



FINAL  
YEAR 2 INTERIM MONITORING REPORT –  
TERMINAL 4 PHASE I REMOVAL ACTION  
PORT OF PORTLAND, PORTLAND, OREGON

**Prepared for**

Port of Portland  
Portland, Oregon

**Prepared by**

Anchor QEA, LLC  
6650 SW Redwood Lane, Suite 333  
Portland, Oregon 97224

**February 2011**

**FINAL**  
**YEAR 2 INTERIM MONITORING REPORT –**  
**TERMINAL 4 PHASE I REMOVAL ACTION**  
**PORT OF PORTLAND, PORTLAND, OREGON**

---

**Prepared for**

Port of Portland  
Portland, Oregon

**Prepared by**

Anchor QEA, LLC  
6650 SW Redwood Lane, Suite 333  
Portland, Oregon 97224

**February 2011**

---

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	General Scope of Interim Monitoring.....	1
1.2	Schedule of Year 2 Interim Monitoring Events .....	2
<b>2</b>	<b>MONITORING RESULTS SUMMARY FOR THE HEAD OF SLIP 3 CAP AREA.....</b>	<b>3</b>
2.1	Armor Layer Stability .....	3
2.1.1	Visual Survey .....	3
2.1.2	Pinch-pile Wall Survey.....	3
2.2	Presence of Sheens .....	5
<b>3</b>	<b>MONITORING RESULTS SUMMARY FOR THE WHEELER BAY SHORELINE STABILIZATION.....</b>	<b>6</b>
3.1	Slope Stability .....	6
3.2	Armor Layer Stability .....	6
3.3	Condition of Habitat Layer.....	7
3.3.1	Erosive Forces .....	10
3.3.2	Expected Future Conditions .....	11
3.4	Establishment of Vegetation.....	11
3.4.1	Willow Planting Establishment.....	12
3.4.2	Grass Planting Establishment .....	12
<b>4</b>	<b>WHEELER BAY SHORELINE STABILIZATION REPAIR SUMMARY .....</b>	<b>14</b>
<b>5</b>	<b>CONCLUSIONS AND NEXT STEPS.....</b>	<b>15</b>
5.1	Head of Slip 3 Cap .....	15
5.2	Wheeler Bay .....	15
5.2.1	Repaired Slope and Armor Layer Stability .....	16
5.2.2	Repaired Vegetation Establishment .....	16
5.2.3	Condition of Habitat Layer .....	17
5.3	Reporting .....	17
<b>6</b>	<b>REFERENCES .....</b>	<b>18</b>

---

## List of Tables

Table 1	Head of Slip 3 Cap Pinch-pile Wall Survey Results .....	4
Table 2	Habitat Material Evaluation Summary .....	9

## List of Figures

Figure 1	Interim Survey Locations
Figure 2	Wheeler Bay Willow Scarp
Figure 3	Wheeler Bay Year 2 Slope Stability Transect Locations
Figure 4	Wheeler Bay Year 2 Habitat Layer Transect Locations and 2008 As-Built
Figure 5a-5i	Photographs from Habitat Material Assessment
Figure 6	Vessel Wake Diagram
Figure 7	Typical Wheeler Bay Slope Repair 2010 As-Built Cross Section
Figure 8	Wheeler Bay Shoreline Stabilization Slope Repair 2010 As-Built

## List of Appendices

Appendix A	Wheeler Bay and Head of Slip 3 Cap Year 2 Visual Slope and Armor Survey Monitoring Report
------------	--

---

## 1 INTRODUCTION

This document provides a summary of the second year monitoring results for the head of Slip 3 cap and Wheeler Bay (WB) shoreline stabilization. Interim monitoring survey locations are depicted on Figure 1. Monitoring was conducted in accordance with the requirements of the *Interim Monitoring and Reporting Plan* (IMRP; Design Analysis Report [DAR] Appendix C; Anchor 2008). A description of the observed site conditions and relevant data summaries are provided in this report. A repair of the WB shoreline was completed during the second year of monitoring to address areas where erosion had occurred. A brief summary of the repair is provided in Section 4, and detailed construction information was provided to the U.S. Environmental Protection Agency (USEPA) on September 17, 2010, in the Removal Action Work Plan for the repair work (Anchor QEA 2010). Post-construction, no areas of erosion were noted during the Year 2 monitoring activities; therefore, recommended corrective actions and a schedule for implementing the corrective actions are not included in this report.

This document (Section 3.3) also provides a summary of the condition of the habitat layer material placed on top of the armor rock layer in WB. The habitat layer material monitoring is not part of the monitoring requirements, but was performed as part of the WB monitoring activities as a pilot project to determine whether the site-specific conditions are conducive to maintaining a sand/gravel habitat layer over the armor layer. If monitoring demonstrates that a habitat layer can be maintained in the long term, this habitat layer may be considered by the National Marine Fisheries Service (NMFS) and USEPA when determining the appropriate mitigation project for the WB shoreline stabilization work that has been completed (NMFS 2008).

### 1.1 General Scope of Interim Monitoring

The IMRP provides the monitoring and reporting requirements between the completion of the Terminal 4 Phase I Removal Action work and the beginning of the Phase II Removal Action work. This work includes the monitoring of the integrity of the head of Slip 3 cap and WB shoreline stabilization, including establishment of vegetation.

The head of Slip 3 cap integrity monitoring was performed to confirm the following:

- Armor layer stability
- Absence of sheens

WB stabilization monitoring was performed to confirm the following:

- Slope stability
- Armor layer stability
- Establishment of vegetation
- Stability and presence of woody debris as designed

In addition, although not a requirement of the IMRP, the condition of the habitat layer material placed on top of the cap armor in WB was assessed.

## **1.2 Schedule of Year 2 Interim Monitoring Events**

The head of Slip 3 sheen observations were conducted on May 19 and October 18, 2010. The Year 2 vegetation assessment at WB was performed on November 4, 2010. WB and the head of Slip 3 cap visual armor and slope stability surveys were conducted on November 9, 2010. The habitat layer material was also observed at WB on June 21 and June 25, 2010. A survey of the pinch-pile wall was performed on November 11, 2010.

---

## **2 MONITORING RESULTS SUMMARY FOR THE HEAD OF SLIP 3 CAP AREA**

A summary description of the observed site conditions and relevant data summaries related to the head of Slip 3 cap area are provided in this section. Additional details are provided in the *Wheeler Bay and Head of Slip 3 Cap Year 2 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A.

### **2.1 Armor Layer Stability**

#### **2.1.1 Visual Survey**

Visual assessments of the head of Slip 3 cap area slope and armor condition were performed on November 9, 2010. The water level during the site visit was approximately +6.3 feet National Geodetic Vertical Datum (NGVD). A description of monitoring activities that were performed and monitoring results are given below.

On November 9, 2010, three transects were re-established on 40-foot spacings perpendicular to the shoreline in the same locations as the Year 1 slope observations. Transects were marked with flags and monitoring staff walked from the upslope edge of the stabilization area to the water. Notes and photographs (provided as Attachments A-3 and A-4 to Appendix A, respectively) were taken to document visual slope stability along each transect. In summary, no areas of instability were noted.

#### **2.1.2 Pinch-pile Wall Survey**

A survey of the pinch-pile wall was completed to assess the stability of the armor layer and in-water portion of the cap in front of the pinch-pile wall. Prior to Year 2 monitoring activities on October 16, 2008, (immediately after completion of construction), a surveyor's spike was inserted in the top of the pinch-pile wall at 40-foot spacings (three monitoring points), and a baseline survey was performed. Two successive surveys were conducted on June 16 and September 16, 2009, and were compared to the baseline survey as part of the Year 1 monitoring activities. On November 11, 2010, an additional survey of the pinch-pile wall was conducted as part of Year 2 monitoring activities. The Port of Portland's (Port's) in-house survey crew completed the pinch-pile wall surveys. The accuracy of the survey method used is +/- 0.6 inches. Results of the surveys are provided in Table 1. The following

recorded measurements indicate that the wall is stable and that the observed measurements are likely within the accuracy of the survey method:

- Over the first 8 months, all three points moved approximately 0.3 inches in a north-northwest direction (parallel to the wall—the wall runs in a north-northwest/south-southwest alignment), which is within the accuracy of the survey method.
- During the next 3-month measurement, all three points moved approximately 0.4 inches in a southwest direction (roughly perpendicular to the wall alignment), which is also within the accuracy of the survey method.
- During the second year measurement, all three points moved by about 0.3 inches in a northerly direction. Again, this is within the accuracy of the survey method.
- Total observed movement over the 2 years was less than 0.4 inches for all three points, which is also within the accuracy of the survey method.

**Table 1**  
**Head of Slip 3 Cap Pinch-pile Wall Survey Results**

Point Number	Coordinates and Elevation	Date				Distance moved (inches)		
		10/16/2008	6/16/2009	9/16/2009	11/11/2010	10/16/08 To 6/16/09	10/16/08 To 9/16/09	10/16/08 To 11/11/10
3000	Northing	66964.660	66964.674	66964.668	66964.679	0.399	0.323	0.240
	Easting	71313.600	71313.603	71313.578	71313.576			
	Elevation	7.740	7.710	7.746	7.740			
3001	Northing	67000.512	67000.531	67000.521	67000.536	0.275	0.290	0.306
	Easting	71307.629	71307.621	71307.607	71307.618			
	Elevation	8.380	8.370	8.379	8.379			
3002	Northing	67030.301	67030.324	67030.304	67030.320	0.324	0.339	0.310
	Easting	71302.597	71302.587	71302.569	71302.581			
	Elevation	7.990	7.980	7.992	7.997			

Note: Horizontal datum: Port of Portland Local Projection (International Feet), Vertical Datum: NGVD 1929 (Feet).

The IMRP specified response actions in the event of movement greater than 1 inch. No significant movement greater than 1 inch compared to baseline was observed. Based on these results, the pinch-pile wall and wedge remain stable.

## 2.2 Presence of Sheens

Surveys for the visual presence of sheens were performed at the end of the second high water season (May 19, 2010) and at the end of the second low water season (October 18, 2010).

The water level was approximately +6.7 feet NGVD during the May 19, 2010 survey, and approximately +2.0 feet NGVD during the October 18, 2010 survey. Monitoring staff walked along 20-foot transects parallel to the shoreline to observe the presence of sheens. No sheens were observed, as documented in Attachments A-5 and A-6 to Appendix A, respectively.

In addition, although not a requirement of the IMRP, surveys for the visual presence of sheens were performed during each light non-aqueous phase liquid (LNAPL) monitoring event completed as part of the required remedial action for the Terminal 4 Slip 3 Upland Facility defined in the Record of Decision (ROD; Oregon Department of Environmental Quality [DEQ] 2003) and the Explanation of Significant Difference (DEQ 2004). No sheens were observed between the completion of the Terminal 4 Phase I Removal Action work through Year 2 of the Interim Monitoring time period, as documented in Ash Creek – NewFields 2008 and 2009, and Ash Creek 2009a, 2009b, 2009c, 2009d, 2010a, 2010b, and 2010c.

---

### **3 MONITORING RESULTS SUMMARY FOR THE WHEELER BAY SHORELINE STABILIZATION**

A summary description of the observed site conditions and relevant data summaries related to the WB shoreline stabilization are provided in this section. Additional details are provided in the *Wheeler Bay and Head of Slip 3 Cap Year 2 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A.

During a site visit conducted on June 21, 2010, a significant erosion scarp was observed at the base of the willow planting area within the first 225 feet from the mouth of the bay. The scarp ranged from 0 to 2 feet in height, and in places extended midway up the willow planting area (Figure 2). A general description of the construction elements of the WB repair are provided in Section 4. Construction of the WB repair work was completed on October 29, 2010.

#### **3.1 Slope Stability**

Visual slope stability observations were made during a site visit on November 9, 2010 after the completion of WB repair work. In accordance with the IMRP, Year 1 transects were re-established, perpendicular to the shoreline at 100-foot centers. A total of eight transects were established and upslope and downslope GPS points were taken for each transect. The transects are depicted on Figure 3. Transects were marked with flags and monitoring staff walked from the upslope edge of the grass planting down to the water. Notes and photographs (provided as Attachments A-1 and A-2 to Appendix A, respectively) were taken to document slope stability at each transect. No sloughing, instability, or erosion was observed in the willow or grass planting areas (the willow planting area is between elevations +15 to +20 feet NGVD and the grass planting area is between elevations +20 to +30 feet NGVD).

#### **3.2 Armor Layer Stability**

Transects were established perpendicular to the shoreline at 100-foot centers as described in Section 3.1 and as depicted on Figure 3. Monitoring staff walked along the transects looking for evidence of erosion within the armor layer. Notes and photographs (provided as

Attachments A-1 and A-2 to Appendix A, respectively) were taken of the armor layer at each transect. The armor layer showed no signs of instability, sloughing, or erosion. All woody debris installed as part of the original and repair design was in place, stable, and in good condition.

### **3.3 Condition of Habitat Layer**

A sand and gravel habitat material mixture was placed over the armor layer on a 3H:1V slope from approximate elevations +10 to +15 feet NGVD during the Terminal 4 Phase I Removal Action construction in 2008 (Figure 4). The habitat layer serves no function of armoring. The intent of the habitat material is to allow it to naturally accrete or erode and provide normative ecological functions. Pursuant to the Biological Opinion, the Port has monitored the habitat material layer over the past 2 years to determine if the habitat layer is eroding or accreting.

Prior to the completion of the WB repair work, site visits on June 21 and 25, 2010 were conducted to quantitatively evaluate the habitat material placed over armor rock. A quantitative estimate of the area and thickness of the habitat material remaining between approximate elevations +10 and +15 feet NGVD was made in the following manner:

- A 670-foot transect was established at approximately elevation +15 feet NGVD from the mouth of the bay to the end of the willow planting area.
- Perpendicular transects (as shown on Figure 4) were established every 25 feet in the high erosion area (0 to 225 feet from the mouth of the bay), and every 50 feet in the less erosion-impacted areas (225 feet to the end of the willow planting area, 670 feet from the mouth of the bay).
- Perpendicular transects extended over the armor rock-placed area from approximate elevations +15 to +10 feet NGVD.
- A quadrat (3 feet by 3 feet) was placed at the top, middle, and bottom of the perpendicular transects. Substrate type was recorded as a percent of area within the quadrat.
- Habitat material thickness up to 12 inches was determined for a single quadrat in each perpendicular transect, alternating between top, middle, and bottom quadrats.

Results of the habitat material layer quantification are summarized below and in Table 2, and photographs from each transect location are shown in Figures 5a-5i. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or large woody debris [LWD]) covered 97 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in only 3 percent of the overall area. The exposed armor rock occurred between 0 and 275 feet from the mouth of the bay between approximate elevations +10 and +15 feet NGVD, which generally corresponds to the area of the June 2010 bank erosion located between approximate elevations +15 to +20 feet NGVD that has been repaired (see Section 4). The rest of the area between 275 and 700 feet from the mouth of the bay where new armor rock was placed remains covered with habitat material, logs, and depositional sand. The average thickness of the habitat material (or other material) overlying the armor rock was greater than 6 inches in the area 0 to 275 feet from the mouth of the bay, and was greater than 10 inches in the remainder of the area from 275 to 700 feet. As such, in the area between 275 to 700 feet from the mouth of the bay, the habitat material has remained on the surface with an average thickness of material of greater than 10 inches. As mentioned previously, the intent of the placed habitat material is to allow it to naturally accrete or erode so it is not expected that all 12 inches of placed material would remain completely in place in the short term or the long term.

**Table 2  
Habitat Material Evaluation Summary**

Perpendicular Transect Location (feet from mouth of bay)	Quadrat Location (Top, Middle, Bottom)	Surface Substrate (percent of quadrat area)							Thickness of Substrate Above Riprap		
		Non-riprap Material					Riprap Material	Total (%)	Habitat Material (inches)	Other Material (inches)	Total Thickness (inches)
		Placed Material from Upslope (%)	Depositional Sand (%)	Habitat Material (%)	Log (%)	Coir Fabric with Placed Fines on Top (%)	Riprap (%)				
25	T	100	0	0	0	0	0	100	0	12	12
25	M	50	0	50	0	0	0	100	-	-	-
25	B	0	0	100	0	0	0	100	-	-	-
50	T	100	0	0	0	0	0	100	-	-	-
50	M	60	0	40	0	0	0	100	3	0	3
50	B	0	0	100	0	0	0	100	-	-	-
75	T	0	0	40	60	0	0	100	-	-	-
75	M	0	0	100	0	0	0	100	-	-	-
75	B	0	0	100	0	0	0	100	> 12	0	> 12
100	T	100	0	0	0	0	0	100	4	8	12
100	M	0	0	100	0	0	0	100	-	-	-
100	B	0	0	100	0	0	0	100	-	-	-
125	T	0	0	80	20	0	0	100	-	-	-
125	M	0	0	95	0	0	5	100	9	0	9
125	B	50	0	50	0	0	0	100	-	-	-
150	T	20	0	80	0	0	0	100	-	-	-
150	M	20	0	80	0	0	0	100	-	-	-
150	B	0	0	95	0	0	5	100	5	0	5
175	T	85	0	15	0	0	0	100	2	0	2
175	M	0	0	35	0	0	65	100	-	-	-
175	B	5	0	75	0	0	20	100	-	-	-
200	T	0	0	15	0	85	0	100	-	-	-
200	M	0	0	80	0	0	20	100	7	0	7
200	B	10	0	90	0	0	0	100	-	-	-
225	T	90	0	5	0	0	5	100	0	0	0
225	M	0	0	75	0	0	25	100	-	-	-
225	B	20	0	80	0	0	0	100	-	-	-
275	T	0	0	90	0	0	10	100	-	-	-
275	M	0	0	85	0	0	15	100	3	0	3
275	B	0	0	100	0	0	0	100	-	-	-
325	T	0	0	100	0	0	0	100	-	-	-
325	M	0	0	100	0	0	0	100	-	-	-
325	B	0	0	100	0	0	0	100	> 12	0	> 12
375	T	0	0	100	0	0	0	100	7	0	7
375	M	0	0	100	0	0	0	100	-	-	-
375	B	0	0	100	0	0	0	100	-	-	-
425	T	0	0	100	0	0	0	100	-	-	-
425	M	0	25	75	0	0	0	100	10.5	0.5	11
425	B	0	0	100	0	0	0	100	-	-	-
475	T	0	0	100	0	0	0	100	-	-	-
475	M	0	0	100	0	0	0	100	-	-	-
475	B	0	0	100	0	0	0	100	> 12	0	> 12
525	T	0	0	100	0	0	0	100	12	0	12
525	M	0	0	100	0	0	0	100	-	-	-
525	B	0	0	100	0	0	0	100	-	-	-
575	T	0	0	100	0	0	0	100	-	-	-
575	M	0	0	100	0	0	0	100	5	0	5
575	B	0	0	0	100	0	0	100	-	-	-
625	T	0	0	100	0	0	0	100	-	-	-
625	M	0	0	25	75	0	0	100	-	-	-
625	B	0	0	25	75	0	0	100	> 12	0	> 12
MEAN_25-275		22	0	68	2	3	6		> 4	2	> 6
MEAN_325-625		0	1	87	12	0	0		> 10	0	> 10
MEAN_ADJST		11	1	77	7	1	3	100	> 7	1	> 8
TOTAL				97			3	100			

Notes:

- Means are frequency adjusted. Sampling frequency between 25 and 200 feet was every 25 feet. Sampling frequency from 225 to 625 feet was every 50 feet.
- Where woody debris was observed, substrate type was recorded as Log only if underlying substrate could not be determined.
- Thickness of habitat material only measured up to 12 inches in depth.

As part of the WB repair between 0 and 275 feet from the mouth of the bay described in Section 4, habitat material present at the time of construction was moved to the side and subsequently re-used at the toe of the new armor rock slope once placement of the armor rock was complete. No new habitat material was placed. As such, the armor rock is the surface layer in this section of WB, and no further monitoring of habitat material will be conducted in subsequent years in this area of WB. In the remaining area of the bay, which is not as exposed to erosive forces (i.e., between 275 and 700 feet from the mouth of the bay), the material is expected to move around, but generally stay where placed. The remaining area from 700 to 820 feet is armor rock where no habitat material was placed; this area represents an area of pre-existing armor rock.

Erosive forces that likely contributed to observed erosion in 2009 and 2010 in the area between 0 and 275 feet from the mouth of the bay, which are expected to continue into the future, are described in the next section.

### **3.3.1 Erosive Forces**

Because current-induced water velocities are low within WB, breaking waves are the largest contributors to the redistribution of the habitat material layer. Waves are generated via vessels (tugs, barges, ships, and personal watercraft) sailing up and down the river. As vessels travel through the water, waves leave the vessels at approximately 140 degrees to the direction of sail (Sorensen 1997), and then break once they hit the shoreline. The majority of the energy in waves generated from vessels sailing downstream past Terminal 4 is dissipated by the piles located under the Berth 410 dock (Figure 6). These waves generally do not break on shore, although some waves do break on the shoreline that is not protected by the piles associated with Berth 410 near Transects 1, 2, and 3. These sections of shoreline correspond to the areas where the most significant erosion was observed during the monitoring activities (Table 2). In addition, waves generated from vessels sailing in the upstream direction break once they hit shore near Transect 7; however, these waves have farther to travel to hit the shoreline, and this area is protected by a significant amount of deposited LWD that acts as armor. As such, minimal erosion has been observed in this area.

### **3.3.2 Expected Future Conditions**

The hydrodynamic conditions that may affect the shoreline at WB in the future are expected to remain similar to those observed from 2008 to 2010. In those areas being exposed to breaking waves (i.e., between 0 and 275 feet from the mouth of the bay), the erosive forces being exerted on the shoreline appear to be redistributing the placed habitat material, and it is expected that these forces will continue in these areas. It is also expected that the areas protected by the piles underneath Berth 410 will remain protected as long as the piles remain in place. Overall, approximately 0.18 acres of the armor rock that was placed in 2008 are expected to remain covered by habitat material. This assumes that all new armor rock placed in 2010 between 0 and 275 feet from the mouth of the bay is exposed on the surface and not covered by habitat material or other material, and that the armor rock between 275 and 700 feet from the mouth of the bay remains covered with sand and gravel habitat material. The remaining area from 700 to 820 feet is armor rock where no habitat material was placed; this area represents an area of pre-existing armor rock.

### **3.4 Establishment of Vegetation**

Year 2 vegetation monitoring occurred during a site visit on November 4, 2010, after the WB shoreline repair was complete. According to the IMRP, the vegetation coverage will be documented in Years 2, 3, and 5 to confirm that the target cover percentages are being achieved.

Based on the vegetation monitoring performed, willow planting and grass planting establishment is anticipated to meet Year 3 goals, including in the newly planted areas. As such, the newly planted areas are not expected to impact the overall coverage goals for Year 3. The areas planted during the repair work will be monitored during Year 3 as detailed in Section 5.2 to confirm that plants and grasses are establishing as expected, and that the overall coverage goals will be achieved during Year 3. No evidence of excessive vegetation destruction by geese or other animals was observed. Additionally, butterfly bush, blackberry, and other noxious weeds were removed in May and June of 2010. No significant presence of noxious weeds was noted during November vegetation monitoring events.

### **3.4.1 Willow Planting Establishment**

Coverage goals for the willow planting between elevations 15 to 20 feet NGVD are:

- 50 percent coverage by Year 3
- 80 percent coverage by Year 5

In accordance with the IMRP, the following Point Intercept Transect (PIT) procedure was used to determine Year 2 coverage:

- Transects were completed every 100 feet along the stabilization area planted.
- A rag tape was laid along the slope from elevation 15 feet to elevation 30 feet NGVD.
- A survey occurred every 2 feet along the tape. If vegetation occurred within a vertical line up from the survey point, this survey point was considered to have vegetative cover.

A statistical average of the percent coverage was determined for the area disturbed by the WB repair construction (i.e., 0 to 275 feet from the mouth of the bay) and the remaining area of the bay. The average coverage for the planted area disturbed by the WB repair construction from 0 to 275 feet from the mouth of the bay was 70 percent. The average coverage for the remaining area from 275 to 700 feet from the mouth of the bay was 74 percent. The average coverage for the entire planting area from 0 to 700 feet from the mouth of the bay was 73 percent. Based on the results of the PIT procedure, the willow planting establishment for the entire planted area, including the new planted areas completed during the repair work, is anticipated to meet Year 3 coverage goals. As such, the new planted areas are not expected to impact the overall coverage goals for Year 3. The areas planted during the repair work will be monitored during Year 3 as described in Section 5.2 to confirm that plants are establishing as expected, and that the overall coverage goals will be achieved during Year 3.

### **3.4.2 Grass Planting Establishment**

Grass planting coverage goals between elevations 20 to 30 feet NGVD are:

- 80 percent coverage in Year 3
- 80 percent coverage in Year 5

In accordance with the IMRP, Year 2 grass coverage was determined based on a visual assessment of the entire elevation 20 to 30 feet NGVD. As part of the repair work, a portion of the site was used to transfer materials downslope (material transfer zone) and was subsequently hydroseeded between 235 and 270 feet from the mouth of the bay (Figure 8). Results of the visual assessment for the area not affected by the material transfer zone indicated more than 95 percent coverage for the grass planted area from 0 to 235 and 270 to 700 feet from the mouth of the bay. At the time of the observation, the area affected by the construction was recently hydroseeded and had zero percent coverage. This area represents approximately 5 percent of the total grass planting area. Therefore, results of the visual assessment for the entire grass planting area including the area affected by the repair work indicated more than 90 percent coverage. Based on the monitoring performed, the entire grass planted area, including the new grass planted area completed during the repair work, is anticipated to meet Year 3 goals. As such, the new grass planted area is not expected to impact the overall coverage goals for Year 3. As with the willow plantings, the grass area planted during the repair work will be monitored during Year 3 as described in Section 5.2 to confirm that grasses are establishing as expected, and that the overall coverage goals will be achieved during Year 3.

---

#### **4 WHEELER BAY SHORELINE STABILIZATION REPAIR SUMMARY**

This section provides a brief summary of the repair work performed at WB. A Closure Report with a detailed description of construction activity was approved by USEPA on February 1, 2011 (Anchor QEA 2011). The repair work included placing additional armor on top of the existing armor, anchoring LWD parallel to the shoreline, and placing additional plantings above the armor protection between 0 and 275 feet from the mouth of the bay. The design modification is intended to better protect the shoreline based on the causes of the current erosion. As a preventative measure, additional plantings and anchored LWD were placed along the remainder of the shoreline between 275 and 700 feet from the mouth of the bay. The major design elements are shown in Figures 7 and 8.

This design modification is consistent with the Terminal 4 Phase I Removal Action final design, which was approved by USEPA. The modified design occurred within the original footprint of the Phase I WB work and consists of similar activities.

---

## **5 CONCLUSIONS AND NEXT STEPS**

### **5.1 Head of Slip 3 Cap**

No instability, sloughing, or sheens were observed; therefore, no further monitoring action beyond what is required in the IMRP is recommended for the head of Slip 3 cap at this time.

Future monitoring will include a visual survey of the slope upland of the pinch-pile wall for sloughing and stability to determine if it is stable, to be performed once yearly during low water levels. In addition, a survey of the pinch-pile wall to assess stability of the wedge in front of the wall will be performed annually during low water levels. These surveys will be conducted at the end of each monitoring year and before high water returns, as required in the IMRP.

Surveys for the visual presence of sheens will be completed at two different water level conditions. Observations will be conducted when the water level is approximately +5 feet NGVD and when the water level is approximately +10 feet NGVD. Depending on the water level, one of these surveys may be conducted concurrently with the visual survey of the slope upland of the pinch-pile wall in October each year until Phase II work begins. Otherwise, the two surveys will be conducted when the water level is at the specified elevations prior to November of each year, as required in the IMRP.

### **5.2 Wheeler Bay**

No instability or sloughing was observed after the completion of the repair work. In addition, willow and grass planting areas, including the areas planted during the repair work, are anticipated to meet Year 3 goals. Therefore, for the area stabilized in 2008 between 275 and 820 feet from the bay, no further monitoring action beyond what is required in the IMRP is recommended at this time. However, additional monitoring is recommended for the area repaired in 2010 between 0 and 275 feet from the mouth of the bay to confirm that the repair is functioning as designed, and that vegetation coverage goals will be attained at the end of Year 3.

Quarterly monitoring is recommended for the Wheeler Bay shoreline stabilization slope repair area (between 0 and 275 feet from the mouth of the bay) to confirm that the repair is

functioning as designed, and that vegetation coverage goals will be attained at the end of Year 3. Quarterly monitoring will occur within the repair area between 0 and 275 feet from the mouth of the bay and consist of a visual survey of the slope for sloughing, stability, and erosion to determine if it is stable. A visual survey of the armor layers will also be completed quarterly to determine if excessive erosion is occurring. Based on the results of the Year 1 vegetation monitoring for the original stabilization work, which showed insignificant change from month to month, vegetation monitoring of the repaired area will also be conducted quarterly between 0 and 275 feet from the mouth of the bay.

Quarterly monitoring is expected to be frequent enough to identify any large-scale issues that could impact the repaired slope and vegetation (e.g., herbivory, drought, or erosion). The quarterly monitoring events will be conducted in approximately January, April, July, and October. One of the quarterly monitoring events will occur after a high water event. The annual Wheeler Bay surveys for the entire shoreline stabilization area will continue to be conducted in October each year as identified in the IMRP (Appendix C of the DAR, Anchor 2008).

### **5.2.1 Repaired Slope and Armor Layer Stability**

Visual monitoring after the completion of the stabilization repair did not find any spots of sloughing, instability, or erosion.

Future monitoring of the repaired shoreline from 0 to 275 feet from the mouth of the bay will occur as outlined above in Section 5.2.

### **5.2.2 Repaired Vegetation Establishment**

It is expected that the repaired vegetation areas will not impact the coverage goals for Years 3 and 5 based on the Year 2 monitoring results. However, these areas will be monitored during the first year after completion of the repair as described above in Section 5.2 to confirm this expectation. If these areas are found to impact the overall coverage goals at any point during Year 3, the coverage goals in these areas will be adjusted to meet goals 3 and 5 years after the completion of the repair work in 2010 rather than the completion of the initial stabilization work in 2008.

### **5.2.3 Condition of Habitat Layer**

No new habitat material was placed in the repaired area between 0 and 275 feet from the mouth of the bay. Existing habitat material in that area is not expected to remain in place due to erosive forces described in Section 3.3.1. In the remaining area of the bay, which is not as exposed to erosive forces (i.e., between 275 and 700 feet from the mouth of the bay) the material is expected to move around, but generally stay where placed. An annual evaluation of the condition of the habitat layer will be performed in this area on the same schedule as the other monitoring activities at WB. Evaluation of the habitat material in this area will be consistent with the method described in Section 3.3.

### **5.3 Reporting**

Annual reports will be submitted to USEPA in December. Annual reports will consist of technical memoranda with color photos of a reasonable size to interpret the conditions, a description of site conditions observed, data summaries, a statement of any deficiencies found, recommended corrective action(s), and a schedule for implementing the corrective action(s).

---

## 6 REFERENCES

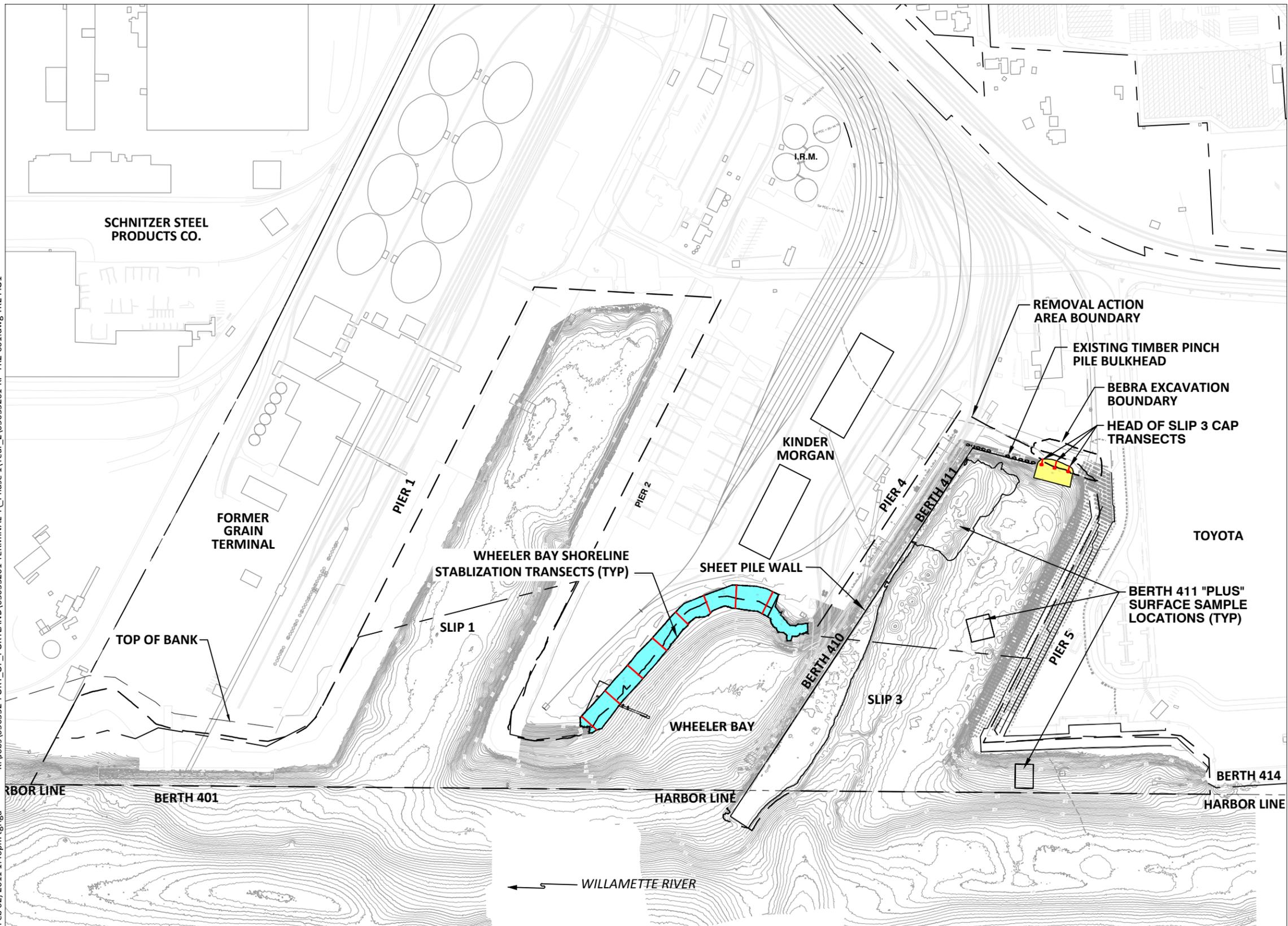
- Anchor Environmental, L.L.C. (Anchor). 2008. *Interim Monitoring and Reporting Plan (IMRP). Appendix C to the Final Design Analysis Report: Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. June 2008.
- Anchor QEA, LLC (Anchor QEA). 2010. *Final Wheeler Bay Shoreline Stabilization Slope Repair Removal Action Work Plan, Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. September 2010.
- Anchor QEA. 2011. *Final Wheeler Bay Shoreline Stabilization Slope Repair Closure Report, Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. January 2011.
- Ash Creek. 2009a. *Quarterly Report – First Quarter 2009 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. May 2009.
- Ash Creek. 2009b. *Quarterly Report – Second Quarter 2009 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. August 11, 2009.
- Ash Creek. 2009c. *Quarterly Report – Third Quarter 2009 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. November 13, 2009.
- Ash Creek. 2009d. *Quarterly Report – Fourth Quarter 2009 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. February 12, 2010.
- Ash Creek. 2010a. *Quarterly Report – First Quarter 2010 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. May 14, 2010.
- Ash Creek. 2010b. *Quarterly Report – Second Quarter 2010 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. August 13, 2010.
- Ash Creek. 2010c. *Quarterly Report – Third Quarter 2010 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. November 12, 2010.
- Ash Creek – NewFields. 2008. *Quarterly Report – Third Quarter 2008 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. November 2008.
- Ash Creek – NewFields. 2009. *Quarterly Report – Fourth Quarter 2008 Terminal 4 Slip 3 Upland Facility*. Prepared for the Port of Portland. February 2009.
- DEQ. 2003. Record of Decision, Port of Portland Terminal 4 Slip 3 Upland. Oregon Department of Environmental Quality. April 21, 2003.

- DEQ. 2004. Explanation of Significant Difference, Port of Portland Terminal 4 Slip 3 Upland Facility. Oregon Department of Environmental Quality. September 1, 2004.
- NMFS. 2008. Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the U.S. Environmental Protection Agency and Port of Portland Terminal 4 Superfund Phase I of the Removal Action, Willamette River (HUC 17090012), Multnomah County, Oregon. July, 2008.
- Sorensen, R.M. 1997. *Interim Report for the Upper Mississippi River – Illinois Waterway System Navigation Study: Prediction of Vessel-Generated Waves with Reference to vessels Common to the Upper Mississippi River System*. Prepared for the U.S. Army Corps of Engineers, Rock Island District, St. Louis District, and St. Paul District. TA7 W3499 R5U7 ENV Report 4 1997. December 1997.

# FIGURES

---

K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year 2\05033201-RP-YR2-001.dwg YR2 FIG1  
Feb 02, 2011 1:46pm tgriga

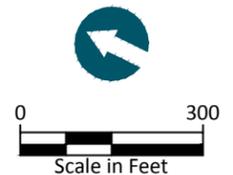


**LEGEND:**

- WHEELER BAY SHORELINE STABILIZATION
- HEAD OF SLIP 3 CAP
- DSL PROPERTY LINE
- TRANSECT
- SURVEYORS SPIKE

**NOTES:**

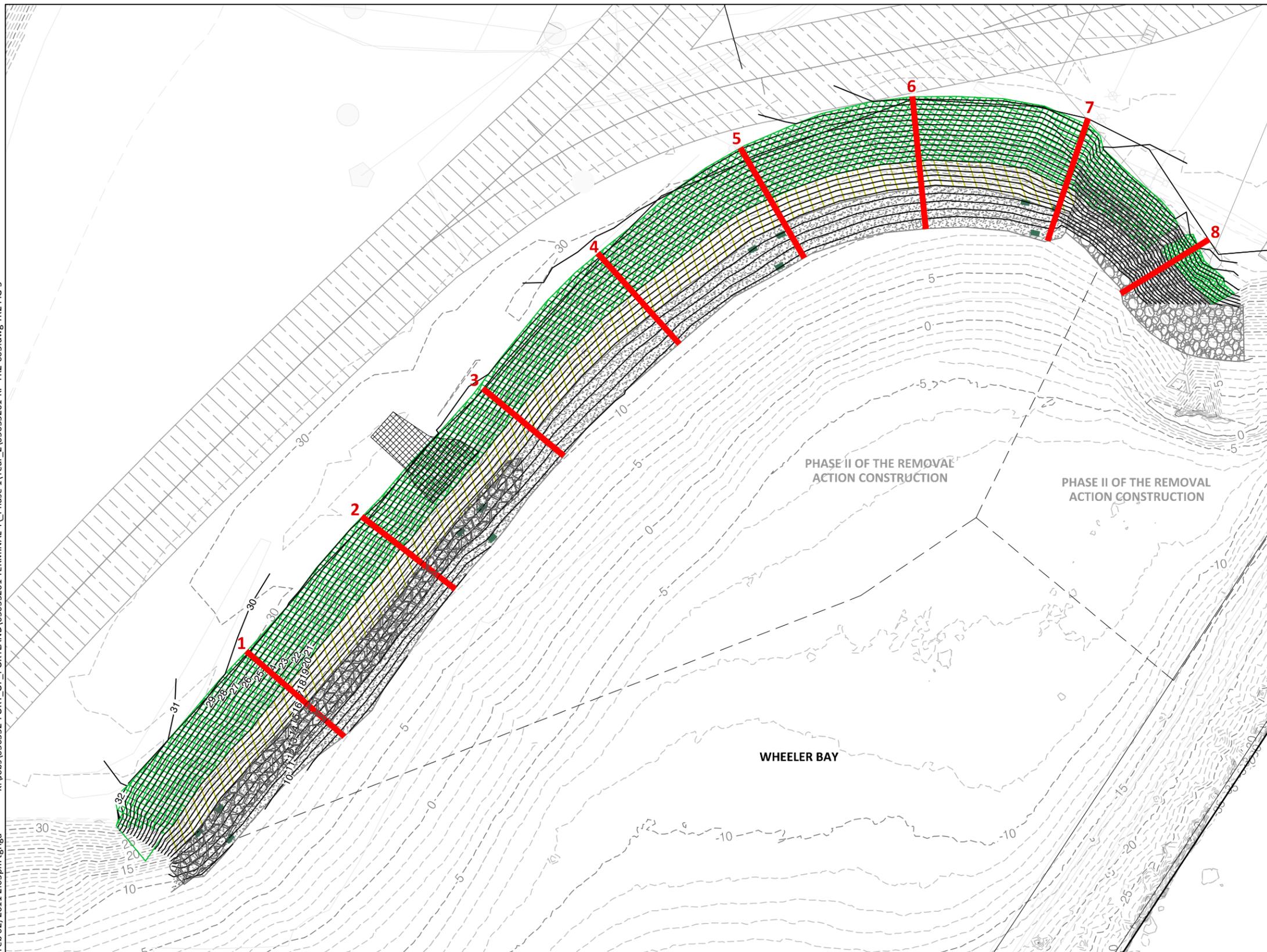
1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)  
VERTICAL DATUM: NGVD 29-47  
CONTOUR INTERVAL = 1FT
2. BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED MAY, 2007





Willow Scarp Example

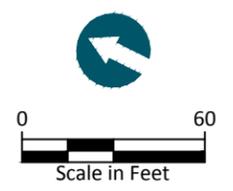
K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year\_2\05033201-RP-YR2-003.dwg YR2 FIG 3  
 Feb 02, 2011 2:05pm tgriga



**LEGEND:**

-  2008 AS-BUILT HYDROSEED AND JUTE MAT
-  2010 AS-BUILT HYDROSEED
-  2008 AS-BUILT COIR FABRIC AND PLANTINGS WITH MULCH
-  2008 AS-BUILT HABITAT ROCK
-  2008 AS-BUILT ARMOR ROCK
-  2010 AS-BUILT ARMOR ROCK
-  2008 AS-BUILT ECOLOGY BLOCK LWD ANCHORS (BURIED MINIMUM 4 FEET BELOW FINISH GRADE)
-  -25- 2008 RE-CONSTRUCTION CONTOURS
-  -20- 2008 AS-BUILT CONTOURS
-  **1** SLOPE STABILITY TRANSECT

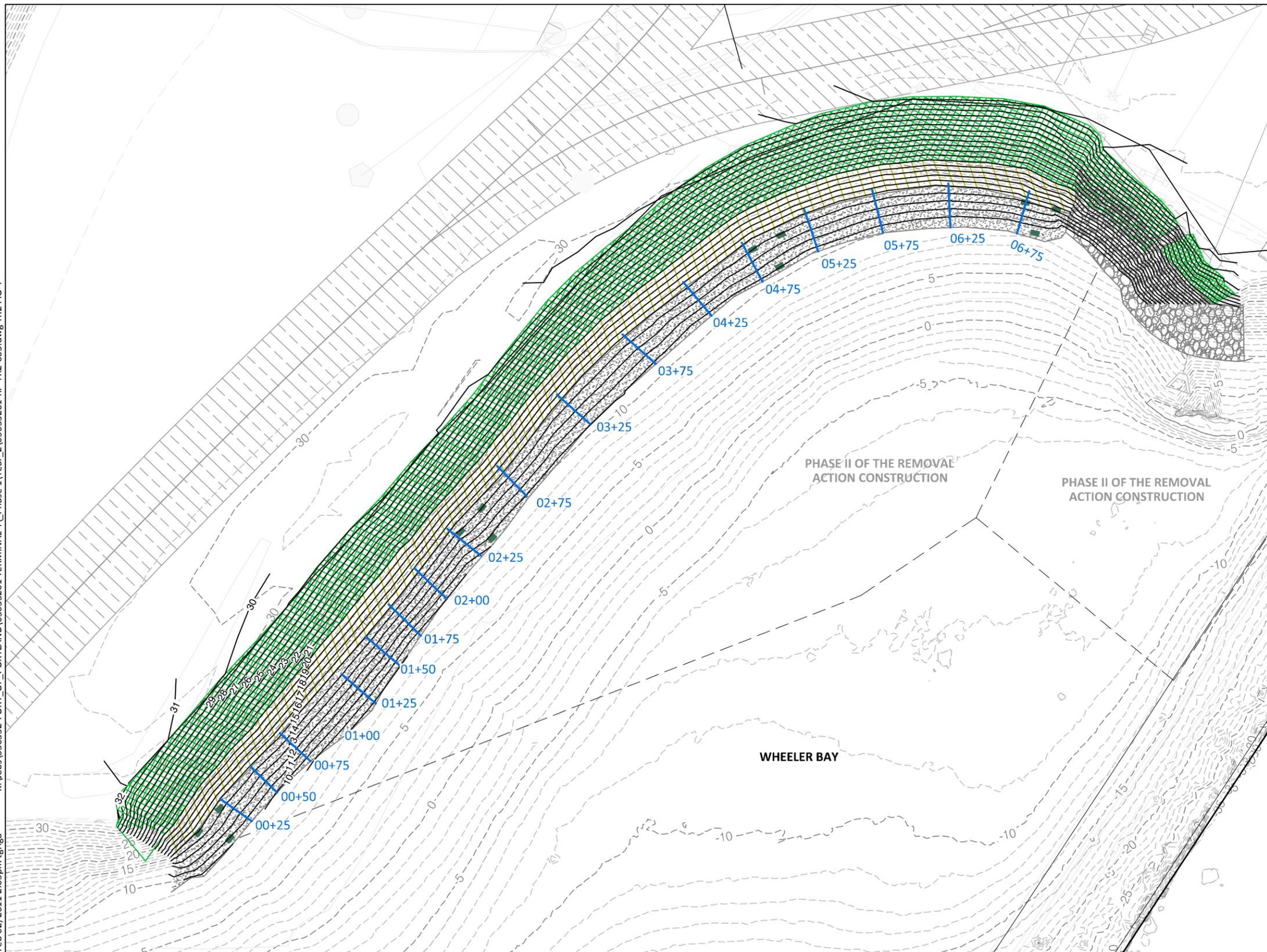
- NOTES:**
1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)  
 VERTICAL DATUM: NGVD 29-47  
 CONTOUR INTERVAL = 1 FT
  2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
  3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
  4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008 AND PROVIDED BY ASH CREEK.



**Figure 3**  
 Wheeler Bay Year 2 Slope Stability Transect Locations  
 Year 2 Interim Monitoring Report - Terminal 4 Phase I Removal Action  
 Port of Portland



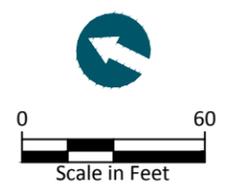
K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year 2\05033201-RP-YR2-003.dwg YR2 FIG 4  
 Feb 02, 2011 2:05pm tgriga



**LEGEND:**

-  2008 AS-BUILT HYDROSEED AND JUTE MAT
-  2008 AS-BUILT COIR FABRIC AND PLANTINGS WITH MULCH
-  2008 AS-BUILT HABITAT ROCK
-  2008 AS-BUILT ARMOR ROCK
-  2008 AS-BUILT ECOLOGY BLOCK LWD ANCHORS (BURIED MINIMUM 4 FEET BELOW FINISH GRADE)
-  2008 RE-CONSTRUCTION CONTOURS
-  2008 AS-BUILT CONTOURS
-  00+25 HABITAT LAYER TRANSECT

- NOTES:**
1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)  
 VERTICAL DATUM: NGVD 29-47  
 CONTOUR INTERVAL = 1 FT
  2. PRE-CONSTRUCTION BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED NOVEMBER, 2007
  3. PRE-CONSTRUCTION UPLAND SURVEY PROVIDED BY PORT OF PORTLAND DATED JANUARY 2008.
  4. AS-BUILT UPLAND SURVEY BY MINISTER-GLASER DATED OCTOBER 13, 2008 AND PROVIDED BY ASH CREEK.



**Figure 4**  
 Wheeler Bay Year 2 Habitat Layer Transect Locations and 2008 As-Built  
 Year 2 Interim Monitoring Report - Terminal 4 Phase I Removal Action  
 Port of Portland



Transect 00+25 (T,M,B)



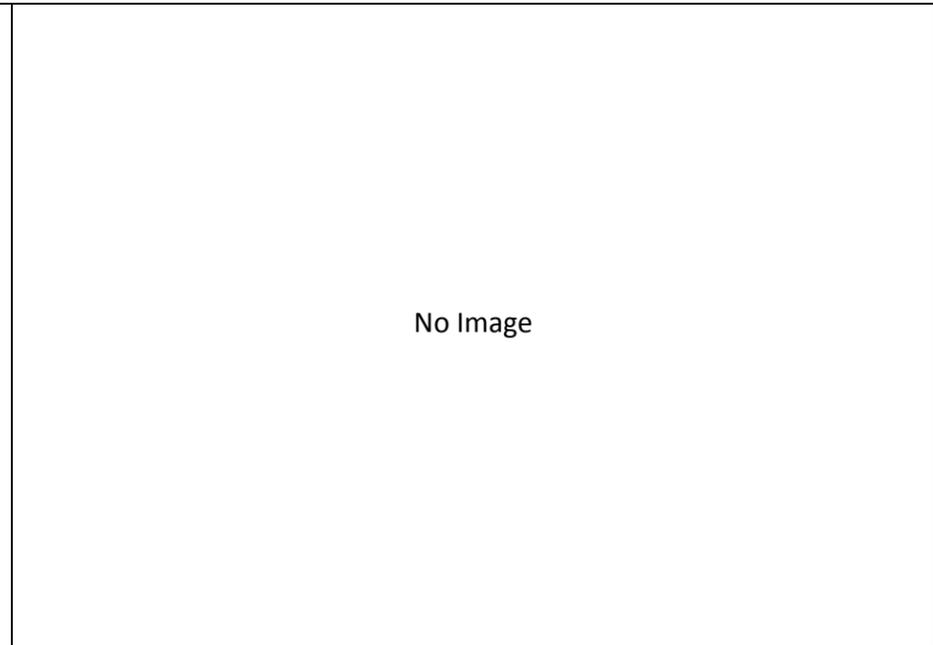
Transect 00+50 (T,M,B)



Transect 00+75 (T,M,B)



Transect 01+00 (T,M,B)



Transect 01+25 (T,M)



Transect 01+50 (T,M,B)



Transect 01+75 (T,M,B)



Transect 02+00 (T,M,B)



Transect 02+25 (T,M,B)



Transect 02+75 (T,M,B)



Transect 03+25 (T,M,B)



Transect 03+75 (T,M,B)



Transect 04+25 (T,M,B)



Transect 04+75 (T,M,B)



Transect 05+25 (T,M,B)

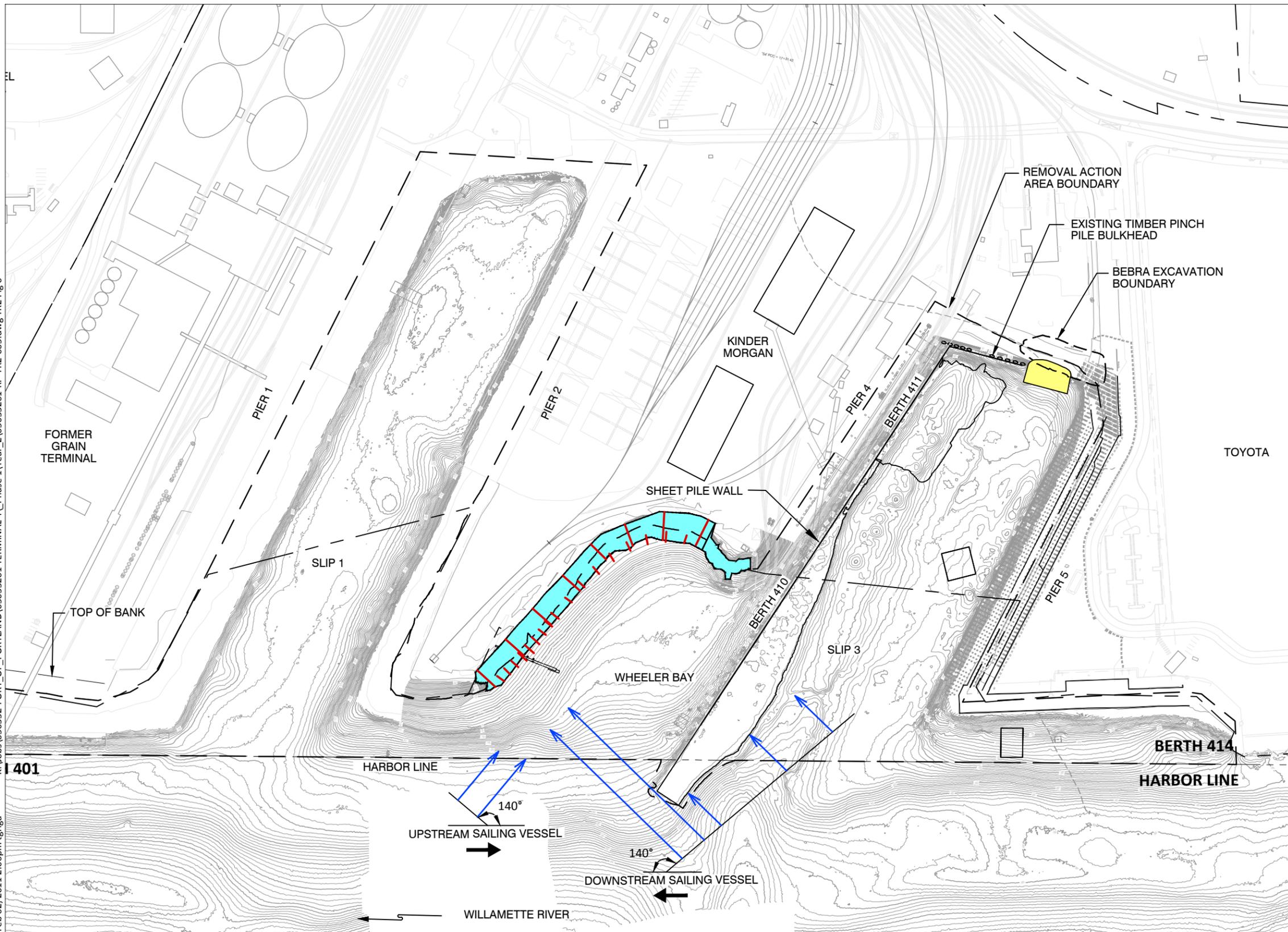


Transect 05+75 (T,M,B)



Transect 06+25 (T,M,B)

K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\_Phase 1\Year 2\05033201-RP-YR2-005.dwg YR2 Fig 6  
 Feb 02, 2011 2:06pm tgriga

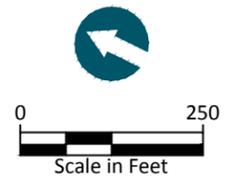


**LEGEND:**

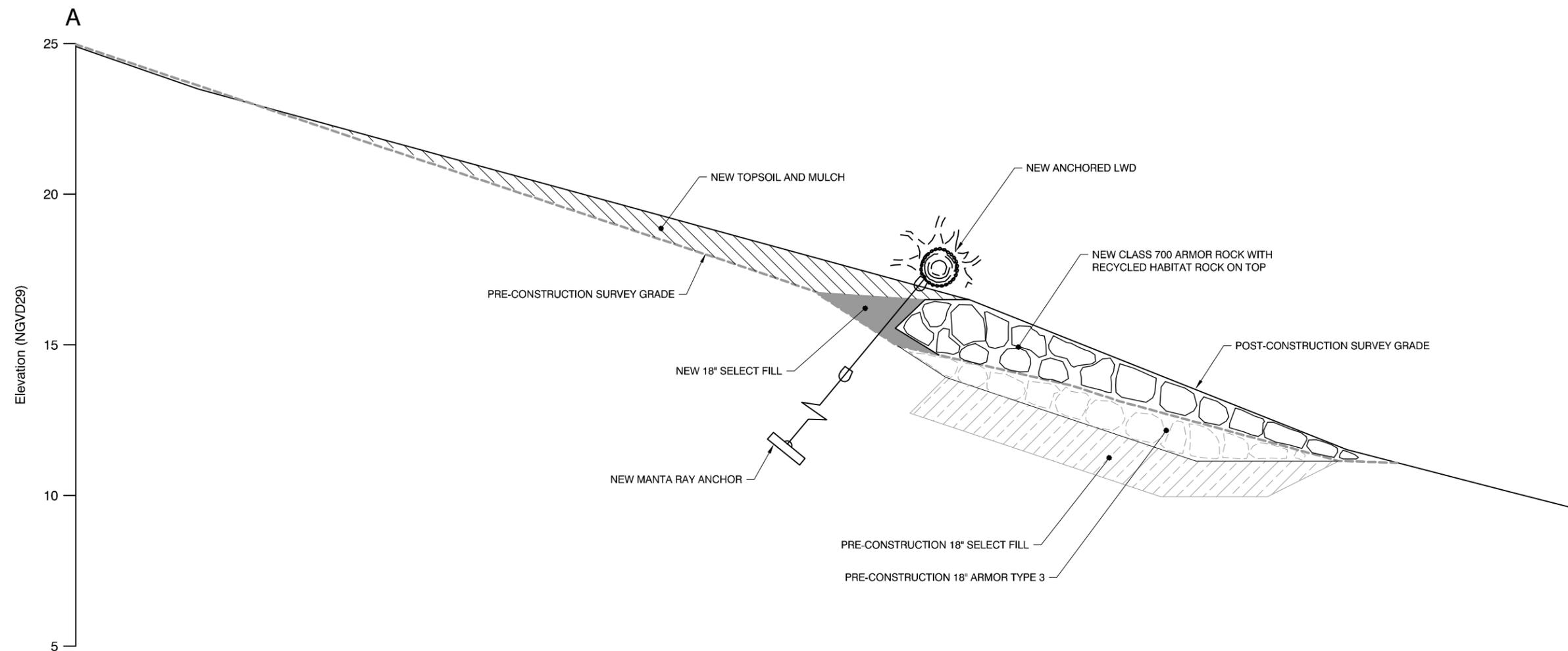
- WHEELER BAY SHORELINE STABILIZATION
- HEAD OF SLIP 3 CAP
- DSL PROPERTY LINE
- TRANSECT
- VESSEL WAKE

**NOTES:**

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)  
 VERTICAL DATUM: NGVD 29-47  
 CONTOUR INTERVAL = 1FT
2. BATHYMETRIC SURVEY BY PORT OF PORTLAND DATED MAY, 2007



K:\Jobs\050332-PORT\_OF\_PORTLAND\05033201\_TERMINAL\_4\Phase 1\Year 2\05033201-RP-YR2-006.dwg YR2 FIG 7  
Feb 02, 2011 2:08pm tgriga

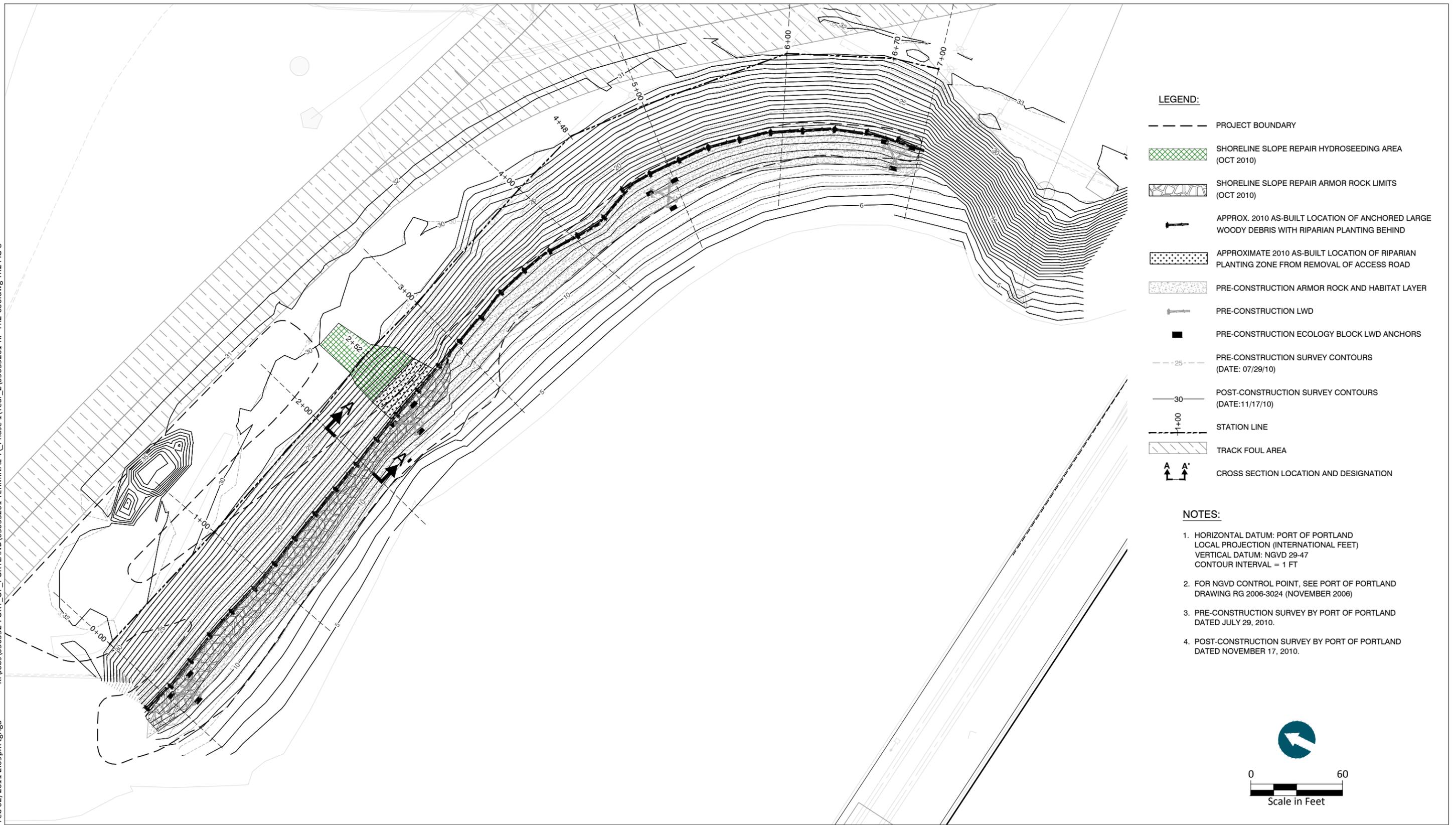


TYPICAL AS-BUILT SLOPE REPAIR SECTION

NOTES:

1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)  
VERTICAL DATUM: NGVD 29-47

K:\Jobs\050332-PORT OF PORTLAND\05033201\_TERMINAL 4\_Phase 1\Year 2\05033201-RP-YR2-006.dwg YR2 FIG 8  
Feb 02, 2011 2:09pm tgriga



APPENDIX A  
WHEELER BAY AND HEAD OF SLIP 3 CAP  
YEAR 2 VISUAL SLOPE AND ARMOR  
SURVEY MONITORING REPORT

---



photographs were taken of slope stability at each transect. Approximate transect locations are shown in Figure A-1 (attached). Actual GPS points are provided in Table 1. Notes and photographs were taken of slope stability at each transect. Data sheets and photographs from the site visit are provided in the attachments to this memorandum (Attachments A-1 and A-2; respectively).

**Table 1**  
**Wheeler Bay Transects**

Transect	Upslope		Downslope	
	Latitude	Longitude	Latitude	Longitude
1	45.60283	122.77720	45.60284	122.77731
2	45.60277	122.77673	45.60266	122.77676
3	45.60259	122.77647	45.60261	122.77676
4	45.60263	122.77608	45.60253	122.77612
5	45.60250	122.77572	45.60242	122.77582
6	45.60225	122.77551	45.60227	122.77554
7	45.60204	122.77528	45.60208	122.77547
8	45.60182	122.77541	45.60192	122.77551

## **Results**

- **Slope stability:** No sloughing, instability, or erosion was observed in the willow or grass planting areas (elevations +15 to +25 feet NGVD).
- **Armor layer stability:** The armor layer at Wheeler Bay showed no signs of instability, sloughing, or erosion during the November 9, 2010 site visit.
- **Stability/presence of woody debris as designed:** All wood debris installed as part of the construction design was in place, stable, and in good condition at the time of both site visits. In addition to the installed large wood debris, a significant amount of drift wood is also present.

## **Head of Slip 3 Cap**

Monitoring of the head of Slip 3 cap was performed to confirm the following:

- Slope stability
  - Absence of sheens
-

Transects were established on 40-foot spacings perpendicular to the shoreline to confirm slope stability. A total of three transects were re-established based on the Year 1 locations. Transects were marked with flags and walked from the upslope edge of the stabilization area to the water on May 19 and October 18, 2010. Notes and photographs were taken of slope stability at each transect. Data sheets and photographs are provided in the attachments (Attachments A-3 and A-4; respectively). Actual GPS points are provided in Table 2.

In addition, the water along the cap was observed for the presence of sheens. Observations occurred during post-high water (May 19, 2010) and post-low water conditions (October 18, 2010). Water levels during the observation events were approximately +6.7 and between +2.0 feet NGVD, respectively. Notes and photographs were taken during observation events. Data sheets and photographs are provided as attachments to this memorandum (Attachments A-5 and A-6; respectively).

## **Results**

No areas of instability were observed along any portion of the stabilized slope. Armor rocks were stable and free of erosion and sloughing. No sheens were observed during either of the sheen observation events.

**Table 2**  
**Slip 3 Transects**

<b>Transect</b>	<b>Latitude</b>	<b>Longitude</b>
1	45.60049	122.77257
2	45.60035	122.77255
3	45.60025	122.77252

Note: No upslope GPS point was taken.

## **Conclusions**

### ***Wheeler Bay***

No sloughing or instability of the slope or armor layer was observed. No further monitoring action beyond what is required by the IMRP is recommended for the Wheeler Bay shoreline at this time.

---

### ***Head of Slip 3 Cap***

No instability, sloughing, or sheens were observed; therefore, no further monitoring action beyond what is required in the IMRP is recommended for the head of Slip 3 cap at this time.

### **REFERENCES**

Anchor Environmental, L.L.C. (Anchor). 2008. Interim Monitoring and Reporting Plan (IMRP). Appendix C to the Final Design Analysis Report: Terminal 4 Phase I Removal Action. Prepared for the Port of Portland. June 2008.

ATTACHMENT A-1  
WHEELER BAY MONITORING DATA  
SHEETS

---

ANCHOR Slope Observation Data Sheet

Observation Date: 11/9/10

Project Name: Year 2 observ. Project No: 050332-01

Observation Crew: G. Nagler + J. Fox

Datum (circle one): NAD 83 / WGS 84 / NAD 27 / Lat long WGS 84 Weather: rainy overcast 40°F.

Transect 1	Upslope Station		Downslope Station	
	N:	E:	N:	E:
Comments: Pix 215	No erosion or slope instability seen.		Pix 216 On Station	

Transect 2	Upslope		Downslope	
	N:	E:	N:	E:
Comments: Pix 217 On station	No erosion or slope instability seen.		Pix 218	
Note: Access road intact no erosion + grass is growing				

Transect 3	Upslope		Downslope	
	N:	E:	N:	E:
Comments: Pix 219 On station	No erosion or slope instability seen.		Pix 220	

Transect 4	Upslope		Downslope	
	N:	E:	N:	E:
Comments: Pix 221 On station	No erosion or slope instability seen.		Pix 222 + 223	

Transect 5	Upslope		Downslope	
	N:	E:	N:	E:
Comments: Pix 224 On station	No erosion or slope instability seen.		Pix 225	

Recorded by: J. Fox, G. Nagler



Slope Observation Data Sheet

Project Name: Year 2 Obsn, Project No: 050332-01

Transect 6	Upslope Station		Downslope Station	
	N	E	N	E
Comments:				
PIX 226 No erosion or slope instability seen PIX 227 On station				

Transect 7	Upslope		Downslope	
	N	E	N	E
Comments:				
PIX 228 No erosion or slope instability seen, PIX 229 On station				

Transect 8	Upslope		Downslope	
	N	E	N	E
Comments:				
PIX 331 No erosion or slope instability seen, PIX 330 On station				

Transect 9	Upslope		Downslope	
	N	E	N	E
Comments:				

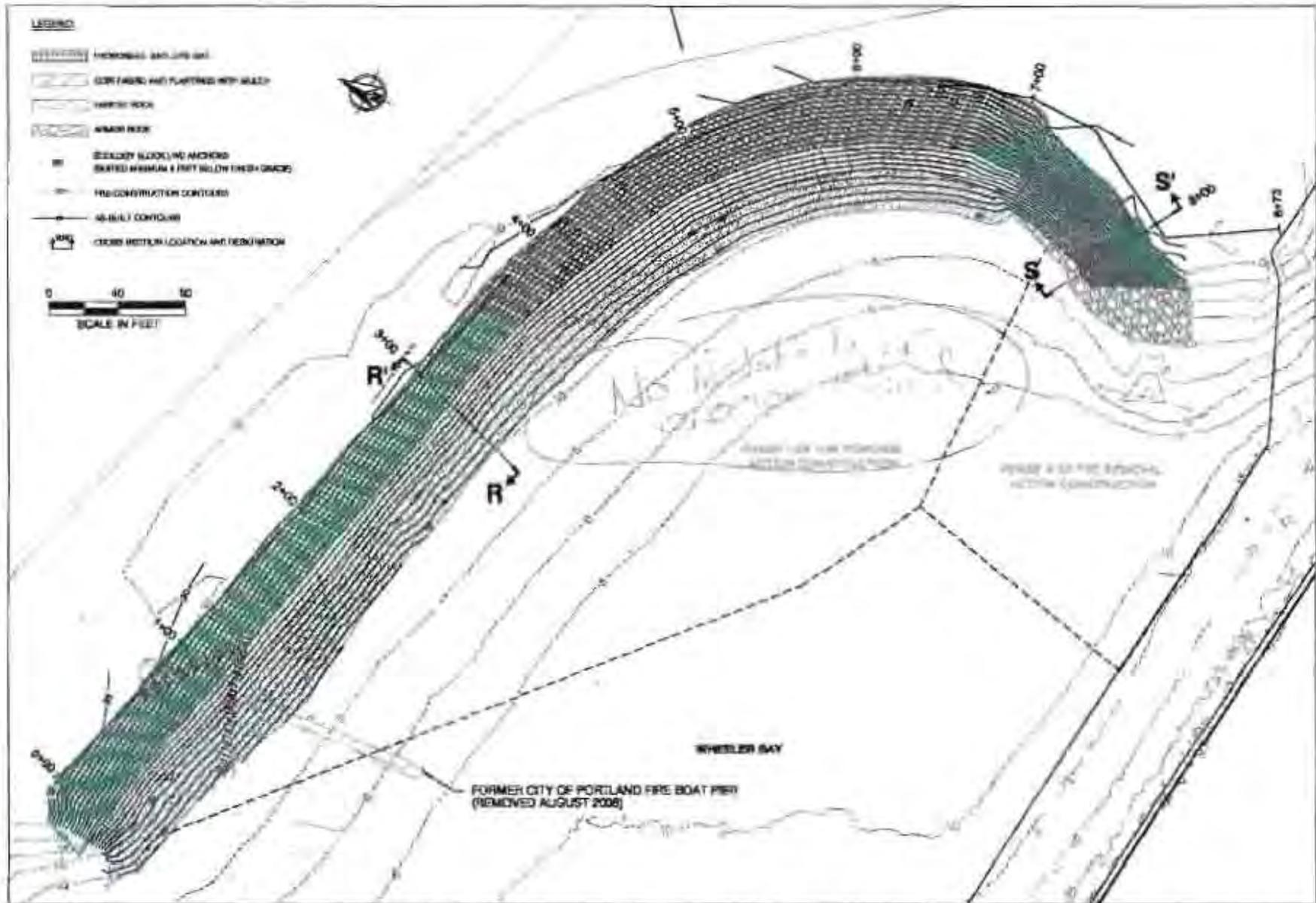
Transect 10	Upslope		Downslope	
	N	E	N	E
Comments:				

Additional Comments:  
PIX of entire slope of looking from transect 1  
232

Recorded by: J. Fox + G. Naylor

# Wheeler Bay Slope + Armor Observation

Date 11/19/10



As-Built Wheeler Bay Shoreline Stabilization Surface Plan View and Cross Section Locations  
Terminal 4, Portland, Oregon



Recorded by S. For. G. Naylor

ATTACHMENT A-2  
WHEELER BAY MONITORING  
PHOTOGRAPHS

---



Transect 1, looking down-slope 11/9/2010



Transect 2, looking down-slope 11/9/2010



Transect 3, looking down-slope 11/9/2010



Transect 4, looking down-slope 11/9/2010



Transect 5, looking down-slope 11/9/2010



Transect 6, looking down-slope 11/9/2010



Transect 7, looking down-slope 11/9/2010



Transect 8, looking down-slope 11/9/2010

ATTACHMENT A-3  
HEAD OF SLIP 3 CAP MONITORING  
DATA SHEETS – SLOPE STABILITY

---

ANCHOR Slope Observation Data Sheet



Project Name: Reel of Slope 3

Project No: 050332-01

Observation Crew: J. Fox Sr. Wagner

Datum (circle one): NAD 83 / WGS 84 / NAD 27 (Lat Long) 11.500m WINDY, OVERCAST

100% level of water table for well 100°F

Transect 1	Upslope			Downslope		
	N	E	S	N	E	S
Comments	Pit 233 sand facing slope			Pit 235 down slope		
	Pit 234 up slope station			No erosion or instability seen		
	On station					

Transect 2	Upslope Station			Downslope Station		
	N	E	S	N	E	S
Comments	Pit 236			Pit 237		
	No erosion or instability seen					
	On station					

Transect 3	Upslope			Downslope		
	N	E	S	N	E	S
Comments	Pit 238			Pit 239		
	No erosion or instability seen					
	On station					
	Pit 240 - North Facing across slope					

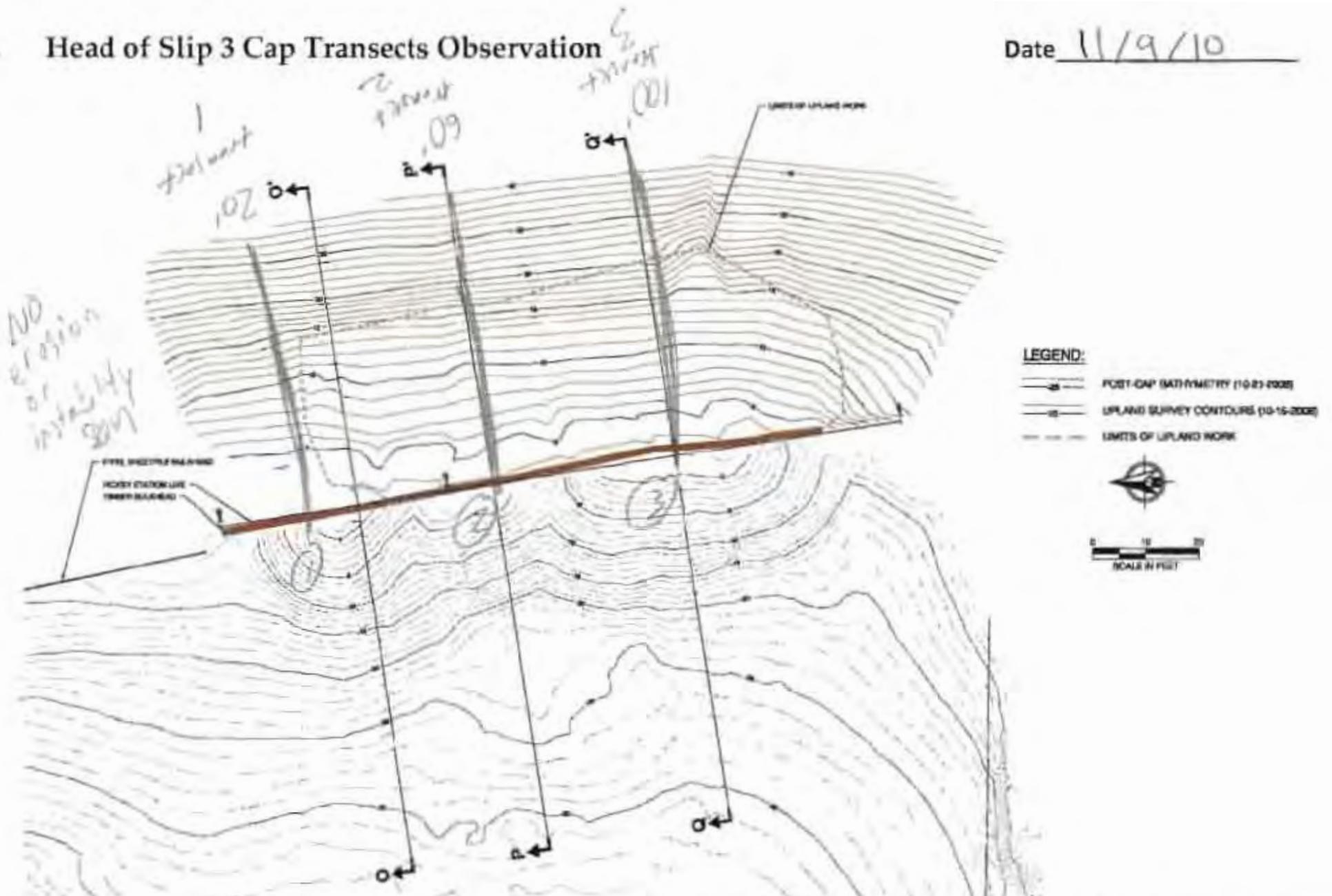
Transect 4	Upslope			Downslope		
	N	E	S	N	E	S
Comments	<del> </del>					

Transect 5	Upslope			Downslope		
	N	E	S	N	E	S
Comments	<del> </del>					

Recorded by: J. Fox

# Head of Slip 3 Cap Transects Observation

Date 11/9/10



As-built Head of Slip 3 Capping and Upland Plan View and Cross Section Locations  
Terminal 4, Portland, Oregon



Recorded by J. Fox, G. Nagler

ATTACHMENT A-4  
HEAD OF SLIP 3 CAP MONITORING  
PHOTOGRAPHS – SLOPE STABILITY

---



Slip 3 slope looking South 11/9/2010



North Transect, looking down-slope 11/9/2010



North Transect, looking up-slope 11/9/10



Middle Transect, looking down-slope 11/9/2010



Middle Transect, looking up-slope 11/9/2010



South Transect, looking down-slope 11/9/2010



South Transect, looking up-slope 11/9/2010



Slip 3 slope looking North 11/9/2010

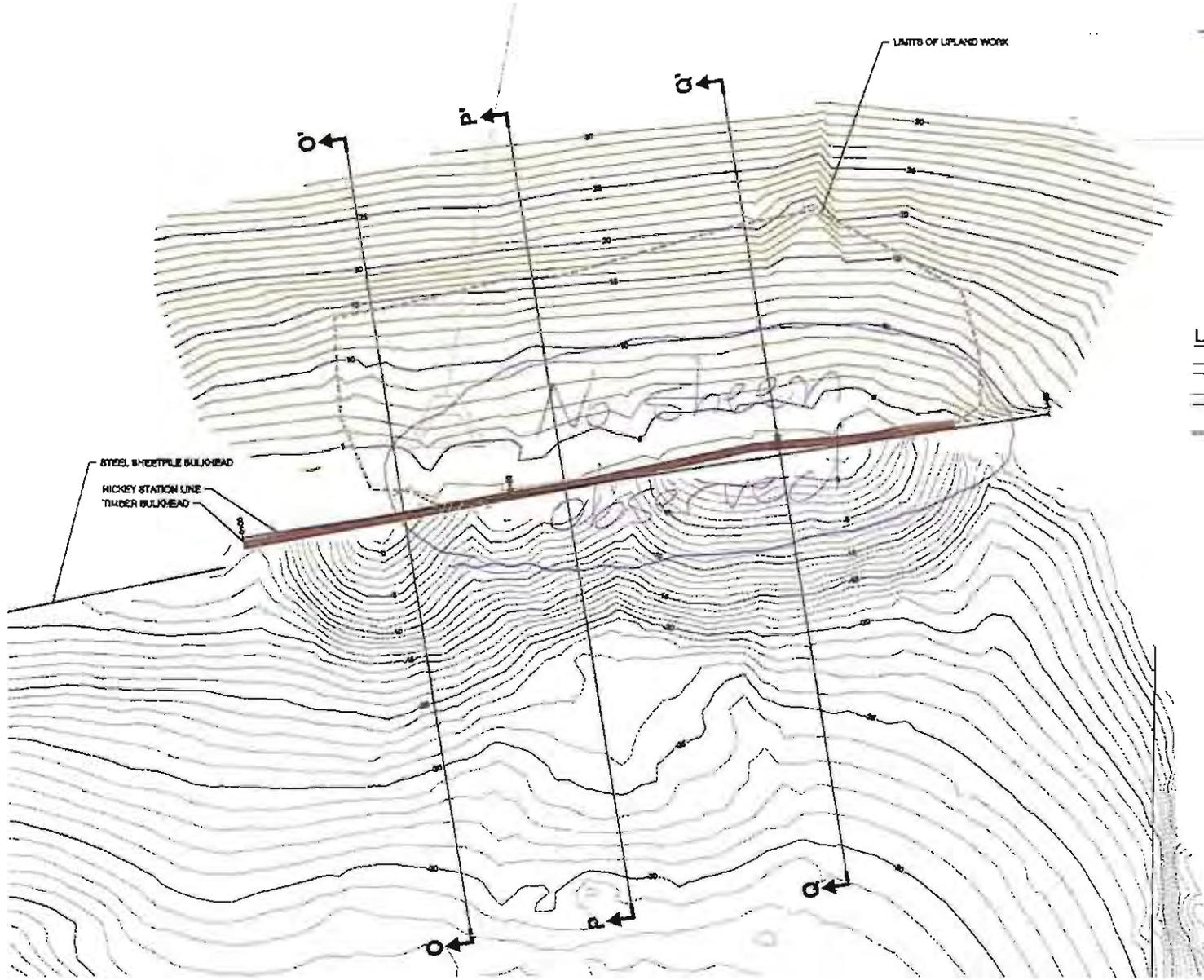
ATTACHMENT A-5  
HEAD OF SLIP 3 CAP MONITORING  
DATA SHEETS – SHEEN

---

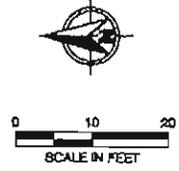
# Head of Slip 3 Cap Transects Observation

Date 5/19/10

Tide 6.7 CRD @  
1140

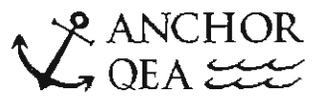


- LEGEND:**
- POST-CAP BATHYMETRY (10-21-2008)
  - UPLAND SURVEY CONTOURS (10-16-2008)
  - LIMITS OF UPLAND WORK



Pictures  
Taken

As-built Head of Slip 3 Capping and Upland Plan View and Cross Section Locations  
Terminal 4, Portland, Oregon



Recorded by D. LAFFAN / G. Nagler

**DAILY SAFETY MEETING RECORD**

Project: T-4 IMRP Slip 3

Date: 5/19/10

Time: 1130

Person Conducting Meeting: G. Nagler

Persons Attending Meeting: D. Laffoon

Topics Addressed/Issues Raised:

Slip trips & fall removal wrap up, rain makes rocks slippery  
Keep distance from water. Call 911 immediately if required.

Date:

Time:

Person Conducting Meeting:

Persons Attending Meeting:

Topics Addressed/Issues Raised:

Date:

Time:

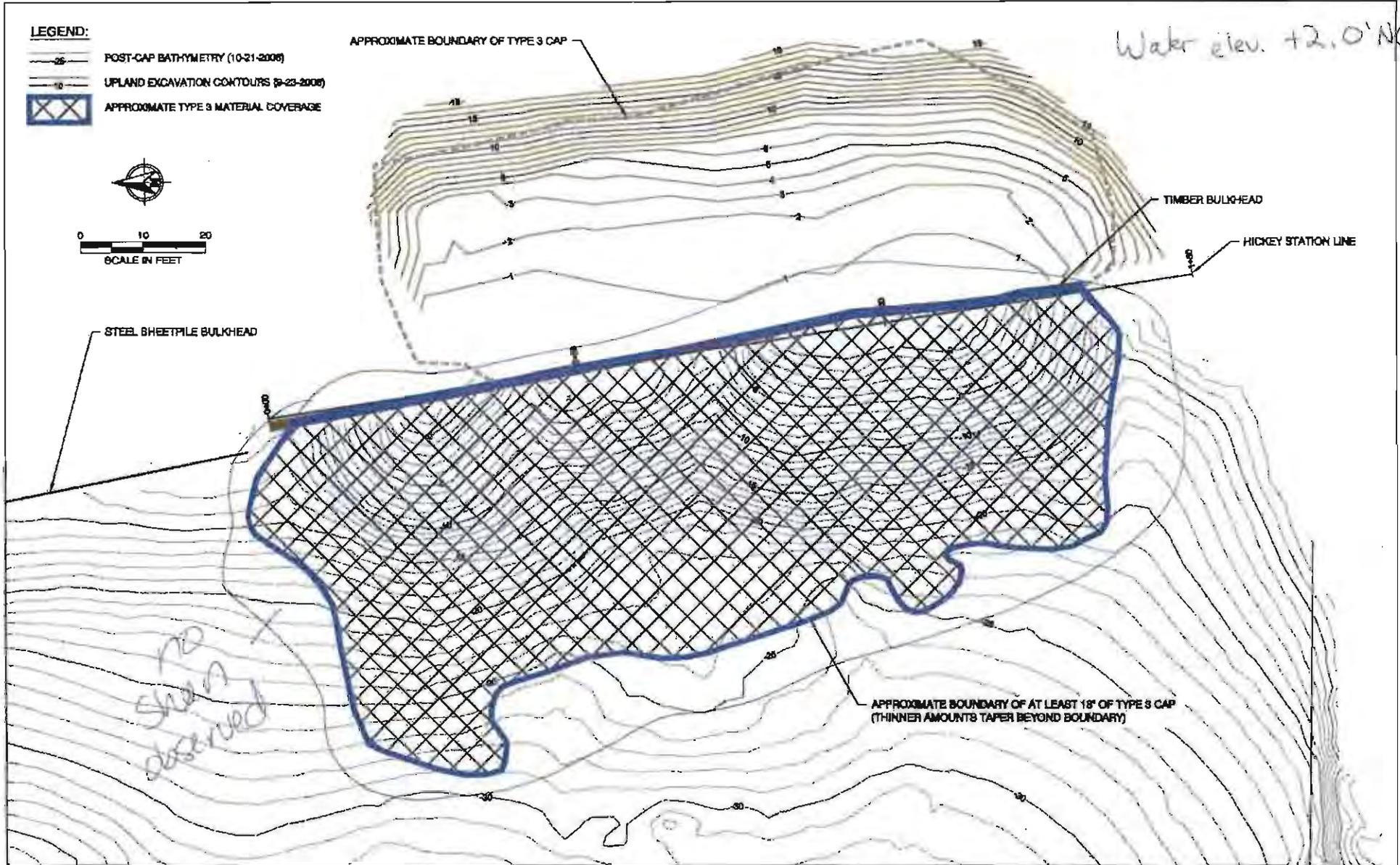
Person Conducting Meeting:

Persons Attending Meeting:

Topics Addressed/Issues Raised:

# Head of Slip 3 Cap Area Observation

Date 10-18-10 9:53-4



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3 Terminal 4, Portland, Oregon



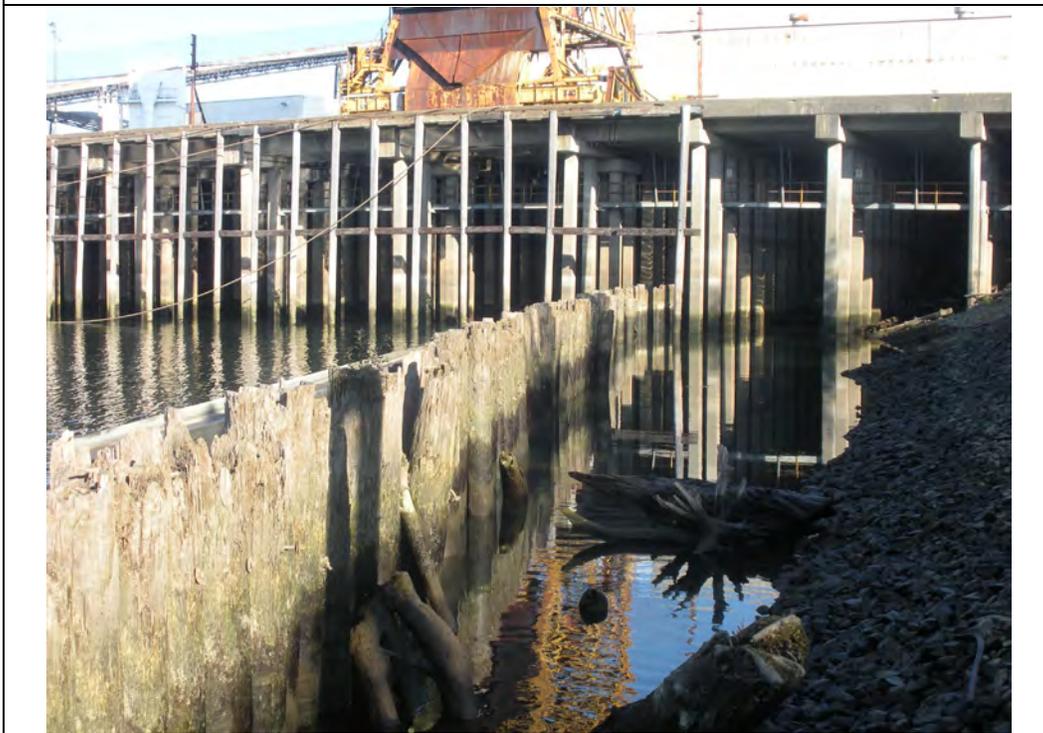
Recorded by G. Nagler + J. Fox

ATTACHMENT A-6  
HEAD OF SLIP 3 CAP MONITORING  
PHOTOGRAPHS – SHEEN

---



High water sheen observation 5/19/2010



Low water sheen observation 10/18/2010