CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD December 22, 2008

SUBJECT: FINAL DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE BLAIR-HYLEBOS REDEVELOPMENT PROJECT, BLAIR WATERWAY (Permit # NWS-2008-781-WRD), COMMENCEMENT BAY, TACOMA, WASHINGTON, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE COMMENCEMENT BAY OPEN WATER SITE OR FOR IN-WATER BENEFICIAL USE.

1. Introduction. 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 approximately 1.6 million cubic yards (cy) of dredged material from the Port of Tacoma East Blair Waterway Cutback, in the Blair Waterway in Tacoma, Washington. An initial, study phase characterization of 1.0 million cy of this total was performed previously, with a draft SDM issued for the material covered under that study. This Final SDM supersedes the Draft SDM: it covers the entire proposed project area which was defined subsequent to the development of a specific project proposal. Disposal of suitable material is anticipated for the Commencement Bay non-dispersive DMMP disposal site, in combination with approved upland sites and/or approved beneficial use sites.

This determination of suitability for open-water disposal is based on the acceptability of the sampling conducted by Port of Tacoma contractors from March 2007 through October 2008 (GeoEngineers 2007, 2008). All relevant test data from these sampling events is contained in reports submitted by GeoEngineers. Collectively, these data were considered sufficient and acceptable for decision-making by the DMMP agencies.

Table 1. Regulatory Tracking Dates

STUDY PHASE: Phase 1	SAP received	December 7, 2006
	SAP review meeting	January 17, 2007
	SAP approved	February 27, 2007
	Sampling dates	March 12-15, 2007
	Data report submitted Revised data report submitted QA/QC report submitted Dioxin QA/QC report submitted	June 4, 2007 August 1, 2007 August 22, 2007 February 27, 2008
	Draft SDM issued	March 6, 2008
	DAIS Tracking	POTEB-1-A-O-242
PROJECT PHASE: Phases 2 and 3	SAPA received	August 7, 2008
	Revised SAPA received	September 3, 2008
	Follow up sampling SAPA received	September 26, 2008
	Sampling dates	August 20-21, 2008 October 6-15, 2008
	Draft Data report submitted Final Data report submitted	November 6, 2008 November 24, 2008
	Recency: LM/M Concern (5-7 years)	March 2012 – 2014
	DAIS Tracking	POTEB-1-A-F-258

Table 2. Project Synopsis

Time of proposed dredging	Late 2009 – Early 2012
Proposed disposal sites	Commencement Bay open water non-dispersive site; and/or at permitted beneficial use site(s); and/or at approved upland locations
Sediment ranking	low-moderate; moderate; native
Predicted dredge volume	1.6 million cubic yards
Project last dredged	New work

2. Background. The Port of Tacoma's Blair Waterway was created incrementally over much of the last century. As the waterway was extended, dredged material was used for fill in areas surrounding the waterway up through the 1970s. The waterway has also been dredged repeatedly in the last few years, beginning with the Sitcum Waterway Remediation Project completed in 1995. That project removed both contaminated and clean material from the waterway in a combined CERCLA cleanup and navigation deepening project. Since that time, Port of Tacoma development projects have led to further deepening of the Blair, expansion of the turning basin, and widening of some portions of the waterway.

The Port of Tacoma is presently planning the Blair-Hylebos Terminal Redevelopment Project (BHTRP) and a project-specific dredging prism is now defined. This project includes a proposed cutback of the eastern shoreline of the outer portion of the Blair Waterway to upgrade the waterway's marine cargo and shipping capabilities. The Port expects widening of the Waterway would occur as a cutback of the eastern shoreline parallel to the existing shoreline for a distance of approximately 4,200 feet (see Figure 1). The total proposed dredging volume is approximately 1,600,000 cubic yards.

3. Eligibility for Open Water Disposal. DMMP policy (PSDDA 1988 and DMMP 2003) states that some apparently upland shoreline materials may be defined as dredged material. Most of the material in this project qualifies as dredge material under the "angle of repose" definition. However, a portion of the additional cutback (Phase 2) material did not meet this definition. For this project, as for previous Port of Tacoma projects, the agencies used a "weight of evidence" approach to evaluate whether the proposed dredged prism was eligible for characterization under the DMMP. The DMMP concurred that the entire dredge prism was eligible for open water disposal, contingent on sampling evidence and project procedures that support the weight-of-evidence assumptions. These assumptions (in bold) and the DMMP weight-of-evidence relative to this project include:

a. **There must be ecological benefit to either the dredging or disposal site.** Benefits to the disposal site are considered relative to the condition of the open-water site before being routinely used for dredged material disposal (DMMP 2003). By definition, any material found suitable for open water disposal under the DMMP program is considered to be of relatively higher quality (less contaminated) than the surface sediments prior to the use of the Commencement Bay site. Thus, this weight-of-evidence opinion is based solely on ecological benefits to the disposal site.
b. **There must be ample reason to believe that the characteristics of the material to be dredged or excavated are substantively similar to the marine/estuarine sediments that are the basis of regional sediment quality criteria and guidelines.** Some reasons are:
    - **The material was once dredged from a nearby waterway and placed in its current location as fill.** The existence of fill from previous dredging in the Blair water in this area is

documented, and this material can be easily identified in sampling cores. Thus, all fill material meets this criterion.

- The work is located in or adjacent to an existing water body and will be conducted from the water (generally, only *de minimis* land-based excavation will be allowed). All this work is adjacent to the Blair waterway. Land-based excavation should only be considered for removal of any contaminated portions of the dredge prism.
- Groundwater/interstitial water is influenced by the adjacent water body (from which dredging would occur). The project area is all tidally influenced, former mudflat, or previously dredged fill. This criterion is presumed to be met.
- There is little evidence for or reason to suspect presence of toxic compounds/elements other than those on the DMMP list of chemicals of concern. The DMMP consulted with the Department of Ecology Toxics Cleanup Program (Joyce Mercuri) for input on this question. This coordination resulted in the identification of former Underground Storage Tanks (USTs) in the project vicinity, leading to further sampling and analysis for petroleum hydrocarbons not found on the DMMP COC list of some portions of the dredge prism (Phase 3 evaluation.)
- Total organic carbon of the dredged material is similar in quantity and quality to that found in sediments of the adjacent water body. The project area is known to be former mudflat, and thus presumably containing sediments with TOC similar to the local estuarine sediments. Fill material is from earlier construction of the waterway.

4. Sampling. Sampling took place in three phases: Phase 1 was the study phase that culminated in the previous draft SDM, Phase 2 consisted of characterization of the additional project area not originally identified in the study phase, and Phase 3 was follow-up characterization of portions of the dredge prism potentially impacted by historical underground storage tanks (UST) sites identified in Phase 2. Sampling and testing took place on approximately 403,817 cy of the total proposed 1.6 million cy project area. The sampled portion of the dredge prism included all material previously placed as fill during formation of the Blair Waterway. As in previous cutback projects along the Blair, only the top eight feet of native sediments were sampled, except for one discrete sample at the bottom of the dredge prism. The remaining 1,196,183 cy in the project area are deep native sediments that the DMMP determined, as part of its Tier 1 evaluation, were not necessary to characterize. This determination was supported by sampling results. All samples were collected with an upland drill rig that took a total of 63 borings according to the approved Sampling and Analysis Plans and Addenda. Samples from all borings taken in a given DMMU were initially composited for analysis, while individual samples from smaller subunits were archived for follow-up analysis as necessary.

4.1. Phase 1 Sampling. Sampling took place from March 12-15, 2007. Samples from all 12 borings taken in a given DMMU were composited for analysis. One sample from deep in the native sediment was taken to rule out contamination from a nearby CERCLA site (Figures 2 & 3).

4.2. Phase 2 Sampling. Sampling took place from August 20-21, 2008. Four borings (S13 – S16) were taken in the additional cutback material proposed for the project phase. Borings were stepped into the dredge prism to obtain material from the actual dredge prism (Figures 4 & 5).

4.3. Phase 3 Sampling. Phase 3 sampling was implemented partially due to findings during SAPA review that some of the additional cutback material did not automatically meet the requirements to be considered dredge material for purposes of open water disposal. Phase 3 consisted of a) follow-up DMMP/SMS sampling for additional information after some Phase 2 samples indicated high levels of PAHs, and b) UST investigation sampling after locations of historical USTs were identified by the Port (Figures 6 &

7). These were all targeted borings meant to identify and/or verify contamination and its extent. Sampling took place from October 5 – 16, 2008.

4.3.1. For the DMMP/SMS evaluation, twenty-nine samples were collected from ten borings to further evaluate the potential presence of PAHs, SVOCs and VOCs in DMMU-14 and DMMU-15. Some of these samples were also part of the UST investigation. Each sample was representative of a discrete depth interval from an individual boring. Samples were collected upgradient, downgradient and north and south of sample locations S-15 and S-16 for the purpose of evaluating the boundaries of the potentially impacted material. These samples were collected in a "step down approach" from two to three borings in order to collect material from the targeted additional dredge material layer. These borings were completed to 8 feet below the native/fill interface. Discrete samples were archived at 2-foot intervals. Samples were homogenized to represent 4-foot intervals in each boring. The samples were analyzed for DMMP/SMS SVOCs/PAHs, VOCs and gasoline-, diesel- and heavy oil-range petroleum hydrocarbons.

4.3.2. For the UST investigation, a total of 35 borings were completed (Figures 6 & 7), in groups of two to six borings in 11 areas of concern. The purpose of the UST investigation sampling was to evaluate potential impacts of former USTs located in, adjacent to, and upgradient from the dredge prism. Borings were completed in some locations to evaluate the lateral limits of potential petroleum hydrocarbon-related impacts, where observed, and are included in the total number of borings (35). Samples were collected continuously from each boring at 2-foot intervals (starting at 4 feet bgs) and two samples from each boring were submitted for analysis of gasoline-, diesel- and heavy oil-range petroleum hydrocarbons and VOCs (including benzene, toluene, ethylbenzene and total xylenes).

Table 3. DMMP/SMS sampling strategy summary

			Volume (cy)
Study Phase 1	Surface Fill (M)	DMMU 1	15,216
		DMMU 2	10,116
		DMMU 3	13,496
	Subsurface Fill (LM)	DMMU 4	52,260
		DMMU 5	43,198
		DMMU 6	42,279
		DMMU 7	25,056
	Subsurface Native (LM)	DMMU 9[1]	40,440
		DMMU 10	37,584
		DMMU 11	37,372
Project Phases 2 & 3	Surface Fill (M)	DMMU 12	12,400
	Subsurface Fill (LM)	DMMU 13	27,900
		DMMU 14	15,500
	Subsurface Native (LM)	DMMU 15	24,800
Project Totals	Total Tested		397,617
	Deep Native - no test		1,202,383
	Project Total		1,600,000

[1] There is no DMMU 8 due to field conditions (less material in fill layer than expected.)

5. Chemical Analysis. The Agencies' approved sampling and analysis plan was followed and quality assurance/quality control guidelines specified by PSEP and the DMMP were generally complied with. Chemical analyses were performed by Columbia Analytical Services (CAS) of Kelso, Washington and

Analytical Resources Incorporated (ARI) of Tukwila, Washington. Conventional results from all DMMU sampling is found in Table 6.

5.1. Phase 1 Analysis (Table 7). Mercury was detected at 0.45 mg/kg in DMMU 2, slightly over the SL of 0.41 mg/kg. PCBs were detected in DMMUs 1 and 3 at levels under the DMMP SLs, but over the SMS guidelines for PCB levels in beneficial use material. The Port chose to forgo further analyses for these three DMMUs and to accept the regulatory determination that would be made based on the chemical analysis only. All three DMMU were surface DMMUs, consisting of the top four feet of fill material placed decades ago as part of the early formation of the Blair waterway.

5.1.1. Project Specific Analyses. Because of proximity to an ongoing Superfund cleanup site (Occidental Chemical Company on the Hylebos Waterway), some additional analyses were required to rule out migration of these contaminants to the study area. The DMMP required analyses for dioxins and furans (PCDD/F) and PCB congeners on material composites representing different sediment depths and potential paths of exposure. PCDD/F, as well as dioxin-like PCB congeners that were not detected with typical Aroclor analysis, have been found on the nearby Superfund site and there was no information with which to rule out the potential for contamination migrating from this site to study area sediments. Five analyses for PCDD/Fs and PCB congeners were performed: C1 was a composite of surface fill DMMUs 1, 2 & 3, C2 was a composite of the DMMUs 4 & 5 (subsurface fill), C3 was a composite of DMMUs 6 & 7 (deeper subsurface fill), and C4 was a composite of DMMUs 9, 10 & 11 (top 4 feet of native material). One discrete sample (S4) was taken at a depth consistent with ground water transport.

5.1.2. Dioxins and Furans (Tables 8 and 9). PCDD/F data were reported as total equivalency quotients (TEQs) using World Health Organization (WHO 2005) toxic equivalency factors for human health/mammals. TEQs were calculated using a value of one half the reporting limit for non-detected values. Data collection, analysis and reporting generally followed guidelines put forth by the DMMP (SMARM 2007).

To evaluate the dioxin data, DMMP used the current interim guidelines in effect since February 2007. These interim guidelines are:

- Based on a comparison of dioxin in test sediments to disposal-site or reference area background.
- For non-dispersive sites, background is defined using disposal-site sediment dioxin data from the vicinity of the disposal site. This data has been collected as part of DMMP site monitoring.
- Disposal-site sediment dioxin concentrations are determined from perimeter, transect, and benchmark locations (e.g. not from any previously-disposed material).
- Dioxin concentrations in any given DMMU may not exceed site maximum.
- Average dioxin concentrations (weighted to the volume of each DMMU) cannot exceed mean disposal site concentration.
- Bioaccumulation testing for dioxin is currently not used to determine suitability for either dispersive or non-dispersive sites.

Monitoring in Commencement Bay found background levels in the area of the disposal site at a mean TEQ of 2.4 ng/kg, and a maximum TEQ of 5.2 ng/kg. The project sample from C1, represented by surface DMMUs 1, 2 & 3, had levels of PCDD/F higher than the Commencement Bay site maximum and thus all material in C1 is unsuitable for disposal at any in-water disposal site or for any in-water beneficial use. The rest of the material tested had levels lower than the site maximum and the volume-weighted mean.

DMMU C1 is composed of surface material that was placed as fill material decades ago in earlier dredging of the Blair Waterway. It appears that the low levels of PCDD/Fs found there are residuals left from the

previously dredged material that was deposited as fill during construction of the waterway. This assumption is based on the distribution of PCDD/Fs, e.g. they were found only at very low levels in the subsurface materials and were not found along potential contaminant pathways from the Occidental Superfund Site at groundwater depths.

5.1.3. PCBs (Table 10). Total PCBs were quantified in test sediments using two different analysis methods; summing homologs and summing Aroclors. Total PCBs based on both methods indicated contamination was highest in the surface composite, and decreased with depth. Total PCBs based on the sum of homologs were lower than the totals based on summing Aroclors. The absence of those PCB homologs which are associated with the presence of dioxin-like congeners as well as the apparent decrease in PCB concentrations with depth, further support our conclusion that contamination does not appear to be moving from the Occidental Superfund site along groundwater or any other pathway to study area sediments.

5.2. Phase 2 Analysis (Table 11). The surface fill portion of the additional project area (DMMU 12) was considered unsuitable for open water disposal prior to Phase 2 due to concentrations of dioxin detected in surface sediments during Phase 1. No additional dioxin analysis was performed during Phases 2 & 3. There were also detected exceedances of the DMMP SL of Dimethyl phthalate (150 µg/kg dry wt) and total PCB Aroclors (200 µg/kg dry wt) in DMMU 12. No further characterization was pursued; DMMU 12 is unsuitable for open water disposal or for in-water beneficial use.

Initial analysis of extract from DMMU 14 found levels of many PAHs over DMMP SLs and even MLs. A follow-up analysis of the original extract confirmed the original results. These analyses--as well as analysis of a DMMU 14 re-extract--were accomplished using the full scan method of GC/MS. The same extracts were also run with the SIM method of GC/MS, which did not quantify any PAHs above DMMP SLs. Subunits of DMMU 14 were also analyzed with the full scan method, which did not quantify any PAHs above DMMP SLs. Though the follow-up subunit analyses did not support finding all of DMMU 14 unsuitable, the DMMP used subunit and UST analyses to define an impacted portion of DMMU 14 as unsuitable for open water disposal.

Dimethyl phthalate was detected in sample DMMU-15 at a concentration of 220 µg/kg. This concentration is greater than the DMMP SL of 71 µg/kg but less than the DMMP ML of 1,400 µg/kg. Follow-up SVOC analysis of the subunit samples for DMMU-15 (S13ZE, S14ZD, S15YD, S16YC) was performed, but COCs were not detected at concentrations greater than DMMP/SL or SMS/SQS criteria. Based on subunit analyses, DMMU 15 was considered suitable for open water disposal.

5.3. Phase 3 UST Analysis (Tables 12 and 13). MTCA criteria were used to evaluate the results of the UST analysis because there are no DMMP or SMS criteria for total petroleum hydrocarbons and most of the DMMP-listed VOCs in soils. It is known that petroleum mixtures can be toxic to marine organisms at concentrations below those used for evaluation of upland material (e.g. MTCA criteria) so the DMMP consulted the Ecology Toxic Cleanup program (Joyce Mercuri) for assistance with interpreting these results. Using their collective best professional judgment, the DMMP compared the results not only to MTCA Method A Cleanup Level (CUL) for unrestricted and industrial land use but also to the SMS/DMMP criteria for total PAHs (total of both LPAH & HPAH DMMP analytes). The chemical analytical results from the UST investigation samples are summarized below. Results were used to define the area of suitability as described in Section 7.

5.3.1. Petroleum Hydrocarbons. Gasoline-, diesel- and/or lube oil-range petroleum hydrocarbons were detected in 35 of the 131 samples analyzed to evaluate potential UST impacts in the proposed dredge area.

- Gasoline-range petroleum hydrocarbons were detected in 10 of the 131 samples analyzed at concentrations ranging from 12 to 570 mg/kg. The concentrations detected in all but one of the samples (sample U4F at 6-8 feet bgs) were less than the MTCA Method A CUL (30 mg/kg) for gasoline-range petroleum hydrocarbons.
- Diesel-range petroleum hydrocarbons were detected in 16 of the 131 samples analyzed at concentrations ranging from 5.9 to 570 mg/kg. The concentrations detected in all of the samples analyzed are less than MTCA Method A CUL for diesel-range petroleum hydrocarbons (2,000 mg/kg).
- Lube oil-range petroleum hydrocarbons were detected in 13 of the 131 samples analyzed at concentrations ranging from 11 to 610 mg/kg. The concentrations detected in all of the samples analyzed are less than the MTCA Method A CUL for lube oil-range petroleum hydrocarbons (2,000 mg/kg).

5.3.2. Volatile Organic Compounds. One or more VOCs including acetone, carbon disulfide, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, tetrachloroethene, methylene chloride and/or vinyl chloride were detected in each of the samples analyzed. The concentrations of the VOCs detected in all but three of the samples analyzed were less than applicable MTCA or DMMP criteria, as follows:

- Methylene chloride was detected in samples U7A (6-8) and U7B (6-8) at concentrations of 28 and 32 µg/kg, respectively. DMMP/SMS criteria have not been developed for methylene chloride. The concentrations detected are greater than MTCA Method A criteria (20 µg/kg).
- Trichloroethene was detected in one sample (U6B [6-8]) at a concentration of 130 µg/kg. This concentration is greater than the DMMP SL (40 µg/kg) and less than the DMMP ML (160 µg/kg). The concentration detected is also greater than MTCA Method A CUL.

6. Comparison to SMS Guidelines (Tables 14, 15, 16 & 17). All results of the chemical analyses were organic carbon normalized, if necessary, and compared to Washington State Sediment Management Standards. Most of the sediments tested had fairly low total organic carbon (TOC) content (less than 1%). Only samples with TOC greater than 0.5% were carbon normalized. Samples with TOC lower than 0.5% were evaluated by comparing dry weight concentrations to dry weight Apparent Effects thresholds. This evaluation showed that all material suitable for open water disposal is also suitable for approved, in water beneficial uses under Washington State Sediment Management Standards and DMMP guidelines. As always, actual beneficial uses must be approved in other applicable permits and/or authorizations.

7. Suitability. This memo documents the suitability of proposed dredged sediments within the Blair-Hylebos Waterway Study Phase Characterization area for open-water disposal. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

Based on the combined information from all chemistry testing results as evaluated by DMMP guidelines and best professional judgment, 1,528,418 cy of proposed dredge material is suitable for unconfined-open-water disposal. This suitable material includes all of DMMUs 4, 6, 7, 9, 10, 13 and 15, portions of DMMUs 5, 11 and 14 (see Table 4) and all deep native material. A total of 71,582 cy is unsuitable for open water disposal at the Commencement Bay open-water disposal site or for in-water beneficial use. The unsuitable material includes all of DMMUs 1, 2, 3 and 12, and portions of DMMUs 5, 11 and 14 as defined in Table 4.

For this project the determination of suitability was complicated by discovery of former UST impacted areas. Characterization during the project phases also altered the suitability as determined during the study phase. As such, the determination of suitability for all sediments is qualified by the following:

1. Cleanup of upland UST-impacted areas associated with the dredge prism must be completed prior to dredging. This includes impacted soils in the vicinity of USTs designated U-4, U-6 and U-7. Cleanup must be conducted under oversight of Ecology's Toxics Cleanup Program. All post-cleanup soils bordering dredging areas must be characterized and found to be either a) suitable for open water disposal (if part of the proposed dredge prism) or b) conforming to State of Washington non-degradation standards (if part of the exposed surface) prior to dredging. The cleanup, particularly the post clean-up monitoring and the timing of clean up relative to dredging, must be coordinated with the DMMP.
2. The volume of material suitable for open water disposal in DMMUs 5, 11 and 14 are qualified, and may vary depending on results of the cleanup performed under #1. Volumes given in this SDM should be construed as approximate and secondary to the vertical and horizontal descriptions of the suitable/unsuitable areas, as well as to any changes due to pre-dredging cleanup.

This memorandum determines the suitability of sediment proposed for dredging as part of the Port of Tacoma Blair-Hylebos Redevelopment Project unconfined open-water disposal at an appropriate DMMP non-dispersive disposal site in Commencement Bay, or at an approved in-water beneficial use site. However, this suitability determination does not constitute final agency approval of the project. Cleanup and dredging plans 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.

Determination of suitability for this entire project is summarized in the following table. A schematic of suitable/unsuitable material is shown in Figure 8.

Table 4. Summary of suitability with approximate volumes

DMMU	Volume (cy)	Approx. Depth (ft. MLLW)	Suitable	Unsuitable[2]	Comments/Qualifiers
1	15,216	+17 to +13 Surface fill		15,126	Dioxins
2	10,116	+17 to +13 Surface fill		10,116	Dioxins, mercury
3	13,496	+17 to +13 Surface fill		13,496	Dioxins
4	52,260	+13 to +5 Subsurface fill	52,260		
5	43,198	+13 to +5 Subsurface fill	30,245	12,944	Southern 200 ft. of subunits S7B and S7C, all of subunits S8B and S8C, and northern half of subunits S9B and S9C are unsuitable; remainder is suitable
6	42,279	+5 to -3 Subsurface fill	42,279		
7	25,056	+5 to -3 Subsurface fill	25,056		
9[1]	40,440	-3 to -11 Upper native	40,440		
10	37,584	-3 to -11 Upper native	37,584		
11	37,372	+5 to -3 Upper native	34,968	2,404	Upper 1 ft of subunit S8D, and upper 1 ft of northern half of subunit S9D are unsuitable; remainder is suitable (PAHs)
12	12,400	+17 to +13		12,400	Dioxins, PCBs, dimethyl phthalate, PAHs
13	27,900	+13 to +3 Subsurface fill	27,900		
14	15,500	+13 to +1 Subsurface fill	10,404	5,096	Northern 800 feet of subunit S15 B (from -4 to 12 ft) are unsuitable; remainder is suitable (PAHs)
15	24,800	+ 5 to -15 Upper native	24,800		
5, 11 & 14	96,070			20,444	Total of unsuitable areas as specified above (PAHs)
Deep Native	1,193,083		1,202,482		
TOTALS	1,600,000		1,528,418	71,582	

[1] There is no DMMU 8 due to field conditions (less material in fill layer than expected.)

[2] Unsuitable volumes may vary depending on cleanup results (see text).

8. References.

DMMP 2003. Determining when material above mean/ordinary high water will be characterized under the DMMP. DMMP Clarification Paper prepared by Tom Gries and Ted Benson for the DMMP agencies, November 17, 2003.

GeoEngineers 2007. Study Phase Characterization, East Blair Waterway, Port of Tacoma, Washington. File No. 0454-094-04

GeoEngineers 2008. Final Dredge Material Characterization Report, Blair-Hylebos Terminal Redevelopment, Port of Tacoma, Washington. File No. 0454-094-08

PSDDA 1988. Evaluation Procedures Technical Appendix (EPTA) – Phase I (Central Puget Sound).

SMARM 2007. Polychlorinated Dioxins and Furans (PCDD/F): Clarification of Procedures for Acquiring Sediment Data. Prepared by Sandy Lemlich (U.S. Army Corps of Engineers); Erika Hoffman (U.S. Environmental Protection Agency); John Wakeman (U.S. Army Corps of Engineers).

World Health Organization (WHO) 2005. *Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds*. ToxSci Advance Access published online July 7, 2006 at http://www.who.int/ipcs/assessment/tef_update/en/

SUBJECT: **FINAL DETERMINATION** ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE BLAIR-HYLEBOS REDEVELOPMENT PROJECT, BLAIR WATERWAY (**Permit # NWS-2008-781-WRD**), COMMENCEMENT BAY, TACOMA, WASHINGTON, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE COMMENCEMENT BAY OPEN WATER SITE OR FOR IN-WATER BENEFICIAL USE.

Concur:

1/8/09
Date

Lauran Cole Warner, Seattle District Corps of Engineers

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Date

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01/08/09
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Puyallup Tribe
DMMO file

9. Data Tables.

Table 5. Conventional results from entire project.

		SURFACE FILL (M)			*SUBSURFACE FILL (LM)*				*SUBSURFACE NATIVE (LM)*			*Discrete*	*Surface Fill (M)*	*Subsurface Fill (LM)*		*Sub-surface Native (LM)*
PARAMETER		DMMU 1	DMMU 2	DMMU 3	DMMU 4	DMMU 5	DMMU 6	DMMU 7	DMMU 9[1]	DMMU 10	DMMU 11	S4	DMMU 12	DMMU 13	DMMU 14	DMMU 15
Volume (cy)		15,216	10,116	13,496	52,260	43,198	42,279	25,056	40,440	37,584	37,372	n/a	12,400	27,900	15,500	24,800
Grain Size	% Gravel	25.2	11.0	20.2	17.1	4.5	0.1	0.2	0.6	1.6	0.6	no data [2]	23.8	8.7	10.6	1.4
	% Sand	65.4	78.1	64.2	64.8	77.1	59.7	63.2	55.4	83.6	79.1		68.7	67.0	69.6	71.0
	% Silt	7.5	9.2	13.1	15.8	15.5	33.7	31.1	33.1	11.1	16.6		9.1	22.0	17.7	20.9
	% Clay	1.6	1.6	2.5	2.3	2.6	6.5	5.5	11.2	3.7	3.8		1.7	3.5	2.0	6.2
	% Fines (clay+silt)	9.1	10.8	15.6	18.1	18.1	40.2	36.6	44.3	14.8	20.4		10.8	25.4	19.7	27.2
Total Solids, %		92.3	93.8	92.2	83.0	84.7	79.6	74.9	78.3	78.3	77.8	82.3	99.9	100.0	99.8	100.0
Total Organic Carbon, %		0.525	0.337	0.200	0.141	0.116	0.310	0.390	0.566	0.430	0.421	0.422	0.23	0.58	0.65	0.3
Total Sulfides, mg/kg		<1.16 U	<1.11 U	2.83	2.87	72.1	156	103	<1.27 U	6.02	2.07	5.09	<1.1 U	<1.3 U	<1.3 U	54
Total Ammonia, mg/kg		<0.11 U	0.11	0.14	0.95	0.25	9.44	1.51	27.7	9.9	2.28	19	0.09	5.3	3.6	11.4

[1] There is no DMMU 8 due to field conditions (less material in fill layer than expected.)

[2] Not enough material collected to analyze for grain sizes in sample S4

Table 6. Results of Phase 1 chemical analysis compared to DMMP guidelines.

Chemical	SL	BT	ML	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
METALS (mg/kg)																									
Antimony	150	---	200	6		5.0	U	5	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U
Arsenic	57	507.1	700	13		5.0	U	5	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U
Cadmium	5.1	11.3	14	0.4		0.2	U	0.2	U	0.2	U	0.2	U	0.3	U	0.3	U	0.2	U	0.2	U	0.3	U	0.3	U
Chromium	---	267	---	24.3		14.7		15.4		13.3		11.3		14.9		14.2		15.6		13.6		13.1		14.5	
Copper	390	1027	1,300	141		24.8		16.7		16.0		11.0		20.5		14.9		18.7		16.1		14.5		15.6	
Lead	450	975	1,200	124		38		12		8		2	U	3	U	3	U	2	U	2	U	3	U	3	U
Mercury	0.41	1.5	2.3	0.32		0.45		0.04	U	0.04	U	0.04	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Nickel	140	370	370	16		11		12		9		8		11		10		11		10		9		10	
Selenium	---	3	---	0.5	U	0.5	U	0.5	U	0.6	U	0.5	U	0.7	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U
Silver	6.1	6.1	8.4	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Zinc	410	2,783	3,800	227		55		42		39		25		27		24		26		27		25		24	
ORGANICS (µg/kg)																									
Acenaphthylene	560	---	1,300	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Acenaphthene	500	---	2,000	<61	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
Anthracene	960	---	13,000	72		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Fluorene	540	---	3,600	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Naphthalene	2,100	---	2,400	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Phenanthrene	1,500	---	21,000	310		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
2-Methylnaphthalene	670	---	1,900	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Total LPAHs	5,200	---	29,000	382		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Benzo(a)anthracene	1,300	---	5,100	130		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Benzo(a)pyrene	1,600	---	3,600	100		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Total Benzofluoranthenes[6]	3,200	---	9,900	240		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Benzo(g,h,i)perylene	670	---	3,200	86		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Chrysene	1,400	---	21,000	170		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Dibenzo(a,h)anthracene	230	---	1,900	42		<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U

Chemical	SL	BT	ML	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Fluoranthene	1,700	4,600	30,000	340		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Indeno(1,2,3-c,d)pyrene	600	---	4,400	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Pyrene	2,600	11,980	16,000	370		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Total HPAHS	12,000	---	69,000	1478		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
CHLORINATED HYDROCARBONS (µg/kg)																									
Hexachlorobenzene	22	168	230	<2.7	Y	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
Hexachlorobutadiene	29	---	270	<2.0	U	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
1,2-Dichlorobenzene	35	---	110	<6.1	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
1,3-Dichlorobenzene	170	---	---	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
1,4-Dichlorobenzene	110	---	120	<61	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
1,2,4-Trichlorobenzene	31	---	64	<6.1	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
PHTHALATES (µg/kg)																									
Dimethyl phthalate	71	---	1,400	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Diethyl phthalate	200	---	1,200	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Di-n-butyl phthalate	1,400	---	5,100	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Butyl benzyl phthalate	63	---	970	<6.1	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<62	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
Bis(2-ethylhexyl) phthalate	1,300	---	8,300	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
Di-n-octyl phthalate	6,200	---	6,200	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
PHENOLS (µg/kg)																									
Pentachlorophenol	400	504	690	<30	U	<30	U	<30	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U
Phenol	420	---	1,200	270		<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
2 Methylphenol	63	---	77	9.1		<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<62	U
4 Methylphenol	670	---	3,600	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<6.2	U
2,4-Dimethylphenol	29	---	210	18		<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
MISCELLANEOUS EXTRACTABLES (µg/kg)																									
Benzoic acid	650	---	760	<610	U	<610	U	<610	U	<620	U	<620	U	<620	U	<620	U	<620	U	<620	U	<610	U	<620	U
Benzyl alcohol	57	---	870	<30	U	<30	U	<30	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U	<31	U
Dibenzofuran	540	---	1,700	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U

Chemical	SL	BT	ML	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Hexachloroethane	1,400	---	14,000	<61	U	<61	U	<61	U	<62	U	<62	U	<62	U	<62	U	<62	U	<62	U	<61	U	<62	U
N-Nitrosodiohenylamine	28	---	130	<6.1	U	<6.1	U	<6.1	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.2	U	<6.1	U	<6.1	U	<6.2	U
VOLATILE ORGANICS (µg/kg)																									
Ethylbenzene	10	---	50	<1.3	U	<1.0	U	<1.2	U	<1.0	U	<1.2	U	<1.4	U	<1.2	U	<1.0	U	<1.2	U	<1.0	U	<1.0	U
Tetrachloroethene	57	---	210	<1.3	U	<1.0	U	<1.2	U	<1.0	U	<1.2	U	<1.4	U	<1.2	U	<1.0	U	<1.2	U	<1.0	U	<1.0	U
Trichloroethene	160	---	1,600	<1.3	U	1.3		<1.2	U	<1.0	U	<1.2	U	<1.4	U	<1.2	U	<1.0	U	<1.2	U	<1.0	U	<1.0	U
Total Xylene (sum of o-,m-,p)	40	---	160	<1.3	U	<1.0	U	2.4		<1.0	U	1.3		<1.4	U	<1.2	U	<1.0	U	<1.2	U	<1.0	U	<1.0	U
PESTICIDES (µg/kg)																									
Aldrin	10	---	---	<2.0	U	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
Chlordane	10	37	---	<2.0	U	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
DDD				<3.9	U	<2.0	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<1.9	U
DDE				<3.9	U	<2.0	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<1.9	U
DDT				<16	Y	<2.0	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<1.9	U
Total DDT	6.9	50	69	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	
Dieldrin	10	---	---	<3.9	U	<2.0	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<2.0	U	<2.0	U	<2.0	U	<1.9	U	<1.9	U
Heptachlor	10	---	---	<2.0	U	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
Lindane	10	---	---	<2.0	U	<0.98	U	<0.98	U	<0.98	U	<0.98	U	<0.96	U	<0.98	U	<0.99	U	<0.99	U	<0.96	U	<0.97	U
PCBs (µg/kg)																									
Aroclor 1016				<8.8	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1221				<8.8	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1232				<8.8	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1242				<8.8	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1248				<8.8	U	<3.9	U	21		<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1254				34	P	<3.9	U	9.1		<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Aroclor 1260				38		<3.9	U	19		<3.9	U	<3.9	U	<3.9	U	<3.9	U	<4.0	U	<3.9	U	<3.9	U	<3.8	
Total PCBs (mg/kg OC)	130	38 (6)	3,100	13.7		<1.16		24.55		<2.77		<3.36		<1.26		<0.69		<0.45		<0.91		<0.93		<0.90	

Notes:
- **Bolded** values indicate exceedance of DMMP SL
- DMMP Criteria are those in place in 2005, when the SAP for this project was approved

Table 7. Results and TEQ comparisons from dioxin/furan analysis.

	TEF	C1	C2	C3	C4	S4	C1	C2	C3	C4	S4	C1	C2	C3	C4	S4
	WHO 2005	ng/kg	ng/kg	ng/kg	ng/kg	ng/kg	ND=1/2 RL TEQ					ND=0 TEQ				
Dioxins																
2,3,7,8-TCDD	1	<0.36	<0.3	<0.18	<0.13	<0.16	0.18	0.15	0.09	0.07	0.08	0	0	0	0	0
1,2,3,7,8-PeCDD	1	2.0	<0.5	<0.25	<0.27	<0.40	2.00	0.25	0.13	0.14	0.20	2.0	0	0	0	0
1,2,3,4,7,8-HxCDD	0.1	<0.6	<0.33	<0.20	<0.28	<0.20	0.03	0.02	0.010	0.014	0.010	0	0	0	0	0
1,2,3,6,7,8-HxCDD	0.1	5	0.7	<0.23	<0.28	<0.24	0.50	0.07	0.012	0.014	0.012	0.50	0.07	0	0	0
1,2,3,7,8,9-HxCDD	0.1	3.2	0.7	<0.19	<0.25	<0.23	0.32	0.07	0.010	0.013	0.012	0.32	0.07	0	0	0
1,2,3,4,6,7,8-HpCDD	0.01	110	14	<0.21	0.5	0.5	1.10	0.14	0.001	0.005	0.005	1.10	0.14	0	0.01	0.01
OCDD	0.0003	970	130	<0.94	<0.38	<0.46	0.291	0.039	0.0001	0.0001	0.0001	0.29	0.04	0	0	0
Furans																
2,3,7,8-TCDF	0.1	8	0.4	<0.12	<0.11	0.1	0.80	0.04	0.006	0.006	0.01	0.80	0.04	0	0	0.01
1,2,3,7,8-PeCDF	0.03	<0.73	<0.38	<0.19	<0.19	<0.26	0.011	0.006	0.003	0.003	0.004	0	0	0	0	0
2,3,4,7,8-PeCDF	0.3	4.8	0.5	<0.23	<0.18	<0.30	1.44	0.15	0.035	0.027	0.045	1.44	0.15	0	0	0
1,2,3,4,7,8-HxCDF	0.1	2.0	<0.31	<0.18	<0.17	<0.13	0.20	0.016	0.009	0.009	0.007	0.20	0	0	0	0
1,2,3,6,7,8-HxCDF	0.1	<0.4	<0.38	<0.18	<0.17	<0.17	0.020	0.019	0.009	0.009	0.009	0	0	0	0	0
1,2,3,7,8,9-HxCDF	0.1	0.9	<0.36	<0.17	<0.18	<0.16	0.09	0.018	0.009	0.009	0.008	0.09	0	0	0	0
2,3,4,6,7,8-HxCDF	0.1	1.2	<0.30	<0.15	<0.15	<0.13	0.12	0.015	0.008	0.008	0.007	0.12	0	0	0	0
1,2,3,4,6,7,8-HpCDF	0.01	21	3.2	<0.12	<0.13	<0.22	0.21	0.03	0.001	0.001	0.001	0.21	0.03	0	0	0
1,2,3,6,7,8,9-HpCDF	0.01	<0.86	0.4	<0.15	<0.21	<0.25	0.004	0.004	0.001	0.001	0.001	0	0.004	0	0	0
OCDF	0.0003	44	7.9	<0.28	0.3	<0.36	0.013	0.002	0.00004	0.0001	0.0001	0.01	0.002	0	0.002	0
Totals							7.33	1.04	0.33	0.32	0.41	7.08	0.55	0.00	0.01	0.02

Table 8. Volume-weighted calculations for dioxin results.

Composite (DMMUs included)	Volume (CY)	TCDD/F TEQ (ND=1/2 RL) ng/kg dry wt.	Product (Vol x TEQ)	Volume weighted avg. for all suitable material	Comments
C1 (DMMUs 1 - 3; surface fill)	38,828	7.33	284,588		unsuitable--Greater than max TEQ (5.2 ng/kg)
C2 (DMMUs 4 & 5; subsurface fill)	95,458	1.04	98,997		
C3 (DMMUs 6 & 7; subsurface fill)	67,335	0.33	21,947		
C4 (DMMUs 9 - 11; native material)	115,396	0.32	36,488		
*No-test Native	683,000	0.32	218,560		
Totals (Suitable): Tested + no-test Native	961,189		375,991	0.39	vol weighted conc. For all suitable project material

Notes:
- all PCDD/F concentrations given in dry wt.
* For no-test native material: PCDD/F TEQ for C4 used to estimate volume weighted concentrations

Table 9. PCB results of both Aroclor and homolog analysis from Phase 1. Homolog analysis provides an estimate of PCB congeners.

	DMMP			SMS																										
	SL	BT	ML	SQS	CSL	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Total Organic Carbon, %						0.53		0.34		0.20		0.14		0.12		0.31		0.39		0.57		0.43		0.42		0.42	
Aroclor PCBs (µg/kg dry wt)																														
Aroclor 1016						8.8	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1221						8.8	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1232						8.8	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1242						8.8	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1248						8.8	U	3.9	U	21		3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1254						34	P	3.9	U	9.1		3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor 1260						38		3.9	U	19		3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Total	130	38[1]	3100			72		3.9	U	49.1		3.9	U	3.9	U	3.9	U	3.9	U	4	U	3.9	U	3.9	U	3.8	U
Aroclor PCBs (mg/kg OC)																														
Aroclor 1016						1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1221						1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1232						1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1242						1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1248						1.68	U	1.2	U	10.5		2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1254						6.48		1.2	U	4.6		2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1260						7.24		1.2	U	9.5		2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
Total				12	65	13.71		1.2	U	24.55		2.77	U	3.36	U	1	U	1	U	0.71	U	0.91	U	0.93	U	0.90	U
PCB congeners via homolog analysis[2]						C1 (surface fill)						C2 (subsurface fill)				C3 (subsurface fill)				C4 (subsurface native)						Discrete	
Mean TOC, %						0.35						0.13				0.35				0.47						0.42	
Total PCBs (µg/kg dry wt.)	130		3100			45.1						9.57				1.08				0.749						1.14	
Total PCBs (mg/kg OC)		38		12	65	12.74						7.45				0.31				0.16						0.27	

Notes:
[1] The DMMP BT is for organic normalized data (mg/kg OC)
[2] Total PCBs determined by EPA Method1668A - high resolution gas chromatograph/mass spectrometer (GC/MS) and derived by summing congener homologs

Table 10. Phase 2 results of chemical analysis compared to DMMP criteria.

	DMMP Criteria[1]			DMMU ID																																									
Chemical	SL	BT	ML	12		13		14		14 Rerun		14 Re-injec-tion		14		15		S15XB		S15YC		S16XB		S8B		S8C		S13ZE		S14ZD		S15YD		S16YC	
Metals (mg/kg dry wt)																																													
Antimony	150	--	200	1.31		0.18		0.24		--		--		--		0.02		--		--		--		--		--		--		--		--		--	
Arsenic	57	507.1	700	3.9		1.4		1.7		--		--		--		1.7		--		--		--		--		--		--		--		--		--	
Cadmium	5.1	11.3	14	0.136		0.054		0.036	B	--		--		--		0.045		--		--		--		--		--		--		--		--		--	
Chromium	--	267	--	7.19		6.79		6.91		--		--		--		6.19		--		--		--		--		--		--		--		--		--	
Copper	390	1,027	1,300	15.6		13.4		10.8		--		--		--		10.8		--		--		--		--		--		--		--		--		--	
Lead	450	975	1,200	22.2		14.2		3.82		--		--		--		2.02		--		--		--		--		--		--		--		--		--	
Mercury	0.41	1.5	2.3	0.028		0.051		0.042		--		--		--		0.018		--		--		--		--		--		--		--		--		--	
Nickel	140	370	370	7.67		6.57		6.25		--		--		--		6.52		--		--		--		--		--		--		--		--		--	
Selenium	--	3	--	0.3	U	0.3	U	0.3	U	--		--		--		0.2	U	--		--		--		--		--		--		--		--		--	
Silver	6.1	6.1	8.4	0.319		0.122		0.061		--		--		--		0.012		--		--		--		--		--		--		--		--		--	
Zinc	410	2,783	3800	37.6		18.2		15.8		--		--		--		13.5		--		--		--		--		--		--		--		--		--	
LPAHs (µg/kg dry wt)								EPA 8270C		EPA 8270C		EPA 8270C		EPA 8270 SIM																															
Acenaphthylene	560	--	1,300	13		1.2	J	70	D	20		83	D	1.8	J	1.6	J	1.5	U	1.5	U	2.1		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	6.4	U
Acenaphthene	500	--	2,000	68		6.1	J	1,000	D	2.4	J	980	D	16		3.2	J	0.36		1.5	U	4.6		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	2	J
Anthracene	960	--	13,000	61		8.1		1,700	D	44		1,600	D	22		2.9	J	1.2		1.5	U	28		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	3.7	J
Fluorene	540	--	3,600	51		6.2	J	1,100	D	29		1,100	D	16		3.3	J	0.84		1.5	U	4.4		4.7	U	4.8	U	6.5	U	6.6	U	1.4	J	3.1	J
Naphthalene	2,100	--	2,400	3.0	J	6.3	U	9,200	D	10		6,800	D	38		6.3	U	5.6		0.83	J	3.2		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	7.9	
Phenanthrene	1,500	--	21,000	190		22		9,300	D	120		7,000	D	88		13		18		2.4		160		4.7	U	4.8		1.7	J	4.4	J	7.2		14	
2-Methylnaphthalene	670	--	1,900	7.3		2.5	J	2,100	D	9.2		1,700	D	9.3		3	J	12		1.6		6		4.7	U	4.8	U	6.5		6.6	U	3.8	J	5.2	J
Total LPAH[2]	5,200	--	29,000	386		43.6		22,370	D	225		17,563	D	182		24		26		3.23		202.3		4.7	U	4.8		1.7		4.4		8.6		30.7	
HPAHs (µg/kg dry wt)																																			
Benzo(a)anthracene	1,300	--	5,100	160		22		2,500	D	17.7		2,400	D	48		9.1		2.5		0.55	J	240		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	5.9	J
Benzo(a)pyrene	1,600	--	3,600	140		14		3,800	D	6.27		3,300	D	52		5.6	J	1	J	0.26	J	190		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	5.5	J
Total Benzofluoranthenes[3]	3,200	--	9,900	321		32.9		3,310	D	15.88		3,650	D	84		12.7		1.68		0.32		366		4.7	U	4.8	U	6.5	U	6.6	U	1.3		9.1	
Benzo(g,h,i)perylene	670	--	3,200	3.8	J	8.6		1,900	D	2.75		1,800	D	45		3.8	J	0.71	J	1.50	U	100		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	4.9	J

	DMMP Criteria[1]			DMMU ID																																									

	DMMP Criteria[1]			DMMU ID														DMMU 14 Subunit Samples						DMMU 5 Subunit Samples above DMMU 14				DMMU 15 Subunit Samples							
Chemical	SL	BT	ML	12		13		14		14 Rerun		14 Re-injec-tion		14		15		S15XB		S15YC		S16XB		S8B		S8C		S13ZE		S14ZD		S15YD		S16YC	
Dibenzofuran	540	--	1,700	23		3.1	J	110	D	14		120		--		2.1	J	5.4		0.98		5.3		4.7	U	4.8	U	6.5	U	6.6	U	1.6	J	2.1	J
Hexachloroethane	1,400	--	14,000	5.4	U	6.3	U	32	U	6.3	U	78	U	--		6.3	U	--		--		--		--		--		6.5	U	6.6	U	6.4	U	6.4	U
N-Nitrosodiphenylamine	28	--	130	5.4	U	6.3	U	32	U	6.3	U	60	U	--		6.3	U	--		--		--		--		--		6.5	U	6.6	U	7.4	U	6.4	U
Volatile Organics (µg/kg dry wt)																																			
Ethylbenzene	10	--	50	5.3	U	6.2	U	6.5	U	--		--		--		4.8	U	--		--		--		--		--		--		--		--		--	
Tetrachloroethene	57	--	210	5.3	U	6.2	U	6.5	U	--		--		--		4.8	U	--		--		--		--		--		--		--		--		--	
Trichloroethene	160	--	1,600	5.3	U	6.2	U	6.5	U	--		--		--		4.8	U	--		--		--		--		--		--		--		--		--	
Xylene (sum o-, m-, p-)	40	--	160	5.3	U	6.2	U	6.5	U	--		--		--		4.8	U	--		--		--		--		--		--		--		--		--	
Pesticides (µg/kg dry weight)																																			
Aldrin	10	--	--	0.54	U	0.63	U	0.63	U	--		--		--		0.63	U	--		--		--		--		--		--		--		--		--	
Chlordane	10	37	--	0.54	Ui	0.63	U	0.63	U	--		--		--		0.63	U	--		--		--		--		--		--		--		--		--	
Total DDT	6.9	50	69	4.5		--		--		--		--		--		--		--		--		--		--		--		--		--		--		--	
Dieldrin	10	--	--	0.54	Ui	0.63	U	0.63	U	--		--		--		0.63	U	--		--		--		--		--		--		--		--		--	
Heptachlor	10	--	--	0.54	Ui	0.63	U	0.63	U	--		--		--		0.63	U	--		--		--		--		--		--		--		--		--	
Lindane	10	--	--	0.54	U	0.63	Ui	0.63	Ui	--		--		--		0.63	U	--		--		--		--		--		--		--		--		--	
PCBs (µg/kg dry weight)																																			
Total PCBs	130	38[6]	3,100	200		--		--		--		--		--		--		--		--		--		--		--		--		--		--		--	

[1] DMMP Criteria Guideline Chemistry Values updated July 2008; Screening Level (SL), Bioaccumulation Trigger (BT), and Maximum Level (ML).

[2] Total LPAHs = The sum of Acenaphthylene, Acenaphthene, Anthracene, Fluorene, Napthalene and Phenanthrene

[4] Total benzofluoranthenes = The sum of the "b," "j" and "k" isomers. The "j" isomer co-elutes with the "k" isomer, thus the concentration of the "j" isomer is included in the concentration for the "k" isomer.

[5] Total HPAHs = The sum of Benzo(a)anthracene, Benzo(a) pyrene, Total Benzofluoranthenes, Benzo(g,h,i)perylene, Chrysene Dibenzo(a,h)anthracene, Fluoranthese, Chrysene, Dibenzo(a,h)athracene, Indeno(1,2,3-c,d)pyrene and pyrene.

[6] Criterion is normalized relative to total organic carbon content and reported in mg/kg

U = Laboratory data qualifier indicating analyte undetected at given reporting limit

I = The MRL/MDL has been elevated due to matrix interference.

J = The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL.

D = Sample diluted due to concentration. Concentration reported is from diluted aliquot.

B = the analyte was found in the associated method blank at a level that is significant to the sample result.

= Chemical not detected above reported level

Highlight indicates analyte detected at a concentration greater than DMMP criteria

Table 11. UST Phase - Summary of petroleum hydrocarbon results.

Sample ID	Sample Depth (feet bgs)	NWTPH-Dx[1] (mg/kg)		NWTPH-Gx (mg/kg)
		Diesel Range	Lube-Oil Range	
U1A (4-6)	4-6	<7.3 U	<13 U	<9.0 U
U1A (6-8)	6-8	<6.4 U	<13 U	<8.5 U
U1B (4-6)	4-6	8.9	30	<8.2 U
U1B (6-8)	6-8	<6.7 U	<13 U	<9.0 U
U2A1 (6-8)	6-8	<5.5 U	<11 U	<6.1 U
U2A1 (8-10)	8-10	<6.2 U	<12 U	<7.4 U
U2A2 (4-6)	4-6	<5.2 U	<10 U	<6.0 U
U2A2 (8-10)	8-10	<5.8 U	<12 U	<7.9 U
U2A3 (6-8)	6-8	<5.7 U	<11 U	<6.8 U
U2A3 (8-10)	8-10	6.2	<12 U	17
U2A4 (4-6)	4-6	<5.1 U	<10 U	<6.3 U
U2A4 (8-10)	8-10	6.9	<13 U	<9.1 U
U2B1 (4-6)	4-6	<5.4 U	11	<6.9 U
U2B1 (8-10)	8-10	<6.3 U	<13 U	<7.9 U
U2B2 (8-10)	8-10	<5.9 U	<12 U	<9.2 U
U2B2 (10-12)	10-12	<6.3 U	<13 U	<8.6 U
U2B3 (8-10)	8-10	<6.0 U	<12 U	<6.9 U
U2B3 (10-12)	10-12	<6.0 U	<12 U	<7.6 U
U2B4 (6-8)	6-8	<5.5 U	<11 U	<6.8 U
U2B4 (8-10)	8-10	<6.1 U	<12 U	<6.7 U
U3A1 (6-8)	6-8	<5.8 U	<12 U	<6.6 U
U3A1 (8-10)	8-10	<6.2 U	<12 U	<7.3 U
U3A2 (6-8)	6-8	<5.3 U	<11 U	<6.8 U
U3A2 (8-10)	8-10	<6.0 U	<12 U	<6.8 U
U3B1 (8-10)	8-10	<5.8 U	<12 U	<6.4 U
U3B1 (12-14)	12-14	<6.1 U	<12 U	<7.7 U
U3B2 (6-8)	6-8	<5.6 U	<11 U	<7.4 U
U3B2 (8-10)	8-10	<6.1 U	<12 U	<7.8 U
U3B3 (8-10)	8-10	<6.0 U	<12 U	<7.4 U
U3B3 (12-14)	12-14	<5.8 U	<12 U	<8.1 U
U3B4 (6-8)	6-8	<5.7 U	<11 U	<6.7 U
U3B4 (8-10)	8-10	<6.2 U	<12 U	14
UA4 (6-8)	6-8	<6.1 U	<12 U	<7.0 U
U4A (10-12)	10-12	8.6	<12 U	<7.9 U
U4B (6-8)	6-8	<6.0 U	<12 U	<7.8 U
U4B (12-13)	12-13	<6.2 U	<12 U	<7.4 U
U4C (6-8)	6-8	<6.0 U	<12 U	<7.5 U
U4C (8-10)	8-10	<5.8 U	<12 U	12
U4D (8-10)	8-10	<6.1 U	<12 U	<7.0 U
U4D (10-12)	10-12	<6.3 U	<13 U	<7.3 U
U4E (8-10)	8-10	<6.1 U	<12 U	<7.6 U
U4E (10-12)	10-12	<6.0 U	<12 U	<7.8 U

Sample ID	Sample Depth (feet bgs)	NWTPH-Dx[1] (mg/kg)		NWTPH-Gx (mg/kg)
		Diesel Range	Lube-Oil Range	
U4F (6-8)	6-8	87	30	570
U4F (8-10)	8-10	25	<12 U	16
U5A (6-8)	6-8	<5.9 U	<12 U	<15 U
U5A (12-14)	12-14	<6.1 U	<12 U	<7.8 U
U5B (6-8)	6-8	<6.1 U	<12 U	<7.6 U
U5B (8-10)	8-10	10	<13 U	<8.2 U
U6A (6-8)	6-8	7.3	<14 U	<9.6 U
U6A (12-14)	12-14	<5.8 U	<12 U	<6.3 U
U6B (6-8)	6-8	<5.8 U	<12 U	13
U6B (12-14)	12-14	<5.9 U	<12 U	<7.3 U
U6C (6-8)	6-8	6.3	<12 U	<7.9 U
U6C (12-14)	12-14	<6.2 U	<12 U	<7.8 U
U7A (6-8)	6-8	8.5	<14 U	<8.7 U
U7A (12-14)	12-14	7.8	<14 U	<8.4 U
U7B (4-6)	4-6	13	50	<6.5 U
U7B (6-8)	6-8	7.5	<13 U	<8.2 U
U8A1 (4-6)	4-6	<5.2 U	<10 U	<6.2 U
U8A1 (6-8)	6-8	<5.6 U	<11 U	<6.9 U
U8A1 (10-12)	10-12	<5.8 U	<12 U	<7.0 U
U8A2 (4-6)	4-6	<5.0 U	<10 U	<6.5 U
U8A2 (6-8)	6-8	<5.5 U	<11 U	23
U8A2 (8-10)	8-10	<6.0 U	<12 U	<6.8 U
U8B1 (4-6)	4-6	<5.6 U	<11 U	<6.3 U
U8B1 (6-8)	6-8	<5.8 U	<12 U	<7.0 U
U8B2 (4-6)	4-6	<5.0 U	<10 U	<6.3 U
U8B2 (6-8)	6-8	<5.6 U	<11 U	<8.0 U
U8B2 (10-12)	10-12	<5.7 U	<12 U	<6.9 U
U8B3 (4-6)	4-6	<5.1 U	<10 U	<6.2 U
U8B3 (6-8)	6-8	<5.6 U	<11 U	<7.0 U
U8B4 (4-6)	4-6	<5.1 U	<10 U	<5.7 U
U8B4 (6-8)	6-8	<5.6 U	<11 U	<6.9 U
U8B4 (8-10)	8-10	<5.8 U	<12 U	<6.9 U
D1Y (4-8)	4-8	570	610	29
D1Y (8-12)	8-12	9.6	<11 U	<6.5 U
D1Y (16-20)	16-20	<6.2 U	<12 U	<7.6 U
D1Y (20-24)	20-24	8.6	<13 U	<8.8 U
D1X (4-8)	4-8	21	190	<7.2 U
D1X (8-12)	8-12	15	140	<6.7 U
D1Z (12-16)	12-16	<6.2 U	<12 U	<7.2 U
D2X (4-8)	4-8	<5.0 U	<10 U	<5.9 U
D2X (8-12)	8-12	11	66	<6.6 U
D2Y (4-8)	4-8	12	81	<6.0 U
D2Y (8-12)	8-12	6.2	34	<7.0 U
D2Y (12-16)	12-16	<6.0 U	<12 U	<6.3 U

Sample ID	Sample Depth (feet bgs)	NWTPH-Dx[1] (mg/kg)		NWTPH-Gx (mg/kg)
		Diesel Range	Lube-Oil Range	
D2Y (16-20)	16-20	<6.2 U	<12 U	<7.6 U
D3X (4-8)	4-8	7.6	<14 U	<9.8 U
D3X (8-12)	8-12	9	59	<7.8 U
D3X (12-16)	12-16	<6.8 U	<14 U	<8.3 U
D3X (16-20)	16-20	<5.6 U	<11 U	<6.5 U
D4X (4-8)	4-8	8.2	14	20
D4X (8-12)	8-12	<6.0 U	<12 U	<9.8 U
D4Y (4-8)	4-8	12	62	<7.7 U
D4Y (8-12)	8-12	<5.4 U	<11 U	<6.7 U
D4Y (12-16)	12-16	6.5	<13 U	<8.9 U
D4Y (16-20)	16-20	8.3	<12 U	<7.6 U
D5X (4-8)	4-8	<5.2 U	<10 U	<6.2 U
D5X (8-12)	8-12	6.7	15	16
D5Y (4-8)	4-8	<5.9 U	<12 U	<8.1 U
D5Y (8-12)	8-12	<5.6 U	<11 U	<6.7 U
D5Y (12-16)	12-16	5.9	<12 U	<7.3 U
D5Y (16-20)	16-20	7.7	<12 U	<7.8 U
MTCA[2] Method A Soil Cleanup Levels for Unrestricted Land Use (ULU)		2,000	2,000	100/30[3]

Notes:

[1] Washington Department of Ecology Method NWTPH-Dx with acid/silica gel cleanup.

[2] Model Toxics Control Act (MTCA).

[3] The MTCA Method A criteria (for unrestricted and industrial land use) is equal to 100 mg/kg in gasoline mixtures without benzene and is equal to 30 mg/kg in gasoline mixtures with benzene.

mg/kg = milligram per kilogram

U = Analyte was not detected at or greater than the listed reporting limit.

Bold type indicates that the detected concentration is greater than the respective MTCA Cleanup Level.

Table 12. UST Phase - Summary of VOC results

Sample ID	Sample Depth (feet bgs)	VOCs[1] (ug/kg dry weight)							
		Acetone	Carbon Disulfide	cis-1,2-dichloroethene	trans-1,2-dichloroethene	Trichloroethene	Tetrachloroethene	Methylene chloride[2]	Vinyl Chloride
U1A (4-6)	4-6	51	7.1	<1.7 U	<1.7 U	<1.7 U	<1.7 U	4.8	<1.7 U
U1A (6-8)	6-8	52	3.8	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.5 U	<1.3 U
U1B (4-6)	4-6	17	3	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U1B (6-8)	6-8	38	2	<1.3 U	<1.3 U	<1.3 U	<1.3 U	6.6	<1.3 U
U2A1 (6-8)	6-8	19	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.1 U	<1.1 U
U2A1 (8-10)	8-10	26	7.4	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<2.1 U	<1.0 U
U2A2 (4-6)	4-6	24	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U2A2 (8-10)	8-10	31	12	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.1 U	<1.1 U
U2A3 (6-8)	6-8	25	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.7 U	<1.3 U
U2A3 (8-10)	8-10	27	5.3	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.3 U	<1.1 U
U2A4 (4-6)	4-6	22	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U2A4 (8-10)	8-10	22	12	<1.4 U	<1.4 U	<1.4 U	<1.4 U	4.3	<1.4 U
U2B1 (4-6)	4-6	22	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.5 U	<1.3 U
U2B1 (6-8)	6-8	39	14	<1.2 U	<1.2 U	<1.2 U	1.5	<2.5 U	<1.2 U
U2B2 (8-10)	8-10	41	12	<1.2 U	<1.2 U	<1.2 U	1.9	<2.4 U	<1.2 U
U2B2 (10-12)	10-12	28	3.8	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.4 U	<1.2 U
U2B3 (8-10)	8-10	38	4.4	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.1 U	<1.1 U
U2B3 (10-12)	10-12	58	6.3	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.3 U	<1.2 U
U2B4 (6-8)	6-8	27	2.8	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.3 U	<1.2 U
U2B4 (8-10)	8-10	30	11	<1.1 U	<1.1 U	<1.1 U	1.2	<2.2 U	<1.1 U
U3A1 (6-8)	6-8	17	7.1	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U3A1 (8-10)	8-10	41	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<1.1 U	4.1	<1.1 U
U3A2 (6-8)	6-8	46	14	<1.3 U	<1.3 U	<1.3 U	<1.3 U	4.6	<1.3 U
U3A2 (8-10)	8-10	15	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.2 U	<1.1 U
U3B1 (8-10)	8-10	14	3	<1.1 U	<1.1 U	<1.1 U	<1.1 U	3.4	<1.1 U
U3B1 (12-14)	12-14	17	3.7	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U3B2 (6-8)	6-8	22	4.1	<1.2 U	<1.2 U	<1.2 U	<1.2 U	4.2	<1.2 U
U3B2 (8-10)	8-10	15	4	<1.2 U	<1.2 U	<1.2 U	<1.2 U	2.7	<1.2 U
U3B3 (8-10)	8-10	13	4.3	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.5 U	<1.2 U
U3B3 (12-14)	12-14	26	2.3	<1.2 U	<1.2 U	<1.2 U	<1.2 U	14	<1.2 U

Sample ID	Sample Depth (feet bgs)	VOCs[1] (ug/kg dry weight)							
		Acetone	Carbon Disulfide	cis-1,2-dichloroethene	trans-1,2-dichloroethene	Trichloroethene	Tetrachloroethene	Methylene chloride[2]	Vinyl Chloride
U3B4 (6-8)	6-8	26	13	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.3 U	<1.2 U
U3B4 (8-10)	8-10	<6.5 U	6.4	<1.3 U	<1.3 U	<1.3 U	<1.3 U	2.9	<1.3 U
U4-A (6-8)	6-8	39	15	17	<1.2 U	2.2	13	<2.3 U	<1.2 U
U4-A (10-12)	10-12	38	54	20	<1.3 U	<1.3 U	<1.3 U	<2.5 U	<1.3 U
U4-B (6-8)	6-8	23	3.2	25	<1.1 U	1.8	30	<2.2 U	<1.1 U
U4-B (12-13)	12-13	27	6.6	1.2	22	<1.2 U	<1.2 U	<2.3 U	<1.2 U
U4-C (6-8)	6-8	31	1.5	3.2	<1.5 U	<1.5 U	2.8	<2.9 U	<1.5 U
U4-C (8-10)	8-10	33	10	20	<1.2 U	<1.2 U	<1.2 U	3	<1.2 U
U4-D (8-10)	8-10	35	12	36	2.2	<1.1	<1.1	<2.2	<1.1
U4-D (10-12)	10-12	27	4.6	48	2.1	<1.1	<1.1	3.6	<1.1
U4-E (8-10)	8-10	37	12	12	<1.2 U	2.6	<1.2 U	<2.4 U	<1.2 U
U4-E (10-12)	10-12	51	10	24	2.1	2.2	<1.3 U	<2.6 U	<1.3 U
U4-F (6-8)	6-8	25	2.2	3.4	<1.1 U	<1.1 U	<1.1 U	<2.2 U	<1.1 U
U4-F (8-10)	8-10	30	8.6	14	<1.2 U	3.2	1.9	<2.4 U	<1.2 U
U5-A (6-8)	6-8	24	1.4	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.3 U	<1.2 U
U5-A (12-14)	12-14	29	6.6	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.5 U	<1.2 U
U5-B (6-8)	6-8	27	8.4	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.5 U	<1.2 U
U5-B (8-10)	8-10	20	5.5	<1.2 U	<1.2 U	<1.2 U	<1.2 U	<2.5 U	<1.2 U
U6-A (6-8)	6-8	19	5.7	2.4	<1.5 U	2.9	38	19	<1.5 U
U6-A (12-14)	12-14	16	9.6	<1.1 U	<1.1 U	<1.1 U	<1.1 U	2.4	2.6
U6-B (6-8)	6-8	29	3.7	60	5.1	130	40	4.4	<1.2 U
U6-B (12-14)	12-14	16	12	<1.2 U	<1.2 U	<1.2 U	<1.2 U	4.2	2.4
U6-C (6-8)	6-8	34	10	2	<1.1 U	8.3	1.3	3.5	<1.1 U
U6-C (12-14)	12-14	34	5.9	23	2.6	<1.1 U	<1.1 U	<2.3 U	9.2
U7-A (6-8)	6-8	53	3.1	<1.4 U	<1.4 U	<1.4 U	<1.4 U	28	<1.4 U
U7-A (12-14)	12-14	26	4.8	<1.4 U	<1.4 U	<1.4 U	<1.4 U	4	<1.4 U
U7-B (4-6)	4-6	19	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<1.3 U	<2.6 U	<1.3 U
U7-B (6-8)	6-8	56	5.2	<1.3 U	<1.3 U	<1.3 U	<1.3 U	32	<1.3 U
U8A1 (4-6)	4-6	11	2.5	<1.2 U	<1.2 U	<1.2 U	<1.2 U	3.6	<1.2 U
U8A1 (6-8)	6-8	13	3.1	<1.3 U	<1.3 U	<1.3 U	<1.3 U	3.2	<1.3 U
U8A1 (10-12)	10-12	27	15	<1.2 U	<1.2 U	<1.2 U	<1.2 U	2.8	<1.2 U
U8A2 (4-6)	4-6	9.5	1.7	<1.3 U	<1.3 U	<1.3 U	<1.3 U	3.1	<1.3 U

Sample ID	Sample Depth (feet bgs)	VOCs[1] (ug/kg dry weight)							
		Acetone	Carbon Disulfide	cis-1,2-dichloroethene	trans-1,2-dichloroethene	Trichloroethene	Tetrachloroethene	Methylene chloride[2]	Vinyl Chloride
U8A2 (6-8)	6-8	10	1.2	<1.1 U	<1.1 U	<1.1 U	<1.1 U	4.2	<1.1 U
U8A2 (8-10)	8-10	25	9.2	<1.1 U	<1.1 U	<1.1 U	<1.1 U	2.4	<1.1 U
U8B1 (4-6)	4-6	14	2.4	<1.1 U	<1.1 U	<1.1 U	<1.1 U	3.1	<1.1 U
U8B1 (6-8)	6-8	20	8.8	<1.1 U	<1.1 U	<1.1 U	<1.1 U	2.5	<1.1 U
U8B2 (4-6)	4-6	15	7	<1.4 U	<1.4 U	<1.4 U	<1.4 U	<2.7 U	<1.4 U
U8B2 (6-8)	6-8	15	2.1	<1.1 U	<1.1 U	<1.1 U	<1.1 U	<2.2 U	<1.1 U
U8B2 (10-12)	10-12	24	18	<1.2 U	<1.2 U	<1.2 U	<1.2 U	4.1	<1.2 U
U8B3 (4-6)	4-6	12	1.8	<1.0 U	<1.0 U	<1.0 U	<1.0 U	2.8	<1.0 U
U8B3 (6-8)	6-8	27	3.5	<1.2 U	<1.2 U	<1.2 U	<1.2 U	2.5	<1.2 U
U8B4 (4-6)	4-6	10	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<1.0 U	<2.1 U	<1.0 U
U8B4 (6-8)	6-8	15	4.1	<1.2 U	<1.2 U	<1.2 U	<1.2 U	3.8	<1.2 U
U8B4 (8-10)	8-10	23	17	<1.2 U	<1.2 U	<1.2 U	<1.2 U	2.8	<1.2 U
MTCA Method A ULU Cleanup Level		NE	NE	NE	NE	30	50	20	NE

Notes:

[1] Volatile organic compounds (VOCs) were analyzed by EPA Method 5035/8260B. Other VOCs were analyzed but not detected.

[2] Methylene chloride is a common laboratory contaminant.

MTCA = Model Toxics Control Act

U = Analyte was not detected at or greater than the listed reporting limit.

-- Not analyzed

NE = Cleanup level Not established for this compound

Bold type indicates that the detected concentration is greater than the respective MTCA Cleanup Level.

Table 13. Phase 1 Chemical analysis results compared to Washington State Sediment Management Standards.

Chemical	SQS	CSL	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Total Organic Carbon, %			0.525		0.337		0.200		0.141		0.116		0.310		0.390		0.566		0.430		0.421		0.422	
METALS (mg/kg dry wt.)																								
Antimony	---	---	6		5.0	U	5	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U
Arsenic	57	93	13		5.0	U	5	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U	6	U
Cadmium	5.1	6.7	0.4		0.2	U	0.2	U	0.2	U	0.2	U	0.3	U	0.3	U	0.2	U	0.2	U	0.3	U	0.3	U
Chromium	260	270	24.3		14.7		15.4		13.3		11.3		14.9		14.2		15.6		13.6		13.1		14.5	
Copper	390	390	141		24.8		16.7		16.0		11.0		20.5		14.9		18.7		16.1		14.5		15.6	
Lead	450	530	124		38		12		8		2	U	3	U	3	U	2	U	2	U	3	U	3	U
Mercury	0.41	0.59	0.32		0.45		0.04	U	0.04	U	0.04	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
Nickel	---	---	16		11		12		9		8		11		10		11		10		9		10	
Selenium	---	---	0.5	U	0.5	U	0.5	U	0.6	U	0.5	U	0.7	U	0.6	U	0.6	U	0.6	U	0.6	U	0.6	U
Silver	6.1	6.1	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Zinc	410	960	227		55		42		39		25		27		24		26		27		25		24	
ORGANICS (mg/kg OC)																								
Acenaphthylene	66	66	11.6	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Acenaphthene	16	57	11.6	U	1.8	U	3.1	U	4.40	U	5.34	U	2	U	1.6	U	1.1	U	1.4	U	1.4	U	1.5	U
Anthracene	220	1,200	13.7		18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Fluorene	23	79	11.6	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Naphthalene	99	170	11.6	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Phenanthrene	100	480	59.0		18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
2-Methylnaphthalene	38	64	11.6	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Total LPAHs [2]	370	780	72.8		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Benzo(a)anthracene	110	270	24.8		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Benzo(a)pyrene	99	210	19.0		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Total Benzofluoranthenes6	230	450	45.7		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Benzo(g,h,i)perylene	31	78	16.4		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U

Chemical	SQS	CSL	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Chrysene	110	460	32.4		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Dibenzo(a,h)anthracene	12	33	8.0		1.8	U	3.1	U	4.4	U	5.3	U	2.0	U	1.6	U	1.1	U	1.4	U	1.4	U	1.5	U
Fluoranthene	160	1,200	64.8		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Indeno(1,2,3-c,d)pyrene	34	88	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Pyrene	1,000	1,400	70.5		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Total HPAHS	960	5,300	281.5		18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
CHLORINATED HYDROCARBONS (mg/kg OC)																								
Hexachlorobenzene	0.38	2.3	0.5	U	0.3	U	0.5	U	0.7	U	0.8	U	0.3	U	0.3	U	0.2	U	0.2	U	0.2	U	0.2	U
Hexachlorobutadiene	3.9	6.2	0.4	U	0.3	U	0.5	U	0.7	U	0.8	U	0.3	U	0.3	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dichlorobenzene	2.3	2.3	1.2	U	1.8	U	3.1	U	4.4	U	5.3	U	2.0	U	1.6	U	1.1	U	1.4	U	1.4	U	1.5	U
1,3-Dichlorobenzene	--	---	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
1,4-Dichlorobenzene	3.1	9	1.2	U	1.8	U	3.1	U	4.4	U	5.3	U	2.0	U	1.6	U	1.1	U	1.4	U	1.4	U	1.5	U
1,2,4-Trichlorobenzene	0.81	1.8	1.2	U	1.8	U	3.1	U	4.4	U	5.3	U	2.0	U	1.6	U	1.1	U	1.4	U	1.4	U	1.5	U
PHTHALATES (mg/kg OC)																								
Diethyl phthalate	61	110	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Dimethyl phthalate	53	53	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Di-n-butyl phthalate	220	1,700	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Butyl benzyl phthalate	4.9	64	1.2	U	1.8	U	3.1	U	4.4	U	5.3	U	2.0	U	15.9	U	1.1	U	1.4	U	1.4	U	1.5	U
Bis(2-ethylhexyl) phthalate	47	78	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
Di-n-octyl phthalate	58	4,500	11.6	U	18.1	U	30.5	U	44.0	U	53.4	U	20.0	U	15.9	U	11.0	U	14.4	U	14.5	U	14.7	U
PHENOLS (µg/kg dry wt.)																								
Pentachlorophenol	360	690	30	U	30	U	30	U	31	U	31	U	31	U	31	U	31	U	31	U	31	U	31	U
Phenol	420	1,200	270		61	U	61	U	62	U	62	U	62	U	62	U	62	U	62	U	61	U	62	U
2 Methylphenol	63	63	9.1		6.1	U	6.1	U	6.2	U	6.2	U	6.2	U	6.2	U	6.2	U	6.1	U	6.1	U	62	U
4 Methylphenol	670	670	61	U	61	U	61	U	62	U	62	U	62	U	62	U	62	U	62	U	61	U	6.2	U
2,4-Dimethylphenol	29	29	18		6.1	U	6.1	U	6.2	U	6.2	U	6.2	U	6.2	U	6.2	U	6.1	U	6.1	U	6.2	U
MISCELLANEOUS EXTRACTABLES																								
Benzoic acid (µg/kg dry wt.)	650	650	610	U	610	U	610	U	620	U	620	U	620	U	620	U	620	U	620	U	610	U	620	U

Chemical	SQS	CSL	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Benzyl alcohol (µg/kg dry wt)	57	73	30	U	30	U	30	U	31	U	31	U	31	U	31	U	31	U	31	U	31	U	31	U
Dibenzofuran (mg/kg OC)	15	58	11.62	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.90	U	10.95	U	14.42	U	14.49	U	14.69	U
Hexachloroethane (mg/kg OC)	--	--	11.62	U	18.1	U	30.5	U	43.97	U	53.45	U	20	U	15.90	U	10.95	U	14.42	U	14.49	U	14.69	U
N-Nitrosodiohenylamine (mg/kg OC)	11	11	1.16	U	1.8	U	3.1	U	4.40	U	5.34	U	2	U	1.59	U	1.10	U	1.42	U	1.45	U	1.47	U
VOLATILE ORGANICS (µg/kg dry wt)																								
Ethylbenzene	--	--	1.3	U	1	U	1.2	U	1	U	1.2	U	1.4	U	1.2	U	1	U	1.2	U	1	U	1	U
Tetrachloroethene	--	--	1.3	U	1	U	1.2	U	1	U	1.2	U	1.4	U	1.2	U	1	U	1.2	U	1	U	1	U
Trichloroethene	--	--	1.3	U	1.3		1.2	U	1	U	1.2	U	1.4	U	1.2	U	1	U	1.2	U	1	U	1	U
Total Xylene (sum of o-,m-,p-)	--	--	1.3	U	1	U	2.4		1	U	1.3		1.4	U	1.2	U	1	U	1.2	U	1	U	1	U
PESTICIDES (µg/kg dry wt)																								
Aldrin	--	--	2	U	0.98	U	0.98	U	0.98	U	0.98	U	0.96	U	0.98	U	0.99	U	0.99	U	0.96	U	0.97	U
Chlordane	--	--	2	U	0.98	U	0.98	U	0.98	U	0.98	U	0.96	U	0.98	U	0.99	U	0.99	U	0.96	U	0.97	U
Total DDT	--	--	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0	ND	0
Dieldrin	--	--	3.9	U	2	U	2	U	2	U	2	U	1.9	U	2	U	2	U	2	U	1.9	U	1.9	U
Heptachlor	--	--	2	U	0.98	U	0.98	U	0.98	U	0.98	U	0.96	U	0.98	U	0.99	U	0.99	U	0.96	U	0.97	U
Lindane	--	--	2	U	0.98	U	0.98	U	0.98	U	0.98	U	0.96	U	0.98	U	0.99	U	0.99	U	0.96	U	0.97	U
PCBs (mg/kg OC)																								
Aroclor 1016	--	--	1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1221	--	--	1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1232	--	--	1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1242	--	--	1.68	U	1.2	U	2.0	U	2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1248	--	--	1.68	U	1.2	U	10.5		2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1254	--	--	6.48		1.2	U	4.6		2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Aroclor 1260	--	--	7.24		1.2	U	9.5		2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U
Total PCBs (mg/kg OC)	12	65	13.71		1.2	U	24.55		2.77	U	3.36	U	1	U	1.00	U	0.71	U	0.91	U	0.93	U	0.90	U

Notes:
- Shaded values indicate elevated non-detects due to low TOC. These are compared to dry wt. AET values in next table.
- **Bolded** values are SMS exceedances

Table 14. Comparison of Phase 1 elevated non-detects to PSEP dry wt. AET values for SMS evaluation.

Chemical	Dry wt AET	DMMU 1		DMMU 2		DMMU 3		DMMU 4		DMMU 5		DMMU 6		DMMU 7		DMMU 9		DMMU 10		DMMU 11		S 4	
Total Organic Carbon, %		0.525		0.337		0.200		0.141		0.116		0.310		0.390		0.566		0.430		0.421		0.422	
ORGANICS																							
Fluorene	540					61	U	62	U	62	U												
2-Methylnaphthalene	670							62	U	62	U												
Benzo(g,h,i)perylene	670							62	U	62	U												
Indeno(1,2,3-c,d)pyrene	600							62	U	62	U												
CHLORINATED HYDROCARBONS (mg/kg OC)																							
Hexachlorobenzene	70	2.7	Y			0.98	U	0.98	U	0.98	U												
1,2-Dichlorobenzene	35					6.1	U	6.2	U	6.2	U												
1,4-Dichlorobenzene	110							6.2	U	6.2	U												
1,2,4-Trichlorobenzene	31	6.1	U	6.1	U	6.1	U	6.2	U	6.2	U	6.2	U	6.2	U	6.2	U	6.1	U	6.1	U	6.2	U
PHTHALATES (mg/kg OC)																							
Dimethyl phthalate	71									62	U												
Butyl benzyl phthalate	63									6.2	U			62.0	U								
Bis(2-ethylhexyl) phthalate	1900									62	U												
MISCELLANEOUS EXTRACTABLES																							
Dibenzofuran (mg/kg OC)	540			61	U	61	U	62	U	62	U	62	U	62	U								

Notes:
- Values given are only for finding that exceeded SMS guidelines due to low TOC

Table 15. Phase 2 chemical results compared to SMS criteria.

Chemical	SMS Criteria		DMMUs									
	SQS	CSL	13		14		14 Rerun		14 Re-injection		14 PAH -SIM	
Total Organic Carbon (%)	--	--	0.58		0.65		0.51		0.65		0.51	
Metals (mg/kg dry weight)												
Arsenic	57	93	1.4		1.7		--		--		--	
Cadmium	5.1	6.7	0.054		0.036		--		--		--	
Chromium	260	270	6.79		6.91		--		--		--	
Copper	390	390	13.4		10.8		--		--		--	
Lead	450	530	14.2		3.82		--		--		--	
Mercury	0.41	0.59	0.051		0.042		--		--		--	
Silver	6.1	6.1	0.122		0.061		--		--		--	
Zinc	410	960	18.2		15.8		--		--		--	
LPAHs (µg/kg OC)					EPA 8270C		EPA 8270C		EPA 8270C		EPA 8270 SIM	
Acenaphthylene	66	66	0.21	J	10.77	D	3.92		12.77	D	0.35	J
Acenaphthene	16	57	1.05	J	153.85	D	0.47	J	150.77	D	3.14	
Anthracene	220	1,200	1.40		261.54	D	8.63		246.15	D	4.31	
Fluorene	23	79	1.07	J	169.23	D	5.69		169.23	D	3.14	
Naphthalene	99	170	1.09	U	1415.38	D	1.96		1046.15	D	7.45	
Phenanthrene	100	480	3.79		1430.77	D	23.53		1076.92	D	17.25	
2-Methylnaphthalene	38	64	0.43	J	323.08	D	1.80		261.54	D	1.82	
Total LPAH[5]	370	780	7.52		3,441.54	D	44.20		2702.00	D	35.65	
HPAHs (µg/kg OC)												
Benzo(a)anthracene	110	270	3.8		384.6		3.5		369.23		9.4	
Benzo(a)pyrene	99	210	2.4		584.6		1.2		507.69		10.2	
Total Benzofluoranthenes[6]	230	450	5.7		509.2		3.1		561.54		16.5	
Benzo(g,h,i)perylene	31	78	1.5		292.3		0.5		276.92		8.8	
Chrysene	110	460	7.4		600		3.8		461.54		17.6	
Dibenzo(a,h)anthracene	12	33	1.1	U	58.5		0.2		55.38		1.7	
Fluoranthene	160	1,200	9.5		953.8		9.6		738.46		23.5	
Indeno(1,2,3-cd)pyrene	34	88	1.5		276.9		0.7		261.54		8.2	

Chemical	SMS Criteria		DMMUs									
	SQS	CSL	13		14		14 Rerun		14 Re-injection		14 PAH -SIM	
Total Organic Carbon (%)	--	--	0.58		0.65		0.51		0.65		0.51	
Pyrene	1,000	1,400	7.9		1384.6		6.5		1,030.77		25.5	
Total HPAHs[7]	960	5,300	40.8		5044.6		29.2		4,263.08		121.5	
Chlorinated Hydrocarbons (µg/kg OC)												
Hexachlorobenzene	0.38	2.3	1.1	U[8]	0.92	U[8]	1.24	U	4.62	U[8]	--	
Hexachlorobutadiene	3.9	6.2	1.1	U	2.00	U	1.24	U	9.69	U[8]	--	
1,2-Dichlorobenzene	2.3	2.3	1.1	U	4.92	U[8]	1.24	U	11.23	U	--	
1,4-Dichlorobenzene	3.1	9	1.1	U	4.92	U	1.24	U	11.23	U[8]	--	
1,2,4-Trichlorobenzene	0.81	1.8	1.1	U	2.00	U[8]	1.24	U	10.00		--	
Phthalates (µg/kg OC)												
Diethyl phthalate	61	110	0.3	J	4.9	U	1.2	U	5.1	U[8]	--	
Dimethyl phthalate	53	53	1.1	U	4.9		2.2		4.6	U	--	
Di-n-butyl phthalate	220	1,700	2.2	U	9.7	U	2.5	U	30.8	U[8]	--	
Di-n-octyl phthalate	58	4,500	1.1	U	4.9	U	1.2	U	6.6	U[8]	--	
Bis (2-ethylhexyl) phthalate	47	78	2.2	J	49.2	U	2.0	J	27.7	U[8]	--	
Butyl benzyl phthalate	4.9	64	1.1	U	4.9	U	1.2	U	12.3	U	--	
Phenols (µg/kg dry weight)												
Pentachlorophenol	360	690	63	U	320	U	63		76.9	U	--	
Phenol	420	1,200	19	U	94	U	19		7.69	U	--	
2 Methylphenol	63	63	6.3	U	32	U	6.3		5.85	U	--	
4 Methylphenol	670	670	6.3	U	32	U	6.3		5.85	U	--	
2,4-Dimethylphenol	29	29	32	U	160	U	32		21.54	U	--	
Miscellaneous Compounds												
Benzoic acid (µg/kg dry weight)	650		130	U	630	U	130	U	2400	U	--	
Benzyl alcohol (µg/kg dry weight)	57	73	13	U	63	U	13	U	53	U	--	
Dibenzofuran (µg/kg OC)	15	58	0.5	J	16.9		2.7		18.5		--	
N-Nitrosodiphenylamine (µg/kg OC)	11	11	0.543	U	2.46	U	0.62		9.23	U	--	
Total PCBs (µg/kg OC)	12	65	2.2	U	2	U	--		--		--	

Notes:

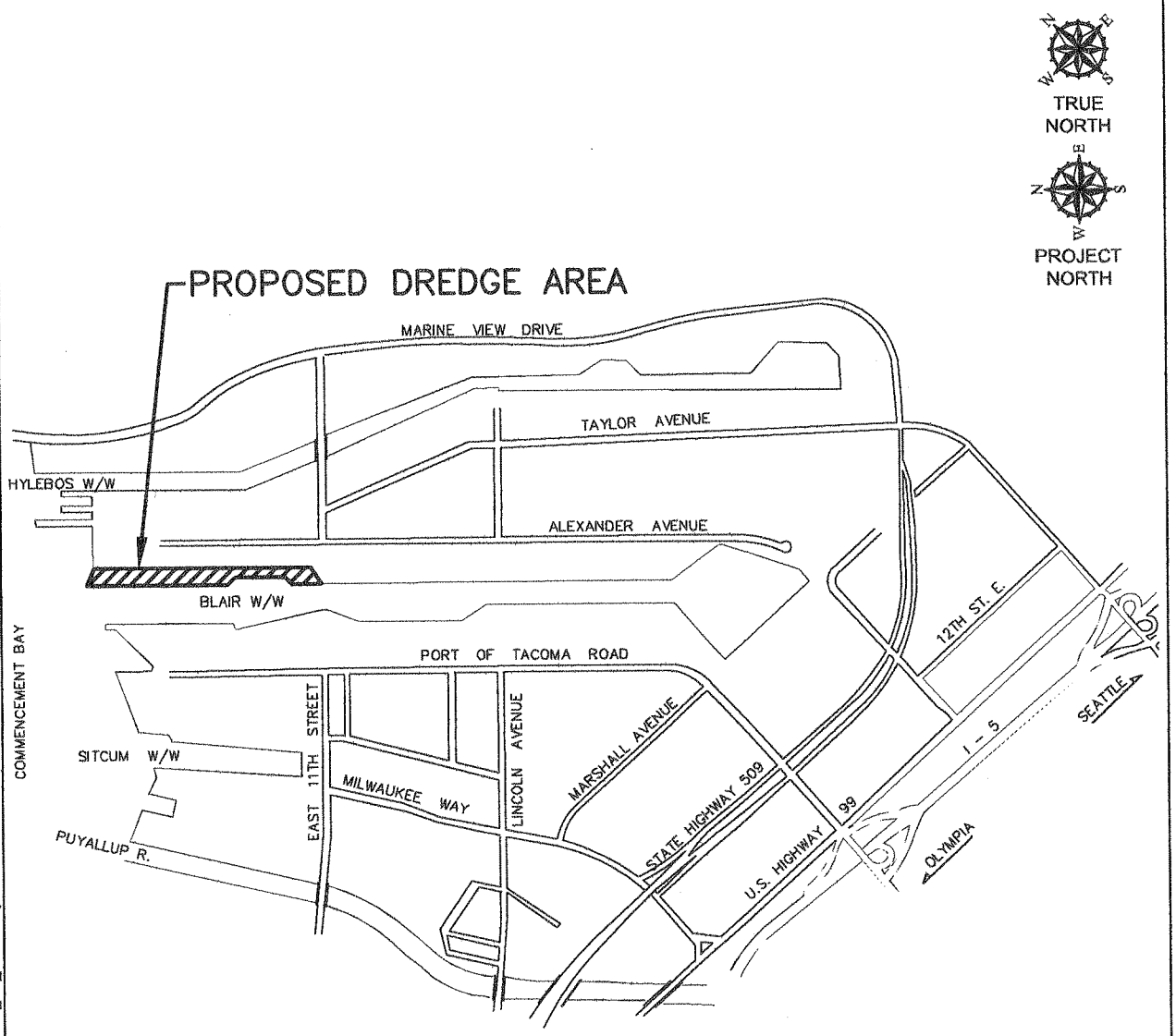
- Values given are only for DMMU with TOC > 0.5%

Table 16. Comparison of Phase 2 elevated non-detects to PSEP dry wt. AET values for SMS evaluation.

	Dry wt AET	DMMU ID				DMMU 14 Subunit Samples						DMMU 5 Subunit Samples above DMMU 14				DMMU 15 Subunit Samples							
Chemical		12		15		S15XB		S15YC		S16XB		S8B		S8C		S13ZE		S14ZD		S15YD		S16YC	
Total Organic Carbon (%)	--	0.23		0.3		0.3		0.09		0.22		0.128		0.186		0.11		0.34		0.14		0.47	
LPAH (ug/kg dry wt)																							
Total LPAH	5,200	386		24		26		3.23		202.3		4.7	U	4.8		1.7		4.4		8.6		30.7	
Acenaphthylene	560	13		1.6	J	1.5	U	1.5	U	2.1		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	6.4	U
Acenaphthene	500	68		3.2	J	0.36		1.5	U	4.6		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	2	J
Anthracene	960	61		2.9	J	1.2		1.5	U	28		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	3.7	J
Fluorene	540	51		3.3	J	0.84		1.5	U	4.4		4.7	U	4.8	U	6.5	U	6.6	U	1.4	J	3.1	J
Naphthalene	2,100	3.0	J	6.3	U	5.6		0.83	J	3.2		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	7.9	
Phenanthrene	1,500	190		13		18		2.4		160		4.7	U	4.8		1.7	J	4.4	J	7.2		14	
2-Methylnaphthalene	670	7.3		3	J	12		1.6		6		4.7	U	4.8	U	6.5		6.6	U	3.8	J	5.2	J
HPAH (ug/kg dry wt)																							
Total HPAH	12,000	1,726		91		17		4		2,205		4.7	U	4.8	U	6.5	U	7.2		11		89	
Benzo(a)anthracene	1,300	160		9.1		2.5		0.55	J	240		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	5.9	J
Benzo(a)pyrene	1,600	140		5.6	J	1	J	0.26	J	190		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	5.5	J
Total Benzofluoranthenes	3,200	321		12.7		1.68		0.32		366		4.7	U	4.8	U	6.5	U	6.6	U	1.3		9.1	
Benzo(ghi)perylene	670	3.8	J	3.8	J	0.71	J	1.50	U	100		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	4.9	J
Chrysene	1,400	110		15		3.6	J	0.76	J	230		4.7	U	4.8	U	6.5	U	1.7	J	2.4	J	11.0	
Dibenzo(a,h)anthracene	230	31		6.3	U	0.36	J	1.50	U	29		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	6.4	U
Fluoranthene	1,700	460		22		2.9		0.71	J	500		4.7	U	4.8	U	6.5	U	3	J	3.9	J	26.0	
Indeno(1,2,3-cd)pyrene	600	110		3.2	J	0.65	J	0.22	J	120		4.7	U	4.8	U	6.5	U	6.6	U	6.4	U	3.9	J
Pyrene	2,600	390		20		3.5		0.73	J	430		4.7	U	4.8	U	6.5	U	2.5	J	3.3	J	23.0	
Miscellaneous Extractables (ug/kg dry wt)																							
Dibenzofuran	540	23		2.1	J	5.4		0.98		5.3		4.7	U	4.8	U	6.5	U	6.6	U	1.6	J	2.1	
Hexachlorobutadiene	11	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
N-Nitrosodiphenylamine	28	5.4	U	6.3	U	--		--		--		--		--		6.5	U	6.6	U	7.4	U	6.4	
Benzoic Acid	650	110	U	130	U	--		--		--		--		--		130	U	140	U	130	U	130	
Benzyl Alcohol	57	11	U	13	U	--		--		--		--		--		6.5	U	6.6	U	6.4	U	6.4	
Hexachloroethane	1,400	5.4	U	6.3	U	--		--		--		--		--		6.5	U	6.6	U	6.4	U	6.4	

	Dry wt AET	DMMU ID				DMMU 14 Subunit Samples						DMMU 5 Subunit Samples above DMMU 14				DMMU 15 Subunit Samples							
Chemical		12		15		S15XB		S15YC		S16XB		S8B		S8C		S13ZE		S14ZD		S15YD		S16YC	
Total Organic Carbon (%)	--	0.23		0.3		0.3		0.09		0.22		0.128		0.186		0.11		0.34		0.14		0.47	
Chlorinated Hydrocarbons (ug/kg dry wt)																							
Hexachlorobenzene	22	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
1,2-Dichlorobenzene	35	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
1,4-Dichlorobenzene	110	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
1,2,4-Trichlorobenzene	31	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
Phthalates (ug/kg dry wt)																							
Bis(2-ethylhexyl)phthalate	1,300	15	J	8.5	J	57	U	58	U	30	J	--		--		13	J	7.6	J	64	U	16	J
Butyl benzyl phthalate	63	5.5	Ui	6.3	U	5.7	U	5.8	U	7.1		--		--		6.5	U	6.6	U	6.4	U	6.4	U
Diethyl phthalate	48	1.6	J	1.6	J	5.7	U	5.8	U	5.8	U	--		--		1.3	J	6.6	U	6.4	U	6.4	U
Dimethyl phthalate	71	150		220		5.7	U	5.8	U	1.4	J	--		--		6.5	U	6.6	U	6.4	U	6.4	U
Di-n-butyl phthalate	1,400	11	U	13	U	12	U	12	U	12	U	--		--		13	U	8.4	J	13	U	13	U
Di-n-octyl phthalate	420	5.4	U	8.5	J	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
PCBs (ug/kg dry wt)																							
Total PCBs	130	200		--		--		--		--		--		--		--		--		--		--	
Phenols (ug/kg dry wt)																							
Pentachlorophenol	140	34	J	63	U	58	U	57	U	58	U	--		--		65	U	66	U	64	U	64	U
Phenol	420	17	U	19	U	17	U	18	U	18	U	--		--		20	U	20	U	20	U	20	U
2 Methylphenol	63	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
4 Methylphenol	670	5.4	U	6.3	U	5.7	U	5.8	U	5.8	U	--		--		6.5	U	6.6	U	6.4	U	6.4	U
2,4-Dimethylphenol	29	5.5	U	5.5	U	29	U	29	U	29	U	--		--		5.5	U	5.5	U	5.5	U	5.5	U

Notes:
- Values given are only for DMMU with TOC < 0.5



VICINITY MAP NO SCALE

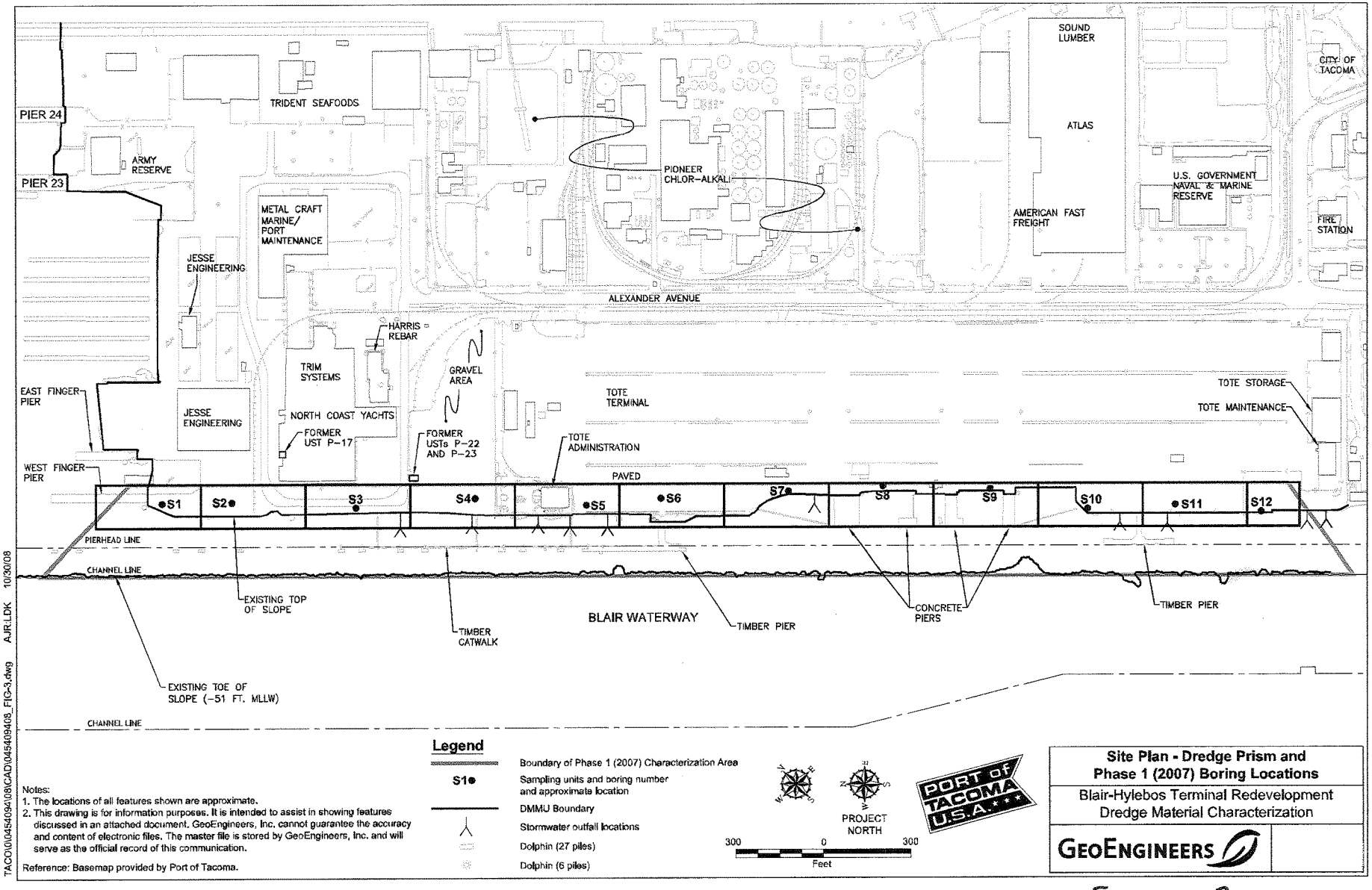
PORT OF TACOMA

PORT of TACOMA U.S.A.

Vicinity Map	
Blair-Hylebos Terminal Redevelopment Dredge Material Characterization	
GEOENGINEERS	Figure 1

Reference: Base drawing provided by Port of Tacoma.

OFFICE:TACO PM VRE P:\0\0454094\08\CAD\SEDIMENT REPORT\0454094\08_SR_FIG-1.dwg\TAB:F1 modified by syl on Nov 05, 2008 - 11:26

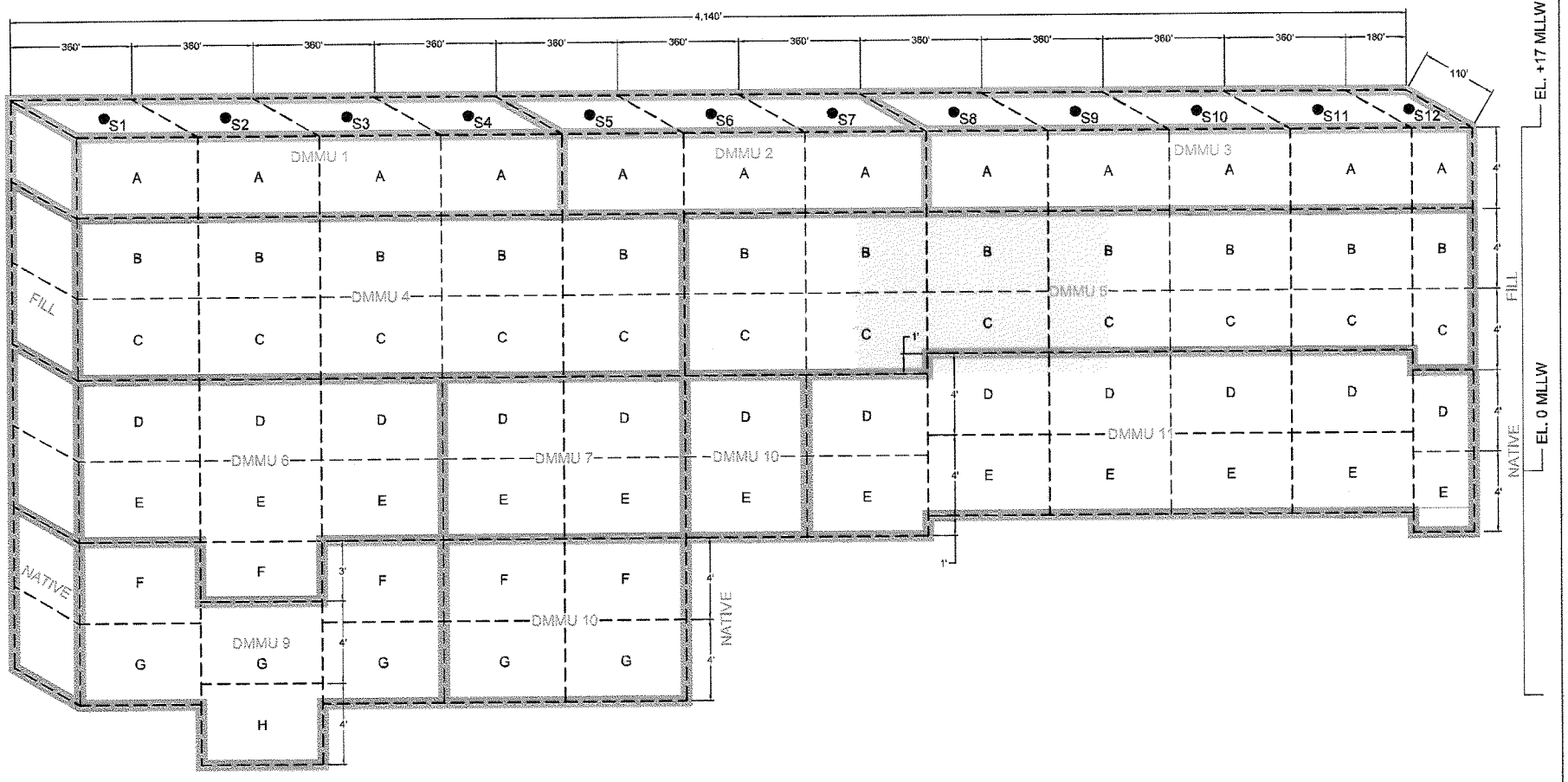


Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Reference: Basemap provided by Port of Tacoma.

TACO\0\0454094\08\CAD\0454094\08_FIG-3.dwg AJR.LDK 10/30/08

Figure 2



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3. DMMU 8 was not encountered in the field.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

Legend

- Surface fill material (Moderate ranking)
- Subsurface fill material (Low-moderate ranking)
- Native material (Low-moderate ranking)
- Approximate vertical and horizontal extent of trichloroethene and methylene chloride impacted dredge material

DMMU Dredge Material Management Unit

A Subunit identification

Not to Scale

PORT of TACOMA U.S.A.

Schematic DMMU Plan - 2007

Blair-Hylebos Terminal Redevelopment
Dredge Material Characterization

GEOENGINEERS

Figure 3

OFFICE:TACO PM:VRE P:\0045\09\09\CAD\SEDIMENT REPORT\045409409_SR_FIG-6.dwg\TAB:F6 modified by jwd on Nov 25, 2008 - 9:07

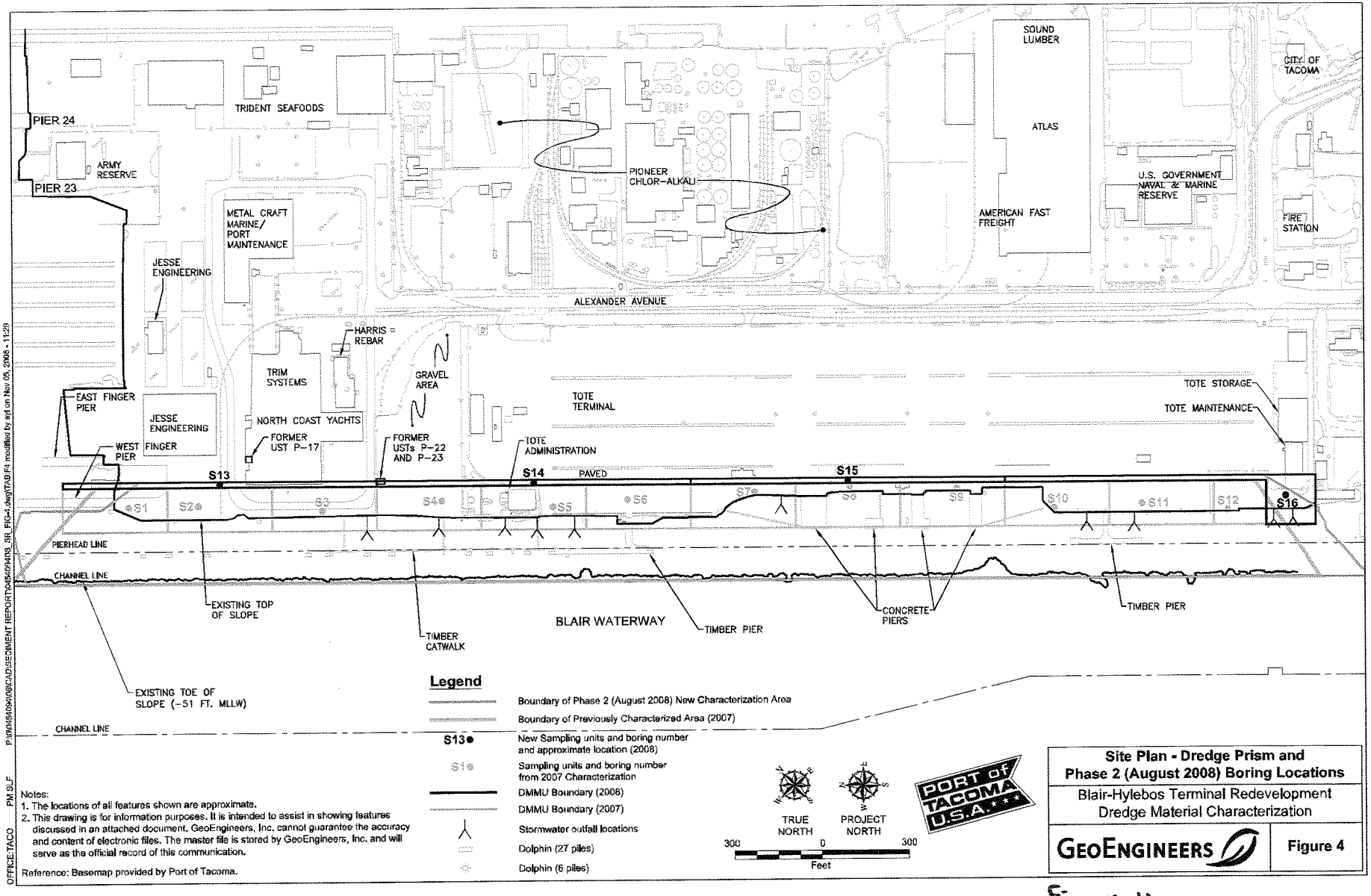
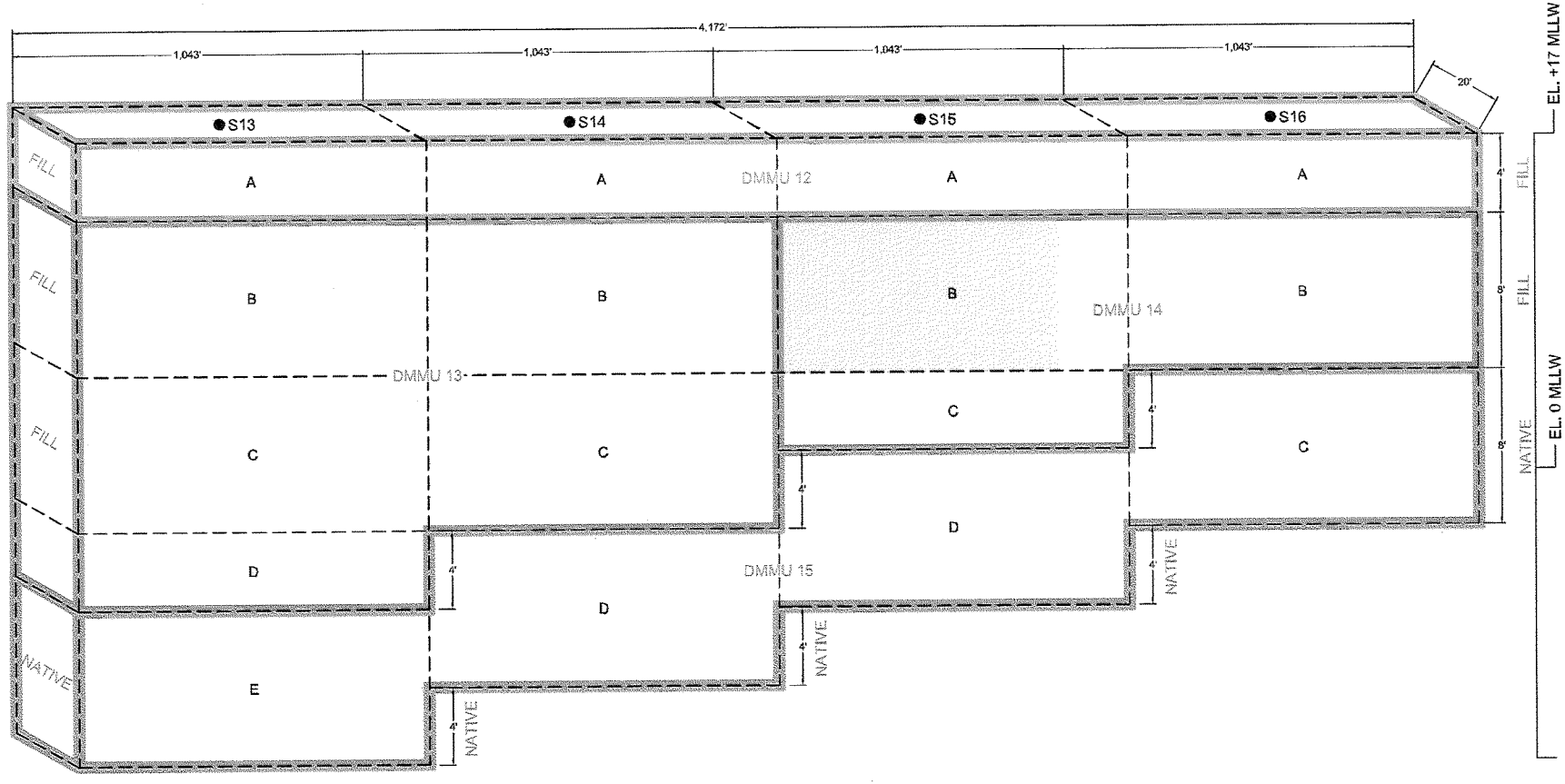

PIER 24
PIER 23
ARMY RESERVE
TRIDENT SEAFOODS
METAL CRAFT MARINE/ PORT MAINTENANCE
JESSE ENGINEERING
PIONEER CHLOR-ALKALI
SOUND LUMBER
ATLAS
AMERICAN FAST FREIGHT
U.S. GOVERNMENT NAVAL & MARINE RESERVE
CITY OF TACOMA
FIRE STATION
ALEXANDER AVENUE
HARRIS REBAR
TRIM SYSTEMS
GRAVEL AREA
TOTE TERMINAL
TOTE STORAGE
TOTE MAINTENANCE
EAST FINGER PIER
JESSE ENGINEERING
WEST FINGER PIER
NORTH COAST YACHTS
FORMER UST P-17
FORMER USTs P-22 AND P-23
TOTE ADMINISTRATION
S13
S14
S15
S16
PAVED
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
PIERHEAD LINE
CHANNEL LINE
EXISTING TOP OF SLOPE
TIMBER CATWALK
BLAIR WATERWAY
TIMBER PIER
CONCRETE PIERS
TIMBER PIER
EXISTING TOE OF SLOPE (-51 FT. MLLW)
CHANNEL LINE
Legend
Boundary of Phase 2 (August 2008) New Characterization Area
Boundary of Previously Characterized Area (2007)
S13 New Sampling units and boring number and approximate location (2008)
S1 Sampling units and boring number from 2007 Characterization
DMMU Boundary (2008)
DMMU Boundary (2007)
Stormwater outfall locations
Dolphin (27 piles)
Dolphin (6 piles)
TRUE NORTH
PROJECT NORTH
300 0 300
Feet
PORT of TACOMA U.S.A.
Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
Reference: Basemap provided by Port of Tacoma.
Site Plan - Dredge Prism and Phase 2 (August 2008) Boring Locations
Blair-Hylebos Terminal Redevelopment
Dredge Material Characterization
GEOENGINEERS
Figure 4
OFFICE:TACO PM SLF P:\0\0404\004\08\CAD\SEDIMENT REPORT\04404\403_9R_FIG-4.dwg\TAB:F4 modified by srj on Nov 05, 2008 - 11:29

Figure 4



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1. The locations of all features shown are approximate.
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3. DMMU 8 was not encountered in the field.

Reference: Drawing created from sketch provided by GeoEngineers' personnel.

Legend

- Surface fill material (Moderate ranking)
- Subsurface fill material (Low-moderate ranking)
- Native material (Low-moderate ranking)
- Approximate vertical and horizontal extent of trichloroethene and methylene chloride impacted dredge material
- DMMU — Dredge Material Management Unit
- A — Subunit identification
- S13● — New Sampling units and boring number and approximate location (2008)

Not to Scale

PORT of TACOMA U.S.A.

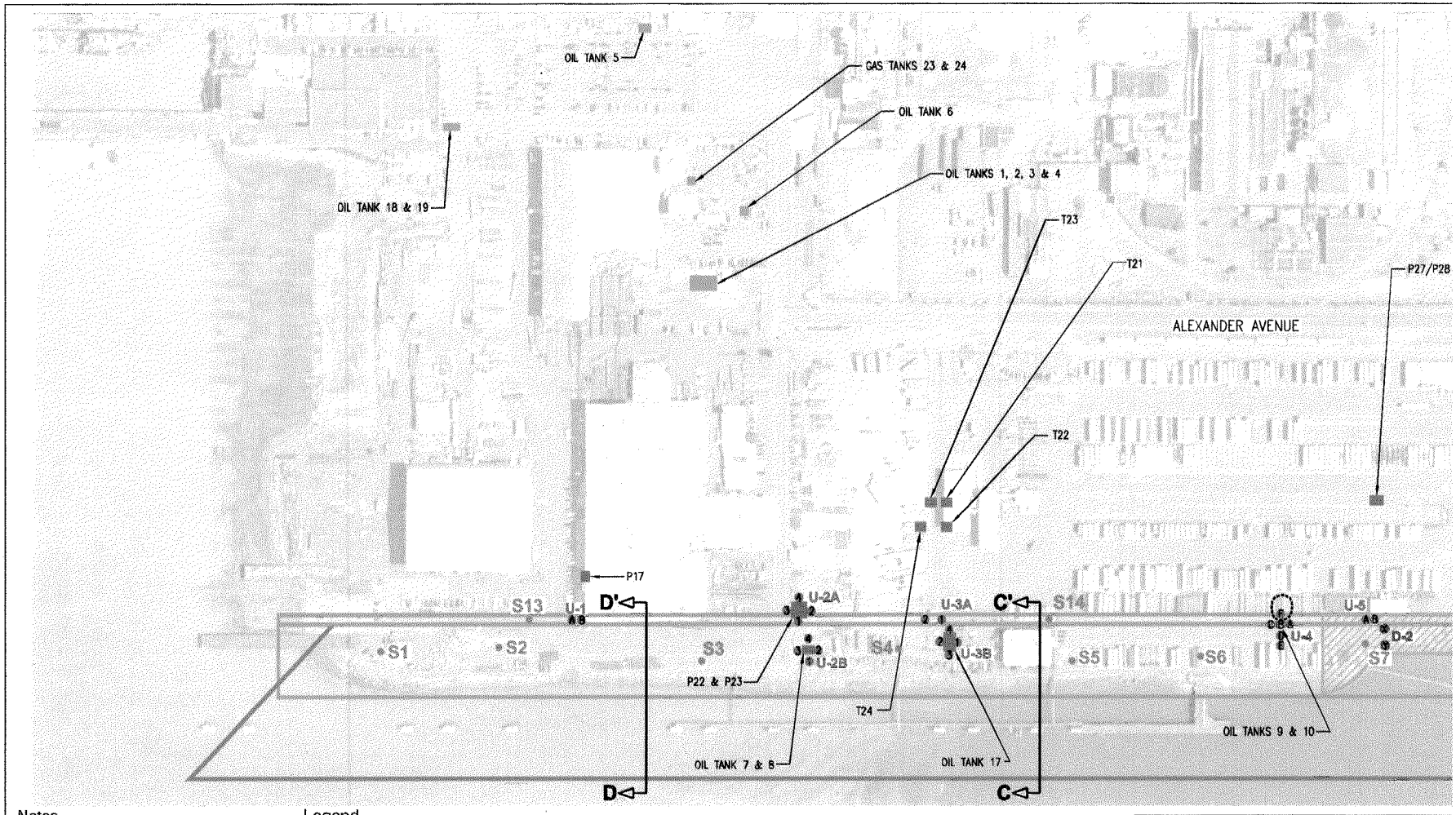
Schematic DMMU Plan - 2008

Blair-Hylebos Terminal Redevelopment
Dredge Material Characterization

GEOENGINEERS

OFFICE:TACO PM:VRE P:\0045409\008\CAD\SEDIMENT REPORT\0454009M08_SR_FIG-7.dwg\TAB:F7 modified by ayl on Nov 24, 2008 - 12:26

Figure 5



Notes

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Reference: Basemap provided by Port of Tacoma.

Legend

- Former tank locations
- Former tank locations that may pose an environmental concern to the dredge prism
- DMMU Boundary
- Boundary of characterized area (2008)
- S9 Recent sampling locations (2007/2008)
- D-1 DMMU follow-up sampling locations
- U-1 Sampling locations related to potential impacts from former USTs
- Approximate extent of petroleum hydrocarbon impacted material upgradient from dredge prism
- Approximate boundary of impacted interval 4 feet to 8 feet below ground surface

TRUE NORTH

PROJECT NORTH

200 0 200
FEET

Site Plan and Phase 3 (October 2008) Sampling Locations - North Portion of Si

Blair-Hylebos Terminal Redevelopment
Dredge Material Characterization

GEOENGINEERS

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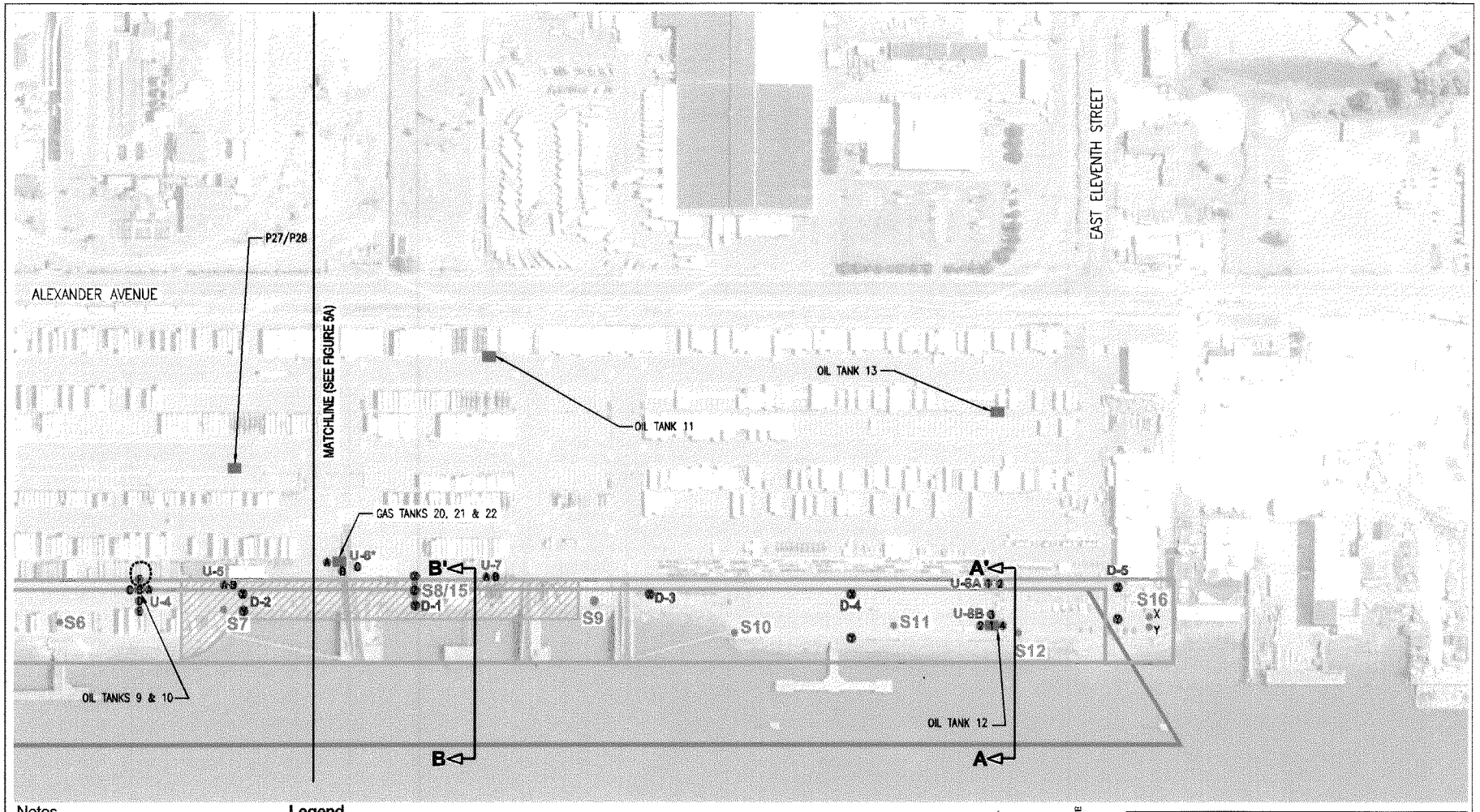
Figure 6



Notes

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Reference: Basemap provided by Port of Tacoma.

Legend

- Former tank locations
- Former tank locations that may pose an environmental concern to the dredge prism
- DMMU Boundary
- Boundary of characterized area (2008)
- S9 Recent sampling locations (2007/2008)
- D-1 DMMU follow-up sampling locations
- U-1 Sampling locations related to potential impacts from former USTs
- U-6* Sample U-6 located to characterize material between former UST and dredge prism to evaluate potential down-gradient impacts
- Approximate extent of petroleum hydrocarbon impacted material upgradient from dredge prism
- Approximate boundary of impacted interval 4 feet to 8 feet below ground surface

TRUE NORTH

PROJECT NORTH

200 0 200

FEET

Site Plan and Phase 3 (October 2008) Sampling Locations - South Portion of Site

Blair-Hylebos Terminal Redevelopment
Dredge Material Characterization

GEOENGINEERS

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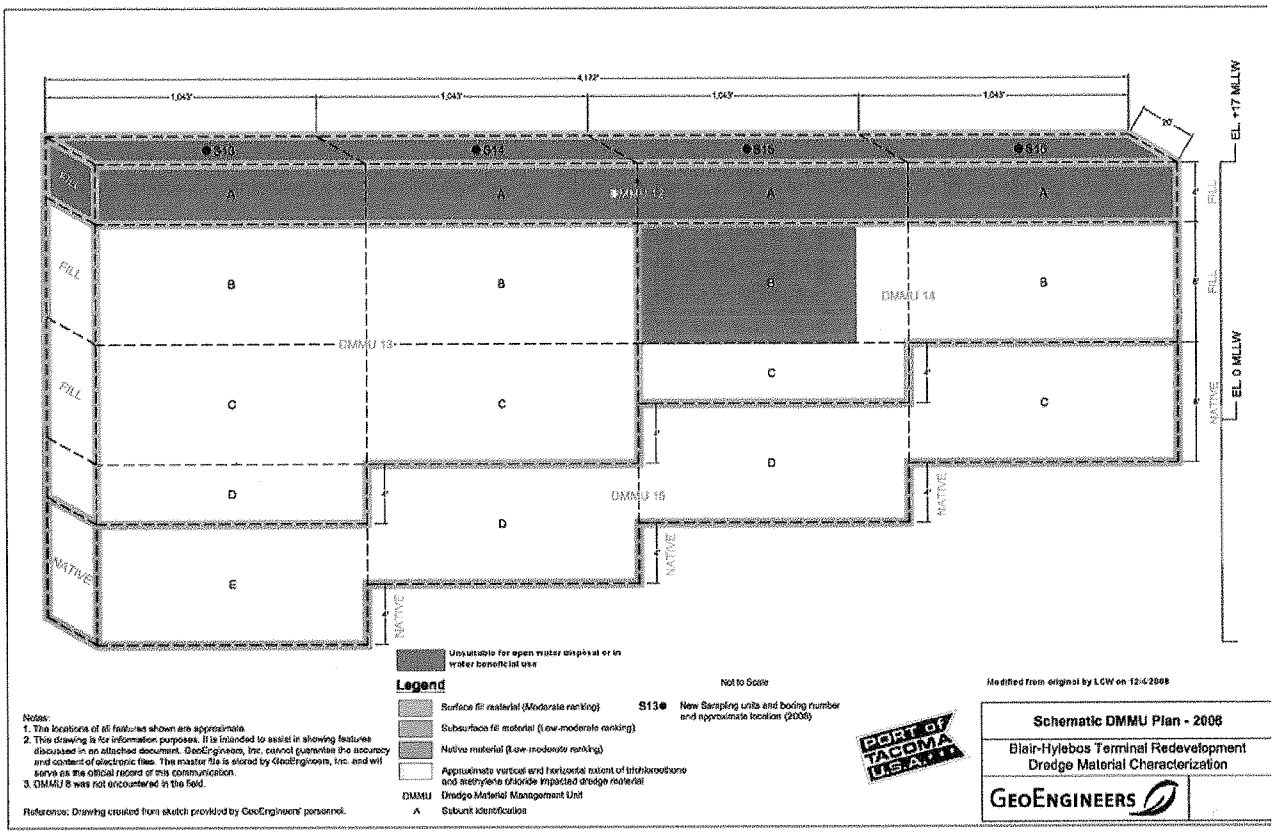
Figure 7.



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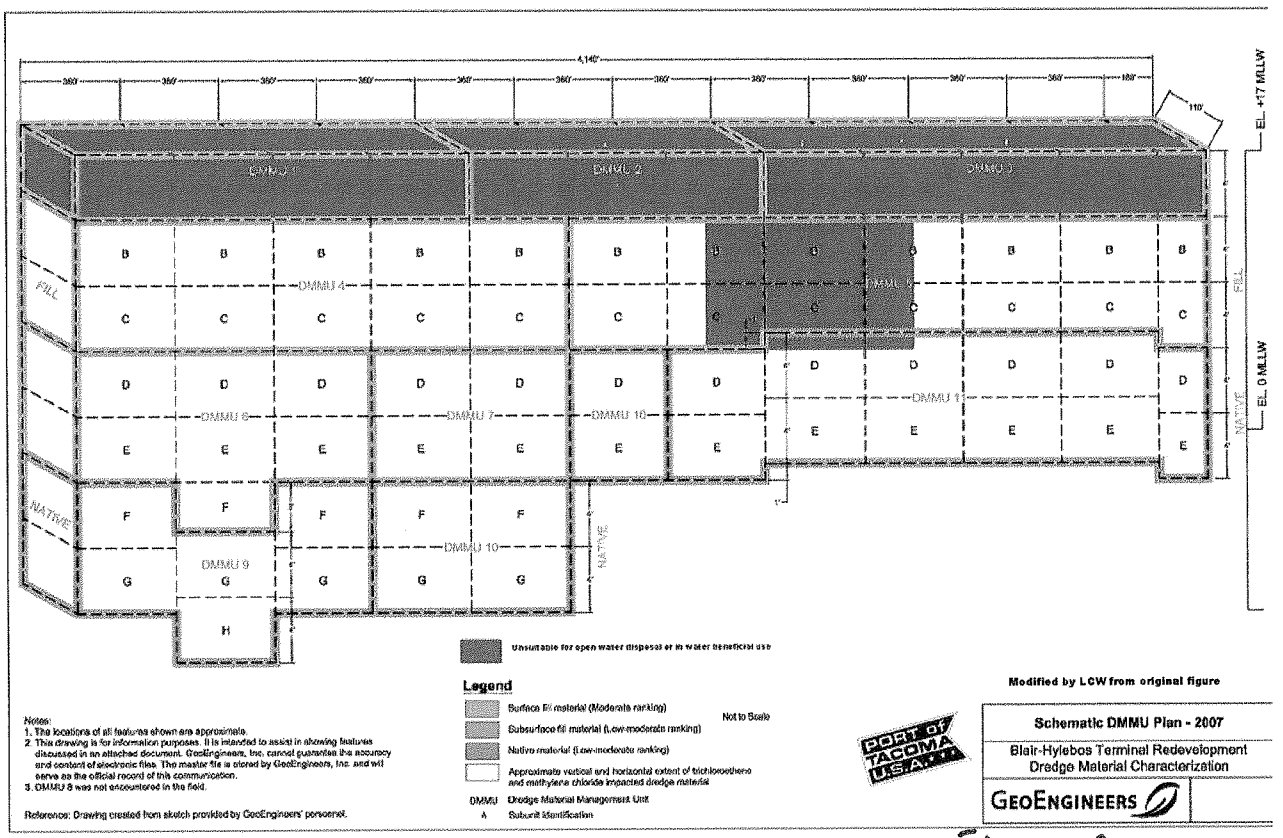

Figure 3