

Appendix C-1
Phase I Bank Visual Inspection
Observations and Photographs

1 Introduction

The Lower Duwamish Waterway (LDW) middle reach Pre-Design Investigation (PDI) Phase I bank inspection was conducted primarily by boat around daytime low tides (2 hours before, 2 hours after) on June 5 and 6, 2023. The inspection included the collection of photographs and detailed observations to document eastern and western bank conditions along the middle reach. During the planning phase of the effort, periods of predicted daytime extreme low tides (i.e., near or less than 0 feet mean lower low water [MLLW]) were identified as potential survey dates; actual inspection dates were selected based on forecasted weather conditions and team availability. In addition, photographs of both sides of the waterway were taken at various hours to capture different lighting conditions. A summary of inspection dates, times, and tidal conditions is provided in Table C1-1.

Table C1-1
Bank Visual Inspection Date and Tide Details

Date	Approximate Time of Inspection ¹	Predicted Low Tide Elevation (ft MLLW)	Time of Predicted Low Tide
June 05, 2023	10:25–14:20	-3.7	12:26
June 06, 2023	11:14–15:27	-3.7	13:13

Notes:

1. The timestamps on the electronic files for the photographs have not been adjusted for daylight savings time and are therefore timestamped one hour ahead of the actual time of survey.

The observations from the Phase I bank visual inspection are included in this appendix in tabular format as Tables C1-2 and C1-3.¹ This introduction provides information to facilitate the review of the detailed observation tables and photographs herein. Methods to collect this information are detailed in the PDI quality assurance project plan (Windward and Anchor QEA 2022).

¹ Digital photographs were provided to the U.S. Environmental Protection Agency (via zip file) as part of the 2023 submittal of the Phase I PDI Data Evaluation Report to which this document is an appendix.

Table C1-2
Lower Duwamish Waterway Middle Reach Shoreline Inspection Summary - West Shoreline

Approximate RM	Adjacent Property Name ¹	FNC Station Start	FNC Station End	General Bank Classification	Bank Description Notes	Approximate Slope Angle (H:V)	Erosion Observed ?	Structures ²	Tribal Fishing Nets	Outfalls	General Vegetation Observations	Phase I RAL Exceedance Area ³
1.6-1.85	Terminal 115 (Northland Services)	113+00	121+60	Bulkhead and armored	Sheetpile under wharf with engineered slope	2:1		#20	105			--
		121+60	127+00	Armored	Semi-engineered with some debris	2:1		#22	103, 104	2220		--
1.85-1.9	Terminal 115 (Seafreeze)	127+00	130+20	Armored	Semi-engineered with some debris	3:1		#24, #48	101 102	2122, 2123, 2125, 2124	Invasive shrubs	--
1.9-2.05	Terminal 115	130+20	131+60	Bulkheaded	Failing wood and concrete wall	Vertical	Potential	Derelict piles				--
		131+60	136+00	Armored	Non-engineered; debris and 8:1 slope in some areas	3:1 to 4:1		Derelict piles	100, 95	2506, 2505		26 (NA)
2.1-2.25	Alaska Marine Lines Yard 2	139+75	146+80	Armored	Combination of engineered and semi--engineered; debris, concrete, and wood present	2:1 to 6:1		#25, Derelict piles, wooden retaining wall		92a	Invasive shrubs	21 (27/24)
2.25-2.55	Boyer Towing	148+40	162+20	Armored	Semi-engineered with some debris and concrete	1:1 to 3:1	Potential	#28, #29, #31		2114, 2115, 2116, Boyer-1, Boyer-2		16 (21) and 12 (17)
2.55-2.75	Pacific Pile and Marine	162+20	165+00	Bulkheaded	Concrete wall	Vertical						--
		165+00	168+00	Unarmored	Non-vegetated with debris and sparse armor	2:1 to 4:1		#33	81	2113 (not verified)	Invasive shrubs	--
	Private Property	168+00	169+00	Bulkheaded	Concrete wall	Vertical						--
	Pacific Pile and Marine	169+00	171+60	Armored	Non-engineered; includes failing wood short wall	3:1		#34, Derelict piles		2112		5 (6/8)
		171+60	174+00	Bulkhead and armored	Sheetpile under wharf with semi--engineered slope; some debris	2:1		#35				5 (6/8)
		174+00	175+20	Armored	Non-engineered with debris and concrete	1:1 to 2:1					Invasive shrubs	5 (6/8)
2.75-2.85	City of Seattle	175+20	179+00	Unarmored	Vegetated restoration area	3:1 to 4:1					Restoration area	5 (6/8)
		179+00	179+20	Armored	Engineered shoreline protection for park	3:1 to 4:1				2107, 2106, 2108		--
2.85-2.95	Silver Bay Logging	179+20	181+00	Bulkhead and armored	Sheetpile under wharf with semi-engineered slope; heavy wood debris	2:1		#37	76			--
		181+00	186+00	Armored	Non-engineered with some debris	5:1 to 6:1		Derelict piles		2109, 2110, 2111	Invasive shrubs	--
3.0	City of Seattle	186+00	187+00	Unarmored	Vegetated restoration area	6:1					Invasive shrubs	--

Notes:
 1. Inlets below the west span of the 1st Ave South Bridge (RM 2.1) and at RM 2.2 were inaccessible at low tides.
 2. Waterway users survey structure number is presented, when applicable.
 3. RAL exceedance areas numbering updates from Phase II are listed in parentheses for reference. See Section 3.4 of the DER for more information on Phase II RAL exceedance areas.
 --: Is not adjacent to a Phase I RAL Exceedance Area
 FNC: Federal Navigation Channel
 RM: river mile

**Table C1-3
Lower Duwamish Waterway Middle Reach Shoreline Inspection Summary - East Shoreline**

Approximate RM/Slip	Adjacent Property Name	FNC Station Start ¹	FNC Station End	General Bank Classification	Bank Description Notes	Approximate Slope Angle (H:V)	Erosion Observed?	Structures ²	Tribal Fishing Nets	Outfalls	General Vegetation Observations	Phase I RAL Exceedance Area ³	
1.6-1.7	Certainfeed	113+00	118+50	Armored	Engineered and semi-engineered; some debris; retaining wall at top of bank	2:1 with some 1:1 areas	Potential	#18, Derelict piles	99	2015, 2016, 2018	Invasive shrubs	--	
Slip 2	Glacier Northwest	S2_0+00	S2_4+95	Armored	Engineered with some debris	1:1 to 2:1	Potential	#21, Derelict piles		GlacierNW-CBP	Invasive shrubs	--	
		S2_4+95	S2_9+45	Unarmored	Non-vegetated; concrete and debris	1:1 to 2:1					Invasive shrubs	--	
		S2_9+45	S2_13+15	Armored	Engineered	2:1					Invasive shrubs	33 (35)	
	Samson Tug and Marine	S2_13+15	S2_16+15	Unarmored	Non-vegetated; concrete and debris	2:1	Potential	#23			Invasive shrubs	31 (33)	
1.75-1.9	Samson Tug and Marine	122+40	125+30	Unarmored	Non-vegetated; concrete and debris	2:1	Potential	Derelict piles			Invasive shrubs	30 (32)	
		125+30	128+00	Armored	Non-engineered; heavy debris and concrete	4:1	Potential	Derelict piles	97	2022		30 (32)	
1.9-1.95	Duwamish Marine Center	128+00	129+00	Armored	Non-engineered; heavy debris and concrete	1:1 to near vertical	Potential	#53				--	
		129+00	130+65	Bulkheaded	Failing wood wall; heavy debris	1:1 to vertical	Potential	Derelict piles; nearshore building				29 (31)	
		130+65	131+45	Unarmored	Non-vegetated; sparse rock and debris	2:1 to 4:1						29 (31)	
2.0	1st Avenue South Bridge	131+45	134+65	Unarmored	Non-vegetated; sparse rock and debris	2:1 to 4:1					Invasive shrubs	29 (31)	
	Public Boat Ramp	134+65	136+00	Armored	Engineered; concrete ramp	3:1						27 (29)	
Slip 3	Muckleshoot Tribe	S3_0+00	S3_2+70	Bulkhead and armored	Sheetpile under wharf with engineered slope	1:1 to 2:1		#27				--	
	Maxum Petroleum	S3_2+70	S3_3+20	Bulkhead and armored	Wooden pile wall	1:1 to near vertical						--	
	Talon	S3_3+20	S3_6+00	armored	Engineered	2:1 to 3:1						--	
		S3_6+00	S3_7+65	Bulkheaded	Sheetpile with short wooden pile wall	Vertical		Mooring piles				--	
	Seatac Marine	S3_7+65	S3_10+65	Unarmored	Non-vegetated; sparse rock and debris	1:1 to 3:1					2024, 2025 Seattle Dist Ctr	Invasive shrubs	--
		S3_10+65	S3_10+95	Bulkheaded	Failing sheetpile; debris	Vertical	Potential						24 (26)
	S3_10+95	S3_18+15	Bulkhead and armored	Sheetpile under wharf with semi-engineered slope with debris	1:1 to 2:1							--	
2.1-2.2	Seatac Marine	139+75	144+40	Bulkhead and armored	Sheetpile under wharf with semi-engineered slope with debris	1:1 to 2:1		#26	91	S Brighton St SD		23 (25)	
2.2-2.25	Bridge Point Seattle (aka Dawne Foods)	144+40	148+40	Armored	Non-engineered; debris and concrete	2:1 to 3:1		Mooring piles		Dawn Foods	Invasive shrubs	18/19/22 (23)	
e32.25-2.35	Private Property	148+40	151+25	Armored	Non-engineered; debris and concrete	2:1 to 3:1		Mooring piles			Invasive shrubs	18/19/22 (23)	
2.35	Myrtle Bay	151+25	154+40	Armored	Semi-engineered with some debris	2:1 to 3:1		Mooring piles		2026, 2027, 2028, 2029, 2030, 2032	Invasive shrubs	15 (20)	

Approximate RM/Slip	Adjacent Property Name	FNC Station Start ¹	FNC Station End	General Bank Classification	Bank Description Notes	Approximate Slope Angle (H:V)	Erosion Observed?	Structures ²	Tribal Fishing Nets	Outfalls	General Vegetation Observations	Phase I RAL Exceedance Area ³
2.4-2.55	Seattle Iron and Metals	154+40	155+00	Armored	Non-engineered with debris	2:1 to 3:1					Invasive shrubs	--
		155+00	156+40	Bulkhead and armored	Sheetpile under wharf with semi-engineered slope with debris	2:1		#30				14 (NA)
		156+40	159+35	Armored	Non-engineered with debris	2:1	Potential		84	2034	Invasive shrubs	14 (NA)
		159+35	159+85	Bulkheaded	Sheetpile	Vertical						--
		159+85	163+25	Bulkhead and armored	Sheetpile under wharf with semi-engineered slope with heavy debris	1:1 to 3:1		#32				11 (13,16)
2.55-2.75	Recology	163+25	171+60	Armored	Non-engineered with cemented materials and debris	1:1 to 3:1	Potential	Derelict piles	82, 83	2036, 2037, 2038, 2039, 2040	Invasive shrubs	9 (9),11 (13,16)
		171+60	172+40	Bulkheaded	Concrete and wood walls	Vertical						9 (9)
2.75-2.8	City of Seattle	172+40	174+10	Bulkheaded	Historic pump station and wooden wing walls	20:1 in front of wall		#63				9 (9)
		174+10	175+70	Armored	Non-engineered with some debris	2:1 to 3:1	Potential		79	CleanScapes B, 2041		9 (9)
2.8-2.85	8th Avenue Terminals	175+70	178+00	Bulkhead and armored	Sheetpile under wharf with engineered slope with some debris	2:1 to 3:1		#36				8 (5)
Slip 4	8th Avenue Terminals	S4_0+00	S4_4+25	Bulkhead and armored	Sheetpile under wharf with engineered slope with some debris	2:1 to 3:1		#36		5007, 5008, 5009, 5010		3 (3)
	Slip 4 EAA	S4_4+25	S4_19+00	Armored	Access was tide restricted	2:1 to 3:1					Restoration area	3 (3)
	Boeing EAA	S4_19+00	S4_24+00	Armored	Semi-engineered	2:1 to 3:1				2052, 2053	Restoration area	--
2.85-3.0	Boeing EAA	180+00	187+00	Unarmored	Vegetated restored area	3:1			74, 73, 72		Restoration area	--

Notes:

- For Slips 2, 3 and 4, stationing was established at the northwest corner of the slip and progresses clockwise. For example, S2_4+95 represents a location 495 feet from the northwest corner of Slip 2.
- Waterway users survey structure number is presented, when applicable.
- RAL exceedance areas numbering updates from Phase II are listed in parentheses for reference. See Section 3.4 of the DER for more information on Phase II RAL exceedance areas.

--: not adjacent to a Phase I RAL exceedance area

DER: data evaluation report

FNC: Federal Navigation Channel

RM: river mile

NA: not applicable

1.1 Detailed Observation Tables

Detailed observations are documented for each discrete shoreline segment, as defined by a change in bank structure classification (i.e., armored, unarmored, and bulkheaded). The following sections describe the various fields presented in Tables C1-2 and C1-3.

1.1.1 River Miles, Adjacent Property Name, and FNC Stationing

Both river miles and Federal Navigation Channel (FNC) stationing were used as reference points for the inspections of the east and west main waterway banks (Tables C1-2 and C1-3). Banks within Slips 2, 3, and 4 were based on distance from the intersection of the main waterway (Table C1-3). River miles and FNC stationing can be found on Maps 2-9a through 2-9e of the DER.

1.1.2 General Bank Classification

The banks of the middle reach of the LDW fall into one of the following classifications: armored (engineered or semi-engineered), unarmored (vegetated, exposed sediment, or sparsely covered), or bulkheaded. Bulkheaded banks most frequently occur coincident with overwater structures and are supported by armored slopes; therefore, some areas are classified as both armored and bulkheaded.

1.1.3 Bank Observations

Areas below mean higher high water transition to a connection point with sediment. This transition is generally accompanied by a change to the more gradual slope of the intertidal sediments.

Concerning banks, the following observations were made:

- **Slope:** Estimated bank slope based on visual inspection and review of bathymetric data
- **Erosion:** "Potential" indicates whether erosion was observed on the bank or could occur due to slope configuration
- **Structures:** Confirmation of structures documented in the LDW Waterway Users Survey (Integral et al. 2018) and identification of undocumented piles and other structures
- **Tribal Fishing Nets:** Designated tribal fishing net locations
- **Outfalls:** Confirmation of outfalls as documented in the LDW Waterway Users Survey (Integral et al. 2018) and identification of pipes

1.1.4 Vegetation Details

Few banks on the main waterway and within Slips 2, 3, and 4 are comprised of significant vegetation other than invasive species. The inlets below the western span of the 1st Ave South Bridge and adjacent to the inlet at RM 2.2W could not be accessed for a complete survey. A complete vegetation survey of banks with RAL exceedance areas was completed during the Phase II PDI and results are documented in Appendix G.

1.1.5 General Notes

This field provides general notes that may apply to the entire segment, regardless of whether the location in question is above, on, or below the bank. Phase II PDI access considerations are also recorded in this field.

1.2 Photographs

Photographs were collected using a global positioning system- and compass-enabled camera that recorded direction and position for every photograph taken. Photographs were taken to provide near-complete coverage of the middle reach banks, from river mile 1.6 to river mile 3.0 on the west and east banks. Table C1-4 provides a photographic summary of the conditions observed at each RAL exceedance area adjacent to the shoreline (see Map 3-3 of the DER for RAL exceedance area locations).

**Table C1-4
Middle Reach Banks Summary and Photographs**

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
3 (3)	8th Avenue Terminals	Armored and bulkheaded	 <p>Northwest</p>	 <p>North</p>
			 <p>Northwest</p>	 <p>Northwest</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
5 (6, 8)	Pacific Pile and Marine	Armored and bulkheaded	 <p>Southwest</p>	 <p>Southwest</p>
			 <p>Southwest</p>	 <p>Southeast</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
8 (5)	8th Avenue Terminals	Armored	 <p>North</p>	 <p>Northeast</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
9 (9)	City of Seattle	Unarmored and bulkhead	 <p>Northwest</p>	 <p>North</p>
			 <p>North</p>	 <p>Northeast</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
11 (13, 16)	Seattle Iron and Metals Recology	Armored and bulkheaded	 <p>Northeast</p>	 <p>Northeast</p>
			 <p>Northeast</p>	 <p>Northeast</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
14 (NA)	Seattle Iron and Metals	Armored	 <p>North</p>	
15 (20)	Myrtle Bay	Armored	 <p>North</p>	 <p>South</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
16 (21)	Boyer Towing	Partially armored	 <p>Northwest</p>	 <p>Southwest</p>
18/19/22 (23)	Bridge Point Seattle (aka Dawne Foods) Private Property	Armored	 <p>Northeast</p>	 <p>Northeast</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
20 (24)	Alaska Marine Lines Yard 2 ICS/NW Cooperage	Unarmored	 <p>West</p>	 <p>West</p>
21 (24, 27)	Alaska Marine Lines Yard 2	Armored and bulkheaded	 <p>South</p>	 <p>South</p>

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
23 (25)	Seatac Marine	Armored and bulkheaded	 <p>North³</p>	 <p>East³</p>
24 (26)	Seatac Marine	Unarmored	 <p>South⁵</p>	

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
26 (NA)	Terminal 115	Bulkhead and armored	 <p>South</p>	 <p>South</p>
27 (29)	Public Boat Ramp	Armored	 <p>North⁵</p>	

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}		
29 (31)	Duwamish Marine Center	Bulkhead	 <p>Northwest</p>	 <p>Northeast</p>	 <p>North</p>
30 (32)	Samson Tug and Marine	Unarmored and armored	 <p>East</p>	 <p>East</p>	

Phase I RAL Exceedance Area ¹	Adjacent Property Name	Bank Type	Photographs ^{2,3,4}	
31 (33)	Samson Tug and Marine	Unarmored	 <p>East</p>	 <p>East</p>
33 (35)	Glacier Northwest	Unarmored and armored	 <p>Southeast</p>	 <p>Southeast</p>

Notes:

1. Numbering updates from Phase II to RAL exceedance areas are listed in parentheses for reference. See Section 3.4 of the DER for more information on Phase II RAL exceedance areas.
2. Photographs were taken during the Phase I PDI.
3. All bank photographs included in this appendix were taken at approximate tide elevations of 0 feet to 2 feet MLLW.
4. Description denotes direction faced while taking photograph.

5. Photograph is a panorama made from stitching multiple photos together; some distortion can be seen.

DER: data evaluation report

MLLW: mean lower low water

PDI: Pre-Design Investigation

RAL: remedial action level

2 References

Integral, Moffat & Nichol, Windward. 2018. Waterway user survey and assessment of in-water structures - data report. Integral Consulting Inc., Moffan & Nichol, and Windward Environmental LLC, Seattle, WA.

Windward, Anchor QEA. 2022. Pre-design investigation quality assurance project plan for the Lower Duwamish Waterway - Middle Reach. Final. Submitted to EPA November 21, 2022. Windward Environmental LLC and Anchor QEA, Seattle, WA.

Attachment C-1-1
Photographs (Provided Separately to EPA
Via ZIP File in 2023)

Appendix C-2

Phase II Detailed Bank Inspection

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1 Introduction

This appendix provides detailed results of Lower Duwamish Waterway (LDW) middle reach Phase II Pre-Design Investigation (PDI) bank inspections that were conducted to satisfy data quality objectives (DQOs) 11 and 14. The Phase II inspections focused on areas with remedial action level (RAL) exceedances based on the Phase I dataset, and included a field visit at low tide to document bank conditions and measure the thickness of sediment over armoring (where applicable), and a desktop analysis of oblique and ortho-aerial photographs.

Observations from a site visit performed on July 22, 2024, were coupled with a review of high-resolution oblique and ortho-aerial photographs to identify locations and extents of bank features found at the 18 Phase I RAL exceedance areas with banks. The following features are documented by RAL exceedance area in Attachment C-2-1:

- Woody vegetation extents
- Extent and other ascertainable features of bank armoring
- Aboveground utilities (e.g., outfalls, storm drains, groundwater monitoring wells)
- Underground or submerged utility corridors that run through banks or cross waterway (if they can be located)
- Large surface debris
- Structures (e.g., corner point of existing structures, fence lines, paved surfaces adjacent to top of bank)

Some areas with RAL exceedances were classified as armored banks during the Phase I PDI. In these areas, as noted in the PDI Quality Assurance Project Plan Addendum No. 1 for Phase II (Anchor QEA and Windward 2024), measuring the thickness of sediment over the armor layer was necessary to determine the location of the toe of the armored bank, and to be able to calculate the volume of sediment overlying the armor layer. The sediment thickness findings are also recorded on Attachment C-2-1, including the following (as applicable):

- Rough location of each transect
 - The first (i.e., highest elevation) probe location is indicated as 0 foot for “Distance Along Transect” on the shoreline conditions inspection forms (Attachment C-2-1). This location was typically at the lowest elevation of the visible armoring (where armoring met sediment) or at the vegetation line if armoring was not visually apparent.
- Observed surface substrate type (e.g., rock, sand, silt, shell)
- Other surface observations of note (e.g., description of visible surface debris)
- Sediment thickness and refusal depth
- Subsurface debris or obstructions encountered during probing

- Any other relevant observations noted during probing (e.g., steep banks, stiffness of layers, access issues)

Table C-2-1 includes a summary of bank areas that were inspected as part of Phase II, and includes additional information related to sediment thickness probing for areas where it was conducted. Detailed observations from field visits and the desktop reviews for each transect are included on Attachment C-2-1 of this appendix.

Table C-2-1
Summary of Phase II Bank Inspection Areas

Phase I RAL Exceedance Area ¹	River Mile ²	Desktop Review Conducted? (Y/N)	Sediment Thickness Probing Conducted? (Y/N)	Approximate Time of Sediment Thickness Probing ³	Predicted Tide Elevation During Sediment Thickness Probing (feet MLLW)	Approximate Area of Bank Observations (square feet)	Range of Probing Refusal Depths (feet)	Bank Classification and Noted Features at Probing Transect
33 (35)	1.75E	Y	Y	11:42	-2.3	1,350	0.25–0.6	Unarmored bank with wood and concrete debris
31 (33)	1.8E	Y	Y	09:57	1.0	1,260	0.5–3	Unarmored bank with gravely sand and occasional concrete debris
30 (32)	1.85E	Y	Y	10:10	0.5	2,000	0.6–3	Armored bank with broken concrete and other debris along the shore
29 (31)	1.95E	Y	Y	10:43	-0.7	2,500	No Refusal	Unarmored bank near outfall 2502 and other structures
27 (29)	2.0E	Y	Y	10:33	-0.3	1,300	0.25–0.5	Armored bank adjacent to paved boat ramp
26 (NA ⁴)	2.05W	Y	Y	11:10	-1.5	3,100	No Refusal	Armored bank near outfall 2506 and 1 st Avenue Bridge structures
24 (26)	2.1E	Y	Y	12:05	-2.6	2,500	0.2--2	Unarmored bank with abundant debris and timber bulkhead
21 (24, 27)	2.2W	Y	Y	11:22	-1.8	20,000	No Refusal	Armored bank adjacent to structures with large concrete slabs and wood debris along the shore
20 (24)	2.2W	Y	N ⁵	--	--	--	--	--
18/19/22 (23)	2.25E	Y	Y	12:30	-2.8	11,000	0.25–No Refusal	Armored bank with concrete debris and near Dawn Foods outfall

Phase I RAL Exceedance Area ¹	River Mile ²	Desktop Review Conducted? (Y/N)	Sediment Thickness Probing Conducted? (Y/N)	Approximate Time of Sediment Thickness Probing ³	Predicted Tide Elevation During Sediment Thickness Probing (feet MLLW)	Approximate Area of Bank Observations (square feet)	Range of Probing Refusal Depths (feet)	Bank Classification and Noted Features at Probing Transect
16 (21)	2.35W	Y	N ⁶	--	--	--	--	--
15 (20)	2.35E	Y	Y	12:44	-2.8	4,500	0.25–1.5	Armored bank with concrete slabs and near outfall 2028 and SBW-B
14 (NA ⁴)	2.45E	Y	Y	12:55	-2.8	1,000	3–No Refusal	Armored bank with wood and concrete debris along with shore and adjacent to structure #30
12 (17)	2.5W	Y	N ⁶	--	--	--	--	--
11 (13, 16)	2.55E	Y	N ⁶	--	--	--	--	--
9 (9)	2.7E	Y	Y	13:23	-2.6	4,000	0.1–1	Armored bank with wood debris across the bank and adjacent to structures
8 (5)	2.8E	Y	N ⁵	--	--	--	--	--
5 (6, 8)	2.75W	Y	Y	13:38	-2.4	6,000	0.5–No Refusal	Unarmored bank with large woody debris habitat features

Notes:

1. RAL exceedance areas numbering updates from Phase II are listed in parentheses for reference. See Section 3.4 of the DER for more information on Phase II RAL exceedance areas.
2. This represents the closest RM to the midpoint of the transects. The side of the bank (i.e., east or west) is included for reference.
3. Time listed represents the estimated start time of each transect where sediment thickness probing occurred on July 22, 2024. On average, inspection durations ranged from 10 to 20 minutes.
4. Based on bioassay data collected during Phase II, the area is no longer a RAL exceedance. See Section 2.1.4 of the DER for additional discussion.
5. Sediment thickness probing not identified for these areas in Phase II QAPP Addenda. Bank inspection activities completed through desktop review of photographs.
6. Sediment thickness probing planned based on Phase II QAPP Addenda but not completed due to blocked access or other considerations (discussed in associated sections).

MLLW: mean lower low water

NA: not applicable

RM: river mile

1.1 Methods

As stated in Section 2.4.2 of the Data Evaluation Report (DER), the Phase II detailed bank inspection builds upon the Phase I visual inspection. This included detailed review of bank features through a desktop review of high-resolution photographs, including ortho-aerial imagery collected as part of the topography survey using the method of photogrammetry conducted by Miller Creek Associates (see Appendix F for more information), and oblique photographs collected by Anchor QEA using a drone on June 24, 2024. All photographs collected during Phase I and Phase II were compiled on an interactive webmap with RAL exceedance areas and site features overlaid.¹ The results in Section 1.2 are conclusions drawn from review of sediment thickness probing field notes and detailed desktop review. Additional notes on bank conditions related to vegetation are included in Appendix G.

1.2 Results

Results for the bank features and sediment thickness for each Phase I RAL exceedance areas identified in the Phase II QAPP Addenda (Anchor QEA and Windward 2024) are summarized in section 1.2.1 through 1.2.18 along with representative photograph(s) for each area included as Figures C-2-1 through C-2-18. For areas where sediment thickness probing was conducted, transect locations are illustrated on the associated photographs. Detailed bank inspection forms for each RAL exceedance area are included as Attachment C-2-1.

This evaluation took place at RAL exceedance areas along banks based on the Phase I dataset. It should be noted that remedial action areas and sediments management areas developed in future remedial design phases may be expanded to include areas outside RAL exceedance areas, leading to potential data gaps and further evaluations.

¹ Features are not included in the images in the following sections; structures and outfalls can be found on Map 2-9, and Phase II RAL exceedance areas can be found on Map 3-3.

1.2.1 RAL Exceedance Area 33 (Revised to 35 on Map 3-3)

Visual observations through desktop analysis of the shoreline noted an armored slope along the upgradient portions of the area. Armoring consisted of riprap and concrete pieces. Debris in the area included concrete slabs, timber, and metal pilings.

Sediment thickness probing was conducted along one transect on the bank of RAL Exceedance Area 33. Visual observations during probing included concrete and sporadic rock in the upgradient portions. The transect began near the lowest elevation of visually observed rock/debris and continued downgradient in 5-foot increments (0, 5, 10 and 15 feet). All sediment thickness measurements along this transect were less than 1 foot. Additional details for the transects can be found in the shoreline conditions forms (Attachment C-2-1). Figure C-2-1 displays a drone oblique for RAL Exceedance Area 33 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-1
Oblique Photograph for RAL Exceedance Area 33



1.2.2 RAL Exceedance Area 31 (Revised to 33 on Map 3-3)

Visual observation from desktop analysis of the shoreline noted an unarmored slope along the upgradient portions of the area. Sporadic rock and concrete were noted at the edge of the vegetation line. Debris in the area included ropes and timber. The RAL exceedance area is south (to the right on Figure C-2-2) of a pier and dolphin.

Sediment thickness probing was conducted along one transect on the bank of RAL Exceedance Area 31. Visual observations during probing included concrete and sporadic rock in the upgradient portions, with no overlying sediment. The transect began near the lowest elevation of visually observed vegetation. Sediment thickness at the edge of vegetation ranged from 2.5 to 3 feet. Probing continued 5 feet downgradient the sediment thickness is 0.5 foot. Further downgradient (10- and 15-foot) sediment thickness ranged from 2.5 to 3 feet. Additional details for the transect can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-2 displays the drone obliques for RAL Exceedance Area 31 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-2
Oblique Photograph for RAL Exceedance Area 31



1.2.3 RAL Exceedance Area 30 (Revised to 32 on Map 3-3)

Visual observation from desktop analysis of the shoreline noted an unarmored slope and armored slope along the upgradient portions of the area. Armoring consisted of riprap and concrete pieces mainly around the pier structure towards the south end of the RAL Exceedance Area. In the armor area debris such as concrete slabs, ropes, and timber were noted. The north end of the RAL Exceedance Area is unarmored with sporadic rock minimal debris (metal pipes).

Sediment thickness probing was conducted along one transect on the bank of RAL Exceedance Area 30. Visual observations during probing included concrete and sporadic rock in the upgradient portions, with no overlying sediment. The transect began near the lowest elevation of visually observed vegetation. Sediment thickness at the edge of vegetation is 3 feet. Probing continued 5 feet downgradient the sediment thickness is 0.6 foot. Further downgradient (10- and 15-foot) sediment thickness is 2.5 feet. Additional details for the transect can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-3 displays the drone obliques for RAL Exceedance Area 30 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-3
Oblique Photograph for RAL Exceedance Area 30

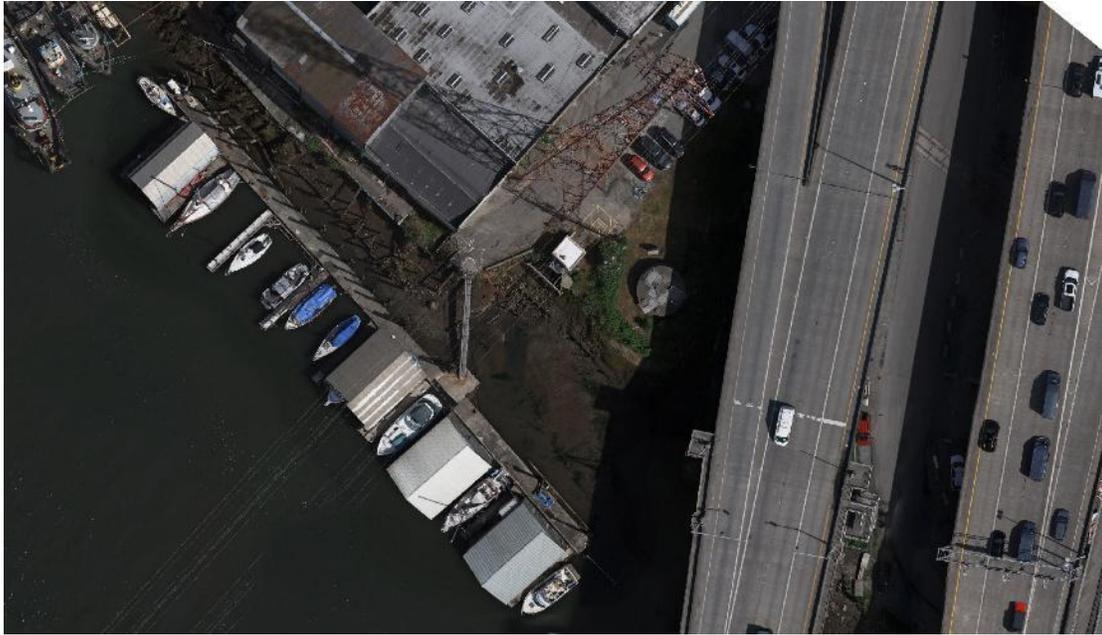


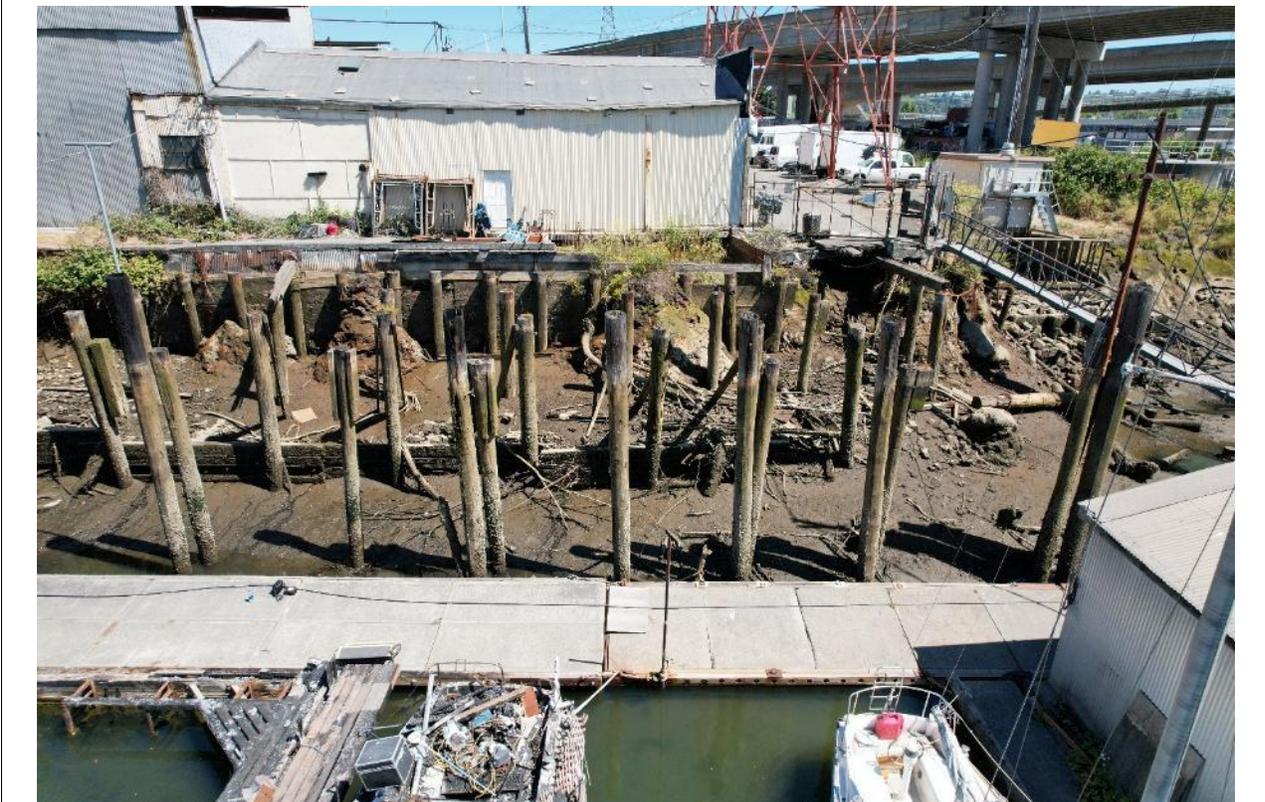
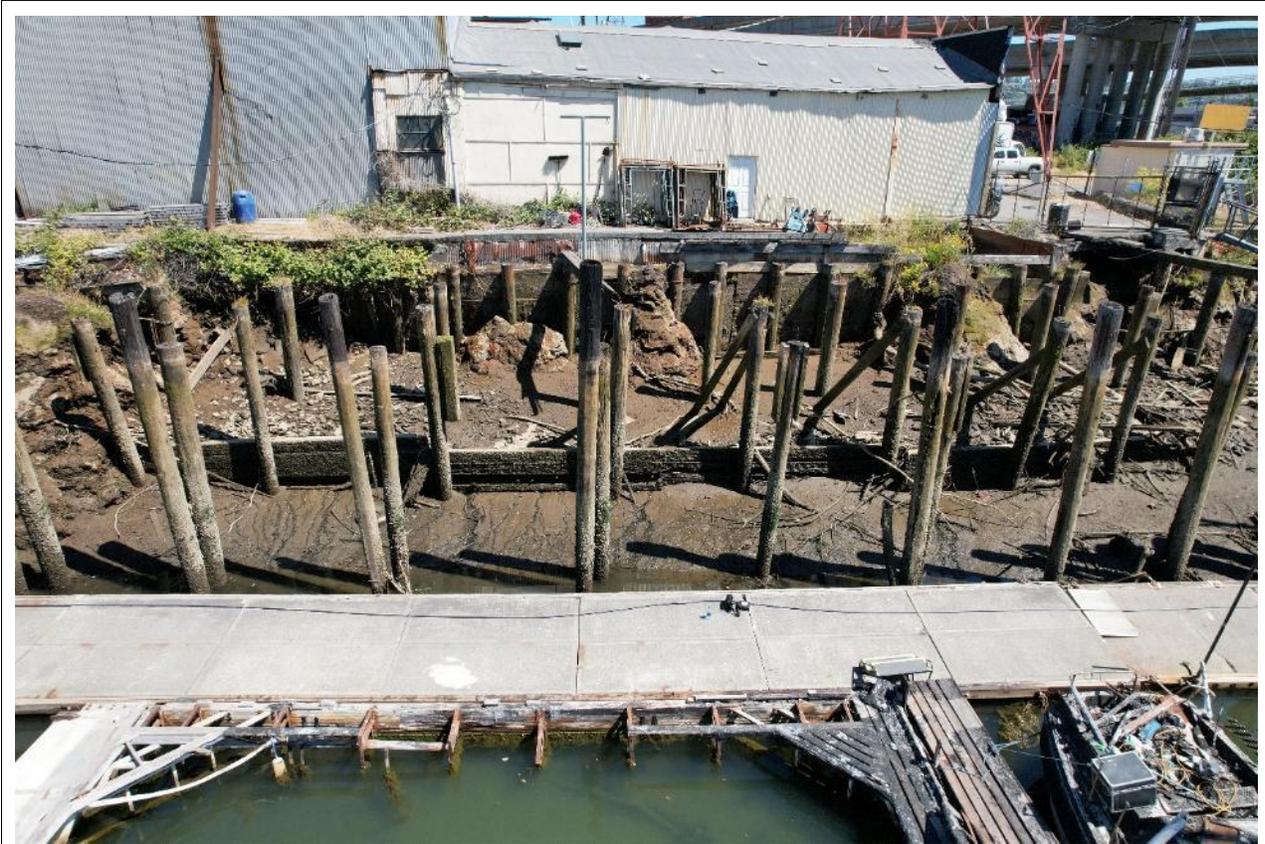
1.2.4 RAL Exceedance Area 29 (Revised to 31 on Map 3-3)

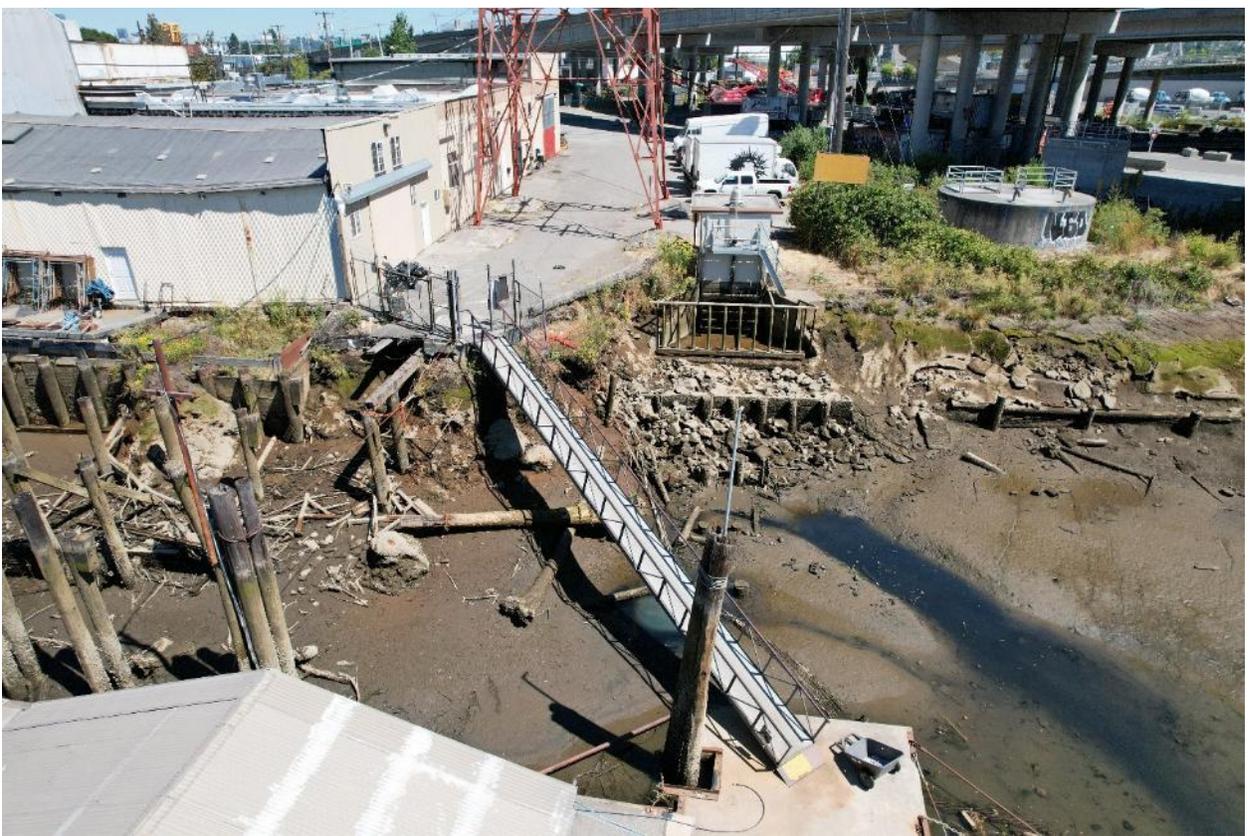
Visual observation from desktop analysis of the shoreline noted the bank included areas that were armored, unarmored, and included a timber bulkhead. Concrete and timber debris were noted on the upgradient portions of the area. The RAL exceedance area includes floating structures offshore, abundant pilings, and an outfall (Outfall 2501). Desktop analysis occurred throughout the RAL exceedance area and was supplemented with field notes in the southern portion. The northern end of the RAL exceedance area was inaccessible during the vegetation and sediment thickness probing investigation.

Sediment thickness probing was conducted along two transects on the bank of RAL Exceedance Area 29. Sediment thickness probing only occurred on the southern end of the RAL exceedance areas. Visual observations during probing included concrete and sporadic rock in the upgradient portions, with no overlying sediment. The transects began near the lowest elevation of visually observed concrete and rock and no refusal was encountered. Probing continued 5 feet downgradient where no refusal was encountered. Additional details for all transects within this area can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-4 displays the drone obliques for RAL Exceedance Area 29 and the red arrows on the last photograph depict the approximate location and direction of the sediment thickness probing transects.

Figure C-2-4
Ortho-aerial and Oblique Photographs for RAL Exceedance Area 29 Displayed from Downriver (Left) to Upriver (Right)









1.2.5 RAL Exceedance Area 27 (Revised to 29 on Map 3-3)

Visual observations from desktop analysis of the shoreline noted an unarmored slope of the north end of a paved boat ramp. Large concrete debris were noted on the upgradient portions of the area, along wood debris further downgradient. The RAL exceedance area is under the First Avenue Bridge and include structures such as bridge foundations.

Sediment thickness probing was conducted along one transect on the bank of RAL Exceedance Area 27. The transect began near the lowest elevation of visually observed debris. Visual observations during probing included sporadic rock and concrete debris in the upgradient portions. Sediment measured between concrete debris was generally 0.5 foot or less in thickness. Probing continued downgradient in 5-foot intervals. Sediment thickness continued to be approximately 0.5 foot or less. The surface substrate transitioned to a silty sand overlaying a gravelly substrate. Brick and wood debris were observed while probing. Reason for refusal was typically due to compact sediment or encountering debris. Additional details for the transect can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-5 displays the drone obliques for RAL Exceedance Area 27 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-5
Oblique Photograph for RAL Exceedance Area 27



1.2.6 RAL Exceedance Area 26 (No longer a RAL Exceedance Area)

Visual observations through desktop analysis of the shoreline noted an armored slope along the upgradient portions of the area. Armoring consisted of riprap and concrete pieces. There was no debris noted throughout the RAL exceedance area. The RAL exceedance area is under the First Avenue Bridge and include structures such as bridge foundations and Outfall 2506.

Sediment thickness probing was conducted along two transects on the bank of RAL Exceedance Area 26. Transects began near the apparent high water markings on the rocks. Visual observation of surface debris and armoring throughout the area generally included sporadic rock, concrete debris, and riprap in places in the upgradient portions, with no sediment covering the armoring. Downgradient of the armoring and concrete debris surface material transitioned to sandy silt. No refusal was encountered when probing. Additional details for all transects within this area can be found in the shoreline conditions forms (Attachment C-2-1). Figure C-2-6 displays the drone obliques for RAL Exceedance Area 26 and the red arrows depict the approximate location and direction of the sediment thickness probing transects.

Figure C-2-6
Oblique Photographs for RAL Exceedance Area 26 Displayed from Upriver (Left) to
Downriver (Right)





1.2.7 RAL Exceedance Area 24 (Revised to 26 on Map 3-3)

Visual observations through desktop analysis of the shoreline noted an unarmored bank with abundant debris along the upgradient portions of the area. Debris was observed throughout the RAL exceedance area included wood and metal pieces, large concrete slabs, and bricks. The RAL exceedance area includes portions under a pier with a timber bulkhead structure on the upgradient portions under the pier.

Sediment thickness probing was conducted along two transects on the bank of RAL Exceedance Area 24. Transects began roughly 15 feet from the edge of vegetation. Due to health and safety concern the transect began where the slope flattened. Visual observation of surface debris and armoring throughout the area generally included sporadic rock and abundant concrete debris in the upgradient portions. Sediment measured between concrete debris was generally 0.5 foot or less in thickness roughly 5 feet downgradient from transect start the observed surface substrate transition to a gravelly sand and sediment thickness was typically 1.5 feet. Roughly 10 feet of downgradient sediment thickness was approximately 2 feet of soft sediment prior to hitting a hard refusal layer. Reason for refusal was typically due to compact sediment. Additional details for both transects can be found in the shoreline conditions forms (Attachment C-2-1). Figure C-2-7 displays the drone obliques for RAL Exceedance Area 24 and the red arrows depict the approximate location and direction of the sediment thickness probing transects.

Figure C-2-7
Oblique Photograph for RAL Exceedance Area 24

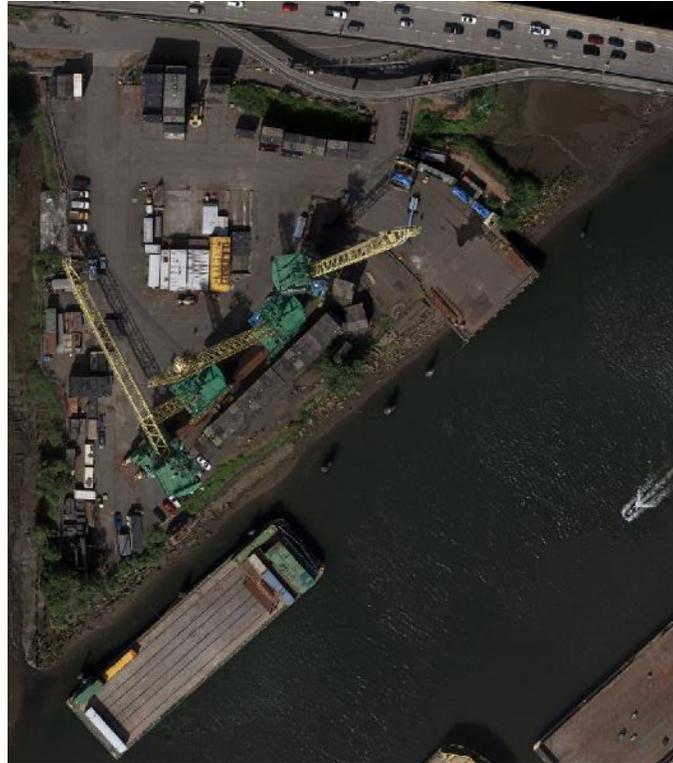


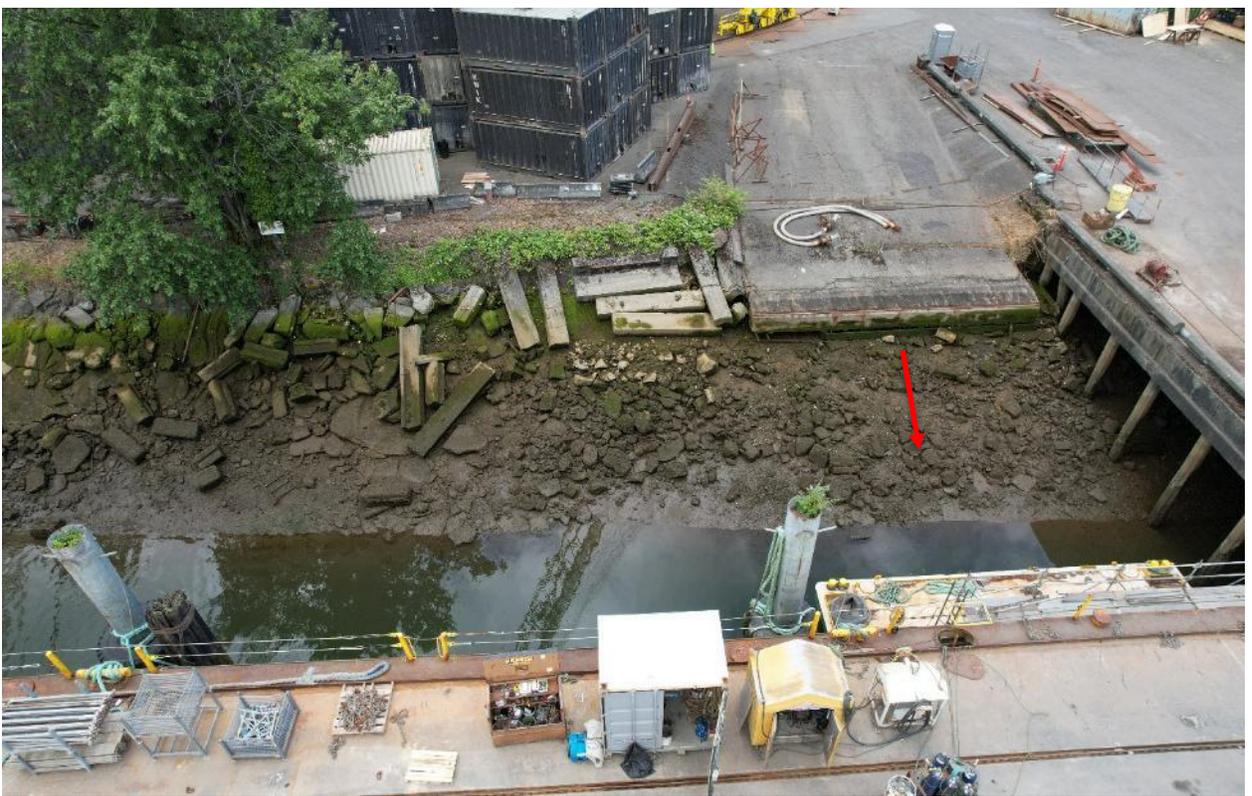
1.2.8 RAL Exceedance Area 21 (Revised to 24 and 27 on Map 3-3)

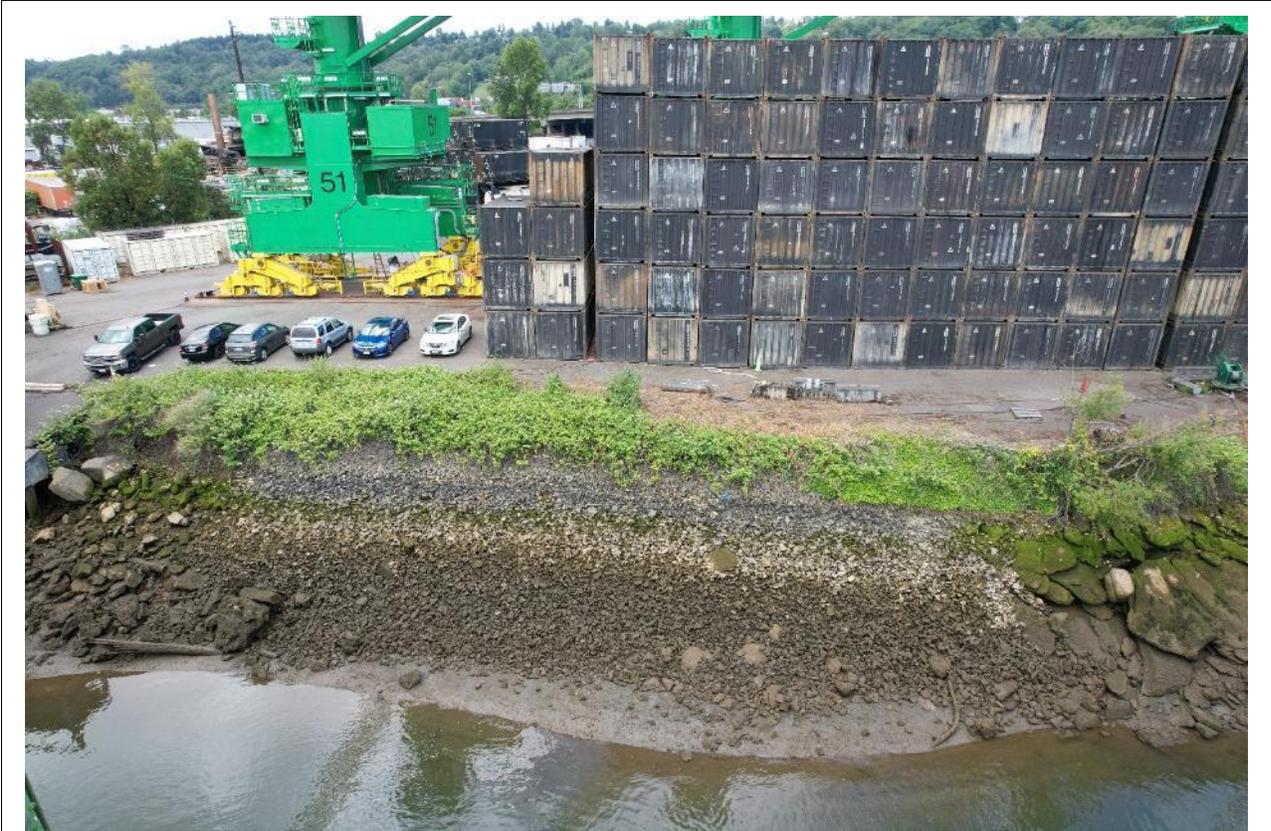
Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring ranged from scattered riprap and concrete to an engineered riprap shoreline. Debris throughout the RAL Exceedance Area include scattered concrete (broken pieces, slabs, and columns) and occasional metal and wood pieces. The southern end of the RAL Exceedance Area contains a double tiered timber bulkhead starting just below the vegetation line. Other structures within the RAL Exceedance Area include an outfall (2508) and pier on the north end of the area

Sediment thickness probing was conducted along four transects on the bank of RAL Exceedance Area 21. Visual observation of surface debris and armoring throughout the area generally included sporadic rock and concrete debris in the upgradient portions, with no sediment covering the armoring. Downgradient of the armoring and concrete debris surface material predominantly consisted of a soft sandy silt. The transect began near the lowest elevation of visually observed armoring, no refusal was encountered. Additional details for all transects within this area can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-8 displays the drone obliques for RAL Exceedance Area 21 and the red arrows depict the approximate location and direction of the sediment thickness probing transects.

Figure C-2-8
Ortho-aerial and Oblique Photographs for RAL Exceedance Area 21 Displayed from Upriver (Left) to Downriver (Right)









1.2.9 RAL Exceedance Area 20 (Revised to 24 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap and large slabs on concrete. Abundant debris throughout the area include broke timber pilings, ecology blocks, scattered wood, and timber cross beams along the inlet bottom. Additionally, there are an abundance of timber pilings cut at the mudline. Structures along the north bank include an ecology block wall and a timber pier. The RAL exceedance area contains two outfalls (2120 and 2118), circled in Figure C-2-9. Structures along the south bank include a timber pier and ecology block wall.

In accordance with QAPP Addendum No. 2 sediment thickness probing did not take place in RAL Exceedance Area 20.

Figure C-2-9
Oblique Photographs for RAL Exceedance Area 20





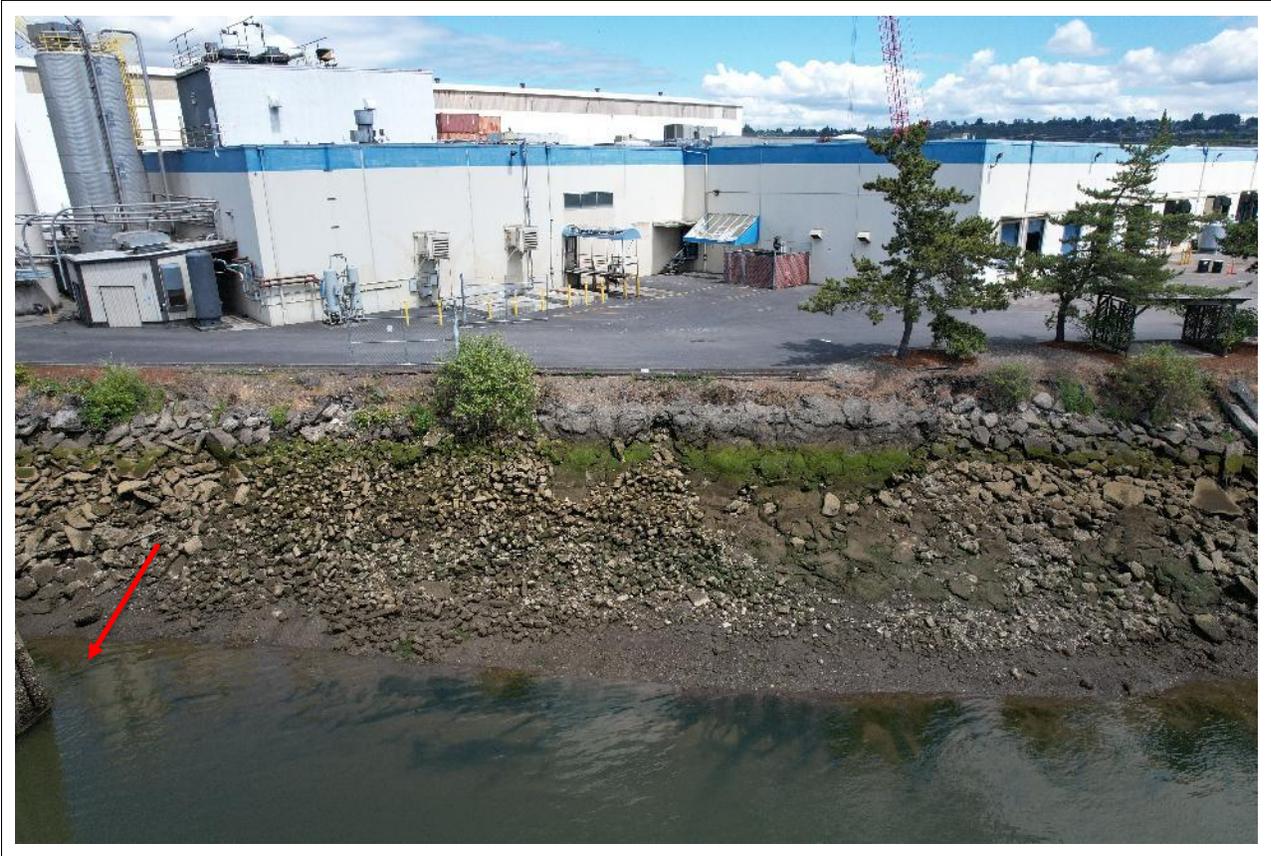
1.2.10 RAL Exceedance Area 18/19/22 (Revised to 23 on Map 3-3)

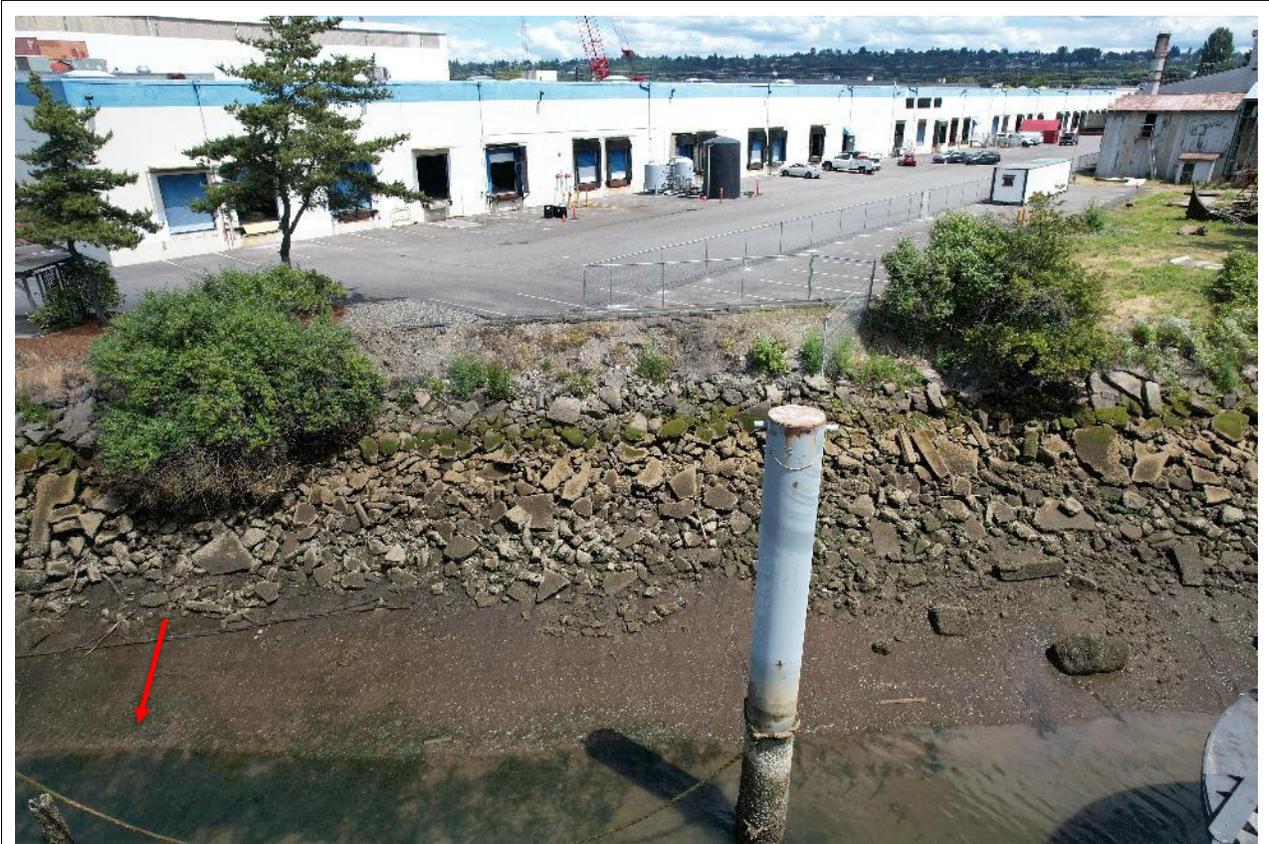
Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap and large chunks of concrete. Debris throughout the RAL exceedance area include concrete with rebar, occasional metal pieces, and scattered rope. The RAL exceedance area contains one outfall (Dawn Foods) circled in Figure C-2-10.

Sediment thickness probing was conducted along four transects on the bank of RAL Exceedance Area 18/19/22. The transects typically began near the lowest elevation of visually observed armoring. Visual observation during probing generally noted debris and armoring throughout the upgradient portions generally included rock and large concrete slabs. Sediment thickness between the armoring pieces were generally approximately 0.5 foot or less, just downgradient of the edge of armoring, sediment thickness ranged from 2.5 to 3 feet. Roughly 5 feet downgradient of the edge of armoring, no refusal was observed. Observed surface material downgradient of armoring predominantly consisted of gravel and silty sand with shell fragments. Additional details for all transects within this area can be found in the shoreline conditions forms (Attachment C-2-1). Figure C-2-10 displays the drone obliques for RAL Exceedance Area 18/19/22 and the red arrow depicts the approximate location and direction of the sediment thickness probing transects.

Figure C-2-10
Ortho-aerial and Oblique Photographs for RAL Exceedance Area 18/19/22 Displayed from
Downriver to Upriver







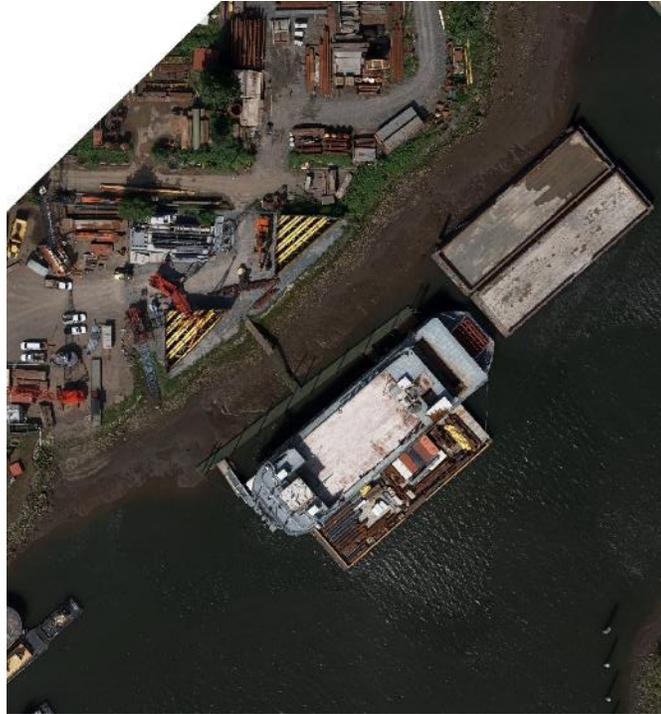


1.2.11 RAL Exceedance Area 16 (Revised to 21 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap and concrete debris. Abundant debris throughout the area include scattered wood and tires throughout the bank. Structures along the bank include a floating pier, timber pilings, and timber dolphins. The RAL Exceedance Area contains two outfalls (2116 and Boyer-1), circled in Figure C-2-11.

This area was inaccessible during sediment thickness probing due to barges moored at the facility.

Figure C-2-11
Ortho-aerial and Oblique Photographs for RAL Exceedance 16 Displayed from Upriver (Left) to Downriver (Right)







1.2.12 RAL Exceedance Area 15 (Revised to 20 on Map 3-3)

Visual observations through desktop analysis of the shoreline noted armoring throughout the upgradient portions of the area. Armoring generally included riprap and large chunks of concrete. Debris throughout the RAL exceedance area includes concrete slabs and occasional metal pieces. The RAL exceedance area contains four outfalls, and Outfalls SBW-B and 2028 were visually confirmed in photographs (circled in Figure C-2-12).

Sediment thickness probing was conducted along one transect on the northern bank of RAL Exceedance Area 15, which was the only portion that wasn't too steep for the field crew to traverse. Transects began roughly 15 feet from the edge of vegetation. Visual observation during probing noted debris and armoring throughout the upgradient portions generally included rock and large concrete slabs, with no sediment covering the armoring. Sediment thickness between the armoring pieces was generally 0.5 foot or less, just downgradient of the edge of armoring, sediment thickness was 1 to 1.5 feet; the reason for refusal was assumed to be armoring. The eastern corner of the bay was inaccessible due to soft sediment. Additional details for the transect can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-12 displays the drone obliques for RAL Exceedance Area 15 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-12
Oblique Photographs for RAL Exceedance 15 Displayed from Downriver (Left) to Upriver (Right)

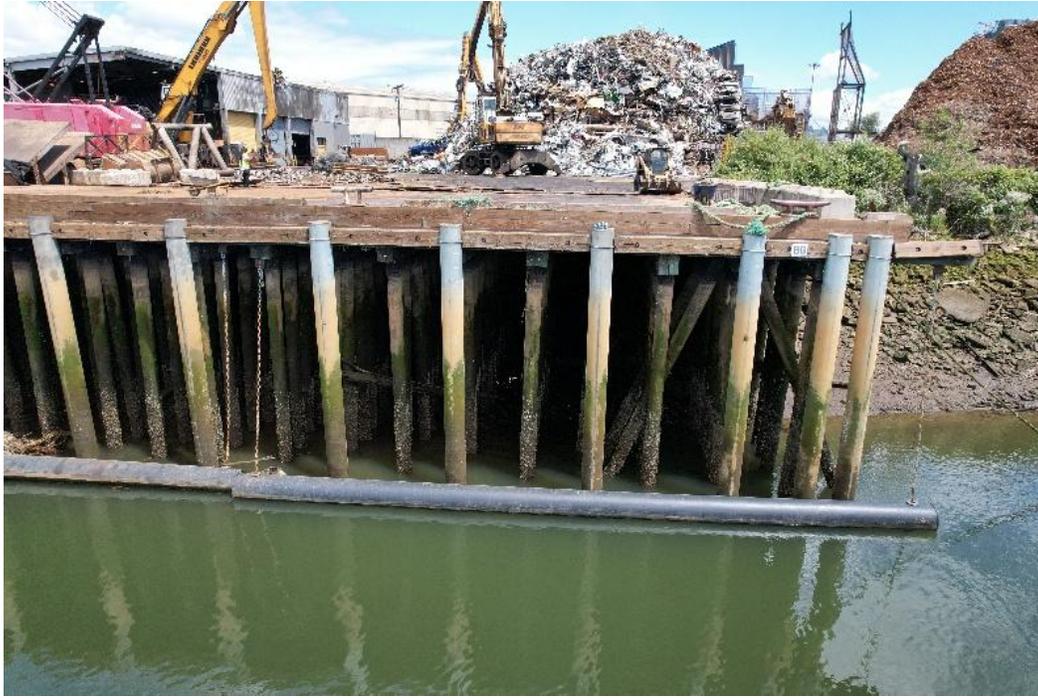


1.2.13 RAL Exceedance Area 14 (No Longer a RAL Exceedance Area)

Visual observation through desktop analysis of the shoreline noted debris armoring throughout the upgradient portions of the area. Armoring generally included bricks, concrete chunks, and rocks. Debris throughout the RAL exceedance area includes wood and occasionally metal pieces. The RAL exceedance area is bordered by a pier on the north end.

Sediment thickness probing was conducted along one transect on the bank of RAL Exceedance Area 14. The transect began near the lowest elevation of visually observed armoring (where the armoring met the sediment). Visual observation during probing noted debris and armoring throughout the upgradient portions generally included rock and concrete debris, with no sediment covering the armoring. Sediment thickness between the armoring pieces was 3 feet. At 5 feet downgradient no refusal was encountered. Reason for refusal was due to concrete or rock. Additional details for the transect can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-11 displays the drone obliques for RAL Exceedance Area 14 and the red arrow depicts the approximate location and direction of the sediment thickness probing transect.

Figure C-2-13
Oblique Photographs for RAL Exceedance Area 14 Displayed from Downriver (Left) to
Upriver (Right)



1.2.14 RAL Exceedance Area 12 (Revised to 17 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap and concrete debris. Some debris was observed on the upgradient portions of the area, debris included scattered wood and concrete. Structures within the area include dolphins, and timber pilings. Structures bordering on the south is a timber bulkhead and to the north include a pier.

This area was inaccessible during sediment thickness probing due to barges moored at the facility.

Figure C-2-14
Oblique Photographs for RAL Exceedance Area 12 Displayed from Upriver (Left) to
Downriver (Right)



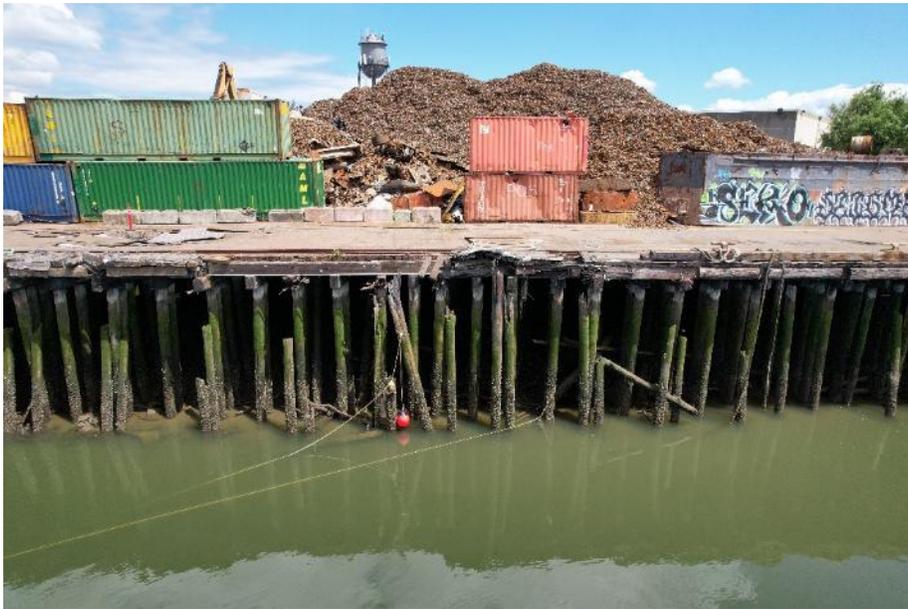
1.2.15 RAL Exceedance Area 11 (Revised to 13 and 16 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap under the wharf and concrete south of the wharf. Debris throughout the area include some scattered wood and concrete throughout the bank. Structures along the bank include a wharf. The RAL exceedance area contains three outfalls (2035, 2036, and 2037), circled in Figure C-2-15.

No sediment thickness probing took place in this area due to health and safety concerns related to accessing the shoreline near the dock structure. Observations took place from a vessel.

Figure C-2-15
Ortho-aerial and Oblique Photographs for RAL Exceedance 11 Displayed from Downriver (Left) to Upriver (Right)







1.2.16 RAL Exceedance Area 9 (9 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring through a majority of the upgradient portions of the area. Armoring generally included sporadic riprap, bricks, and large concrete debris. Additionally, a timber bulkhead spans roughly 80 feet on either side of the Georgetown pump station with no armoring down gradient. Debris throughout the RAL exceedance area includes wood (broken pilings, pilings cut at the mudline, and branches), bricks, and occasional metal pipes. Observed surface material was predominately sand with silt. Structures along the bank include the historic intake structure building. The RAL exceedance area contains three outfalls. One outfall (DuwReload) was visually confirmed in photographs circled in Figure C-2-16.

Sediment thickness probing was conducted along two transects on the bank of RAL Exceedance Area 9. The transects for sediment thickness began near the lowest elevation of visually observed armoring (where the armoring met the sediment). Visual observation during probing noted debris and armoring throughout the upgradient portions generally included sporadic rock and concrete debris, with no sediment covering the armoring. Sediment thickness between the armoring pieces ranged from 1 to 3 inches. Ranging from 10 to 15 feet downgradient of the beginning of the transects, no refusal was encountered. Downgradient of the armoring and concrete debris surface material transitioned to a sand silt with gravel. Reasons for refusal were typically due to concrete and sand layers. Additional details for all transects within this area can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-16 displays the drone obliques for RAL Exceedance Area 9 and the red arrows depict the approximate location and direction of the sediment thickness probing transects.

Figure C-2-16
Ortho-aerial and Oblique photographs for RAL Exceedance 9 Displayed from Downriver (Left) to Upriver (Right)





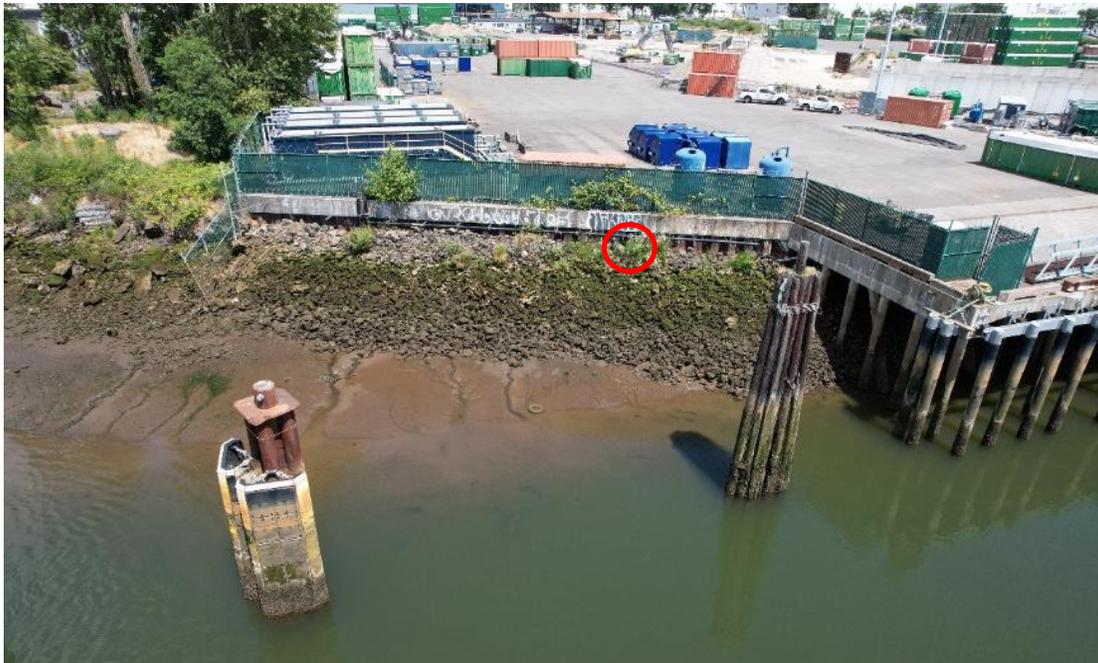


1.2.17 RAL Exceedance Area 8 (Revised to 5 on Map 3-3)

Visual observation through desktop analysis of the shoreline noted armoring along the upgradient portions of the area. Armoring generally included riprap with a bulkhead. Trace debris were observed in the area (tires). Structures along the bank include a timber piling and wharf to the south of the area. The RAL exceedance area contains one outfall (2042), circled in Figure C-2-17.

In accordance with the QAPP, sediment thickness probing did not take place in RAL Exceedance Area 8.

Figure C-2-17
Oblique Photographs for RAL Exceedance Area 8

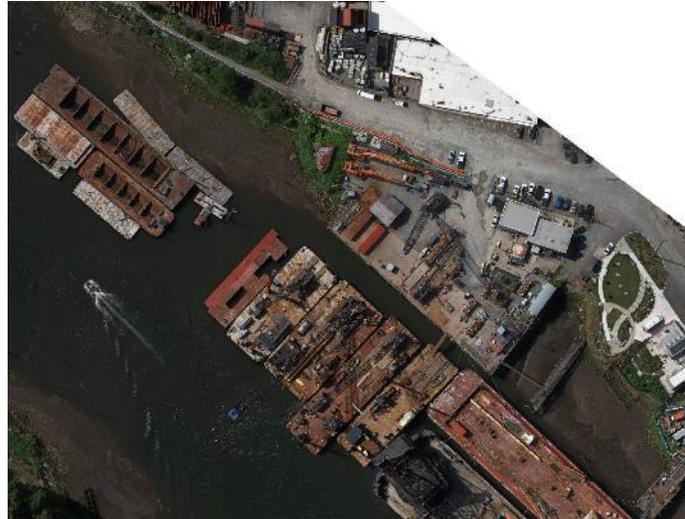


1.2.18 RAL Exceedance Area 5 (Revised to 6 and 8 on Map 3-3)

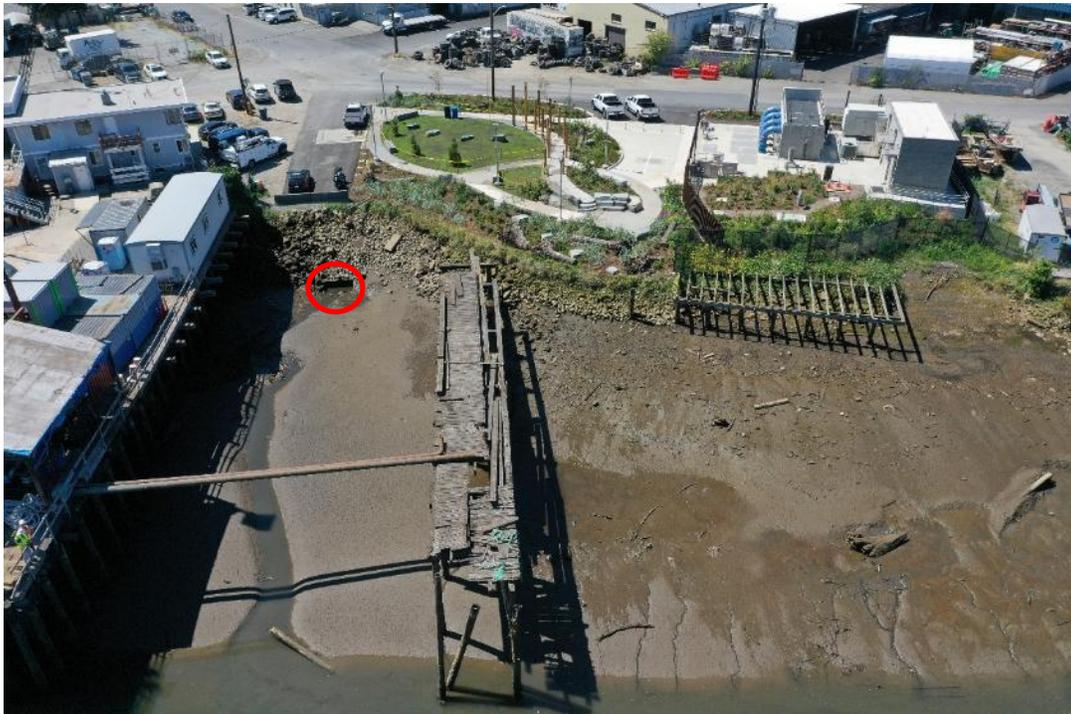
Visual observation through desktop analysis of the shoreline noted debris and armoring through the upgradient portion of the area. Armoring generally included sporadic riprap and smaller rocks, and large woody debris installed for habitat on the southern end of the RAL exceedance area. Debris throughout RAL exceedance area included wood and concrete (broken pilings, slabs, and sporadic ecology blocks). The RAL exceedance contains a pier around RM 2.7W and Outfall 2112 (circled in Figure C-2-18) just north of the pier.

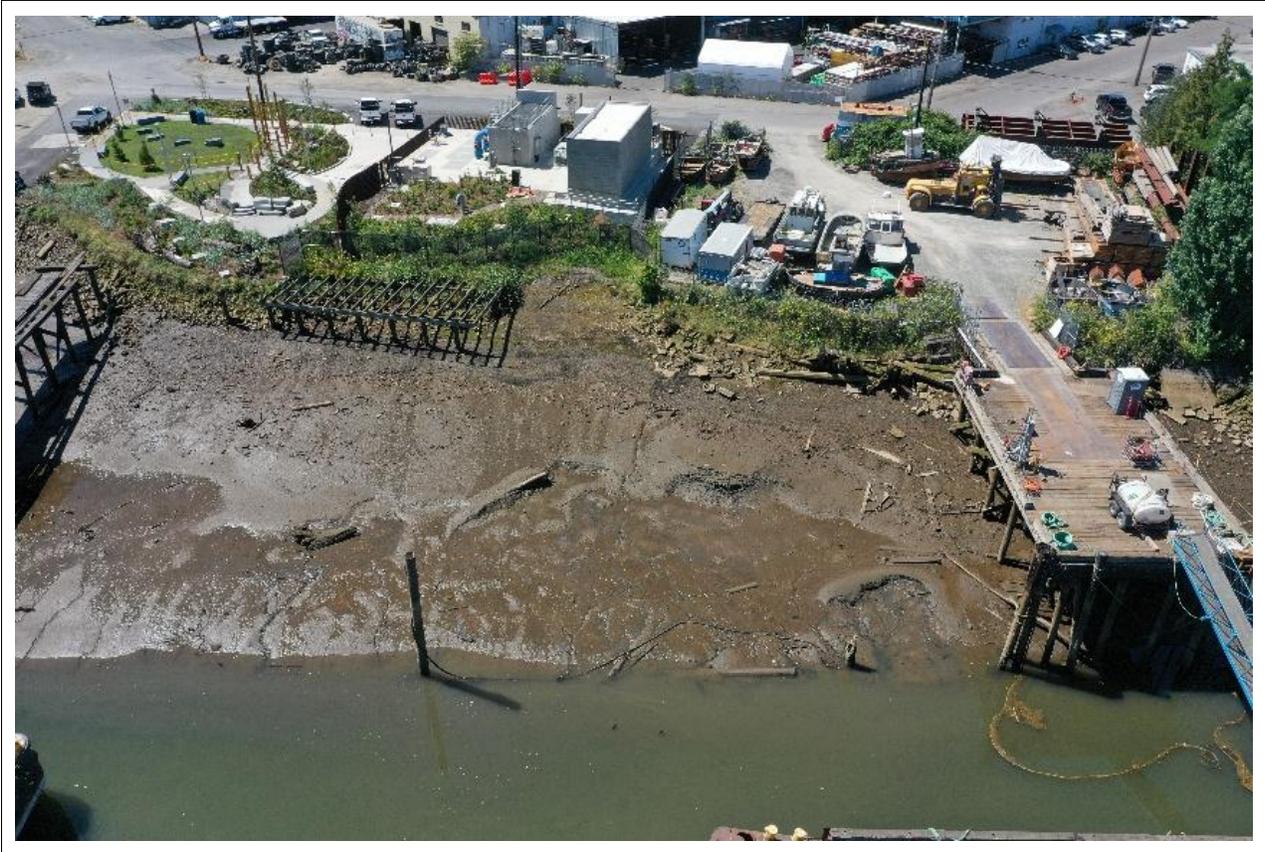
Sediment thickness probing was conducted along four transects on the bank of RAL Exceedance Area 5. The transects for sediment thickness typically began near the lowest elevation of visually observed armoring (where the armoring met the sediment). Visual observation during probing noted debris and armoring throughout the area generally included sporadic rock and concrete debris in the upgradient portions, with no sediment covering the armoring. Downgradient of the armoring and concrete debris surface material transitioned to silt with gravel. Sediment thickness between the armoring typically ranged from 3 feet to no refusal. Reasons for refusal were typically due to compact sand. Additional details for all transects within this area can be found in the shoreline conditions form (Attachment C-2-1). Figure C-2-13 displays the drone obliques for RAL Exceedance Area 5 and the red arrows depicts the approximate location and direction of the sediment thickness probing transects.

Figure C-2-18
Ortho-aerial and Oblique Photographs for RAL Exceedance 5 Displayed from Upriver (Left) to Downriver (Right)









2 References

Anchor QEA and Windward (Windward Environmental, LLC), 2024. *Pre-Design Investigation Quality Assurance Project Plan Addendum No. 1 for the Lower Duwamish Waterway Middle Reach - Phase II Sampling.*

Anchor QEA and Windward (Windward Environmental LLC). 2024b. *Quality assurance project plan addendum No. 2 for the Lower Duwamish Waterway middle reach - Phase II sampling for the Inlet at RM 2.2W.*

Attachment C-2-1

Shoreline Conditions Inspection Forms

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 33		Time	11:48
	Revised in Phase II: 35			
Transect Line(s)	A		Tide	-2.3 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
At edge of rock 0 ft	Averaged 3-7 in	Hit hard stone/concrete	Rock and concrete along the bank which transitions into sand and gravel.	
5 ft	Averaged 3-7 in	Hit hard stone/concrete	Transitions down to sand and gravel	
10 ft	Averaged 3-7 in	Hit hard stone/concrete	Transitions from gravel and sand to softer silts and sand	
15 ft	Averaged 3-7 in	Hit hard stone/concrete	Could not reach the whole area as the tide does not go low enough to expose enough walkable area	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Trees (Pacific crabapple, shore pine, merlot redbud, cherry laurel) and shrubs (Himalayan blackberry) along the top of bank		
Bank Armoring	Y	Engineered armor along the north end and unarmored slope along the south end		
Above ground Utilities	N			
Debris	Y	Wood and concrete		
Structures	Y	Ecology blocks along top of bank		
Fencing	N			
Other	N			
Photographs				
				
Aerial with markup showing approximate transect location		RAL Exceedance Area 33 looking southeast		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 31		Time	9:57
	Revised in Phase II: 33			
Transect Line(s)	A		Tide	1.0 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Between rock/debris:	2.5-3 ft	Compact sand	Concrete debris and rock, transitions into large gravel sized rock	
At edge of rock/debris (0 ft):	0.5 ft	Hit hard stone/concrete	Larger gravelly sand and occasional concrete debris and rock or other debris	
5 ft:	0.5 ft	Hit hard stone/concrete	Transition from larger gravel to smaller gravel more sand	
10 ft:	2.5-3 ft	Compact sand	Transitions into a silty sand	
15 ft:	2.5-3 ft	Compact sand		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry) and tree (vine maple) at top of bank		
Bank Armoring	N			
Above ground Utilities	Y	Utility pole at top of bank		
Debris	Y	Some wood debris along shore		
Structures	Y	Ecology block wall and containers along top of bank; pier at one end and dolphins in the water		
Fencing	N			
Paving	N			
Other	N			
Photographs				
				
Aerial with markup showing approximate transect location		RAL Exceedance Area 31 looking east		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 30		Time	10:10
	Revised in Phase II: 32			
Transect(s)	A		Tide	0.5 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
At edge of Vegetation/rock	0 ft:	3 ft	Compact sand/gravel	Less rock than Area 31; gravel is smaller. Approximately 1 inch of silty sand overtop of gravel nearing the water
5 ft:	0.6 ft	Armoring (hit hard stone/concrete)		
10 ft:	2.5 ft	Compact sand/gravel		
15 ft:	2.5 ft	Compact sand/gravel		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry and Japanese knotweed) at top of bank		
Bank Armoring	Y	Non-engineering armoring along the bank which transitions into sand and gravel		
Above ground Utilities	Y	Utility pole at top of bank		
Debris	Y	Pipe, and broken concrete and other debris found along the shore		
Structures	Y	Ecology block wall and containers along top of bank; pier at one end and dolphins in the water		
Fencing	N			
Paving	N			
Other	N			
Photographs				
				
Aerial with markup showing approximate transect location		RAL Exceedance Area 30 looking east		



RAL Exceedance Area 30 looking east



RAL Exceedance Area 30 looking east

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 29 Revised in Phase II: 31		Time	10:43
Transect(s)	A		Tide	-0.7 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Edge of Concrete and Rock (0 ft):	No refusal	NA	Some concrete debris and rock transitions into soft sand/silt with small gravel. Started transect at the edge of the concrete debris and rock, another interval was taken 5 ft away at the water's edge and no refusal was hit at either point.	
5ft:	No refusal	NA		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Narrow strip of shrubs (butterfly bush and black locust) and trees (snowberry) along top of bank		
Bank Armoring	N			
Above ground Utilities	Y	Transmission tower, utility pole, and aboveground concrete structure at top of bank		
Debris	N			
Structures	Y	Timber piles, floating dock and gangway, timber bulkhead, outfall		
Fencing	N			
Paving	Y	Paved trail and road		
Other	N	See additional notes for RAL exceedance area transect B		

Photographs



Aerial with markup showing approximate transect location



RAL Exceedance 29 Area looking northeast

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 29		Time	10:43
	Revised in Phase II: 31			
Transect(s)	B		Tide	-0.7 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
Edge of concrete debris and rock (0 ft):		No refusal	NA	Some concrete debris and rock transitions into soft sand/silt with small gravel
5ft		No refusal	NA	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Narrow strip of shrubs (butterfly bush and black locust) and trees (snowberry) along top of bank		
Bank Armoring	N			
Above ground Utilities	Y	Outfalls 2502 transmission tower, utility pole, and above ground concrete structure at top of bank		
Debris	Y	Wood and concrete		
Structures	Y	Timber bulkhead, floating dock and gangway, dolphin near First Avenue Bridge foundations		
Fencing	N			
Paving	Y	Paved trail and road		
Other	N	See additional notes for RAL exceedance area transect A		
Photographs				
				
RAL Exceedance Area 29 looking east		Aerial with markup showing approximate transect location		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II	Date	July 22, 2024
Crew	Anchor QEA		
RAL Exceedance Area	Phase I: 27	Time	10:33
	Revised in Phase II: 29		
Transect(s)	A	Tide	-0.3 ft MLLW

Sediment Thickness

Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes
Between rocks and concrete (0 ft):	3-6 in	Concrete and rock	Rocks and concrete from vegetation until approximately 15 ft from vegetation line
5 ft:	3 in	Gravel/cobble	Large gravel/cobble transitions into soft sediment that appear to be a depositional layer over more gravel/cobble. Met refusal along the whole shore due to brick and wood debris.
10 ft:	3-6 in		
15 ft:	3 in		

Bank Features Inspection

Class	Present (Y/N)	Notes
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, snowberry, ocean spray) and trees (domestic plum) along top of bank
Bank Armoring	N	
Above ground Utilities	N	
Debris	Y	Brick and wood debris layered with armoring
Structures	Y	First Avenue Bridge foundations
Fencing	N	
Paving	Y	Paved boat ramp next to bank and paved road at top of bank
Other	N	

Photographs



Aerial showing approximate transect location



RAL Exceedance Area 27 looking north

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 26		Time	11:10
	Revised in Phase II: NA			
Transect(s)	A and B		Tide	-1.5 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Between rocks (0 ft) Continued in 5ft increments to water	No refusal	NA	Large cobble and concrete engineered armoring at the top of the shore that seems to be on top of sand/silt; transitions to gravel with some cobble mixed in then to soft sand/silt. A sheen was observed on the sediment on the probe after pulling from the sediment.	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan and butterfly bush) and trees (shore pine) along top of bank		
Bank Armoring	Y	Engineered concrete armoring that transitions to gravel, then soft sand/silt		
Above ground Utilities	Y	Outfall 2506		
Debris	Y	Wood debris on bank		
Structures	Y	First Avenue Bridge foundations		
Fencing	N			
Paving	Y	Paved trail and fenced property		
Other	N			
Photographs				
				
RAL Exceedance Area 26 looking northwest		RAL Exceedance Area 26 looking northwest with approximate transect locations (and outfall circled)		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 24		Time	12:05
	Revised in Phase II: 26			
Transect(s)	A/B		Tide	-2.6 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
Broken Concrete/armored area (measured in between broken pieces)	0 ft:	3-7 in	Hit hard stone/concrete	Concrete debris transitions into gravel.
	5 ft:	1.5 ft	Gravel/compact sediment	
	10 ft:	2 ft	Compact sediment	Approximately 2 ft of soft sediment before hitting hard refusal layer underneath
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan and Japanese knotweed) and trees (scouler willow) along top of bank		
Bank Armoring	N			
Above ground Utilities	Y	Outfall 2025 (not visible in pictures)		
Debris	Y	Bricks, wood, and concrete		
Structures	Y	Timber bulkhead, pier		
Fencing	Y	Metal sheet fence		
Paving	Y	Paved pier		
Other	N			

Photographs



RAL Exceedance Area 24 looking east



RAL Exceedance Area 24 looking northeast with approximate transect locations



RAL Exceedance Area 24 looking southeast



RAL Exceedance Area 24 looking southeast

Project	Lower Duwamish Waterway Middle Reach PDI Phase II	Date	July 22, 2024
Crew	True North, Bright Engineering, Anchor QEA		
RAL Exceedance Area	Phase I: 18/19/22	Time	12:30
	Revised in Phase II: 23		
Transect(s)	A	Tide	-2.8 ft MLLW

Sediment Thickness

Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes
In between rocks	3 in refusal	Hit hard stone/concrete	Rocky upper bank with concrete slabs; hard refusal under the concrete slabs
edge of rock 0 ft:	2.5-3 ft	Concrete/gravel	Transitions from concrete to large gravel to silt/sand with lots of shell fragments.
5 ft:	No refusal	NA	
10 ft:	No refusal	NA	

Bank Features Inspection

Class	Present (Y/N)	Notes
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Pacific rhododendron) and large trees (Pacific crabapple, black locust, black cottonwood scouler willow, Douglas fir, and madrone) at top of bank
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs; is hard refusal under the concrete slabs
Above ground Utilities	Y	Dawn Foods Outfall (visible in photograph)
Debris	Y	Concrete slabs
Structures	Y	Metal pile in water
Fencing	N	
Paving	Y	Paved road at top of bank
Other	N	

Photographs



RAL Exceedance Area 18/19/22 looking northeast



Aerial looking northeast showing approximate transect location



RAL Exceedance Area 18/19/22 showing Dawn Foods Outfall



Aerial showing looking northeast

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 18/19/22		Time	12:30
	Revised in Phase II: 23			
Transect(s)	B		Tide	-2.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
In between rocks	3 in.	refusal	Hit hard stone/concrete	Rocky upper bank with concrete slabs; hard refusal under the concrete slabs
edge of rock	2.5-3 ft		Concrete/gravel	Transitions from concrete to large gravel to silt/sand with lots of shell fragments.
0 ft:				
5 ft:	No refusal		NA	
10 ft:	No refusal		NA	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Pacific rhododendron) and large trees (Pacific crabapple, black locust, black cottonwood scouler willow, Douglas fir, and madrone) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs; hard refusal under the concrete slabs		
Above ground Utilities	N			
Debris	Y	Concrete slabs		
Structures	Y	Dolphins in water; shelter structure at top of bank		
Fencing	N			
Paving	Y	Paved road at top of bank		
Other	N			
Photographs				
				
Aerial looking northeast		Aerial looking northeast showing approximate transect location		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 18/19/22		Time	12:30
	Revised in Phase II: 23			
Transect(s)	C		Tide	-2.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
In between rocks	3 in	refusal	Hit hard stone/concrete	Rocky upper bank with concrete slabs; hard refusal under the concrete slabs Transitions from concrete to large gravel to silt/sand with lots of shell fragments.
edge of rock	2.5-3 ft		Concrete/gravel	
0 ft:				
5 ft:	No refusal		NA	
10 ft:	No refusal		NA	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, and Pacific rhododendron) and trees (Pacific crabapple, black locust, black cottonwood scouler willow, Douglas fir, and madrone) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs		
Above ground Utilities	N			
Debris	Y	Concrete slabs		
Structures	Y	Dolphins in water		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paved road at top of bank		
Other	N			
Photographs				
				
Aerial looking northeast showing approximate transect location		RAL Exceedance Area 18/19/22 looking northeast		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 18/19/22		Time	12:30
	Revised in Phase II: 23			
Transect(s)	D		Tide	-2.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
In between rocks	3 in	refusal	Hit hard stone/concrete	Rocky upper bank with concrete slabs; hard refusal under the concrete slabs Transitions from concrete to large gravel to silt/sand with lots of shell fragments.
edge of rock	2.5-3 ft		Concrete/gravel	
0 ft:				
5 ft:	No refusal		NA	
10 ft:	No refusal		NA	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, and Pacific rhododendron) and large trees (Pacific crabapple, black locust, black cottonwood scouler willow, Douglas fir, and madrone) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs		
Above ground Utilities	N			
Debris	N	Concrete slabs		
Structures	Y	Dolphins in water		
Fencing	N			
Paving	Y	Paved road at top of bank		
Other	N			
Photographs				
				
Aerial looking northeast showing approximate transect location		RAL Exceedance Area 18/19/22 looking northeast		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 21		Time	11:22
	Revised in Phase II: 24 and 27			
Transect(s)	A		Tide	-1.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Moving from concrete to water's edge in 5 ft increments:	No refusal	NA	Broken concrete which transitions into gravel overtop of soft sand/silt	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Scotch broom, and English ivy), and large trees (black cottonwood and scouler willow) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank		
Above ground Utilities	Y	Utility pole at top of bank		
Debris	Y	Large logs, large concrete slabs, and other wood debris scattered around bank		
Structures	Y	Double tiered timber bulkhead wall, dolphins, and pilings		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paved road at top of bank		
Other	N			
Photographs				
				
Aerial looking southwest showing approximate transect location		Aerial looking northwest		



RAL Exceedance Area 21 looking southwest



RAL Exceedance Area 21 looking southwest

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 21		Time	11:22
	Revised in Phase II: 24 and 27			
Transect(s)	B		Tide	-1.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Moving from armoring to water's edge in 5 ft increments:	No refusal	NA	Broken concrete that transitions into gravel overtop of soft sand/silt	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Scotch broom, and English ivy) and trees (black cottonwood and scouler willow) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs; hard refusal under the concrete slabs		
Above ground Utilities	N			
Debris	Y	Wood and concrete debris		
Structures	Y	Bulkhead with large emergency response container on top that extends over the bank; ; ecology blocks at top of bank; dolphins in water		
Fencing	N			
Paving	Y	Paved road at top of bank and bulkhead extending over the bank		
Other	N			

Photographs



Aerial looking northwest showing approximate transect location



Aerial looking northwest



RAL Exceedance Area 21 looking southwest



RAL Exceedance Area 21 looking southwest

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 21		Time	11:22
	Revised in Phase II: 24 and 27			
Transect(s)	C		Tide	-1.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Moving from armoring to water's edge in 5 ft increments:	No refusal	NA	Broken concrete that transitions into gravel overtop of soft sand/silt	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Scotch broom, and English ivy) and trees (black cottonwood and scouler willow) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs; hard refusal under the concrete slabs		
Above ground Utilities	N			
Debris	Y	Broken concrete (slabs and columns) on bank		
Structures	Y	Ecology blocks at top of bank; dolphins in water		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paved road at top of bank		
Other	N			
Photographs				
				
<p>Aerial looking southwest showing approximate transect location</p>		<p>RAL Exceedance Area 21 looking north</p>		



RAL Exceedance Area 21 looking northwest



RAL Exceedance Area 21 looking southwest

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 21		Time	11:22
	Revised in Phase II: 24 and 27			
Transect(s)	D		Tide	-1.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Moving from armoring to water's edge in 5 ft increments:	No refusal	NA	Broken concrete that transitions into gravel overtop of soft sand/silt	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, Scotch broom, and English ivy) and large trees (black cottonwood and scouler willow) at top of bank		
Bank Armoring	Y	Engineer-armored upper bank, heavily armored with concrete slabs; hard refusal under the concrete slabs		
Above ground Utilities	N			
Debris	N	Large broken concrete (slabs and columns) across bank		
Structures	Y	Concrete wharf Ecology blocks at top of bank, Dolphins in water		
Fencing	N			
Paving	Y	Paved road at top of bank		
Other	N			

Photographs



Aerial looking southwest showing approximate transect location



RAL Exceedance Area 21 looking northwest



RAL Exceedance Area 21 looking southwest



RAL Exceedance Area 21 looking northwest

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	--
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 20		Time	--
	Revised in Phase II: 24			
Transect(s)	NA		Tide	--
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
No sediment thickness probing took place due to health and safety concerns.				
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Trees and bushes present		
Bank Armoring	Y	Engineered armored slope		
Above ground Utilities	Y	Outfall (2120 and 2118)		
Debris	Y	Broke pilings, timber, concrete slabs, and timber cross beams		
Structures	Y	Ecology block wall and 2 piers		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paving upland on both sides of the inlet		
Other	N			

Photographs



Aerial looking west showing outfall locations



Aerial of RAL Exceedance Area 20 looking east



Aerial of RAL Exceedance Area 20 looking south



Aerial of RAL Exceedance Area 20 looking west

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	--
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 16		Time	--
	Revised Phase II: 21			
Transect(s)	NA		Tide	--
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
No sediment thickness probing took place in this area.				
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Bushes present		
Bank Armoring	Y	Armored slope on upgradient portions		
Above ground Utilities	Y	Outfalls (2116 and Boyer 1)		
Debris	Y	Concrete and tires		
Structures	Y	Floating Dock and dolphins		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paving upland		
Other	N			

Photographs



Aerial looking southwest showing outfall locations



Aerial of RAL Exceedance Area 16 looking west



RAL Exceedance Area 16 looking southwest



Aerial of RAL Exceedance Area 16 looking west

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 15		Time	12:44
	Revised in Phase II: 20			
Transect(s)	A		Tide	-2.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Between concrete 0 ft:	3 in	Armoring (hit hard stone/concrete)	Steep armored slope with concrete slabs; transitions into gravel mixed with soft sediment (approximately 1-1.5 ft of soft sediment over top of concrete armoring/gravel (refusal after the 1.5 ft); moved transect to the northmost end of Area 15 due to inaccessible soft sediment	
5ft:	1-1.5 ft			
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, butterfly bush, and English ivy) and large trees (shore pine and white spruce) at top of bank		
Bank Armoring	Y	Engineered armored slope with concrete slabs; transitions into gravel mixed with soft sediment		
Above ground Utilities	Y	Outfalls 2028 and SBW-B (both shown in pictures)		
Debris	N			
Structures	Y	Building at top of bank; large broken concrete on bank		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paving between building at top of bank		
Other	N			

Photographs



RAL Exceedance Area 15 looking east showing approximate transect location



RAL Exceedance Area 15 looking east



RAL Exceedance Area 15 looking northeast showing Outfall SBW-B



RAL Exceedance Area 15 looking northeast showing Outfall 2028

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 14		Time	12:55
	Revised in Phase II: NA			
Transect(s)	A		Tide	-2.8 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Along armored slope edge:	3 ft under armor	Armoring (hit hard stone/concrete)	Very steep engineer-armored shore leading from water; could not safely probe under armoring higher toward vegetation line due to safety precautions; armor is same concrete slabs as elsewhere; near structure #30	
5 ft from armored slope (water's edge)	No refusal after armoring ends	NA		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, and butterfly bush) and trees (vine maple) at top of bank		
Bank Armoring	Y			
Above ground Utilities				
Debris	Y	Wood and concrete debris		
Structures	Y	Wharf on the north end, ecology blocks at top of bank; dolphins in water		
Fencing	N			
Paving	Y	Paved bulkhead besides transect and paving at top of bank		
Other	N			

Photographs



Aerial looking southwest showing approximate transect location



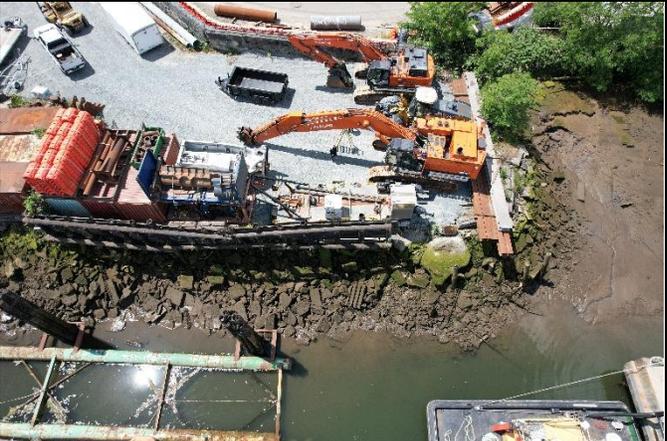
Aerial looking northeast



RAL Exceedance Area 14 looking northeast



RAL Exceedance Area 14 looking east

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	--
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 12		Time	--
	Revised in Phase II: 17			
Transect(s)	NA		Tide	--
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
No sediment thickness probing took place in this area.				
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Bushes and trees present		
Bank Armoring	Y	Armored slope on upgradient portions		
Above ground Utilities	Y	Utility poles upland		
Debris	Y	Concrete.		
Structures	Y	Pier, gangway, and dolphins		
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paving upland		
Other	N			
Photographs				
				
Aerial of RAL Exceedance Area 12 looking northwest		Aerial of RAL Exceedance Area 12 looking west		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II	Date	--
Crew	Anchor QEA		
RAL Exceedance Area	Phase I: 11	Time	--
	Revised in Phase II: 13 and 16		
Transect(s)	NA	Tide	--

Sediment Thickness

Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes
No sediment thickness probing took place in this area.			

Bank Features Inspection

Class	Present (Y/N)	Notes
Woody Vegetation	Y	Bushes and trees present on southern end
Bank Armoring	Y	Armored slope on upgradient portions
Above ground Utilities	Y	Outfalls (2035, 2036, and 2037)
Debris	Y	Concrete
Structures	Y	Wharf
Fencing	Y	Chain-link fence at top of bank
Paving	Y	Paving upland
Other	N	

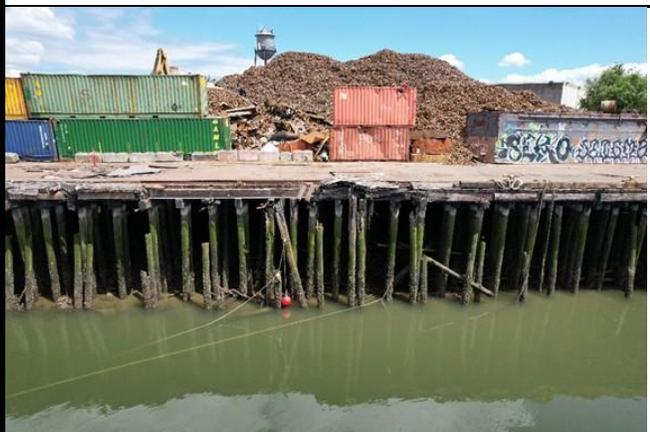
Photographs



Aerial looking east showing locations of outfalls



Aerial looking east showing locations of outfalls



RAL Exceedance Area 11 looking east



RAL Exceedance Area 11 looking east

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 9		Time	13:23
	Phase II: 9			
Transect(s)	A		Tide	-2.6 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Edge of armored slope (between armoring):	1 in	Armoring (hit hard stone/concrete)	Broken concrete armor that transitions to gravel then soft silts and sands	
5 ft from armored slope:	3 in	Compact sediment		
10 ft from armored slope:	0.5-1 ft	Compact sediment		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (butterfly bush) and trees (black locust, Lombardy poplar, and madrone) at top of bank		
Bank Armoring	Y	Non-engineered broken concrete armor that transitions to gravel, then soft silts and sands		
Above ground Utilities	Y	Outfall DuwReload		
Debris	Y	Wood debris across bank		
Structures	Y	Intake building, gabion cage		
Fencing	Y	Chain-link fence along bank and at top of concrete platform		
Paving	Y	Industrial property on top of bank		
Other	N			

Photographs



Aerial looking southeast showing approximate transect location



Aerial looking southeast showing approximate transect location



RAL Exceedance Area 9 looking southeast showing outfall location



RAL Exceedance Area 9 looking east

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 9		Time	13:23
	Phase II: 9			
Transect(s)	B		Tide	-2.6 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Edge of armored slope (between armoring):	1 in	Armoring (hit hard stone/concrete)	Broken concrete armor that transitions to gravel then soft silts and sands.	
5 ft from armored slope:	3 in	Compact sediment		
10 ft from armored slope:	0.5-1 ft	Compact sediment		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (butterfly bush) and trees (black locust, Lombardy poplar, madrone) at top of bank.		
Bank Armoring	Y	Non-engineered broken concrete armor that transitions to gravel then soft silts and sands.		
Above ground Utilities	N			
Debris	N			
Structures	Y	Large broke concrete slabs on armored slope. Eroded pile area structure on bank.		
Fencing	N			
Paving	N			
Other	N			
Photographs				
				
Aerial looking northeast showing approximate transect location		RAL Exceedance Area 9 looking east		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 5		Time	13:38
	Revised in Phase II: 6 and 8			
Transect(s)	A		Tide	-2.4 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes	
Edge of concrete debris 0 ft:	No refusal but occasional rock hit at 3ft	NA	Broken that transitions into gravel to soft sediment with algae over top.	
5 ft:	0.5 ft	Compact sediment		
10 ft	2.5 ft	Compact sediment		
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, Japanese knotweed, and English ivy) and trees (black locust, Lombardy poplar, black cottonwood, scouler willow, Douglas fir, white spruce, and red alder) at top of bank		
Bank Armoring	N			
Above ground Utilities	N			
Debris	Y	Wood and concrete debris		
Structures	N			
Fencing	N			
Paving	Y	Paved trail, park and industrial property at top of bank behind dense vegetation		
Other	N			
Photographs				
				
Aerial looking southwest showing approximate transect location		Aerial looking southwest		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 5		Time	13:38
	Revised in Phase II: 6 and 8			
Transect(s)	B		Tide	-2.4 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
Edge of concrete debris	0 ft:	No refusal	NA	Broken armoring that transitions into gravel to soft sediment with algae over top
5 ft:				
10 ft				
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, Japanese knotweed, and English ivy) and large trees (black locust, Lombardy poplar, black cottonwood, scouler willow, Douglas fir, white spruce, and red alder) at top of bank		
Bank Armoring	N			
Above ground Utilities	N			
Debris	Y	Wood and concrete debris		
Structures	N			
Fencing	N			
Paving	Y	Paved trail and industrial property at top of bank behind dense vegetation		
Other	N			
Photographs				
				
Aerial looking southwest		Aerial looking southwest showing approximate transect location		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II		Date	July 22, 2024
Crew	Anchor QEA			
RAL Exceedance Area	Phase I: 5		Time	13:38
	Revised in Phase II: 6 and 8			
Transect(s)	C		Tide	-2.4 ft MLLW
Sediment Thickness				
Probing Location	Probing Depth	Refusal	Assumed refusal Reason	Notes
Edge of concrete debris 0 ft:		No refusal	NA	Broken armoring that transitions into gravel to soft sediment with algae over top.
5 ft:		1.5 ft	Compact sediment	
10 ft		No refusal	NA	
Bank Features Inspection				
Class	Present (Y/N)	Notes		
Woody Vegetation	Y	Shrubs (Himalayan blackberry, Japanese knotweed, and English ivy) and trees (black locust, Lombardy poplar, black cottonwood, scouler willow, Douglas fir, white spruce, and red alder) at top of bank		
Bank Armoring	N			
Above ground Utilities	N			
Debris	Y	Wood and concrete debris		
Structures	N			
Fencing	Y	Chain-link fence at top of bank		
Paving	Y	Paved trail and industrial property at top of bank behind dense vegetation		
Other	N			
Photographs				
				
Aerial looking west showing approximate transect location		Aerial looking west		

Project	Lower Duwamish Waterway Middle Reach PDI Phase II	Date	July 22, 2024
Crew	Anchor QEA		
RAL Exceedance Area	Phase I: 5	Time	13:38
	Revised in Phase II: 6 and 8		
Transect(s)	D	Tide	-2.4 ft MLLW

Sediment Thickness

Probing Location	Probing Depth Refusal	Assumed refusal Reason	Notes
Edge of concrete debris 0 ft:	No refusal	NA	Broken concrete that transitions into gravel to soft sediment with algae over top
5 ft:			
10 ft			

Bank Features Inspection

Class	Present (Y/N)	Notes
Woody Vegetation	Y	Shrubs (Himalayan blackberry, Japanese knotweed, and English ivy) and trees (black locust, Lombardy poplar, black cottonwood, scouler willow, Douglas fir, white spruce, and red alder) at top of bank
Bank Armoring	Y	
Above ground Utilities	Y	Utility pole at top of bank
Debris	Y	Wood and concrete debris
Structures	Y	Timber Wharf; industrial equipment, containers, and vessel storage at top of bank behind vegetation
Fencing	Y	Chain-link fence at top of bank
Paving	Y	Paved industrial property upland
Other	N	

Photographs



RAL Exceedance Area 5 looking east



Aerial looking West showing approximate transect location