

Appendix H

Sediment Thickness Inspection Results, Field Logs, and Pictures

1 Introduction

This appendix provides detailed results of Pre-Design Investigation (PDI) Phase II measurements of sediment thickness over armored banks; efforts to collect these measurements were conducted in the upper reach of the Lower Duwamish Waterway Superfund site from July 19, 2021, through July 23, 2021. Some areas with remedial action level (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 for Phase II (Phase II QAPP Addendum) (Anchor QEA and Windward 2021), measuring the thickness of sediment over the armor layer is 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. A summary of inspection dates, times, and tidal conditions is provided in Table H-1 for the nine areas where sediment thickness measurements were conducted.

Table H-1
Sediment Thickness Inspection Date and Tide Details

River Mile ¹	Date	Approximate Time of Inspection	Approximate Tide Elevation (ft MLLW)
3.3W	7/22/2021	11:40 to 12:10	-1.30 to -1.28
3.5W	7/23/2021	11:06 to 11:20	-2.40 to -2.39
3.9E	7/20/2021	9:40 to 9:50	0.09
4.1E	7/19/2021 to 7/20/2021	(10:10-11:30) (8:10-9:32)	-1.13 to 5.58
4.2E (Slip 6)	7/23/2021	9:09 to 10:22	-2.36 to -0.91
4.6E	7/20/2021	10:25 to 10:58	3.03 to 3.88
4.7W	7/21/2021	10:19 to 10:40	-1.27 to -0.9
4.8W	7/21/2021	10:57 to 11:38	0 to 1.03
4.9E	7/21/2021 to 7/22/2021	(12:55-13:00) (9:07-11:23)	-2.34 to 5.22

Notes:

1. This represents the closest river mile to the midpoint of the transects. Additionally, the side of the bank (i.e., east or west) is included for reference.

MLLW: mean lower low water

Map 2-10 provides an overview of the areas where sediment thickness measurements were conducted. Detailed observations documented for each transect are included on the field forms (Attachment H-1 of this appendix). Transect locations are illustrated on Maps H-1 through H-9 of this appendix, including the sediment thickness at each probed location and the assumed toe location of armored slope at locations where armoring was present. The first (i.e., highest elevation) probe location is indicated as 0 ft "Distance Along Transect" on the field forms. This location was typically at the highest elevation of the visible armoring (if accessible) or at the vegetation line if armoring was not visually apparent. The starting locations are noted on the field forms.

Other items noted during investigation include the following:

- Water depth measurement in feet and time of measurement (if applicable)
- Coordinates of each probe point
- Observed surface substrate type (e.g., rock, sand, silt, shell) and color
- Other surface observations of note (e.g., description of visible surface debris)
- Sediment thickness/depth of layers penetrated/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)

1.1 Results

1.1.1 *Transects Near River Mile 3.3W*

Sediment thickness probing was conducted along two transects on the west bank of the upper reach near river mile (RM) 3.3. The transects began approximately 15 ft downslope from the vegetation line. Visual observations of surface debris and armoring throughout the area generally included small river rock and concrete debris for the uppermost 15 ft of the transects, with no sediment covering the armoring. From 15 to 20 ft downgradient of the beginning of the transects, the observed surface material was predominately sediment and gravel, with sediment thickness above armoring ranging from approximately 1.5 to 4 ft. Beyond 20 ft downgradient of the beginning of the transects, no refusal was encountered, indicating the toe of armoring.

During sediment thickness probing, stiff sand layers and layers suspected to be wood debris were encountered throughout the area. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-1 illustrates the approximate toe of armoring and the sediment thickness at each probed location, as identified during the sediment thickness investigation. Figure H-1 depicts the typical surface conditions encountered along the transects near RM 3.3W.

Figure H-1
Transects Near RM 3.3W, Typical Surface Conditions Along Transects



1.1.2 *Transects Near River Mile 3.5W*

Sediment thickness probing was conducted along two transects on the west bank of the upper reach near RM 3.5. The transects began approximately 5 ft upslope of the lowest elevation visually observed edge of riprap armoring, where the sediment met the riprap. Riprap armoring extended from the beginning of the transect approximately 30 ft up a steep slope and terminated at a bulkhead. From the beginning of the transect to approximately 5 ft downgradient, the observed surface material consisted primarily of riprap at both transects with no sediment overlay. The distance down the transect to no refusal was approximately 6 to 9 ft downgradient, indicating the assumed toe of armoring. It is assumed that the existing armoring is mostly visible within this area, with very little sediment overlying the armoring. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-2 illustrates the approximate toe of bank armoring and the sediment thickness at each probed location, as identified during the sediment thickness investigation. Figure H-2 depicts the typical surface conditions encountered along the transects near RM 3.5W.

Figure H-2 Transects Near RM 3.5W, Typical Surface Conditions Along Transects

1.1.3 *Transects Near River Mile 3.9E*

Sediment thickness probing was conducted along one transect on the east bank of the upper reach near RM 3.9. The transect began at the vegetation line with riprap extending approximately 5 ft upslope of the vegetation line. From the beginning of the transect to approximately 5 ft downgradient, the observed surface material was riprap greater than 1 ft in diameter, with no sediment overlay. At approximately 20 ft downgradient of the beginning of the transect, 0.5 ft of sediment was measured, with an observed surface of sediment with small pebbles and gravel. The distance down the transect to no refusal was 24 ft, indicating the toe of armor. Additional details for the transect within this area can be found in the field forms (Attachment H-1). Map H-3 illustrates the approximate toe of bank armoring and the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-3 depicts the typical surface conditions encountered along the transects near RM 3.9E.

Figure H-3
Transects Near RM 3.9E, Typical Surface Conditions Along Transect



1.1.4 Transects Near River Mile 4.1E

Sediment thickness probing was conducted along 10 transects on the east bank of the upper reach near RM 4.1. Visual observations of surface material and armoring throughout the upgradient portions of the area generally included riprap and smaller rocks, with concrete debris observed sporadically at some transects. The transects typically began near the lowest elevation visually observed edge of the riprap armoring, where the sediment met the riprap or near the vegetation line. Sediment thickness above armoring within the upper portions of the transects typically ranged from 0.17 to 2.2 ft. The distance downgradient along the transect to no refusal varied throughout the area from approximately 8 to 21 ft downgradient, indicating the toe of armoring. During the

sediment thickness probing, some stiff sand layers were encountered. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-4 illustrates the approximate toe of bank armoring and the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-4 depicts the typical surface conditions encountered along the transects near RM 4.1E.

Figure H-4
Transects Near RM 4.1E, Typical Surface Conditions Along
Transects



1.1.5 Transects Near River Mile 4.2E

The investigation area on the east bank of the upper reach near RM 4.2 (and within Slip 6) was not accessible on foot. Therefore, jet probing was conducted from a watercraft along two transects within this area. The slope was armored with riprap, beginning at a bulkhead on the upgradient side and extending to the water level on the downgradient side. The transects began 30 to 40 ft downslope of the bulkhead, where the riprap met the waterline. From the beginning of the transect to approximately 15 ft downgradient, sediment thickness ranged from 0 to 6.33 ft, with the refusal interpreted to be gravel and riprap. Probing continued to approximately 20 to 25 ft downgradient. Refusal was encountered downgradient of the assumed toe of armoring. Reasons for refusal beyond the interpreted toe of armoring were judged to be a stiff clay/silt layer and gravel. The jet probe was not able to penetrate this layer, but the audible feedback provided by the probe was indicative of gravel. Additional details for all transects within this area can be found in the field forms

(Attachment H-1). Map H-5 illustrates the approximate toe of bank armoring and the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-5 depicts the typical surface conditions encountered along the transects near RM 4.2E.

Figure H-5
Transects Near RM 4.2E, Typical Surface Conditions Along Transects



1.1.6 *Transects Near River Mile 4.6E*

Sediment thickness probing was conducted along three transects on the east bank of the upper reach near RM 4.6. Visual observations of surface material throughout the upgradient portions of the area generally included mixed debris (surficial metal and concrete debris), organics, and sediment. Armoring was not visually apparent on the surface. All transects began at the vegetation line, with steep banks continuing 5 to 10 ft upgradient of the vegetation line. Sediment thickness above refusal within the upper portions of the transects typically ranged from 2.5 to 4 ft. While refusal due to scattered debris and consolidated sand layers was encountered during some probes, it is assumed that continuous armoring does not exist within this area. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-6 illustrates the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-6 depicts the typical surface conditions encountered along the transects near RM 4.6E.

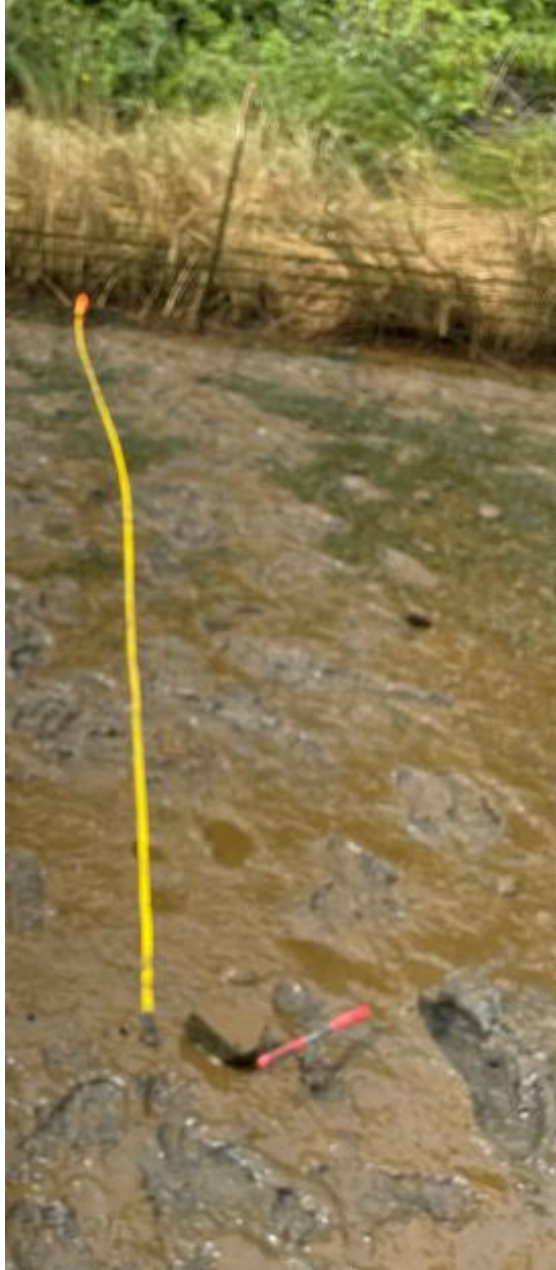
Figure H-6
Transects Near RM 4.6E, Typical Surface Conditions Along
Transects



1.1.7 Transects Near River Mile 4.7W

Sediment thickness probing was conducted along two transects on the west bank of the upper reach near RM 4.7. Visual observations of surface material included small, scattered rocks approximately 1 to 3 in. in diameter, but consistent armoring was not apparent. The transects typically began near the downgradient edge of the vegetation line. During the sediment thickness probing, wood or stiff layers were encountered and led to refusal, but it is assumed that continuous armoring does not exist within this area. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-7 illustrates the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-7 depicts the typical surface conditions encountered along the transects near RM 4.7W.

Figure H-7
Transects Near RM 4.7W, Typical Surface Conditions Along
Transects



1.1.8 Transects Near River Mile 4.8W

Sediment thickness probing was conducted along five transects on the west bank of the upper reach near RM 4.8. The surface was relatively bare, with little to no debris or armoring present. The transects typically began near the downgradient edge of the vegetation line. During the sediment thickness probing, stiff sand layers were encountered, and some sporadic hard contacts below grade

led to refusal. However, continuous armoring was not encountered within this area. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-8 illustrates the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-8 depicts the typical surface conditions encountered along the transects near RM 4.8W.

Figure H-8
Transects Near RM 4.8W, Typical Surface Conditions Along
Transects



1.1.9 Transects Near River Mile 4.9E

Sediment thickness probing was conducted along 10 transects on the east bank of the upper reach near RM 4.9. Visual observations of the surface included armoring throughout the upgradient portions of the area and sporadic concrete and wood debris at some transects. The transects typically began near the lowest elevation visually observed edge of the riprap armoring, where the sediment met the riprap. Sediment thickness above armoring within the upper portions of the transects typically ranged from 0.25 to 3 ft. The distance down the transect to no refusal varied throughout the area from approximately 0 to 30 ft downgradient, indicating the toe of armoring.

During the sediment thickness probing, some stiff sand layers were encountered. Additional details for all transects within this area can be found in the field forms (Attachment H-1). Map H-9 illustrates the approximate toe of bank armoring and the sediment thickness at each probed location as identified during the sediment thickness investigation. Figure H-9 depicts the typical surface conditions encountered along the transects near RM 4.9E.

Figure H-9
Transects Near RM 4.9E, Typical Surface Conditions Along Transects



2 References

Anchor QEA, Windward. 2021. Quality assurance project plan addendum: pre-design surveys of the Lower Duwamish Waterway upper reach. Final. Submitted to EPA June 25, 2021. Anchor QEA and Windward Environmental LLC, Seattle, WA.

3 Attachments

Attachment H-1 Field Forms
Maps H-1 through H-9

FINAL

Appendix H

Attachment H-1

Final LDW DER_Appendix H_AttH1a_toEPA_071522

Final LDW DER_Appendix H_AttH1b_toEPA_071522

Final LDW DER_Appendix H_AttH1c_toEPA_071522

Final LDW DER_Appendix H_AttH1d_toEPA_071522

Final LDW DER_Appendix H_AttH1e_toEPA_071522

Final LDW DER_Appendix H_AttH1f_toEPA_071522

Final LDW DER_Appendix H_AttH1g_toEPA_071522

Final LDW DER_Appendix H_AttH1h_toEPA_071522

Final LDW DER_Appendix H_AttH1i_toEPA_071522

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 3.3W

Survey Station: 502+40

Date 7/22/2021

Tide Level -1.30 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:40	1"-3" river rock, concrete debris	0	Concrete	1"-3" river rock, concrete debris	1274397.52	196452.93	Started 15' downslope from vegetation line
2	5	11:42	1"-3" river rock, concrete debris	0	Concrete	1"-3" river rock, concrete debris	1274398.88	196456.04	Concrete debris
3	10	11:44	1"-3" river rock, concrete debris	0	Concrete	1"-3" river rock, concrete debris	1274400.67	196459.05	Concrete debris
4	15	11:46	1"-3" river rock, concrete debris	0	Concrete	1"-3" river rock, concrete debris	1274403.86	196462.82	Concrete debris
5	18	11:47	Smaller surface rock	4	Compacted sediment	Smaller river rock and concrete chunks	1274405.77	196466.58	Concrete debris
6	20	11:48	Stiff sand	>5	N/A	Silt and Sand	1274407.72	196468.72	Stiff sand throughout

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.
2. ft: Feet
3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 3.3W

Survey Station: 502+80

Date 7/22/2021

Tide Level (MLLW) -1.28 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:55	Concrete debris, smaller river rock	0	Concrete	Concrete debris	1274365.11	196467.91	Started 15' downslope from vegetation line
2	5	11:57	Concrete debris, smaller river rock	0	Concrete	Concrete debris	1274368.24	196471.08	Large concrete debris, pilings
3	10	11:59	Concrete debris, smaller river rock	0	Concrete	Concrete debris	1274370.32	196473.57	
4	15	12:01	Concrete debris, smaller river rock	0	Concrete	Concrete debris	1274372.16	196476.55	
5	20	12:02	Less rock, no concrete, some wood debris	1.5	Concrete or rock	Sand and gravel	1274374.02	196478.90	
6	25	12:04	Less rock, no concrete, some wood debris	1.5	Concrete or rock	Sand and gravel	1274375.94	196481.26	
7	30	12:06	Less rock, no concrete, some wood debris	>5	N/A	Sand and gravel	1274376.89	196482.56	
8	29	12:10	Less rock, no concrete, some wood debris	>5	N/A	Sand and gravel	1274377.46	196483.13	Assumed toe

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.
2. ft: Feet
3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

RAL Exceedance Area

Transect #

Date

Tide Level

Location ID	Distance Along Transect (ft)	Water Depth Time	Water Depth (ft)	Probing Time	Observed substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed refusal reason	Lat	Long	Other Notable Observations

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 3.5W

Survey Station: 493+00

Date 7/23/2021

Tide Level -2.40 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:12	Riprap and gravel	0	Riprap	Riprap	1275076.15	195832.08	Extremely low tide, able to access by foot instead of using jet probe Started 30' downslope at the edge of riprap, steep slope
2	5	11:14	Riprap and gravel	0	Riprap	Riprap	1273074.3	195839.5	
3	7	11:16	Riprap, gravel, and sediment	2	Riprap and gravel	Riprap	1275078.1	195842.9	
4	9	11:20	Sediment	>5	N/A	None	1275085.2	195844.7	Gravel layer at 4.5' bml, Assumed toe

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 3.5W

Survey Station: 492+60

Date 7/23/2021

Tide Level (MLLW) -2.39 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:06	Riprap	0	Riprap	Riprap	1275111.3	195821.5	Extremely low tide, able to access by foot instead of using jet probe Armor extends up slope by about 30' to bulkhead from starting point. steep riprap, no debris
2	5	11:07	Riprap	0	Riprap	Riprap	1275115.1	195824.4	
3	6	11:10	Sediment	>5	N/A	None	1275115.7	195824.7	Assumed toe

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.
2. ft: Feet
3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 3.9E

Survey Station: 306+60

Date 7/20/2021

Tide Level (MLLW) 0.09 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:40	Medium to large riprap, 1' 2' in diameter	0	Rock	Rock	1276451.2	193754.5	Riprap extends around 5' above blackberry vegetation
2	5	9:41	Greater than 1' diameter riprap	0	Rock	Rock	127445.25	193752.7	
3	10	9:42	Greater than 1' diameter riprap	0	Rock	Rock	1276449.8	193747.4	
4	15	9:44	Greater than 1' diameter riprap	0	Rock	Rock	1276435.1	193749.1	
5	20	9:46	Small pebbles gravel and sediment	0.5	Rock	Rock	1276431.34	193745.2	Gravel and sediment in top 6" overlying hard rock
6	24	9:50	Small pebbles gravel and sediment	> 5	None	None	1276425.1	193745.8	Toe of slope at 24' along transect. Gravel and sediment matrix in top 6" and stiff layer 48" below mudline
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.0E

Survey Station: 309+30

Date 7/19/2021

Tide Level (MLLW) 3.45 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:10	Riprap slope	0	Rock	Riprap	1276551.58	193559.37	Top of slope at vegetation line
2	5	10:12	Riprap slope	0	Rock	Riprap	1276554.01	193553.99	Riprap slope
3	8	10:15	Toe of slope, soft sediment	1.2	Rock	Rock	1276554.53	193552.04	Soft sediment overlying riprap
4	10	10:20	Soft sediment	0.58	Rock	Rock	1276554.78	1935505.40	Soft sediment
5	11	10:22	Soft sediment	>5	No refusal	None	1276554.97	193548.54	Pushed rod to full length, firmer material (sand) at the bottom
6	12	10:25	Soft sediment	0.7	Rock debris	Rock debris	1276555.36	193545.88	Variable rock obstruction at transect within 2' either side
7	13	10:27	Soft sediment	0.66	Rock debris	Rock debris	1276555.76	193543.56	Variable rock obstruction at transect within 2' either side
8	14	10:28	Soft sediment	>5	No refusal	None	-	-	Very soft sediment, no refusal No GPS taken due to soft sediment
9	15	10:30	Soft sediment	>5	No refusal	None	-	-	Very soft sediment, cannot walk offshore or will get stuck in sediment No GPS taken due to soft sediment

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.0E

Survey Station: 310+20

Date 7/19/2021

Tide Level (MLLW) 4.52 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:50	Large riprap	0	Riprap rock visible	Riprap	1276640.93	193551.85	Measurement taken in riprap slope area, medium to large riprap present
2	5	10:51	Organic debris near riprap and sediment	0.17	Riprap rock area	Riprap, rock	1276636.99	193547.48	Pocket of depositional organic debris and sediment in riprap spaces
3	10	10:55	Organic debris near riprap and sediment	0.21	Riprap rock area	Riprap, rock	1276633.17	193543.01	Pocket of depositional organic debris and sediment in riprap spaces
4	15	10:57	Riprap pieces	0	Riprap rock near toe	Riprap, rock	1276629.77	193538.46	Measured near toe of large riprap
5	20	10:58	Small rock pieces on surface	>5	No refusal	None	1276627.31	193533.29	Stiff material at depth but no refusal to 60"
6	25	11:02	Small rock pieces on surface	>5	No refusal	None	1276624.11	193529.09	Stiff material at depth but no refusal to 60"
7	30	11:05	Brown sediment surface	>5	No refusal	None	1276620.15	193526.72	Stiff material at depth but no refusal to 60"
8	35	11:07	Brown sediment surface	>5	No refusal	None	1276613.64	193525.23	Stiff material at depth but no refusal to 60"
9	40	11:15	Brown sediment surface	>5	No refusal	None	1976612.87	193520.25	Stiff material at depth but no refusal to 60"

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.0E

Survey Station: 310+90

Date 7/19/2021

Tide Level (MLLW) 5.58 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:17	Riprap slope	0	Visible rock	Visible riprap	1276658.22	193481.11	Riprap slope with some concrete
2	5	11:18	Riprap slope	0	Visible rock	Visible riprap	1276652.93	193478.87	Riprap slope with some concrete
3	10	11:19	Riprap slope	0	Visible rock	Visible riprap	1276647.39	193476.69	Riprap slope with some concrete
4	15	11:20	Riprap slope	0.17	Rock	Visible riprap	1276644.34	193474.41	Some sediment in riprap
5	19	11:22	Toe of riprap; soft sediment	0.5	Rock buried at toe	Buried riprap	1276641.08	193473.85	Soft sediment, sticky, hard rock refusal
6	20	11:25	Toe of riprap; soft sediment	0.75	Rock buried at toe	Buried riprap	1276638.47	193472.66	Soft sediment, sticky
7	21	11:30	Soft sediment	>5	No refusal	None	1276637.13	193472.06	Soft sediment, pushed to maximum probe length. Tide approximately 5.6' at 11:15, could not go out farther due to incoming tide and boots getting stuck

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.0E

Survey Station: 311+40

Date 7/20/2021

Tide Level (MLLW) -0.24 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:30	Large riprap	0	Rock	Rock	1276670.76	193425.4	Top of slope extends 5 to 10' behind blackberry vegetation
2	5	9:31	Medium riprap	0	Rock	Rock	1276664.61	193424.03	
3	10	9:32	Small gravel	>5	None	None	1276659.86	193422.14	Toe of slope, stiff layer at approximately 48"

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.0E

Survey Station: 312+00

Date 7/20/2021

Tide Level (MLLW) -0.55 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:20	Small to medium riprap with some large concrete	0	Rock and concrete	Rock and concrete	1276677.69	193371.88	Top of slope extends > 5' to 10' behind blackberry vegetation
2	5	9:21	Small to medium riprap with some large concrete	0	Rock and concrete	Rock and concrete	1276672.88	193370.82	
3	10	9:22	Small to medium riprap with some large concrete	0	Rock and concrete	Rock and concrete	1276669.88	193369.19	Large square concrete chunk
4	11	9:25	Toe of riprap slope	>5	None	None	1276668.13	193369.02	Some surficial pebbles and gravel over firm sandy silt, no stiff layer below mudline observed
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.0E

Survey Station: 312+70

Date 7/20/2021

Tide Level (MLLW) -0.55 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:12	Riprap rock and concrete foundation pieces	0	Rock	Rock	1276690.14	193307.58	1'-2' size riprap slope with large concrete at the top of the slope near vegetation
2	5	9:15	Riprap rock	0	Rock	Rock	1276684.13	193306.5	1'-2' diameter riprap armor
3	10	9:18	Riprap rock	0	Rock	Rock	1276680.46	193304.67	1'-2' diameter riprap armor
4	12.5	9:20	Edge of riprap rock	>5	None	None	1276677.79	193303.74	Probed at edge of riprap toe, stiff layer at approximately 50" below mudline
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.0E

Survey Station: 313+60

Date 7/20/2021

Tide Level (MLLW) -0.81 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:00	Concrete rubble at high water mark	0	Concrete armor	Concrete	1276680.47	193222.37	Large concrete armor bump out on shoreline
2	5	9:01	Concrete rubble	0	Concrete armor	Concrete	1276673.20	193223.18	Large concrete armor bump out on shoreline
3	10	9:02	Concrete rubble near visible toe	0	Concrete armor	Concrete	1276667.45	193221.44	Large concrete armor bump out on shoreline
4	13	9:05	Soft brown sandy silt	>5	None	None	1276664.09	193219.28	Very stiff layer at approximately 4' below mudline, toe of slope at this location
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.0E

Survey Station: 313+90

Date 7/20/2021

Tide Level (MLLW) -1 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	8:40	Large concrete debris	0	Concrete rubble armor	Concrete	1276693.62	193203.38	Armor begins to push out into river at this location, no rock, only large concrete, above water line
2	5	8:41	Concrete debris	0	Concrete rubble armor	Concrete	1276687.94	193200.34	Concrete in intertidal zone
3	10	8:42	Concrete debris and sediment	2.2	Hard rock or concrete	Pipe and concrete debris	1276684.30	193195.22	Smaller concrete rubble mixed with sediment, variable penetration in area, 26" penetration is representative, toe of armored slope
4	13	8:45	Silty and small concrete pieces adjacent	>5	None	None	1276681.25	193191.12	Stiff layer at 43" and 57"
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.0E

Survey Station: 314+70

Date 7/20/2021

Tide Level (MLLW) -1.08 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	8:25	Riprap near vegetation	0	Riprap rock	Rock	1276720.44	193124.66	Riprap slope at vegetation line
2	5	8:27	Riprap slope	0	Riprap rock	Rock	1276713.51	193123.72	Riprap slope, smaller piece of riprap material
3	10	8:29	Brown sandy silt, no refusal, toe of riprap	>5	None	None	1276707.46	193120.92	Approximately toe of riprap, stiff layer at 47"
4	15	8:31	Brown sandy silt with organic material	>5	None	None	1276703.48	193116.31	No rock at surface, firm sandy silt, stiff layer at 51"
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 44.0E

Survey Station: 315+30

Date 7/20/2021

Tide Level (MLLW) -1.13 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	8:10	Riprap armor slope	0	Rock slope	Riprap material	1276734.22	193062.48	Riprap at vegetation line
2	5	8:12	Riprap slope	0	Rock slope	Riprap material	1276726.8	193062.19	Smaller riprap and rock
3	8.5	8:14	Toe of riprap	>5	No refusal	Some small rock at surface	1276723.8	193059.81	Approximate toe of riprap, some small rock on surface, at approximately 4.5' at depth, stiff layer material
4	10	8:16	Near toe of riprap	>5	No refusal	Small rock on sediment surface	1276721.15	193059.79	Sandy silt and small rock at surface, stiff layer 4.5' below mudline
5	12	8:18	Sandy silt	>5	No refusal	None	1276718.89	193057.96	Sandy silt, stiff layer at 4.5' below mudline
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.2E (Slip 6)

Survey Station: 330+40

Date 7/23/2021

Tide Level (MLLW) -0.91 ft

Location ID	Distance Along Transect (ft)	Water Depth Time	Water Depth (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Northing	Easting	Other Notable Observations
1	0	9:09	0	9:10	Riprap	0	Riprap	1277407.88	192800.69	Start 30' downslope from structure at riprap and water edge
2	5	9:11	2	9:13	Sediment and riprap	0.25	Riprap	1277405.31	192805.79	From 5'-25' (along transect line) top layer is mud
3	10	9:14	3	9:15	Sediment and riprap	2	Riprap	1277404.58	192808.85	Starting at 10'-15' (along transect line) there is a layer of gravel on top of riprap but able to get through
4	15	9:18	3	9:19	Sediment with gravel, riprap	5.6	Riprap	1277405.09	192812.19	
5	20	9:24	4	9:25	Sediment with gravel	7.25	Riprap and gravel	1277401.28	192815.56	Probed three locations: Two locations, gravel at refusal Once location, seemed like riprap at refusal Assumed toe near 20'
6	25	9:30 9:50	3.9 3.4	9:30 9:51	Sediment	7.8	Gravel	1277399.69	192820.99	From 20'-25' (along transect line) probe is being sucked in likely from a stiff clay/silt layer at 5-7.8' in depth Hit hard layer at refusal likely gravel, could not penetrate

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.
2. ft: Feet
3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Jet Probe)

Transect Near River Mile: 4.2E (Slip 6)

Survey Station: 330+70

Date 7/23/2021

Tide Level (MLLW) -2.36 ft

Location ID	Distance Along Transect (ft)	Water Depth Time	Water Depth (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed refusal reason	Northing	Easting	Other Notable Observations
1	10	10:01	1.5	10:02	Sediment and riprap	5.3	Riprap	1277372.52	192798.63	Started 40' downslope from structure, 10' from riprap meets water
2	15	10:04	2.5	10:05	Sediment	6.33	Gravel and riprap	1277370.91	192802.58	3 locations probed: 2 could not penetrate due to gravel 1 could not penetrate due to riprap Assumed toe
3	20	10:22	3	10:25	Sediment	7.1	Gravel	1277367.65	192808.38	Similar gravel layer (to 32B-2), could not penetrate

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.6E

Survey Station: 361+90

Date 7/20/2021

Tide Level (MLLW) 3.03 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:50	Brown sediment and grass like organics	>5	None	Minor surface debris encountered	1277420.8	190617.6	Heavy vegetation, bank extends 5'-10' steeply behind vegetation, no observed armor, surface debris
2	5	10:52	Mixed debris and sediment, brick concrete rebar	4	Firm layer (not rock)	Mixed surface debris	1277419.3	190615.3	No apparent armor on surface, surficial metal debris and concrete
3	10	10:55	Mixed debris and sediment, brick concrete rebar	>5	None	None	1277417.9	190610.03	
4	15	10:58	Mixed debris and sediment, brick concrete rebar	>5	None	None	1277415.9	190605.3	Surface debris mixed in upper foot, some sand/gravel in upper foot, probe pushed to full penetration, very stiff at 48"

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.6E

Survey Station: 362+30

Date 7/20/2021

Tide Level (MLLW) 3.03 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:40	Concrete pieces at toe of steep bank	0	Concrete	Concrete	1277392.1	190632.2	Heavy vegetation, bank is steep, vegetation extends 5'-10' up almost vertically, no apparent armor observed on steep bank
2	5	10:42	Mixed concrete pieces	4	Dense layer (not rock)	Surficial scattered concrete	1277388.8	190627.1	Scattered concrete chunks/debris on surface
3	10	10:45	Sediment with organics	>5	None	None	1277385.7	190620.8869	Stiff layer at 24" below mudline
4	15	10:47	Sediment with organics	>5	None	None	1277383.5	190615.7	

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.6E

Survey Station: 362+60

Date 7/20/2021

Tide Level (MLLW) 3.88 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:25	Mixed debris and sediment at vegetation line	2.5	Rock or debris	Brick, rebar, concrete chunks	1277420.75	190617.58	Distance zero at vegetation line, steep bank continues 5'-10' beyond vegetation, no armoring observed
2	5	10:27	Mixed debris and sediment	4	Rock or debris	Brick, rebar, concrete chunks	1277419.13	190615.30	Variable debris in sediment, sediment thickness is the average of four test probes
3	10	10:30	Sediment, organics, and debris	4	Rock or debris	Small rocks and concrete pieces	1277417.96	190610.03	0"-12" of variable surface rocks, gravel and debris
4	15	10:35	Sediment, organics, and debris	>5	None	Debris in top 2'	1277415.96	190605.49	Variable debris in upper 2' but no refusal with probe
5	20	10:37	Brown silty sediment	>5	None	None	-	-	No GPS taken due to soft sediment
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.7W

Survey Station: 417+30

Date 7/21/2021

Tide Level (MLLW) -1.27 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:19	Brown sediment, mixed small rock	1.25	Wood or harder layer	Small 1"-3" rock	1277118.24	189905.17	Started 2' down from vegetation due to fence, no riprap observed, 15" below mudline, stiff layer
2	5	10:25	Brown sediment, mixed small rock	1.25	Rock	Small 1"-3" rock	1277123.15	189910.09	At 15" hit rock, no riprap
3	10	10:30	Brown sediment, mixed small rock	1.25	Wood or harder layer	Small 1"-3" rock	1277127.35	189914.35	At 15" hit rock, no riprap
4	15	10:35	Brown sediment, mixed small rock	>5	None	Small 1"-3" rock	1277129.01	189919.73	Variable stiff layers but no refusal
5	20	10:37	Brown sediment, mixed small rock	>5	None	Small 1"-3" rock	1277132.83	189923.46	Less stiff layers than previous, just silt
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.7W

Survey Station: 416+80

Date 7/21/2021

Tide Level (MLLW) -0.9 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:37	Silt, brown sediment mixed with small rock	>5	N/A	Small rock	1277162.18	189879.76	Stiff layer at 3' below mudline, started at vegetation line, no rock, stiff sand layer
2	5	10:39	Silt, brown sediment mixed with small rock	>5	N/A	Small rock	1277165.66	189885.66	No stiff layers
3	10	10:40	Silt, brown sediment mixed with small rock	>5	N/A	Small rock	1277168.91	189891.45	No stiff layers
Notes									
1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.									
2. ft: Feet									
3. N/A: Not Applicable									

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

RAL Exceedance Area _____
 Transect # _____
 Date _____
 Tide Level (MLLW) _____

Location ID	Distance Along Transect (ft)	Water Depth Time	Water Depth (ft)	Probing Time	Observed substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed refusal reason	Lat	Long	Other Notable Observations

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.8W

Survey Station: 412+20

Date 7/21/2021

Tide Level (MLLW) 0 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:57	Brown Silty Sand	>5	N/A	None	1277326.12	190005.35	Started at vegetation line, stiff sand layer at 55"
2	5	10:58	Brown Silty Sand	>5	N/A	None	1277324.54	190011.73	Stiff sand layer at 47"
3	10	11:00	Brown Silty Sand	>5	N/A	None	1277324.40	190016.55	No stiff layers

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.
2. ft: Feet
3. Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.8W

Survey Station: 411+50

Date 7/21/2021

Tide Level (MLLW) 0 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:03	Sand with traces of silt	>5	N/A	None	1277390.91	190013.30	Stiff layer at 6" below mudline
2	5	11:05	Sand with traces of silt	>5	N/A	None	1277391.33	190018.8	Stiff layer at 6" below mudline, at 2' no refusal
3	10	11:06	Sand with traces of silt	>5	N/A	None	1277388.33	190023.92	Continuously stiff down to 60" below mudline
4	15	11:07	Sand with traces of silt	>5	N/A	None	1277388.72	190031.01	Continuously stiff down to 60" below mudline

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.8W

Survey Station: 410+80

Date 7/21/2021

Tide Level (MLLW) 0.54 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:08	Sand with traces of silt	>5	N/A	None	1277445.03	190045.87	Variable stiff layers throughout 60"
2	5	11:09	Sand with traces of silt	>5	N/A	None	1277451.58	190047.51	Variable stiff layers throughout 60"
3	10	11:12	Sand with traces of silt	>5	N/A	None	1277455.63	190050.62	Variable stiff layers throughout 60"
4	15	11:15	Sand with traces of silt	>5	N/A	None	1277461.49	190052.68	Variable stiff layers throughout 60"

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.8W

Survey Station: 410+30

Date 7/21/2021

Tide Level (MLLW) 1.03 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:32	Silt with vegetation on top	2	Vegetation, very stiff layer (sand)	None	1277451.95	190010.51	Stiff layer at 3-10"
2	5	11:34	Silt with vegetation on top	2.5	Vegetation, very stiff layer (sand)	None	1277449.84	190017.92	Stiff layer at 1.5'
3	10	11:36	Silt with vegetation on top	1.5	Vegetation, very stiff layer (sand)	None	1277451.77	190023.33	Stiff layer at 8"
4	15	11:38	Silt with vegetation on top	0.67	Vegetation, very stiff layer (sand)	None	1277454.38	190026.61	Stiff layer at 8"

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.8W

Survey Station: 407+10

Date 7/21/2021

Tide Level (MLLW) 0.54 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:20	Sand with traces of silt, some rock at the surface	>5	N/A	Some rock	1277499.21	190014.3	Variable stiff layers throughout 60", some rock on surface
2	5	11:22	Sand with traces of silt, some rock at the surface	>5	N/A	Some rock	1277500.71	190019.96	Stiff layer at 3.5'
3	10	11:25	Sand with traces of silt, some rock at the surface	>5	N/A	No rock	1277501.19	190026.09	No notable stiff layer
4	15	11:27	Sand with traces of silt, some rock at the surface	>5	N/A	No rock	1277304.76	190030.23	No notable stiff layer

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

RAL Exceedance Area _____
 Transect # _____
 Date _____
 Tide Level (MLLW) _____

Location ID	Distance Along Transect (ft)	Water Depth Time	Water Depth (ft)	Probing Time	Observed substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed refusal reason	Lat	Long	Other Notable Observations

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 371+40

Date 7/22/2021

Tide Level (MLLW) -1.73 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:17	Silt and sand debris	0	Concrete	Concrete	1278243.89	190428.49	Erosion in area with concrete debris, started at vegetation line
2	5	11:19	Silt and sand debris	>5	N/A	Concrete debris in places	1278241.29	190425.06	No refusal under concrete debris
3	10	11:22	Silt and sand debris	>5	N/A	Concrete debris in places	1278238.83	190422.91	
4	15	11:23	Silt and sand debris	>5	N/A	None	1278236.82	190420.34	End of surface concrete debris

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 371+90

Date 7/22/2021

Tide Level (MLLW) -2.11 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	11:05	Concrete debris and riprap	0	Concrete debris and riprap	Large tree, pillings, concrete debris, riprap, and other debris	1278284.13	190396.49	Riprap 10' up slope, large concrete debris, started at vegetation line, very steep
2	5	11:07	Concrete debris and riprap	0	Concrete debris and riprap	Large tree, pillings, concrete debris, riprap, and other debris	1278281.59	190393.18	
3	10	11:10	Concrete (one large slab)	0	Concrete	Large tree, pillings, concrete debris, riprap, and other debris	1278278.43	190390.74	One large concrete slab, otherwise no refusal
4	11	11:11	N/A	>5	N/A	random debris	-	-	

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 372+40

Date 7/22/2021

Tide Level (MLLW) -2.34 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:40	Concrete and sediment	0	Concrete	Concrete and debris	1278328.51	190373.20	Concrete, very steep slope
2	5	10:41	Concrete and sediment	0	Concrete	Concrete and debris	1278328.6	190372.10	
3	10	10:42	Concrete and sediment	0	Concrete	Concrete and debris	1278327.4	190370.21	Less concrete debris
4	15	10:45	Concrete and sediment	0.5	Concrete	Concrete and debris	-	-	
5	20	10:50	Concrete and sediment	4	Concrete	Concrete and debris	-	-	Concrete below, could not access further down the bank (drops off into the water)

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 372+80

Date 7/22/2021

Tide Level (MLLW) -2.34 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:30	Concrete debris	0	Concrete	Concrete	1278368.95	190362.8	Riprap continues up slope from the start at the vegetation line
2	5	10:32	Concrete debris	0	Concrete	Concrete	1278368.16	190356.6	
3	10	10:33	Concrete debris	0	Concrete	Concrete	1278368.29	190355.13	
4	15	10:35	Sediment, silt and sand	>5	N/A	Wood debris	1278368.29	190348.25	Wood debris to the north and south
5	20	10:37	Sediment	>5	N/A	Wood debris	-	-	Wood debris to the north and south, No GPS taken due to soft sediment
6	11	10:38	Sediment	>5	N/A	Wood debris	1278368.42	190353.7	Wood debris to the north and south, assumed toe

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 373+50

Date 7/22/2021

Tide Level (MLLW) -2.34 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:17	Riprap	0	Riprap	Riprap, large tree	1278429.8	190356	Large tree just to the north of the probing area
2	5	10:18	Riprap	0	Riprap	Riprap, large tree	1278429.1	190344	Large tree just to the north of the probing area
3	10	10:19	Riprap	0	Riprap	Riprap, large tree	1278428.1	190342	Large tree just to the north of the probing area
4	15	10:20	Sediment	>5	N/A	Large tree	1278427.6	190342.2	Large tree just to the north of the probing area
5	11	10:22	Sediment	>5	N/A	N/A	1278426	190341.27	Assume toe

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 373+90

Date 7/22/2021

Tide Level (MLLW) -2.34 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	10:02	Concrete debris, sediment	0	Concrete	Concrete	1278466.67	190317.64	Small concrete debris area with pillings and wood debris
2	5	10:04	Concrete debris, sediment	0	Concrete	Concrete	1278461.46	190314.07	Small concrete debris area with pillings and wood debris
3	10	10:06	Concrete debris, sediment	>5	N/A	None	1278457.29	190309.41	Small concrete debris area with pillings and wood debris
4	7	10:10	Concrete debris, sediment	>5	N/A	None	1278458.52	190311.27	Small concrete debris area with pillings and wood debris, assumed toe Pilings 5' to the north of transect line located 15' to 20' down transect

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 374+30

Date 7/22/2021

Tide Level (MLLW) -2.34 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:56	Vegetation, sediment, logs	>5	N/A	Logs and vegetation	1278494.62	190284.58	Started at vegetation line, boulders 10' above vegetation line, very stiff through
2	5	9:57	Vegetation, sediment, logs	>5	N/A	Logs and vegetation	1278491.92	190282.01	very stiff through
3	10	9:58	Vegetation, sediment, logs	>5	N/A	Logs and vegetation	1278490.47	190280.49	No stiff layer

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 375+20

Date 7/22/2021

Tide Level (MLLW) -2.33 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:26	Mix of gravel and riprap with sediment	0.5	Rock	Mix of gravel and riprap with sediment	1278553.58	190248.76	Starting at vegetation line, vertical rock wall off of outfall
2	5	9:28	Mix of gravel and riprap with sediment	1	Rock	Mix of gravel and riprap with sediment	1278549.25	190245.34	Near vertical rock wall off of outfall
3	10	9:29	Mix of gravel and riprap with sediment	2.75	Rock	Mix of gravel and riprap with sediment	1278544.93	190241.55	Stiff layer at 1' of gravel
4	15	9:31	Mix of gravel and riprap with sediment	1	Gravel	Mix of gravel and riprap with sediment	1278540.85	190238.28	Stiff layer at 1' of gravel, refusal does not feel like riprap
5	20	9:35	Mix of gravel and riprap with sediment	1	Gravel	Mix of gravel and riprap with sediment	1278537.55	190234.45	Stiff layer from 1' to 3.6' of gravel, 3.6' achieve in one probe, others refused at 1'
6	25	9:37	Mix of gravel and riprap with sediment	1	Gravel	Mix of gravel and riprap with sediment	1278534.1	190231.86	Stiff layers of gravel continuously below 1'
7	30	9:42	Mix of gravel and riprap with sediment	3	Gravel	Mix of gravel and riprap with sediment	1278514.41	190211.67	Assumed toe, measured the next 5' at 1' increments, all no refusal

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 375+70

Date 7/21/2021

Tide Level (MLLW) 5.22 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	12:55	Silt, brown sediment, rock and riprap	0	Concrete debris	Concrete debris	1278581.78	190209.57	Mix of concrete and debris at vegetation line
2	5	12:57	Silt, brown sediment, rock and riprap	0	Concrete debris	Concrete debris	1278578.64	190205.88	Mix of concrete and debris
3	10	12:59	Some concrete debris	>5	N/A	None	1278575.70	190203.22	Assumed toe, some fallen concrete at surface
4	15	13:00	No debris	>5	N/A	None	1278572.22	190201.09	Sediment, no stiff layers

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

LDW Upper Reach Phase II PDI: Sediment Thickness Over Armored Banks (Hand Probe)

Transect Near River Mile: 4.9E

Survey Station: 376+20

Date 7/22/2021

Tide Level (MLLW) -1.72 ft

Location ID	Distance Along Transect (ft)	Probing Time	Observed Substrate (e.g., rock, sand, silt, shell)	Sediment Thickness (ft)	Assumed Refusal Reason	Surface Debris or Obstructions Encountered	Northing	Easting	Other Notable Observations
1	0	9:07	Some gravel, silt/sand	0.25	Rock	Some gravel	1278610.37	190174.32	Gravel and silt/sand mix
2	5	9:08	Some gravel, silt/sand	2.67	Rock	Some gravel	1278604.12	190174.66	Gravel and silt/sand mix
3	10	9:09	Some gravel, silt/sand	>5	N/A	Some gravel	1278597.13	190168.95	Assumed toe
4	15	9:10	Some gravel, silt/sand	>5	N/A	Some gravel	1278598.75	190171.33	
5	9	9:11	Some gravel, silt/sand	4.6'	Rock	Some gravel	1278593.89	190168.36	

Notes

1. Tide measurements are based on the on-site tide gauge, installed by Gravity Marine Consulting for the LDW Phase II PDI.

2. ft: Feet

3. N/A: Not Applicable

