ANCHOR QEA

1423 Third Avenue, Suite 300
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

# MEMORANDUM

| | | | |
|---|---|---|---|
| **To:** | Lisa Pearson, Washington State Department of Ecology | **Date:** | September 15, 2009 |
| **From:** | Dan Berlin, Anchor QEA, LLC<br>Liz Vonckx, Anchor QEA, LLC | **Project:** | 080166-01 |
| **Cc:** | Joanne Snarski, Port of Olympia | | |
| **Re:** | 3-Month Monitoring Results - Berths 2 and 3 Interim Cleanup Action Pilot Study | | |

This memorandum summarizes the results of sediment chemistry monitoring and a bathymetric conditions survey performed by the Port of Olympia (Port) as part of the Berths 2 and 3 Interim Cleanup Action Pilot Study (Interim Action) in West Bay in Olympia, Washington. This monitoring and survey work was conducted 3 months following completion of the Interim Action, as required in the Water Quality Monitoring and Sediment Sampling Plan (Sampling Plan; Anchor Environmental 2008). This memorandum includes sediment chemistry and bathymetry results. Previous sampling conducted for the site as part of the Interim Action is documented in the Completion Report – Berths 2 and 3 Interim Action Cleanup (Anchor QEA 2009).

## 1 BACKGROUND

The Port entered into an Agreed Order (AO) (No. DE 6083) with the Washington State Department of Ecology (Ecology) to complete an interim cleanup action to address cleanup of West Bay sediments adjacent to the Port's Berths 2 and 3 in South Budd Inlet, Olympia, Washington, and to accomplish maintenance dredging to a minimum of -39 feet below mean lower low water (MLLW). The Interim Action was completed on March 3, 2009 with final placement of clean sand cover in the dredged area. Previous chemical sampling and bathymetric data collection was conducted prior to dredging (September 2008), following dredging (February 2009), and following placement of the clean sand cover (March 2009). Those results are included in the Completion Report. This memorandum contains results from sediment monitoring and bathymetric data collection conducted in June 2009.

## 2 SEDIMENT MONITORING

Per the Sampling Plan (Anchor Environmental 2008), sediment sampling was conducted on surface sediment (0 to 10 centimeters [cm]) in the berth area (BA-24, BA-25, BA-26, and BA-27B), underpier area (UP-20, UP-21, UP-22, and UP-23B), and at ambient locations outside of the berth area (BI-C16, BI-S27, and AM-28). The methodology was identical to that used for samples collected during the post-cover sampling performed in March 2009.

Coordinates of each location sampled in June 2009 are provided in Table 1. Sample locations from the March 2009 post-cover sampling event were revisited[1]. Sediment chemistry results are presented in Table 2 and Figure 1. Laboratory results and validation reports are included in Attachments A and B, respectively.

Sampling was conducted for 10 of the 11 samples on June 5, 2009. Underpier sample UP-21 was inaccessible on June 5, 2009 due to the presence of a "camel" that provides an offset from the pierface for vessel moorage. The "camel" was moved with support from divers and additional Port employees to accommodate sampling. Sampling at UP-21 occurred at the earliest possible date between Marine Terminal vessel calls on June 18, 2009.

As shown in Table 3, the surface sediment chemistry results from the 3-month post-cover sampling in June 2009 are similar to the post-cover survey results from March 2009. The mean concentration in the berth area was 2.4 parts per trillion toxic equivalency (TEQ), compared to 0.16 TEQ in the March 2009 post-cover event. Underpier samples from the 3-month monitoring event (mean 37.1 TEQ) were similar to the post-cover sampling (mean 38.9 TEQ). Ambient samples from the 3-month monitoring event (mean 22.7 TEQ) were also similar to the post-cover sampling (mean 23.8 TEQ).

As discussed with Ecology, it is expected that cover material placed in the berth area will equilibrate with background concentrations of West Bay sediments as normal sediment

[1] The location of BA-25 was not shown correctly in figures of the Completion Report. However, the coordinates for that location presented in Table 2 of the Completion Report are accurate. This location was inadvertently moved during the March 2009 post-cover sampling. The same location was revisited during the June 2009 monitoring event and will continue to be revisited during subsequent monitoring events.

deposition continues. Ecology's sediment characterization study indicated that average sediment concentrations in West Bay were 19.0 TEQ (SAIC 2008). Similarly, underpier samples and ambient samples are anticipated to become more similar to the bay-wide mean with continued deposition.

## 3 BATHYMETRIC SURVEY RESULTS

Multibeam bathymetric surveys were conducted just after the placement of the sand cover (March 12, 2009) and 3 months following placement (June 24, 2009). The June survey was conducted by eTrac Engineering using a multibeam sonar system. The survey included the dredged portions of the berth area as well as the underpier area. The survey was conducted in accordance with requirements presented in the Sampling Plan.

Results of the June bathymetric survey are provided in Figures 2 through 8. Figure 1 presents a plan view of the bathymetry results along with cross section locations. Ten cross sections are presented in Figures 3 through 7. In addition to the multibeam bathymetric survey, Port staff also collected leadline measurements at the pierface on July 13, 2009. As shown on each figure, the results of the leadline measurements and June multibeam bathymetric survey agree substantially with one another at each cross section.

As part of the Interim Action, the area immediately adjacent to the pierface was dredged to between -40 and -41 feet MLLW; however, sloughing from the underpier slope resulted in an accumulation of material at the pierface shortly after the dredging was completed. The approach to dredge at the pierface to allow the slope to slough in a controlled manner was discussed with Ecology during development of the Interim Action Plan. This approach was determined to be the most environmentally protective and present the least risk to the pile supported structure. However, the slope sloughed less than expected during construction. As discussed with Ecology during plan development, this outcome meant that sloughing was likely to continue after dredging was complete until the slope reached equilibrium.

Table 4 provides a summary of bathymetry measurement comparisons between the March and June surveys. Based on the cross sections from the post-cover survey conducted in March, elevations at the pierface following placement of the sand cover ranged from -35.2 to –39.9 feet MLLW, except at the northern-most corner. Section 15+40 is located at the very

northern edge of the dredge area (Figure 7) and contains small areas with higher elevations. The mean depth at the pierface was -37.1 feet MLLW.

Based on the cross sections from the June survey, sediment elevations at the pierface within the dredged berth area range from -34.9 to -38.2 feet MLLW, except at the northern-most corner (which measured -30.2 feet MLLW). The mean depth was -36.0 feet MLLW. The mudline elevation along the pierface increased an average of 1.1 feet (Table 4). The increase in elevation along the pierface is attributed to additional sloughing from the underpier areas. The increased sediment elevation at the pierface and underpier sloughing is shown in the comparison of the March and June bathymetric surveys in Figure 8.

As expected, the data suggest that sloughing continues to occur under the pier. Based on the cross sections from the post-cover survey, the horizontal distance under the pier to the top of the sloughing ranged from 1.5 to 13 feet from the fender line, except at the northern-most corner (which had no sloughing). The average horizontal distance of sloughing underpier was 7.5 feet. Based on the cross sections from the June survey, the horizontal distance under the pier to the top of the sloughing ranged from 7.5 to 13 feet, except at the northern-most corner (which had no sloughing). The average horizontal distance of sloughing underpier was 9.0 feet. It is anticipated that as sloughing continues, a shallower slope will result down to the berth area.

Sloughing is likely to continue until the slope reaches equilibrium. The Port has installed temporary mooring camels along the pierface as an interim measure to provide an offset from the toe of slope for berthing vessels. The degree and timing of additional sloughing could warrant additional dredging along the pierface. The Port will continue to take regular leadline measurements at the pierface and will coordinate with Ecology if increases in mudline elevations at the pierface create challenges to navigation in the berths. If so, additional dredging may be warranted, pending discussion with Ecology.

## 4 NEXT STEPS

Monitoring events will continue at 6-month intervals through December 2010. The next event will be conducted in December 2009 and will consist of surface sediment sampling and bathymetric surveying. In the event that navigation becomes limited on the berth area due

to sloughing, the Port will inform Ecology and coordinate next steps.

## 6 REFERENCES

Anchor Environmental, L.L.C. 2008. Water Quality Monitoring and Sediment Sampling Plan. Prepared for the Port of Olympia. September.

Anchor QEA, LLC. 2009. Completion Report – Berths 2 and 3 Interim Action Cleanup. Prepared for the Port of Olympia. June.

SAIC. 2008. Sediment Characterization Study, Budd Inlet, Olympia, WA, Final Data Report. Prepared for the Washington State Department of Ecology. March 12.

# ATTACHMENTS

## Table 1
## 2009 3-Month Post-Cover Surface Sediment Sample Coordinates

| Station ID | | Actual Coordinates[1] | | | |
|---|---|---|---|---|---|
| | | Latitude (°N) | Longitude (°W) | Northing (feet) | Easting (feet) |
| Underpier | PO-UP-20-SE | 47 03.2034 | 122 54.3436 | 636401 | 1040845 |
| | PO-UP-21-SE | 47 03.2457 | 122 54.3508 | 636659 | 1040823 |
| | PO-UP-22-SE | 47 03.2790 | 122 54.3557 | 636862 | 1040809 |
| | PO-UP-23B-SE | 47 03.3133 | 122 54.3608 | 637071 | 1040794 |
| Berth Area | PO-BA-24-SE | 47 03.2001 | 122 54.3601 | 636383 | 1040776 |
| | PO-BA-25-SE | 47 03.2274 | 122 54.3604 | 636549 | 1040780 |
| | PO-BA-26-SE | 47 03.2772 | 122 54.3650 | 636852 | 1040770 |
| | PO-BA-27B-SE | 47 03.3123 | 122 54.3760 | 637067 | 1040731 |
| Ambient | PO-AM-28-SE | 47 03.3417 | 122 54.3982 | 637248 | 1040644 |
| | BI-S37 | 47 03.2880 | 122 54.4394 | 636927 | 1040463 |
| | BI-C16 | 47 03.2225 | 122 54.3922 | 636523 | 1040647 |

Notes:

1 Washington South Zone, NAD 83 geographic and state plane coordinates – U.S. survey feet

## Table 2
## 3-Month Post-Cover Sediment Chemistry Results

| | Berth Area | | | | Underpier Area | | | | Ambient Samples | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BA-24 | BA-25 | BA-26 | BA-27B | UP-20 | UP-21 | UP-22 | UP-23B | BI-C16 | BI-S37 | AM-28 |
| Sample Date | 6/5/09 | 6/5/09 | 6/5/09 | 6/5/09 | 6/5/09 | 6/18/09 | 6/5/09 | 6/5/09 | 6/5/09 | 6/5/09 | 6/5/09 |
| Sample Interval | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm | 0 - 10 cm |
| **Conventional Parameters (pct)** | | | | | | | | | | | |
| Total organic carbon | **1.2** | **0.37** | **0.41** | **0.44** | **4.6** | **3.6** | **4.2** | **6.0** | **3.5** | **3.5** | **3.6** |
| Total solids | **60** | **82** | **80** | **78** | **28** | **27** | **26** | **25** | **27** | **29** | **28** |
| **Grain Size (pct)** | | | | | | | | | | | |
| Cobbles | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** |
| Gravel | **18** | **20** | **22** | **29** | **4.1** | **0.5** | **0.4** | **0.7** | **0.1** | **0** | **0** |
| Sand | **63** | **75** | **73** | **66** | **15** | **21** | **7.9** | **6.6** | **4.5** | **2.2** | **4** |
| Silt | **15** | **2.9** | **2.9** | **3.2** | **70** | **69** | **82** | **82** | **84** | **84** | **84** |
| Clay | **0.8** | **0.8** | **0.7** | **0.7** | **1.6** | **1.8** | **2.8** | **0.3** | **1.7** | **4.3** | **2.6** |
| Fines (Silt + Clay) | **15.8** | **3.7** | **3.6** | **3.9** | **71.6** | **70.8** | **84.8** | **82.3** | **85.7** | **88.3** | **86.6** |
| **Dioxin Furans (ng/kg)** | | | | | | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) | **0.111 J** | 0.0841 U | **0.0412 J** | **0.0643 J** | **0.711** | **0.745 J** | **0.647** | **0.88** | **0.566** | **0.606** | **0.688** |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) | **0.657 J** | **0.233 J** | **0.21 J** | **0.236 J** | **4.42** | **3.62** | **4.34** | **4.91** | **2.92** | **3.44** | **3.38** |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | **1.2 J** | **0.504 J** | **0.388 J** | **0.509 J** | **9.25** | **8.83** | **8.18** | **9.17** | **5.18** | **6.08** | **5.97** |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) | **5.56** | **2.09 J** | **1.92 J** | **2.14 J** | **40.7** | **34.8** | **42.5** | **41.4** | **26.7** | **30.1** | **30.1** |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) | **2.5** | **0.959 J** | **0.792 J** | **0.887 J** | **19.1** | **16.4** | **17.4** | **19.3** | **11.2** | **12.3** | **12.4** |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) | **136** | **57.6** | **38.1** | **46.1** | **1420** | **1490** | **1270** | **1060** | **595** | **593** | **606** |
| 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) | **1330** | **588** | **314** | **408** | **15700 J** | **16800 J** | **10900 J** | **8950** | **5350** | **4800** | **4980** |
| 2,3,7,8-Tetrachlorodibenzofuran (TCDF) | **0.43 J** | **0.153 J** | **0.139 J** | **0.151 J** | **2.69** | **2.29** | **2.8** | **2.87** | **2.29** | **2.64** | **2.72** |
| 1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) | **0.43 J** | **0.16 J** | **0.146 J** | **0.196 J** | **2.61** | **2.34 J** | **3.24** | **3.23** | **2.25 J** | **2.53** | **2.59** |
| 2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) | **0.86 J** | **0.372 J** | **0.379 J** | **0.33 J** | **5.36** | **4.75** | **6.27** | **7.54** | **4.37** | **4.67** | **5.03** |
| 1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) | **2.1 J** | **0.757 J** | **0.849 J** | **0.943 J** | **14.1** | **12.5** | **15.7** | **19.4** | **10.7** | **11.7** | **11.9** |
| 1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) | **1.07 J** | **0.39 J** | **0.329 J** | **0.417 J** | **6.86** | **5.77** | **6.57** | **7.83** | **4.99** | **5.28** | **5.59** |
| 1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) | **0.517 J** | **0.202 J** | **0.18 J** | **0.181 J** | **2.7** | **2.83** | **3.44** | **3.63** | **2.21 J** | **2.66** | **2.66** |
| 2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) | **1.76 J** | **0.636 J** | **0.54 J** | **0.576 J** | **10.1** | **8.08** | **10** | **11.9** | **7.46** | **8.35** | **8.71** |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF) | **33.5** | **12.9** | **10.7** | **13.3** | **242** | **206** | **235** | **270** | **170** | **192** | **245** |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF) | **1.31 J** | **0.562 J** | **0.531 J** | **0.628 J** | **10.5** | **9.49** | **9.56** | **11.5** | **6.29** | **6.62** | **6.44 J** |
| 1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF) | **69.5** | **27.7** | **20.5** | **27.4** | **707** | **615** | **559** | **673** | **306** | **312** | **342** |
| Total Tetrachlorodibenzo-p-dioxin (TCDD) | **4.8 J** | **1.78 J** | **1.71 J** | **2.05 J** | **25.1 J** | **25.3 J** | **31.5 J** | **29.9 J** | **24.1 J** | **31.6 J** | **31.5 J** |
| Total Pentachlorodibenzo-p-dioxin (PeCDD) | **8.38 J** | **3.38 J** | **3.06 J** | **3.42 J** | **54.7** | **51.5 J** | **58 J** | **60.9** | **45 J** | **55.8** | **53.9 J** |
| Total Hexachlorodibenzo-p-dioxin (HxCDD) | **58.8** | **25.8** | **18.5** | **21.3 J** | **611** | **641** | **530** | **465** | **277** | **290** | **293** |
| Total Heptachlorodibenzo-p-dioxin (HpCDD) | **440** | **213** | **97.8** | **131** | **6640** | **8200** | **5340** | **3340** | **1830** | **1410** | **1500** |
| Total Tetrachlorodibenzofuran (TCDF) | **6.78 J** | **2.52 J** | **2.04 J** | **2.5 J** | **41.4 J** | **35.8 J** | **41.7 J** | **44.4 J** | **34.6 J** | **41.9 J** | **43 J** |
| Total Pentachlorodibenzofuran (PeCDF) | **10.7 J** | **4.24 J** | **3.79 J** | **4.53 J** | **75.4 J** | **62.6 J** | **80 J** | **85.2 J** | **59.3 J** | **68.9 J** | **65.4 J** |
| Total Hexachlorodibenzofuran (HxCDF) | **43.2** | **15.7 J** | **14.5 J** | **16.3 J** | **286** | **239 J** | **301** | **351 J** | **211** | **238** | **246 J** |
| Total Heptachlorodibenzofuran (HpCDF) | **92.9 J** | **36.2** | **30 J** | **36.4** | **767** | **650** | **674** | **810** | **460** | **505** | **581 J** |
| Total Dioxin/Furan TEQ (U = 0) | **4.68** | **1.81** | **1.48** | **1.72** | **39.01** | **37.29** | **36.21** | **36.00** | **21.35** | **22.88** | **23.83** |

Notes:

**Bold = Detected result**

J = Estimated value

U = Compound analyzed, but not detected above detection limit

Data Validated by LDC, Level III

TEQ values as of 2005, World Health Organization

## Table 3
## 2009 Post-Cover Surface Sediment Results

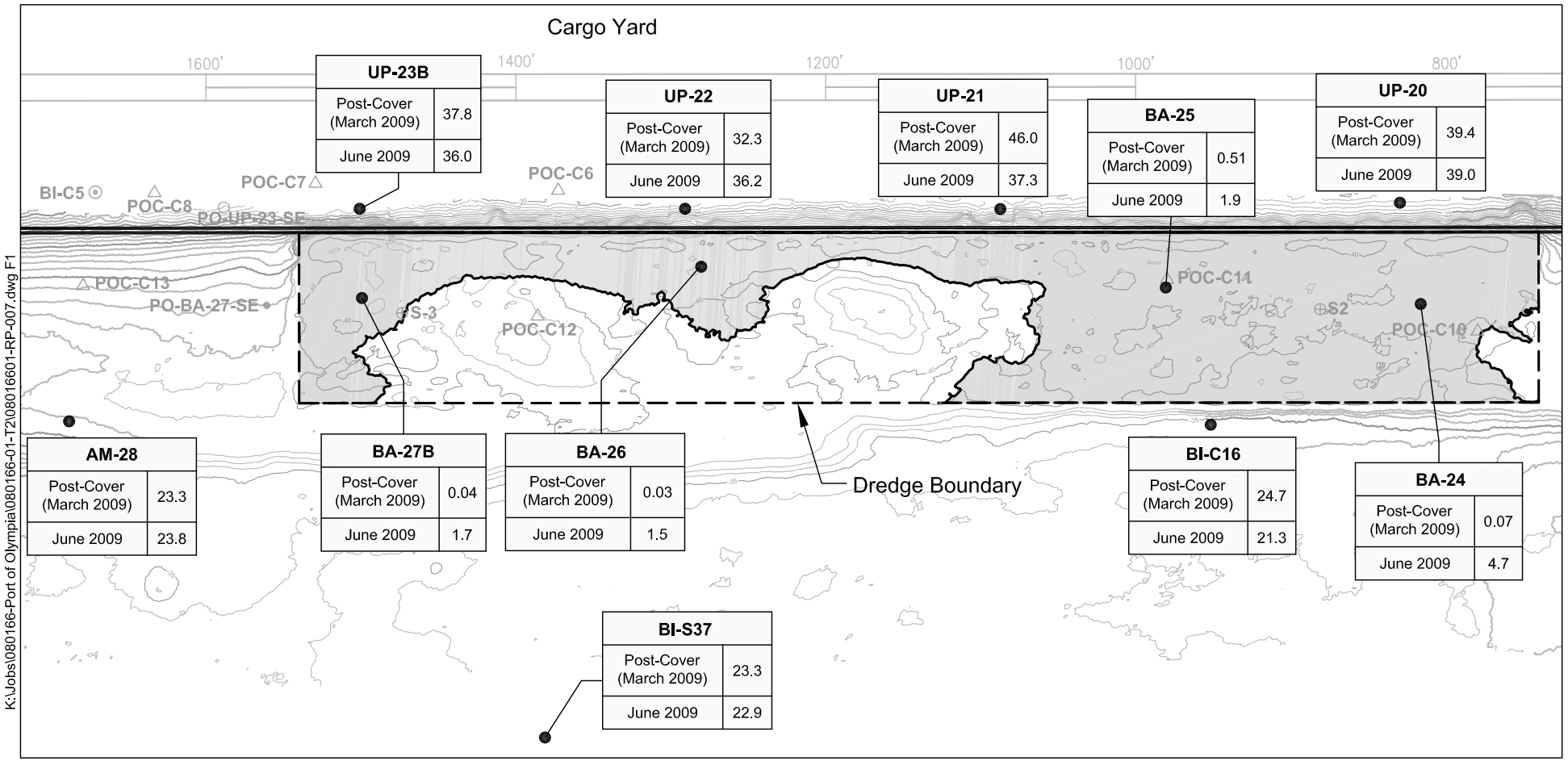
| | Post-Cover Survey (March 2009) | 3-Month Post-Cover Survey (June 2009) |
|---|---|---|
| **Underpier Area** | | |
| UP-20 | **39.4** | **39.0** |
| UP-21 | **46.0** | **37.3** |
| UP-22 | **32.3** | **36.2** |
| UP-23B | **37.8** | **36.0** |
| Average | **38.9** | **37.1** |
| **Berth Area** | | |
| BA-24 | **0.1** | **4.7** |
| BA-25 | **0.5** | **1.8** |
| BA-26 | **0.0** | **1.5** |
| BA-27B | **0.0** | **1.7** |
| Average | **0.2** | **2.4** |
| **Ambient Samples** | | |
| BI-C16 | **24.7** | **21.3** |
| BI-S37 | **23.3** | **22.9** |
| AM-28 | **23.3** | **23.8** |
| Average | **23.8** | **22.7** |

Note:

TEQ values calculated using World Health Organization (2005)

**Table 4**
**Bathymetry Comparison**

| | Post-Cover Elevation (feet MLLW) March 9, 2009 | 3-Month Survey Elevation (feet MLLW) June 24, 2009 | Change in Mudline Elevation at Pierface (feet) | Distance Under Pier to Top of Sloughed Slope (from fender line; feet MLLW) | | Increase in Lateral Distance to Top of Sloughed Slope (feet) |
|---|---|---|---|---|---|---|
| | | | | March 9, 2009 | June 24, 2009 | |
| **Cross Section** | | | | | | |
| 7+40 | **-35.2** | **-34.9** | **0.3** | **7.0** | **8.0** | **1.0** |
| 7+90 | **-39.9** | **-38.2** | **1.6** | **11.0** | **11.5** | **0.5** |
| 8+90 | **-37.6** | **-37.3** | **0.3** | **9.0** | **11.0** | **2.0** |
| 9+70 | **-35.6** | **-36.6** | **-1.1** | **1.5** | **8.5** | **7.0** |
| 10+90 | **-37.7** | **-36.2** | **1.5** | **12.0** | **12.0** | **0.0** |
| 11+90 | **-39.6** | **-37.5** | **2.0** | **4.0** | **7.5** | **3.5** |
| 12+90 | **-36.8** | **-35.9** | **0.9** | **13.0** | **13.0** | **0.0** |
| 13+90 | **-37.7** | **-36.7** | **1.0** | **10.0** | **10.0** | **0.0** |
| 14+90 | **-39.0** | **-36.6** | **2.4** | **7.0** | **8.0** | **1.0** |
| 15+40 | **-31.8** | **-30.2** | **1.5** | **0.0** | **0.0** | **0.0** |
| Minimum | **-39.9** | **-38.2** | **-1.1** | **0.0** | **0.0** | **0.0** |
| Average | **-37.1** | **-36.0** | **1.1** | **7.5** | **9.0** | **1.5** |
| Maximum | **-31.8** | **-30.2** | **2.4** | **13.0** | **13.0** | **7.0** |




K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-007.dwg F1

Sep 02, 2009 9:05am heriksen

**HORIZONTAL DATUM**: Horizontal datum is Washington State Plane - South Zone (NAD 83(91)), U.S. survey feet.
**VERTICAL DATUM**: Vertical datum is Mean Lower Low Water (MLLW).
**NOTES**:

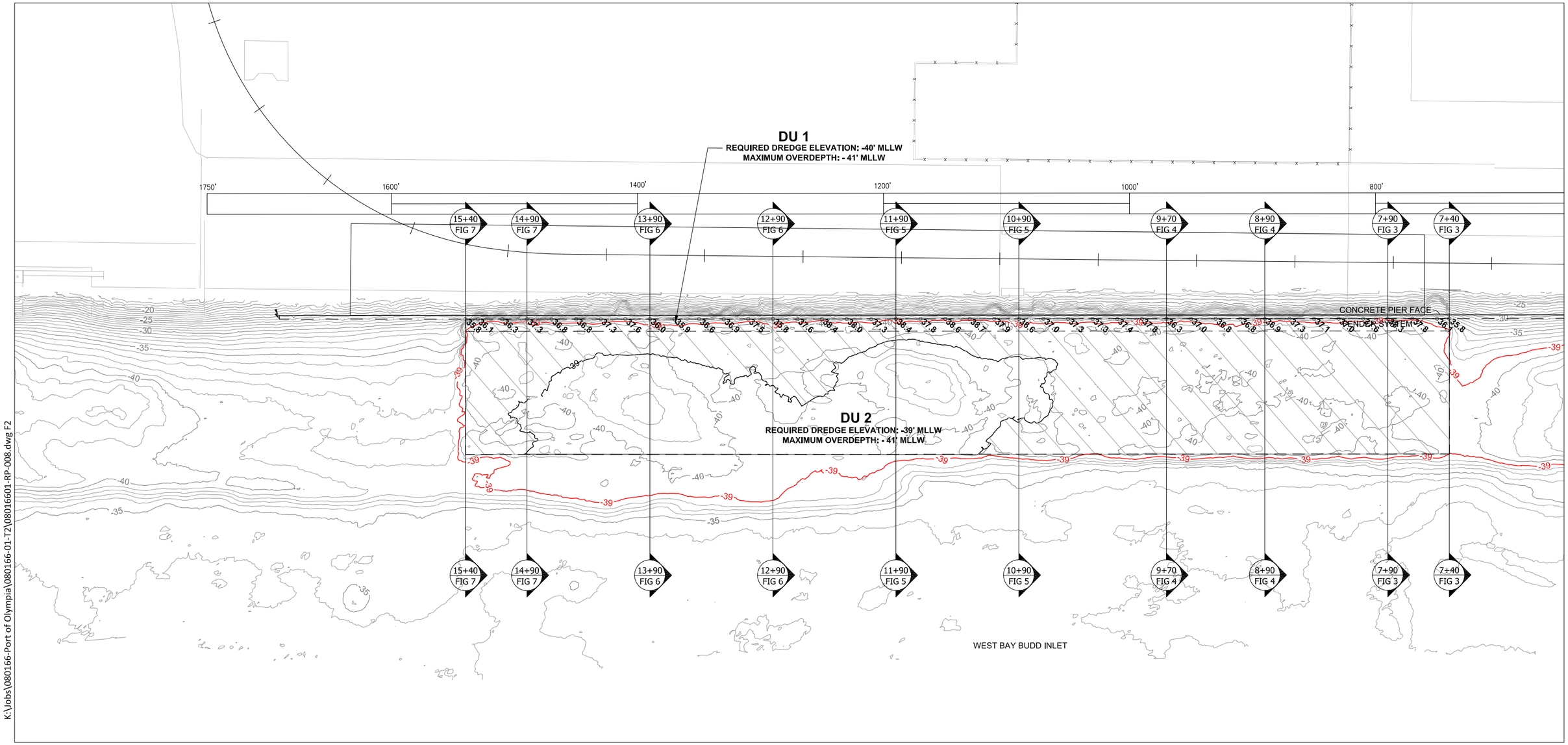
1. Bathymetric survey provided by David Evans and Associates, Inc., dated June 24, 2009.
2. Contour interval is 1 foot.

Dredged Area
BA-27 2009 Sediment Grab Location
S4 Core Sample - DMMP 2006
BI-C4 Core Sample - Ecology 2007
POC-S2 Surface Sample - Port 2007
POC-S5 Core Sample - Port 2007
PO-UP-22-SE Core Sample - Port 2008
PO-BA-27-SE Core Sample - Port 2008

0 100
Scale in Feet

ANCHOR QEA

**Figure 1**
Post-Construction Dioxin Concentrations
Berth 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




K:\Jobs\080166-Port of Olympia\080166-01-T2\08016601-RP-008.dwg F2

Sep 09, 2009 1:08pm heriksen

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

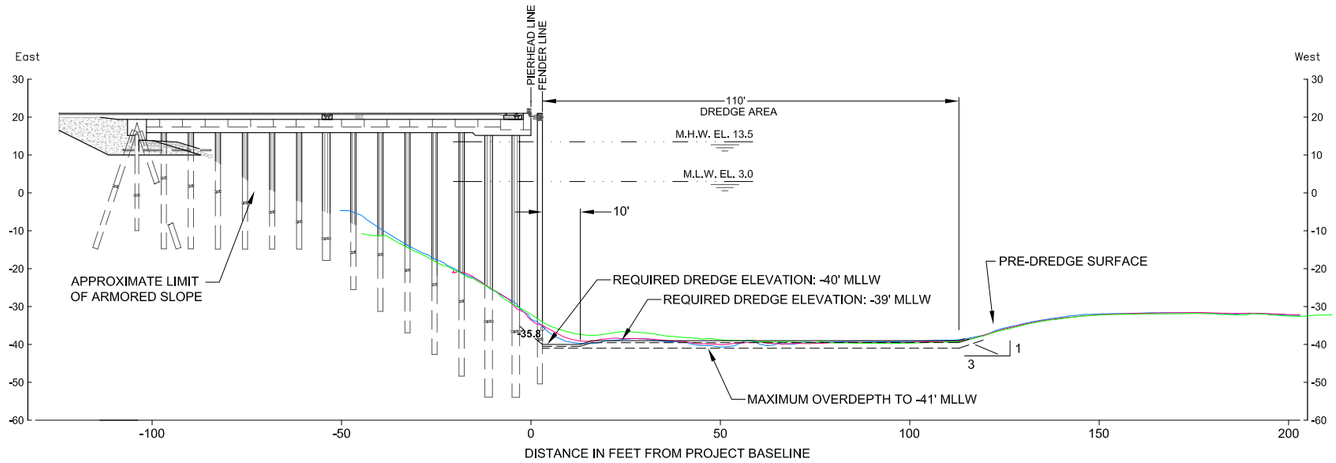
**NOTES:** CONTOUR INTERVAL IS 1 FOOT.

FENDER LINE
PIERHEAD LINE
CONTOURS
RAIL LINE
DREDGE AREA
DREDGED AREA
-39 FEET MLLW
LEADLINE ELEVATION IN FEET (JULY 13, 2009)

0 80
Scale in Feet

ANCHOR QEA

**Figure 2**
3-Month Post-Dredge Bathymetry
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia



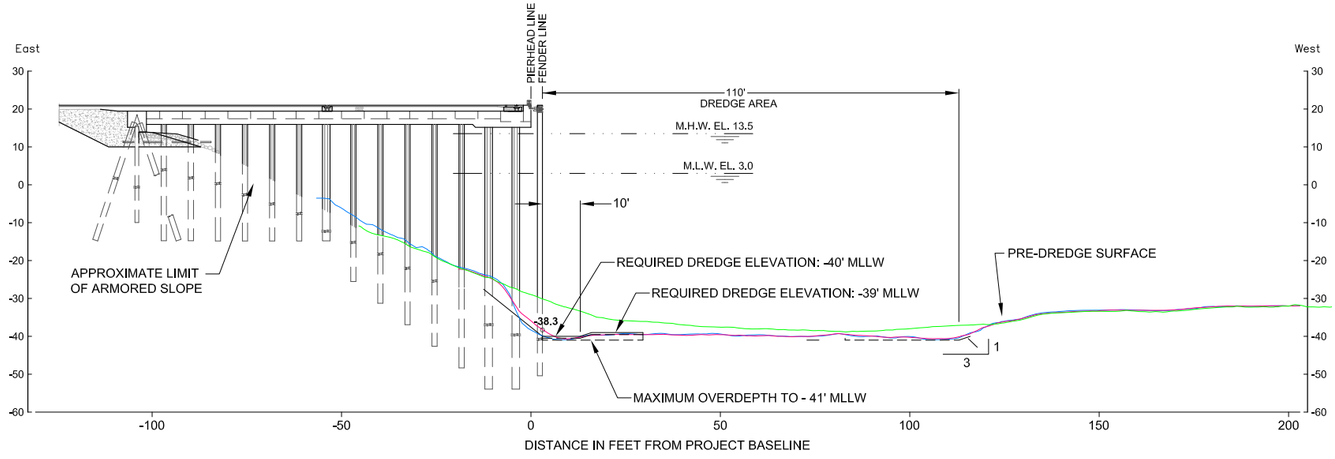

7+40 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008

POST-COVER MARCH 12, 2009

CONDITIONS JUNE 24, 2009

-35.8 ○ LEADLINE ELEVATION IN FEET




7+90 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

0 40
Scale in Feet

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

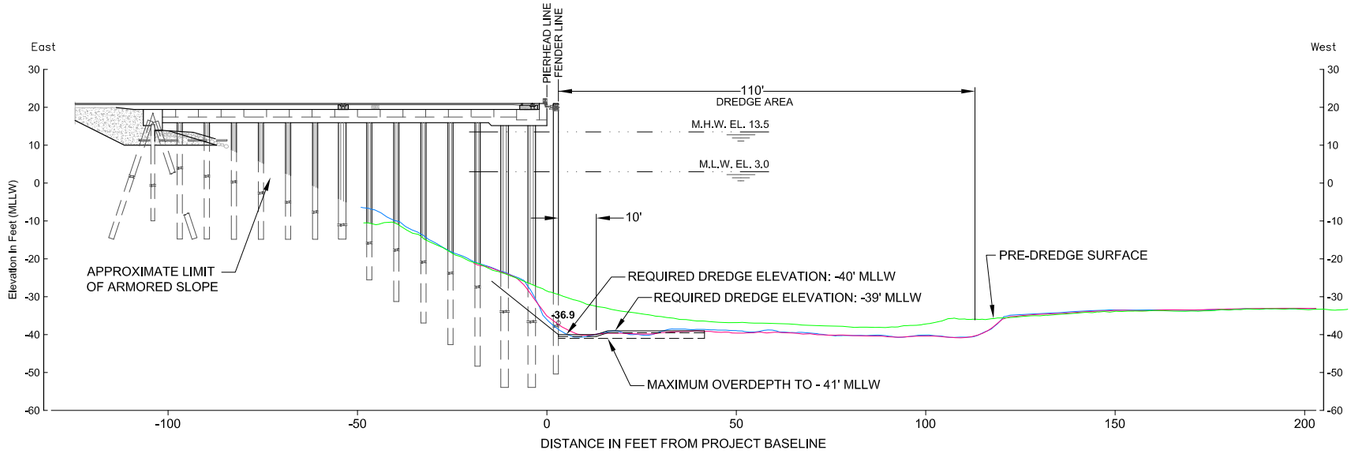
**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

POST-DREDGE BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

K:\Jobs\080166-Port of Olympia\080166-01-T2\080166-01-RP-008.dwg F3
Sep 09, 2009 2:52pm heriksen

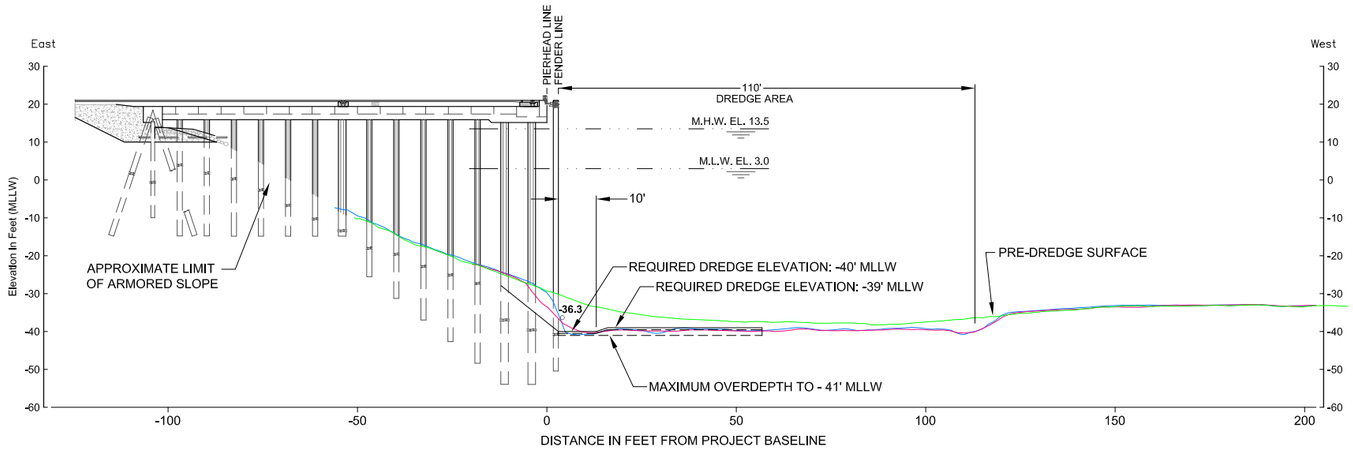
ANCHOR QEA

**Figure 3**
Cross Sections 7+40 and 7+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




8+90 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 12, 2009
CONDITIONS JUNE 24, 2009
-35.8 ○ LEADLINE ELEVATION IN FEET




9+70 FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

0 40
Scale in Feet

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

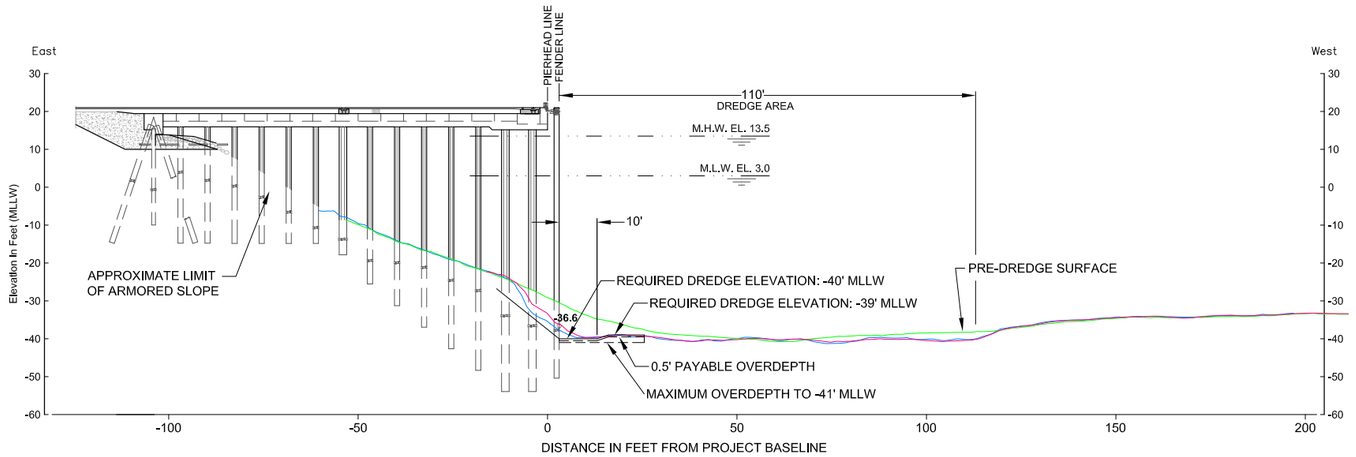
**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

POST-DREDGE BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

Sep 09, 2009 2:53pm heriksen K:\Jobs\080166-Port of Olympia\080166-01-T2\080166O1-RP-008.dwg F4

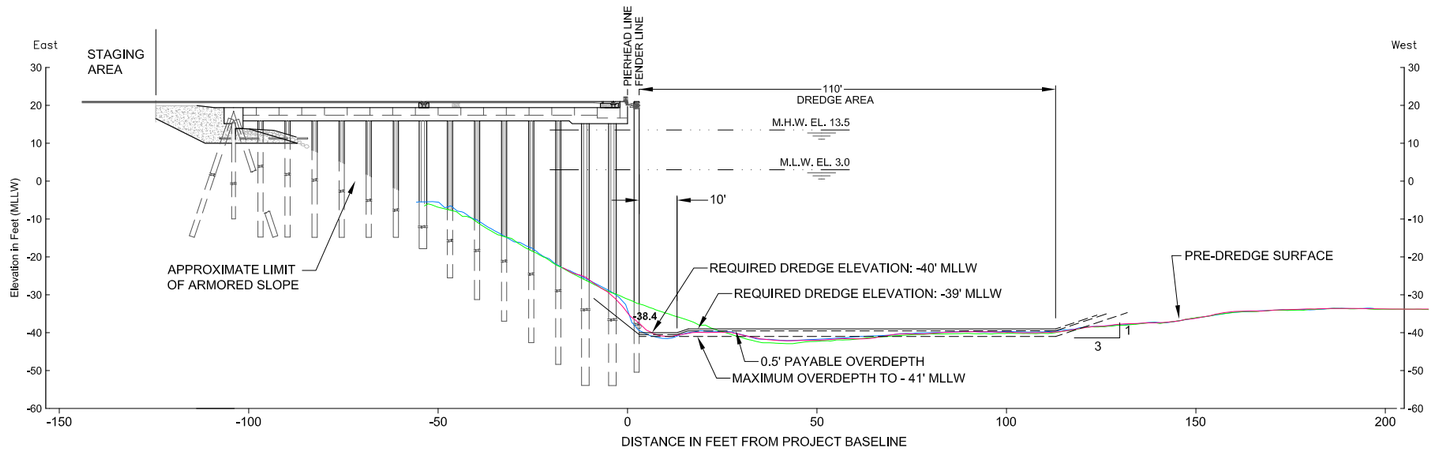
ANCHOR QEA

**Figure 4**
Cross Sections 8+90 and 9+70
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




10+90 / FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 12, 2009
CONDITIONS JUNE 24, 2009
-35.8 ○ LEADLINE ELEVATION IN FEET




11+90 / FIG 1 **CROSS SECTION**
SCALE: 1" = 40'

0 40
Scale in Feet

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

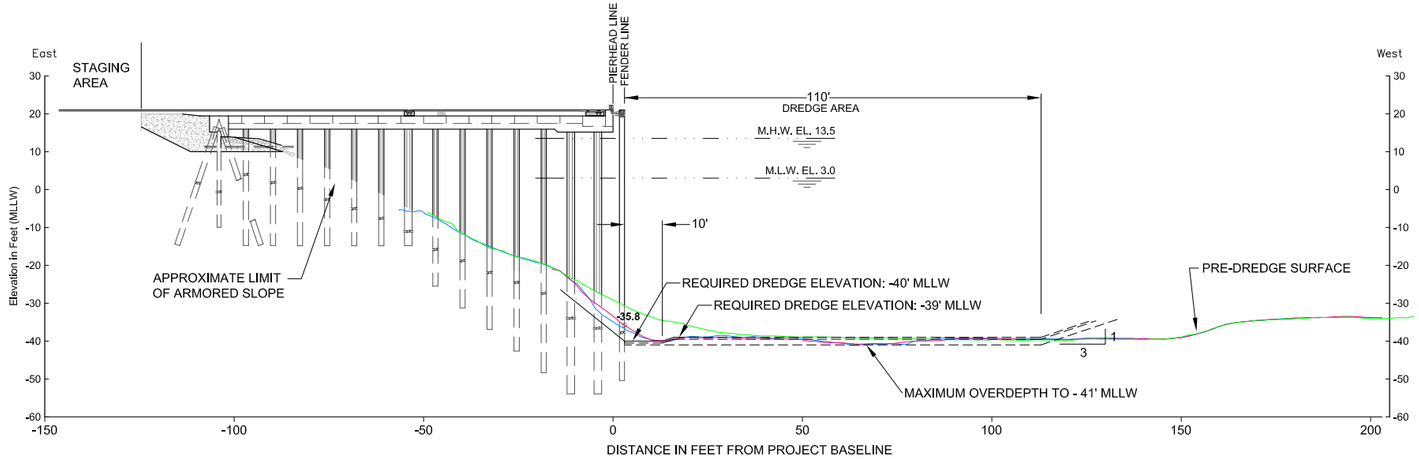
**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

POST-DREDGE BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

K:\Jobs\080166-Port of Olympia\080166-01-T2\080166O1-RP-008.dwg F5
Sep 09, 2009 2:53pm heriksen

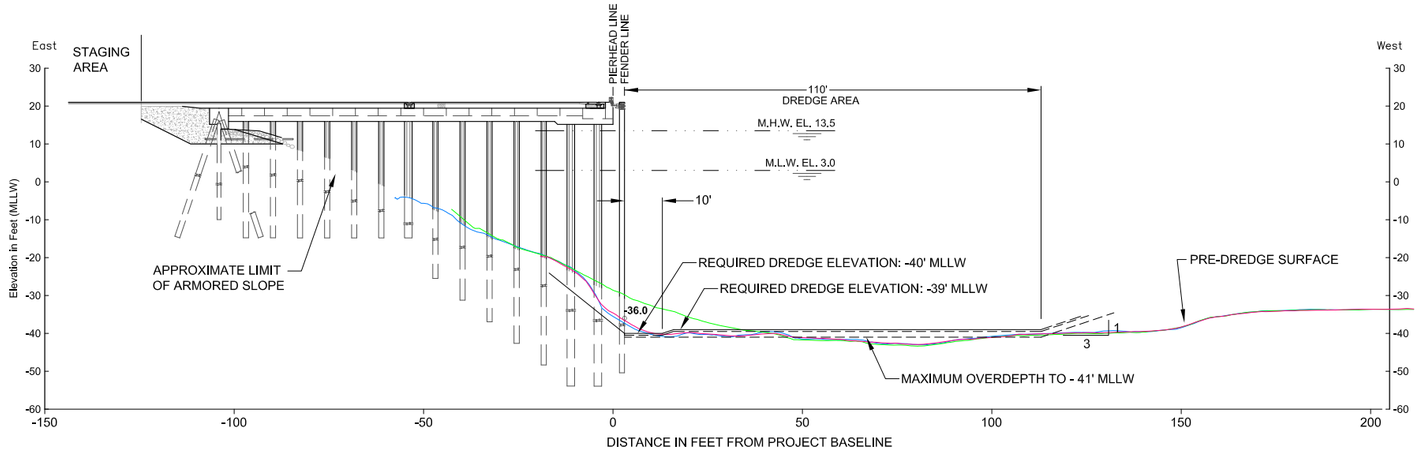
ANCHOR QEA

**Figure 5**
Cross Sections 10+90 and 11+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




12+90 / FIG 1 CROSS SECTION
SCALE: 1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 12, 2009
CONDITIONS JUNE 24, 2009
-35.8 ○ LEADLINE ELEVATION IN FEET




13+90 / FIG 1 CROSS SECTION
SCALE: 1" = 40'

0 40
Scale in Feet

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

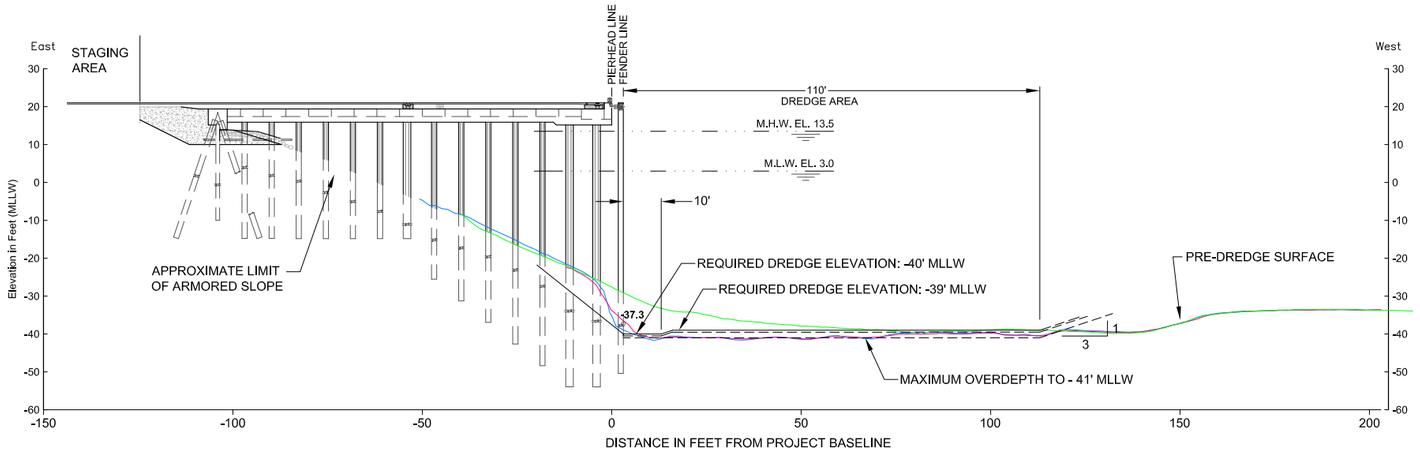
**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

POST-DREDGE BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

K:\Jobs\080166-Port of Olympia\080166-01-T2\080166O1-RP-008.dwg F6
Sep 09, 2009 2:54pm heriksen

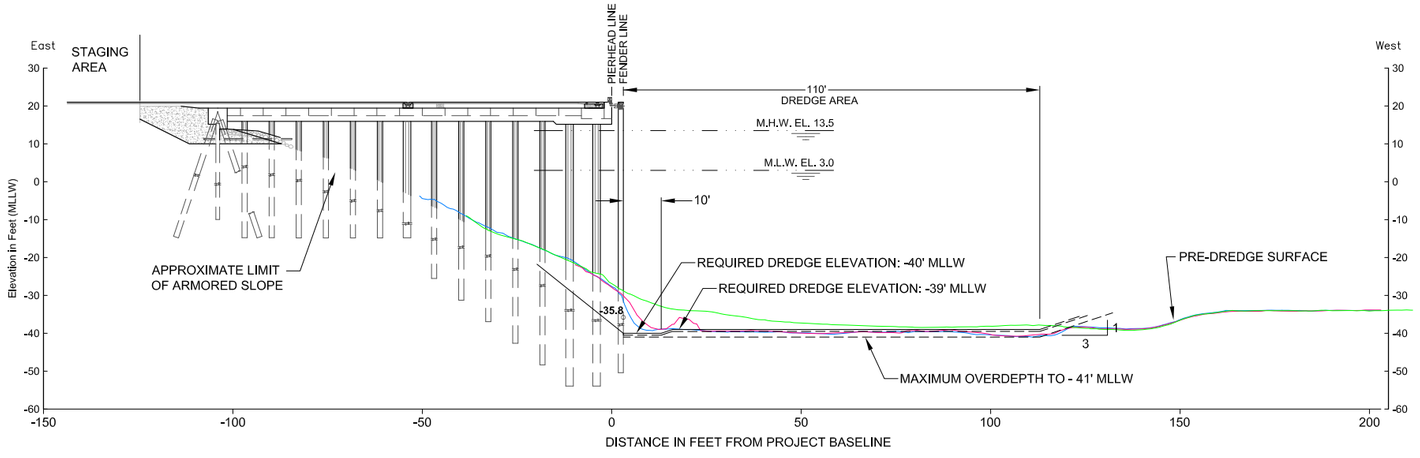
ANCHOR QEA

**Figure 6**
Cross Sections 12+90 and 13+90
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




14+90 / FIG 1 **CROSS SECTION**
SCALE:1" = 40'

PRE-DREDGE MARCH 27, 2008
POST-COVER MARCH 12, 2009
CONDITIONS JUNE 24, 2009
-35.8 ○ LEADLINE ELEVATION IN FEET




15+40 / FIG 1 **CROSS SECTION**
SCALE:1" = 40'

0 40
Scale in Feet

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

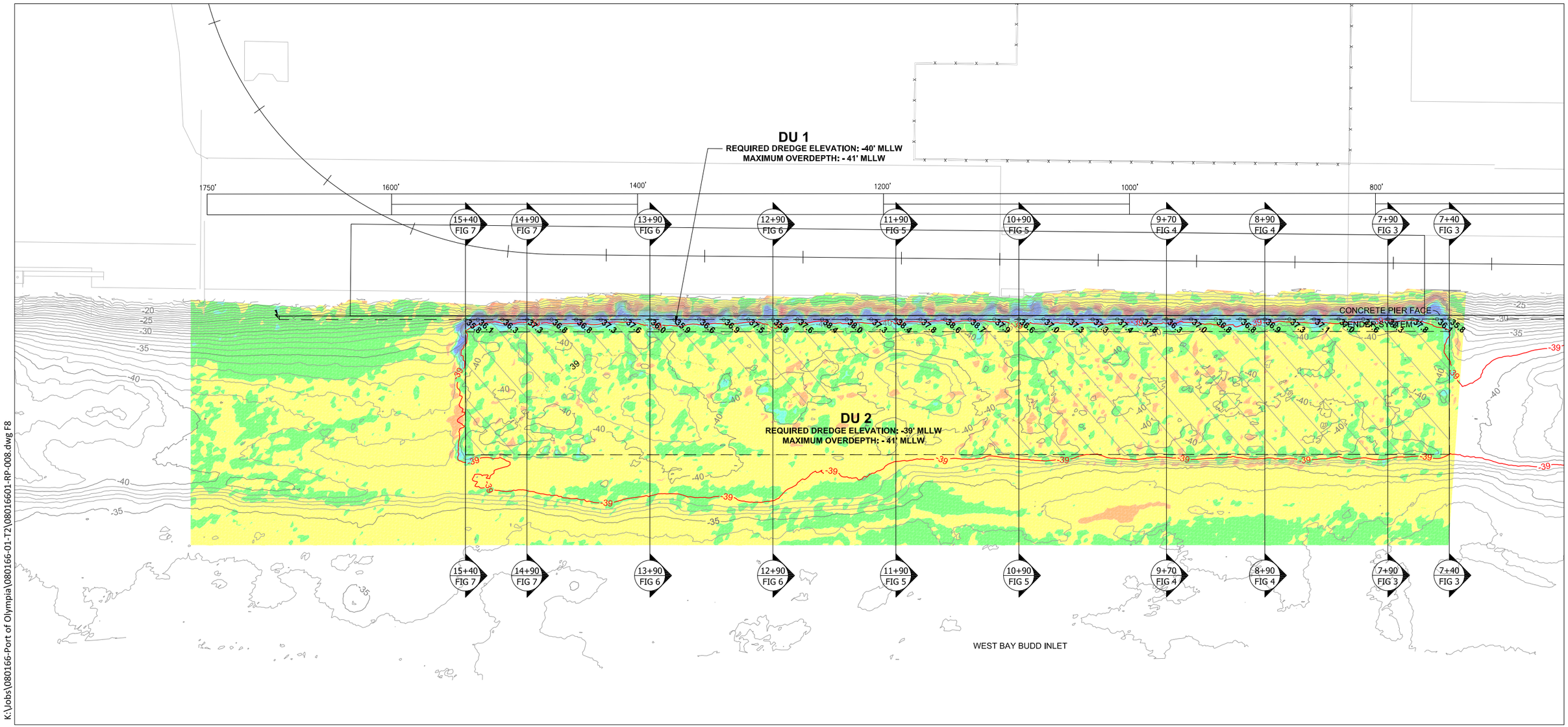
**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

POST-DREDGE BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

K:\Jobs\080166-Port of Olympia\080166-01-T2\080166O1-RP-008.dwg F7
Sep 09, 2009 2:54pm heriksen

ANCHOR QEA

**Figure 7**
Cross Sections 14+90 and 15+40
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia




K:\Jobs\080166-Port of Olympia\080166-01-T2\080166011-RP-008.dwg F8

Sep 09, 2009 1:34pm heriksen

**HORIZONTAL DATUM:** WASHINGTON STATE PLANE - SOUTH ZONE (NAD 83(91)), U.S. SURVEY FEET.

**VERTICAL DATUM:** NOS MEAN LOWER LOW WATER (MLLW).

**SURVEY:** 3-MONTH POST-COVER BATHYMETRIC SURVEY PROVIDED BY eTRAC, DATED JUNE 24, 2009.

**NOTES:** CONTOUR INTERVAL IS 1 FOOT.

ISOPACH SHOWING DIFERENCE IN FEET BETWEEN THE POST COVER SURVEY CONDUCTED ON 03/12/2009 AND THE CURRENT CONDITION AS OF 06/24/2009

| RANGE BEG. | RANGE END |
|---|---|
| < -2.00 | -1.50 |
| -1.50 | -1.00 |
| -1.00 | -0.50 |
| -0.50 | 0.00 |
| 0.00 | 0.50 |
| 0.50 | 1.00 |
| 1.00 | 1.50 |
| 1.50 | > 2.00 |

FENDER LINE
PIERHEAD LINE
CONTOURS
RAIL LINE

DREDGED AREA
-39 FEET MLLW
-35.8 LEADLINE ELEVATION IN FEET (JULY 13, 2009)

0 80
Scale in Feet

**Figure 8**
Comparison of March and June Bathymetric Surveys
Berths 2 and 3 Interim Cleanup Action Pilot Study
Port of Olympia

ANCHOR QEA