Updated February 13, 2009

CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD November 25, 2008

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED MAINTENANCE DREDGED MATERIAL FROM PORT OF TACOMA WASHINGTON UNITED TERMINAL PROJECT WHARF MAINTENANCE DREDGING, AND CUTBACK CONSTRUCTION DREDGING (NWS-2008- 01340-WRD) IN COMMENCEMENT BAY, WASHINGTON EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT A DMMP NON-DISPERSIVE OPEN-WATER DISPOSAL SITE.

1. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) on the suitability of an estimated 28,400 cy of maintenance material within the Wharf area (e.g., estimated dredging prism thickness of 4-6 feet, including 1.5 horizontal to 1 vertical side slopes to -51 feet MLLW + 2 feet of allowable overdredge), and an estimated 200,000 cy of Cutback material (e.g., extending from ground surface at +20 feet MLLW to an elevation of -51 feet MLLW + 2 feet of allowable overdredge) within the Port of Tacoma Washington United Terminal Project, for open-water unconfined disposal at the Commencement Bay non-dispersive open-water disposal site in Tacoma, Washington.

2. This suitability determination addendum supplements the 3 October 2008 High Spot area suitability determination (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/POT-WUT-HS-SDM-09.pdf), and the total proposed dredging volume evaluated in this suitability determination is estimated at 228,400 cy for unconfined-open-water disposal. cy (see Table 1).

Table 1. Washington United Terminal Project dredging characterization SAP Breakdown.

Dredging Subarea	DMMU ID (characterized depth)	Core Station ID (WUT)	Volume (cy)
Wharf High Spot	WUT-5 (-44.6 to -53 ft MLLW)	05-01, 05-02	5,600 (3 October 2008 SDM)
Wharf subarea	WUT-4 (-47.5 to -53 ft MLLW)	04-01, 04-02, 04-03, 04-04	28,400
Cutback area	WUT-01 (+20 to +16 ft MLLW) WUT-02 (+16 to +8 ft MLLW) WUT-03 (+8 to 0 ft MLLW): Native Native: (0 ft to -53 ft MLLW)	BH1, BH2, BH3 BH1, BH2, BH3 BH1, BH2, BH3 Uncharacterized	12,300 24,700 24,700 61,700 (characterized footprint) 138,300 (uncharacterized)
Total Project :	5 DMMUs 4 DMMUs	9 Core Stations 7 Core Stations	95,700 cy (characterized Volume) 228,400 cy (Total volume this SDM) 234,000 cy (Total Project Volume)

Table 2. Project Details

SAP received	May 30, 2008
SAP approved	June 25, 2008
Sampling dates: Wharf Area (includes High Spot Area) (vibracorer) Bank Cutback area (Truck mounted Drill Rig with 3-foot-long split-spoon sampler)	July 29, 2008 August 21, 2008
Final data characterization report for High Spot Subarea submitted Final data characterization report for Wharf and Bank Cutback subareas	September 29, 2008 November 11, 2008
Recency Determination: Bank Cutback subarea (top 4 feet: +20 to +16 ft MLLW): Moderate (5 years) Wharf (includes High Spot), Bank Cutback (+16 to 0 ft MLLW: Low-Moderate Concern (6 years)	 Aug 2013 July- Aug 2014
DAIS reference number: High Spot Wharf subarea: Wharf and Bank Cutback subarea:	WUTHS--1-A-F-259 PTWUT-1-A-F-263

3. Background. As noted in Tables 1 and 2 above, the results described in this suitability determination cover the remainder of the Wharf dredging area and the Bank Cutback dredging area. Although the Blair Waterway is currently ranked Low Concern, the Port of Tacoma tested the maintenance dredge material in the Wharf area at a Low-Moderate Ranking, and the top 4 feet of the Bank Cutback area at a Moderate Ranking, and material below 4 feet at a Low-Moderate Rank (see Table 2).

4. SAP review and Sampling. The draft SAP was submitted to DMMP agencies for review on May 30, 2008 and approved on June 25, 2008. The sampling was initiated and completed in two phases, with the Wharf subarea sampled on July 29, 2008 by vibracorer, with 4-vibracore samples collected for one composited DMMU (C4); and the Bank Cutback area sampled by Truck mounted Drill Rig using a 3-foot-long split-spoon sampler on August 21, 2008, where 3 Core Stations were composited for three DMMUs (C1, C2, C3)(see Table 1, Figure 1: Vicinity Map; Figure 2: Plan view of Wharf and bank cutback dredging areas; Figure 3: Cross Section depicting DMMU layout for Bank Cutback material; and Figure 4: Actual & Proposed Plan View sampling locations for Wharf and Bank Cutback subareas). The testing within the cutback area included testing of the top 8 feet of the Native sediments (+8 ft to 0 ft MLLW), with no testing of the Native sediments from 0 ft MLLW to limits of cutback dredging prism at -53 ft MLLW. The testing also included evaluation of dioxins/furans, as well as the PSDDA/DMMP Chemical of Concern list. The approved sampling and analysis plan was generally followed. The sampling and analysis characterization report was submitted to the DMMP agencies for review on November 11, 2008, and the DMMP agencies concluded that the quality assurance/quality control guidelines specified by the DMMP were generally complied with, and these data were deemed suitable for decision-making using best-professional-judgment.

4. Chemical Analysis and Comparison with DMMP Marine Guidelines. The Agencies' approved sampling and analysis plan was followed and quality assurance/quality control guidelines specified by PSEP and DMMP were generally complied with. A summary of chemical analysis results for all COC except dioxins/furans is provided in Table 3, and demonstrates that for the 4 DMMUs analyzed, there were no detected or undetected chemicals exceeding either DMMP-Marine guidelines.

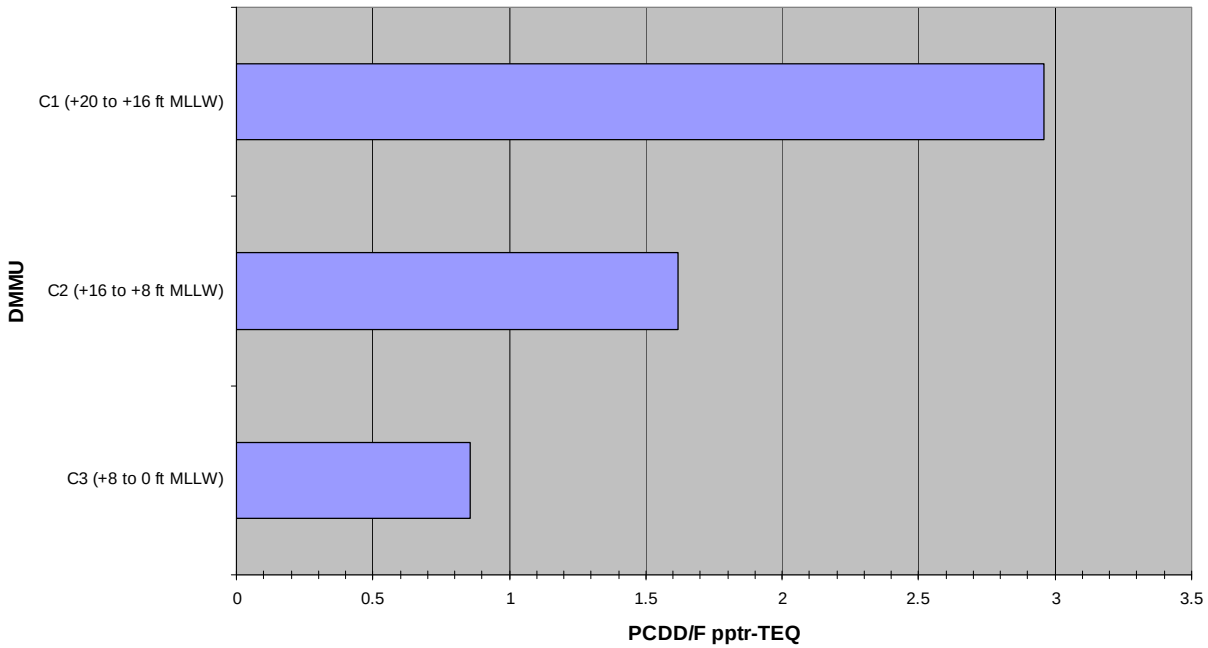
5. Dioxin Testing Results Summary. Table 4 provides the results of dioxin/furan testing results for the four DMMUs, with the concentrations within the Bank Cutback Material ranging from the high of 2.96 pptr-TEQ from the surface DMMU C1 decreasing with depth to the lowest at 0.856 pptr-TEQ (U = ½ detection limit) in DMMU C3. The dioxin/furan concentrations were quantitated at 2.64 pptr-TEQ (U = ½ detection limit) in the Wharf dredging area.

6. Dioxin Interim Interpretative Framework. The DMMP agencies are currently using an interim process for interpreting dioxin data (http://www.nws.usace.army.mil/PublicMenu/Menu.cfm?sitename=DMMO&pagename=Dioxin_Guidelines) pending the development of a programmatic regulatory framework, expected sometime in 2009. The interim guidelines provides a project specific comparison of dioxin/furan concentrations in project dredged material to the disposal site background outside the disposal site. The guidelines applicable to the Commencement Bay non-dispersive disposal site specify the following:
   - ✓ Comparison of dioxin in test sediments to disposal-site background
   - ✓ Background is defined using disposal site specific monitoring, which defined an offsite maximum concentration of 5.2 pptr-TEQ, and an offsite average concentration of 2.4 pptr-TEQ
   - ✓ Dioxin concentrations in any given DMMU may not exceed the site maximum (5.2 pptr-TEQ)
   - ✓ Average dioxin concentrations (weighted to the volume of each DMMU cannot exceed the mean site concentration (2.4 pptr-TEQ)

7. Dioxin Interpretation on Suitability for Unconfined-Open-Water Disposal. As summarized in paragraph 5 above, all four DMMUs were quantitated below the site maximum of 5.2 pptr-TEQ. Table 5 provides the volume

weighted averages for all four DMMUs, which indicate the volume weighted average concentration for the 90,100 cy of characterized material is 1.91 pptr-TEQ, and averaged 1.27 pptr-TEQ, when the 138,300 cy of native sediments and 228,400 cy total volume is included. The native sediments were not tested, and dioxin/furan concentrations in DMMU-C3 (+8 to 0 feet MLLW) were used to perform this calculation, and represent a conservative estimate, as dioxin concentrations were found to decrease with depth (Figure 5). Both averages are below the Commencement Bay offsite average of 2.4 pptr-TEQ, and indicate all 228,400 cy is suitable for unconfined-open-water disposal based on the interim guidelines.

Figure 5. Bank Cutback Dioxin Concentrations



8. Suitability for Unconfined-Open Water Disposal. Therefore, based on the Dioxin and non-dioxin Chemistry testing results, all 228,400 cubic yards of maintenance dredged material and Bank Cutback material is suitable for unconfined-open-water disposal at the Commencement Bay disposal site based on best-professional-judgment. Dredging of these DMMUs should be accomplished within the same dredging season, because two of the 4 DMMUs tested exceed the site average concentration of 2.4 pptr-TEQ. Therefore, dredging of DMMUs 4 and 1 must include dredging and disposal of DMMUs 2 and 3 at a minimum to insure the volume weighted average is below the Commencement Bay offsite average of 2.4 pptr-TEQ (see Table 5).

9. This memorandum affirms the suitability of the sediment proposed for dredging at the Port of Tacoma Washington United Terminal Wharf maintenance dredging area and bank cutback dredging area for unconfined-open-water disposal at an appropriate DMMP non-dispersive disposal site in Commencement Bay. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED MAINTENANCE DREDGED MATERIAL FROM PORT OF TACOMA WASHINGTON UNITED TERMINAL PROJECT HIGH SPOT MAINTENANCE DREDGING, (NWS-2008-01128-WRD) IN COMMENCEMENT BAY, WASHINGTON EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT A DMMP NON- DISPERSIVE OPEN-WATER DISPOSAL SITE.

Concur:

Oct 9, 2008
Date

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Oct 9, 2008
Date

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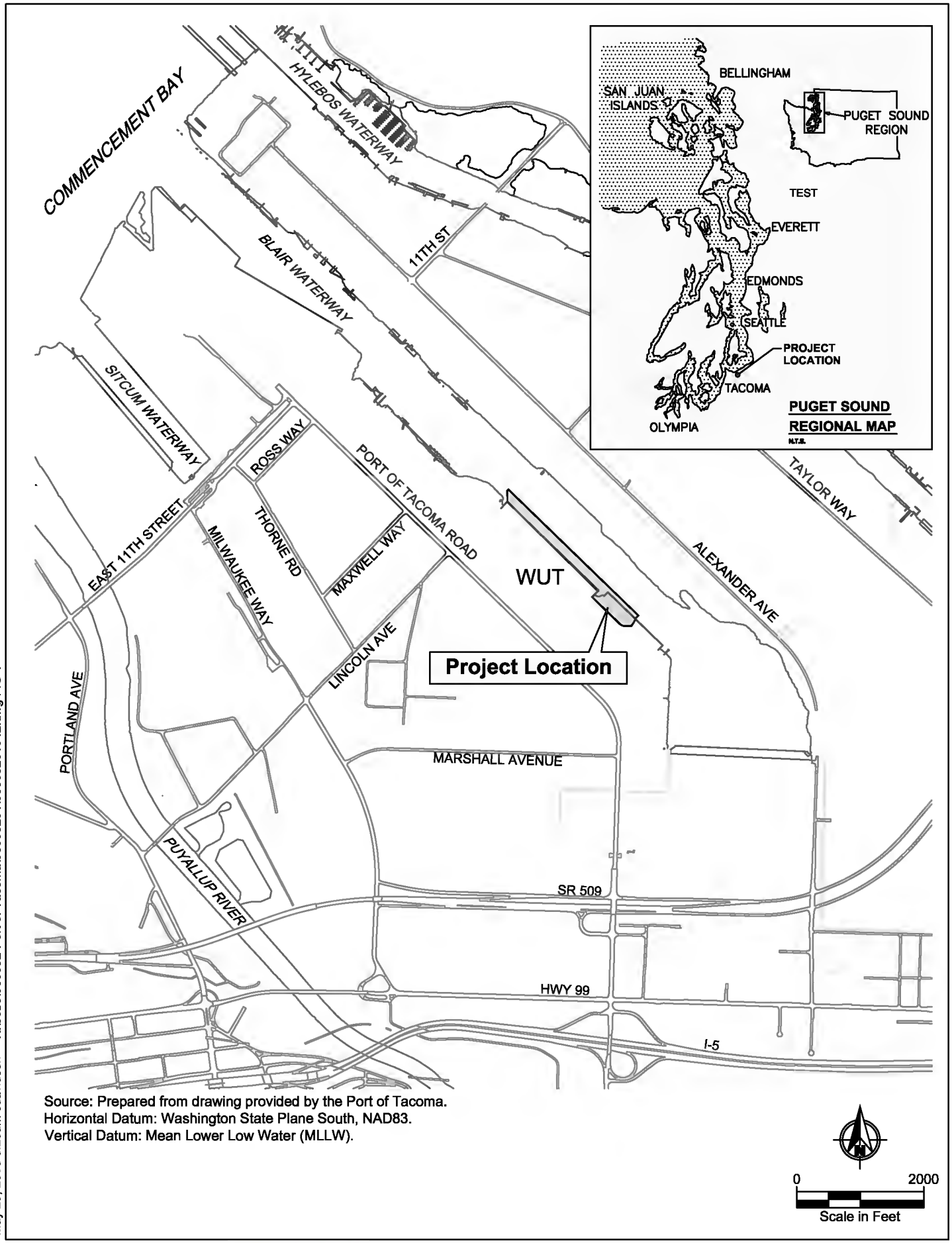


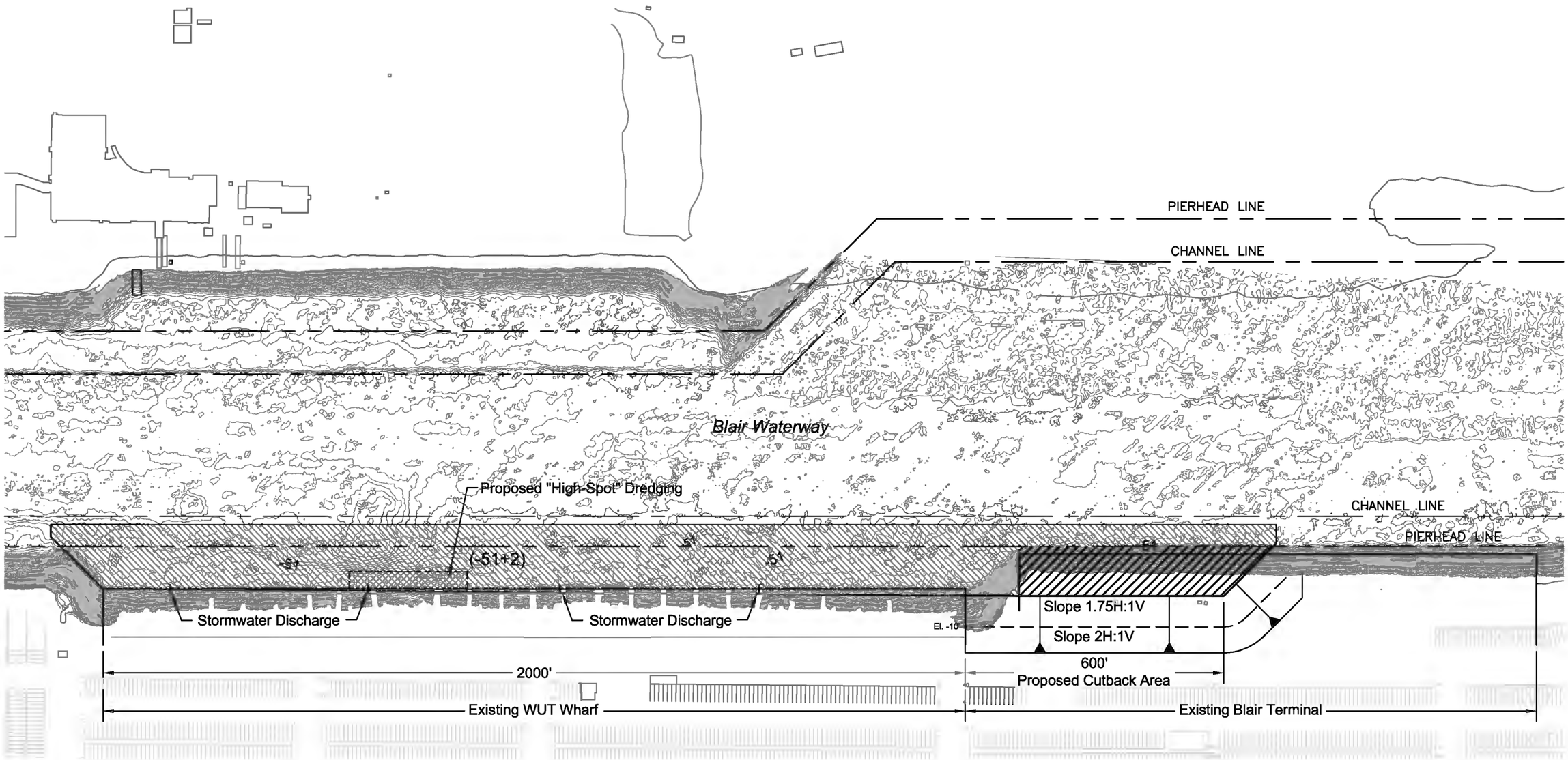
Source: Prepared from drawing provided by the Port of Tacoma.
Horizontal Datum: Washington State Plane South, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

May 29, 2008 8:23am cdavidson K:\Jobs\060092-Port of Tacoma\06009201\06009201042.dwg FIG 1

ANCHOR ENVIRONMENTAL, L.L.C.

PORT of TACOMA U.S.A.

Figure 1
Vicinity Map
Blair Waterway



Source: Drawing prepared from survey provided by CRA dated 12/19/2007.
Horizontal Datum: Washington State Plane South, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

(-51+2) Design Depth Elevation and Allowable Overdepth in Feet

Proposed Maintenance Dredging (Approximate)

Proposed "High-Spot" Dredging (Approximate)

Proposed Cut-Back Area (Approximate)

May 29, 2008 8:32am cdavidson K:\Jobs\060092-Port of Tacoma\06009201\06009201035.dwg FIG 2

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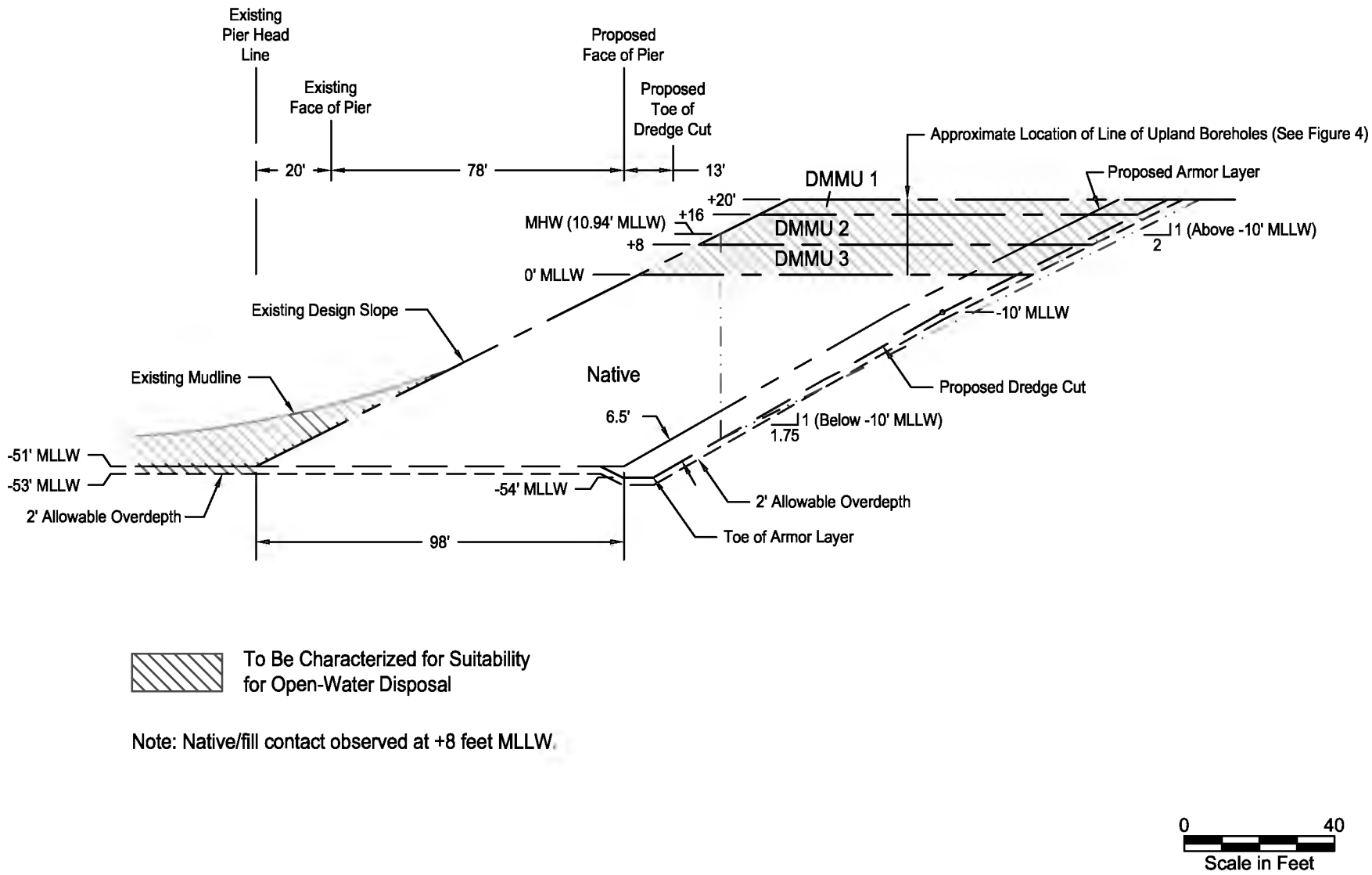
Figure 2
Plan View of Proposed Dredging and Cutback Areas
Blair Waterway



Note: Native/fill contact observed at +8 feet MLLW.

Plotted: Oct 31, 2008 4:02pm evonckx K:\Jobs\060092-Port of Tacoma\06009201\06009201040.dwg FIG 3

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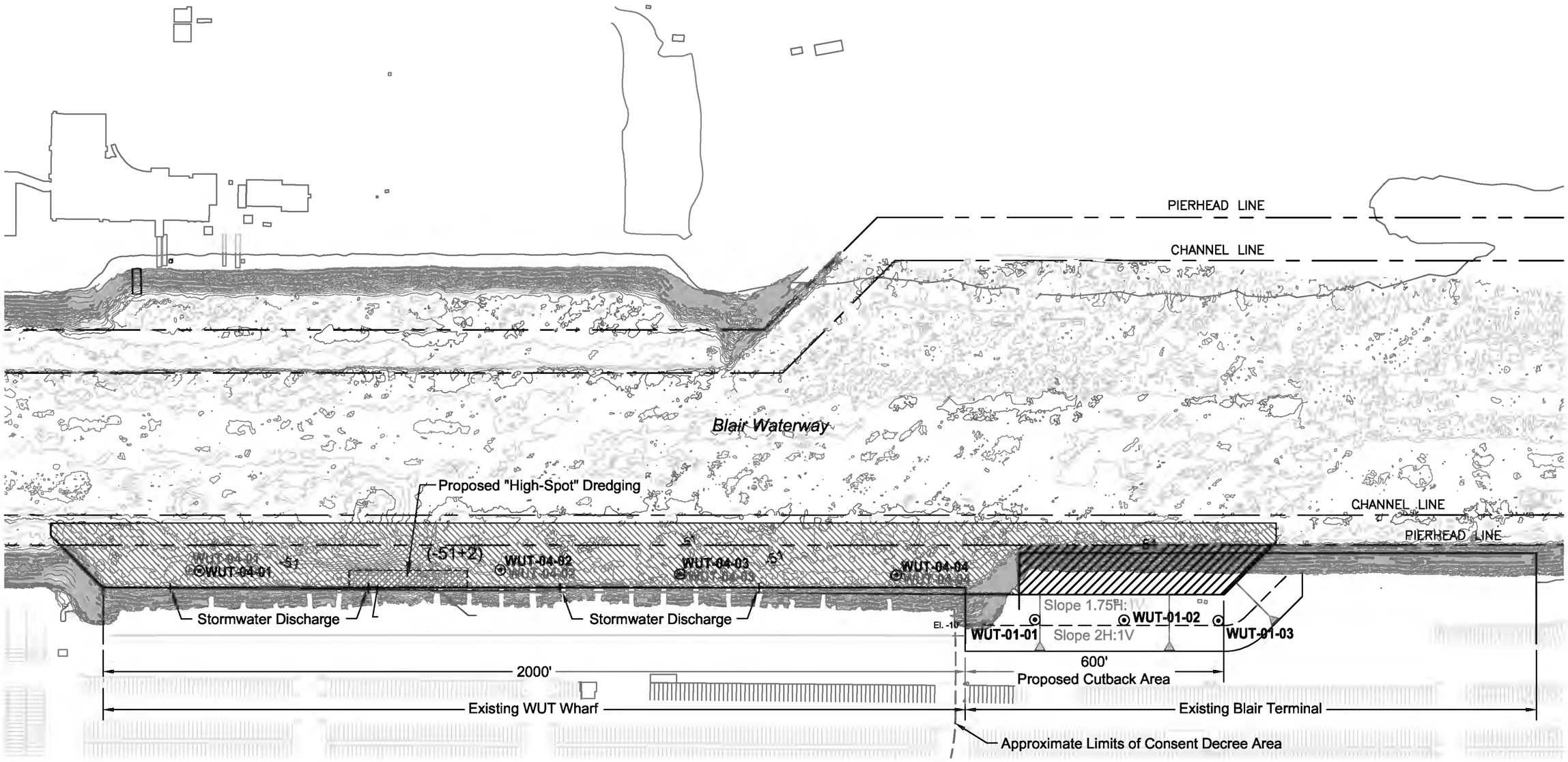
Figure 3
Dredged Material Management Unit (DMMU) Layout for Cutback Material
Blair Waterway



Legend

(-51+2)	Design Depth Elevation and Allowable Overdepth in Feet
	Proposed Maintenance Dredging (Approximate)
	Proposed "High-Spot" Dredging (Approximate)
	Proposed Cut-Back Area (Approximate)
WUT-04-01	Proposed Sample Location and Designation
WUT-04-01	Actual Sample Location and Designation

0 240
Scale in Feet

Source: Drawing prepared from survey provided by CRA dated 12/19/2007.
Horizontal Datum: Washington State Plane South, NAD83.
Vertical Datum: Mean Lower Low Water (MLLW).

Oct 31, 2008 4:05pm evonckx K:\Jobs\060092-Port of Tacoma\06009201\06009201063.dwg FIG 4

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Figure 4
Actual and Proposed Sampling Locations for Maintenance Dredging and Bank Cutback
Blair Waterway

Table 3
Summary of Sediment Chemical Results Compared to DMMP Evaluation Criteria

Sample	Dredged Material Management Program Criteria			WUT-01-CS	WUT-02-CS	WUT-03-CS	WUT-04-CS
Sample Date				8/21/08	8/21/08	8/21/08	7/30/08
Depth	Screening Level	Bioaccumulation Trigger	Maximum Level	Composite	Composite	Composite	Composite
Conventionals (mg/kg)							
Sulfide	--	--	--	1.08 U	**5.66**	**2.37**	**2.18 J**
Conventionals (mg-N/kg)							
Ammonia	--	--	--	**0.81**	**9.28**	**21.4**	**0.12 J**
Conventionals (pct)							
Total organic carbon	--	--	--	**0.291**	**0.408**	**1.08**	**0.443**
Total Solids	--	--	--	**92.6**	**83.4**	**72**	**81.8**
Total solids (preserved)	--	--	--	**92.6**	**83.7**	**72.6**	**78.6**
Total volatile solids	--	--	--	**1.11**	**1.51**	**2.42**	**1.99**
Grain Size (pct)							
Gravel	--	--	--	**31.1**	**1.6**	**2.1**	**1.4**
Sand	--	--	--	**50.2**	**57.6**	**47.2**	**83.3**
Silt	--	--	--	**13.8**	**33.3**	**36.3**	**10.3**
Clay	--	--	--	**4.9**	**7.5**	**14.4**	**5.1**
Fines (Silt + Clay)	--	--	--	**18.7**	**40.8**	**50.7**	**15.5**
Metals (mg/kg)							
Antimony	150	--	200	5 U	6 U	7 U	6 UJ
Arsenic	57	507.1	700	5 U	6 U	7 U	6 U
Cadmium	5.1	11.3	14	0.2 U	0.2 U	0.3 U	0.2 U
Chromium	--	267	--	**18.8**	**13.3**	**16.9**	**12.8**
Copper	390	1027	1300	**13.8**	**13.9**	**20.4**	**18.2**
Lead	450	975	1200	2 U	2 U	3 U	**4**
Mercury	0.41	1.5	2.3	0.04 U	0.04 U	0.06 U	0.05 U
Nickel	140	370	370	**17**	**11**	**12**	**10**
Selenium	--	3	--	5 U	6 U	7 U	0.2 U
Silver	6.1	6.1	8.4	0.3 U	0.3 U	0.4 U	0.4 U
Zinc	410	2783	3800	**24**	**23**	**30**	**29**
Organometallic Compounds							
Tributyltin ion in porewater[1] (µg/L)	0.15	0.15	--	--	--	--	--
Tributyltin ion in sediment (µg TBT/kg)	73	--	--	3.5 U	3.4 U	3.8 U	3.3 U
Dibutyltin ion in sediment (µg TBT/kg)	--	--	--	5.2 U	5 U	5.7 U	5 U
Butyltin ion in sediment (µg TBT/kg)	--	--	--	3.7 U	3.5 U	4 U	3.5 U
LPAHs (µg/kg)							
Total LPAH [2]	5200	--	29000	19 U	20 U	20 U	19 U
Naphthalene	2100	--	2400	19 U	20 U	20 U	19 UJ
Acenaphthylene	560	--	1300	19 U	20 U	20 U	19 U
Acenaphthene	500	--	2000	19 U	20 U	20 U	19 U
Fluorene	540	--	3600	19 U	20 U	20 U	19 U
Phenanthrene	1500	--	21000	19 U	20 U	20 U	19 U
Anthracene	960	--	13000	19 U	20 U	20 U	19 U
2-Methylnaphthalene	670	--	1900	19 U	20 U	20 U	19 U
HPAHs (µg/kg)							
Total HPAH	12000	--	69000	19 U	20 U	20 U	**10**
Fluoranthene	1700	4600	30000	19 U	20 U	20 U	19 U
Pyrene	2600	11980	16000	19 U	20 U	20 U	**10 J**
Benzo(a)anthracene	1300	--	5100	19 U	20 U	20 U	19 U
Chrysene	1400	--	21000	19 U	20 U	20 U	19 U
Total Benzofluoranthenes (b, j, k) [3]	3200	--	9900	19 U	20 U	20 U	19 U
Benzo(a)pyrene	1600	--	3600	19 U	20 U	20 U	19 U
Indeno(1,2,3-cd)pyrene	600	--	4400	19 U	20 U	20 U	19 U
Dibenzo(a,h)anthracene	230	--	1900	19 U	20 U	20 U	19 U
Benzo(g,h,i)perylene	670	--	3200	19 U	20 U	20 U	19 U
Chlorinated Hydrocarbons (µg/kg)							
1,3-Dichlorobenzene	170	--	--	0.8 U	0.9 U	1 U	1.2 U
1,4-Dichlorobenzene	110	--	120	0.8 U	0.9 U	1 U	1.2 U
1,2-Dichlorobenzene	35	--	110	0.8 U	0.9 U	1 U	1.2 U
1,2,4-Trichlorobenzene	31	--	64	4.2 U	4.6 U	5.1 U	5.8 U
Hexachlorobenzene	22	168	230	0.97 U	0.98 U	0.99 U	19 U
Phthalates (µg/kg)							
Dimethylphthalate	71	--	1400	19 U	20 U	20 U	19 U
Diethylphthalate	200	--	1200	19 U	20 U	20 U	19 U
Di-n-butylphthalate	1400	--	5100	19 U	20 U	20 U	19 U
Butylbenzylphthalate	63	--	970	19 U	20 U	20 U	19 U
Bis(2-Ethylhexyl)phthalate	1300	--	8300	**15 J**	**12 J**	20 U	**11 J**
Di-n-octylphthalate	6200	--	6200	19 U	20 U	20 U	19 U
Phenols (µg/kg)							
Phenol	420	--	1200	19 U	20 U	20 U	19 U
2-Methylphenol	63	--	77	19 U	20 U	20 U	19 U
4-Methylphenol	670	--	3600	19 U	20 U	20 U	19 U
2,4-Dimethylphenol	29	--	210	19 U	20 U	20 U	19 UJ
Pentachlorophenol	400	504	690	97 U	98 U	99 U	97 U
Miscellaneous Extractables (µg/kg)							
Benzyl alcohol	57	--	870	19 U	20 U	20 U	19 UJ
Benzoic acid	650	--	760	190 U	200 U	200 U	190 U
Dibenzofuran	540	--	1700	19 U	20 U	20 U	19 U
Hexachloroethane	1400	--	14000	19 U	20 U	20 U	19 UJ
Hexachlorobutadiene	29	--	270	0.97 U	0.98 U	0.99 U	19 UJ
n-Nitroso-di-phenylamine	28	--	130	19 U	20 U	20 U	19 UJ

Table 3
Summary of Sediment Chemical Results Compared to DMMP Evaluation Criteria

Sample	Dredged Material Management Program Criteria			WUT-01-CS	WUT-02-CS	WUT-03-CS	WUT-04-CS
Sample Date		Bioaccumulation		8/21/08	8/21/08	8/21/08	7/30/08
Depth	Screening Level	Trigger	Maximum Level	Composite	Composite	Composite	Composite
Volatile Organics (µg/kg)							
Trichloroethene	160	--	1600	0.8 U	0.9 U	1 U	1.2 U
Tetrachloroethene	57	--	210	0.8 U	0.9 U	1 U	1.2 U
Ethylbenzene	10	--	50	0.8 U	0.9 U	1 U	1.2 U
m,p-Xylene	--	--	--	0.8 U	0.9 U	1 U	1.2 U
o-Xylene	--	--	--	0.8 U	0.9 U	1 U	1.2 U
Total Xylene [(4)]	40	--	160	0.8 U	0.9 U	1 U	1.2 U
Pesticides (µg/kg)							
Total DDT [(5)]	6.9	50	69	1.9 U	2 U	2 U	2 U
4,4'-DDD	--	--	--	1.9 U	2 U	2 U	2 U
4,4'-DDE	--	--	--	1.9 U	2 U	2 U	2 U
4,4'-DDT	--	--	--	1.9 U	2 U	2 U	2 UJ
Aldrin	10	--	--	0.97 U	0.98 U	0.99 U	1 U
Total Chlordane [(6)]	10	37		0.97 U	0.98 U	0.99 U	1 U
alpha-Chlordane (cis-Chlordane)	--	--	--	0.97 U	0.98 U	0.99 U	1 U
gamma-Chlordane (trans, beta-Chlordane)	--	--	--	0.97 U	0.98 U	0.99 U	1 U
cis-Nonachlor	--	--	--	1.9 UJ	2 UJ	2 UJ	2 U
Oxychlordane	--	--	--	1.9 UJ	2 UJ	2 UJ	2 U
trans-Nonachlor	--	--	--	1.9 UJ	2 UJ	2 UJ	2 U
Dieldrin	10	--	--	1.9 U	2 U	2 U	2 U
Heptachlor	10	--	--	0.97 U	0.98 U	0.99 U	1 U
gamma-BHC (Lindane)	10	--	--	0.97 U	0.98 U	0.99 U	1 U
PCBs (mg/kg OC)							
Total PCB	--	38	--	3.33 U	2.38 U	0.917 U	2 U
PCBs (µg/kg)							
Total PCB	130	--	3100	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1016	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1221	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1232	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1242	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1248	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1254	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1260	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1262	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Aroclor 1268	--	--	--	9.7 U	9.7 U	9.9 U	9.9 U
Dioxin/Furans (TEQ)							
WHO TEQ (ND = 0; EMPC = 0)[(7)]	--	--	--	**2.81**	**1.5**	**0.001**	**2.56**
WHO TEQ (ND = DL/2; EMPC = 0)[(7)]	--	--	--	**2.96**	**1.62**	**0.856**	**2.64**
Dioxin/Furans (pg/g)							
2,3,7,8-Tetrachlorodibenzo-p-dioxin	--	--	--	0.3 U	0.208 U	0.252 U	0.153 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	--	--	--	**0.688 J**	**0.375 J**	0.964 U	**0.33 J**
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	**0.739 J**	0.182 U	0.517 U	**0.466 J**
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	--	--	--	**2.87**	**1.33 J**	0.566 U	**2.35 J**
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	--	--	--	**1.59 J**	**0.666 J**	0.618 U	**1.06 J**
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	--	--	--	**62**	**27.1**	0.348 U	**46.5**
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	--	--	--	**724**	**308**	**1.74 J**	**505**
2,3,7,8-Tetrachlorodibenzofuran	--	--	--	**0.245 J**	**0.589**	0.189 U	**0.773**
1,2,3,7,8-Pentachlorodibenzofuran	--	--	--	**0.404 J**	**0.343 J**	0.663 U	**1.6 J**
2,3,4,7,8-Pentachlorodibenzofuran	--	--	--	**0.881 J**	**0.619 J**	0.671 U	**1.06 J**
1,2,3,4,7,8-Hexachlorodibenzofuran	--	--	--	**1.51 J**	**0.94 J**	0.179 U	**4.25**
1,2,3,6,7,8-Hexachlorodibenzofuran	--	--	--	**0.489 J**	**0.459 J**	0.163 U	**1.2 J**
1,2,3,7,8,9-Hexachlorodibenzofuran	--	--	--	**0.646 J**	**0.384 J**	0.241 U	**0.627 J**
2,3,4,6,7,8-Hexachlorodibenzofuran	--	--	--	**0.81 J**	**0.487 J**	0.187 U	**0.701 J**
1,2,3,4,6,7,8-Heptachlorodibenzofuran	--	--	--	**9.83**	**6.93**	0.152 U	**8.55**
1,2,3,4,7,8,9-Heptachlorodibenzofuran	--	--	--	**1.04 J**	**0.609 J**	0.188 U	**1.22 J**
1,2,3,4,5,6,7,8-Octachlorodibenzofuran (OCDF)	--	--	--	**28.3**	**24.1**	0.805 U	**27.3**

Notes:

Bold = Detected result

J = Estimated value

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

(1) Insufficient porewater was available in the sample to test for tributyltin; therefore, tributyltin was analyzed in bulk sediment.

(2) 2-Methylnapthalene is not included in the sum of LPAHs

(3) Benzo(j)fluoranthene is included in the total of benzo(b&k)fluoranthenes

(4) Total xylene is the sum of o-, m-, p- isomers

(5) Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

(6) Total Chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane, gamma-chlordane), cis-nonaclor, trans-nonaclor and oxychlordane.

(7) The Commencement Bay Disposal Site mean dioxin concentration is 2.1 ng/kg TEQ and the maximum is 4.1 ng/kg TEQ.

Data measured in dry weight basis

-- = results not reported or not applicable

Totals are calculated as the sum of all detected results. If all are undetected results, the highest reporting limit value is reported as the sum.

Table 4. Washington United Terminal Project dioxin/furan testing results summary

Analyte	WHO (05) TEF	WUT-HS-95-CS (High Spot) DMMU-C5			WUT-01-CS (Cutback) DMMU-C1			WUT-02-CS (Cutback) DMMU-C2			WUT-03-CS (Cutback) DMMU-C3			WUT-04-CS (Wharf) DMMU-C4		
		ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ
2,3,7,8-TCDD	1	0.181	U	0.0905	0.3	U	0.15	0.208	U	0.104	0.252	U	0.126	0.153	U	0.0765
1,2,3,7,8-PeCDD	1	0.27	U	0.135	0.688	J	0.688	0.375	J	0.375	0.964	U	0.482	0.33	J	0.33
1,2,3,4,7,8-HxCDD	0.1	0.232	U	0.0116	0.739	J	0.0739	0.182	U	0.0091	0.517	U	0.02585	0.466	J	0.0466
1,2,3,6,7,8-HxCDD	0.1	0.501	U	0.02505	2.87		0.287	1.33	J	0.133	0.566	U	0.0283	2.35	J	0.235
1,2,3,7,8,9-HxCDD	0.1	0.255		0.0255	1.59	J	0.159	0.666	J	0.0666	0.618	U	0.0309	1.06	J	0.106
1,2,3,4,6,7,8-HpCDD	0.01	11.4		0.114	62		0.62	27.1		0.271	0.348	U	0.00174	46.5		0.465
OCDD	0.0003	124		0.0372	724		0.2172	308		0.0924	1.74	J	0.000522	505		0.1515
2,3,4,7,8-PeCDF	0.3	0.244	U	0.0366	0.881	J	0.2643	0.619	J	0.1857	0.671	U	0.10065	1.06	J	0.318
2.3.7.8-TCDF	0.1	0.177		0.0177	0.245	J	0.0245	0.589		0.0589	0.189	U	0.00945	0.773		0.0773
1,2,3,4,7,8-HxCDF	0.1	0.742		0.0742	1.51	J	0.151	0.94	J	0.094	0.179	U	0.00895	4.25		0.425
1,2,3,6,7,8-HxCDF	0.1	0.244	U	0.0122	0.489	J	0.0489	0.459	J	0.0459	0.163	U	0.00815	1.2	J	0.12
2,3,4,6,7,8-HxCDF	0.1	0.244	U	0.0122	0.81	J	0.081	0.487	J	0.0487	0.187	U	0.00935	0.701	J	0.0701
1,2,3,7,8,9-HxCDF	0.1	0.244	U	0.0122	0.646	J	0.0646	0.384	J	0.0384	0.241	U	0.01205	0.627	J	0.0627
1,2,3,7,8-PeCDF	0.03	0.251		0.00753	0.404	J	0.01212	0.343	J	0.01029	0.671	U	0.010065	1.6	J	0.048
1,2,3,4,6,7,8-HpCDF	0.01	1.85		0.0185	9.83		0.0983	6.93		0.0693	0.152	U	0.00076	8.55		0.0855
1,2,3,4,7,8,9-HpCDF	0.01	0.158	U	0.00079	1.04	J	0.0104	0.609	J	0.00609	0.188	U	0.00094	1.22	J	0.0122
OCDF	0.0003	6.08		0.001824	28.3		0.00849	24.1		0.00723	0.805	U	0.00012075	27.3		0.00819
Total TEQ: (U = 1/2)				0.633			2.959			1.616			0.856			2.638
Total TEQ: (U = 0)				0.296			2.809			1.503			0.001			2.561
Total TOC, %:				0.571			0.291			0.408			1.08			0.443

LQ = Laboratory Qualifier
U = undetected at the reported concentration
J = Estimated Concentration (< reporting limit)
Wharf High Spot (3 October 08 SDM)
Wharf + Bank Cutback

Table 5. Washington United Terminal Project dioxin/furan volume weighted summary of testing results

DMMU (Core ID)	Depth, ft (MLLW)	Volume (CY)	TCDD/F TEQ	ng/kg-dw	Product (Vol x TEQ)	ng x cy/kg x DMMU	Product/total	Loading contribution/Suitable DMMU	Grain Size Characterization					
									%Gravel	%Sand	%Silt	%Clay	%Fines	%TOC
C4 (WUT-04-CS)(Wharf)	-47.5 to -53	28,400	2.638	ng/kg-dw	74,919.20	ng x cy/kg	0.4346	ng/kg-dw/DMMU	1.4	83.3	10.3	5.1	15.5	2.4
C1 (WUT-01-CS)(Cutback)	+20 to +16	12,300	2.959	ng/kg-dw	36,395.70	ng x cy/kg	0.2111	ng/kg-dw/DMMU	31.1	50.2	13.8	4.9	18.7	2.3
C2 (WUT-02-CS)(Cutback)	+16 to +8	24,700	1.616	ng/kg-dw	39,915.20	ng x cy/kg	0.2316	ng/kg-dw/DMMU	1.6	57.6	33.3	7.5	40.8	1.4
C3 (WUT-03-CS)(Cutback)	+8 to 0	24,700	0.856	ng/kg-dw	21,143.20	ng x cy/kg	0.1227	ng/kg-dw/DMMU	2.1	47.2	36.3	14.4	50.7	0.74
WUT (Native: Cutback)*	0 to -53	138,300	0.856	ng/kg-dw	118,384.80	ng x cy/kg	0.6868	ng/kg-dw/DMMU	NT	NT	NT	NT	NT	NT
Totals (Suitable): Characterized Only:		90,100	2.017		172,373.30	ng x cy/kg	1.91	ng/kg-dw/Project						
Totals (Suitable): Characterized + Native:		228,400			290,758.10	ng x cy/kg	1.27	ng/kg-dw/Project						

*Native material uncharacterized: PDCDD/F for DMMU-C3 (WUT-03-CS) used to estimate Volume weighted concentrations; NT = Not tested.