



FINAL
YEAR 3 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

May 2012

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1 INTRODUCTION

This document provides a summary of the third 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) and the *Final Year 2 Interim Monitoring Report* (Anchor QEA 2011a). 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 third 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 December 12, 2011, in the *Draft 2011 Wheeler Bay Shoreline Stabilization Slope Repair Closure Report* (Anchor QEA 2011b).

This document (Section 3) also provides a summary of monitoring results for the 2010 repaired shoreline at Wheeler Bay (between 0 and 275 feet from the mouth of the bay). The monitoring requirements for the repaired shoreline were described in the 2010 *Final Wheeler Bay Shoreline Stabilization Slope Repair Closure Report* (2010 Closure Report; Anchor QEA 2011c). Although not required by the IMRP, this document also summarizes monitoring results for the existing habitat layer (between 275 and 700 feet from the mouth of the bay) as described in the Year 2 Monitoring Report (Anchor QEA 2011a).

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. Additional monitoring requirements of the habitat layer and repaired shoreline at Wheeler Bay were established in the Year 2 Monitoring Report (Anchor QEA 2011a) and the 2010 Closure Report (Anchor QEA 2011c).

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

- Armor layer stability
- Absence of sheens

WB stabilization monitoring of the 2010 repaired slope (between 0 and 275 feet from the mouth of the bay) was performed to confirm the following:

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

WB stabilization monitoring of the existing slope (between 275 and 700 feet from the mouth of the bay) was performed to confirm the items above and also the condition of the habitat layer.

1.2 Schedule of Year 3 Interim Monitoring Events

The following list summarizes the monitoring events conducted during Year 3:

- The head of Slip 3 sheen observations were conducted on May 12 and November 4, 2011.
- Slip 3 cap visual armor and slope stability surveys were conducted on November 4, 2011.
- A survey of the pinch-pile wall was performed on September 9, 2011.
- The Year 3 vegetation assessment and visual armor and slope stability survey of the existing shoreline (from 275 to 700 feet from the mouth of the bay) at WB was performed on October 27, 2011.
- The habitat layer material of the existing slope was also observed at WB on October 27, 2011.
- Quarterly monitoring of the vegetation and slope stability of the repaired shoreline (from 0 to 275 feet from the mouth of the bay) was performed on February 2, April 27, June 29, and October 27, 2011.

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 3 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A.

2.1 Armor Layer Stability

2.1.1 Visual Survey

A visual assessment of the head of Slip 3 cap area slope and armor condition was performed on November 4, 2011. The water level during the site visit was approximately +3.2 feet National Geodetic Vertical Datum (NGVD). A description of monitoring activities that were performed and monitoring results are given below.

On November 4, 2011, three transects were re-established on 40-foot spacing perpendicular to the shoreline in the same locations as the Year 2 slope observations. Monitoring staff walked from the upslope edge of the stabilization area to the water. Notes and photographs (provided as Attachments A-4 and A-5 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. 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 spacing (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. On September 22, 2011, the most recent survey of the pinch-pile wall was conducted as part of Year 3 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 southeast 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 approximately 0.3 inches in a northerly direction, which is within the accuracy of the survey method.
- During the third year measurement, all three points were surveyed to be 0.6 inches or less east of the original surveyed location. Again, this is within the accuracy of the survey method.
- The total observed movement over 3 years was less than 0.6 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	Coordinate and Elevation	Survey Date					Distance Moved							
							Delta (feet)				Delta (inches)			
		10/16/2008	6/16/2009	9/16/2009	11/11/2010	9/22/2011	10/16/08 to 6/16/09	10/16/08 to 9/16/09	10/16/08 to 11/11/10	10/16/08 to 09/22/11	10/16/08 to 6/16/09	10/16/08 to 9/16/09	10/16/08 to 11/11/10	10/16/08 to 09/22/11
3000	Northing	66964.660	66964.674	66964.668	66964.679	66964.667	-0.014	0.008	-0.019	-0.007	0.399	0.323	0.240	0.586
	Easting	71313.600	71313.603	71313.578	71313.576	71313.580	-0.003	0.025	0.002	0.020				
	Elevation	7.740	7.710	7.746	7.740	7.784	0.030	-0.006	0.006	-0.044				
3001	Northing	67000.512	67000.531	67000.521	67000.536	67000.510	-0.019	0.010	-0.023	0.002	0.275	0.290	0.306	0.249
	Easting	71307.629	71307.621	71307.607	71307.618	71307.610	-0.008	0.022	0.011	0.019				
	Elevation	8.380	8.370	8.379	8.379	8.372	0.010	0.001	0.001	0.008				
3002	Northing	67030.301	67030.324	67030.304	67030.320	67030.299	-0.023	-0.003	-0.019	0.002	0.324	0.339	0.310	0.380
	Easting	71302.597	71302.587	71302.569	71302.581	71302.566	0.010	0.028	0.016	0.031				
	Elevation	7.990	7.980	7.992	7.997	7.984	0.010	-0.002	-0.007	0.006				

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 12, 2011) and at the end of the second low water season (November 4, 2011). The water level was approximately +9.6 feet NGVD during the May 12, 2011 survey, and approximately +3.2 feet NGVD during the November 4, 2011 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-6 and A-7 to Appendix A.

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 3 of the interim monitoring time period, as documented in Ash Creek – NewFields 2008 and 2009, and Ash Creek 2009a, 2009b, 2009c, 2009d, 2010a, 2010b, 2010c, 2011a, and 2011b.

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 3 Visual Slope and Armor Survey Monitoring Report*, provided as Appendix A, and *Wheeler Bay Interim Monitoring Repaired Slope Visual Vegetation and Slope Observation Report*, provided as Appendix B.

3.1 Slope Stability

Year 3 visual slope stability observations were made during a site visit on October 27, 2011, after the completion of WB repair work. In accordance with the IMRP, transects were established perpendicular to the shoreline at 100-foot centers. A total of seven transects were established. The transects are depicted on Figure 2. 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. A 1-foot scarp was observed in the willow planting area at transects between Station 4+50 and 6+50. The scarp was unchanged from the WB shoreline observation conducted on June 29, 2011 (as described in Section 3.1.1, below). No sloughing, instability, or other areas of erosion were 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).

3.1.1 Repaired Shoreline Slope Stability

In accordance with Section 11 of the 2010 Closure Report (Anchor QEA 2011c), a quarterly monitoring of the repaired slope (between 0 and 275 feet from the mouth of the bay) was performed. Each monitoring event consisted of a visual survey of the repaired slope for signs of sloughing, instability, and erosion. Three transects were established perpendicular to the shoreline at Stations 00+04, 01+50, and 03+00 for first, second, and fourth quarter monitoring events. Transects were walked from upslope to downslope, and any areas of erosion, instability, or sloughing were noted. Notes and photographs (provided as Attachments B-1 through B-8 of Appendix B) were taken to document slope stability at each transect.

No significant areas of erosion, sloughing, or instability were observed during the first and second quarter visual monitoring. Third quarter visual monitoring was performed on June 29, 2011, following a high water event. A visual survey of the entire 670-foot-long shoreline was performed, and some areas of erosion were noted. Overall, a portion of the orange construction fabric used for demarcation of soil not to be disturbed was visible in one primary location between Stations 2+90 and 3+31, as well as two secondary locations at Stations 0+08 and 3+49. Specific findings from the site visits including photographs and field notes are provided in Appendix B. A repair of the shoreline was completed on October 13, 2011. Fourth quarter visual monitoring was performed on October 27, 2011. No areas of sloughing or instability or erosion were observed.

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 2. 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 design was in place, stable, and in good condition.

3.2.1 Repaired Shoreline Armor Layer Stability

In accordance with Section 11 of the 2010 Closure Report (Anchor QEA 2011c), quarterly monitoring of the repaired slope (between 0 and 275 feet from the mouth of the bay) was performed. Each monitoring event consisted of a visual survey of the repaired slope for signs of sloughing or erosion of the armor layer. Three transects were established perpendicular to the shoreline at Stations 00+04, 01+50, and 03+00 for first, second, and fourth quarter monitoring events. A post high-water observation was conducted during the third quarter monitoring event. The entire WB bank from 0 to 670 feet from the mouth of the bay was walked by monitoring staff. Effects of the high water event were documented. Notes and photographs (provided as Attachments B-1 through B-8 of Appendix B) were taken during each site visit. The armor layer showed no signs of instability, sloughing, or erosion. All woody debris installed as part of the 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 3 horizontal to 1 vertical (3H:1V) slope from approximate elevations +10 to +15 feet NGVD during the Terminal 4 Phase I Removal Action construction in 2008 (Figure 2). 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 (NMFS 2008), the Port has monitored the habitat material layer over the past 3 years to determine if the habitat layer is eroding or accreting.

After the completion of the 2011 WB repair work, a site visit on October 27, 2011 was conducted to quantitatively evaluate the habitat material placed over armor rock. In accordance with the Year 2 Monitoring Report (Anchor QEA 2011a), the quantitative assessment was conducted using the same methods used during the second year of WB monitoring. A quantitative estimate of the coverage and thickness of the habitat material present in the existing shoreline between Stations 3+40 and 6+70 and 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 2) were established every 50 feet in the existing shoreline area between 340 and 625 feet from the mouth of the bay
- The Year 2 transect at 325 feet was moved to 340 feet due to recycled habitat material placed below the 2011 repair armor as part of the 2011 repair. This area between elevations +10 and +13 feet NGVD and Stations 2+80 and 3+40 is assumed to have 100 percent coverage and greater than 12 inches of habitat material thickness due to additional habitat material that was taken from the 2011 repair area and placed downslope of the repair area.
- 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.

The existing 2008 Phase I armor rock between elevations +10 and +13 feet NGVD, at Stations 2+80 to 3+40, and between elevations +10 and +15 feet NGVD, at Stations 3+40 to 7+00, is currently covered by habitat material. Results of the habitat material layer quantification are summarized below and in Table 2 of Appendix A, and photographs from each transect location are shown in Attachment A-3 of Appendix A. As expected, the areas protected by the piles underneath Berth 410 (between Station 3+25 and 6+25) continue to be shielded from erosive forces. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or large woody debris [LWD]) covered 99.8 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in only 0.3 percent of the overall area. Average total thickness of material above riprap was greater than 9 inches with greater than 8 inches of habitat material. Year 3 coverage and thickness of the habitat material is consistent with Year 2 habitat evaluation results.

3.4 Establishment of Vegetation

Year 3 vegetation monitoring occurred during a site visit on October 27, 2011, after the 2011 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 5 goals, including in the areas newly planted as part of the 2010 repair. As such, the newly planted areas are not expected to impact the overall coverage goals for Year 5. No evidence of excessive vegetation destruction by geese or other animals was observed. Additionally, thistle, blackberry, and other noxious weeds were removed in July and October of 2011. Limited thistle and blackberry was noted during October vegetation monitoring events.

Additionally, quarterly visual vegetation monitoring was performed on the 2010 repaired area between 0 and 275 feet from the mouth of the bay. No significant mortality or grazing was observed in the willow or grass planted area. Notes and photographs from the site visits are provided in Attachments B-1 through B-8 of Appendix B.

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 3 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.

Results of the PIT procedure are provided in Table 2 and summarized below. A statistical average of the percent coverage was determined for the 2010 and 2011 repaired shoreline (between 0 to 338 feet from the mouth of the bay, not including areas covered by armor as part of the 2010 and 2011 repairs) and the remaining area of the bay. Average Year 3 coverage results for both the repaired and existing areas increased over Year 2 coverage results. The average coverage for the planted area disturbed by the 2010 and 2011 WB repair construction from 0 to 338 feet from the mouth of the bay increased to 74 percent in Year 3 from 70 percent in Year 2. The average coverage for the remaining area from 340 to 700 feet from the mouth of the bay increased to 88 percent in Year 3 from 74 percent in Year 2. The average Year 3 coverage for the entire planting area from 0 to 700 feet from the mouth of the bay was 81 percent.

Based on the results of the PIT procedure, the willow planting establishment for the entire planted area, including the areas impacted during the 2010 and 2011 repair work, is anticipated to meet Year 5 coverage goals.

**Table 2
Habitat Material Evaluation Summary**

Station	Rag Tape	Willow Coverage (Y/N)
00+00	2	Y
	4	Y
	6	Y
	8	Y
	10	N
	12	N
	14	N
01+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	Y
02+00	2	Y
	4	Y
	6	Y
	8	Y
	10	Y
	12	Y
	14	N
03+00	2	N
	4	N
	6	N/A ¹
	8	N/A ¹
	10	N/A ¹
	12	N/A ¹
	14	N/A ¹
04+00	2	Y
	4	Y
	6	Y
	8	Y
	2	Y
	4	Y
	6	Y
05+00	8	Y
	10	Y
	12	Y
	14	Y
	2	Y
	4	Y
	6	Y
06+00	8	Y
	10	Y
	12	Y
	14	N
	2	Y
	4	Y
	6	Y
06+95	8	Y
	10	Y
	12	N
	14	N
MEAN_0-695		0.81
MEAN_0-200_400-695		0.85
MEAN_0-300		0.74
MEAN_400-695		0.88

Note:

NA¹: 2011 repaired area. Riprap below 4 feet. No willow planting present.

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 3 grass coverage was determined based on a visual assessment of the entire elevation 20 to 30 feet NGVD. As part of the 2011 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. 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 2011 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 2011 repair work, is anticipated to meet Year 5 goals. As such, the new grass planted area is not expected to impact the overall coverage goals for Year 5.

4 2011 WHEELER BAY SHORELINE STABILIZATION REPAIR SUMMARY

This section provides a brief summary of the 2011 repair work performed at WB. A Closure Report with a detailed description of construction activity was submitted to USEPA on December 12, 2011 (Anchor QEA 2011b). The repair work included placing armor in the main area of erosion and additional select fill over the two small isolated areas of exposed demarcation fabric at Stations 0+08 and 3+49. The armor placement occurred between Stations 2+90 to 3+38, as shown on Figure 3. The upslope extent of the armor placement was to the scarp with the downslope edge to the existing armor layer. This design modification is intended to better protect the shoreline based on the causes of the current erosion.

This design modification is consistent with the Terminal 4 Phase I Removal Action and 2010 WB Repair final design (Anchor QEA 2010), which were approved by USEPA. The modified design occurred within the original footprint of the Phase I WB work and consisted 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 2012 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 2012 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. Otherwise, the two surveys will be conducted when the water level is at the specified elevations prior to November, as required in the IMRP.

5.2 Wheeler Bay

No instability or sloughing was observed after the completion of the 2011 repair work. In addition, willow and grass planting areas, including the areas hydroseeded during the 2011 repair work, meet Year 3 goals and are anticipated to meet Year 5 goals. However, due to the fact that erosion requiring repair work occurred in both 2010 and 2011, USEPA is requiring quarterly monitoring for the entire Wheeler Bay shoreline that was subject to the 2008 stabilization (between 0 and 820 feet from the mouth of the bay) to confirm that the stabilized shoreline is functioning as designed.

Quarterly monitoring will consist of a visual survey of the slope for sloughing, stability, and erosion. A visual survey of the armor layers will also be completed quarterly to determine if excessive erosion is occurring.

Quarterly monitoring is expected to be frequent enough to identify any large-scale issues that could impact the stabilized slope (e.g., sloughing or erosion). The quarterly monitoring events will be conducted in approximately January, April, July, and October. However, the first quarterly event occurred prior to receiving the comment from USEPA requiring the Port to extend the monitoring along the length of the stabilized shoreline, so the first event only includes the repaired area between 0 and 340 feet from the mouth of the bay. One of the quarterly monitoring events will occur after a high water event.

5.2.1 Repaired Slope and Armor Layer Stability

Visual monitoring after the completion of the 2011 repair did not find any spots of sloughing, instability, or erosion.

Future monitoring of the repaired shoreline from 0 to 340 feet from the mouth of the bay will occur as outlined above in Section 5.2.

5.2.2 Repaired Vegetation Establishment

Based on Year 3 monitoring of the 2010 repaired vegetation between 0 and 275 feet from the mouth of the bay, the grass and willow plantings meet Year 3 coverage goals and are expected to meet Year 5 coverage goals. Therefore, no monitoring is suggested in addition to the monitoring already required by the IMRP (Appendix C of the DAR, Anchor 2008).

5.2.3 Condition of Habitat Layer

No new habitat material was placed with the intent of covering armor rock in the repaired area between 0 and 280 feet from the mouth of the bay. Below the 2011 armor rock placement area (between 280 and 340 feet from the mouth of the bay), existing habitat rock was re-used to cover all 2008 Phase I armor rock between elevations +10 and +13 feet NGVD. Results of Year 3 monitoring efforts to quantify the amount of habitat material remaining between 340 and 700 feet from the mouth of the bay indicate little change compared to Year 2 conditions, and additional material was placed below the 2011 repair area between 280 and 340 feet from the mouth of the bay as described previously. Continued 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).

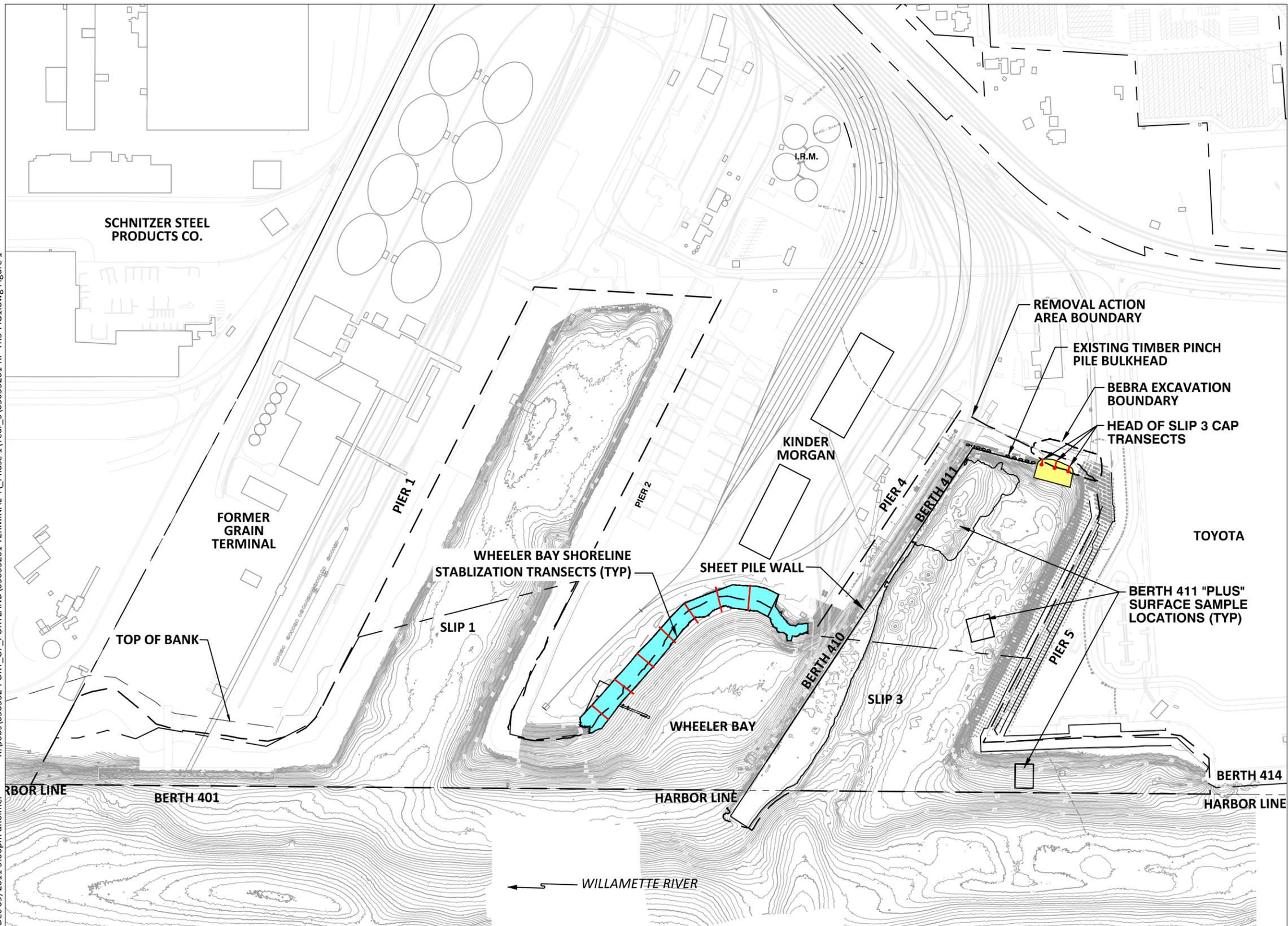
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FIGURES

K:\Jobs\050332-PORT_OF_PORTLAND\05033201_TERMINAL_4_Phase 1\Year_3\05033201-RP-YR3-FIG1.dwg Figure 1
Dec 09, 2011 3:06pm dholmer



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

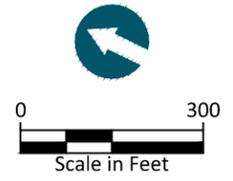
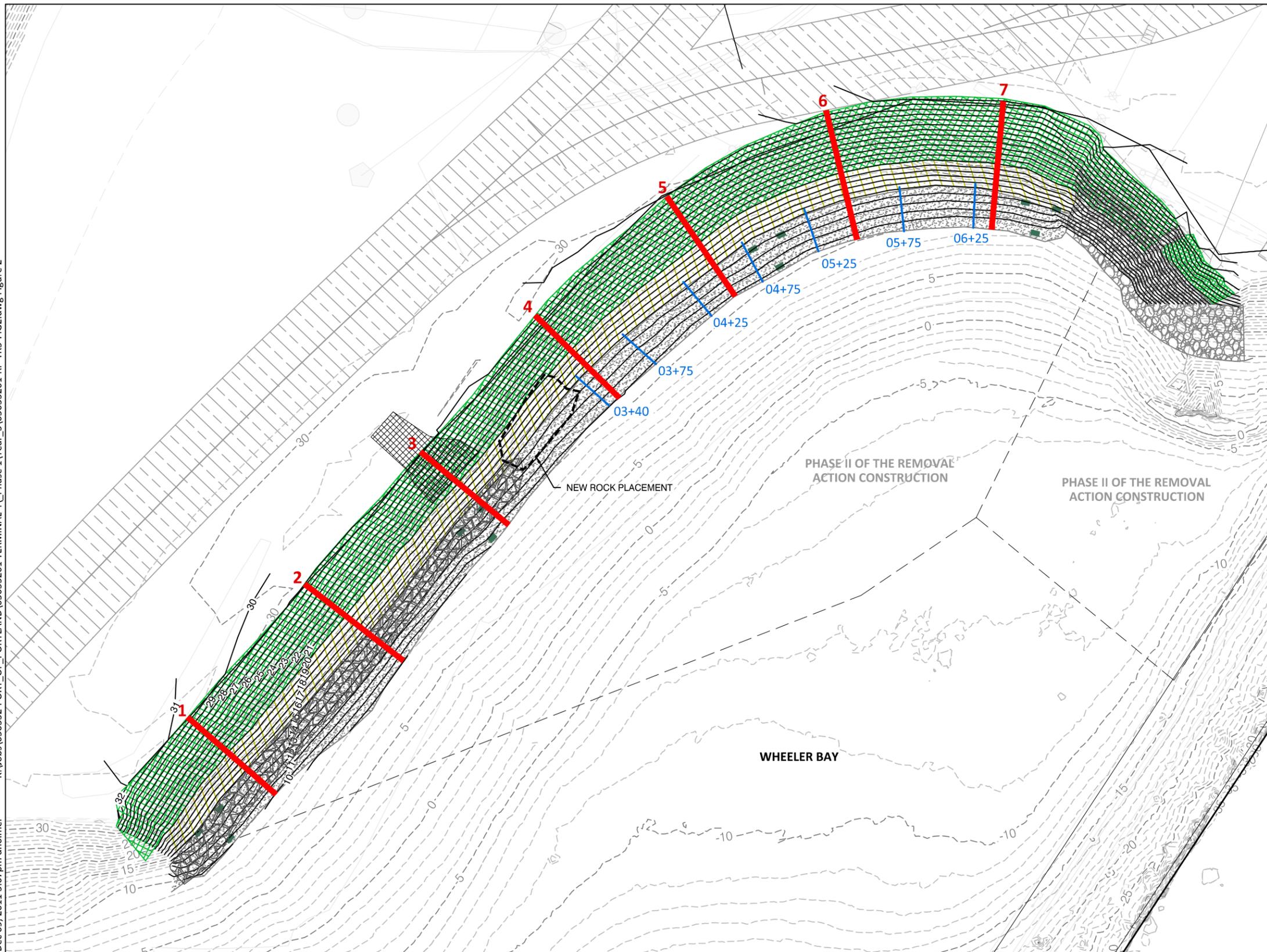


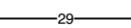
Figure 1
Interim Survey Locations
Year 3 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Portland, Oregon



K:\Jobs\050332-PORT_OF_PORTLAND\05033201_TERMINAL_4_Phase 1\Year_3\05033201-RP-YR3-FIG2.dwg Figure 2
 Dec 09, 2011 3:07pm dholmer



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
-  -29- 2008 AS-BUILT CONTOUR
-  03+40 HABITAT LAYER TRANSECT
-  1 SLOPE STABILITY TRANSECT
-  2011 AS-BUILT ARMOR ROCK

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.



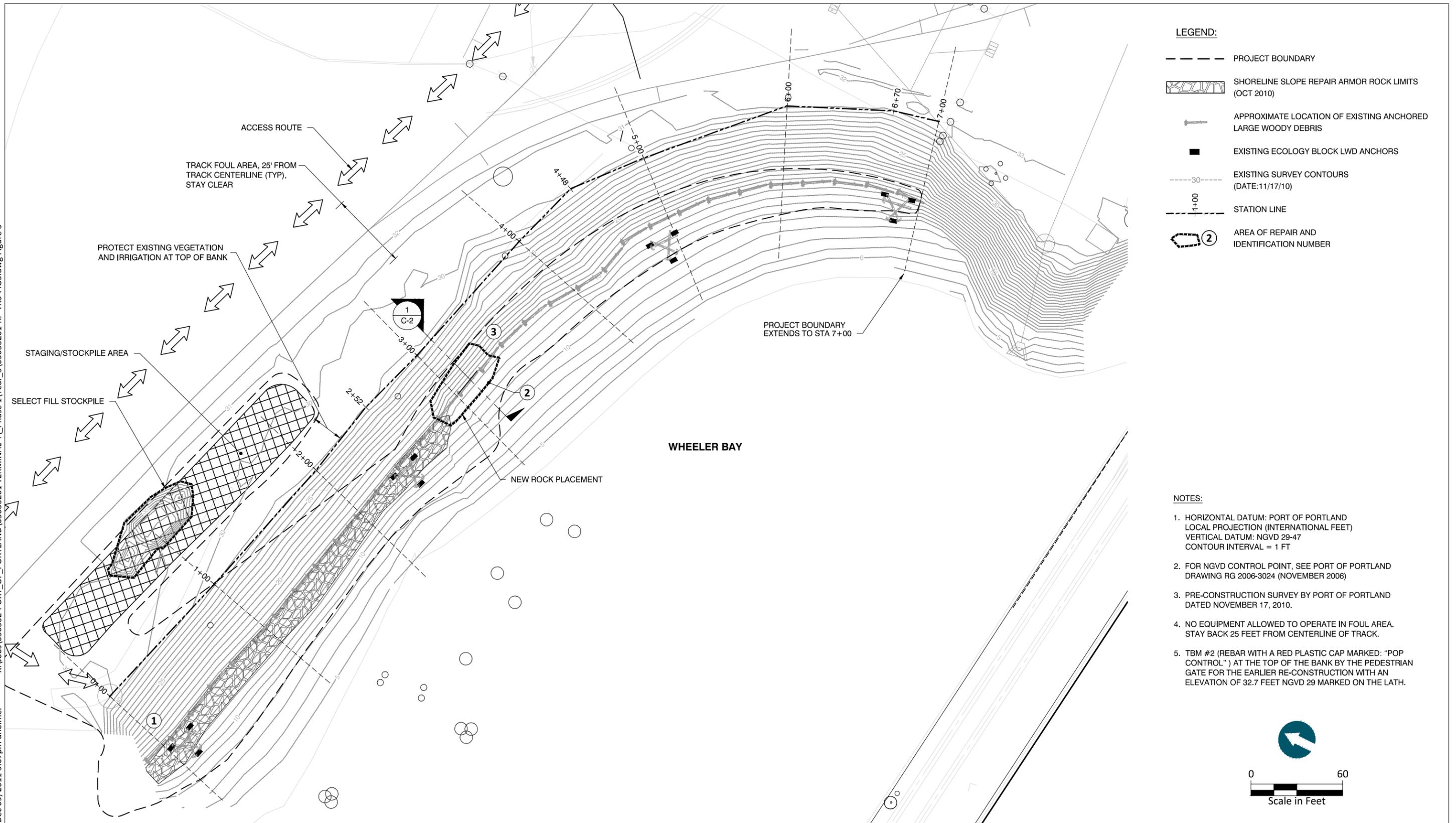


Scale in Feet



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

K:\Jobs\050332-PORT_OF_PORTLAND\05033201_TERMINAL_4_Phase 1\Year_3\05033201-RP-YR3-FIG3.dwg Figure 3
Dec 09, 2011 3:07pm dholmer



- LEGEND:**
- PROJECT BOUNDARY
 - SHORELINE SLOPE REPAIR ARMOR ROCK LIMITS (OCT 2010)
 - APPROXIMATE LOCATION OF EXISTING ANCHORED LARGE WOODY DEBRIS
 - EXISTING ECOLOGY BLOCK LWD ANCHORS
 - 30--- EXISTING SURVEY CONTOURS (DATE:11/17/10)
 - 1+00 STATION LINE
 - AREA OF REPAIR AND IDENTIFICATION NUMBER

- NOTES:**
1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
VERTICAL DATUM: NGVD 29-47
CONTOUR INTERVAL = 1 FT
 2. FOR NGVD CONTROL POINT, SEE PORT OF PORTLAND DRAWING RG 2006-3024 (NOVEMBER 2006)
 3. PRE-CONSTRUCTION SURVEY BY PORT OF PORTLAND DATED NOVEMBER 17, 2010.
 4. NO EQUIPMENT ALLOWED TO OPERATE IN FOUL AREA. STAY BACK 25 FEET FROM CENTERLINE OF TRACK.
 5. TBM #2 (REBAR WITH A RED PLASTIC CAP MARKED: "POP CONTROL") AT THE TOP OF THE BANK BY THE PEDESTRIAN GATE FOR THE EARLIER RE-CONSTRUCTION WITH AN ELEVATION OF 32.7 FEET NGVD 29 MARKED ON THE LATH.

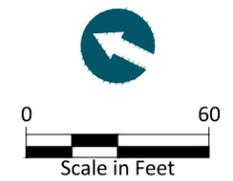


Figure 3
2011 Shoreline Stabilization Slope Repair Plan
Year 3 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Portland, Oregon

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

MEMORANDUM

To: John Verduin, P.E.; Anchor QEA
From: Gabe Nagler; Anchor QEA
Cc: Elizabeth Appy and Ben Hung; Anchor QEA
Re: Wheeler Bay and Head of Slip 3 Cap Year 3 Visual Slope and Armor Survey Monitoring Report, Terminal 4 Removal Action, Port of Portland

YEAR 3 SLOPE AND ARMOR OBSERVATIONS

In accordance with the *Interim Monitoring and Reporting Plan* (IMRP; Design Analysis Report [DAR] Appendix C; Anchor 2008), a visual assessment of the Wheeler Bay (WB) and Slip 3 slope and armor condition was performed on October 27 and November 4, 2011. The 2011 repair of the Wheeler Bay shoreline was completed on October 13, 2011, which was prior to the site visits. The water level during the site visits was +4.7 and +3.2 feet National Geodetic Vertical Datum (NGVD), respectively. Additionally, observations for the presence of sheen were conducted at the head of Slip 3 on May 12 and November 4, 2011. Water levels during these two site visits were approximately +9.6 and +3.2 feet NGVD, respectively.

A description of all Year 3 monitoring activities performed and results is given below.

Wheeler Bay

Monitoring of WB was performed to confirm the following:

- Slope stability
- Armor layer stability
- Stability/presence of woody debris as designed
- Condition of the habitat layer

In addition, quarterly monitoring of the 2010 repaired slope (between 0 and 275 feet from the mouth of the bay) was performed to confirm that the repair is functioning as designed. Results from these supplemental monitoring events are provided in a separate memorandum.

On October 27, 2011, seven slope observation transects were established perpendicular to the shoreline at 100-foot centers. Transects were walked from the upslope edge of the grass planting down to the water. Notes and photographs were taken of slope stability at each transect. Approximate transect locations are shown in Figure A-1. Upslope and downslope transect coordinates 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	122° 46' 38.238"	45° 36' 10.344"	122° 46' 38.474"	45° 36' 9.713"
2	122° 46' 36.878"	45° 36' 10.088"	122° 46' 37.075"	45° 36' 9.405"
3	122° 46' 35.528"	45° 36' 9.835"	122° 46' 35.737"	45° 36' 9.215"
4	122° 46' 34.154"	45° 36' 9.599"	122° 46' 34.444"	45° 36' 8.975"
5	122° 46' 32.845"	45° 36' 9.234"	122° 46' 33.312"	45° 36' 8.647"
6	122° 46' 31.671"	45° 36' 8.651"	122° 46' 32.48"	45° 36' 8.178"
7	122° 46' 30.982"	45° 36' 7.788"	122° 46' 31.933"	45° 36' 7.53"

In addition, a quantitative estimate of the coverage and thickness of the habitat material present in the existing shoreline between Stations 3+40 and 6+70 and 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.
 - The Year 2 transect at 325 feet was moved to 340 feet due to recycled habitat material placed below the 2011 repair armor as part of the 2011 repair. This area between elevations +10 and +13 feet NGVD and Stations 2+80 and 3+40 is assumed to have 100 percent coverage and greater than 12 inches of habitat material thickness.
 - 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

Slope stability: A 1-foot scarp was observed in the willow planting area at transects 5 and 7. The scarp was unchanged from the third quarter WB shoreline observation conducted on June 29, 2011. No orange demarcation layer material was exposed by the scarp and the scarp did not appear to impact slope stability. No sloughing, instability, or other areas of erosion were 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 October 27, 2011 site visit.

Stability/presence of woody debris as designed: All woody debris installed as part of the construction design was in place, stable, and in good condition at the time of the visit. In addition to the installed large wood debris, a significant amount of drift wood was also present.

Condition of habitat layer: Results of the habitat material layer quantification are summarized below and in Table 2, and photographs from each transect location are shown in Attachment A-3. Habitat material and other types of non-armor rock material (i.e., placed material from upslope, depositional sand, or large woody debris [LWD]) covered 99.8 percent of the slope where habitat material was placed over armor rock. Armor rock was observed on the surface in only 0.3 percent of the overall area. Average total thickness of material above riprap was greater than 9 inches, with greater than 8 inches of habitat material.

Table 2
Year 3 Habitat Layer Assessment

Perpendicular Transect Location (feet from mouth of bay)	Quadrat Location (Top, Middle, Bottom)	Surface Substrate (percent of quadrat area)						Total (%)	Thickness of substrate above riprap		
		Non-riprap Material					Riprap		Habitat Mix (inches)	Other Material (inches)	Total Thickness (inches)
		Placed material from upslope (%)	Depositional Sand (%)	Habitat Mix (%)	Log (%)	Coir fabric w/ placed fines on top (%)	Riprap (%)				
325	T			100				100	> 12	0	> 12
325	M			100				100			
325	B			100				100			
375	T			40	60			100			
375	M		90	10				100	2	0.5	2.5
375	B		100					100			
425	T		95	0.5			5	100.5			
425	M		100	0.5				100.5			
425	B		100					100	11	0	11
475	T		50	20	30			100	8	0	8
475	M		5	85	10			100			
475	B		0.5	10	90			100.5			
525	T		5	90		5	0.5	100.5			
525	M		100					100	> 12	0.5	> 12
525	B		95	5				100			
575	T		10	40	40	10		100			
575	M		35	30	35			100			
575	B		100	0.5				100.5	> 12	0	> 12
625	T	30			70			100		6	6
625	M		50	10	40			100			
625	B		55	5	40		0.5	100.5			
MEAN_TOP		0	0	100	0	0	0		7	2	9
MEAN_MIDDLE		0	4	86	11	0	0		7	0	7
MEAN_BOTTOM		0	0	75	25	0	0		12	0	12
MEAN_325-625		1.4	47.2	30.8	19.8	0.7	0.3		8	1	9

Notes:

- a Where woody debris was observed, substrate type was recorded as Log only if underlying substrate could not be determined.
- b Thickness of habitat mix only measured up to 12 inches in depth.

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 spacing perpendicular to the shoreline to confirm slope stability. A total of three transects were re-established based on the Year 1 and 2 locations. Transects were walked from the upslope edge of the stabilization area to the water on May 12 and November 4, 2011. Notes and photographs were taken of slope stability at each transect. Data sheets and photographs are provided in Attachments A-4 and A-5, respectively. Transect coordinates are provided in Table 3.

Table 3
Slip 3 Transects

Transect	Latitude	Longitude
1	45.60049	122.77257
2	45.60035	122.77255
3	45.60025	122.77252

Note: No upslope GPS point was taken.

In addition, the water along the cap was observed for the presence of sheens. Observations occurred during post-high water (May 12, 2011) and post-low water conditions (October 27, 2011). Water levels during the observation events were approximately +9.6 and +3.2 feet NGVD, respectively. Notes and photographs were taken during observation events. Data sheets and photographs are provided in Attachments A-6 and A-7, 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.

Conclusions

Wheeler Bay

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

As expected, the condition of the habitat layer in areas protected by the piles underneath Berth 410 (between Station 3+25 and 6+25) continues to be shielded from erosive forces. Year 3 coverage and thickness of the habitat material is consistent with Year 2 habitat evaluation results.

Head of Slip 3 Cap

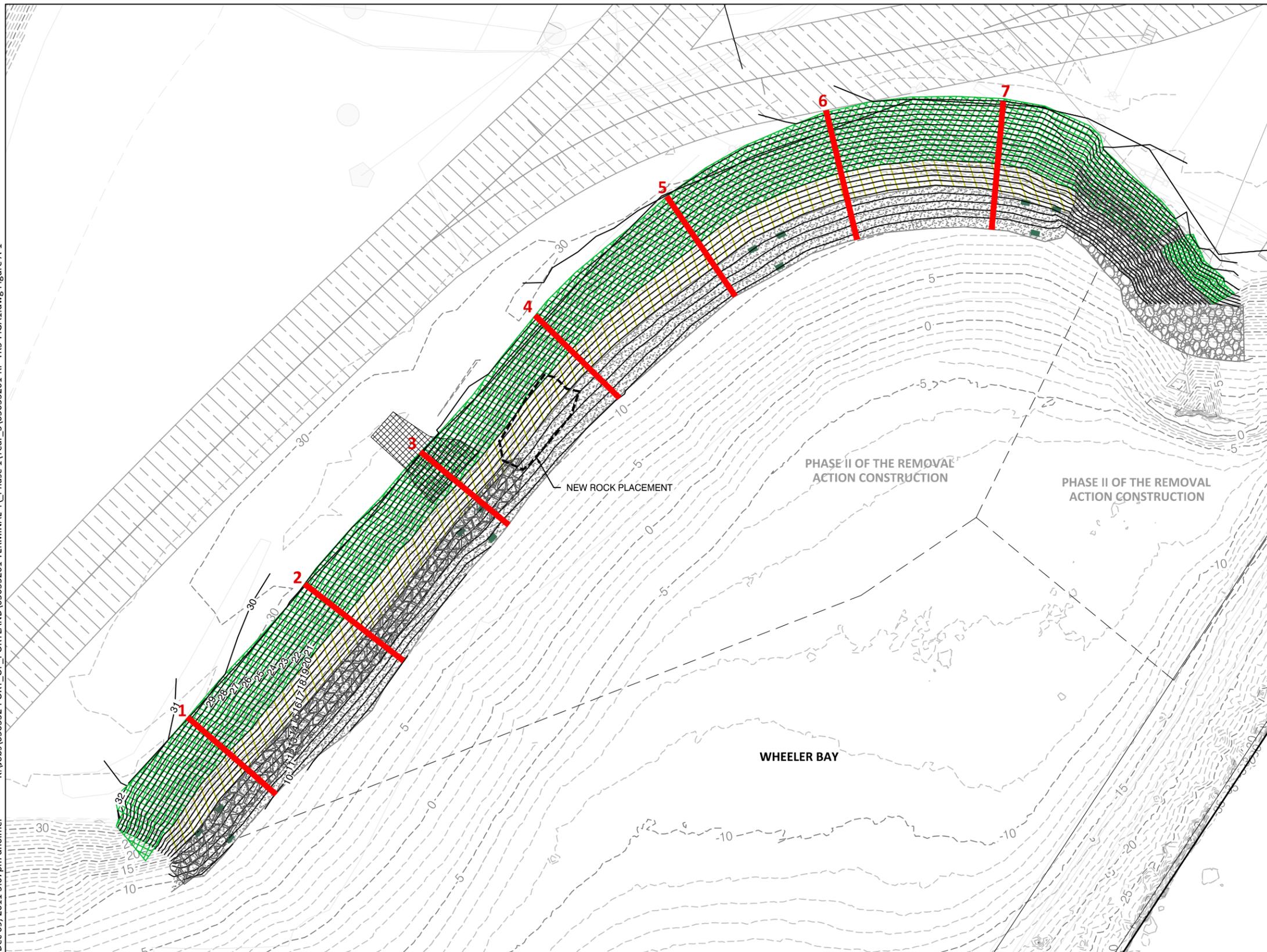
No instability, sloughing, or sheens were observed; therefore, no further monitoring action beyond what is required in the IMRP is recommended for the head of Slip 3 cap at this time.

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.
- Anchor QEA, LLC (Anchor QEA). 2011. *Final Year 2 Interim Monitoring Report, Terminal 4 Phase I Removal Action*. Prepared for the Port of Portland. February 2011.
-

FIGURES

K:\Jobs\050332-PORT_OF_PORTLAND\05033201_TERMINAL_4_Phase 1\Year_3\05033201-RP-YR3-FIGA1.dwg Figure A-1
Dec 09, 2011 3:07pm dholmer



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
- 29 2008 AS-BUILT CONTOUR
- 1 SLOPE STABILITY TRANSECT
- 2011 AS-BUILT ARMOR ROCK

- 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.

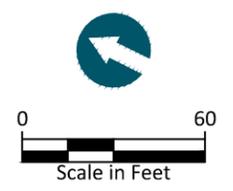


Figure A-1
Wheeler Bay Year 3 Slope Stability Transect Locations
Appendix A, Year 3 Interim Monitoring Report - Terminal 4 Phase I Removal Action
Port of Portland

ATTACHMENT A-1
WHEELER BAY MONITORING DATA
SHEETS

ANCHOR Slope Observation Data Sheet
QEA

Project Name: Year 3 slope observation Project No: 050332-01

Observation Crew: G. Nagler

Datum (circle one): ~~NAD 83 / WGS 84 / NAD 27 / Lat long~~ on station Weather: Sunny, 55°

Transect 1 0+50	Upslope 0643		Downslope 0644	
	N:	E:	N:	E:
Comments: 1' scarp in willow planting. No other signs of sloughing or erosion.				

Transect 2 1+50	Upslope 0641		Downslope 0642	
	N:	E:	N:	E:
Comments: No sloughing or erosion				

Transect 3 2+50	Upslope 0639		Downslope 0640	
	N:	E:	N:	E:
Comments: No sloughing or erosion				

Transect 4 3+50	Upslope 0637		Downslope 0638	
	N:	E:	N:	E:
Comments: No sloughing or erosion				

Transect 5 4+50	Upslope 0635		Downslope 0636	
	N:	E:	N:	E:
Comments: 1' scarp in willow planting area. No other areas of sloughing or erosion				

Recorded by: Gabe Nagler



Slope Observation Data Sheet

Observation Date: 10/27/11

Project Name: Year 3 slope observation.

Project No: 050332-01

Transect 6 5+50	Upslope 0633		Downslope 0634	
	N:	E:	N:	E:
Comments: 1' scarp in willow planting area. No other areas of sloughing or erosion.				

Transect 7 6+50	Upslope # 0630		Downslope 0631	
	N:	E:	N:	E:
Comments: 1' scarp in willow planting area. No other sloughing or erosion.				

Transect 8	Upslope		Downslope	
	N:	E:	N:	E:
Comments:				

Transect 9	Upslope		Downslope	
	N:	E:	N:	E:
Comments:				

Transect 10	Upslope		Downslope	
	N:	E:	N:	E:
Comments:				

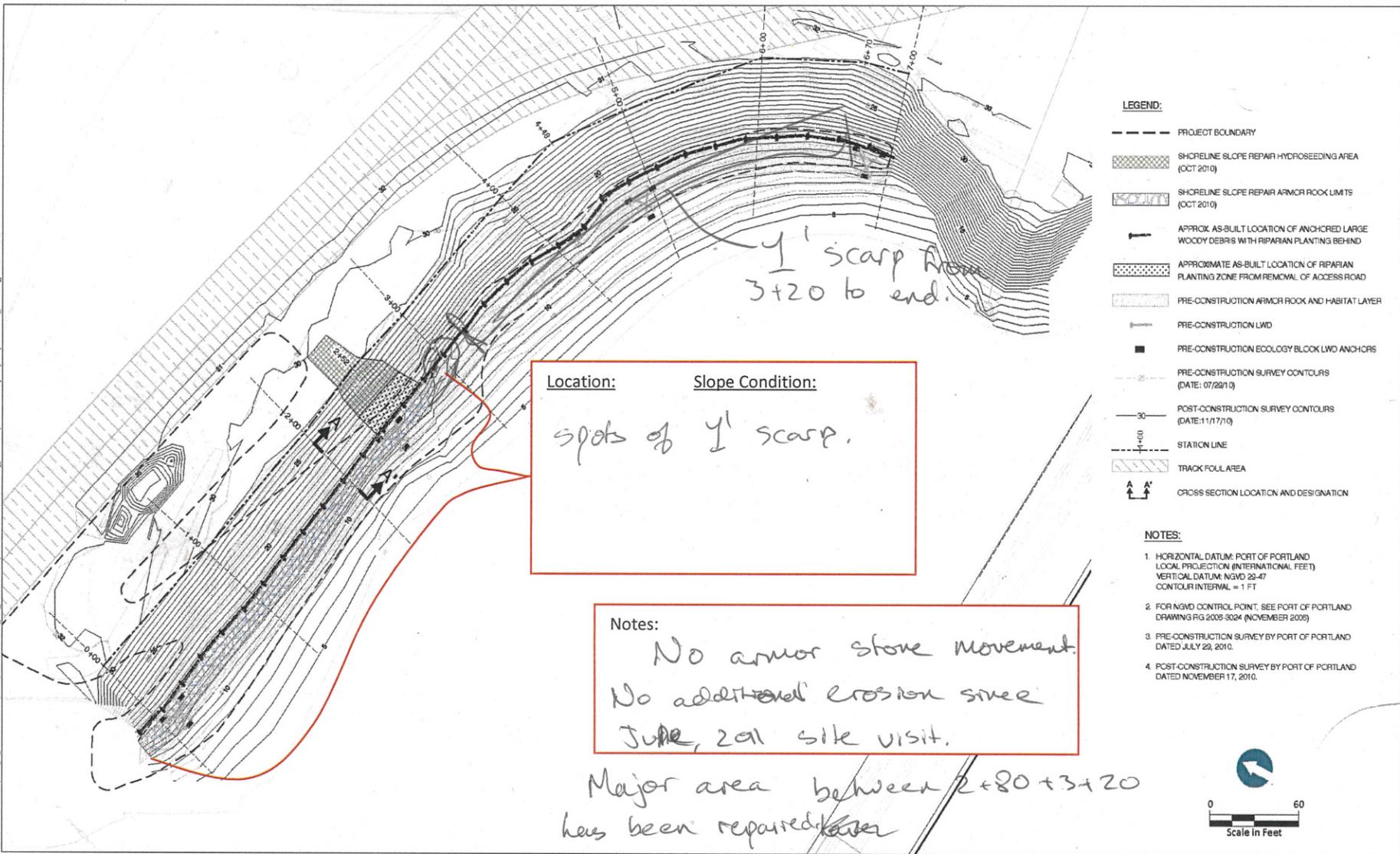
Additional Comments:
Scarp is unchanged from ~~last~~ June 2011 site visit in areas not repaired in 2011.

Recorded by: Gabe Nager

Wheeler Bay Slope Repair Observation Map

Date 10/27/11

4th Q repaired slope observation, Year 2 existing observation.



K:\Jobs\050332-PORT OF PORTLAND\05033201 TERMINAL A Phase 1\Wheeler Bay Repair\WBRC-1_C-4.dwg BACH FIG 2
Jan 25, 2011 2:23pm tgr/pa



Recorded by Gabe Nagler
Weather Sunny, 55° F.

ATTACHMENT A-2
WHEELER BAY MONITORING
PHOTOGRAPHS



Transect 1, looking down-slope



Transect 1, looking up-slope



Transect 2, looking down-slope



Transect 2, looking up-slope



Transect 3, looking down-slope



Transect 3, looking up-slope



Transect 4, looking down-slope



Transect 4, looking up-slope



Transect 5, looking down-slope



Transect 5, looking up-slope



Transect 6, looking down-slope



Transect 6, looking up-slope

No Photo Available

Transect 7, looking down-slope

No Photo Available

Transect 7, looking up-slope

ATTACHMENT A-3
WHEELER BAY HABITAT MATERIAL
ASSESSMENT PHOTOGRAPHS



Transect 03+40 (T,M,B)



Transect 03+40 (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)

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

ANCHOR Slope Observation Data Sheet
QEA

Project Name: Slip 3 Year 3 Project No: 050332-01

0900

Observation Crew: G. Nagler

Datum (circle one): NAD 83 / WGS 84 / NAD 27 / Lat long

Weather: overcast

On target

Transect 1

Upslope 0711		Downslope 0712	
N:	E:	N:	E:

Comments:

No signs of sloughing or instability.

Transect 2

Upslope 0713		Downslope 0714	
N:	E:	N:	E:

Comments:

No signs of sloughing or instability

Transect 3

Upslope 0715		Downslope 0716	
N:	E:	N:	E:

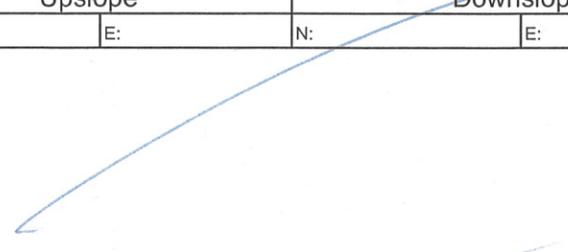
Comments:

No signs of sloughing or instability

Transect 4

Upslope		Downslope	
N:	E:	N:	E:

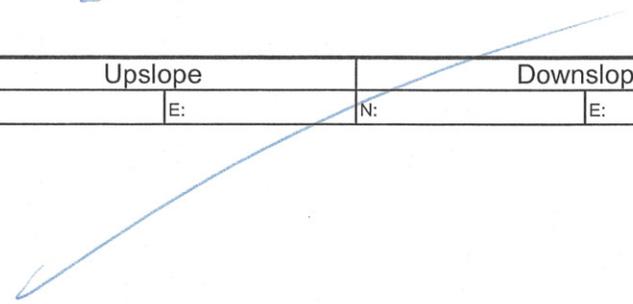
Comments:



Transect 5

Upslope		Downslope	
N:	E:	N:	E:

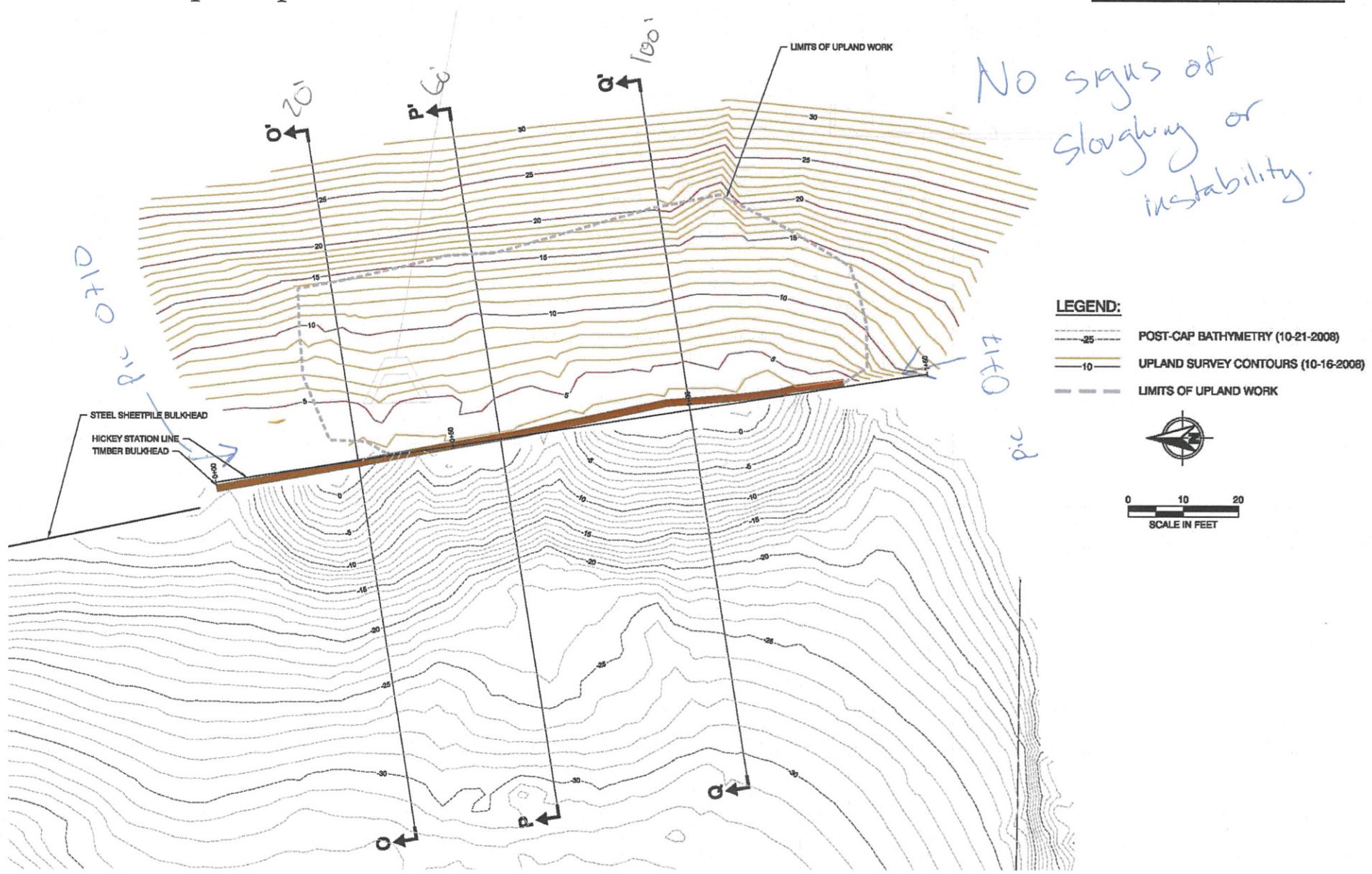
Comments:



Recorded by: G. Nagler

Head of Slip 3 Cap Transects Observation

Date 11/4/11



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



Recorded by G. Nagler

ATTACHMENT A-5
HEAD OF SLIP 3 CAP MONITORING
PHOTOGRAPHS – SLOPE STABILITY



Slip 3 slope looking South



North Transect, looking down-slope



North Transect, looking up-slope



Middle Transect, looking down-slope



Middle Transect, looking up-slope



South Transect, looking down-slope



South Transect, looking up-slope

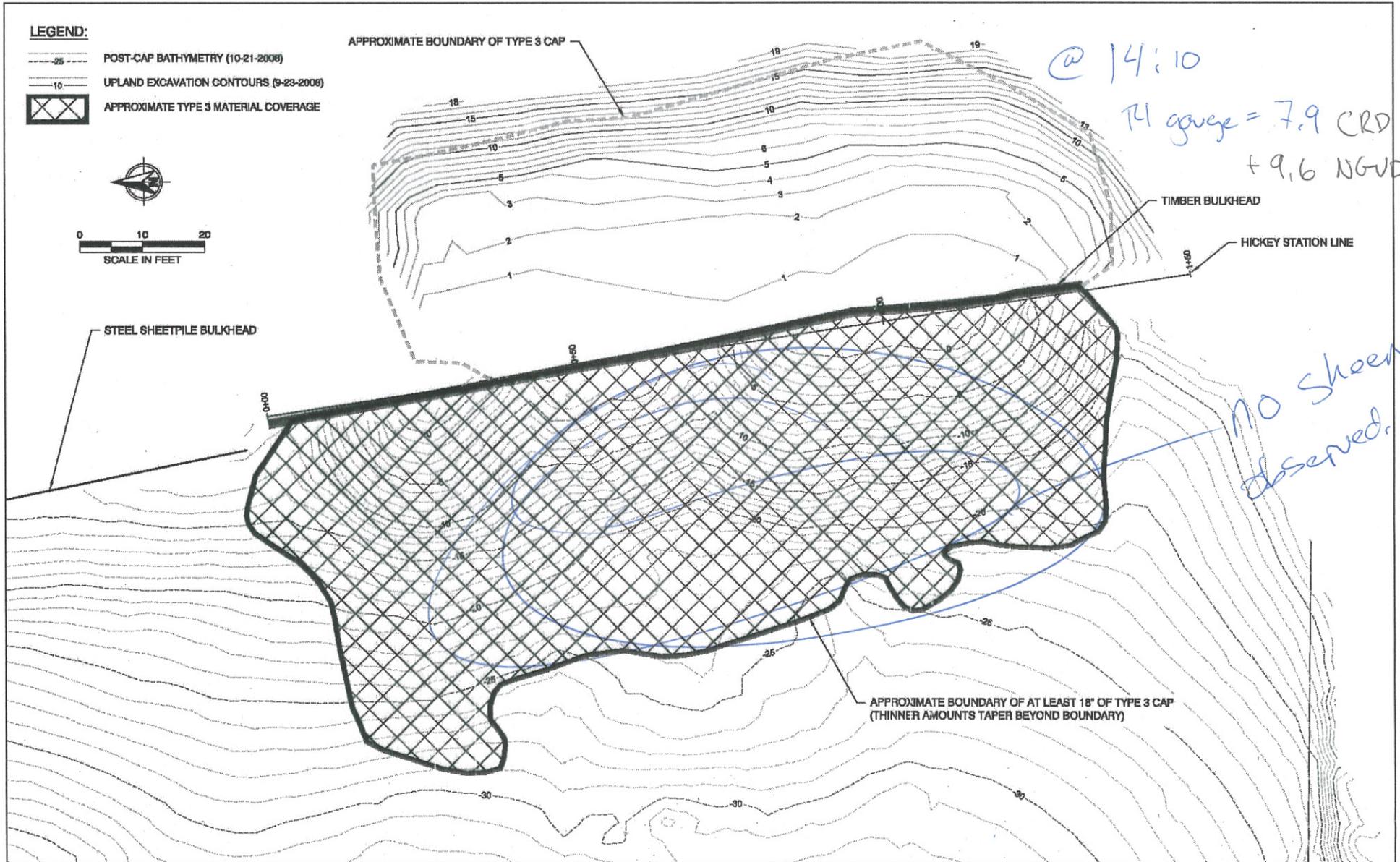


Slip 3 slope looking North

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

Head of Slip 3 Cap Area Observation

Date 5/12/11



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

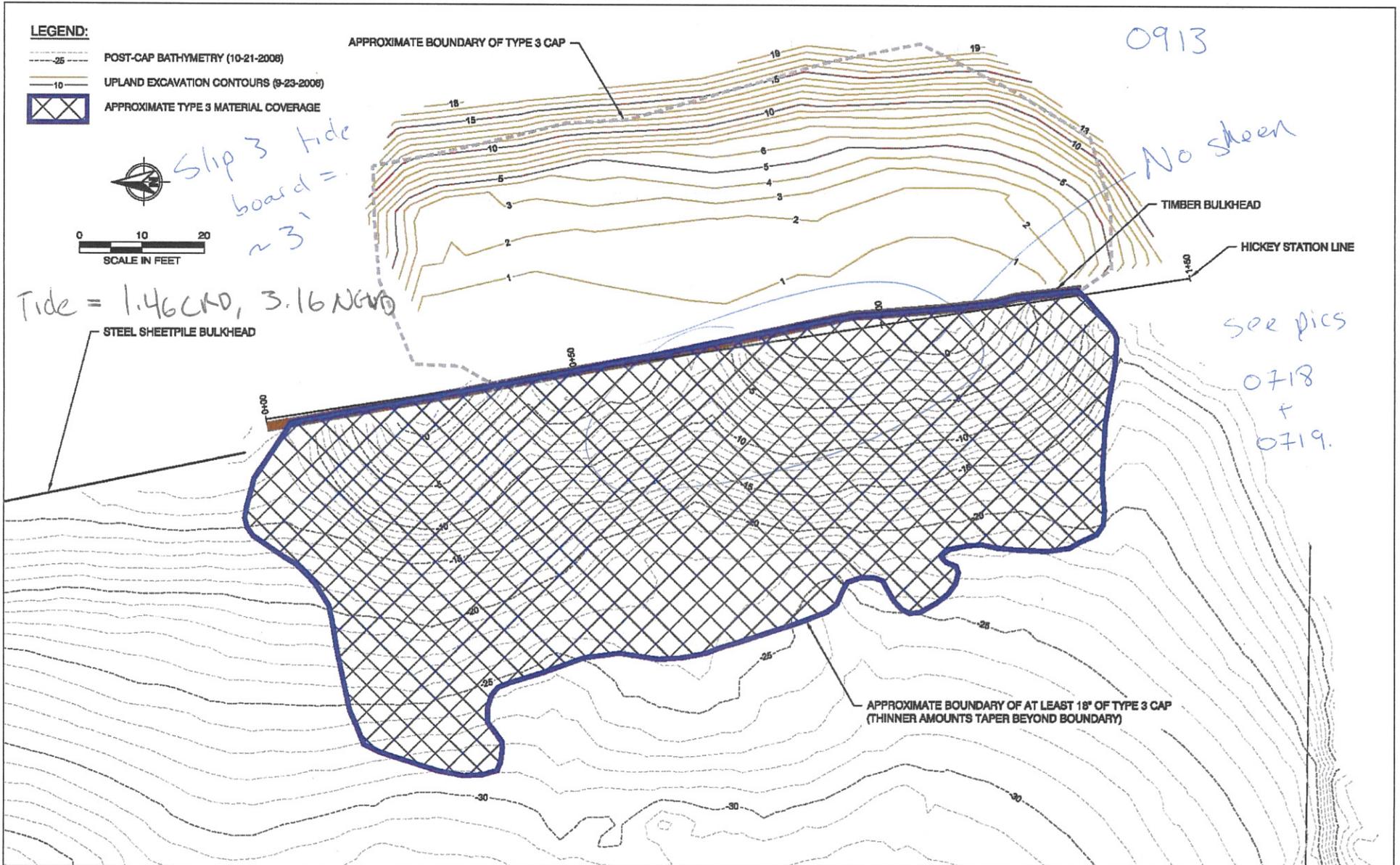


Recorded by G. Nagler + D. Floor

Head of Slip 3 Cap Area Observation

Year 3 low water obs.

Date 11/4/11



Extent of Type 3 Cap Placement and Extent of Upland Excavation -Head of Slip 3

Terminal 4, Portland, Oregon



Recorded by G. Nagler

ATTACHMENT A-7
HEAD OF SLIP 3 CAP MONITORING
PHOTOGRAPHS – SHEEN



High water observation 5/19/2011: No sheen



Low water observation 10/27/2011: No sheen

APPENDIX B
WHEELER BAY INTERIM MONITORING
REPAIRED SLOPE VISUAL VEGETATION
AND SLOPE OBSERVATION REPORT

MEMORANDUM

To: John Verduin, P.E.; Anchor QEA
From: Gabe Nagler; Anchor QEA
Cc: Elizabeth Appy and Ben Hung; Anchor QEA
Re: Wheeler Bay Interim Monitoring Repaired Slope Visual Vegetation and Slope Observation Report – Year 3, Terminal 4 Removal Action, Port of Portland

WHEELER BAY REPAIRED SHORELINE MONITORING

A repair of the Wheeler Bay (WB) shoreline was completed during the second year of monitoring to address areas where erosion had occurred. Construction of the Year 2 WB repair work was completed on October 29, 2010. In accordance with the 2010 Closure Report (Anchor QEA 2011), quarterly monitoring was performed for the Year 2 shoreline stabilization 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 would be attained at the end of Year 3.

Quarterly monitoring of the Year 2 repaired shoreline occurred on February 2, April 27, June 29, and October 27, 2011. Additional repairs of the WB shoreline were completed on October 13, 2011, prior to the fourth quarter monitoring event.

Description of Monitoring Activity

Quarterly monitoring was performed within the repair area between 0 and 275 feet from the mouth of the bay and consisted of a visual survey of the slope for sloughing, stability, and erosion. A visual survey of the armor layers was also completed quarterly to determine if excessive erosion was occurring. Visual vegetation monitoring of the repaired area was also conducted quarterly between 0 and 275 feet from the mouth of the bay.

During each quarterly monitoring event, photographs were taken at nine fixed points. Photographs were taken in groups of three; one in the grass planting area, one in the willow planting area, and one in the armored bank area. Three fixed photograph points were

established at Stations 0+00, 1+50, and 3+00. Additional photographs and notes were taken to document any areas of erosion.

Observation Results

Observation results from the quarterly monitoring events are described below.

1st Quarter Monitoring

Grass height was approximately 5 centimeters (cm) with greater than 95 percent coverage. Willow height ranged from 0.3 to 2 meters tall. No significant mortality was observed. No areas of erosion, sloughing, or instability were noted in the grass, willow, or armor rock areas. Some blackberry and dormant thistle were present in the grass planting area. Notes and photographs are provided in Attachments B-1 and B-2, respectively.

2nd Quarter Monitoring

Grass height was between 5 and 20 cm with greater than 95 percent coverage. Willow height ranged from 2 to 3 meters tall. No significant mortality was observed. One small area of bark mulch fill upslope of the large woody debris at Station 00+05 was observed to have settled. No other areas of erosion, sloughing, or instability were noted in the grass, willow, or armor rock areas. Some blackberry and thistle were present in the grass planting area. Notes and photographs are provided in Attachments B-3 and B-4, respectively.

3rd Quarter Monitoring

High river levels occurred in late May and June, during which the Willamette River reached approximately elevation 18.7 feet National Geodetic Vertical Datum (NGVD), and the water level remained above the ordinary high water elevation (16.6 feet NGVD) for over 4 weeks. A site visit of WB was performed on June 28, 2011 to conduct a post high-water monitoring event that coincided with the 3rd quarter monitoring event.

The following specific observations were made:

- Stations 0+00 to 1+75: 1- to 2-foot erosion scarp of the willow planting zone (demarcation fabric not exposed except for Station 0+08 where a very small 1-inch area of demarcation fabric is visible).
 - Stations 1+75 to 2+00: No erosion.
-

- Stations 2+00 to 2+25: 0.5-foot erosion scarp of the willow planting zone (demarcation fabric not exposed).
- Stations 2+25 to 2+90: No erosion.
- Stations 2+90 to 3+31: 2-foot erosion scarp of the willow planting zone (demarcation fabric visible—exposure amount ranging from patches to several feet into the slope).
- Stations 3+32 to 6+70: 1-foot erosion scarp of the willow planting zone (demarcation fabric not exposed except for Station 3+49 where a very small patch of demarcation fabric is visible).

Overall, a portion of the orange construction fabric used for demarcation of soil not to be disturbed was visible in one primary location between Stations 2+90 and 3+31, as well as two secondary locations at Stations 0+08 and 3+49.

Field notes and photographs from the site visit are provided in Attachments B-5 and B-6, respectively.

4th Quarter Monitoring

Fourth quarter monitoring was conducted after the completion of the 2011 repairs to the WB shoreline. Grass height was approximately 15 cm with greater than 95 percent coverage. Willow height ranged from 1.5 to 3 meters tall. No significant mortality was observed. No areas of erosion, sloughing, or instability were noted in the grass, willow, or armor rock areas. Some residual thistle and blackberry were observed after the Port of Portland weeding event. Notes and photographs are provided in Attachments B-7 and B-8, respectively.

CONCLUSIONS

Based on Year 3 quarterly monitoring of the vegetation and repaired slope, vegetation meets Year 3 coverage goals and is expected to meet Year 5 coverage goals. No areas of erosion within the repaired slope area were observed after completion of the 2011 repair.

REFERENCES

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.

ATTACHMENT B-1
1ST QUARTER MONITORING DATA
SHEETS



Project Name: T-4, Wheeler Bay

Project No: 050332-01

Observation Crew: D. Laffoon & G. Nagler

Weather: Sunny, 45°F, SE light wind

Photo Point ID: 1G Time: 1535

Station # 00+04

No sloughing or instability

Photo Bearing	140	--
Photo ID #	<u>512</u>	--

Photo Point ID: 1W Time: 1536

Station # 00+04

" "

Photo Bearing	140	--
Photo ID #	<u>513</u>	--

Photo Point ID: 1R Time: 1538

Station # 00+04

" "

Photo Bearing	140	--
Photo ID #	<u>514</u>	--

Photo Point ID: 2G Time: 1540

Station # 01+40

" "

Photo Bearing	320	140
Photo ID #	<u>515</u>	<u>516</u>

Photo Point ID: 2W Time: 1542

Station # 01+40

" "

Photo Bearing	320	140
Photo ID #	<u>517</u>	<u>518</u>

Photo Point ID: 2R Time: 1543

Station # 01+40

" "

Photo Bearing	320	140
Photo ID #	<u>519</u>	<u>520</u>

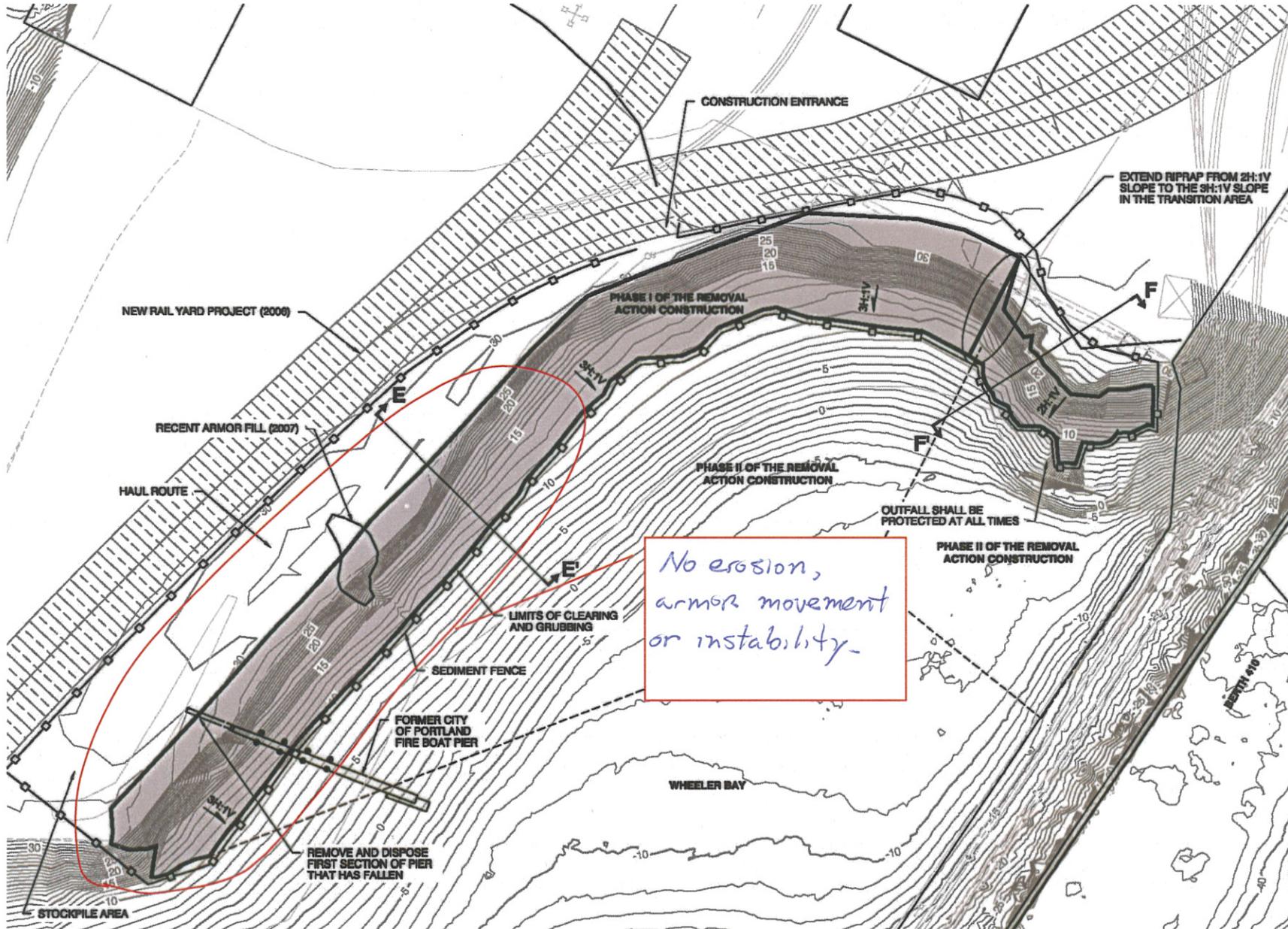
Project Name: T-4, Wheeler Bay

Project No: 050332-01

Photo Point ID: <u>3G</u>	Time: <u>1547</u>						
Station # <u>03+00</u>	No sloughing or instability						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>524</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	524	--	
Photo Bearing	320	--					
Photo ID #	524	--					
Photo Point ID: <u>3W</u>	Time: <u>1549</u>						
Station # <u>03+00</u>	" "						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>525</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	525	--	
Photo Bearing	320	--					
Photo ID #	525	--					
Photo Point ID: <u>3R</u>	Time: <u>1551</u>						
Station # <u>03+00</u>	" "						
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>526</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	526	--	
Photo Bearing	320	--					
Photo ID #	526	--					
Comments (flooding, erosion, vandalism, plant mortality?): <u>NO</u> Armor stone movement? <u>-none</u> Instability? <u>-none</u> Sloughing? <u>-none</u> Approx. Willow Height: <u>0.3-2 m, 60-80% coverage</u> Approx. Grass Height: <u>5cm, 1-100% coverage</u> Goose Grazing? <u>Yes, on grass, goose droppings present (52-57' @ 61+60 to 02+40)</u> Invasive Species? <u>Some dormant thistle, blackberry</u>							
Other notes: <u>wiring to irrigation appears to be cut from repair work and may require maintenance (reattachment)</u>							
Acronyms: G = grass area, W = willow area, R = rock/riprap area							

Wheeler Bay Slope Repair Observation Map

Date 2/2/11



Recorded by A. Nagler & D. Laffoon



T-4 Wheeler Bay Slope Repair Observation
DAILY SAFETY MEETING RECORD

Project # 050332-01

Date: 2/2/11

Time: 1508

Person Conducting Meeting: G. Nagler

Persons Attending Meeting: D. Laffoon

PPE Requires: Level D

Topics Addressed/Issues Raised:

Dock shack gate access.
Watch your step, trip hazards, ankle twists
Watch for train when near tracks
Always carry TWIC card

Date:

Time:

Person Conducting Meeting:

Persons Attending Meeting:

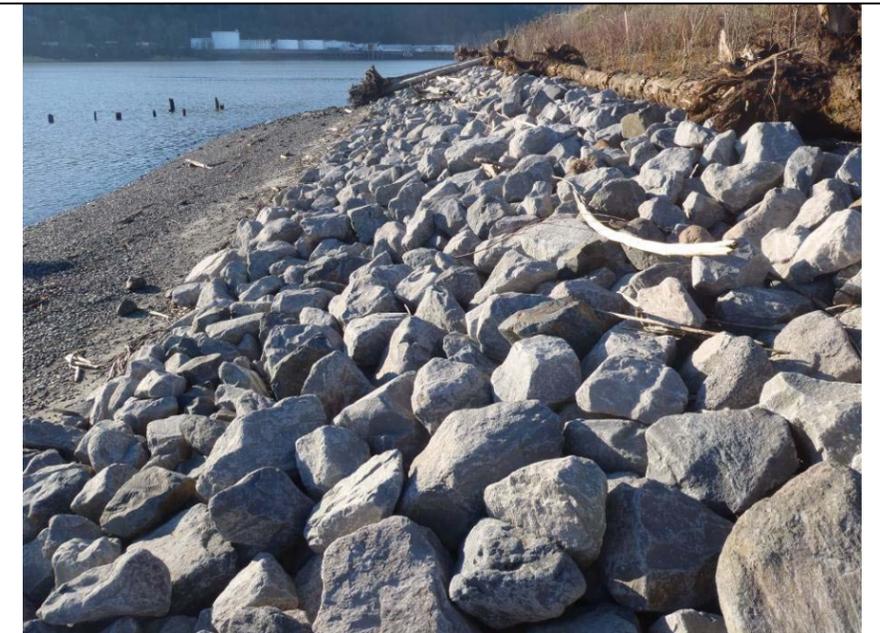
PPE Required:

Topics Addressed/Issues Raised:

ATTACHMENT B-2
1ST QUARTER MONITORING
PHOTOGRAPHS



Transect 00+04 @ 140 degrees (G, W, R)



Transect 01+40 @ 320 degrees (G, W, R)



Transect 01+40 @ 140 Degrees (G, W, R)



Transect 03+00 @ 320 degrees (G, W, R)

ATTACHMENT B-3
2ND QUARTER MONITORING DATA
SHEETS

Project Name: T-4, Wheeler Bay

Project No: 050332-01

Observation Crew: <u>G. Nagler D. Laffan</u>		
Weather: <u>Overcast, light ea north wind</u>		
Photo Point ID: <u>01 G</u>	Time: <u>1607</u>	
Station # <u>00+04</u>	No signs of sloughing or erosion	
Photo Bearing	140	--
Photo ID #	<u>005</u>	--
Photo Point ID: <u>01 W</u>	Time: <u>1608</u>	
Station # <u>00+04</u>	Small "collapse" behind LWD @ 00-05 @ rip rap interface, DICS 008, 9+10 Not likely to spread.	
Photo Bearing	140	--
Photo ID #	<u>006</u>	--
Photo Point ID: <u>01 R</u>	Time: <u>1609</u>	
Station # <u>00+04</u>	See comment above.	
Photo Bearing	140	--
Photo ID #	<u>007</u>	--
Photo Point ID: <u>02 G</u>	Time: <u>1619</u>	
Station # <u>01+40</u>	No signs of sloughing or erosion	
Photo Bearing	320	140
Photo ID #	<u>012</u>	<u>015</u>
Photo Point ID: <u>02 W</u>	Time: <u>1620</u>	
Station # <u>01+40</u>	"	
Photo Bearing	320	140
Photo ID #	<u>013</u>	<u>016</u>
Photo Point ID: <u>02 R</u>	Time: <u>1621</u>	
Station # <u>01+40</u>	"	
Photo Bearing	320	140
Photo ID #	<u>014</u>	<u>017</u>

001+2 overview
 3 electrical
 011 - dock debris

Project Name: T-4, Wheeler Bay

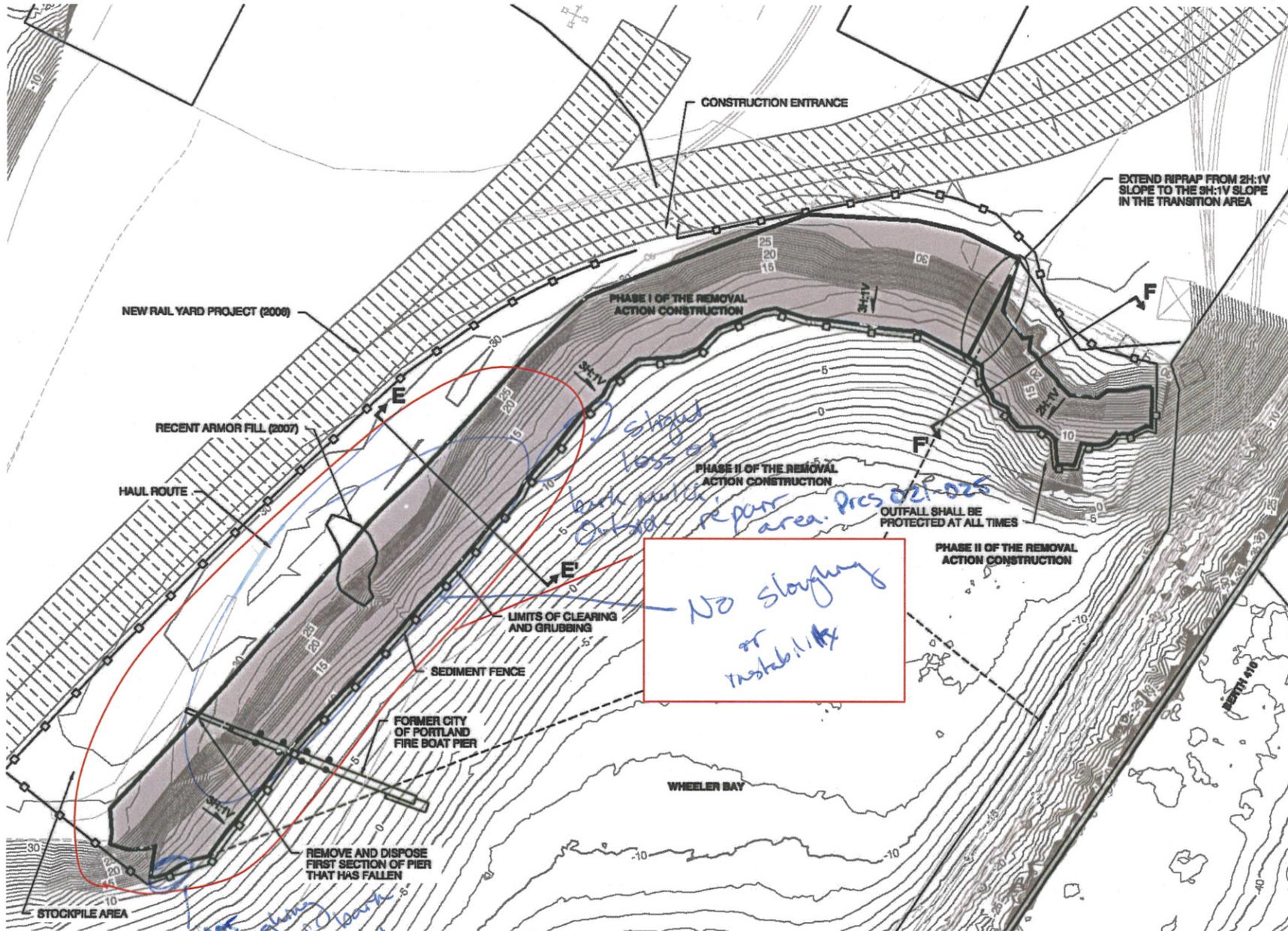
Project No: 050332-01

<p>Photo Point ID: <u>03G</u> Time: <u>1628</u></p> <p>Station # <u>03+00</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>018</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	018	--	<p>No sloughing / instability or erosion</p>
Photo Bearing	320	--					
Photo ID #	018	--					
<p>Photo Point ID: <u>03W</u> Time: <u>1629</u></p> <p>Station # <u>03+00</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>019</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	019	--	<p>No sloughing, erosion or instability.</p>
Photo Bearing	320	--					
Photo ID #	019	--					
<p>Photo Point ID: <u>03R</u> Time: <u>1630</u></p> <p>Station # <u>03+00</u></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Photo Bearing</td> <td style="width: 30%;">320</td> <td style="width: 40%;">--</td> </tr> <tr> <td>Photo ID #</td> <td>020</td> <td>--</td> </tr> </table>	Photo Bearing	320	--	Photo ID #	020	--	<p>loss Slight loss of bark mulch @ LWD. Sule mat exposed. Located @ 03+30-03+50' outside of repaired slope.</p>
Photo Bearing	320	--					
Photo ID #	020	--					
<p>Comments (flooding, erosion, vandalism, plant mortality?): <u>None</u></p> <p>Armor stone movement? <u>NO</u></p> <p>Instability? <u>None</u></p> <p>Sloughing? <u>see notes above</u></p> <p>Approx. Willow Height: <u>3-5'</u></p> <p>Approx. Grass Height: <u>5-20cm</u></p> <p>Goose Grazing? <u>minimal</u></p> <p>Invasive Species? <u>spots of blackberries + thistle.</u></p>							
<p>Other notes:</p> <p style="font-size: 1.2em;">Wiring to irrigation requires reattachment before summer season.</p>							
<p>Acronyms: G = grass area, W = willow area, R = rock/riprap area</p>							

Pics 021-025

Wheeler Bay Slope Repair Observation Map

Date 4/27/11



2 staged loss of bank mulch. Outside repair area. Pres 021-025

No sloping or instability

minor sloping of bank mulch soil. see pres 008, 009 + 010



Recorded by G. Nagler



T-4 Wheeler Bay Slope Repair Observation
DAILY SAFETY MEETING RECORD

Project # 050332-01

Date: 4/27/11

Time: 16:00

Person Conducting Meeting: D. Laffoon

Persons Attending Meeting: G. Nagler

PPE Requires: Level D

Topics Addressed/Issues Raised:

- Trails
- footing on riprap
- stay away from water's edge.

Date:

Time:

Person Conducting Meeting:

Persons Attending Meeting:

PPE Required:

Topics Addressed/Issues Raised:

ATTACHMENT B-4
2ND QUARTER MONITORING
PHOTOGRAPHS



Transect 00+04 @ 140 degrees (G, W, R)



Transect 01+40 @ 320 degrees (G, W, R)



Transect 01+40 @ 140 Degrees (G, W, R)



Transect 03+00 @ 320 degrees (G, W, R)



Area of settling behind LWD at Station 00+05

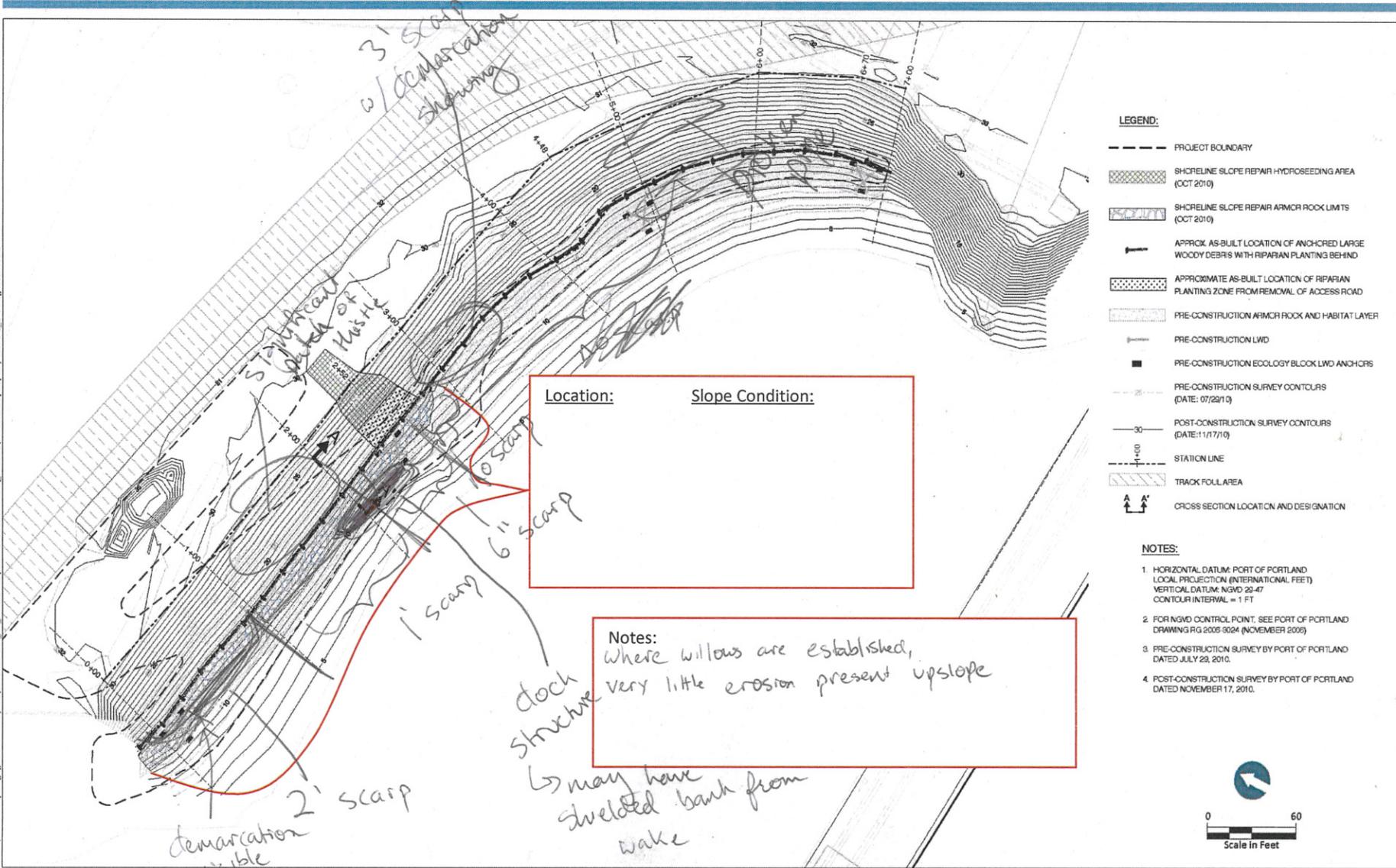
ATTACHMENT B-5
3RD QUARTER MONITORING DATA
SHEETS

Wheeler Bay Slope Repair Observation Map

Date 6/29/11

@ 16:00

K:\Jobs\0508332-PORT OF PORTLAND\050833201 TERMINAL A Phase 1\Wheeler Bay Repair\WBRR-C-1_C-4.dwg RACR FIG 2
Jan 25, 2011 2:23pm tpj/ljp



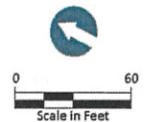
- LEGEND:**
- PROJECT BOUNDARY
 - [Cross-hatched box] SHORELINE SLOPE REPAIR HYDROSEEDING AREA (OCT 2010)
 - [Dotted box] SHORELINE SLOPE REPAIR ARMOR ROCK LIMITS (OCT 2010)
 - [Arrow pointing to line] APPROX. AS-BUILT LOCATION OF ANCHORED LARGE WOODY DEBRIS WITH RIPARIAN PLANTING BEHIND
 - [Dotted box] APPROXIMATE AS-BUILT LOCATION OF RIPARIAN PLANTING ZONE FROM REMOVAL OF ACCESS ROAD
 - [Hatched box] PRE-CONSTRUCTION ARMOR ROCK AND HABITAT LAYER
 - [Arrow pointing to line] PRE-CONSTRUCTION LWD
 - [Black square] PRE-CONSTRUCTION ECOLOGY BLOCK LWD ANCHORS
 - PRE-CONSTRUCTION SURVEY CONTOURS (DATE: 07/29/10)
 - POST-CONSTRUCTION SURVEY CONTOURS (DATE: 11/17/10)
 - STATION LINE
 - [Hatched box] TRACK FOLL AREA
 - [North arrow and 'A-A'] CROSS SECTION LOCATION AND DESIGNATION

- NOTES:**
1. HORIZONTAL DATUM: PORT OF PORTLAND LOCAL PROJECTION (INTERNATIONAL FEET)
VERTICAL DATUM: NGVD 29-47
CONTOUR INTERVAL = 1 FT
 2. FOR NGVD CONTROL POINT, SEE PORT OF PORTLAND DRAWING RG 2005 9024 (NOVEMBER 2009)
 3. PRE-CONSTRUCTION SURVEY BY PORT OF PORTLAND DATED JULY 29, 2010.
 4. POST-CONSTRUCTION SURVEY BY PORT OF PORTLAND DATED NOVEMBER 17, 2010.

Location: _____ Slope Condition: _____

Notes:
Where willows are established, very little erosion present upslope

dock structure
↳ may have shielded bank from wake



Recorded by G. Nagler + D. Lafloon

Weather _____

ATTACHMENT B-6
3RD QUARTER MONITORING
PHOTOGRAPHS



Demarcation fabric observed at Station 0+00



Demarcation fabric observed at Station 2+90



Demarcation fabric observed at Station 2+90



Demarcation fabric observed at Station 3+20



Demarcation fabric observed at Station 3+49

ATTACHMENT B-7
4TH QUARTER MONITORING DATA
SHEETS



Slope Repair Observation Data Sheet

Project Name: T-4, Wheeler Bay

Project No: 050332-01

Vegetation Visual Observation.

of repaired slope area

Observation Crew: Gabe Nagler

Weather: Sunny, 55°F

Photo Point ID: 01G Time: 1540

Station # 0+00

Photo Bearing	140	--
Photo ID #	0645	--

Photo Point ID: 01W Time: 1541

Station # 0+00

Photo Bearing	140	--
Photo ID #	0646	--

Photo Point ID: 01R Time: 1545

Station # 0+00

Photo Bearing	140	--
Photo ID #	0647	--

Photo Point ID: 2G Time: 1345

Station # 1+50

Photo Bearing	320	140
Photo ID #	0648	0649

Photo Point ID: 2W Time: 1346

Station # 1+50

Photo Bearing	320	140
Photo ID #	0650	0651

Photo Point ID: 2R Time: 1348

Station # 1+50

Photo Bearing	320	140
Photo ID #	0652	0653

Project Name: T-4, Wheeler Bay

Project No: 050332-01

Photo Point ID: 3G Time: 1549
 Station # 3+00

Photo Bearing	320	140
Photo ID #	0654	0655

Photo Point ID: 3W Time: 1550
 Station # 3+00

Photo Bearing	320	140
Photo ID #	0656	0657

Photo Point ID: 3R Time: 1551
 Station # 3+00

Photo Bearing	320	140
Photo ID #	0658	0659

Comments (flooding, erosion, vandalism, plant mortality?): none
 Armor stone movement? none
 Instability? none
 Sloughing? none
 Approx. Willow Height: 5-9 ft
 Approx. Grass Height: 15 cm
 Goose Grazing? none
 Invasive Species? some mistle, blackberry. Most has been removed by Port landscape crew.

Other notes:

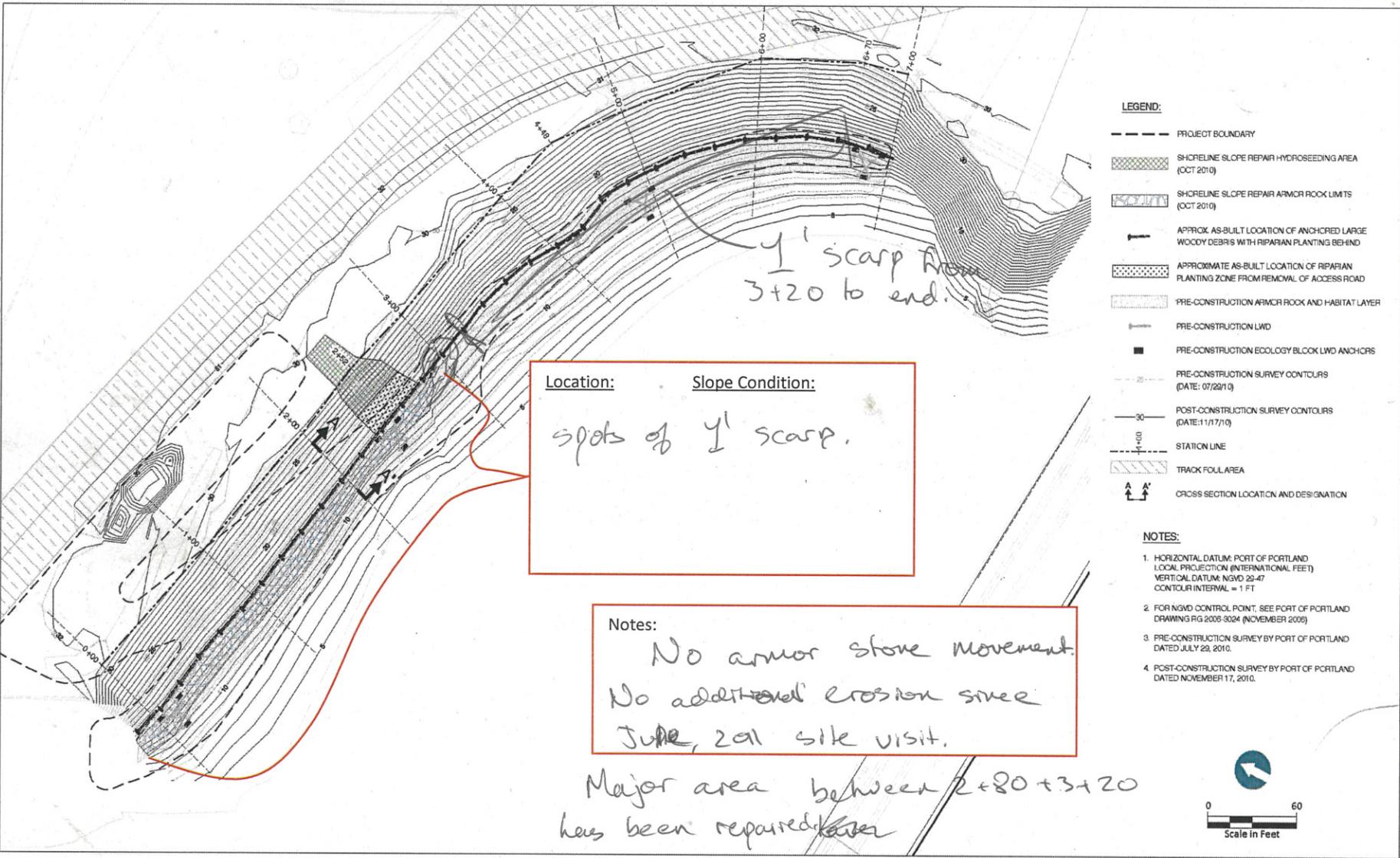
none

Acronyms: G = grass area, W = willow area, R = rock/riprap area

Wheeler Bay Slope Repair Observation Map

Date 10/27/11

4th Q repaired slope observation, Year 2 existing observation.



K:\Jobs\050332\PORT OF PORTLAND\05033201 TIDMINAL A Phase 1\Wheeler Bay Repair\WBR-C-1_C-4.dwg (ACR) FIG 2
Jan 25, 2011 2:23pm tgriga



Recorded by Gabe Nagler

Weather Sunny, 55° F.



DAILY SAFETY MEETING RECORD

Date: 10/27/11

Time: 1422

Person Conducting Meeting: G. Nagler

Persons Attending Meeting: _____

PPE Requires: Level 0

Topics Addressed/Issues Raised:

Train traffic, cars, loose balling.

Slips/trips + falls.

Date:

Time:

Person Conducting Meeting:

Persons Attending Meeting:

PPE Required:

Topics Addressed/Issues Raised:

ATTACHMENT B-8
4TH QUARTER MONITORING
PHOTOGRAPHS



Transect 00+04 @ 140 degrees (G, W, R)



Transect 01+40 @ 320 degrees (G, W, R)



Transect 01+40 @ 140 degrees (G, W, R)



Transect 03+00 @ 320 degrees (G, W, R)



Transect 01+40 @ 140 degrees (G, W, R)



Transect 03+00 @ 320 degrees (G, W, R)



Transect 03+00 @ 140 degrees (G, W, R)