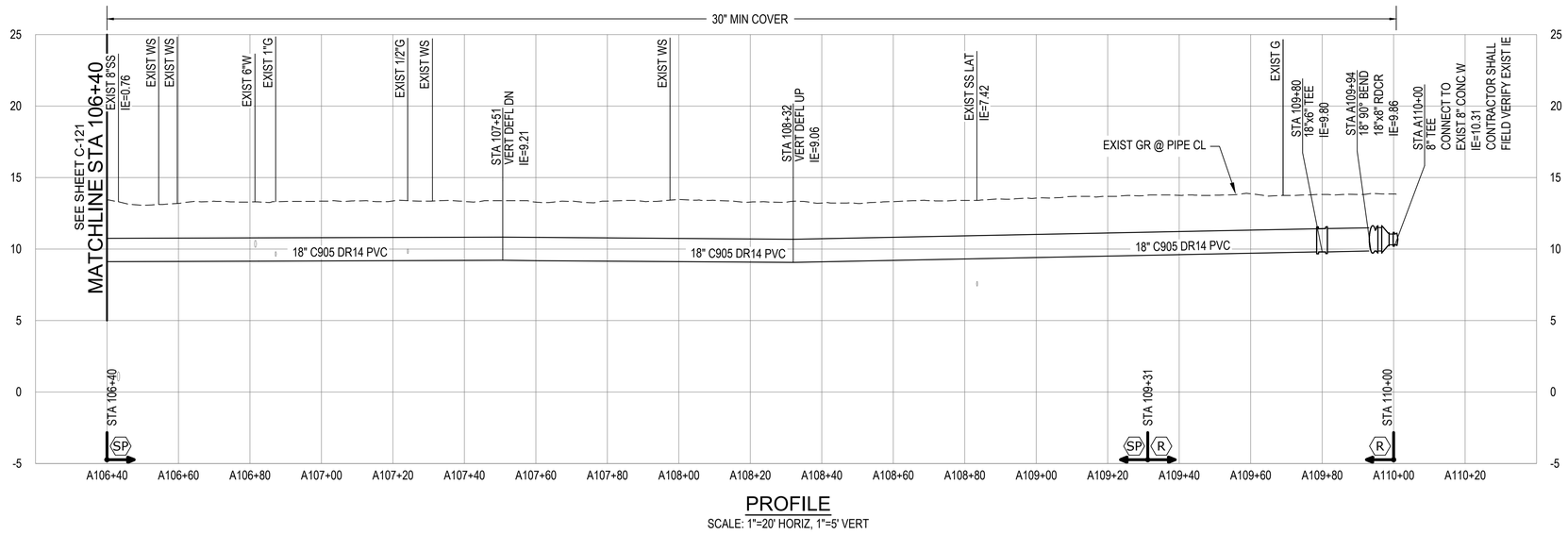
Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-121.dwg, Plotted Date: March 4, 2025 1:53 PM By: Andy Miles



PLAN
SCALE: 1"=20'

KEY NOTES

1. STA A106+53
   ADJUST EXIST WS OVER 18" W
2. STA A106+59
   ADJUST EXIST WS OVER 18" W
3. STA A106+82
   ADJUST EXIST 6"W OVER 18" W
4. STA A107+30
   ADJUST EXIST WS OVER 18" W
5. STA A107+97
   ADJUST EXIST WS OVER 18" W
6. COORDINATE ADJUSTMENT OF GAS UTILITY W/ NW NATURAL
7. FURNISH & INSTALL:
   STA A109+80
   1-18"x6" DI TEE, MJ
   1- FH ASSY, SEE DET 3, SHT C-503



PROFILE
SCALE: 1"=20' HORIZ, 1"=5' VERT

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Consultant:

BID SET

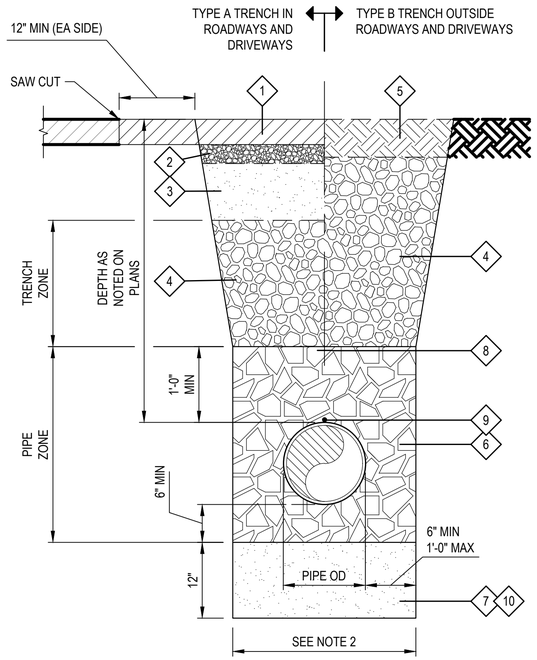
Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
PLAN AND PROFILE STA
A106+40 TO STA A110+00

Designed By: KJM	CONSOR Project No.: W231023OR
Drawn By: KJM	Issued On: MARCH 2025
Checked By: ATM	Drawing No.: C-122
Approved By: ATM	0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



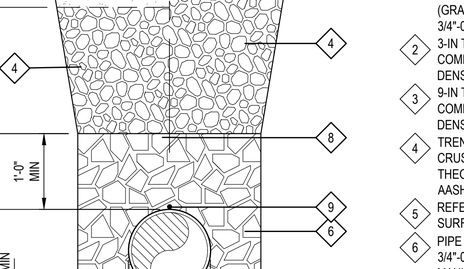
KEYNOTES

1. LEVEL 3, 1/2" MIX HMAC COMPACTED TO 92% MAXIMUM THEORETICAL DENSITY PER AASHTO T 209. MATCH EXISTING AC THICKNESS OR 8-IN, WHICHEVER IS GREATER. MAXIMUM AC BASE COURSE LIFTS SHALL BE 3-IN. MAXIMUM WEARING COURSE LIFTS SHALL BE 2-IN. FOR NON-AC (GRAVEL) ROADWAYS AND DRIVEWAYS, BRING 3/4"-0" CRUSHED ROCK BACKFILL TO GRADE.
2. 3-IN THICK CRUSHED SURFACING TOP COURSE COMPACTED TO 95% MAXIMUM THEORETICAL DENSITY PER AASHTO T-99.
3. 9-IN THICK CRUSHED SURFACING BASE COURSE COMPACTED TO 95% MAXIMUM THEORETICAL DENSITY PER AASHTO T-99.
4. TRENCH ZONE BACKFILL: USE CLASS B 3/4"-0" CRUSHED ROCK COMPACTED TO 95% MAXIMUM THEORETICAL DENSITY IN ACCORDANCE WITH AASHTO T-99.
5. REFER TO SURFACE RESTORATION PLANS FOR SURFACING REQUIREMENTS.
6. PIPE ZONE BEDDING AND BACKFILL: USE CLASS B 3/4"-0" CRUSHED ROCK COMPACTED TO 95% MAXIMUM THEORETICAL DENSITY IN ACCORDANCE WITH AASHTO T-99.
7. REMOVE UNSUITABLE MATERIAL AND INSTALL FOUNDATION MATERIAL PER SPECIFICATIONS (ENGINEER APPROVAL REQUIRED).
8. DETECTABLE MARKING TAPE
9. TRACER WIRE
10. IN AREAS OF HIGH GROUNDWATER, INSTALL CRUSHED ROCK DRAINAGE LAYER AND NON-WOVEN GEOTEXTILE BETWEEN SUBGRADE AND BOTTOM AND SIDES OF ROCK DRAINAGE LAYER. INSTALL DRAINAGE LAYER IN ACCORDANCE WITH GEOTECHNICAL RECOMMENDATIONS AND SPECIFICATIONS. ENGINEER APPROVAL REQUIRED.

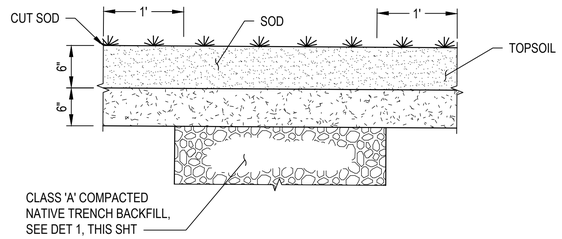
NOTES:

1. TRENCH BACKFILL SHALL BE PLACED IN HORIZONTAL LAYERS NO MORE THAN 6 INCHES THICK AND COMPACTED TO THE DENSITIES SPECIFIED.
2. MAX TRENCH WIDTH SHALL BE 18 INCHES PLUS 1.5 TIMES THE OUTSIDE DIA OF THE PIPE OR 30 INCHES, WHICHEVER IS GREATER, TYPICAL.
3. INSTALL DETECTABLE MARKING TAPE AS REQ'D.
4. INSTALL TRACER WIRE AS REQ'D.
5. BACKSLOPE TRENCH WALLS OR PROVIDE VERTICAL SHORING TO CONFORM WITH OSHA REQUIREMENTS.
6. COORDINATE FINAL RESTORATION LIMITS WITH OWNER.
7. SAND SEAL ALL ASPHALT JOINTS.

1 -- TYPICAL TRENCH SECTION
SCALE: NTS



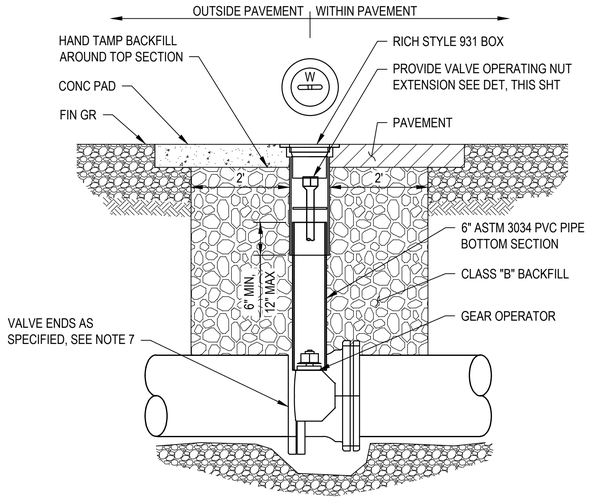
4 -- TYPICAL WATERLINE PLACEMENT
SCALE: NTS



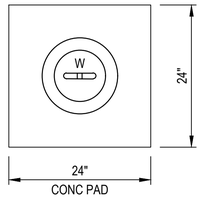
NOTES:

1. NON-PAVED SURFACES SHALL BE RESURFACED TO MATCH EXISTING. FINISH TRENCH SURFACE TO MATCH ORIGINAL CONTOURS. REPLACE EXIST LANDSCAPING.
2. CUT SOD WITH SOD HARVESTING EQUIPMENT AND STOCKPILE BESIDE TRENCH.
3. EXCAVATE TOPSOIL AND STOCKPILE BESIDE TRENCH, SEPARATE FROM SOD.
4. PROTECT EXIST WETLANDS AND GRASS AREAS WITH GEOTEXTILE BENEATH STOCKPILES.
5. FURNISH AND INSTALL CLASS "A" NATIVE TRENCH BACKFILL TO 1' BELOW FINISH GRADE COMPACTED TO 95% MAXIMUM DENSITY PER AASHTO T-99.
6. REPLACE TOPSOIL AND STOCKPILED SOD TO MATCH ORIGINAL LANDSCAPE AND CONTOURS.

2 -- TYPICAL WETLAND AND GRASS AREAS SURFACE RESTORATION
SCALE: NTS



5 -- VALVE BOX DETAIL
SCALE: NTS

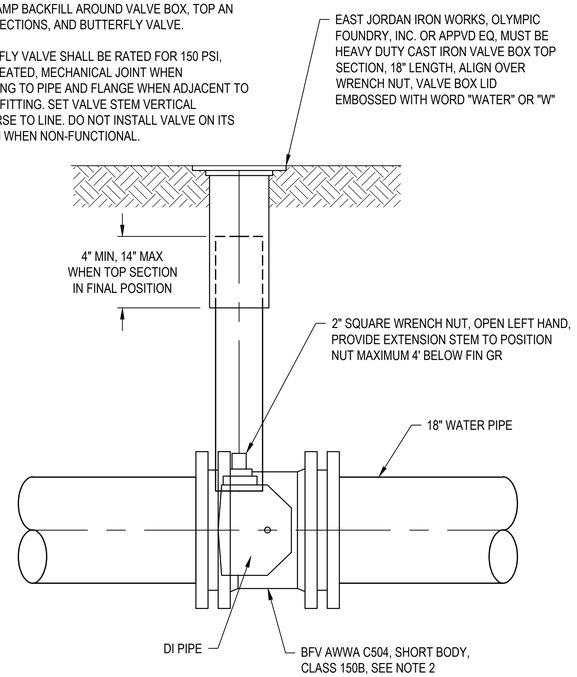


NOTES:

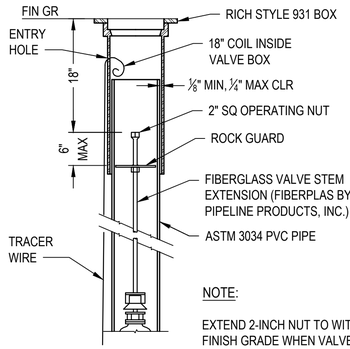
1. VALVE BOX NOT TO REST ON OPERATING ASSEMBLY.
2. OPERATING NUT EXTENSION REQUIRED WHEN VALVE NUT IS DEEPER THAN 3-FEET FROM FINISHED GRADE. SEE DETAIL 2, THIS SHEET.
3. CENTER VALVE BOX ON AXIS OF OPERATING NUT.
4. PROVIDE 24-INCH SQUARE BY 6-INCH THICK CONCRETE PAD AROUND VALVE BOX OUTSIDE OF PAVED AREAS AS SHOWN IN CONCRETE PAD DETAIL.
5. ORIENT GEAR OPERATOR TO CENTERLINE SIDE IN ROADWAYS.
6. USE CLASS B TRENCH BACKFILL A MINIMUM OF 2-FEET EACH SIDE OF VALVE.
7. COAT VALVE ENDS WITH WAX TAPE PER SPECS. WRAP VALVE AND PIPING WITH POLYETHYLENE TUBING.

NOTES:

1. HAND TAMP BACKFILL AROUND VALVE BOX, TOP AN BOTTOM SECTIONS, AND BUTTERFLY VALVE.
2. BUTTERFLY VALVE SHALL BE RATED FOR 150 PSI, RUBBER-SEATED, MECHANICAL JOINT WHEN CONNECTING TO PIPE AND FLANGE WHEN ADJACENT TO ANOTHER FITTING. SET VALVE STEM VERTICAL TRANSVERSE TO LINE. DO NOT INSTALL VALVE ON ITS SIDE EVEN WHEN NON-FUNCTIONAL.



3 -- BURIED BUTTERFLY VALVE DETAIL
SCALE: NTS



NOTE:

EXTEND 2-INCH NUT TO WITHIN 18" OF FINISH GRADE WHEN VALVE NUT IS DEEPER THAN 3-FEET FROM FINISHED GRADE.

6 -- OPERATING NUT EXTENSION DETAIL
SCALE: NTS

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY. 12, 2025 ANDREW THOMAS MILES RENEWS 12-31-26

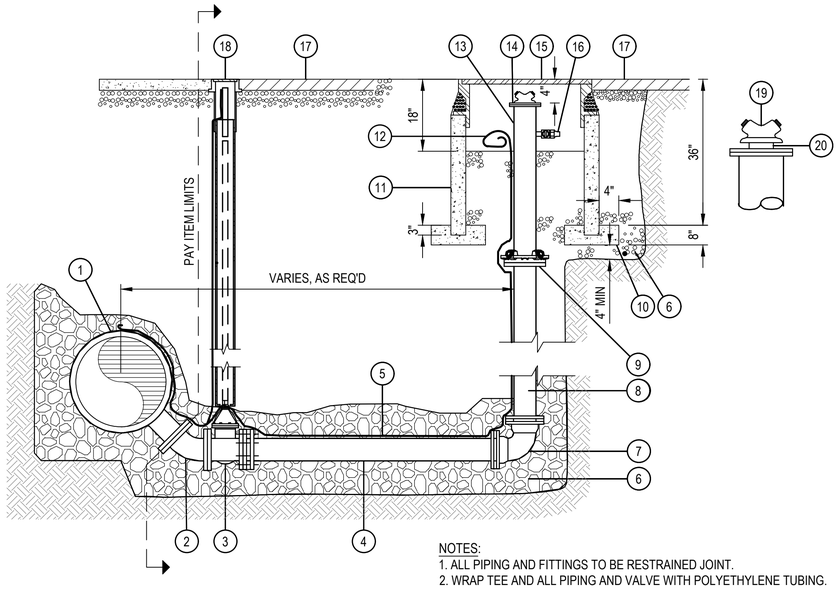
Client / Owner: THE CITY OF WARRENTON OREGON

Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title: CIVIL DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-501

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

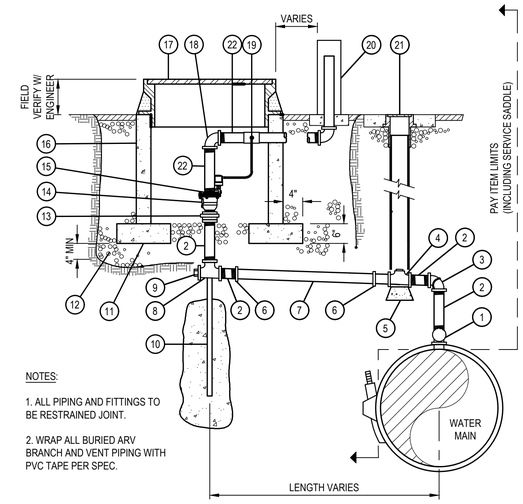


KEYNOTES

1. 18"x6" DI TEE, MJxFLG, ROTATED DOWN 45°
2. 6" 45° DI BEND, FLG
3. 6" GV, FLGxMJ
4. 6" DI W, PExPE, SLP UP @ 1%
5. TRACER WIRE
6. BFILL ¾"-0" CR COMPACTED TO 100% MAX DENSITY PER AASHTO T-99
7. 6" DI 90° BEND, MJ
8. 6" DI W, PExFLG
9. 6" DI FLG CPLG ADPTR
10. 3000 PSI CONC CONTINUOUS FOOTING
11. 24" CONC PIPE C-76 CLASS III
12. 18" COIL
13. 6" DI FLGxPE SPL (MIN 3' SPL LENGTH)
14. 6" DI BLIND FLG TAPPED FOR NPT CONNECTION
15. STD APWA 24" HEAVY DUTY MH COVER & FRAME, LOC IN FIELD AS APPVD BY ENGINEER
16. ¾" BALL CORP STOP
17. RESTORE SURFACE PER TYPICAL TRENCH SECTION
18. VALVE BOX, SEE DET 5, SHT C-501
19. 4"x2.5"x2.5" NPT ROOF MANIFOLD, MODEL IRC4025 BY DIXON VALVE OR APPVD EQ
20. 4" NPT BRASS NIPPLE

NOTES:
1. ALL PIPING AND FITTINGS TO BE RESTRAINED JOINT.
2. WRAP TEE AND ALL PIPING AND VALVE WITH POLYETHYLENE TUBING. COAT ALL FITTINGS WITH WAX TAPE PER SPECS.
3. BOND ALL PIPE AND JOINTS TO MAIN.
4. EXTEND TRACER WIRE INTO VALVE BOX AND MANHOLE.

1 -- 6" BLOW-OFF VALVE ASSEMBLY
SCALE: NTS

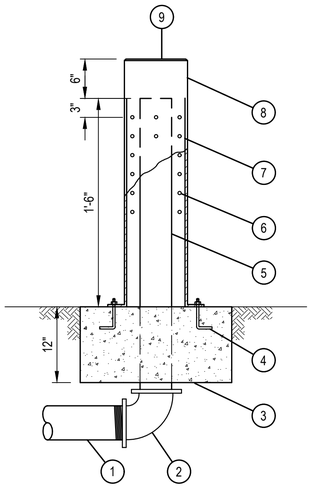


KEYNOTES

1. 2" CORP STOP AND SERVICE SADDLE
2. 2" BRONZE PIPE
3. 2" DOUBLE BRONZE 90° JOINT SWING
4. 2" GATE VALVE W/ 2" OPERATING NUT FIPTxFIPT
5. 8"x8"x8" CONC PIER BLOCK
6. 2" BRONZE TO HDPE ADAPTER
7. 2" HDPE DR7 PIPE, SLP UP TO VALVE @ 1% MIN
8. 2" BRONZE TEE
9. 2" BRONZE PLUG
10. 1" GALV SCH 40 PIPE, LENGTH TO PROVIDE 3-FT EMBEDMENT IN CONC & EXTEND TO AIR VALVE, STRAP TO 2" BRONZE PIPE RISER
11. 3000 PSI CONC CONTINUOUS FOOTING
12. BASE & BFILL ¾"-0" CR
13. 2" DIELECTRIC UNION, FIPTxFIPT
14. 2" COMBINATION AIR VALVE, DEZURIK MODEL APCO AVV-1800/1800K OR APPVD EQ
15. RING GASKET TO CONVERT NPSM TO NPT
16. 27" CONC PIPE C-76 CLASS III, LENGTH AS REQ'D
17. 24" STD MH FRAME & COVER
18. 2" 316 SSTL ELBOW
19. ¼" PEX-A TUBING TAPPED INTO 2" 316 SSTL PIPE
20. 6" STAND PIPE, SEE DTL, THIS SHT
21. VALVE BOX, SEE DTL X, THIS SHT
22. 2" 316 SSTL PIPE

NOTES:
1. ALL PIPING AND FITTINGS TO BE RESTRAINED JOINT.
2. WRAP ALL BURIED ARV BRANCH AND VENT PIPING WITH PVC TAPE PER SPEC.

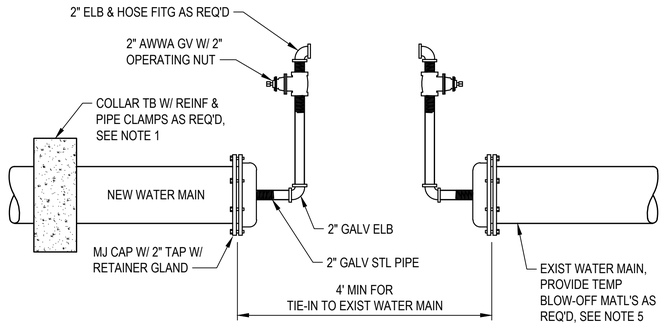
2 -- 2" COMBINATION AIR RELEASE VALVE ASSEMBLY
SCALE: NTS



KEYNOTES

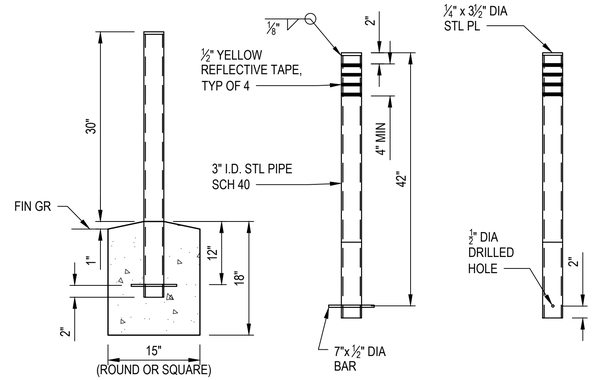
1. 2" 316 SSTL PIPE
2. 2" 316 SSTL ELBOW
3. 18"x18"x12" CONC SUPPORT PAD
4. ¾" 316 SSTL ANCHOR BOLTS (12" LONG) & NUTS, 4 TOTAL SPACED EVENLY
5. 316 SSTL PIPE W/ PLAIN END AT TOP
6. 6 COLUMNS OF 5-¾" HOLES, 3" MIN SPACING
7. TACKWELD ⅛" MESH 316 SST SCREEN INSIDE 6" PIPE TO COVER HOLES
8. 6" SCH 40x25" FAB STL PIPE W/ 11" DIA x ⅜" THK ANCHOR FLG
9. ¼" STL PLATE, WELL & GRIND BEVEL

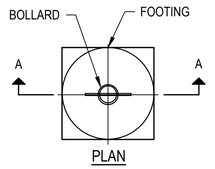
3 -- STANDPIPE DETAIL
SCALE: NTS



NOTES:
1. CONTRACTOR SHALL PROVIDE TEMPORARY THRUST RESTRAINTS AS REQ'D.
2. SEE SPECIFICATIONS REGARDING DISPOSAL/ DECHLORINATION OF SUPERCHLORINATED WATER.
3. PROVIDE LARGER BLOW-OFF PIPING MATERIAL AT CONTRACTOR'S OPTION.
4. WHERE BLOW-OFF IS TO BE REMOVED, CONTRACTOR SHALL CONDUCT OPERATIONS TO PREVENT SUBSEQUENT CONTAMINATION OF APPROVED DISINFECTED WATER MAIN.
5. PROVIDE TEMPORARY BLOW-OFF ON EXISTING WATER MAIN AS REQ'D TO FACILITATE TESTING AND DISINFECTION OF NEW MAINS. CONTRACTOR SHALL PROVIDE BACKFLOW PREVENTION DEVICE FOR TEMPORARY CONNECTION TO EXISTING WATER SYSTEM. CONTRACTOR SHALL DISINFECT EXISTING WATER MAIN PER REQ'S OF AWWA C651 DURING INSTALLATION OF TEMPORARY BLOW-OFF ASSEMBLY.

4 -- TEMPORARY BLOW-OFF ASSEMBLY
SCALE: NTS





BOLLARD NOTES:

1. CONCRETE FOOTINGS SHALL HAVE 15" MIN DIAMETER AND 3000 PSI MINIMUM 28 DAY COMPRESSIVE STRENGTH.

2. THREE (3) BOLLARDS SHALL BE PLACED AT EACH PROPOSED FIRE HYDRANT AND AIR RELEASE VALVE LOCATION. SPECIFIC BOLLARD ARRANGEMENTS SHALL BE AS DIRECTED IN THE FIELD BY ENGINEER.

5 -- NON-REMOVABLE BOLLARD
SCALE: NTS

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY. 12, 2025 ANDREW THOMAS MILES RENEWS 12-31-26

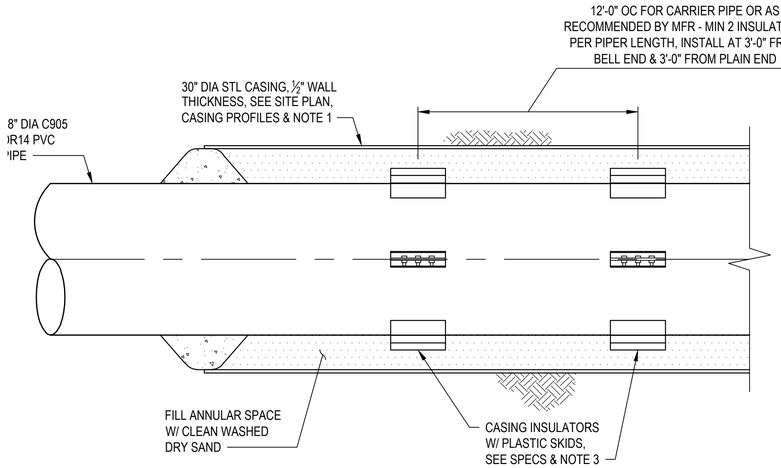
Client / Owner: THE CITY OF WARRENTON OREGON

Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

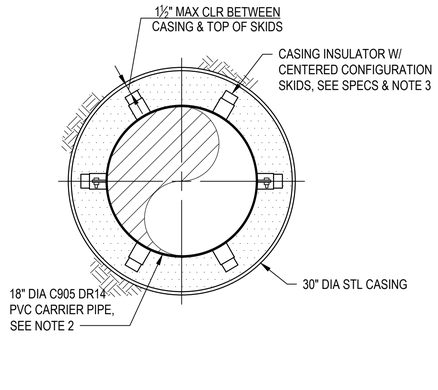
Drawing Title: CIVIL DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-502

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



END DETAIL

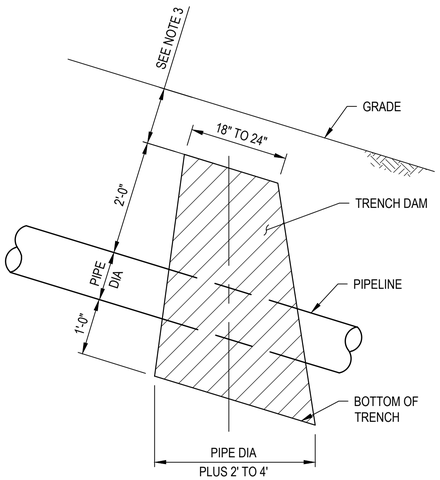


SECTION

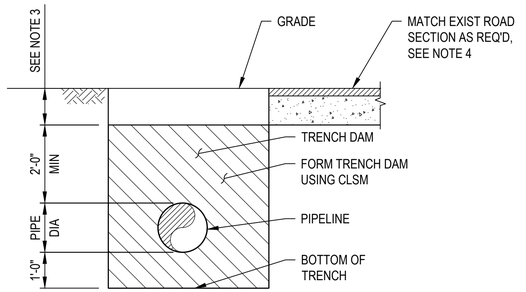
NOTES:

1. NEW 30" ASTM A252 STEEL CASING. SEE SPECIFICATIONS.
2. PROVIDE 4" MINIMUM CLEARANCE BETWEEN CASING AND CARRIER PIPE BELLS AND APPURTENANCES.
3. CONTRACTOR TO VERIFY CASING SIZE PRIOR TO ORDERING AND SIZING CASING INSULATORS.
4. ALL CARRIER PIPE TO BE RESTRAINED, C905 DR14 PVC.

1 -- CASING DETAIL
SCALE: NTS



ELEVATION

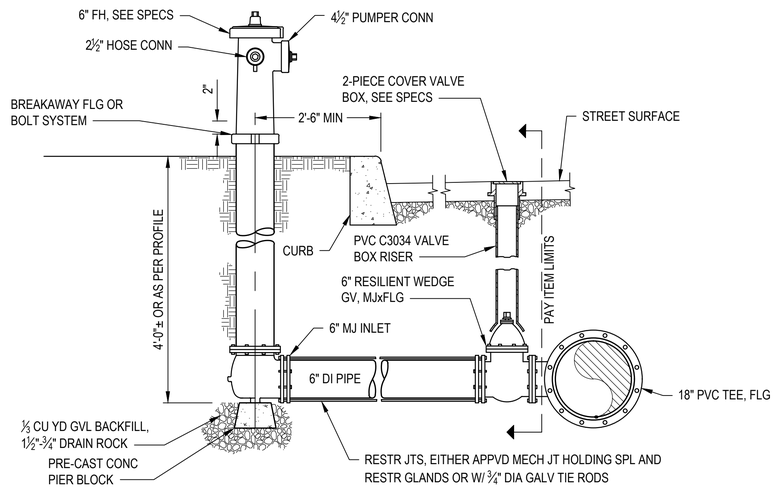


SECTION

NOTES:

1. CONSTRUCT TRENCH DAMS WITH CSLM.
2. APPROXIMATE LOCATION OF TRENCH DAMS ARE SHOWN ON PLAN SHEETS. COORDINATE EXACT LOCATION WITH FIELD ENGINEER.
3. FORM AND POUR CLSM UP TO BOTTOM OF EXIST ROAD BASE ELEVATION.
4. ALLOW CLSM TO CURE SUFFICIENTLY BEFORE RE-OPENING ROAD TO TRAFFIC. WHERE SUFFICIENT CURE TIME IS NOT POSSIBLE, PROVIDE STEEL SHEETING OVERNIGHT TO PLATE AFFECTED ROAD/TRENCH SECTION, AS APPROVED BY CITY INSPECTOR.

2 -- TRENCH DAM SECTION
SCALE: NTS



3 -- 6" FIRE HYDRANT ASSY
SCALE: NTS

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2020 ANDREW THOMAS MILES RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

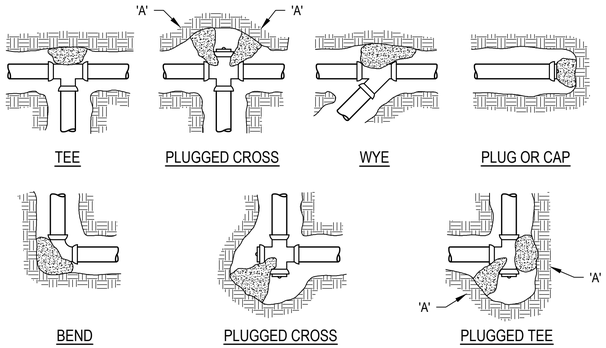
Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title: CIVIL DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-503

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-503.dwg, Plotted Date: March 4, 2025 1:56 PM By: Andy Miles



TEE | PLUGGED CROSS | WYE | PLUG OR CAP

BEND | PLUGGED CROSS | PLUGGED TEE

BEARING AREA, 'A', OF THRUST BLOCKS IN SQUARE FEET*							
FITTING SIZE	TEE, WYE, PLUG OR CAP	90° BEND, PLUGGED CROSS	TEE PLUGGED ON RUN		45° BEND	22° BEND	11° BEND
	A	A	A_1	A_2	A	A	A
4	1.4	1.9	2.7	1.9	1.0	-	-
6	2.8	4.0	5.6	4.0	2.1	1.1	-
8	4.8	6.8	9.6	6.8	3.7	1.9	0.9
10	7.3	10.3	14.5	10.3	5.6	2.8	1.4
12	10.3	14.5	20.4	14.5	7.9	4.0	2.0
14	13.8	19.5	27.5	19.5	10.6	5.4	2.7
16	17.8	25.2	35.5	25.2	13.6	7.0	3.5
18	22.4	31.7	44.7	31.7	17.1	8.7	4.4
20	27.5	38.9	54.8	38.9	21.0	10.7	5.4
24	39.2	55.5	78.3	55.5	30.0	15.3	7.7

NOTES:

1. CONCRETE THRUST BLOCKING SHALL BE POURED AGAINST UNDISTURBED EARTH.

2. KEEP CONCRETE CLEAR OF JOINT AND ACCESSORIES. INSTALL ISOLATION MATERIAL BETWEEN PIPE AND/OR FITTINGS BEFORE POURING BLOCKING.

3. THE REQUIRED THRUST BEARING AREAS FOR SPECIAL CONNECTIONS ARE SHOWN ENCIRCLED ON THE PLANS; e.g. 15 INDICATES 15 SQUARE FEET BEARING AREA REQUIRED.

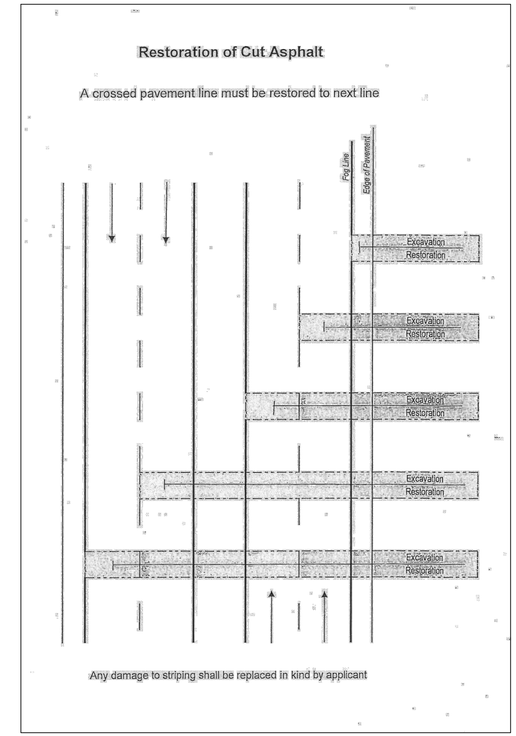
4. IF NOT SHOWN ON PLANS, REQUIRED BEARING AREAS AT FITTING SHALL BE AS INDICATED IN TABLE, ADJUSTED IF NECESSARY, TO CONFORM TO THE TEST PRESSURE(S) AND ALLOWABLE SOIL BEARING STRESS(ES) STATED IN THE SPECIFICATIONS.

5. BEARING AREAS AND SPECIAL BLOCKING DETAILS SHOWN ON PLANS TAKE PRECEDENCE OVER BEARING AREAS AND BLOCKING DETAILS SHOWN ON THIS DETAIL.

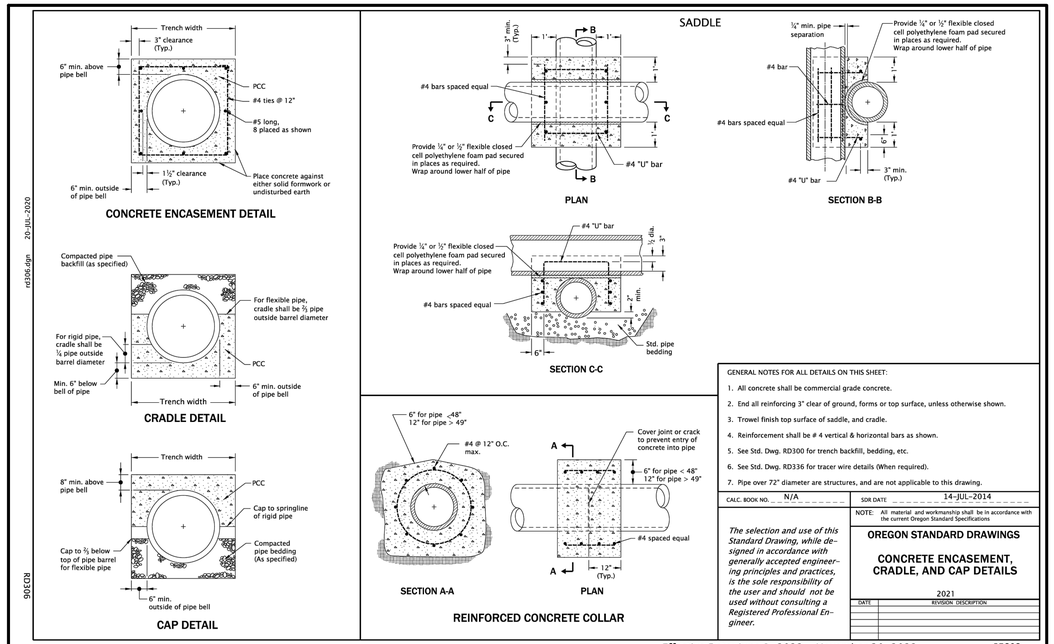
6. CONCRETE SHALL BE 3000 PSI MINIMUM 28 DAY COMPRESSIVE STRENGTH.

7. BEARING AREAS WHERE EXISTING PIPE WILL BE ABANDONED IN PLACE, AS SHOWN ON PLAN, SHALL INCLUDE ½" STEEL PLATE AT THE BASE OF THE THRUST BLOCK. THE MINIMUM BEARING AREA OF THE STEEL PLATE SHALL BE BASED ON DATA FROM THE TABLE.

1 -- STANDARD THRUST BLOCK DETAILS
SCALE: NTS



3 -- RESTORATION OF CUT ASPHALT
SCALE: NTS



2 -- CONCRETE ENCASEMENT
SCALE: NTS

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2020 ANDREW THOMAS MILES RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title: CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title: CIVIL DETAILS

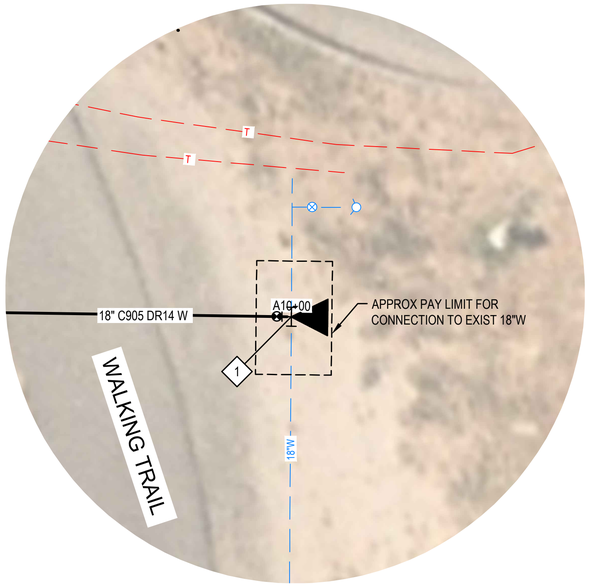
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-504

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-504.dwg, Plotted Date: March 4, 2025 1:57 PM By: Andy Miles

KEY NOTES

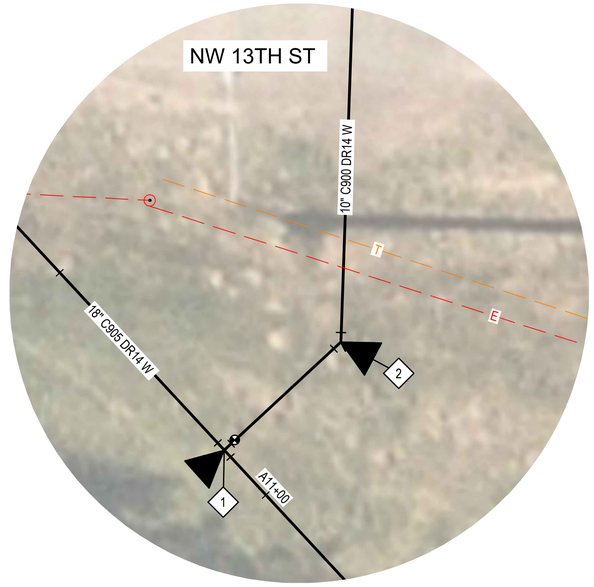
1. STA A10+00
   FURNISH & INSTALL:
   1-18" TEE MJ, W/ TB
   1-18" BFV, MJ (W)
   CONNECT TO EXIST 18"W



1 C-101 NW 13TH ST
EXIST 18" W CONNECTION
SCALE: 1"=5'

KEY NOTES

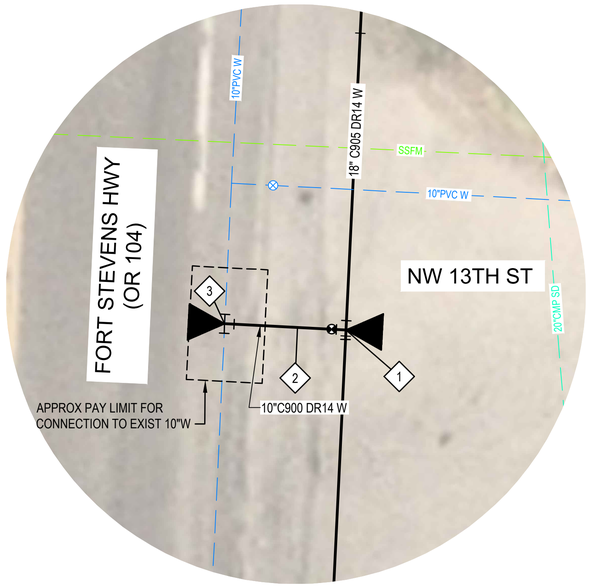
1. STA A11+04
   FURNISH & INSTALL:
   1-18"x10" DI TEE, MJ W/ TB
   1-10" DI GV, MJ (NE)
   50 LF-10" C900 DR14 PVC W, RESTR
2. FURNISH & INSTALL:
   1-10" DI 45 BEND, MJ W/ TB
   49 LF 10" C900 DR14 PVC W, RESTR



2 C-101 NW 13TH ST
EXIST 10" W CONNECTION
SCALE: 1"=5'

KEY NOTES

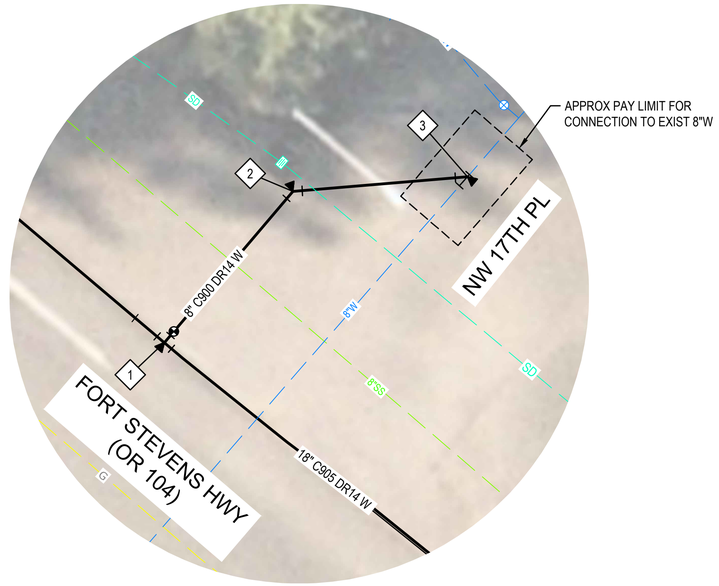
1. STA A24+20
   FURNISH & INSTALL:
   1-18"x10" DI TEE, MJ W/ TB
   1-10" GV, MJ (W)
2. FURNISH & INSTALL:
   8 LF-10" C900 DR14 PVC WATERLINE, RESTR
3. FURNISH & INSTALL:
   1-10" DI TEE, MJ W/ TB
   2-10" CPLG
   CONNECT TO EXIST 10"W



3 C-104 NW 13TH ST & FORT STEVENS HWY
EXIST 10" W CONNECTION
SCALE: 1"=5'

KEY NOTES

1. STA A43+37
   FURNISH & INSTALL:
   1-18"x8" DI TEE, MJ W/ TB
   1-8" GV, MJ (NE)
   14 LF-8" C900 DR14 PVC W, RESTR
2. FURNISH & INSTALL:
   1-8" 45° DI BEND, MJ, W/ TB
   11 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI WYE, MJ, W/ TB
   2-8" CPLG
   CONNECT TO EXIST 8"W



4 C-108 NW 17TH PL & FORT STEVENS HWY
EXIST 8" W CONNECTION
SCALE: 1"=5'

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Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2020
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
WATER CONNECTION DETAILS

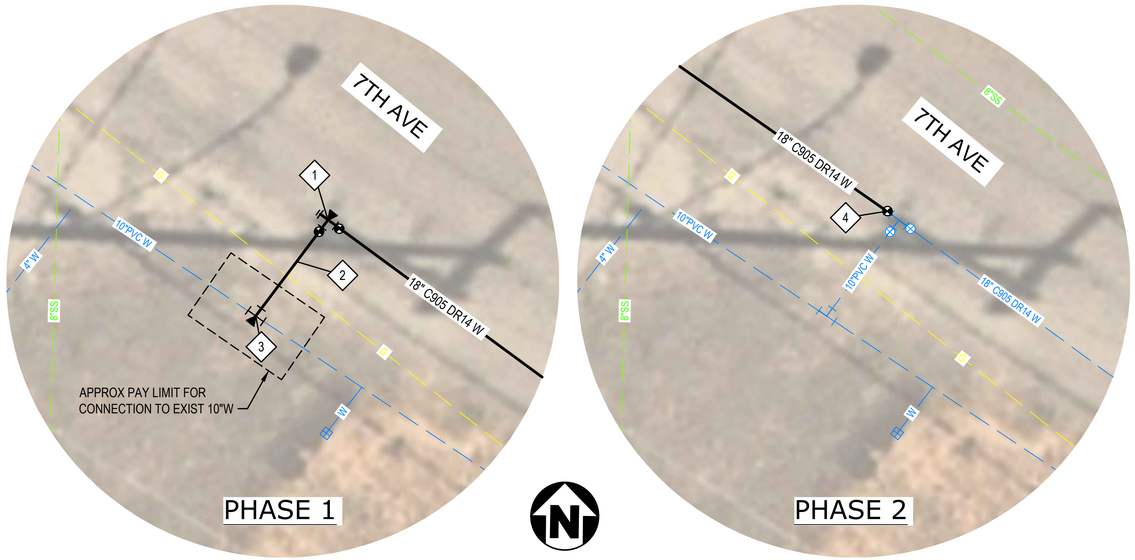
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-505

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_WW\231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-505.dwg, Plotted Date: March 4, 2025 1:58 PM By: Andy Miles

KEY NOTES

1. STA A54+89
   FURNISH & INSTALL:
   1-18"x10" TEE, MJ, W/ TB
   1-18" DI BFV, MJ (SE)
   1-10" DI GV, MJ (SW)
   1-18" BLIND FLG, MJ (NW)
2. FURNISH & INSTALL:
   8 LF-10" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-10" DI TEE, MJ, W/ TB
   2-10" CPLG
   CONNECT TO EXIST 10" W
4. STA A54+89
   REMOVE EXIST 18" BLIND FLG
   FURNISH & INSTALL:
   1-18" DI BFV, MJ
   BEGIN 18" C905 PVC W (PHASE 2)



1 C-110 PHASE 1 & PHASE 2 CONNECTION
SCALE: 1"=5'

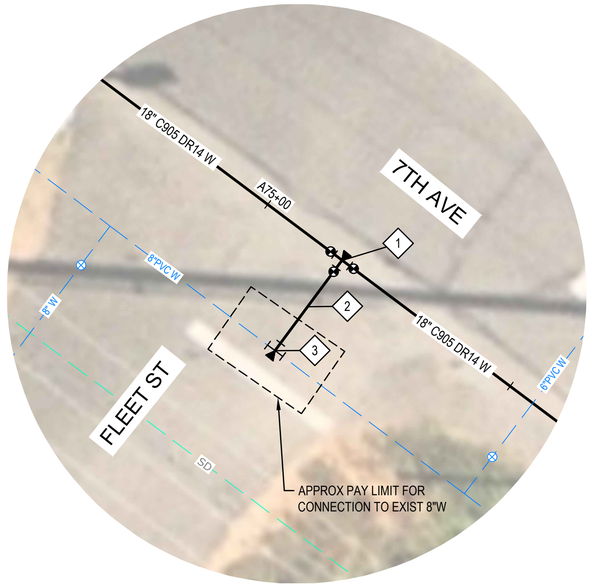
KEY NOTES

1. STA A61+83
   FURNISH & INSTALL:
   1-18"x8" DI TEE, MJ
   1-18" DI BFV, MJ (SE)
   1-10" DI GV, MJ (SW)
2. FURNISH & INSTALL:
   7 LF 8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ
   2-8" CPLG
   CONNECT TO EXIST 8" W

2 C-112 7TH AVE & DESDEMONA ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

KEY NOTES

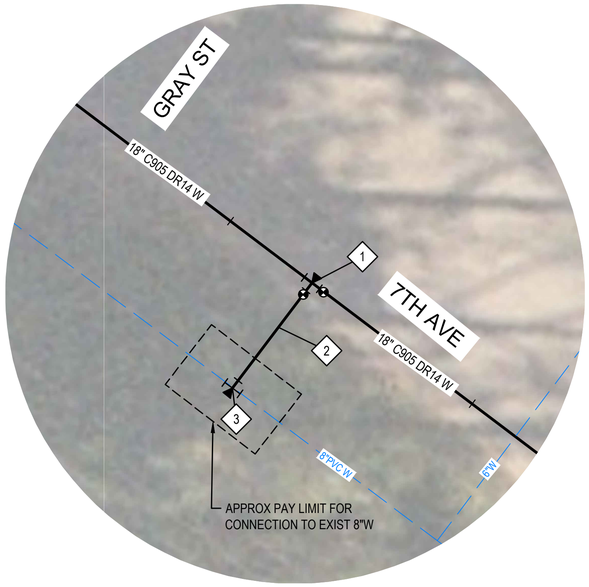
1. STA A74+94
   FURNISH & INSTALL:
   1-18"x8" DI TEE, MJ, W/ TB
   2-18" DI BFV, MJ (SE, NW)
   1-8" DI GV, MJ (SW)
2. FURNISH & INSTALL:
   8 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ, W/ TB
   2-8" CPLG
   CONNECT TO EXIST 8" W



3 C-115 7TH AVE & FLEET ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

KEY NOTES

1. STA A81+73
   FURNISH & INSTALL:
   1-18"x8" DI TEE, MJ, W/ TB
   1-18" BFV, MJ (SE)
   1-8" GV, MJ (SW)
2. FURNISH & INSTALL:
   9 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ, W/ TB
   2-8" CPLG
   CONNECT TO EXIST 8" W



4 C-116 7TH AVE & GRAY ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

consor

This document, ideas, and designs incorporated herein, are an instrument of professional service, and is not to be used, in whole or in part, for any other project without the written authorization of CONSOR.

Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2025
ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner:
THE CITY OF WARRENTON
OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
WATER CONNECTION DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM

CONSOR Project No.: W231023OR
Issued On: MARCH 2025
Drawing No.: C-506
0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

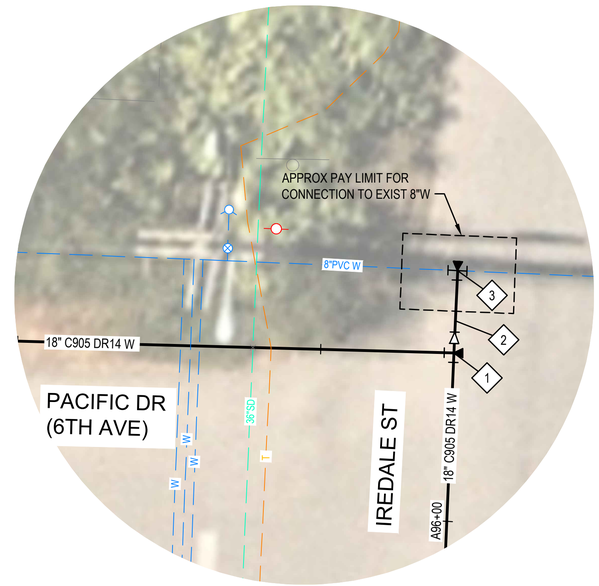
KEY NOTES

1. STA A39+73
   FURNISH & INSTALL:
   1-18"x10" DI TEE, MJ, W/ TB
   1-18" BFV, MJ (SE)
   1-10" GV, MJ (SW)
2. FURNISH & INSTALL:
   49 LF 10" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ, W/ TB
   1-10"x18" RDCR, MJ (NE)
   2-8" CPLG
   CONNECT TO EXIST 8" W

1 C-117 7TH AVE & HECETA ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

KEY NOTES

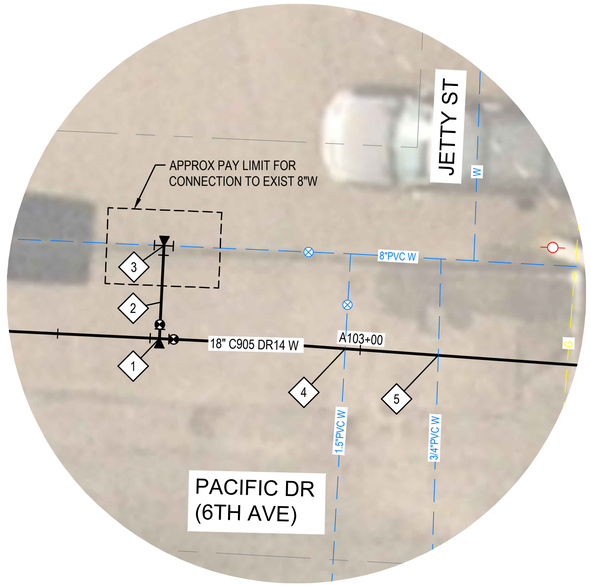
1. STA A96+11
   FURNISH & INSTALL:
   1-18"x18" DI TEE, MJ
   1-18"x8" RDCR, MJ (N)
2. FURNISH & INSTALL:
   7 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ
   2-8" CPLG
   CONNECT TO EXIST 8" W



2 C-119 PACIFIC DR & IREDALE ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

KEY NOTES

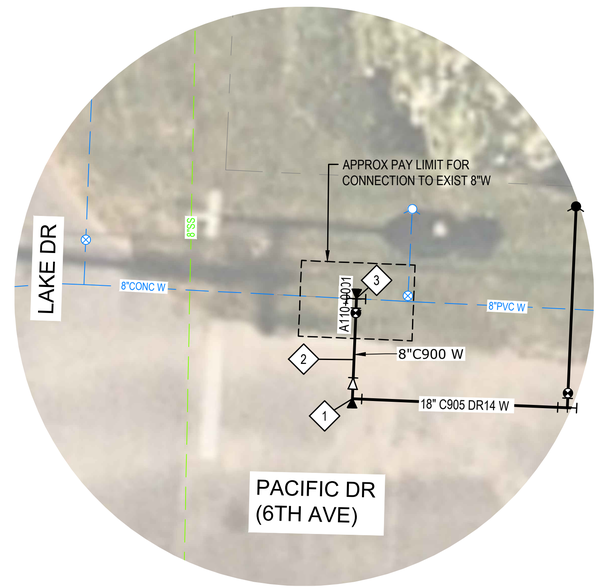
1. STA A103+13
   FURNISH & INSTALL:
   1-18"x8" DI TEE, MJ, W/ TB
   1-18" BFV, MJ (E)
   1-8" GV, MJ (N)
2. FURNISH & INSTALL:
   7 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ, W/ TB
   2-8" CPLG
   CONNECT TO EXIST 8" W
4. STA A102+94
   REALIGN EXIST 1.5" W BELOW 18" W
5. STA A102+35
   REALIGN EXIST 3/4" W BELOW 18" W



3 C-121 PACIFIC DR & JETTY ST
EXIST 8" W CONNECTION
SCALE: 1"=5'

KEY NOTES

1. STA A109+94
   FURNISH & INSTALL:
   1-18" 90° DI TEE, MJ, W/ TB
   1-18"x8" DI RDCR, MJ (N)
   ROTATE BENDS AS REQ'D
2. FURNISH & INSTALL:
   4 LF-8" C900 DR14 PVC W, RESTR
3. FURNISH & INSTALL:
   1-8" DI TEE, MJ, W/ TB
   1-8" GV, MJ (S)
   2-8" CPLG
   CONNECT TO EXIST 8" W



4 C-122 PACIFIC DR & LAKE DR
EXIST 8" W CONNECTION
SCALE: 1"=5'

consor
This document, ideas, and designs incorporated herein, are an instrument of professional service, and is not to be used, in whole or in part, for any other project without the written authorization of CONSOR.

Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2020 ANDREW THOMAS MILES RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

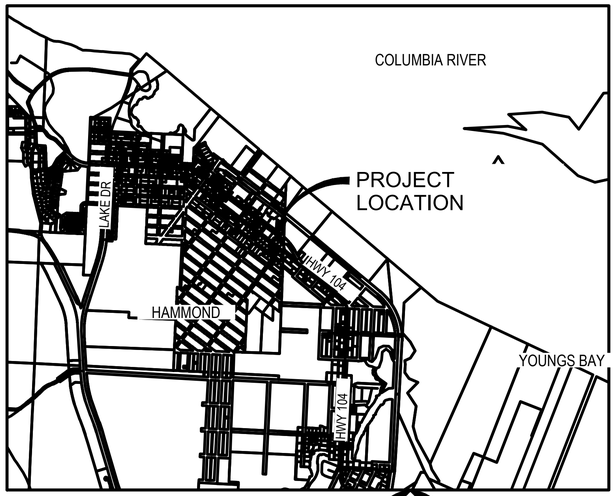
Drawing Title:
CIVIL
WATER CONNECTION DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-507

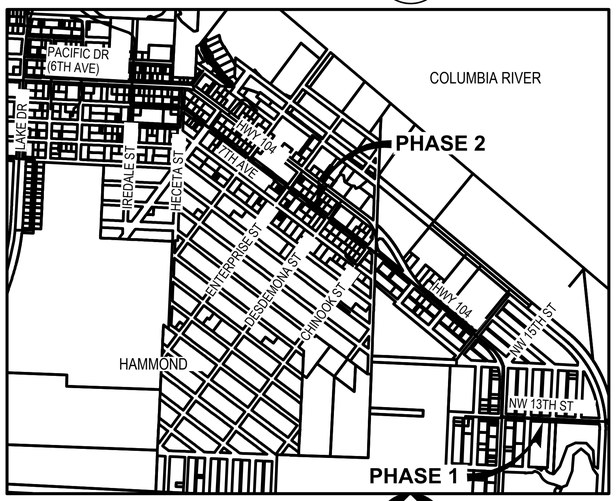
0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_W\W231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-507.dwg, Plotted Date: March 4, 2025 2:02 PM By: Andy Miles

EROSION AND SEDIMENT CONTROL PLAN



VICINITY MAP
SCALE: 1"=5000'



LOCATION MAP
SCALE: 1"=1000'

THIS PROJECT IS SUBJECT TO THE TERMS AND CONDITIONS SET FORTH IN THE DRAINAGE, EROSION AND SEDIMENT CONTROL PERMIT ISSUED BY CITY OF WARRENTON. GIVEN THE LAND DISTURBANCE IS LESS THAN 1 ACRE, A DEQ 1200-C PERMIT IS NOT REQUIRED FOR THIS PROJECT.

THE EROSION AND SEDIMENT CONTROL PLAN DRAWINGS NOTES ON THIS SHEET REFERENCE DEQ 1200-C PERMIT LANGUAGE. THESE NOTES ARE PROVIDED AS GUIDANCE AND BEST MANAGEMENT PRACTICES FOR COMPLYING WITH CITY OF WARRENTON PERMIT. NOT ALL DEQ 1200-C LANGUAGE IS APPLICABLE FOR THIS PROJECT.

SHEET INDEX
EROSION AND SEDIMENT CONTROL PLANS

C-1001	ESC COVER SHEET & NOTES
C-101 TO C-122	ESC PLANS - WATERLINE
C-1501	ESC DETAILS

RAIN GAUGE:
ASTORIA REGIONAL AIRPORT (KAST), NOAA RAIN GAUGE
LAT: 46.15694°N, LON: 123.8825°W, ELEV: 10FT
HYPERLINK: HTTPS://W1.WEATHER.GOV/DATA/OBHISTORY/KAST.HTML

POLLUTANT-GENERATING ACTIVITIES:
1. PIPELINE TRENCHING

PROJECT LOCATIONS:
NW 13TH ST, FORT STEVENS HWY (OR 104), 7TH AVE, IREDALE ST, PACIFIC DR, HAMMOND, WARRENTON, OR 97121

PROPERTY DESCRIPTIONS:
TAX PARCELS
CLATSOP COUNTY, OREGON

NARRATIVE DESCRIPTIONS:
EXISTING SITE CONDITIONS
STATE OF OREGON AND CITY OF WARRENTON ROADWAYS AND UNIMPROVED RIGHTS-OF-WAY

DEVELOPED CONDITIONS AND DESCRIPTION
APPROX. 4,500 FT OF 18-IN C905 DR14 PVC WATERLINE WILL BE INSTALLED PARALLEL TO EXISTING WATERLINE.

NATURE OF CONSTRUCTION ACTIVITY AND ESTIMATED TIME TABLE
PIPELINE UTILITY INSTALLATION (2025)

TOTAL DISTURBED AREA:
PIPELINE UTILITY: 0.52 ACRES (22,445 SQ.FT.)

EXISTING REPLACED IMPERVIOUS SURFACE AREA:
0.12 ACRES (5,102 SQ.FT.)

PROPOSED IMPERVIOUS SURFACE AREA:
N/A

SOIL CLASSIFICATION:
COQUILLE-CLATSOP COMPLEX, PROTECTED, 0 TO 1% SLOPES (MAP UNIT 12A)
COQUILLE VARIANT SILT LOAM, 0 TO 1% SLOPES (MAP UNIT 13A)
WALDPORT FINE SAND, 3 TO 15% SLOPES (MAP UNIT 70C)

RECEIVING WATER BODIES:
NOTHING DIRECT. COLUMBIA RIVER IS 0.2 MILES NORTH/EAST OF PROJECT SITE.

ATTENTION EXCAVATORS:
OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THESE RULES FROM THE CENTER BY CALLING 503-232-1987. IF YOU HAVE ANY QUESTIONS ABOUT THE RULES, YOU MAY CONTACT THE CENTER. YOU MUST NOTIFY THE CENTER AT LEAST TWO BUSINESS DAYS, BEFORE COMMENCING AN EXCAVATION. CALL 503-246-6699.

* HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.I.(3))
* ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS.
* INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS.
* RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, RETAIN THE ESCP AT THE CONSTRUCTION SITE OR AT ANOTHER LOCATION. (SCHEDULE B.2.A)

ASSOCIATED PERMITS
CITY OF WARRENTON, PUBIC WORKS CONSTRUCTION PERMIT <<PENDING>>
OREGON DEPT OF TRANSPORTATION, PERMIT NO. 01M_41513

STANDARD EROSION AND SEDIMENT CONTROL PLAN DRAWING NOTES:

1. ONCE KNOWN, INCLUDE A LIST OF ALL CONTRACTORS THAT WILL ENGAGE IN CONSTRUCTION ACTIVITIES ON SITE, AND THE AREAS OF THE SITE WHERE THE CONTRACTOR(S) WILL ENGAGE IN CONSTRUCTION ACTIVITIES. REVISE THE LIST AS APPROPRIATE UNTIL PERMIT COVERAGE IS TERMINATED (SECTION 4.4.C.I). IN ADDITION, INCLUDE A LIST OF ALL PERSONNEL (BY NAME AND POSITION) THAT ARE RESPONSIBLE FOR THE DESIGN, INSTALLATION AND MAINTENANCE OF STORMWATER CONTROL MEASURES (E.G. ESCP DEVELOPER, BMP INSTALLER (SEE SECTION 4.10), AS WELL AS THEIR INDIVIDUAL RESPONSIBILITIES. (SECTION 4.4.C.II)
2. VISUAL MONITORING INSPECTION REPORTS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS. (SECTION 6.5)
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS. (SECTION 6.5.O)
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. (SECTION 4.7)
5. THE PERMIT REGISTRANT MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT. (SECTIONS 4 AND 4.11)
6. THE ESCP MUST BE ACCURATE AND REFLECT SITE CONDITIONS. (SECTION 4.8)
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT WITHIN 10 DAYS. (SECTION 4.9)
8. SEQUENCE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION. (SECTION 2.2.2)
9. CREATE SMOOTH SURFACES BETWEEN SOIL SURFACE AND EROSION AND SEDIMENT CONTROLS TO PREVENT STORMWATER FROM BYPASSING CONTROLS AND PONDING. (SECTION 2.2.3)
10. IDENTIFY, MARK, AND PROTECT (BY CONSTRUCTION FENCING OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS. (SECTION 2.2.1)
11. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED. (SECTION 2.2.5)
12. MAINTAIN AND DELINEATE ANY EXISTING NATURAL BUFFER WITHIN THE 50-FEET OF WATERS OF THE STATE. (SECTION 2.2.4)
13. INSTALL PERIMETER SEDIMENT CONTROL, INCLUDING STORM DRAIN INLET PROTECTION AS WELL AS ALL SEDIMENT BASINS, TRAPS, AND BARRIERS PRIOR TO LAND DISTURBANCE. (SECTIONS 2.1.3)
14. CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME, TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNELS AND STREAM BANKS. (SECTIONS 2.1.1. AND 2.2.16)
15. CONTROL SEDIMENT AS NEEDED ALONG THE SITE PERIMETER AND AT ALL OPERATIONAL INTERNAL STORM DRAIN INLETS AT ALL TIMES DURING CONSTRUCTION, BOTH INTERNALLY AND AT THE SITE BOUNDARY. (SECTIONS 2.2.6 AND 2.2.13)
16. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. (SECTION 2.2.14)
17. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES. TEMPORARY OR PERMANENT STABILIZATIONS MEASURES ARE NOT REQUIRED FOR AREAS THAT ARE INTENDED TO BE LEFT UNVEGETATED, SUCH AS DIRT ACCESS ROADS OR UTILITY POLE PADS.(SECTIONS 2.2.20 AND 2.2.21)
18. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS. (SECTION 2.3.7)
19. KEEP WASTE CONTAINER LIDS CLOSED WHEN NOT IN USE AND CLOSE LIDS AT THE END OF THE BUSINESS DAY FOR THOSE CONTAINERS THAT ARE ACTIVELY USED THROUGHOUT THE DAY. FOR WASTE CONTAINERS THAT DO NOT HAVE LIDS, PROVIDE EITHER (1) COVER (E.G., A TARP, PLASTIC SHEETING, TEMPORARY ROOF) TO PREVENT EXPOSURE OF WASTES TO PRECIPITATION, OR (2) A SIMILARLY EFFECTIVE MEANS DESIGNED TO PREVENT THE DISCHARGE OF POLLUTANTS (E.G., SECONDARY CONTAINMENT). (SECTION 2.3.7)
20. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND- DISTURBING ACTIVITIES. (SECTION 2.2.7)
21. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE. (SECTION 2.2.7.F)
22. CONTROL PROHIBITED DISCHARGES FROM LEAVING THE CONSTRUCTION SITE, I.E., CONCRETE WASH-OUT, WASTEWATER FROM CLEANOUT OF STUCCO, PAINT AND CURING COMPOUNDS. (SECTIONS 1.5 AND 2.3.9)
23. ENSURE THAT STEEP SLOPE AREAS WHERE CONSTRUCTION ACTIVITIES ARE NOT OCCURRING ARE NOT DISTURBED. (SECTION 2.2.10)
24. PREVENT SOIL COMPACTION IN AREAS WHERE POST-CONSTRUCTION INFILTRATION FACILITIES ARE TO BE INSTALLED. (SECTION 2.2.12)
25. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, FERTILIZER, PESTICIDES AND HERBICIDES, PAINTS, SOLVENTS, CURING COMPOUNDS AND ADHESIVES FROM CONSTRUCTION OPERATIONS. (SECTIONS 2.2.15 AND 2.3)
26. PROVIDE PLANS FOR SEDIMENTATION BASINS THAT HAVE BEEN DESIGNED PER SECTION 2.2.17 AND STAMPED BY AN OREGON PROFESSIONAL ENGINEER. (SEE SECTION 2.2.17.A)
27. IF ENGINEERED SOILS ARE USED ON SITE, A SEDIMENTATION BASIN/IMPOUNDMENT MUST BE INSTALLED. (SEE SECTIONS 2.2.17 AND 2.2.18)
28. PROVIDE A DEWATERING PLAN FOR ACCUMULATED WATER FROM PRECIPITATION AND UNCONTAMINATED GROUNDWATER SEEPAGE DUE TO SHALLOW EXCAVATION ACTIVITIES. (SEE SECTION 2.4)
29. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES. (SECTION 2.3)
30. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL. (SECTION 2.2.9)
31. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE. (SECTION 2.3.5)
32. IF AN ACTIVE TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN ENVIRONMENTAL MANAGEMENT PLAN APPROVAL FROM DEQ BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SECTION 1.2.9)
33. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SECTION 2.2)
34. AS NEEDED BASED ON WEATHER CONDITIONS, AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SECTION 2.2.8)
35. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL. (SECTION 2.1.5.B)
36. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT AND BEFORE BMP REMOVAL. (SECTION 2.1.5.C)
37. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT. (SECTION 2.1.5.D)
38. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN-UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DEPARTMENT OF STATE LANDS REQUIRED TIMEFRAME. (SECTION 2.2.19.A)
39. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SECTION 2.2.19)
40. DOCUMENT ANY PORTION(S) OF THE SITE WHERE LAND DISTURBING ACTIVITIES HAVE PERMANENTLY CEASED OR WILL BE TEMPORARILY INACTIVE FOR 14 OR MORE CALENDAR DAYS. (SECTION 6.5.F.)
41. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SECTION 2.2.20)
42. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED, ALL TEMPORARY EROSION CONTROLS AND RETAINED MOVED AND DISPOSED OF PROPERLY, UNLESS NEEDED FOR LONG TERM USE FOLLOWING TERMINATION OF PERMIT COVERAGE. (SECTION 2.2.21)

BMP MATRIX FOR CONSTRUCTION PHASES:
REFER TO DEQ GUIDANCE MANUAL FOR A COMPREHENSIVE LIST OF AVAILABLE BMP'S.

BMP	UTILITY INSTALLATION	FINAL STABILIZATION	WET WEATHER OCT 1-MAY 31 (IF REQ'D)
EROSION PREVENTION			
GROUND COVER	X	X	X
PLASTIC SHEETING	X		X
DUST CONTROL	X		X
TEMPORARY STABILIZATION	X		X
PERMANENT STABILIZATION	X	X	X
SEDIMENT CONTROL			
SEDIMENT FENCE (PERIMETER)	X	X	X
SEDIMENT FENCE (INTERIOR)	X		X
STRAW WATTLES	X	X	X
DEWATERING (GENERAL)	X		X
RUN-OFF CONTROL			
CONSTRUCTION ENTRANCE	X	X	X
POLLUTION PREVENTION			
HAZ WASTE MGMT	X	X	X
SPILL KIT ON-SITE	X	X	X
CONCRETE WASH OUT AREA	X		X

RATIONALE STATEMENT:
A COMPREHENSIVE LIST OF AVAILABLE BEST MANAGEMENT PRACTICES (BMP) OPTIONS BASED ON DEQ'S GUIDANCE MANUAL HAS BEEN REVIEWED TO COMPLETE THIS EROSION AND SEDIMENT CONTROL PLAN. SOME OF THE ABOVE LISTED BMPS WERE NOT CHOSEN BECAUSE THEY WERE DETERMINED TO NOT EFFECTIVELY MANAGE EROSION PREVENTION AND SEDIMENT CONTROL FOR THIS PROJECT BASED ON SPECIFIC SITE CONDITIONS, INCLUDING SOIL CONDITIONS TOPOGRAPHIC CONSTRAINTS, ACCESSIBILITY TO THE SITE, AND OTHER RELATED CONDITIONS, AS THE PROJECT PROGRESSES AND THERE IS A NEED TO REVISE THE ESC PLAN, AN ACTION PLAN WILL BE SUBMITTED.

INITIAL

PERMITTEE'S SITE INSPECTOR:
TBD

COMPANY/AGENCY: TBD
PHONE: TBD
FAX: TBD
E-MAIL: TBD
DESCRIPTION OF EXPERIENCE: TBD

THE PERMITTEE IS REQUIRED TO MEET ALL THE CONDITIONS OF THE 1200C PERMIT. THIS ESCP AND GENERAL CONDITIONS HAVE BEEN DEVELOPED TO FACILITATE COMPLIANCE WITH THE 1200C PERMIT REQUIREMENTS. IN CASES OF DISCREPANCIES OR OMISSIONS, THE 1200C PERMIT REQUIREMENTS SUPERCEDE REQUIREMENTS OF THIS PLAN.

OWNER:
CITY OF WARRENTON,
DEPT OF PUBLIC WORKS
45 SW 2ND ST
WARRENTON, OR 97146
CONTACT: TWYLA VITTETOE
PHONE: (503) 861-0912
EMAIL:
TVITTETOE@WARRENTONOREGON.US

DESIGN ENGINEER:
CONSOR
400 E MILL PLAIN BLVD, SUITE 400
VANCOUVER, WA 98660
CONTACT: ANDY MILES, P.E.
PHONE: (360) 448-4230
EMAIL: ANDY.MILES@CONSORENG.COM

CONTRACTOR:
TBD

INSPECTION FREQUENCY:

SITE CONDITION	MINIMUM FREQUENCY
1. ACTIVE PERIOD	ON INITIAL DATE THAT LAND DISTRURBANCE ACTIVITIES COMMENCE. WITHIN 24 HOURS OF ANY STORM EVENT, INCLUDING RUNOFF FROM SNOW MELT, THAT RESULTS IN DISCHARGE FROM SITE. AT LEAST ONCE EVERY 14 DAYS, REGARDLESS OF WHETHER STORMWATER RUNOFF IS OCCURING.
2. INACTRIVE PERIODS GREATER THAN FOURTEEN (14) DAYS	THE INSPECTOR MAY REDUCE THE FREQUENCY OF INSPECTIONS IN ANY AREA OF THE SITE WHERE THE STABILIZATION STEPS IN SECTION 2.2.20 HAVE BEEN COMPLETED TO TWICE PER MONTH FOR THE FIRST MONTH, NO LESS THAN 14 CALENDAR DAYS APART, THEN ONCE PER MONTH.
3. PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER	IF SAFE, ACCESSIBLE AND PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT DISCHARGE POINT OR DOWNSTREAM LOCATION OF THE RECEIVING WATERBODY.
4. PERIODS DURING WHICH CONSTRUCTION ACTIVITIES ARE SUSPENDED AND RUNOFF IS UNLIKELY DUE TO FROZEN CONDITIONS.	VISUAL MONITORING INSPECTIONS MAY BE TEMPORARILY SUSPENDED. IMMEDIATELY RESUME MONITORING UPON THAWING, OR WHEN WEATHER CONDITIONS MAKE DISCHARGES LIKELY.
5. PERIODS DURING WHEN CONSTRUCTION ACTIVITIES ARE CONDUCTED AND RUNOFF IS UNLIKELY DURING FROZEN CONDITIONS.	VISUAL MONITORING INSPECTIONS MAY BE REDUCED TO ONCE A MONTH. IMMEDIATELY RESUME MONITORING UPON THAWING, OR WHEN WEATHER CONDITIONS MAKE DISCHARGES LIKELY.

This document, ideas, and designs incorporated herein, are an instrument of professional service, and is not to be used, in whole or in part, for any other project without the written authorization of CONSOR.

Consultant:

BID SET

Engineer's Seal:
REGISTERED PROFESSIONAL ENGINEER
PE96202
OREGON
MAY 12, 2025
ANDREW THOMAS MILES
RENEWS 12-31-26

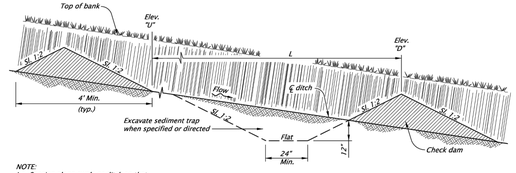
Client / Owner: THE CITY OF WARRENTON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION
WATERLINE PHASE 1

Drawing Title:
CIVIL
EROSION CONTROL COVER SHEET

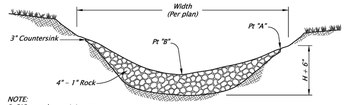
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM

CONSOR Project No.: W231023OR
Issued On: MARCH 2025
Drawing No.: C-1001
0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE



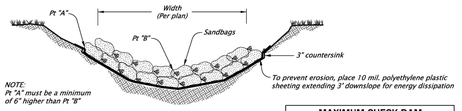
NOTE:
L = Spacing along swale or ditch so that Elevation "U" equals Elevation "D".

TYPICAL PROFILE SECTION CHECK DAMS (SHOWN WITH AGGREGATE)
NOT TO SCALE



NOTE:
Pt "A" must be a minimum of 6" higher than Pt "B"

AGGREGATE CHECK DAM - TYPE 1
NOT TO SCALE



NOTE:
Pt "A" must be a minimum of 6" higher than Pt "B"

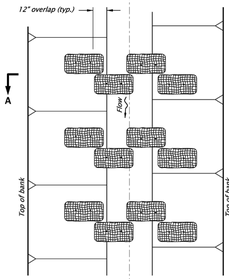
To prevent erosion, place 10 mil. polyethylene plastic sheeting extending 3' downslope for energy dissipation

SANDBAG CHECK DAM - TYPE 4
NOT TO SCALE

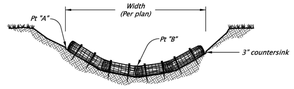
MAXIMUM CHECK DAM SPACING "L"				
Ditch Grade	H=8"	H=12"	H=18"	H=24"
10%	* *	* *	15'	20'
9%	* *	* *	16'	22'
8%	* *	* *	18'	25'
7%	* *	* *	21'	28'
6%	* *	16'	25'	33'
5%	* *	20'	30'	40'
4%	16'	25'	37'	50'
3%	22'	33'	50'	66'
2%	33'	50'	75'	100'

* * Not allowed H = Min. dam height

NOTES:
1. *Type 3 – stake biofilter bags with two 2"x2"x18" (minimum) wood stakes per bag. Drive stakes a minimum of 6" into the ground and flush with the top of the bags. Omit stakes if placed over paved surfaces. Overlap bags 12" minimum at each joint.*
2. *Type 4 – Tightly abut or overlap ends of sandbags at each joint.*
3. *Spacing between check dams for all check dam types shall comply with the typical profile section shown above.*



PLAN



SECTION A-A

BIOFILTER BAG CHECK DAM - TYPE 3
NOT TO SCALE

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

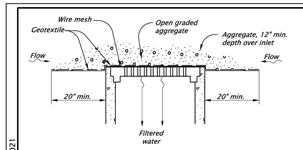
All materials shall be in accordance with the current Oregon Standard Specifications.
OREGON STANDARD DRAWINGS
CHECK DAMS TYPE 1, 3 AND 4
2024

DATE	REVISION DESCRIPTION
01-2021	REMOVED CALC BOOK NUMBERS

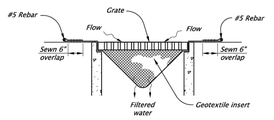
CALC BOOK NO. N/A | SDR DATE 20-JAN-2021 | **RD1005**

RD1005.dgn 20-JAN-2021

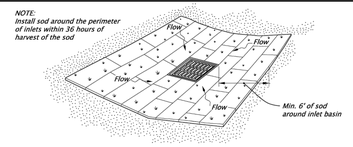
Effective Date: June 1, 2024 – November 30, 2024



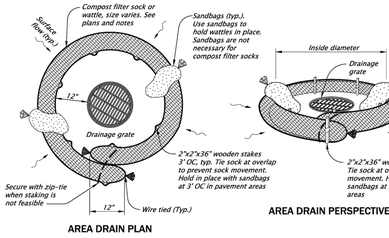
GEOTEXTILE/WIRE MESH/AGGREGATE - TYPE 2
NOT TO SCALE



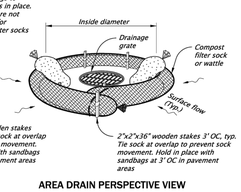
PREFABRICATED FILTER INSERT - TYPE 3
NOT TO SCALE



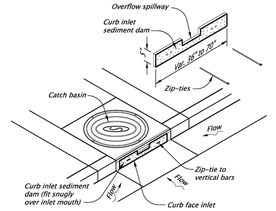
SOD PROTECTION - TYPE 6
NOT TO SCALE



AREA DRAIN PLAN



AREA DRAIN PERSPECTIVE VIEW

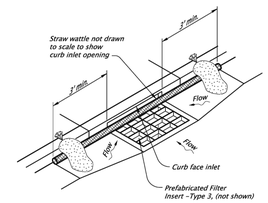


CURB INLET SEDIMENT DAM - TYPE 10
NOT TO SCALE

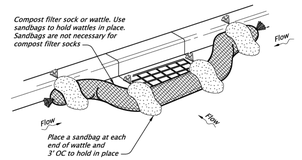
(Type 7 cont.)
Use 12" to 18" dia sock in non-traffic areas or areas where the larger socks can be used safely.
use synthetic mesh socks for temporary installations.

Type 10 – Curb inlet sediment dam
Fit curb inlet sediment dam snugly into inlet mouth. Curb inlet sediment dam is required for use with inlet filter insert where at-grade inlet grate and curb inlet are combined at a catch basin.

Type 11 – Wattle barrier with filter insert
Install prefabricated filter insert per Type 3 detail.
Install wattles over opening and 36" to each side of opening tight against curb. Adjust wattle to force storm water to flow through filter insert or wattle prior to leaving the site.
Adjust, replace or modify the inlet protection as needed to prevent sediment laden water from entering the catch basin.



WATTLE BARRIER WITH FILTER INSERT - TYPE 11
NOT TO SCALE



CURB INLET PERSPECTIVE VIEW

COMPOST FILTER SOCK OR WATTLE - TYPE 7
NOT TO SCALE

NOTES:
Type 2 – Geotextile/wire mesh/aggregate
Place the wire mesh over the grate. Place sediment fence geotextile over the wire mesh and perimeter area around structure.
Install aggregate over the geotextile fabric.

Type 3 – Prefabricated filter inserts
Install prefabricated filter inserts according to the plans, special provisions, and manufacturer recommendations. Prefabricated inserts with provisions for overflow are allowed only when accompanied by additional BMP's to prevent the potential of sediments entering project storm systems. Field fabricated inserts are not allowed.

Type 7 – Compost filter sock
Drive 2"x2" wood stakes a minimum of 6" into ground and flush with the top of the sock.
Overlap ends of sock per manufacturers recommendations (12"min., 36" max.). Use 8" to 12" dia sock on curbside in traffic areas.

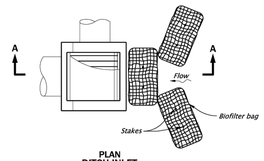
All materials shall be in accordance with the current Oregon Standard Specifications.
OREGON STANDARD DRAWINGS
INLET PROTECTION TYPE 2, 3, 6, 7, 10 AND 11
2024

DATE	REVISION DESCRIPTION
01-2021	REMOVED CALC BOOK NUMBERS
01-2021	MOVED NOTES UP FROM OVERLAPPING THE SHEET BORDER

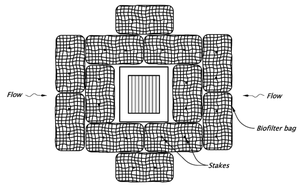
CALC BOOK NO. N/A | SDR DATE 20-JAN-2021 | **RD1010**

RD1010.dgn 20-JAN-2021

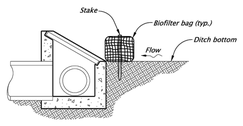
Effective Date: June 1, 2024 – November 30, 2024



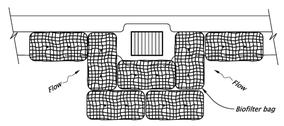
PLAN
DITCH INLET



PLAN
AREA DRAIN



SECTION A-A
DITCH INLET



PLAN
CATCH BASIN

BIOFILTER BAGS - TYPE 4
NOT TO SCALE

NOTES:
1. *Stake biofilter bags with 2"x2"x36" wood stakes, and use a minimum 2 stakes per bag. Drive stakes a minimum of 6" into the ground and flush with the top of the bags.*
2. *Omit stakes when bags are placed on pavement surface.*
3. *Overlap all bag joints 6".*
4. *Biofilter bags used on active roadways are easily displaced and made ineffective if struck by vehicles. If struck by a cyclist, falls with injury could result. On active roadways alternative inlet protection should be considered.*

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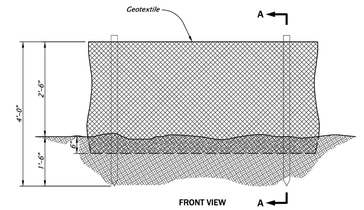
All materials shall be in accordance with the current Oregon Standard Specifications.
OREGON STANDARD DRAWINGS
INLET PROTECTION TYPE 4
2024

DATE	REVISION DESCRIPTION
01-2021	REMOVED CALC BOOK NUMBERS

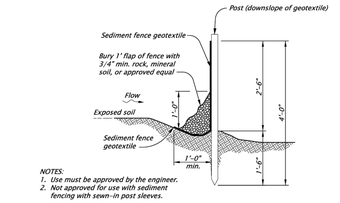
CALC BOOK NO. N/A | SDR DATE 20-JAN-2021 | **RD1015**

RD1015.dgn 20-JAN-2021

Effective Date: June 1, 2024 – November 30, 2024

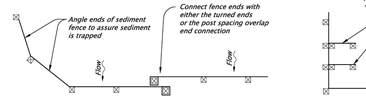


SEDIMENT FENCE AND GEOTEXTILE BURY DETAIL - TYPE 1
NOT TO SCALE

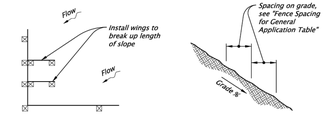


NOTES:
1. *Use must be approved by the engineer.*
2. *Not approved for use with sediment fencing with sewn-in post sleeves.*

ALTERNATE SEDIMENT FENCE WITHOUT TRENCHING - TYPE 2
NOT TO SCALE



PLAN VIEW

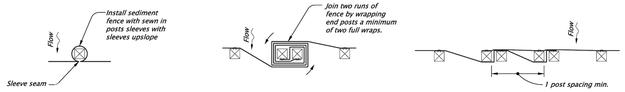


TERMINATION AT CORNER OR PROPERTY LINE

GENERAL NOTES:
1. *Use 2"x2" wood fence posts.*
2. *Posts to be installed on downhill side of sediment fence geotextile. Position posts to prevent separation from geotextile.*
3. *Compact filter fabric trench backfill and soil on uphill side of fence.*
4. *Locate fence no closer than three feet to the toe of a slope.*
5. *Wing spacing shall comply with "Fence Spacing for General Application Table".*

FENCE SPACING FOR GENERAL APPLICATION TABLE	
INSTALL PARALLEL ALONG CONTOURS AS FOLLOWS	
GRADE	MAXIMUM SPACING ON GRADE
Grade < 10%	300'
10% ≤ Grade < 15%	150'
15% ≤ Grade < 20%	100'
20% ≤ Grade < 30%	50'
30% ≤ Grade	25'

POST SPACING TABLE	
6'	Sediment Fence with Geotextile elongation less than 50%
4'	Sediment Fence with Geotextile elongation 50% or more



GEOTEXTILE WITH POST SLEEVES | **TURNED ENDS CONNECTION** | **POST SPACING OVERLAP CONNECTION**

GEOTEXTILE END CONNECTIONS
NOT TO SCALE

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OREGON STANDARD DRAWINGS
SEDIMENT FENCE
2024

DATE	REVISION DESCRIPTION
01-2021	REMOVED CALC BOOK NUMBERS

CALC BOOK NO. N/A | SDR DATE 20-JAN-2021 | **RD1040**

RD1040.dgn 20-JAN-2021

Effective Date: June 1, 2024 – November 30, 2024

consor

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Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2020 ANDREW THOMAS MILES RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title:
CIVIL
EROSION CONTROL DETAILS

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM

CONSOR Project No.: W231023OR
Issued On: MARCH 2025
Drawing No.: C-1501

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

Drawing Path and Name: G:\PDX_Projects\23\Vertical_W\W231023OR.00 - Warrenton Hammond Transmission Waterline\12 CADD\12-5 Sheets\231023_C-1501.dwg, Plotted Date: March 4, 2025 2:03 PM By: Andy Miles

PLAN
SCALE: 1"=200'

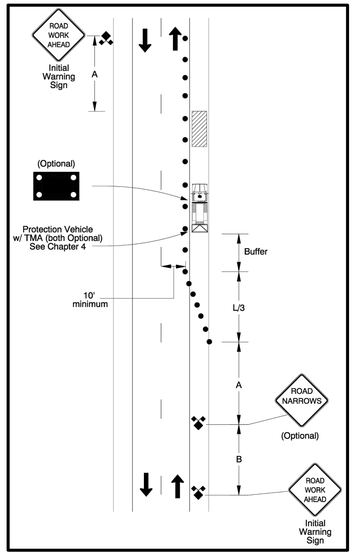
TRAFFIC CONTROL NOTES:

1. USE SIGN SPACING FROM ODOT STANDARD DRAWING TM800 (POSTED SPEED = 45 MPH), SEE SHT C-2501.

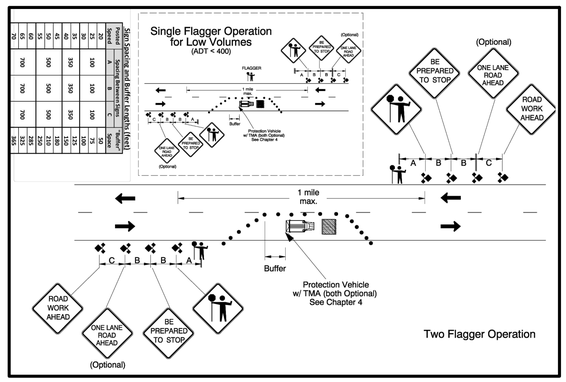
2. SIGNING AND OTHER TRAFFIC CONTROL DEVICES SHOWN TO BE INSTALLED IN CONJUNCTION WITH THE WORK AREAS SHALL MOVE WITH THE WORK AREAS.

3. CONTRACTOR TO PROVIDE ADDITIONAL TRAFFIC CONTROL PLANS INCLUDING INTERSECTION WORK ZONE, TEMPORARY PEDESTRIAN ACCESS ROUTE (TPAR) AND OTHER APPLICABLE WORK ZONE DETAILS.

4. CONTRACTOR SHALL COMPLY W/ REQUIREMENTS OF ODOT RIGHT-OF-WAY PERMIT.



1 SHOULDER WORK W/ MINOR ROAD ENCROACHMENT
SCALE: NTS



2 STATIONARY LANE CLOSURE W/ FLAGGING
SCALE: NTS

SIGN LEGEND

1 — ROAD WORK AHEAD (W20-1, 48"x48") OR SHOULDER WORK AHEAD (W20-4, 36"x36")

2 — END ROAD WORK (G20-2, 48"x24")

LAYOUT LEGEND

- TEMPORARY TRAFFIC CONTROL SIGN
- DIRECTION OF TRAVEL
- WORK ZONE

This document, ideas, and designs incorporated herein, are an instrument of professional service, and is not to be used, in whole or in part, for any other project without the written authorization of CONSOR.

Consultant:

BID SET

Engineer's Seal: REGISTERED PROFESSIONAL ENGINEER, PE96202, OREGON, MAY 12, 2025, ANDREW THOMAS MILES
RENEWS 12-31-26

Client / Owner: THE CITY OF WARRENTON, OREGON

Project Title:
CITY OF WARRENTON
HAMMOND TRANSMISSION WATERLINE PHASE 1

Drawing Title:
CIVIL
TRAFFIC CONTROL PLAN

Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-2101

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

TAPER TYPES & FORMULAS	
TAPER	FORMULA
Merging (Lane Closure)	"L"
Shifting	"L"/2 or ½"L"
Shoulder Closure	"L"/3 or ⅓"L"
Flagging (See Drg. TM850)	50' – 100'
Downstream (Termination)	Varies (See Drawings)

★ Use Pre-Construction Posted Speed to select the Speed from the Tables below:

TEMPORARY BARRIER FLARE RATE TABLE	
★SPEED (mph)	MINIMUM FLARE RATE
≤ 30	8:1
35	9:1
40	10:1
45	12:1
50	14:1
55	16:1
60	18:1
65	19:1
70	20:1

MINIMUM LENGTHS TABLE					
"L" VALUE FOR TAPERS (ft)					BUFFER "B" (ft)
	W = Lane or Shoulder Width being closed or shifted				
★ SPEED (mph)	W ≤ 10	W = 12	W = 14	W = 16	
25	105	125	145	165	75
30	150	180	210	240	100
35	205	245	285	325	125
40	265	320	375	430	150
45	450	540	630	720	180
50	500	600	700	800	210
55	550	660	770	880	250
60	600	720	840	960	285
65	650	780	910	1000	325
70	700	840	980	1000	365
FREEWAYS					
55	1000	1000	1000	1000	250
60	1000	1000	1000	1000	285
65	1000	1000	1000	1000	325
70	1000	1000	1000	1000	365

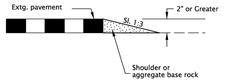
NOTES:
- For Lane closures where W < 10', use "L" value for W = 10'.
- For Shoulder closures where W < 10', use "L" value for W = 10' or calculate "L" using formula, for Speeds ≥ 45: L = WS, Speeds < 45: L = S²W/60, S = Speed, W=Width

TRAFFIC CONTROL DEVICES (TCD) SPACING TABLE				
★ SPEED (mph)	Sign Spacing (ft)			Max. Channelizing Device Spacing (ft)
	A	B	C	
20 – 30	100	100	100	20
35 – 40	350	350	350	20
45 – 55	500	500	500	40
60 – 70	700	700	700	40
Freeway	1000	1500	2640	40

NOTES:
- Place traffic control devices on 10 ft. spacing for intersection and access radii.
- When necessary, sign spacing may be adjusted to fit site conditions. Limit spacing adjustments to 30% of the "A" dimension for all speeds.

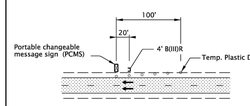
01-JUL-2022 TM800.dgn

NOTES:
- When paved shoulders adjacent to excavations are less than four feet wide protect longitudinal abrupt edge as shown.
- Use aggregate wedge when abrupt edge is 2 inches or greater.



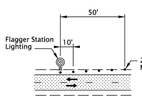
EXCAVATION ABRUPT EDGE

NOTES:
- Install PCMS beyond the outside shoulder, when possible.
- Use the appropriate type of barricade panels for PCMS location. Right shoulder, use Type BI(II)R Left shoulder, use Type BI(II)L
- Use six drums in shoulder taper on 20' spacing. The drums and barricade may be omitted when PCMS is placed behind a roadside barrier.
- Detail as shown is used for trailered and non-crashworthy components of:
  - Portable Traffic Signals
  - Smart Work Zone Systems



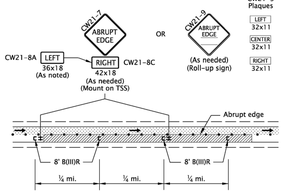
PORTABLE CHANGEABLE MESSAGE SIGN (PCMS) INSTALLATION

NOTES:
- Install Flagger Station Lighting beyond the outside shoulder, where practical.
- Use six tubular markers in shoulder taper on 10' spacing.
- Place cart / generator / power supply off of the shoulder, as far as practical.



FLAGGER STATION LIGHTING DELINEATION

NOTES:
- Abrupt edges may be created by paving, operations, excavations or other roadway work. Use abrupt edge signing for longitudinal abrupt edges of 1 inch or greater.
- If the excavation is located on left side of traffic, replace the 8' BI(II)R barricades with 8' BI(II)L barricades and replace the "RIGHT" (CW21-8C) riders with "LEFT" (CW21-8A) riders.
- Continue signing and other traffic control devices throughout excavation area at spacings shown.
- If roll-up signs are used, attach the correct (CW21-9) plaques to the sign face using hook and loop fasteners. Place roll-up signs in advance of barricades.



TYPICAL ABRUPT EDGE DELINEATION

GENERAL NOTES FOR ALL TCP DRAWINGS:
- Signs and other Traffic Control Devices (TCD) shown are the minimum required.
- Place a barricade approx. 20' ahead of all sequential arrow boards.
- Arrows shown in roadway are directional arrows to indicate traffic movements.
- All signs are 48" x 48" unless otherwise shown. Use fluorescent orange sheeting for the background of all temporary warning signs.
- All diamond shaped warning signs mounted on barrier sign supports shall be 36" by 36". All other signs mounted on barrier sign supports shall not exceed 12 sq. ft. in total sign area.
- Low speed highways have a pre-construction posted speed of 40 mph or less. High speed highways have a pre-construction posted speed of 45 mph or higher.
- Do not locate sign supports in locations designated for bicycle or pedestrian traffic.
- Combine drawing details to complete temporary traffic control for each work activity.
- Coordinate and control pedestrian movements through a Temporary Accessible Route using Flaggers, Traffic Control Measures, or as directed.
- To be accompanied by Dwg. Nos. TM820 & TM821.

Temp. Plastic Drums See TCD Spacing Table for max. spacing.
28" Tubular Markers See TCD Spacing Table for max. spacing.
UNDER TRAFFIC
UNDER CONSTRUCTION

The selection and use of this Standard Drawing, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the user and should not be used without first consulting a Registered Professional Engineer.

All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

TABLES, ABRUPT EDGE AND PCMS DETAILS

2024

DATE	REVISION DESCRIPTION
07-2022	Added a note for TPMS.

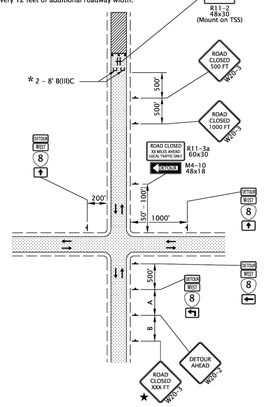
CALC. BOOK NO. ___ N/A ___ SDR DATE 01-JUL-2022 **TM800**

Effective Date: June 1, 2024 – November 30, 2024

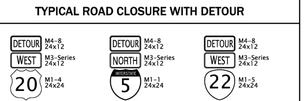
01-JUL-2020 TM840.dgn

NOTES:
If closure point is less than 1500 ft. from nearest intersection, use a "ROAD CLOSED TO THRU TRAFFIC" (R11-4)sign in place of the "ROAD CLOSED XX MILES AHEAD" sign.

★ If the roadway width (between edges of pavement) at the closure point exceeds 24 feet, place one additional 8' BI(II)C barricade for every 12 feet of additional roadway width.

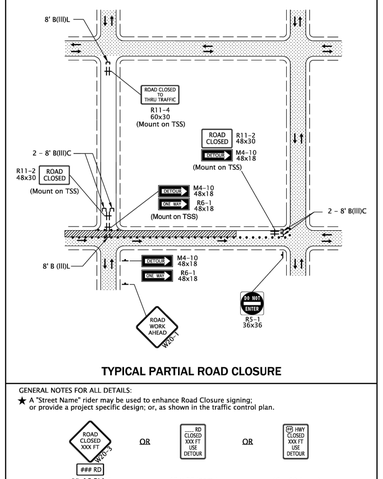


TYPICAL ROAD CLOSURE WITH DETOUR



NOTE:
- When detour routes overlap, each Route Shield will include a seperate cardinal direction, detour, and directional arrow auxiliary sign assembly.

TYPICAL TRAILBLAZER ASSEMBLY



TYPICAL PARTIAL ROAD CLOSURE

GENERAL NOTES FOR ALL DETAILS:
★ A "Street Name" rider may be used to enhance Road Closure signing; or provide a project specific design; or, as shown in the traffic control plan.

ROAD CLOSED XXX FT R11-2 48x30
Rd
##x18 Rider
Rider width to be determined by width of street name.

OR

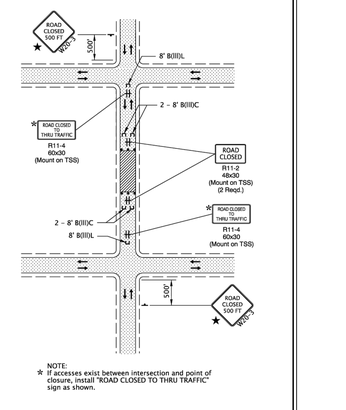
DO NOT ENTER R5-1 36x36
ROAD CLOSED XXX FT R11-2 48x30
USE DETOUR
48 x 60 (nom.)
Project Specific Design

OR

DO NOT ENTER R5-1 36x36
ROAD CLOSED 300 FT R11-4 48x30
USE DETOUR
48 x 60 (nom.)
Project Specific Design

- Use a minimum of two Type III barricades for a road closure. For roads > 36' wide between curbs or edge of pavement, use a minimum of three Type III barricades for the closure point.
- For full road closures, the C or LR barricade may be used.
- Place additional signing as directed.
- To determine sign spacing A, B, & C, use the "TRAFFIC CONTROL DEVICES (TCD) SPACING TABLE" on Dwg. TM800.
- To be accompanied by Dwg. Nos.TM820 & TM821.

28" Tubular Markers See TCD Spacing Table on TM800 for max. spacing.
UNDER TRAFFIC
UNDER CONSTRUCTION



NOTE:
★ If accesses exist between intersection and point of closure, install "ROAD CLOSED TO THRU TRAFFIC" sign as shown.

TYPICAL ROAD CLOSURE

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All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

CLOSURE DETAILS

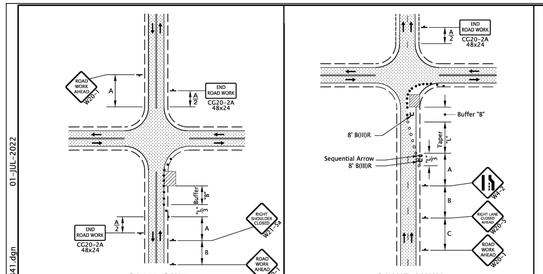
2024

DATE	REVISION DESCRIPTION

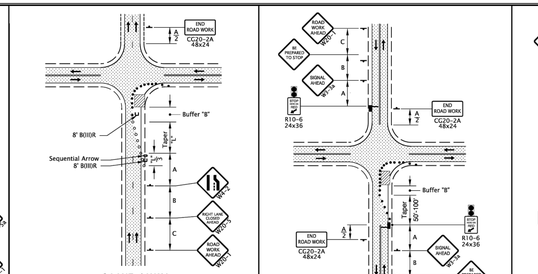
CALC. BOOK NO. ___ N/A ___ SDR DATE 01-JUL-2020 **TM840**

Effective Date: June 1, 2024 – November 30, 2024

01-JUL-2022 TM841.dgn

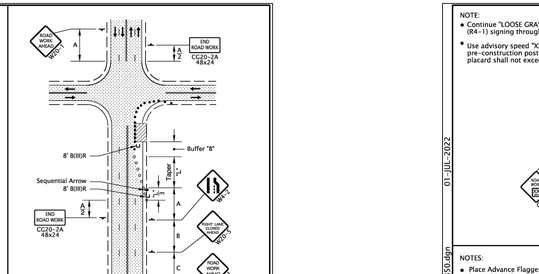


2-Lane, 2-Way
SHOULDER CLOSURE

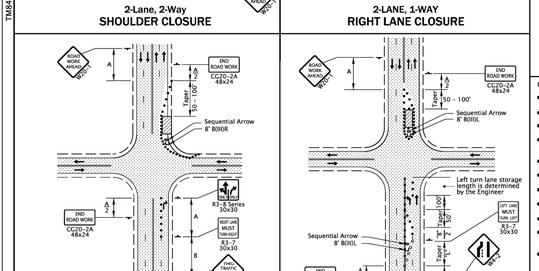


2-LANE, 1-WAY
RIGHT LANE CLOSURE

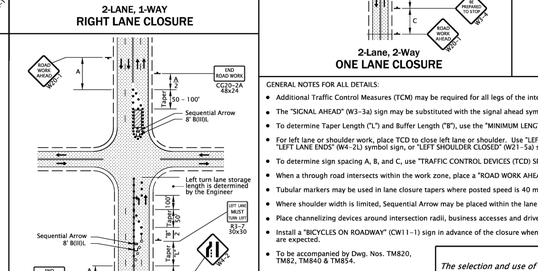
2-Lane, 2-Way
ONE LANE CLOSURE



4-Lane, 2-Way
RIGHT LANE CLOSURE, NEAR SIDE



4-Lane, 2-Way
RIGHT LANE CLOSURE, FAR SIDE



4-Lane, 2-Way
LEFT LANE CLOSURE, FAR SIDE

GENERAL NOTES FOR ALL DETAILS:
- Additional Traffic Control Measures (TCM) may be required for all legs of the intersection.
- The "SIGNAL AHEAD" (W3-3a) sign may be substituted with the signal ahead symbol (W3-3) sign.
- To determine Taper Length ("L") and Buffer Length ("B"), use the "MINIMUM LENGTHS TABLE" on Dwg. TM800.
- For left lane or shoulder work, place TCD to close left lane or shoulder. Use "LEFT LANE CLOSED AHEAD" (W20-5) sign, "LEFT LANE ENDS" (W4-2L) symbol sign, or "LEFT SHOULDER CLOSED" (W21-5a) sign, where applicable.
- To determine sign spacing A, B, and C, use "TRAFFIC CONTROL DEVICES (TCD) SPACING TABLE" on Dwg. TM800.
- When a through road intersects within the work zone, place a "ROAD WORK AHEAD" (W20-1) sign in advance of the intersection at sign spacing A.
- Tubular markers may be used in lane closure tapers where posted speed is 40 mph or less.
- Where shoulder width is limited, Sequential Arrow may be placed within the lane closure taper.
- Place channelizing devices around intersection radii, business accesses and driveways at 10' spacing.
- Install a "BICYCLES ON ROADWAY" (CW11-1) sign in advance of the closure when a bike lane is closed, or when the shoulder is closed and bikes are expected.
- To be accompanied by Dwg. Nos. TM820, TM82, TM840 & TM854.

Automated Flagging Assistance Device (AFAD)
28" Tubular Markers See TCD Spacing Table on TM800 for max. spacing.
Temp. Plastic Drums See TCD Spacing Table on TM800 for max. spacing.
UNDER TRAFFIC
UNDER CONSTRUCTION

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OREGON STANDARD DRAWINGS

INTERSECTION WORK ZONE DETAILS

2024

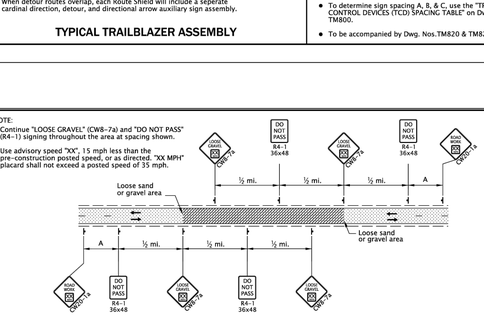
DATE	REVISION DESCRIPTION

CALC. BOOK NO. ___ N/A ___ SDR DATE 01-JUL-2022 **TM841**

Effective Date: June 1, 2024 – November 30, 2024

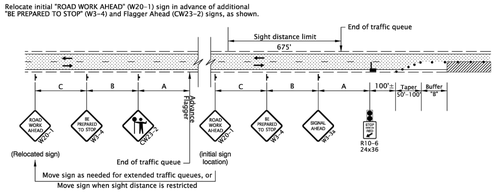
01-JUL-2022 TM850.dgn

NOTE:
- Continue "LOOSE GRAVEL" (CW8-7a) and "DO NOT PASS" (R4-1) signing throughout the area at spacing shown.
- Use advisory speed "XX", 15 mph less than the pre-construction posted speed, or as directed. "XX MPH" placard shall not exceed a posted speed of 35 mph.



2-Lane, 2-Way Roadway
LOOSE GRAVEL IN ROADWAY SIGNING

NOTES:
- Place Advance Flagger and additional signing when traffic queues extend beyond initial warning signing OR when sight distance is restricted.
- Relocate initial "ROAD WORK AHEAD" (W20-1) sign in advance of additional "BE PREPARED TO STOP" (W3-4) and Flagger Ahead (CW23-2) signs, as shown.
- Place additional Tubular Markers for Flagger and Advance Flagger Stations according to FLAGGER STATION DELINEATION detail.

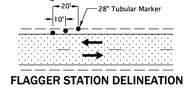


ADVANCE FLAGGER FOR EXTENDED TRAFFIC QUEUES

GENERAL NOTES FOR ALL DETAILS:
- The "SIGNAL AHEAD" (W3-3a) sign may be substituted with the Signal Ahead (W3-3) symbol sign.
- Cover existing passing zone signing, as directed.
- Install temporary striping as required.
- To determine Taper Length ("L") and Buffer Length ("B"), use the "MINIMUM LENGTHS TABLE" shown on Dwg. No. TM800.
- To determine sign spacing A, B, and C, use "TRAFFIC CONTROL DEVICES (TCD) SPACING TABLE" on Dwg. No. TM800.
- Install a "BICYCLES ON ROADWAY" (CW11-1) sign in advance of the closure when a bike lane is closed, or when the shoulder is closed and bikes are expected.
- At night, flagger stations shall be illuminated according to the FLAGGER STATION LIGHTING DELINEATION detail on Dwg No. TM800.
- To be accompanied by Dwg. Nos. TM820, TM821 & TM854.

Automated Flagging Assistance Device (AFAD)
28" Tubular Markers on 20' max. spacing for flagger tapers and stations
28" Tubular Markers See TCD Spacing Table on TM800 for max. spacing.
UNDER TRAFFIC
UNDER CONSTRUCTION
CONSTRUCTION UNDER TRAFFIC

NOTE:
- Use a minimum of 3 tubular markers in shoulder taper on 10' spacing for flagger station delineation.



FLAGGER STATION DELINEATION

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All materials shall be in accordance with the current Oregon Standard Specifications.

OREGON STANDARD DRAWINGS

2-LANE, 2-WAY ROADWAYS

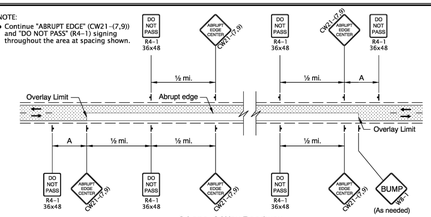
2024

DATE	REVISION DESCRIPTION
01-2022	Added AFADs to drawing.

CALC. BOOK NO. ___ N/A ___ SDR DATE 01-JUL-2022 **TM850**

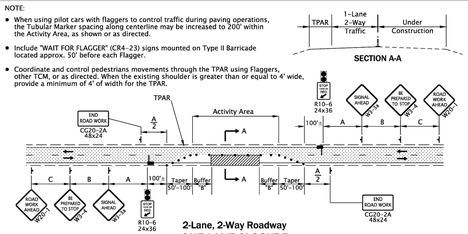
Effective Date: June 1, 2024 – November 30, 2024

NOTE:
- Continue "ABRUPT EDGE" (CW21-7,9)) and "DO NOT PASS" (R4-1) signing throughout the area at spacing shown.



2-Lane, 2-Way Roadway
OVERLAY AREA SIGNING

NOTES:
- When using pilot cars with flaggers to control traffic during paving operations, the Tubular Marker spacing along centerline may be increased to 200' within the Activity Area, as shown or as directed.
- Include "WAIT FOR FLAGGER" (CR4-23) signs mounted on Type II Barricade located approx. 50' before each Flagger.
- Coordinate and control pedestrians movements through the TPAR using Flaggers, other TCM, or as directed. When the existing shoulder is greater than or equal to 4' wide, provide a minimum of 4' of width for the TPAR.



2-Lane, 2-Way Roadway
ONE LANE CLOSURE

Consultant:	
Engineer's Seal:	REGISTERED PROFESSIONAL ENGINEER PE96202 OREGON MAY 12, 2025 ANDREW THOMAS MILES RENEWS 12-31-26
Client / Owner:	THE CITY OF WARRENTON OREGON
Project Title:	CITY OF WARRENTON HAMMOND TRANSMISSION WATERLINE PHASE 1
Drawing Title:	CIVIL TRAFFIC CONTROL DETAILS
Designed By:	KJM
Drawn By:	KJM
Checked By:	ATM
Approved By:	ATM
CONSOR Project No.:	W231023OR
Issued On:	MARCH 2025
Drawing No.:	C-2501

BID SET

consor
This document, ideas, and designs incorporated herein, are an instrument of professional service, and is not to be used, in whole or in part, for any other project without the written authorization of CONSOR.

0 1/2 1 IF BAR DOES NOT MEASURE 1" DRAWING IS NOT TO SCALE

City Commission Agenda Memo

Meeting Date: April 8th, 2025
From: Kevin Gorman, Public Works Director
Subject: Raw Waterline RP-2 Easements

Summary:

The Raw Waterline RP-2 Project requires six new easements to accommodate the planned waterline alignment along the roadway. These include three permanent easements and three temporary construction easements. While existing easements are already in place, the new alignment shifts the waterline closer to the road to improve accessibility, reduce land disturbance, and streamline construction. The easements were prepared by the City's legal team and reviewed by the affected property owners. Following review and signature by all parties, Commission approval is required to authorize the City Manager to sign and record the easements.

Recommendation/Suggested Motion:

"I move to approve the City Manager to execute and record the easement agreements for the Raw Waterline RP-2 Project."

Alternative:

Other action as deemed appropriate by the City Commission
OR
None recommended

Fiscal Impact:

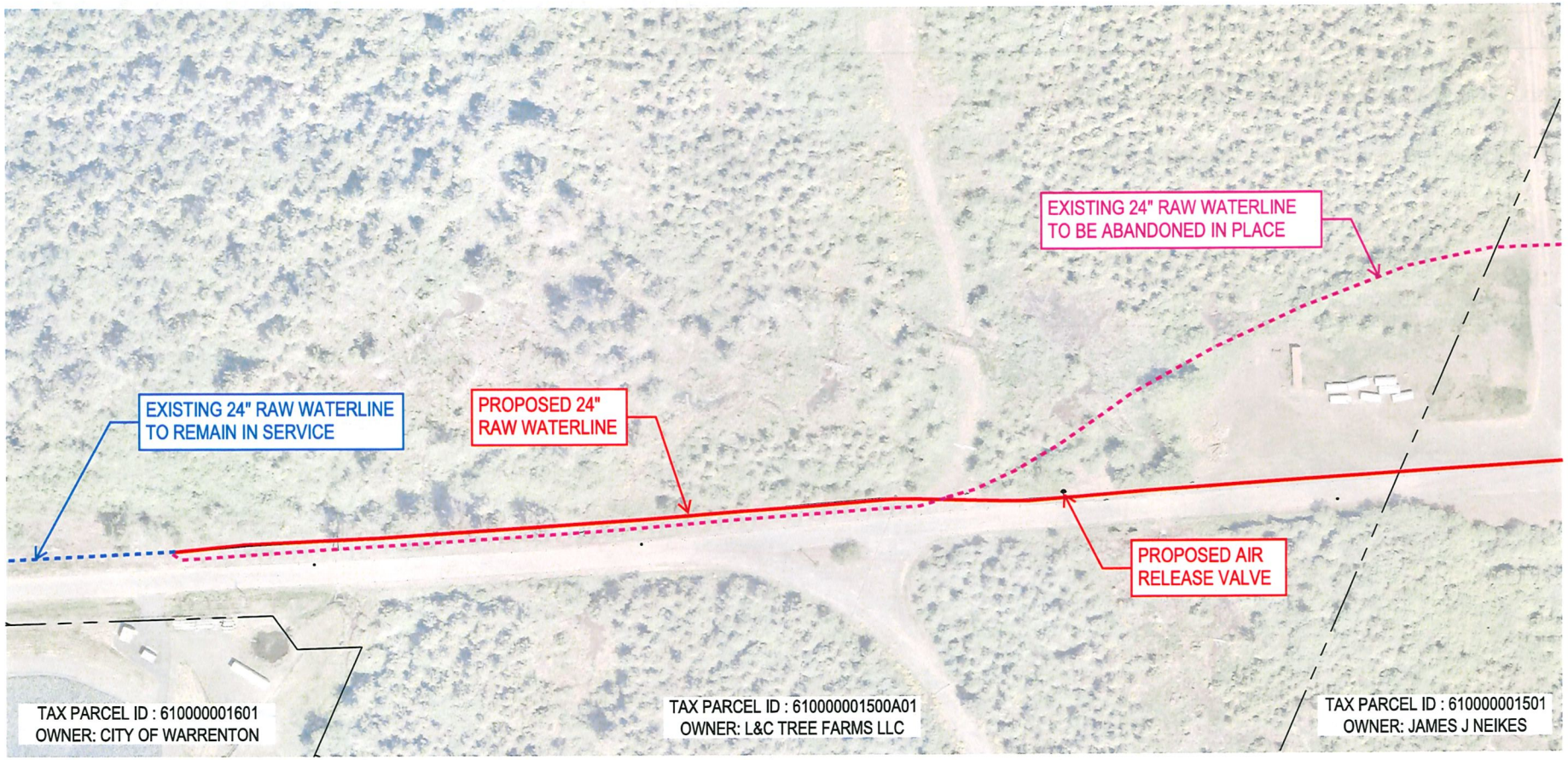
There is no fiscal impact, as there are no costs associated with acquiring these easements.

Attachments:

- Attachment #1: Easement Location Map
- Attachment #2: L&C Tree Farm, LLC Permanent Water Utility Easement (Tax lot 610000001500)
- Attachment #3: L&C Tree Farm, LLC Permanent Water Utility Easement (Tax lot 610000001600)
- Attachment #4: L&C Tree Farm, LLC Temporary Construction Easement (Tax lot 610000001500)
- Attachment #5: L&C Tree Farm, LLC Temporary Construction Easement (Tax lot 610000001600)
- Attachment #6: The Estate of James Joseph Neikes Permanent Water Utility Easement (Tax lot 610000001501)
- Attachment #7: The Estate of James Joseph Neikes Temporary Construction Easement(Tax lot 610000001501)

Approved by City Manager: Esther J. Moberg

Attachment #1 Easement Location Map (4 pages.)



NOTES:
1. WATERLINES AND APPURTENANCES ARE APPROXIMATE LOCATION. SPECIFIC LOCATION WILL BE DELINEATED IN CONSTRUCTION DRAWINGS.
2. AERIAL IMAGERY AND TAX PARCEL INFO ARE TAKEN FROM CLATSOP COUNTY GIS.

PLAN
SCALE: 1"=100'

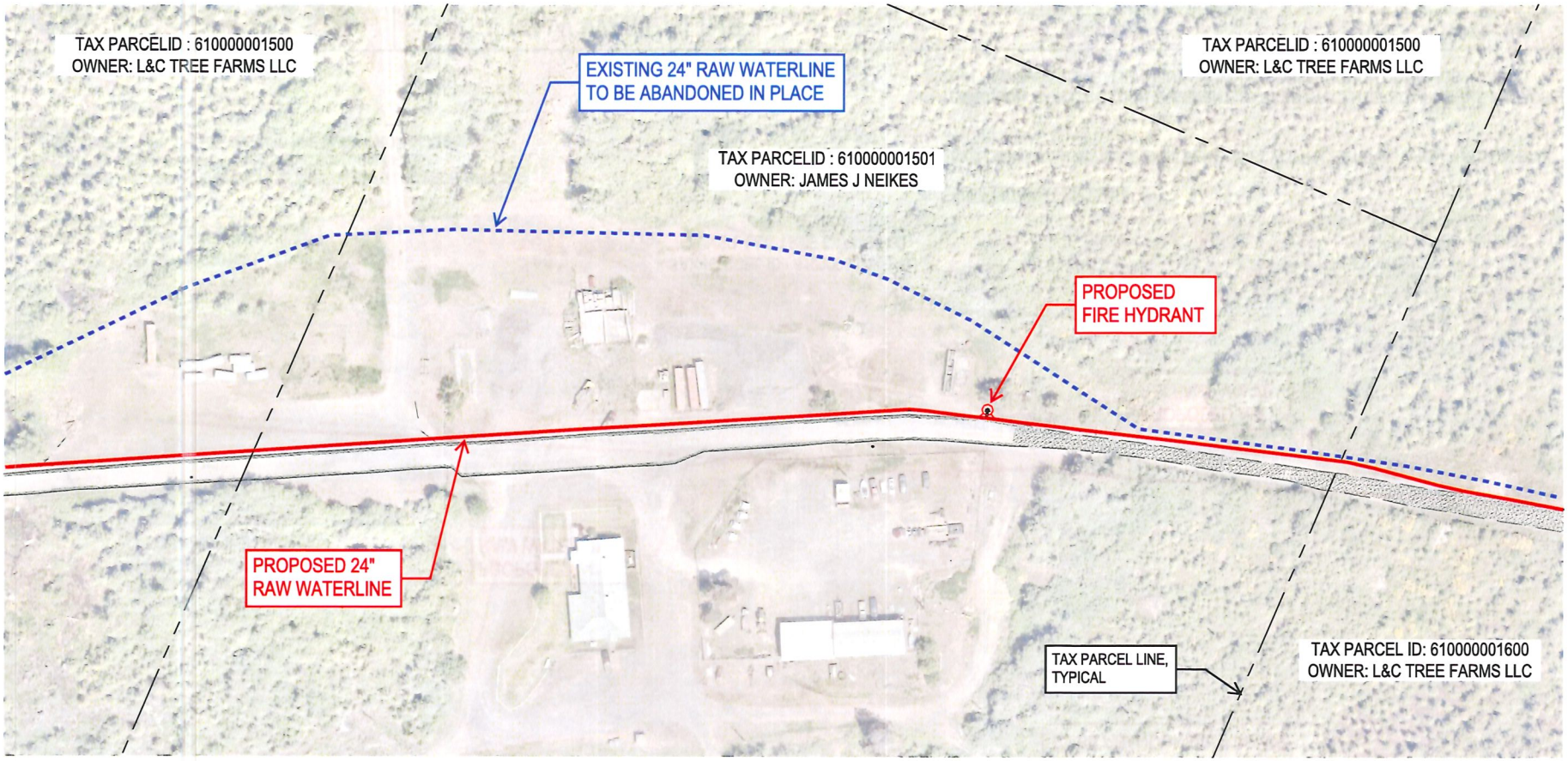
EASEMENT DESCRIPTIONS

PERMANENT MAINTENANCE EASEMENT: 20-FT WIDTH CENTERED UPON THE 24-IN RAW WATERLINE AS CONSTRUCTED.

TEMPORARY CONSTRUCTION EASEMENT: 30-FT WIDTH CENTERED UPON THE PROPOSED 24-IN RAW WATERLINE ALIGNMENT SHOWN IN CONSTRUCTION DRAWINGS.

consor	RAW WATERLINE REPLACEMENT RP2	FIGURE A PROPOSED WATERLINE EASEMENT L&C TIMBERLANDS LLC PROPERTY	DATE: APRIL 2024 JOB NO: W231024OR.00

\\consor.local\fion_V-W\Projects\OR\Warrenton\2023\W231024OR.0012 CADD\12-9 Figures_W231024OR_Nuveen Easement_Figures.dwg



NOTES:
1. WATERLINES AND HYDRANT ARE APPROXIMATE LOCATION. SPECIFIC LOCATION WILL BE DELINEATED IN CONSTRUCTION DRAWINGS.
2. AERIAL IMAGERY AND TAX PARCEL INFO ARE TAKEN FROM CLATSOP COUNTY GIS.

PLAN
SCALE: 1"=100'

EASEMENT DESCRIPTIONS

PERMANENT MAINTENANCE EASEMENT: 20-FT WIDTH CENTERED UPON THE 24-IN RAW WATERLINE AS CONSTRUCTED.

TEMPORARY CONSTRUCTION EASEMENT: 30-FT WIDTH CENTERED UPON THE PROPOSED 24-IN RAW WATERLINE ALIGNMENT SHOWN IN CONSTRUCTION DRAWINGS.

consor	RAW WATERLINE REPLACEMENT RP2	FIGURE A PROPOSED WATERLINE EASEMENT NEIKES PROPERTY	DATE: JAN 2024 JOB NO: W231024OR.00

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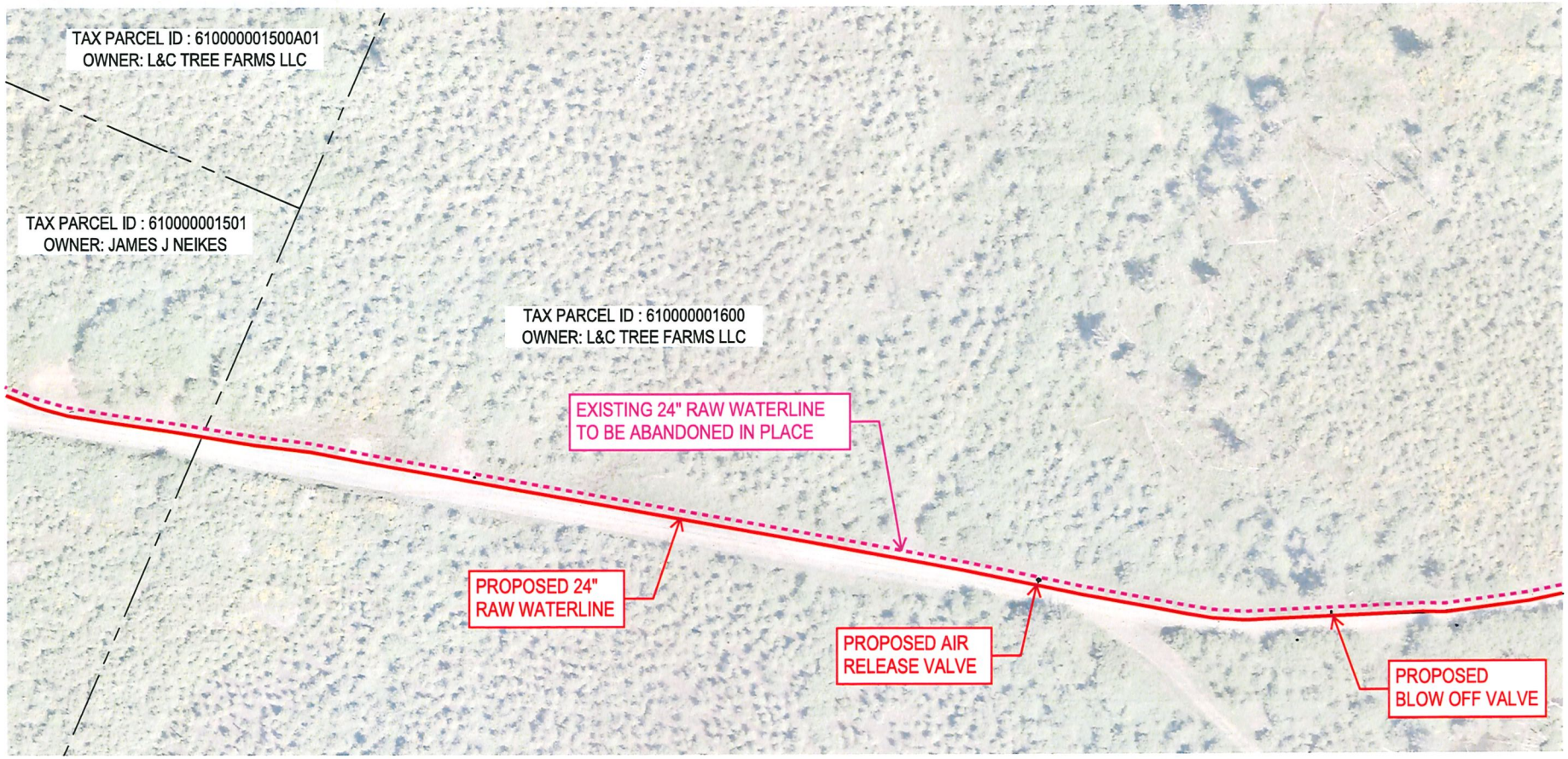

NOTES:
1. WATERLINES AND APPURTENANCES ARE APPROXIMATE LOCATION. SPECIFIC LOCATION WILL BE DELINEATED IN CONSTRUCTION DRAWINGS.
2. AERIAL IMAGERY AND TAX PARCEL INFO ARE TAKEN FROM CLATSOP COUNTY GIS.

PLAN
SCALE: 1"=100'

EASEMENT DESCRIPTIONS

PERMANENT MAINTENANCE EASEMENT: 20-FT WIDTH CENTERED UPON THE 24-IN RAW WATERLINE AS CONSTRUCTED.

TEMPORARY CONSTRUCTION EASEMENT: 30-FT WIDTH CENTERED UPON THE PROPOSED 24-IN RAW WATERLINE ALIGNMENT SHOWN IN CONSTRUCTION DRAWINGS.

consor	RAW WATERLINE REPLACEMENT RP2	FIGURE B PROPOSED WATERLINE EASEMENT L&C TIMBERLANDS LLC PROPERTY	DATE: APRIL 2024 JOB NO: W231024OR.00

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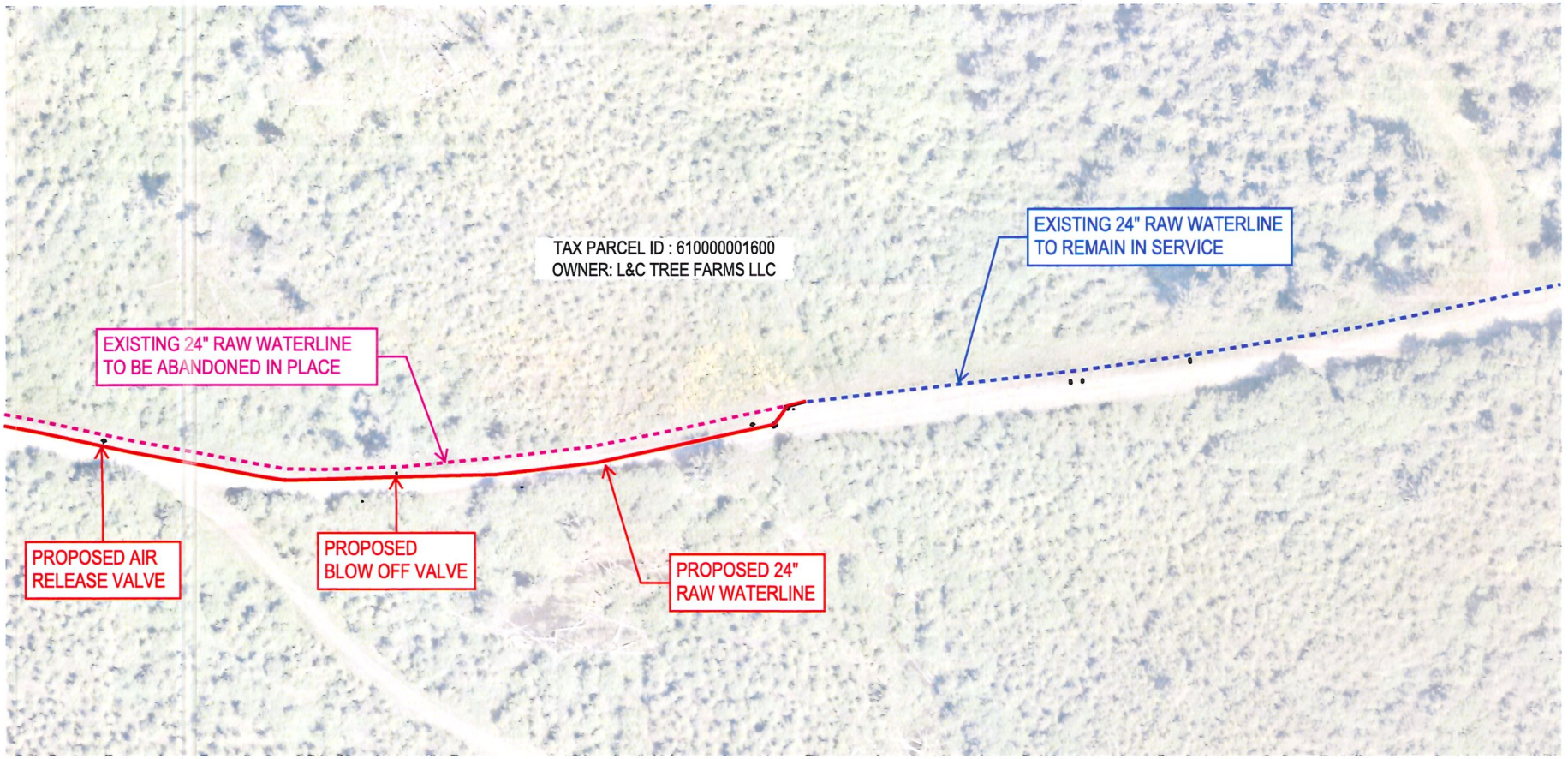

NOTES:
1. WATERLINES AND APPURTENANCES ARE APPROXIMATE LOCATION. SPECIFIC LOCATION WILL BE DELINEATED IN CONSTRUCTION DRAWINGS.
2. AERIAL IMAGERY AND TAX PARCEL INFO ARE TAKEN FROM CLATSOP COUNTY GIS.

PLAN
SCALE: 1"=100'

EASEMENT DESCRIPTIONS

PERMANENT MAINTENANCE EASEMENT: 20-FT WIDTH CENTERED UPON THE 24-IN RAW WATERLINE AS CONSTRUCTED.

TEMPORARY CONSTRUCTION EASEMENT: 30-FT WIDTH CENTERED UPON THE PROPOSED 24-IN RAW WATERLINE ALIGNMENT SHOWN IN CONSTRUCTION DRAWINGS.

consor	RAW WATERLINE REPLACEMENT RP2	FIGURE C PROPOSED WATERLINE EASEMENT L&C TIMBERLANDS LLC PROPERTY	DATE: APRIL 2024 JOB NO: W231024OR.00

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AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: L&C Tree Farms, LLC
85892 Lewis & Clark RD
Seaside, OR 97138

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

PERMANENT WATER UTILITY EASEMENT – TAXLOT 610000001500

RECITALS:

A. Grantor owns the real property described in Clatsop County Deed Record No. 201505488 ("Property").

B. The City installs, removes, and maintains utilities throughout the city, include waterlines.

C. The City requires a permanent easement on the Property ("Easement") to allow access to and to inspect, maintain, repair, and undertake other activities related to the water pipeline utility that it will construct in the location depicted in **Exhibit A** ("Easement Area").

D. Grantor desires to grant to the City and the City desires to accept from the Grantor a permanent easement over the Easement Area pursuant to the terms of this Agreement.

NOW, THEREFORE, the true consideration for the Easement is the mutual covenants and agreements contained herein, the receipt and sufficiency of which are acknowledged; the parties agree as follows ("Agreement"):

1. Grant of Permanent Utility Easement. Grantor, and Grantor's heirs, successors and assigns, grants and conveys to the City, a permanent, nonexclusive easement for the purpose of designing, accessing, constructing, reconstructing, operating, and maintaining a water utility easement and a water blow-off valve (BOV) assembly in the Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Easement Area as allowed under Section 3 below. In the event that the Easement Area overlaps with any preexisting easement areas granted to the City, the creation of this Easement Area shall not be construed to extinguish or otherwise impact or limit the City's rights to any preexisting easement areas. The BOV installed in the Easement Area is designated solely for system maintenance and water release and shall not be used for any non-essential or non-emergency purposes and shall only be operated by the City.

2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Easement Area for all purposes related to a water pipeline and related facilities. The Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, operating, and maintaining a water pipeline and related facilities that are above ground and underground and a water blow-off valve (BOV) assembly. The City has the right to excavate, construct, install, place, lay, operate, inspect, maintain, relocate, add to, and remove underground pipelines, related structures and facilities within the Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, maintenance, inspection, removal, or efficient service of all or any part of its respective water system on or from the Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Easement Area at any and all times for the exercise of any of the easement rights. The BOV in the Easement Area shall be used exclusively for system maintenance purposes to release water as needed.

3. Restrictions on City's Use of Easement Area; Damage. The City shall use the Easement Area as necessary for the purpose described in this Easement. At the City's sole cost and expense, the City agrees to repair any and all damage caused to the Easement Area or Grantor's Property by the City. The City shall stabilize any disturbed soils and reasonably restore the Easement Area following completion of any construction in the Easement Area by the City to the same or better condition as existed in the Easement Area prior to the work. However, if restoration requires the replacement of any trees or vegetation, any trees will be replaced with trees no larger than four-inches in diameter, and any plants will be replaced with plants in two-gallon containers. The size and species of any trees or vegetation replaced will be solely at the City's discretion. After restoration is complete, Grantor is responsible for watering and maintaining the vegetation.

4. Liability for Non-easement Property. The City shall be liable for any damage to the Property that is caused by the City. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Easement Area and other area of the Property that City has damaged. Notice shall be sent to:

   City of Warrenton
   Attn: Public Works
   P.O. Box 250
   Warrenton, OR 97146

5. Grantor's Reservation of Rights; Limitation on Reserved Rights.

   5.1. Grantor reserves the right to continued use of the surface area within the Easement Area for all lawful purposes that do not interfere with, and are not inconsistent with, the City's rights granted in this Easement.

   5.2. This reservation of rights does not include the right to build structures or place objects in the Easement Area that obstruct access to the Easement Area without the City's permission, or to create other impediments to the City's easement rights. Any such obstruction may be summarily removed by the City, and there shall be no claim

allowed for damage to or destruction of the building, structure or object that the City removed. This reservation of rights does not include the right to engage in or allow any action that disturbs the subjacent or lateral support of the Easement Area.

6. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.
7. Grantor's Warranty. Grantor agrees that it has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.
8. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.
9. Legal Effect; Shall Run with the Land. The Permanent Easement shall become effective and binding on the date signed by the Grantor and inure to the benefit of Grantor and the City, and their respective heirs, personal representatives, successors and assigns. This Easement shall run with the land.
10. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.
11. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.
12. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this 17 day of March, 2025.

GRANTOR:
L&C Tree Farms, LLC

[NAME] Kevin Brown

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 17, 2025, by Whitney Johnson.

OFFICIAL STAMP
WHITNEY MARIE JOHNSON
NOTARY PUBLIC-OREGON
COMMISSION NO. 1014679
MY COMMISSION EXPIRES AUGUST 02, 2025

Whitney Johnson
Notary Public for Oregon
My commission expires: Aug. 02, 2025

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____
_____, City of Warrenton
Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____
Notary Public for Oregon
My commission expires:_____

S&F Land Services
812 avenue F, Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 11/15/2024
INITIALS: TLO

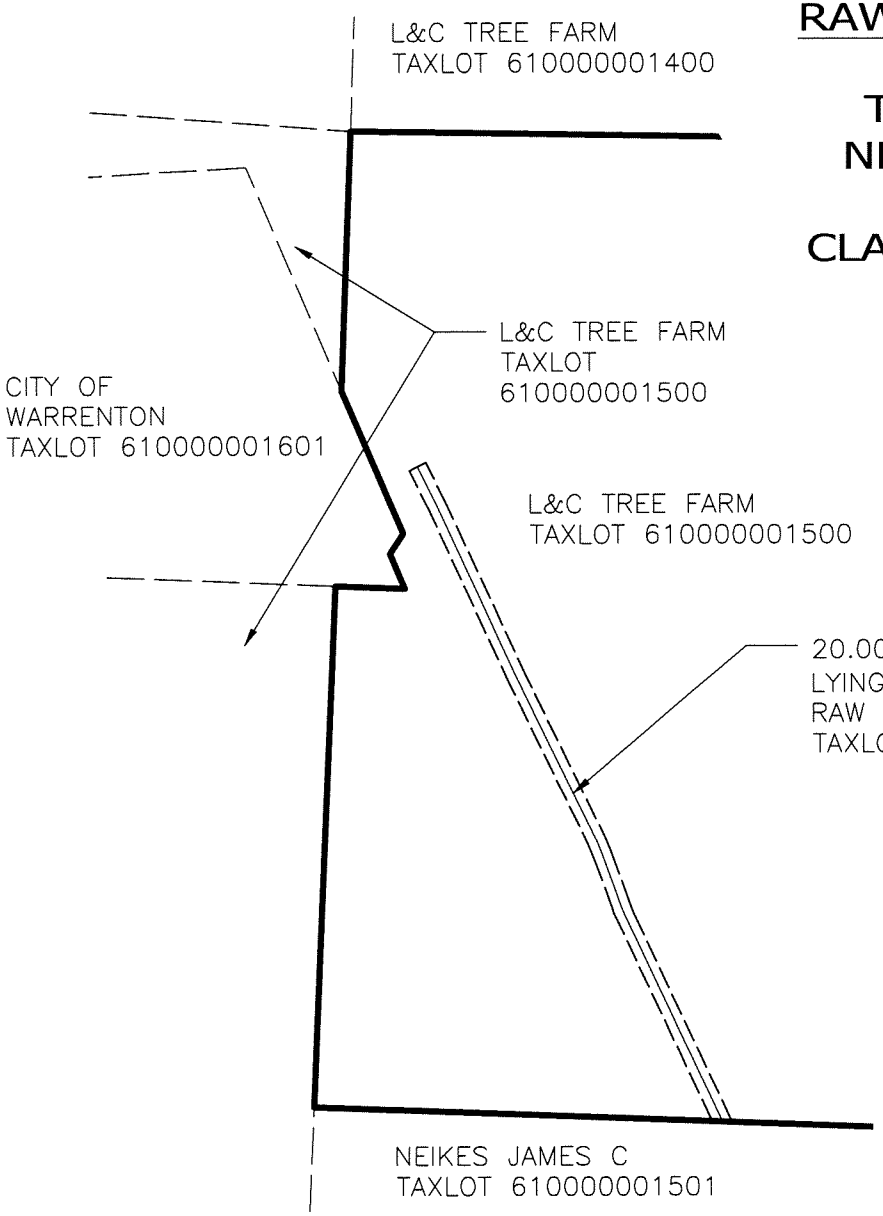
LEGAL DESCRIPTION 24 INCH RAW WATERLINE
L&C TREE FARMS LLC - TAXLOT 610000001500

A 20.00 FEET WIDE PERMANANT EASEMENT FOR THE PURPOSES OF CONSTRUCTION, RECONSTRUCTION, MAINTENANCE, INSPECTION, EFFICIENT SERVICE OR REMOVAL. SAID EASEMENT LYING 10.00 FEET EITHER SIDE OF THAT 24 INCH DIAMETER PIPELINE, AS CONSTRUCTED, OVER ACROSS, AND THROUGH A PORTION OF TAXLOT 610000001500 OWNED BY L&C TREE FARMS LLC AND LOCATED IN THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDIAN, IN CLATSOP COUNTY, OREGON.

RENEWS 6/30/26

RAW WATERLINE EASEMENT EXHIBIT

TAXLOT 610000001500
NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



1 INCH = 300 FEET

REGISTERED
PROFESSIONAL
LAND SURVEYOR

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

RENEWS 6/30/26

20.00' WIDE EASEMENT FOR MAINTENANCE OF WATERLINE LYING 10.00' EITHER SIDE OF THAT 24 INCH DIAMETER RAW WATERLINE AS CONSTRUCTED CLATSOP COUNTY TAXLOT 610000001500 OWNED BY L&C TREE FARM

LEGEND:

- BOUNDARY LINE
- LOT LINE
- EASEMENT
- SECTION LINE

S&F Land Services

Date: 06/06/2024
Proj No: 24G03207

812 AVE F
SEASIDE, OR 97138
(503) 738-3425

www.sflands.com
info@sflands.com

AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: L&C Tree Farms, LLC
85892 Lewis & Clark RD
Seaside, OR 97138

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

PERMANENT WATER UTILITY EASEMENT – TAXLOT 610000001600

RECITALS:

A. Grantor owns the real property described in Clatsop County Deed Record No. 201505488 ("Property").
B. The City installs, removes, and maintains utilities throughout the city, including waterlines.
C. The City requires a permanent easement on the Property ("Easement") to allow access to and to inspect, maintain, repair, and undertake other activities related to the water pipeline utility that it will construct in the location depicted in **Exhibit A** ("Easement Area").
D. Grantor desires to grant to the City and the City desires to accept from the Grantor a permanent easement over the Easement Area pursuant to the terms of this Agreement.

NOW, THEREFORE, the true consideration for the Easement is the mutual covenants and agreements contained herein, the receipt and sufficiency of which are acknowledged; the parties agree as follows ("Agreement"):

1. Grant of Permanent Utility Easement. Grantor, and Grantor's heirs, successors and assigns, grants and conveys to the City, a permanent, nonexclusive easement for the purpose of designing, accessing, constructing, reconstructing, operating, and maintaining a water utility easement and a water blow-off valve (BOV), and combination air release valves (CARV) in the Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Easement Area as allowed under Section 3 below. In the event that the Easement Area overlaps with any preexisting easement areas granted to the City, the creation of this Easement Area shall not be construed to extinguish or otherwise impact or limit the City's rights to any preexisting easement areas. The BOV and CARV installed in the Easement Area are designated solely for system maintenance, water

release, and air release and shall not be used for any non-essential or non-emergency purposes, and shall only be operated by the City.

2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Easement Area for all purposes related to a water pipeline and related facilities including a water blow-off valve (BOV) and a combination air release valve (CARV). The Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, operating, and maintaining a water pipeline and related facilities that are above ground and underground. The City has the right to excavate, construct, install, place, lay, operate, inspect, maintain, relocate, add to, and remove underground pipelines, related structures and facilities, including the BOV and CARV, within the Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, maintenance, inspection, removal, or efficient service of all or any part of its respective water system on or from the Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Easement Area at any and all times for the exercise of any of the easement rights. The BOV shall be used exclusively for system maintenance and water release by the City, while the CARV is installed for air release/vacuum as needed to maintain operational efficiency.

3. Restrictions on City's Use of Easement Area; Damage. The City shall use the Easement Area as necessary for the purpose described in this Easement. At the City's sole cost and expense, the City agrees to repair any and all damage caused to the Easement Area or Grantor's Property by the City. The City shall stabilize any disturbed soils and reasonably restore the Easement Area following completion of any construction in the Easement Area by the City to the same or better condition as existed in the Easement Area prior to the work. However, if restoration requires the replacement of any trees or vegetation, any trees will be replaced with trees no larger than four-inches in diameter, and any plants will be replaced with plants in two-gallon containers. The size and species of any trees or vegetation replaced will be solely at the City's discretion. After restoration is complete, Grantor is responsible for watering and maintaining the vegetation.

4. Liability for Non-easement Property. The City shall be liable for any damage to the Property that is caused by the City. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Easement Area and other area of the Property that City has damaged. Notice shall be sent to:

   City of Warrenton
   Attn: Public Works
   P.O. Box 250
   Warrenton, OR 97146

5. Grantor's Reservation of Rights; Limitation on Reserved Rights.

   5.1. Grantor reserves the right to continued use of the surface area within the Easement Area for all lawful purposes that do not interfere with, and are not inconsistent with, the City's rights granted in this Easement.

5.2. This reservation of rights does not include the right to build structures or place objects in the Easement Area that obstruct access to the Easement Area without the City's permission, or to create other impediments to the City's easement rights. Any such obstruction may be summarily removed by the City, and there shall be no claim allowed for damage to or destruction of the building, structure or object that the City removed. This reservation of rights does not include the right to engage in or allow any action that disturbs the subjacent or lateral support of the Easement Area.

6. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.

7. Grantor's Warranty. Grantor agrees that it has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.

8. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.

9. Legal Effect; Shall Run with the Land. The Permanent Easement shall become effective and binding on the date signed by the Grantor and inure to the benefit of Grantor and the City, and their respective heirs, personal representatives, successors and assigns. This Easement shall run with the land.

10. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.

11. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.

12. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this 17 day of March, 2025.

GRANTOR:
L&C Tree Farms, LLC

[NAME] Kevin Brown

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 17, 2025, by Whitney Johnson.

OFFICIAL STAMP
WHITNEY MARIE JOHNSON
NOTARY PUBLIC-OREGON
COMMISSION NO. 1014679
MY COMMISSION EXPIRES AUGUST 02, 2025

Whitney Johnson
Notary Public for Oregon
My commission expires: Aug. 02, 2025

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____
_____, City of Warrenton
Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____
Notary Public for Oregon
My commission expires:_____

S&F Land Services
812 avenue F, Seaside OR 97138
503-738-3425 – www.sflands.com

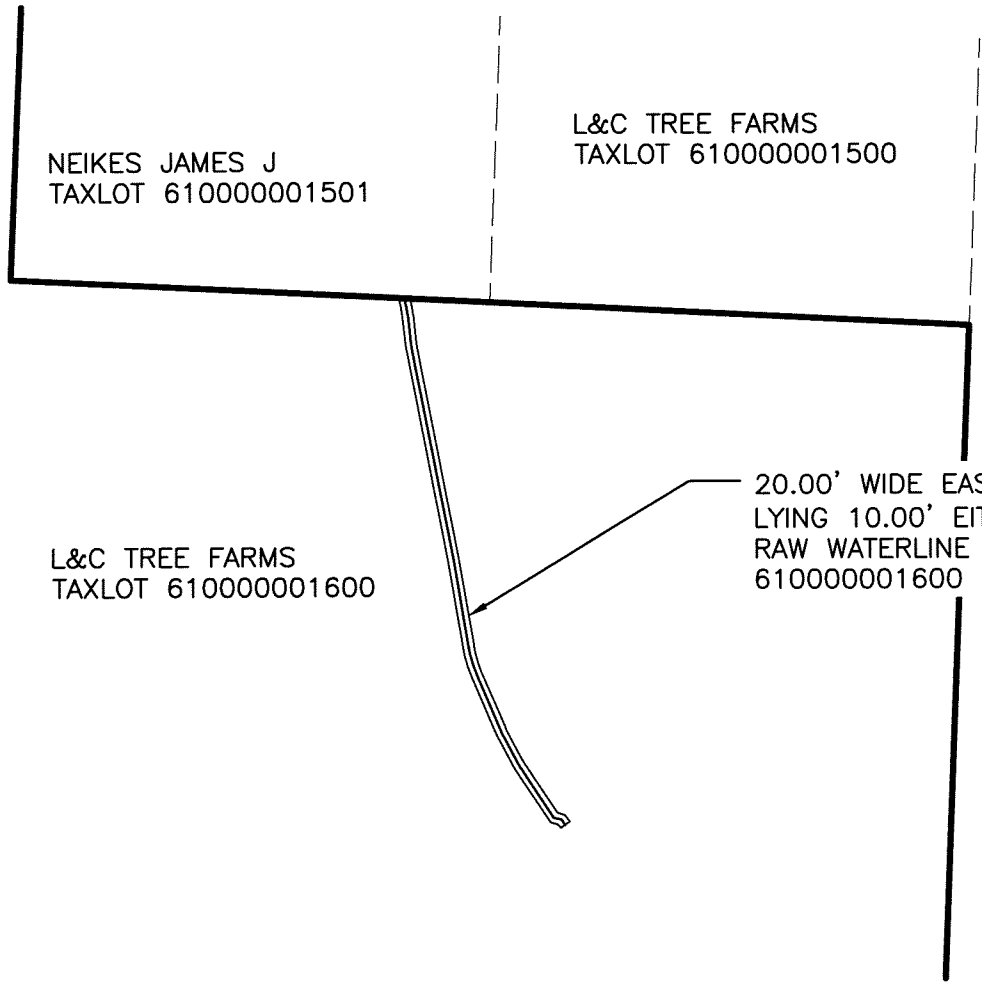
PROJECT NO.: 24G032
DATE: 11/15/2024
INITIALS: TLO

LEGAL DESCRIPTION 24 INCH RAW WATERLINE
L&C TREE FARMS LLC - TAXLOT 610000001600

A 20.00 FEET WIDE PERMANANT EASEMENT FOR THE PURPOSES OF CONSTRUCTION, RECONSTRUCTION, MAINTENANCE, INSPECTION, EFFICIENT SERVICE OR REMOVAL. SAID EASEMENT LYING 10.00 FEET EITHER SIDE OF THAT 24 INCH DIAMETER PIPELINE, AS CONSTRUCTED, OVER ACROSS, AND THROUGH A PORTION OF TAXLOT 610000001600 OWNED BY L&C TREE FARMS LLC AND LOCATED IN THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDIAN, IN CLATSOP COUNTY, OREGON.

RENEWS 6/30/26

RAW WATERLINE EASEMENT EXHIBIT
TAXLOT 610000001600
NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



1 INCH = 500 FEET

REGISTERED
PROFESSIONAL
LAND SURVEYOR

Jack L. White II

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

RENEWS 6/30/26

LEGEND:

BOUNDARY LINE

EASEMENT

LOT LINE

S&F Land Services

Date: 04/05/2024
Proj No: 24G03206

812 AVE F
SEASIDE, OR 97138
(503) 738-3425

www.sflands.com
info@sflands.com

AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: L&C Tree Farms, LLC
85892 Lewis & Clark RD
Seaside, OR 97138

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

TEMPORARY CONSTRUCTION EASEMENT – TAX LOT 610000001500

RECITALS:

A. Grantor owns the real property described in Clatsop County Deed Record No. 201505488 ("Property").

B. The City requires a temporary construction easement ("Easement") on the Property to allow the City to access and construct a water line in the locations described in **Exhibit A** ("Temporary Construction Easement Area").

C. Grantor desires to grant to the City and the City desires to accept from the Grantor a temporary construction easement pursuant to the terms of this Agreement.

NOW, THEREFORE, the parties agree as follows ("Agreement"):

1. Grant of Permanent Utility Easement. In consideration of the mutual benefits, covenants, and terms contained herein, the receipt and sufficiency of which is hereby acknowledged, Grantor, and Grantor's heirs, successors and assigns, grants and conveys to the City, a permanent, nonexclusive easement for the purpose of designing, accessing, constructing, reconstructing, operating, and maintaining a water utility easement in the Temporary Construction Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Temporary Construction Easement.
2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Temporary Construction Easement Area for all purposes related to a water pipeline and related facilities. The Temporary Construction Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, and operating a water pipeline and related facilities that are above ground and underground, this can include items such as fire hydrants, blow-off valve assemblies, combination air release valves, and bollards. The City has the right to excavate, construct, install, place, lay, operate, inspect, relocate, add to, and remove underground pipelines, related structures and facilities within the Temporary

Construction Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Temporary Construction Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, inspection, efficient service, or removal of all or any part of its respective water system on or from the Temporary Construction Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Temporary Construction Easement Area at any and all times for the exercise of any of the easement rights.

3. Noninterference. Grantor and its heirs, successors, and assigns will not interfere with the City's use of the Temporary Construction Easement Area or the rights granted herein and agrees not to build, construct, improve and/or plant (or permit or allow others to do so) any structures, edifices, plants or other objects within the areas of the Temporary Construction Easement Area during the term of this Easement.

4. Temporary Construction Easement Area Condition. The City shall return the Temporary Construction Easement Area to a good condition (i.e. repair/replace soil disturbance and/or vegetation; removal of construction debris, rocks/gravel and other materials; etc.) with all damage resulting from or arising out of said use to be repaired by the City. In addition, the City shall repair (or pay for the repair of) any damage to the Property caused by the City's activities in the Temporary Construction Easement Area. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Temporary Construction Easement Area and adjacent property. Notice shall be sent to:

   City of Warrenton
   Attn: Public Works
   P.O. Box 250
   Warrenton, OR 97146

5. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Temporary Construction Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.

6. Grantor's Warranty. Grantor agrees that Grantor has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.

7. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.

8. Expiration of Easement. The Easement will terminate upon the Owner's issuance of a Certificate of Final Completion to the Contractor for the construction project and shall have no further force or effect thereafter.

9. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.

10. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.

11. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this 17 day of March, 2025.

GRANTOR:
L&C Tree Farms, LLC

Kevin Brown

[NAME] Kevin Brown

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 17, 2025, by Whitney Johnson.

OFFICIAL STAMP
WHITNEY MARIE JOHNSON
NOTARY PUBLIC-OREGON
COMMISSION NO. 1014679
MY COMMISSION EXPIRES AUGUST 02, 2025

Whitney Johnson
Notary Public for Oregon
My commission expires: Aug. 02, 2025

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____, City of Warrenton
Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____
Notary Public for Oregon
My commission expires:_____

S&F Land Services
812 Avenue F, Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 06/06/2024
INITIALS: TLO

TEMPORARY CONSTRUCTION EASEMENT LEGAL DESCRIPTION
L&C TREE FARMS, LLC TAX LOT 610000001500

A 30.00 FEET WIDE EASEMENT FOR THE PURPOSES OF CONSTRUCTION OVER ACROSS, AND THROUGH A PORTION OF TAXLOT 610000001500 OWNED BY L&C TREE FARMS LLC AND LOCATED IN THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDIAN IN CLATSOP COUNTY, OREGON. THE CENTERILINE OF WHICH IS MORE PARTICULARLY DESCRIBED AS FOLLOWS.

COMMENCING AT THE SOUTHEAST CORNER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST, WILLAMETTE MERIDIAN, WHICH IS MARKED BY A 3 ¼ INCH ALUMINUM CAP STAMPED "CLATSOP COUNTY SURVEYOR S13 S24 S18 S19"

THENCE NORTHERLY ALONG THE SECTION LINE NORTH 02°14'47" EAST, A DISTANCE OF 2628.55 FEET

THENCE DEPARTING SAID SECTION LINE, NORTH 87°04'12" WEST A DISTANCE OF 1309.39 FEET TO THE SOUTHEAST CORNER OF THAT PROPERTY DESCRIBED IN INSTRUMENT NUMBER 20130648.

THENCE NORTH 02°17'36" EAST, A DISTANCE OF 952.75 FEET;

THENCE NORTH 87°51'17" WEST, A DISTANCE OF 639.06 FEET TO THE POINT OF BEGINNING.;

THENCE NORTH 25°04'46" WEST, A DISTANCE OF 378.46 FEET;

THENCE NORTH 21°04'12" WEST, A DISTANCE OF 11.73 FEET;

THENCE NORTH 19°32'32" WEST, A DISTANCE OF 90.04 FEET;

THENCE NORTH 22°41'28" WEST, A DISTANCE OF 24.17 FEET;

THENCE NORTH 25°50'24" WEST; A DISTANCE OF 299.06 FEET;

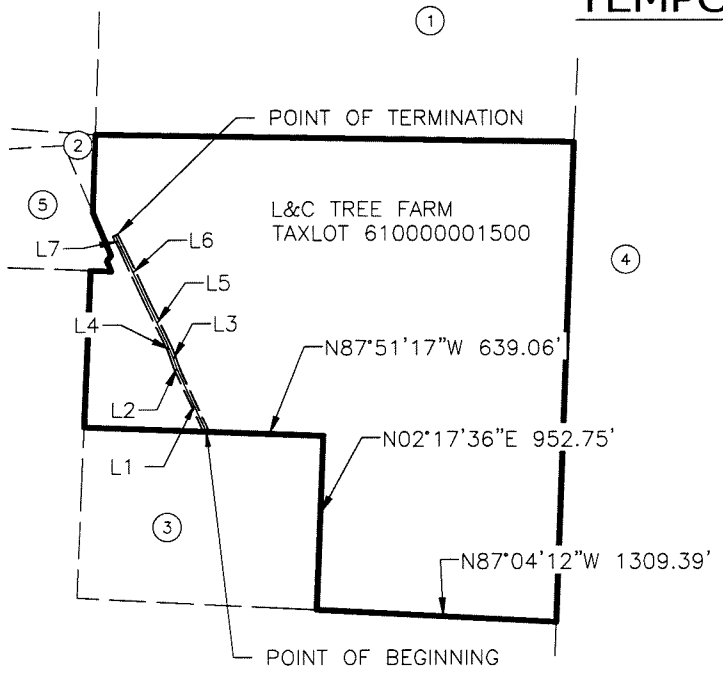
THENCE NORTH 24°41'57" WEST, A DISTANCE OF 312.81 FEET;

THENCT NORTH 26°18'15" WEST, A DISTANCE OF 71.91 FEET TO THE POINT OF TERMINATION.

BEARINGS BASED ON CLATSOP COUNTY SURVEY B-12978.

CONTAINING 35,271 SQUARE FEET, PLUS OR MINUS.

TEMPORARY CONSTRUCTION EASEMENT EXHIBIT
TAXLOT 610000001500
NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



LINE TABLE		
LINE #	BEARING	DISTANCE
L1	N25°04'46"W	378.46'
L2	N21°04'12"W	11.73'
L3	N19°32'32"W	90.04'
L4	N22°41'28"W	24.17'
L5	N25°50'24"W	299.06'
L6	N24°41'57"W	312.81'
L7	N26°18'15"W	71.91'

REGISTERED
PROFESSIONAL
LAND SURVEYOR

Jack L. White II

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

RENEWS 6/30/26

LEGEND:

- EASEMENT
- SECTION LINE
- LOT LINE

ADJOINING PARCELS:

1. L&C TREE FARM TAXLOT 610000001400
2. L&C TREE FARMS TAXLOT 610000001600
3. NEIKES, JAMES J TAXLOT 610000001501
4. L&C TREE FARMS TAXLOT 610000000600
5. CITY OF WARRENTON TAXLOT 610000001601

1 INCH = 1000 FEET

13 18
19 24

S&F Land Services

Date: 06/06/2024
Proj No: 24G03206

812 AVE F
SEASIDE, OR 97138
(503) 738-3425

www.sflands.com
info@sflands.com

AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: L&C Tree Farms, LLC
85892 Lewis & Clark RD
Seaside, OR 97138

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

TEMPORARY CONSTRUCTION EASEMENT – TAX LOT 610000001600

RECITALS:

A. Grantor owns the real property described in Clatsop County Deed Record No. 201505488 ("Property").

B. The City requires a temporary construction easement ("Easement") on the Property to allow the City to access and construct a water line in the locations described in **Exhibit A** ("Temporary Construction Easement Area").

C. Grantor desires to grant to the City and the City desires to accept from the Grantor a temporary construction easement pursuant to the terms of this Agreement.

NOW, THEREFORE, the parties agree as follows ("Agreement"):

1. Grant of Permanent Utility Easement. In consideration of the mutual benefits, covenants, and terms contained herein, the receipt and sufficiency of which is hereby acknowledged, Grantor, and Grantor's heirs, successors and assigns, grants and conveys to the City, a permanent, nonexclusive easement for the purpose of designing, accessing, constructing, reconstructing, operating, and maintaining a water utility easement in the Temporary Construction Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Temporary Construction Easement.
2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Temporary Construction Easement Area for all purposes related to a water pipeline and related facilities. The Temporary Construction Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, and operating a water pipeline and related facilities that are above ground and underground, this can include items such as fire hydrants, blow-off valve assemblies, combination air release valves, and bollards. The City has the right to excavate, construct, install, place, lay, operate, inspect, relocate, add to, and remove underground pipelines, related structures and facilities within the Temporary

Construction Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Temporary Construction Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, inspection, efficient service, or removal of all or any part of its respective water system on or from the Temporary Construction Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Temporary Construction Easement Area at any and all times for the exercise of any of the easement rights.

3. Noninterference. Grantor and its heirs, successors, and assigns will not interfere with the City's use of the Temporary Construction Easement Area or the rights granted herein and agrees not to build, construct, improve and/or plant (or permit or allow others to do so) any structures, edifices, plants or other objects within the areas of the Temporary Construction Easement Area during the term of this Easement.

4. Temporary Construction Easement Area Condition. The City shall return the Temporary Construction Easement Area to a good condition (i.e. repair/replace soil disturbance and/or vegetation; removal of construction debris, rocks/gravel and other materials; etc.) with all damage resulting from or arising out of said use to be repaired by the City. In addition, the City shall repair (or pay for the repair of) any damage to the Property caused by the City's activities in the Temporary Construction Easement Area. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Temporary Construction Easement Area and adjacent property. Notice shall be sent to:

   City of Warrenton
   Attn: Public Works
   P.O. Box 250
   Warrenton, OR 97146

5. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Temporary Construction Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.

6. Grantor's Warranty. Grantor agrees that Grantor has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.

7. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.

8. Expiration of Easement. The Easement will terminate upon the Owner's issuance of a Certificate of Final Completion to the Contractor for the construction project and shall have no further force or effect thereafter.

9. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.

10. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.

11. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this 17 day of March, 2025.

GRANTOR:
L&C Tree Farms, LLC

Kevin Brown

[NAME] Kevin Brown

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 17, 2025, by Whitney Johnson.

OFFICIAL STAMP
WHITNEY MARIE JOHNSON
NOTARY PUBLIC-OREGON
COMMISSION NO. 1014679
MY COMMISSION EXPIRES AUGUST 02, 2025

Whitney Johnson
Notary Public for Oregon
My commission expires: Aug. 02, 2025

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____, City of Warrenton
Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____
Notary Public for Oregon
My commission expires:_____

S&F Land Services
812 Avenue F, Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 06/06/2024
INITIALS: TLO

TEMPORARY CONSTRUCTION EASEMENT LEGAL DESCRIPTION
L&C TREE FARMS LLC, TAXLOT 610000001600

A 30.00 FEET WIDE EASEMENT FOR THE PURPOSES OF CONSTRUCTION, OVER ACROSS, AND THROUGH A PORTION OF THAT PROPERTY DESCRIBED IN CLATSOP COUNTY INSTRUMENT NUMBER 201303648 AND LOCATED IN THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDAIN IN CLATSOP COUNTY, OREGON. THE CENTERLINE OF WHICH IS MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST, WILLAMETTE MERIDIAN, WHICH IS MARKED BY A 3 ¼ INCH ALUMINUM CAP STAMPED "CLATSOP COUNTY SURVEYOR S13 S24 S18 S19"

THENCE NORTHERLY ALONG THE SECTION LINE NORTH 02°14'46" EAST, A DISTANCE OF 2628.55 FEET

THENCE DEPARTING SAID SECTION LINE, NORTH 87°04'12" WEST A DISTANCE OF 1309.39 FEET TO THE SOUTHEAST CORNER OF THAT PROPERTY DESCRIBED IN INSTRUMENT NUMBER 20130648.

THENCE NORTH 87°04'12" WEST, A DISTANCE OF 223.53 FEET TO THE **POINT OF BEGINNING**.

SAID POINT OF BEGENNING ON A CURVE TO THE RIGHT, SAID CURVE HAVING A 278.09 FOOT RADIUS, WITH A DELTA ANGLE OF 10°03'01", WITH AN ARC LENGTH OF 48.78 FEET, HAVING A CHORD BEARING OF SOUTH 11°10'08 EAST, A CHORD LENGTH OF 48.72 FEET;

THENCE SOUTH 6°18'19" EAST 70.89 FEET TO A CURVE TO THE LEFT;

SAID CURVE HAVING A 257.90 FOOT RADIUS, WITH A DELTA ANGLE OF 5°16'43", WITH AN ARC LENGTH OF 23.76 FEET, HAVING A CHORD BEARING OF SOUTH 8°36'55" EAST, A CHORD LENGTH OF 23.75 FEET;

THENCE SOUTH 10°55'31" EAST 589.57 FEET;

THENCE SOUTH 9°43'18" EAST 233.83 FEET TO A CURVE TO THE LEFT;

SAID CURVE HAVING A 327.05 FOOT RADIUS, WITH A DELTA ANGLE OF 15°04'24", WITH AN ARC LENGTH OF 86.04 FEET, HAVING A CHORD BEARING OF SOUTH 15°34'13" EAST, A CHORD LENGTH OF 85.79 FEET;

THENCE SOUTH 23°02'36.78" EAST 162.78 FEET TO A CURVE TO THE LEFT;

SAID CURVE HAVING A 259.50 FOOT RADIUS, WITH A DELTA ANGLE OF 5°15'02", WITH AN ARC LENGTH OF 23.78 FEET, HAVING A CHORD BEARING OF SOUTH 25°21'21" EAST, A CHORD LENGTH OF 23.77 FEET;

THENCE SOUTH 27°40'06" EAST 71.63 FEET TO A CURVE TO THE LEFT;

SAID CURVE HAVING A 256.06 FOOT RADIUS, WITH A DELTA ANGLE OF 6°10'20", WITH AN ARC LENGTH

S&F Land Services
812 Avenue F, Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 06/06/2024
INITIALS: TLO

OF 27.58 FEET, HAVING A CHORD BEARING OF SOUTH 30°24'60" EAST, A CHORD LENGTH OF 27.57 FEET;

THENCE SOUTH 33°09'54" EAST 160.23 FEET;

THENCE SOUTH 74°48'07" EAST 21.59 FEET:

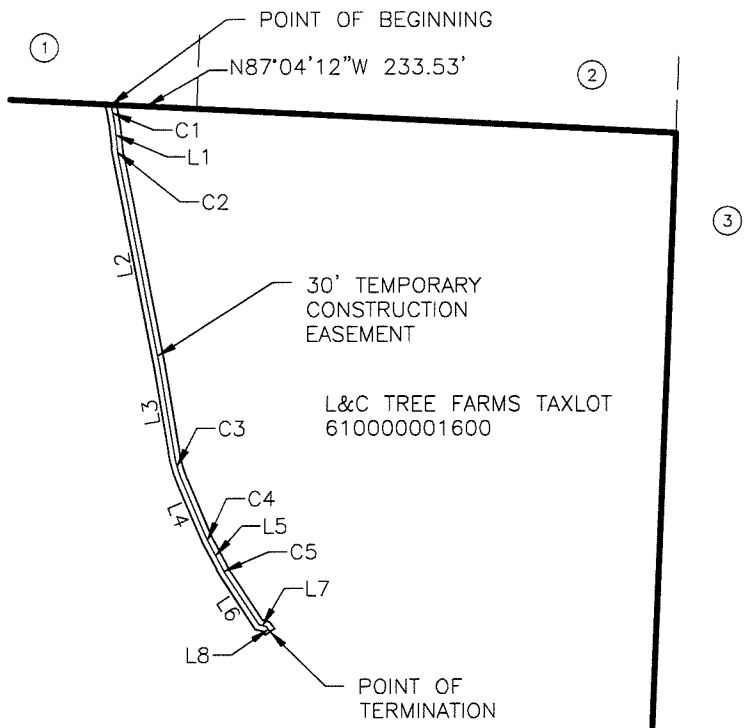
THENCE SOUTH 35°45'04" EAST 17.61, FEET TO THE **POINT OF TERMINATION**.

BEARINGS BASED ON CLATSOP COUNTY SURVEY B-12978

CONTAINING 46,168 SQUARE FEET, PLUS OR MINUS.

TEMPORARY CONSTRUCTION EASEMENT EXHIBIT

TAXLOT 610000001600
NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



REGISTERED PROFESSIONAL LAND SURVEYOR

Jack L. White II

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

RENEWS 6/30/26

LINE TABLE		
LINE #	BEARING	DISTANCE
L1	N6°18'19"W	70.89'
L2	N10°55'31"W	589.57'
L3	N9°43'18"W	233.83'
L4	N23°02'37"W	162.78'
L5	N27°40'06"W	71.63'
L6	N33°09'54"W	160.23'
L7	N74°48'07"W	21.59'
L8	N35°45'04"W	17.61'

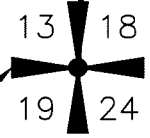
CURVE TABLE					
CURVE NO.	DELTA	RADIUS	LENGTH	CHORD	CHORD LEN
C1	10°03'01"	278.09'	48.78'	N11°10'08"W	48.72'
C2	5°16'43"	257.90'	23.76'	N8°36'55"W	23.75'
C3	15°04'24"	327.05'	86.04'	N15°34'13"W	85.79'
C4	5°15'02"	259.50'	23.78'	N25°21'21"W	23.77'
C5	6°10'20"	256.06'	27.58'	N30°25'00"W	27.57'

ADJOINING PARCELS:

1. NEIKES, JAMES J TAXLOT 610000001501
2. L&C TREE FARMS TAXLOT 610000001500
3. L&C TREE FARMS TAXLOT 610000000600

1 INCH = 500 FEET

POINT OF COMMENCEMENT



LEGEND:

EASEMENT

BOUNDARY LINE

LOT LINE

S&F Land Services

Date: 06/06/2024
Proj No: 24G03207

812 AVE F
SEASIDE, OR 97138
(503) 738-3425

www.sflands.com
info@sflands.com

AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: The Estate of James Joseph Neikes
34755 HWY 101 Business
Astoria, OR 97103

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

PERMANENT WATER UTILITY EASEMENT

RECITALS:

A. Grantor owns real property described by **Exhibit A** ("Property"), which is attached and incorporated by this reference.

B. Sirpa Duoos is the duly appointed Personal Representative of the will and estate of the Grantor. The Letters Testamentary appointing Sirpa Duoos as such are attached as **Exhibit B** and incorporated herein by this reference.

C. The City installs, removes, and maintains utilities throughout the city, including waterlines.

D. The City requires a permanent easement on the Property ("Easement") to allow access to and to inspect, maintain, repair, and undertake other activities related to the water pipeline utility that it will construct in the location depicted in **Exhibit C** ("Easement Area").

E. Grantor desires to grant to the City and the City desires to accept from the Grantor a permanent easement over the Easement Area pursuant to the terms of this Agreement.

NOW, THEREFORE, the true consideration for the Easement is the mutual covenants and agreements contained herein, the receipt and sufficiency of which are acknowledged; the parties agree as follows ("Agreement"):

1. Grant of Permanent Utility Easement. Grantor, and Grantor's heirs, successors and assigns, grants and conveys to the City, a permanent, nonexclusive easement for the purpose of designing, accessing, constructing, reconstructing, operating, and maintaining a water utility easement and a fire hydrant in the Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Easement Area as allowed under Section 3 below. The hydrant installed in the Easement Area is designated solely for emergency fire protection and shall not be used for any non-emergency purposes. The water supplied by this hydrant is non-potable and unsuitable for drinking or other

potable uses. The City reserves the right to restrict access to ensure that its use is limited to emergencies, thereby preventing any impact on the City's primary drinking water operations

2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Easement Area for all purposes related to a water pipeline and related facilities. The Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, operating, and maintaining a water pipeline and related facilities that are above ground and underground and a fire hydrant that will be above ground. The City has the right to excavate, construct, install, place, lay, operate, inspect, maintain, relocate, add to, and remove underground pipelines, related structures and facilities within the Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, maintenance, inspection, efficient service, or removal of all or any part of its respective water system on or from the Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Easement Area at any and all times for the exercise of any of the easement rights. The hydrant in the Easement Area shall be used exclusively for emergency fire protection purposes. Flow and pressure from the hydrant are dependent on water levels and WTP pump operations, with low gravity-driven static pressures, which vary. Non-emergency use of the hydrant is strictly prohibited to maintain adequate pressure and flow for the City's drinking water supply

3. Restrictions on City's Use of Easement Area; Damage. The City shall use the Easement Area as necessary for the purpose described in this Easement. At the City's sole cost and expense, the City agrees to repair any and all damage caused to the Easement Area or Grantor's Property by the City. The City shall stabilize any disturbed soils and reasonably restore the Easement Area following completion of any construction in the Easement Area by the City to the same or better condition as existed in the Easement Area prior to the work. However, if restoration requires the replacement of any trees or vegetation, any trees will be replaced with trees no larger than four-inches in diameter, and any plants will be replaced with plants in two-gallon containers. The size and species of any trees or vegetation replaced will be solely at the City's discretion. After restoration is complete, Grantor is responsible for watering and maintaining the vegetation.

4. Liability for Non-easement Property. The City shall be liable for any damage to the Property that is caused by the City and its officers, employees, agents, assigns, public utility providers, and independent contractors. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Easement Area and other area of the Property that City has damaged. Notice shall be sent to:

   City of Warrenton
   Attn: Public Works
   P.O. Box 250
   Warrenton, OR 97146

5. Grantor's Reservation of Rights; Limitation on Reserved Rights.

5.1. Grantor reserves the right to continued use of the surface area within the Easement Area for all lawful purposes that do not interfere with, and are not inconsistent with, the City's rights granted in this Easement.

5.2. This reservation of rights does not include the right to build structures or place objects in the Easement Area that obstruct access to the Easement Area without the City's permission, or to create other impediments to the City's easement rights. Any such obstruction may be summarily removed by the City, and there shall be no claim allowed for damage to or destruction of the building, structure or object that the City removed. This reservation of rights does not include the right to engage in or allow any action that disturbs the subjacent or lateral support of the Easement Area.

6. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.

7. Grantor's Warranty. Grantor agrees that it has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.

8. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.

9. Legal Effect; Shall Run with the Land. The Permanent Easement shall become effective and binding on the date signed by the Grantor and inure to the benefit of Grantor and the City, and their respective heirs, personal representatives, successors and assigns. This Easement shall run with the land.

10. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.

11. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.

12. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any

provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this _____ day of _____, 2025.

GRANTOR:
The Estate of James Joseph Neikes

Sirpa Duoos
_____
Sirpa Duoos, Personal Representative of the Estate of James Joseph Neikes

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 18, 2025, by Sirpa Duoos.

OFFICIAL STAMP
TANYA SHEA HELMERSEN
NOTARY PUBLIC - OREGON
COMMISSION NO. 1051240
MY COMMISSION EXPIRES AUGUST 28, 2028

Tanya Helmersen
_____
Notary Public for Oregon
My commission expires: August 28, 2028

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____
_____, City of Warrenton
Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____
Notary Public for Oregon
My commission expires:_____

Recording Instrument #: 201303648
Recorded By: Clatsop County Clerk
# of Pages: 10 Fee: 87.00
Transaction date: 4/26/2013 11:06:56
Deputy: tromeyn

Recorded by Ticor
Title Ins. Co. 36041 321259

When recorded, return to:
Weyerhaeuser NR Company
P. O. Box 9777, CH1-F23
Federal Way, WA 98063-9777

Send Tax Statements to:
James J. Neikes
34755 Hwy 101 Business
Astoria, Oregon 97103

Map / Tax Lot No. 610000001501 **Account No.** 7800
Vacant Land Seaside OR

SPECIAL WARRANTY DEED

WEYERHAEUSER NR COMPANY, a Washington corporation, P. O. Box 9777, Federal Way, Washington 98063-9777 ("**Grantor**"), for valuable consideration, receipt of which is hereby acknowledged, conveys and specially warrants to **JAMES J. NEIKES**, 34755 Hwy 101 Business, Astoria, Oregon 97103 ("**Grantee**"), the real property situated in **Clatsop County, Oregon**, described on **Exhibit A** attached hereto and by this reference made a part hereof, free of encumbrances created or suffered by the Grantor, except for the encumbrances of title and reservations as set forth on said Exhibit A.

The true and actual consideration for this transfer is: $280,000.00.

Grantee or anyone claiming by, through or under Grantee, hereby fully and irrevocably releases Grantor, Grantor's parent company, and any of the parent company subsidiaries, including their agents and representatives (collectively, the "**Indemnified Parties**"), from any and all claims that it may now have or hereafter acquire against the Indemnified Parties for any cost, loss, liability, damage, expense, action or cause of action, whether foreseen or unforeseen, arising from or related to any defects, errors or omissions on or in the property, the presence of environmentally hazardous, toxic or dangerous substances, or any other conditions (whether patent, latent or otherwise) affecting the property. Grantee further acknowledges and agrees that this release shall be given full force and effect according to each of its expressed terms and provisions, including, but not limited to, those relating to unknown and suspected claims, damages and causes of action. As a material covenant and condition of this Deed, Grantee agrees that in the event of any such defects, errors or omissions, the presence of environmentally hazardous, toxic or dangerous substances, or any other conditions affecting the property, Grantee shall look solely to the Indemnified Parties predecessors in interest for any redress or relief, except for claims against Grantor based upon any obligations and liabilities of Grantor expressly provided in this Deed.

WNR/Neikes
Temp File No. T2013-205ph

The above provisions are specifically bargained for and represent a material part of Grantor's consideration for this conveyance.

BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON TRANSFERRING FEE TITLE SHOULD INQUIRE ABOUT THE PERSON'S RIGHTS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010. THIS INSTRUMENT DOES NOT ALLOW USE OF THE PROPERTY DESCRIBED IN THIS INSTRUMENT IN VIOLATION OF APPLICABLE LAND USE LAWS AND REGULATIONS. BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON ACQUIRING FEE TITLE TO THE PROPERTY SHOULD CHECK WITH THE APPROPRIATE CITY OR COUNTY PLANNING DEPARTMENT TO VERIFY THAT THE UNIT OF LAND BEING TRANSFERRED IS A LAWFULLY ESTABLISHED LOT OR PARCEL, AS DEFINED IN ORS 92.010 OR 215.010, TO VERIFY THE APPROVED USES OF THE LOT OR PARCEL, TO DETERMINE ANY LIMITS ON LAWSUITS AGAINST FARMING OR FOREST PRACTICES, AS DEFINED IN ORS 30.930, AND TO INQUIRE ABOUT THE RIGHTS OF NEIGHBORING PROPERTY OWNERS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010

[SIGNATURES ON FOLLOWING PAGE]

Dated: April 24th, 2013

WEYERHAEUSER NR COMPANY

By: Thomas J. Gideon
Title: Executive Vice President

By: Peggy Hebblethwaite
Title: Assistant Secretary

Dated: 4-25-13, 2013

Accepted hereby:

James J. Neikes

WNR/Neikes
Temp File No. T2013-205ph

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 24th day of April, 2013, before me personally appeared Thomas F. Gideon and Peggy Hebblethwaite, to me known to be the Executive Vice President and Assistant Secretary, respectively, of **WEYERHAEUSER NR COMPANY**, the corporation that executed the within and foregoing Deed, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument.

In witness whereof I have hereunto set my hand and affixed my official seal the day and year first above written.

KATHLEEN E. SAPINORO NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 09-08-16

Kathleen E. Sapinoro
Notary Public
My appointment expires: 9/8/2016

STATE OF OREGON)
) ss.
COUNTY OF Clatsop)

On this 25th day of April, 2013, personally appeared before me, **JAMES J. NEIKES**, and acknowledged before me on this day that, being informed of the contents of this instrument, he executed the same voluntarily on the day the same bears date.

In witness whereof I have hereunto set my hand and affixed my official seal the day and year first above written.

OFFICIAL SEAL
BARBARA JEAN ZIELINSKI
NOTARY PUBLIC-OREGON
COMMISSION NO. 442978
MY COMMISSION EXPIRES OCTOBER 4, 2013

Barbara Zielinski
Notary Public
My appointment expires: 10-4-13

WNR/Neikes
Temp File No. T2013-205ph

Non-Order Search
2013-3648 DEW 04-26-2013
Page 4 of 10
Requested By: paigestump, Printed: 1/21/2025 6:05 PM
1.6.2025 Commission Packet
Page 2130 of 2163

EXHIBIT A

IN CLATSOP COUNTY, OREGON

TOWNSHIP 6 NORTH, RANGE 10 WEST, WILLAMETTE MERIDIAN

Section 13: S½N½SW¼NE¼ and S½SW¼NE¼

TOGETHER WITH a non-exclusive appurtenant easement, as reserved by Grantor in the deed dated August 18, 2009, recording instrument #200908127 and re-recorded #200909388, to reconstruct, maintain and use the existing road, hereinafter referred to as "**Access Road**", along a right of way 100 feet in width, being 50 feet on either side of the road centerline as now constructed, upon, over and across the **W½NE¼; SW¼NW¼; NE¼SW¼ and W½SW¼ of Section 13, Township 6 North, Range 10 West, W.M.**; said Access Road is located approximately as shown on the attached Exhibit A-1. Said access being subject to the terms and conditions as stated in said Deed.

TOGETHER WITH a perpetual easement as reserved by Grantor in the deed dated August 18, 2009, recording instrument #200908127 and re-recorded #200909388, to maintain, operate, repair, improve reconstruct and use the water reservoir, water pipeline and related facilities (the "**Water System**") located in the E½ of Section 13, Township 6 North, Range 10 West, W.M., Clatsop County, Oregon, approximately as shown on attached Exhibit A-2 to serve property herein being described and conveyed to Grantee. The Water System consists of the water reservoir located in the SW¼NW¼NW¼SE¼ of said Section 13; and water pipelines located in the NW¼NE¼, the N½N½SW¼NE¼ and the NW¼SE¼ of said Section 13 and such other related facilities as may be necessary to maintain, operate, repair, improve, reconstruct and use the Water System. The right conveyed herein shall be subject to the covenant and agreement identified as "9" in the Bargain and Sale Deed to the city of Warrenton recorded April 12, 2001, Clatsop County Recording instrument #200103387. TOGETHER with the rights to use the existing roads and right of way over and across the Lewis and Clark Mainline road and the BR 5 road in the SE¼ of said Section 13, to provide access to the Water System. The approximate location of such existing roads being shown on the attached Exhibit A-1.

RESERVATION:
Grantor hereby expressly saves, excepts, and reserves out of the grant hereby made, unto itself and its successors and assigns forever, all oil, gas, and other liquid or gaseous hydrocarbons including, without limitation, coal seam gas; geothermal resources including, without limitation, geothermal steam and heat; base and precious metals; ores; coal; lignite; peat; clays; and minerals of any and every nature, kind, or description whatsoever now or hereafter susceptible of commercial exploitation (collectively "**Mineral Resources**") in or upon said land, together with the right to enter upon said land, at any and all times, for the purpose of exploring the same for such Mineral Resources by geological, geophysical, geochemical, or other means, and for

WNR/Neikes
Temp File No. T2013-205ph

drilling, opening, developing, and working mines and wells thereon and taking out, extracting, or removing therefrom by any means whether now in use or hereafter developed, including by surface and sub-surface mining methods, all such Mineral Resources, and to occupy and make use of so much of the surface of said land as may be reasonably necessary or convenient for said purposes, together with the right to store, save, transport, treat, process, market, or otherwise utilize such Mineral Resources so produced, together with all rights and powers in, to, and over said land, whether herein expressed or not, reasonably necessary or convenient to render beneficial and efficient the complete enjoyment of the property and rights hereby reserved; *provided*, however, that Grantee and Grantee's heirs, representatives, successors, and assigns, shall be paid just and reasonable compensation for any injury or damage to the surface of said land or to the crops or improvements thereon caused by the exercise of any rights herein reserved; and *provided further*, that the exercise of such rights by Grantor and its successors and assigns shall not be postponed or delayed so long as Grantor or its successors or assigns is making reasonable efforts to agree upon or have determined such just and reasonable compensation.

Subject to:

1. Rights reserved in federal patents or state deeds, mineral or fossil rights reservations, exceptions or conveyances made by prior owners.

2. As disclosed by the assessment and tax roll, the land herein described has been classified/assessed as forestland. If the land becomes disqualified for this special classification/assessment under ORS Chapter 321 or any subsequent statute, any additional tax or penalties plus interest that may be levied shall be the responsibility of Grantee.

3. Taxes or special assessments which are not yet payable or which are not shown as existing liens by the public records.

4. All planning, zoning, health and other governmental regulations, if any, affecting the subject Property; all building, use, zoning, environmental and protected species restrictions general to the area.

5. Discrepancies, conflicts in boundary lines, shortage in area, encroachments or other facts which a correct survey would disclose.

6. Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

7. Rights of the State of Oregon in and to that portion of the Property, if any, lying in the bed or former bed of all rivers and creeks, if it is navigable.

8. Any question that may arise due to shifting or change in the course of any river or creek located on the Property.

9. Any prohibition or limitation on the use, occupancy or improvements of the Property resulting from the rights of the public or riparian owners to use any waters which may cover the Property or to use any portion of the Property which is now or may formerly have been covered by water.

10. All matters of public record, and all covenants, conditions, reservations, restrictions, easements and rights of way for public and/or private roads and roadways, railroads and utilities heretofore established and existing on said Property and all matters evident on the ground.

11. Easement for right of way contained in:
Document: Deed
In favor of: Astoria and Portland Railway Company
Recorded: April 21, 1892 in Book 24 at page 318

12. Easement for right of way contained in:
Document: Warranty Deed
In favor of: Lewis & Clark Railroad Company
Recorded: July 5, 1924 in Book 114 at page 486

13. Easement for right of way contained in:
Document: Warranty Deed
In favor of: Lewis & Clark Railroad Company
Recorded: July 5, 1924 in Book 114 at page 487

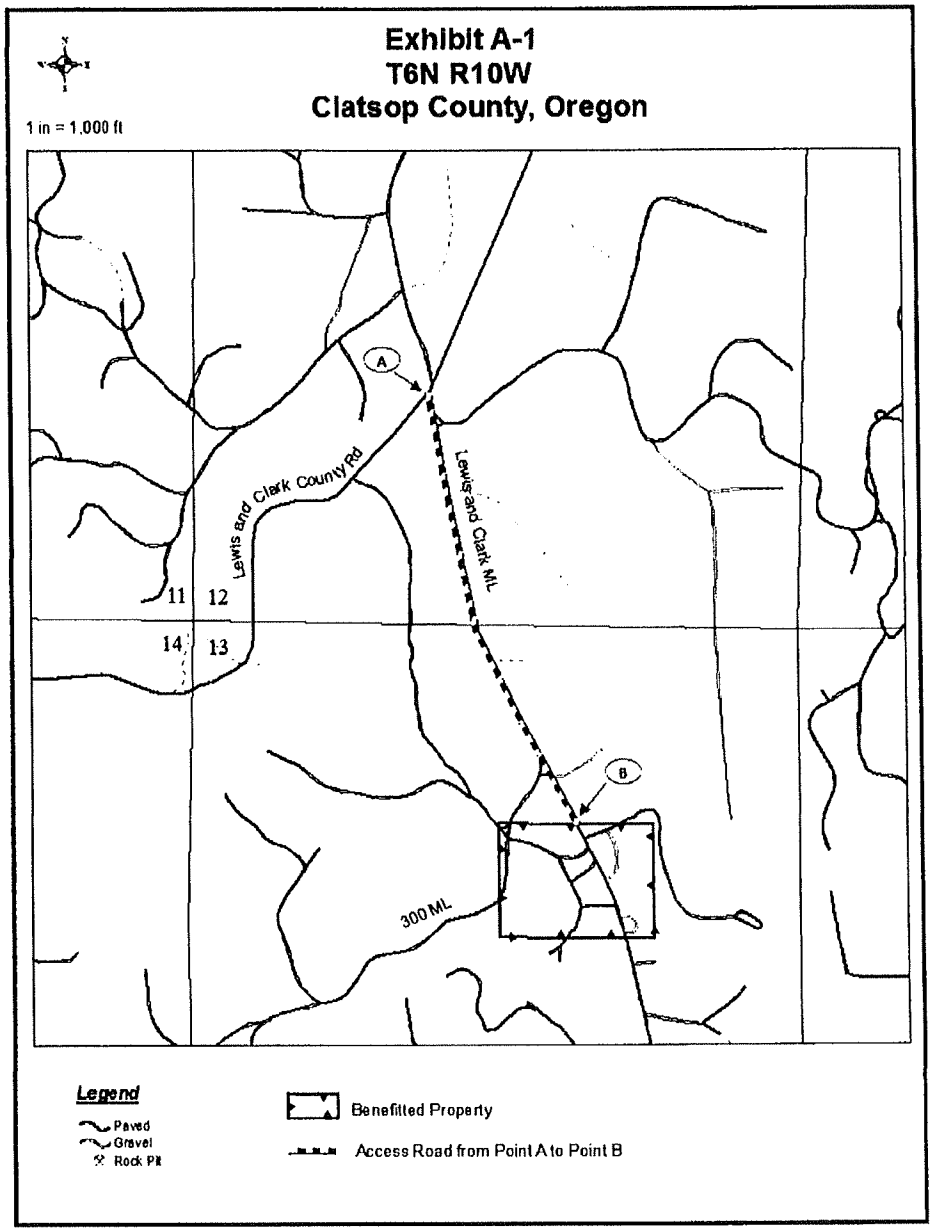
14. Easement for right of way contained in:
Document: Quitclaim Deed
In favor of: Clatsop County
Recorded: March 19, 1935 in Book 136 at page 521

15. Terms and Conditions for water pipeline easement set out in:
Document: Agreement
In favor of: The City of Warrenton
Recorded: July 18, 1951 in Book 213 at page 664

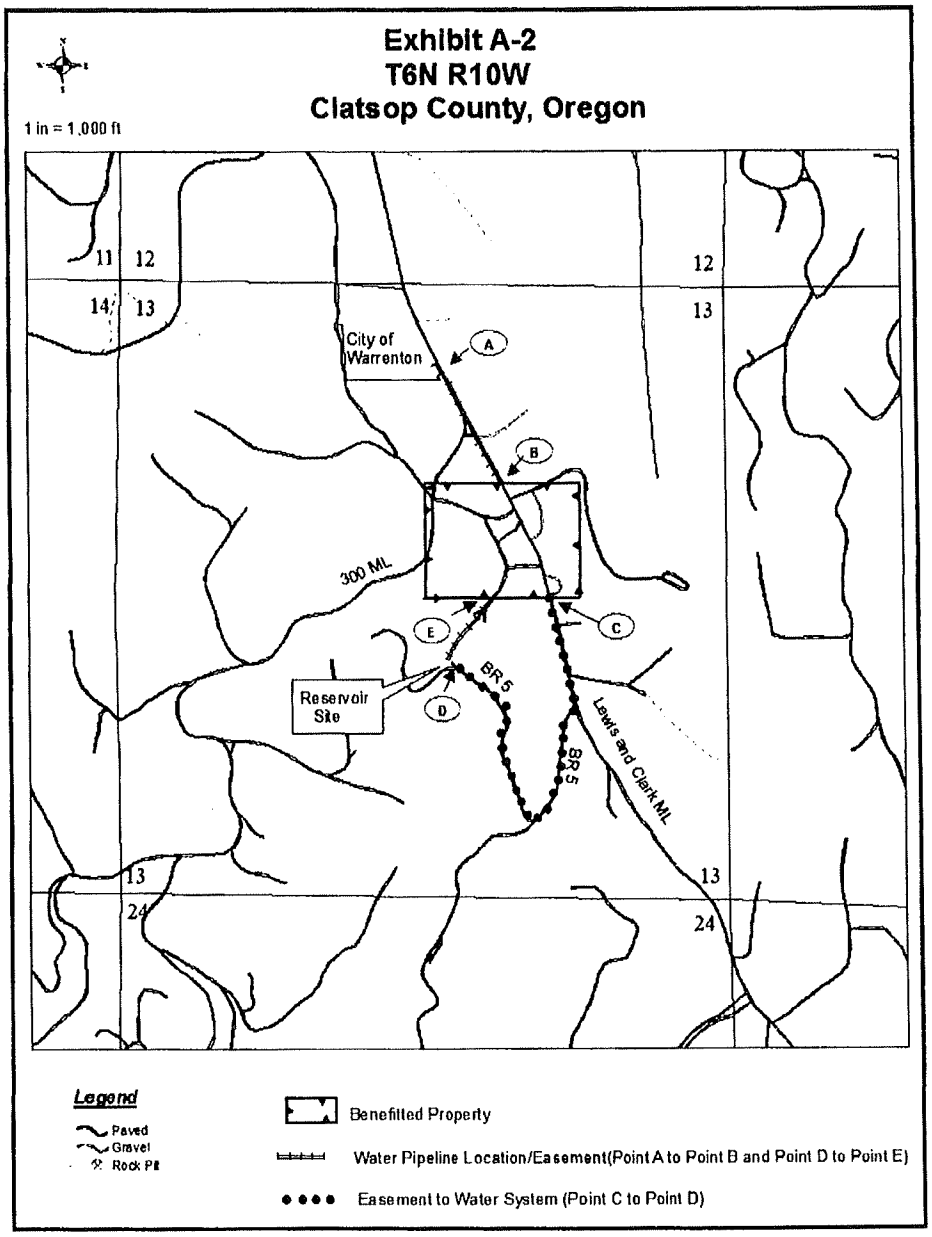
WNR/Neikes
Temp File No. T2013-205ph

16. Easement for road access contained in:
Document: Special Warranty Deed
Date: August 18, 2009
Grantee: Lewis & Clark Oregon Buyer, LLC
Recording #: #200908127 and re-recorded #200909388

- - - End of Exhibit A - - -



WNR/Neikes
Temp File No. T2013-205ph



WNR/Neikes
Temp File No. T2013-205ph

Verified Correct Copy of Original 9/14/2023.

FILED

IN THE CIRCUIT COURT OF THE STATE OF OREGON CLATSOP
FOR THE COUNTY OF CLATSOP
PO Box 835 Astoria Oregon 97103

2023 SEP 13 PM 4:54

TRIAL COURT ADMINISTRATOR

In the Matter of:

James Joseph Neikes
Deceased

Case No: 23PB08181

LETTERS TESTAMENTARY

BY

The court certifies that:

The will of James Joseph Neikes, deceased, has been proved.

Sirpa Duoos has been appointed Personal Representative of the will and estate of the decedent.

September 13, 2023
Date

Probate Commissioner, (signature)

Loretta Breedlove
Print Name

CIRCUIT COURT • CLATSOP COUNTY
STATE OF OREGON

I certify that the Letters Testamentary in this case are still in full force and effect and have not been revoked or set aside. I certify that this is a true, complete, and accurate copy of the original Letters Testamentary filed in this case.

9-14-23
Date

Court Clerk, (signature)

Loretta Breedlove
Print Name

CIRCUIT COURT • CLATSOP COUNTY
SEAL
STATE OF OREGON

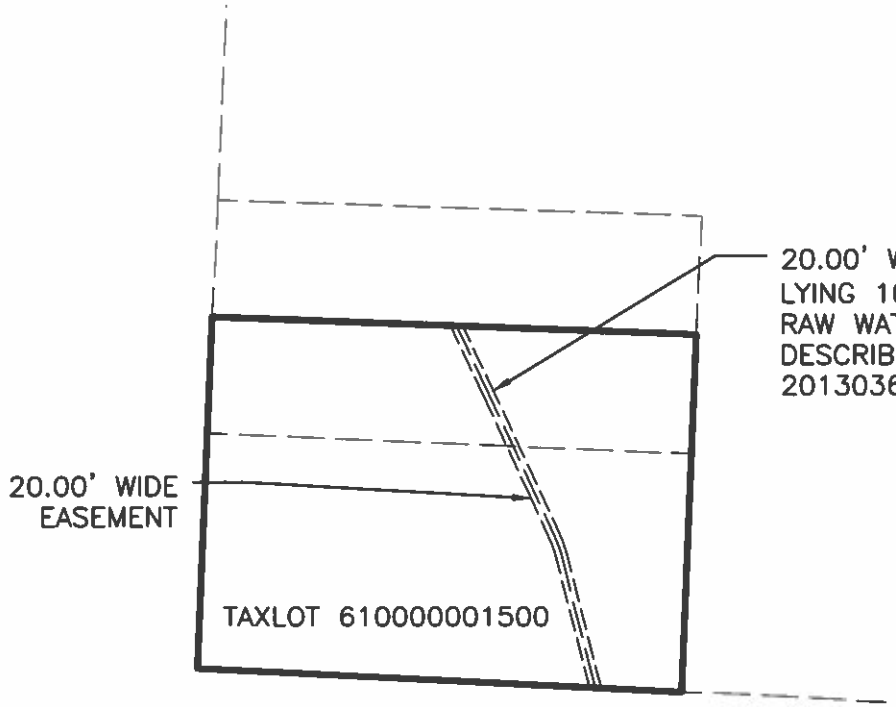
S&F Land Services
Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 11/15/2024
INITIALS: TLO

LEGAL DESCRIPTION 24 INCH RAW WATERLINE

A 20.00 FEET WIDE PERMANANT EASEMENT FOR THE PURPOSES OF CONSTRUCTION, RECONSTRUCTION, MAINTENANCE, INSPECTION, EFFICIENT SERVICE OR REMOVAL. SAID EASEMENT LYING 10.00 FEET EITHER SIDE OF THAT 24 INCH DIAMETER PIPELINE, AS CONSTRUCTED, OVER ACROSS, AND THROUGH A PORTION OF THAT PROPERTY DESCRIBED IN CLATSOP COUNTY INSTRUMENT NUMBER 20130648 AND LOCATED IN THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDIAN, IN CLATSOP COUNTY, OREGON.

RAW WATERLINE EASEMENT EXHIBIT
TAXLOT 610000001500
SW 1/4, NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



LEGEND:

- BOUNDARY LINE
- EASEMENT
- SECTION LINE
- LOT LINE

1 INCH = 500 FEET

REGISTERED PROFESSIONAL LAND SURVEYOR
Jack L. White II
OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

EXPIRES 6/30/24

S&F Land Services

Date: 04/05/2024
Proj No: 24G03206

1725 N ROOSEVELT DR, STE B, SEASIDE, OR 97138
(503) 738-3425

www.sflands.com
info@sflands.com

AFTER RECORDING, RETURN TO:

City of Warrenton
Attn: City Recorder
P.O. Box 250
Warrenton, OR 97146

NO CHANGE IN TAX STATEMENTS

GRANTOR: The Estate of James Joseph Neikes
34755 HWY 101 Business
Astoria, OR 97103

GRANTEE/CITY: City of Warrenton, an Oregon municipal corporation

TEMPORARY CONSTRUCTION EASEMENT

RECITALS:

A. Grantor owns real property described in **Exhibit A** ("Property"), which is attached and incorporated by this reference.

B. Sirpa Duoos is the duly appointed Personal Representative for the will and estate of the Grantor. The Letters Testamentary appointing Sirpa Duoos as such are attached as **Exhibit B** and incorporated herein by this reference.

C. The City requires a temporary construction easement ("Easement") on the Property to allow the City to access and construct a water line in the locations described in **Exhibit C** ("Temporary Construction Easement Area").

D. Grantor desires to grant to the City and the City desires to accept from the Grantor a temporary construction easement pursuant to the terms of this Agreement.

NOW, THEREFORE, the parties agree as follows ("Agreement"):

1. Grant of Temporary Construction Easement. In consideration of the mutual benefits, covenants, and terms contained herein, the receipt and sufficiency of which is hereby acknowledged, Grantor, and Grantor's heirs, successors, and assigns, grants and conveys to the City a temporary, nonexclusive construction easement for the purpose of accessing and constructing a water line within the Temporary Construction Easement Area. Grantor also grants to the City the right of reasonable access over other parts of the Property that are adjacent to the Temporary Construction Easement for construction-related activities.
2. City's Rights. Grantor shall allow the City and its officers, employees, agents, assigns, public utility providers, and independent contractors to use the Temporary Construction Easement Area for all purposes related to a water pipeline and related facilities. The Temporary Construction Easement Area shall be used for ingress and egress of personnel and for the purposes of accessing, constructing, reconstructing, and operating a water pipeline and related facilities that are above ground and underground, this can include items such as

fire hydrants, blow-off valve assemblies, combination air release valves, and bollards. The City has the right to excavate, construct, install, place, lay, operate, inspect, relocate, add to, and remove underground pipelines, related structures and facilities within the Temporary Construction Easement Area. The City has the right to cut, trim, plant, and remove trees or other vegetation within the Temporary Construction Easement Area. The City has the right to remove other obstructions that may endanger or interfere with the construction, reconstruction, inspection, efficient service, or removal of all or any part of its respective water system on or from the Temporary Construction Easement Area without the necessity at any time of procuring the consent or permission of anyone. The City has the right to enter the Temporary Construction Easement Area at any and all times for the exercise of any of the easement rights.

3. Noninterference. Grantor and its heirs, successors, and assigns will not interfere with the City's use of the Temporary Construction Easement Area or the rights granted herein and agrees not to build, construct, improve and/or plant (or permit or allow others to do so) any structures, edifices, plants or other objects within the areas of the Temporary Construction Easement Area during the term of this Easement.

4. Temporary Construction Easement Area Condition. The City shall return the Temporary Construction Easement Area to good condition (i.e., repair/replace soil disturbance and/or vegetation; removal of construction debris, rocks/gravel, and other materials). All damage resulting from or arising out of said use shall be repaired by the City, including any damage caused by the City, its officers, employees, agents, assigns, public utility providers, and independent contractors. The City shall have a reasonable time, not to exceed two weeks after notice from Grantor, to restore the Temporary Construction Easement Area and adjacent property. Notice shall be sent to:

   City of Warrenton

   Attn: Public Works

   P.O. Box 250

   Warrenton, OR 97146

5. Indemnification. Each party shall defend, indemnify, and hold the other party, its officers, employees, and agents harmless from and against any and all claims (including third party claims for damages for property removed from the Temporary Construction Easement Area), demands, liabilities, judgments, awards, fines, liens, losses, damages, and expenses of any kind, including attorneys' fees at trial or on appeal, incurred by the indemnifying party to the extent arising either directly or indirectly from and to the extent of any act, error, omission or negligence of indemnifying party, its employees, contractors, licensees, or agents under this Agreement. Nothing in this Agreement, City's approval of plans and specifications, or inspection of work is an acknowledgement of responsibility or liability unless otherwise provided by applicable law.

6. Grantor's Warranty. Grantor agrees that Grantor has the right to convey the Easement to the City and to provide quiet possession to the City. Grantor warrants to the City that the person executing this Agreement on behalf of Grantor is duly authorized to make this conveyance.

7. Breach; Remedies; Equitable Relief. Grantor acknowledges that the rights granted to the City are unique in that money damages alone for breach of the Easement by Grantor are

inadequate, and that the City may bring an action at law or a suit in equity to obtain relief, including specific performance, injunctive relief and any other available equitable remedy.

8. Expiration of Easement. The Easement will terminate upon the City's issuance of a Certificate of Final Completion to the contractor responsible for the construction project ("Contractor") and shall have no further force or effect thereafter.

9. Attorneys' Fees. In the event any action is brought to enforce, modify or interpret the provisions of this Agreement, each party shall bear the expense of its own attorney fees and costs incurred in connection with such action.

10. Severability. Nothing contained in this Agreement shall be construed to require the commission of any act contrary to law, and if there is any conflict between any provisions of the Easement and any present or future statute, law, ordinance or regulation to which the parties have no legal right to contract, the latter shall prevail. However, the provision of the Easement, which is affected shall be curtailed and limited only to the extent necessary to bring them within the requirements of the law, and all other provisions of the Easement shall remain in effect.

11. Waiver. Either party's failure to require performance of any provision of the Easement shall not limit the party's right to enforce the provision, nor shall any waiver of any breach of any provision be a waiver of any succeeding breach of the provision or a waiver of the provision itself or any other provision.

THE EASEMENT is granted this ____ day of _____, 2025.

GRANTOR:
The Estate of James Joseph Neikes

Sirpa Duoos

Sirpa Duoos, Personal Representative of the Estate of James Joseph Neikes

STATE OF OREGON)
) ss.
County of Clatsop)

This instrument was acknowledged before me on March 18, 2025, by Sirpa Duoos.

OFFICIAL STAMP
TANYA SHEA HELMERSEN
NOTARY PUBLIC - OREGON
COMMISSION NO. 1051240
MY COMMISSION EXPIRES AUGUST 28, 2028

Tanya Helmersen

Notary Public for Oregon
My commission expires: August 28, 2028

THE EASEMENT is accepted by the City of Warrenton, Oregon.

_____

_____, City of Warrenton

Esther Moberg, City Manager

STATE OF OREGON)
) ss.
County of Clatsop_____)

This instrument was acknowledged before me on _____, 2025, by_____.

_____

Notary Public for Oregon

My commission expires:_____

Recording Instrument #: 201303648
Recorded By: Clatsop County Clerk
# of Pages: 10 Fee: 87.00
Transaction date: 4/26/2013 11:06:56
Deputy: tromeyn

Recorded by Ticor
Title Ins. Co. 36041 3012159

When recorded, return to:
Weyerhaeuser NR Company
P. O. Box 9777, CH1-F23
Federal Way, WA 98063-9777

Send Tax Statements to:
James J. Neikes
34755 Hwy 101 Business
Astoria, Oregon 97103

Map / Tax Lot No. 610000001501 **Account No.** 7800
Vacant Land Seaside OR

SPECIAL WARRANTY DEED

WEYERHAEUSER NR COMPANY, a Washington corporation, P. O. Box 9777, Federal Way, Washington 98063-9777 ("**Grantor**"), for valuable consideration, receipt of which is hereby acknowledged, conveys and specially warrants to **JAMES J. NEIKES**, 34755 Hwy 101 Business, Astoria, Oregon 97103 ("**Grantee**"), the real property situated in **Clatsop County, Oregon**, described on **Exhibit A** attached hereto and by this reference made a part hereof, free of encumbrances created or suffered by the Grantor, except for the encumbrances of title and reservations as set forth on said Exhibit A.

The true and actual consideration for this transfer is: $280,000.00.

Grantee or anyone claiming by, through or under Grantee, hereby fully and irrevocably releases Grantor, Grantor's parent company, and any of the parent company subsidiaries, including their agents and representatives (collectively, the "**Indemnified Parties**"), from any and all claims that it may now have or hereafter acquire against the Indemnified Parties for any cost, loss, liability, damage, expense, action or cause of action, whether foreseen or unforeseen, arising from or related to any defects, errors or omissions on or in the property, the presence of environmentally hazardous, toxic or dangerous substances, or any other conditions (whether patent, latent or otherwise) affecting the property. Grantee further acknowledges and agrees that this release shall be given full force and effect according to each of its expressed terms and provisions, including, but not limited to, those relating to unknown and suspected claims, damages and causes of action. As a material covenant and condition of this Deed, Grantee agrees that in the event of any such defects, errors or omissions, the presence of environmentally hazardous, toxic or dangerous substances, or any other conditions affecting the property, Grantee shall look solely to the Indemnified Parties predecessors in interest for any redress or relief, except for claims against Grantor based upon any obligations and liabilities of Grantor expressly provided in this Deed.

WNR/Neikes
Temp File No. T2013-205ph

The above provisions are specifically bargained for and represent a material part of Grantor's consideration for this conveyance.

BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON TRANSFERRING FEE TITLE SHOULD INQUIRE ABOUT THE PERSON'S RIGHTS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010. THIS INSTRUMENT DOES NOT ALLOW USE OF THE PROPERTY DESCRIBED IN THIS INSTRUMENT IN VIOLATION OF APPLICABLE LAND USE LAWS AND REGULATIONS. BEFORE SIGNING OR ACCEPTING THIS INSTRUMENT, THE PERSON ACQUIRING FEE TITLE TO THE PROPERTY SHOULD CHECK WITH THE APPROPRIATE CITY OR COUNTY PLANNING DEPARTMENT TO VERIFY THAT THE UNIT OF LAND BEING TRANSFERRED IS A LAWFULLY ESTABLISHED LOT OR PARCEL, AS DEFINED IN ORS 92.010 OR 215.010, TO VERIFY THE APPROVED USES OF THE LOT OR PARCEL, TO DETERMINE ANY LIMITS ON LAWSUITS AGAINST FARMING OR FOREST PRACTICES, AS DEFINED IN ORS 30.930, AND TO INQUIRE ABOUT THE RIGHTS OF NEIGHBORING PROPERTY OWNERS, IF ANY, UNDER ORS 195.300, 195.301 AND 195.305 TO 195.336 AND SECTIONS 5 TO 11, CHAPTER 424, OREGON LAWS 2007, SECTIONS 2 TO 9 AND 17, CHAPTER 855, OREGON LAWS 2009, AND SECTIONS 2 TO 7, CHAPTER 8, OREGON LAWS 2010

[SIGNATURES ON FOLLOWING PAGE]

Dated: April 24th, 2013

WEYERHAEUSER NR COMPANY

By: Thomas L Gideon
Title: Executive Vice President

By: Peggy Hebbethwaite
Title: Assistant Secretary

Dated: 4-25-13, 2013

Accepted hereby:

James J. Neikes

WNR/Neikes
Temp File No. T2013-205ph

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 24th day of April, 2013, before me personally appeared Thomas L. Lideen and Peggy Hebblethwaite, to me known to be the Executive Vice President and Assistant Secretary, respectively, of **WEYERHAEUSER NR COMPANY**, the corporation that executed the within and foregoing Deed, and acknowledged said instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument.

In witness whereof I have hereunto set my hand and affixed my official seal the day and year first above written.

KATHLEEN E. SAPINORO NOTARY PUBLIC STATE OF WASHINGTON COMMISSION EXPIRES 09-08-16

Kathleen E. Sapinoro
Notary Public
My appointment expires: 9/8/2016

STATE OF OREGON)
) ss.
COUNTY OF Clatsop)

On this 25th day of April, 2013, personally appeared before me, **JAMES J. NEIKES**, and acknowledged before me on this day that, being informed of the contents of this instrument, he executed the same voluntarily on the day the same bears date.

In witness whereof I have hereunto set my hand and affixed my official seal the day and year first above written.

OFFICIAL SEAL
BARBARA JEAN ZIELINSKI
NOTARY PUBLIC-OREGON
COMMISSION NO. 442978
MY COMMISSION EXPIRES OCTOBER 4, 2013

Barbara Zielinski
Notary Public
My appointment expires: 10-4-13

WNR/Neikes
Temp File No. T2013-205ph

EXHIBIT A

IN CLATSOP COUNTY, OREGON

TOWNSHIP 6 NORTH, RANGE 10 WEST, WILLAMETTE MERIDIAN

Section 13: S½N½SW¼NE¼ and S½SW¼NE¼

TOGETHER WITH a non-exclusive appurtenant easement, as reserved by Grantor in the deed dated August 18, 2009, recording instrument #200908127 and re-recorded #200909388, to reconstruct, maintain and use the existing road, hereinafter referred to as "**Access Road**", along a right of way 100 feet in width, being 50 feet on either side of the road centerline as now constructed, upon, over and across the **W½NE¼; SW¼NW¼; NE¼SW¼ and W½SW¼ of Section 13, Township 6 North, Range 10 West, W.M.**; said Access Road is located approximately as shown on the attached Exhibit A-1. Said access being subject to the terms and conditions as stated in said Deed.

TOGETHER WITH a perpetual easement as reserved by Grantor in the deed dated August 18, 2009, recording instrument #200908127 and re-recorded #200909388, to maintain, operate, repair, improve reconstruct and use the water reservoir, water pipeline and related facilities (the "**Water System**") located in the E½ of Section 13, Township 6 North, Range 10 West, W.M., Clatsop County, Oregon, approximately as shown on attached Exhibit A-2 to serve property herein being described and conveyed to Grantee. The Water System consists of the water reservoir located in the SW¼NW¼NW¼SE¼ of said Section 13; and water pipelines located in the NW¼NE¼, the N½N½SW¼NE¼ and the NW¼SE¼ of said Section 13 and such other related facilities as may be necessary to maintain, operate, repair, improve, reconstruct and use the Water System. The right conveyed herein shall be subject to the covenant and agreement identified as "9" in the Bargain and Sale Deed to the city of Warrenton recorded April 12, 2001, Clatsop County Recording instrument #200103387. TOGETHER with the rights to use the existing roads and right of way over and across the Lewis and Clark Mainline road and the BR 5 road in the SE¼ of said Section 13, to provide access to the Water System. The approximate location of such existing roads being shown on the attached Exhibit A-1.

RESERVATION:
Grantor hereby expressly saves, excepts, and reserves out of the grant hereby made, unto itself and its successors and assigns forever, all oil, gas, and other liquid or gaseous hydrocarbons including, without limitation, coal seam gas; geothermal resources including, without limitation, geothermal steam and heat; base and precious metals; ores; coal; lignite; peat; clays; and minerals of any and every nature, kind, or description whatsoever now or hereafter susceptible of commercial exploitation (collectively "**Mineral Resources**") in or upon said land, together with the right to enter upon said land, at any and all times, for the purpose of exploring the same for such Mineral Resources by geological, geophysical, geochemical, or other means, and for

WNR/Neikes
Temp File No. T2013-205ph

drilling, opening, developing, and working mines and wells thereon and taking out, extracting, or removing therefrom by any means whether now in use or hereafter developed, including by surface and sub-surface mining methods, all such Mineral Resources, and to occupy and make use of so much of the surface of said land as may be reasonably necessary or convenient for said purposes, together with the right to store, save, transport, treat, process, market, or otherwise utilize such Mineral Resources so produced, together with all rights and powers in, to, and over said land, whether herein expressed or not, reasonably necessary or convenient to render beneficial and efficient the complete enjoyment of the property and rights hereby reserved; *provided*, however, that Grantee and Grantee's heirs, representatives, successors, and assigns, shall be paid just and reasonable compensation for any injury or damage to the surface of said land or to the crops or improvements thereon caused by the exercise of any rights herein reserved; and *provided further*, that the exercise of such rights by Grantor and its successors and assigns shall not be postponed or delayed so long as Grantor or its successors or assigns is making reasonable efforts to agree upon or have determined such just and reasonable compensation.

Subject to:

1. Rights reserved in federal patents or state deeds, mineral or fossil rights reservations, exceptions or conveyances made by prior owners.

2. As disclosed by the assessment and tax roll, the land herein described has been classified/assessed as forestland. If the land becomes disqualified for this special classification/assessment under ORS Chapter 321 or any subsequent statute, any additional tax or penalties plus interest that may be levied shall be the responsibility of Grantee.

3. Taxes or special assessments which are not yet payable or which are not shown as existing liens by the public records.

4. All planning, zoning, health and other governmental regulations, if any, affecting the subject Property; all building, use, zoning, environmental and protected species restrictions general to the area.

5. Discrepancies, conflicts in boundary lines, shortage in area, encroachments or other facts which a correct survey would disclose.

6. Indian tribal codes or regulations, Indian treaty or aboriginal rights, including easements or equitable servitudes.

7. Rights of the State of Oregon in and to that portion of the Property, if any, lying in the bed or former bed of all rivers and creeks, if it is navigable.

8. Any question that may arise due to shifting or change in the course of any river or creek located on the Property.

9. Any prohibition or limitation on the use, occupancy or improvements of the Property resulting from the rights of the public or riparian owners to use any waters which may cover the Property or to use any portion of the Property which is now or may formerly have been covered by water.

10. All matters of public record, and all covenants, conditions, reservations, restrictions, easements and rights of way for public and/or private roads and roadways, railroads and utilities heretofore established and existing on said Property and all matters evident on the ground.

11. Easement for right of way contained in:
Document: Deed
In favor of: Astoria and Portland Railway Company
Recorded: April 21, 1892 in Book 24 at page 318

12. Easement for right of way contained in:
Document: Warranty Deed
In favor of: Lewis & Clark Railroad Company
Recorded: July 5, 1924 in Book 114 at page 486

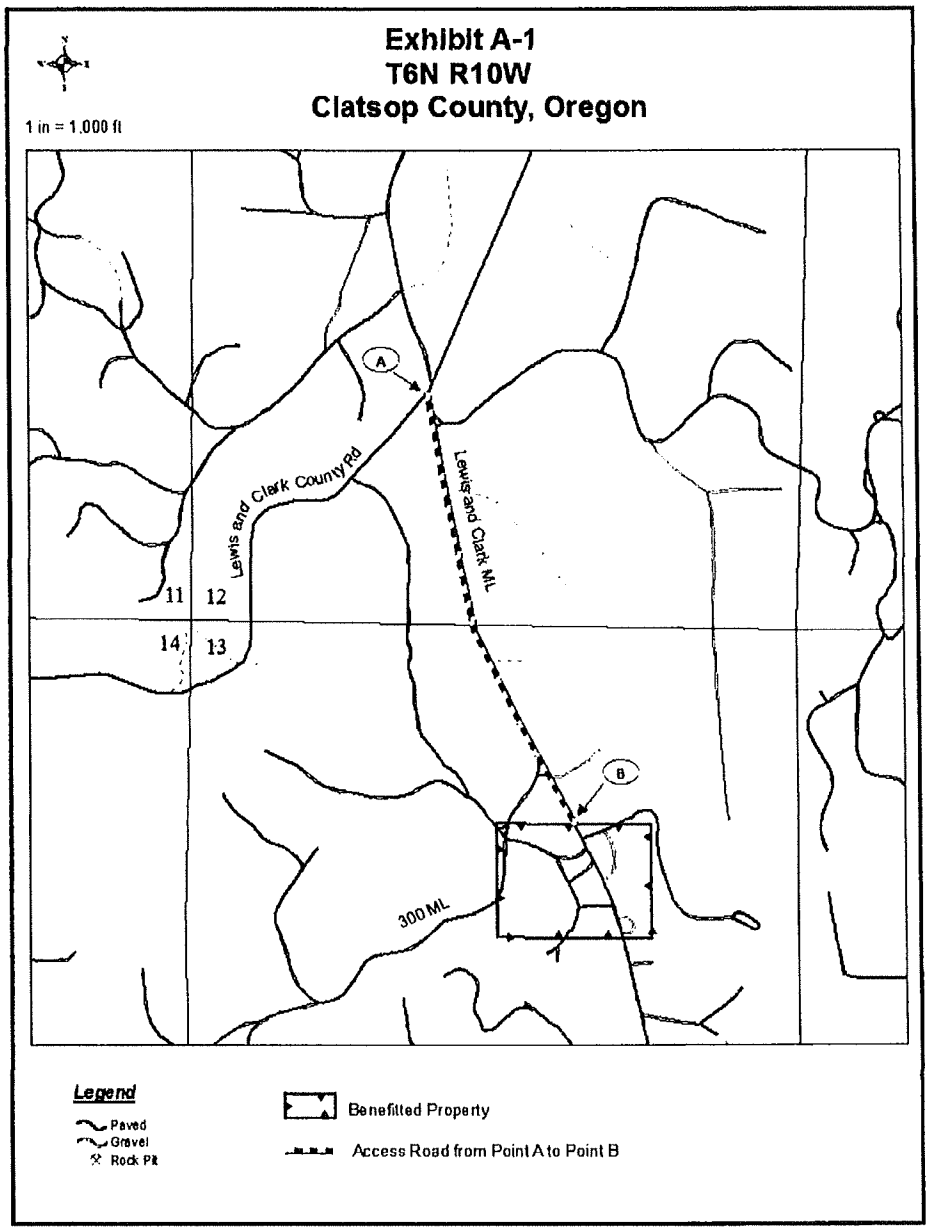
13. Easement for right of way contained in:
Document: Warranty Deed
In favor of: Lewis & Clark Railroad Company
Recorded: July 5, 1924 in Book 114 at page 487

14. Easement for right of way contained in:
Document: Quitclaim Deed
In favor of: Clatsop County
Recorded: March 19, 1935 in Book 136 at page 521

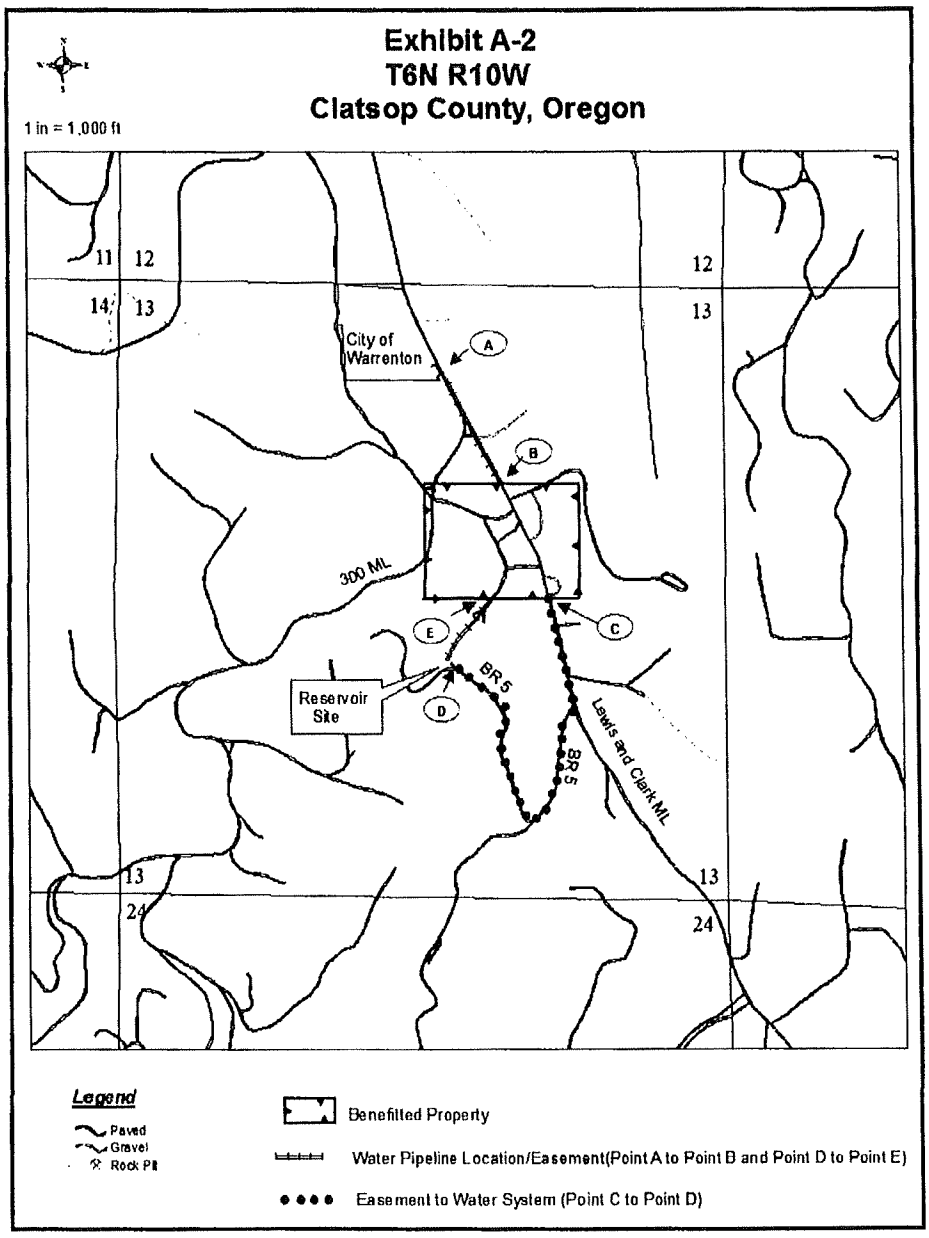
15. Terms and Conditions for water pipeline easement set out in:
Document: Agreement
In favor of: The City of Warrenton
Recorded: July 18, 1951 in Book 213 at page 664

16. Easement for road access contained in:
Document: Special Warranty Deed
Date: August 18, 2009
Grantee: Lewis & Clark Oregon Buyer, LLC
Recording #: #200908127 and re-recorded #200909388

- - - End of Exhibit A - - -



WNR/Neikes
Temp File No. T2013-205ph



WNR/Neikes
Temp File No. T2013-205ph

Verified Correct Copy of Original 9/14/2023.

FILED

IN THE CIRCUIT COURT OF THE STATE OF OREGON
FOR THE COUNTY OF CLATSOP
PO Box 835 Astoria Oregon 97103

2023 SEP 13 PM 4:54

TRIAL COURT ADMINISTRATOR

In the Matter of:

James Joseph Neikes
Deceased

Case No: 23PB08181

LETTERS TESTAMENTARY

BY

The court certifies that:

The will of James Joseph Neikes, deceased, has been proved.

Sirpa Duoos has been appointed Personal Representative of the will and estate of the decedent.

September 13, 2023
Date

Probate Commissioner, (signature)

Loretta Breedlove
Print Name

CIRCUIT COURT • CLATSOP COUNTY
STATE OF OREGON

I certify that the Letters Testamentary in this case are still in full force and effect and have not been revoked or set aside. I certify that this is a true, complete, and accurate copy of the original Letters Testamentary filed in this case.

9-14-23
Date

Court Clerk, (signature)

Loretta Breedlove
Print Name

CIRCUIT COURT • CLATSOP COUNTY
SEAL
STATE OF OREGON

S&F Land Services
1725 N. Roosevelt Dr. Suite B Seaside OR 97138
503-738-3425 – www.sflands.com

PROJECT NO.: 24G032
DATE: 04/05/2023
INITIALS: TLO

TEMPORARY CONSTRUCTION EASEMENT LEGAL DESCRIPTION

A 30.00 FEET WIDE EASEMENT FOR THE PURPOSES OF CONSTRUCTION, CENTERED ON THE BELOW DESCRIBED CENTERLINE, OVER ACROSS, AND THROUGH A PORTION OF THAT PROPERTY DESCRIBED IN CLATSOP COUNTY INSTRUMENT NUMBER 20130648 AND LOCATED IN THE SOUTHWEST QUARTER OF THE NORTHEAST QUARTER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST OF THE WILLAMETTE MERIDAIN IN CLATSOP COUNTY, OREGON. MORE PARTICULARLY DESCRIBED AS FOLLOWS.

COMMENCING AT THE SOUTHEAST CORNER OF SECTION 13, TOWNSHIP 6 NORTH, RANGE 10 WEST, WILLAMETTE MERIDIAN, WHICH IS MARKED BY A 3 ¼ INCH ALUMINUM CAP STAMPED "CLATSOP COUNTY SURVEYOR S13 S24 S18 S19"

THENCE NORTHERLY ALONG THE SECTION LINE NORTH 02°14'46" EAST, A DISTANCE OF 2628.55 FEET

THENCE DEPARTING SAID SECTION LINE, NORTH 87°04'12" WEST A DISTANCE OF 1309.39 FEET TO THE SOUTHEAST CORNER OF THAT PROPERTY DESCRIBED IN INSTRUMENT NUMBER 20130648.

THENCE NORTH 87°04'12" WEST, A DISTANCE OF 223.53 FEET TO THE POINT OF BEGINNING.

THENCE NORTH 14°23"35" WEST, A DISTANCE OF 381.30 FEET TO THE BEGINNING OF A CURVE TO THE LEFT;

THENCE ALONG SAID 230.04 FOOT RADIUS CURVE TO THE LEFT AN ARC LENGTH OF 40.00 FEET, WITH A DELTA ANGLE OF 9°57'45", HAVING A CHORD BEARING OF NORTH 20°28'54" WEST, A CHORD LENGTH OF 39.95 FEET.

THENCE NORTH 24°47'21" WEST, A DISTANCE OF 430.97 FEET TERMINATING ON THE ON THE NORTH PROPERTY LINE OF SAID PROPERTY DESCRIBED IN INSTRUMENT NUMBER 20130648.

BEARINGS BASED ON CLATSOP COUNTY SURVEY B-12978

CONTAINING 31,626 SQUARE FEET, PLUS OR MINUS.

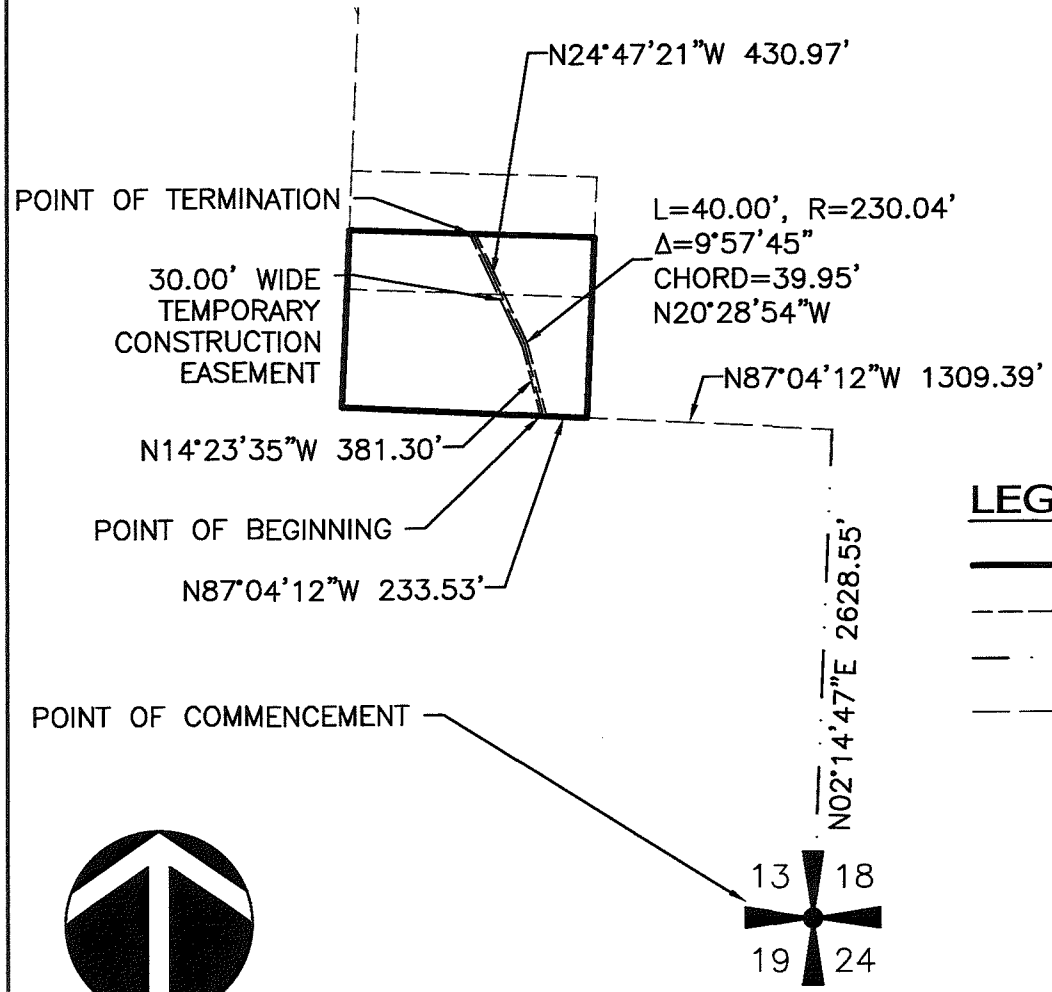
REGISTERED
PROFESSIONAL
LAND SURVEYOR

Jack L. White II

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

EXPIRES 6/30/24

TEMPORARY CONSTRUCTION EASEMENT EXHIBIT
TAXLOT 610000001500
SW 1/4, NE 1/4, S13, T6N, R10W, W.M.,
CLATSOP COUNTY, OREGON



REGISTERED
PROFESSIONAL
LAND SURVEYOR

Jack L. White II

OREGON
SEPTEMBER 10, 2019
JACK L. WHITE II
91987PLS

EXPIRES 6/30/24

LEGEND:

- BOUNDARY LINE
- EASEMENT
- SECTION LINE
- LOT LINE

1 INCH = 1000 FEET

S&F Land Services

Date: 04/05/2024
Proj No: 24G03206

1725 N ROOSEVELT DR, STE B, SEASIDE, OR 97138
(503) 738-3425
www.sflands.com
info@sflands.com

City Commission Agenda Memo

Meeting Date: April 8, 2025
From: Kevin Gorman, Public Works Director
Subject: Ft. Stevens Guardhouse Street Closure

Summary:

The Ft. Stevens Guardhouse has been undergoing renovations since last year. In the previous year, phase 1, exterior work was completed to address foundation issues. This year, phase 2 Right of Way (ROW) permit has been submitted to continue the renovation efforts at the Guardhouse.

As part of this application, a road closure of Russell Drive is required for the duration of the renovations to facilitate upgrades to the electrical systems and the installation of water proofing at the Guardhouse.

We are requesting approval to close Russell Drive from now until May 19, 2025, to complete the necessary water proofing and electrical upgrades at the Ft. Stevens Guardhouse.

Recommendation/Suggested Motion:

"I move to approve the proposed road closure for the Ft. Stevens Guardhouse renovations."

Alternative:

Other actions as deemed appropriate by the City Commission
OR
None recommended

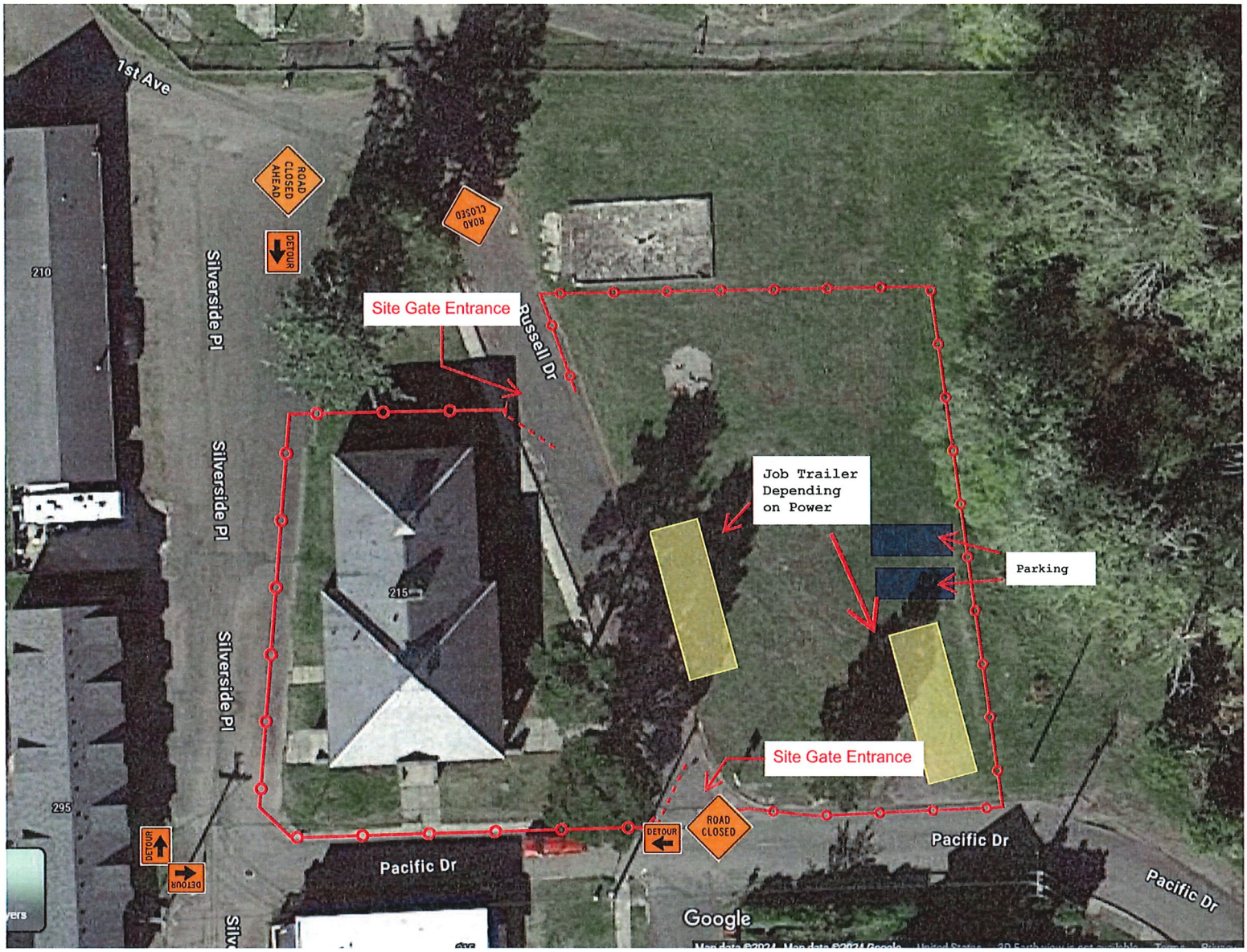
Fiscal Impact:

No fiscal impact is anticipated.

Attachments:
(All supporting documentation, i.e., maps, exhibits, etc., must be attached to this memorandum.)

- GIS Map
- Traffic Control Plan

Approved by City Manager: _____


1st Ave
ROAD CLOSED AHEAD
DETOUR
ROAD CLOSED
210
Silverside Pl
Site Gate Entrance
Russell Dr
Silverside Pl
Job Trailer Depending on Power
Parking
215
Silverside Pl
Site Gate Entrance
295
DETOUR
DETOUR
Pacific Dr
DETOUR
ROAD CLOSED
Pacific Dr
Pacific Dr
Google

Outlook

Fw: Request for Meeting and City Support for Frolic and Lark

From Henry Balensifer <hbalensifer@warrentonoregon.us>
Date Thu 3/20/2025 8:32 AM
To Dawne Shaw <dshaw@warrentonoregon.us>

Also to go forward for consideration.

Sent via Mobile

From: Frolic & Lark <hello@frolicandlarkplaystudio.com>
Sent: Thursday, March 20, 2025 7:48:10 AM
To: Henry Balensifer <hbalensifer@warrentonoregon.us>
Subject: Request for Meeting and City Support for Frolic and Lark

Dear Mayor Balensifer,

I hope you're doing well. I am reaching out to request a meeting with you to discuss Frolic and Lark, an indoor playground and child care facility designed to address the critical shortage of early childhood care and family-friendly spaces in Warrenton.

As you may know, Clatsop County is facing a significant lack of child care options, leaving many families without reliable, affordable care. Frolic and Lark aims to help fill this gap by providing a safe, engaging space for young children, along with much-needed after-school care. In addition to supporting local families, our facility will contribute to the local economy by offering a welcoming indoor space for visitors, particularly during the rainy months.

We are in the process of applying for funding through the Child Care Infrastructure Fund (CCIF), a grant program administered by the Oregon Department of Early Learning and Care (DELC) and Business Oregon. As part of our application, we are seeking a letter of support from the City of Warrenton to highlight the importance of expanding child care and play-based opportunities in our community. Your support would be invaluable in demonstrating the need for this project and its benefits to Warrenton families.

I would love the opportunity to meet with you at your convenience to share more about our vision and explore ways to collaborate.

Thank you for your time and consideration. I look forward to connecting soon.

Best,
Nicole Bian

Frolic & Lark Play Studio

www.frolicandlarkplaystudio.com

City Commission Agenda Memo

Meeting Date: April 8th, 2025
From: Kevin Gorman, Public Works Director
Subject: Discussion item - Repealing Municipal Code Chapter 8.20 – Fluoride Supplementation

Summary:

The Public Works Department wanted to bring forward a discussion item regarding repealing Municipal Code Chapter 8.20 – Fluoride Supplementation, which mandates the addition of fluoride to the City's public water supply. This recommendation follows a recent internal supply chain analysis, which identified that the fluoride currently used is sourced exclusively from China and subject to existing and potentially increasing import tariffs. Staff estimates a 24% cost increase due to these tariffs, with the potential for further escalation.

In addition to the financial impact, there is increasing community concern regarding the health implications of fluoridating the public water system, particularly given that fluoride supplementation is not a state required practice for cities with populations under 10,000. Staff have also raised serious safety concerns over the years related to the handling and storage of the concentrated fluoride chemical.

There are no known domestic suppliers of fluoride additives. Furthermore, because the chemical is classified as hazardous, the City incurs added costs associated with hazardous materials storage fees and increased shipping costs due to efforts to remain under regulated weight thresholds. Ceasing fluoride supplementation would eliminate these costs and reduce operational risks.

When fluoride supplementation was first recommended decades ago, there was a push to assist dental care for lower income families through fluoride in public water supplies, this is not something that we can concretely show is currently significantly helping families in Warrenton. In the past two decades, public opinion has turned toward preserving a more natural approach to water supplies, with only the minimum treatment additives required to make water safe for drinking per Oregon Health Authority standards.

Should the commission express interest in bringing this code amendment back, staff will follow up with the public hearing process for a code repeal.

Fiscal Impact:

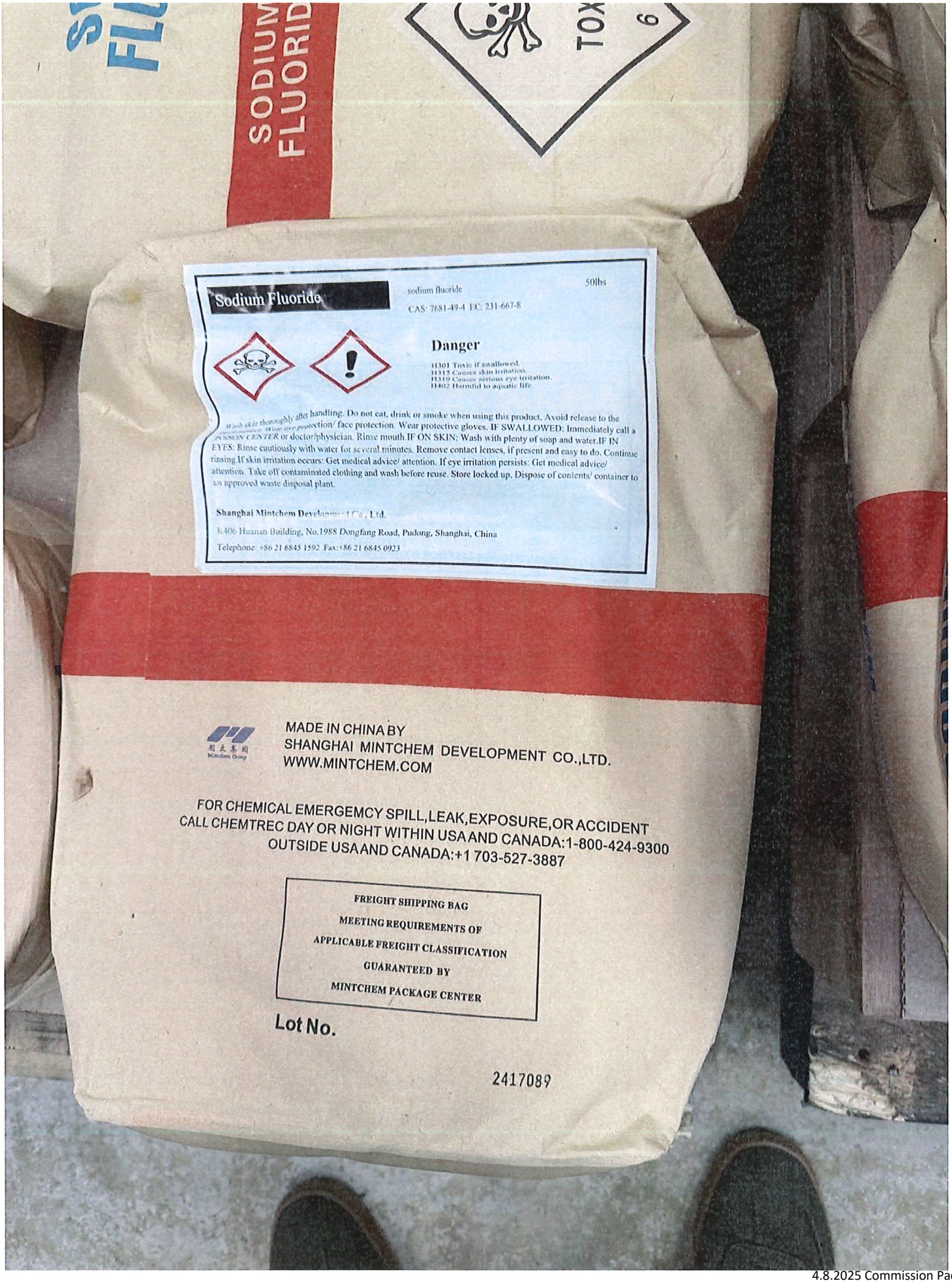
Removing fluoride supplementation is expected to save approximately $23,000 annually, depending on the volume of water produced and tariff increases. This figure includes avoided costs from material purchases, hazardous materials fees, increased shipping charges, and maintenance impacts.

Attachments:
(All supporting documentation, i.e., maps, exhibits, etc., must be attached to this memorandum.)

- Photos of fluoride in Water Treatment Plant storage.

Approved by City Manager: Esther Moberg

SODIUM
FLUORIDE
SODIUM
FLUORIDE
CLASS 6.1 UN 1690 PGIII
CAS# 7681-49-4
MINIMUM% SODIUM FLUORIDE-98.5%
50 LBS.
NET WT.
22.68 Kg.
TOXIC
6
50 LBS.
NET WT.
22.68 Kg.


SODIUM FLUORIDE
TOX
6
Sodium Fluoride
sodium fluoride
50lbs
CAS: 7681-49-4 EC: 231-667-8
Danger
H301 Toxic if swallowed.
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H402 Harmful to aquatic life.
Wash skin thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment. Wear eye protection/ face protection. Wear protective gloves. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth.IF ON SKIN: Wash with plenty of soap and water.IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.If skin irritation occurs: Get medical advice/ attention. If eye irritation persists: Get medical advice/ attention. Take off contaminated clothing and wash before reuse. Store locked up. Dispose of contents/ container to an approved waste disposal plant.
Shanghai Mintchem Development Co., Ltd.
R406 Huanan Building, No.1988 Dongfang Road, Pudong, Shanghai, China
Telephone: +86 21 6845 1592 Fax:+86 21 6845 0923
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