CENWS-OD-TS-NR-DMMO

MEMORANDUM FOR: RECORD December 4, 2014

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF DREDGED MATERIAL FROM THE WESTHAVEN COVE FEDERAL NAVIGATION PROJECT, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT, FOR OPEN-WATER DISPOSAL AT THE SOUTH JETTY OR POINT CHEHALIS DISPERSIVE SITES, OR FOR BENEFICIAL USE.

1. Introduction. This memorandum 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) regarding the suitability of material from the Westhaven Cove Federal Navigation Project for unconfined open-water disposal at the South Jetty or Point Chehalis estuarine sites, or for beneficial use. The requirements for determining the suitability of this material are documented in the "*Dredged Material Evaluation and Disposal Procedures – User Manual*" (DMMP, 2013), as amended by updates subsequently made through the Sediment Management Annual Review process.

2. Project Background. As authorized by Congress, the Seattle District, U.S. Army Corps of Engineers (USACE) is responsible for maintenance dredging of the navigation channel at Westhaven Cove in Westport, Washington (Figure 1). The authorized depth of the channel is minus 16-feet Mean Lower Low Water (MLLW), with an allowance for one foot of advanced maintenance and one foot of overdepth dredging. Thus, the total characterization depth for this project is -18 ft MLLW.

   Westhaven Cove includes the Northwest Entrance Channel, Southeast Entrance Channel, Access Channel and Turning Basin. A bathymetric survey of the project was conducted by the Corps of Engineers in September 2013. This survey indicated that maintenance dredging was needed. Based on a second survey in April 2014, the dredging volume to -18 ft MLLW, including side slopes and a 15% contingency factor, was estimated to be 47,120 cubic yards (cy).

   The most recent suitability determination for Westhaven Cove is dated July 8, 1998 (DMMP, 1998). The Corps proposed dredging 23,000 cy of material from the Southeast entrance and disposing of the material at the Point Chehalis open-water disposal site. The project was ranked moderate for characterization. Sediments collected from the entrance were principally silty sands. There were no detected or non-detected exceedances of the screening levels (SLs) for the DMMP chemicals of concern (COC) in effect at that time. Dioxin concentrations were below 5 ng/kg for 2,3,7,8-TCDD and 15 ng/kg toxicity equivalents (TEQ), which are the bioaccumulation triggers (BTs) for dredging projects in Grays Harbor. Bioassays were run concurrently with the chemical analyses; the sediments passed the DMMP evaluation guidelines and the dredged material was found suitable for open-water disposal.

3. Project Summary. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	Moderate
Proposed dredging volume	47,120 cy
Proposed dredging depth	-18 feet MLLW (including 1 foot of advanced maintenance and 1 foot of overdepth)
Draft SAP received	July 18, 2014
Draft SAP returned for revisions	July 28, 2014
Revised SAP received	July 31, 2014
Revised SAP approved	August 1, 2014
Sampling dates	August 4-7, 2014
Draft data report received	November 10, 2014
Comments provided on draft report	November 17, 2014
Final data report received	November 30, 2014
DMMP tracking number	WESTH-1-A-F-360
Recency expiration date (moderate rank = 5 years)	August 2019

4. Project Ranking and Sampling Requirements. The Westhaven Cove federal navigation project is associated with Westport Marina. The DMMP ranking for marinas in Grays Harbor is "moderate" (DMMP, 2013). Therefore, the DMMP agencies assigned a moderate rank to the federal project. Maintenance dredging at Westhaven Cove has not occurred for more than ten years. Because sediment has accumulated over the course of many years, it is considered heterogeneous in nature.

In the Dredged Material Management Program, "surface" material (i.e. the top 4 feet) is treated differently from "subsurface" material (deeper than 4 feet) for the purpose of calculating the number of dredged material management units (DMMUs) and samples needed. However, for this project there was relatively little material deeper than 4 feet and the material that was deeper than 4 feet could not be dredged separately. Therefore, all sediment was considered to be surface sediment.

The number of samples and DMMUs were calculated using the following guidelines:

- Maximum volume of sediment represented by each field sample = 4,000 cubic yards
- Maximum volume of sediment represented by each DMMU = 16,000 cubic yards

The project was divided into a total of four DMMUs, each represented by a composite of sediment samples from two to four locations. See Figure 2 for the DMMU boundaries and the dredged material volume represented by each DMMU.

5. Sampling. Sampling took place August 4-7, 2014 using a vibracore sampler (DOF/SEE, 2014b). Figure 2 shows both target and actual sampling locations. Tables 2 and 3 include information for the samples collected and the compositing scheme.

   Only minor difficulties were encountered during sampling. The sampling and analysis plan (DOF/SEE, 2014a) included a target recovery rate of 75%. On the first day of sampling, two cores that did not meet the target rate (cores 11 and 14, with recovery rates of 71.4% and 69.1% respectively) were not rejected by the contractor, but instead were used in the composite sample representing DMMU 4. The recovery rates for the other two cores from DMMU 4 (cores 12 and 13) were 85.7% and 84.3% respectively, resulting in an average of 77.6% for the four cores from DMMU 4. The DMMP agencies decided that, overall, the samples collected from DMMU 4 adequately represented the dredged material in that DMMU. Therefore, the contractor was not required to resample DMMU 4. All other cores met the 75% recovery target, with an average recovery rate of 78.7% for all cores collected.

   A second issue concerned the volume of sediment needed from each DMMU for testing and archiving. DMMUs 2, 3 and 4 were each represented by a composite of sediment from four sampling stations, which together provided the necessary volume. In contrast, the sampling and analysis plan only included two sampling stations for DMMU 1, due to the smaller dredged material volume being represented by that DMMU. Based on experience from the first day of sampling, the contractor notified DMMO that two sampling stations would not provide adequate volume. DMMO instructed the contractor to collect an additional core from the target locations for cores 1 and 2. These additional cores were numbered 15 and 16. Hence, DMMU 1 was represented by a composite of core samples from cores 1, 2, 15 and 16.

6. Chemical and Sediment Conventional Analysis. The dredged material analysis included sediment conventionals, the full suite of standard DMMP chemicals of concern, dioxins/furans and tributyltin (TBT). Table 4 includes the results for all analyses but dioxins/furans, the results for which are provided in Table 5.

   The grain-size data show that the proposed dredged material is predominantly a mixture of silt and sand, with minor fractions of gravel and clay. The total organic carbon concentration ranged widely, from 0.8 in the northwest entrance channel (DMMU 1) to 3.3 percent in the turning basin (DMMU 3). The sulfides concentrations were moderately high, ranging from 437 to 1,570 mg/kg for the composites. Ammonia concentrations were relatively low, ranging from 13 to 96 mg/kg.

   None of the DMMUs had any detected exceedances of the DMMP screening levels (SLs). For the non-detects, all reporting limits were below SL as well. Based on the absence of SL exceedances, bioassay testing was not required for this project.

   TBT was undetected in porewater extracts from all DMMUs, with a reporting limit well below the bioaccumulation trigger (BT) of 0.15 ug/l. The dioxin/furan concentrations ranged from 1.5 to 6.4 ng/kg toxicity equivalents (TEQ, with U = ½ estimated detection limit), which were also well below the BT of 15 ng/kg for projects in Grays Harbor. Concentrations of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) ranged from 0.3 to 1.2 ng/kg, below the BT of 5 ng/kg for TCDD. Based on the absence of BT exceedances, bioaccumulation testing was not required for this project.

Stage-4 data validation (EPA, 2009) was conducted for dioxins/furans, TBT, semivolatiles, PCBs and pesticides. Stage-3a data validation was conducted for sediment conventional and metals analyses. Data qualifiers assigned during validation have been incorporated into Tables 4 and 5.

7. Biological Testing. No bioassays or bioaccumulation testing were required for this project.

8. Sediment Exposed by Dredging. The sediment to be exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's antidegradation standard (Ecology, 2013) as described in DMMP guidance (DMMP, 2008). Comparison of the proposed dredged material to SQS serves as a first-tier indicator for this purpose. Table 6 provides this comparison and shows that there were no detected or undetected exceedances of SQS for any chemical.

   There is no reason to believe that the chemical quality of the sediment to be exposed by dredging differs in any way from the proposed dredged material. Therefore, the agencies determined that there was no need for the analysis of Z-samples for this project. Based on the results for the dredged material, the sediment that will be exposed by dredging is not anticipated to have any exceedances of SQS. Therefore, this project is in compliance with the State of Washington anti-degradation standard.

9. Beneficial-Use Analysis. As indicated in the previous section, the proposed dredged material had no detected or nondetected exceedances of SQS. Therefore, with respect to chemical quality, the dredged material is suitable for in-water beneficial use.

10. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for the dredging from the Westhaven Cove federal navigation project for open-water disposal. The approved sampling and analysis plan was followed and the data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP.

    Based on the results of the previously described testing, the DMMP agencies concluded that **all 47,120 cubic yards of dredged material are suitable** for placement at the South Jetty and Point Chehalis dispersive sites. The dredged material is also suitable, with regard to chemical quality, for in-water beneficial use.

    This suitability determination does ***not*** constitute final agency approval of the project. 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.

11. References.

DMMP, 1998. *Determination on the Suitability of Maintenance Material Dredged from the East Entrance to Westhaven Cove Marina in Grays Harbor, Washington, Evaluated under Section 404 of the Clean Water Act for Open-Water Disposal at the Point Chehalis Disposal Site.* Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program. July 8, 1998.

DMMP, 2008. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program. June 2008.

DMMP, 2013. *Dredged Material Evaluation and Disposal Procedures (User Manual).* Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program. July 2013.

Ecology, 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology. February 2013.

EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. U.S. Environmental Protections Agency. January 2009.

DOF/SEE, 2014a. *Sampling and Analysis Plan, Westhaven Cove Federal Navigation Improvement Project – Dredged Material Characterization, Westport, Washington.* Prepared for the US Army Corps of Engineers by Dalton, Olmsted and Fuglevand, Inc. and Science and Engineering for the Environment, LLC. July 31, 2014.

DOF/SEE, 2014b. *Data Report; Westhaven Cove Federal Navigation Project, Dredged Material Characterization, Westport, Washington.* Prepared for the US Army Corps of Engineers by Dalton, Olmsted and Fuglevand, Inc. and Science and Engineering for the Environment, LLC. November 30, 2014.

12. Agency Signatures.

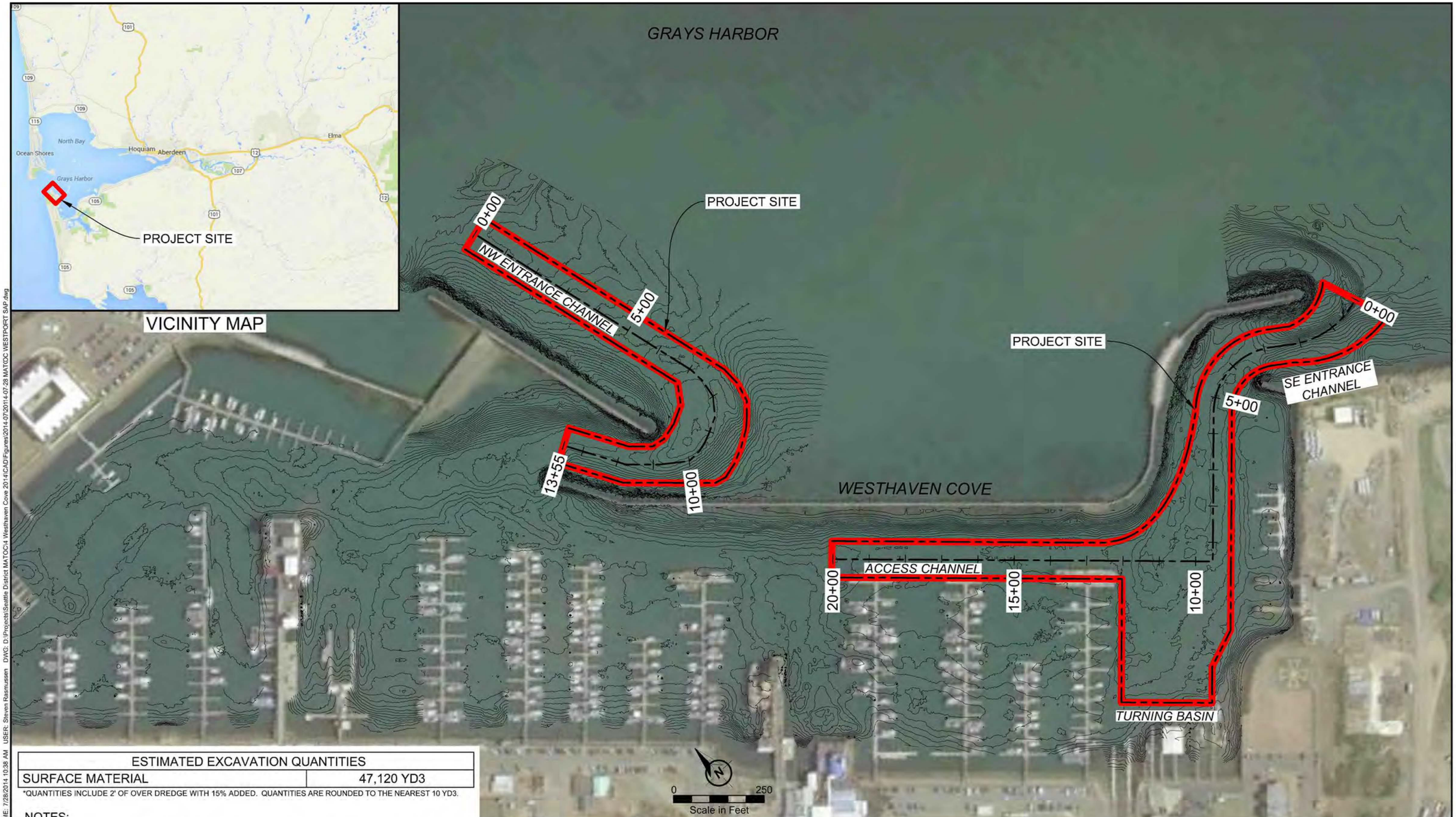
The signed document is on file in the Dredged Material Management Office.

Concur:

_____	_____
Date	David Fox, P.E. - Seattle District Corps of Engineers
_____	_____
Date	Justine Barton - Environmental Protection Agency
_____	_____
Date	Laura Inouye, Ph.D. - Washington Department of Ecology
_____	_____
Date	Celia Barton - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Elizabeth Chien, CENWS-OD-TS-NS
Marc Horton, Port of Grays Harbor
Tim Thompson, SEE
Nancy O'Bourke, DOF



ESTIMATED EXCAVATION QUANTITIES	
SURFACE MATERIAL	47,120 YD3

*QUANTITIES INCLUDE 2' OF OVER DREDGE WITH 15% ADDED. QUANTITIES ARE ROUNDED TO THE NEAREST 10 YD3.

NOTES:

1. BATHYMETRIC CONTOURS GENERATED FROM HYDRO SURVEY DATA COLLECTED APRIL 14, 15, 16, AND 21, 2014 BY USACE.
2. HORIZONTAL COORDINATE SYSTEM WASHINGTON STATE PLANE SOUTH, VERTICAL TIDAL DATUM NOS MLLW EPOCH 1960-1978, US FOOT.
3. BASE MAP DRAWING INFORMATION PROVIDED BY USACE.
4. BACKGROUND IMAGE SOURCE: GOOGLE EARTH 9/3/2011

LEGEND

- PROJECT BOUNDARY
- NAVIGATION CHANNEL
- NAVIGATION CHANNEL CENTERLINE
- EXISTING CONTOURS

U.S. ARMY CORPS OF ENGINEERS

SEATTLE DISTRICT MATOC
SEATTLE, WASHINGTON

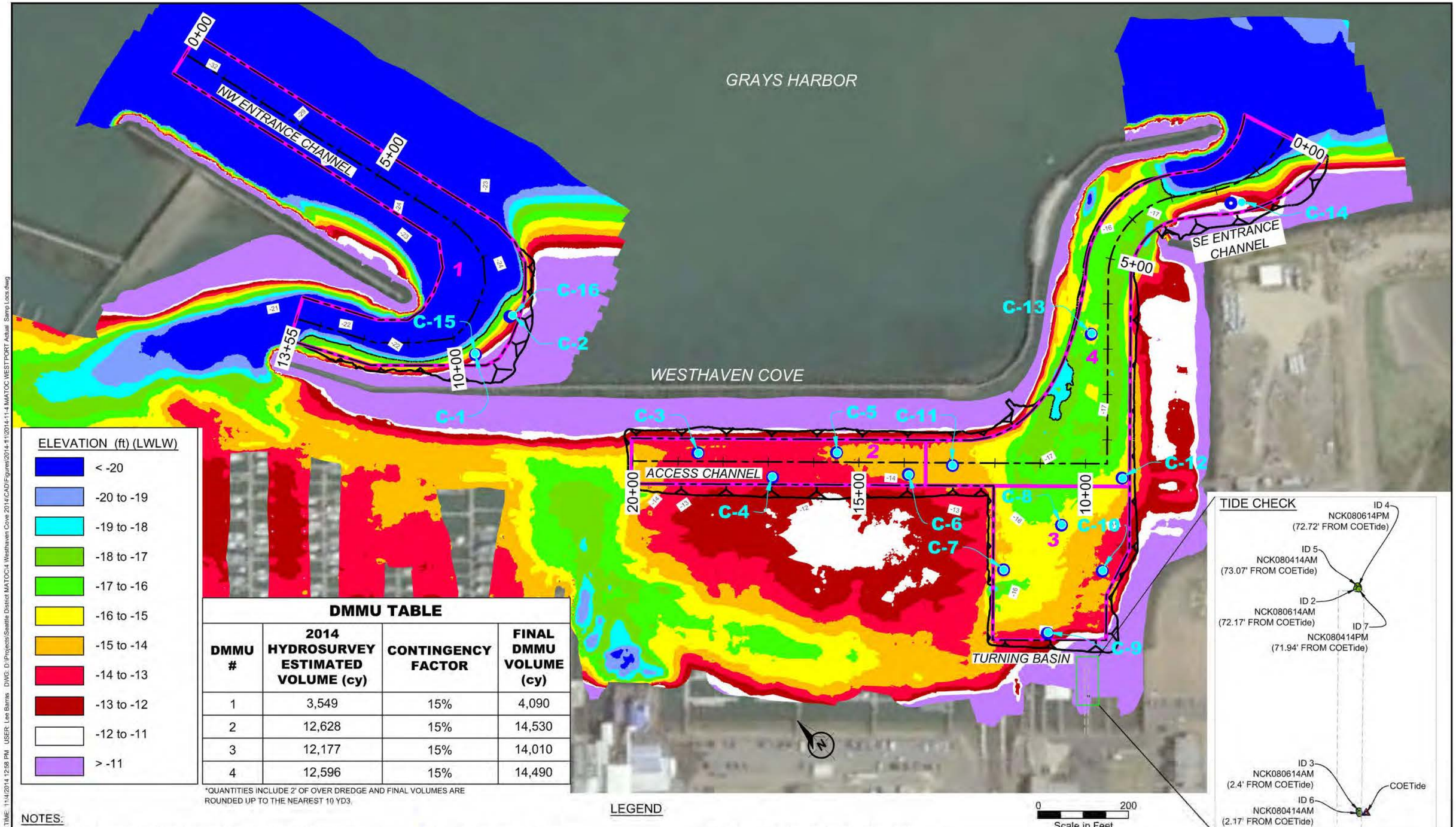
VICINITY MAP FOR THE WESTHAVEN COVE FEDERAL NAVIGATION CHANNEL

DALTON OLMSTED FUGLEVAND

FIGURE
1

JULY 28, 2014

PLOT TIME: 7/28/2014 10:40 AM MOD TIME: 7/28/2014 10:38 AM USER: Steven Rasmussen DWG: D:\Projects\Seattle District MATOC\4 Westhaven Cove 2014\CAD\Figures\2014-07\2014-07-28 MATOC WESTPORT SAP.dwg



ELEVATION (ft) (LWLW)

- < -20
- -20 to -19
- -19 to -18
- -18 to -17
- -17 to -16
- -16 to -15
- -15 to -14
- -14 to -13
- -13 to -12
- -12 to -11
- > -11

DMMU TABLE

DMMU #	2014 HYDROSURVEY ESTIMATED VOLUME (cy)	CONTINGENCY FACTOR	FINAL DMMU VOLUME (cy)
1	3,549	15%	4,090
2	12,628	15%	14,530
3	12,177	15%	14,010
4	12,596	15%	14,490

*QUANTITIES INCLUDE 2' OF OVER DREDGE AND FINAL VOLUMES ARE ROUNDED UP TO THE NEAREST 10 YD3.

NOTES:

1. BATHYMETRIC CONTOURS GENERATED FROM HYDRO SURVEY DATA COLLECTED APRIL 14, 15, 16, AND 21, 2014 BY USACE.
2. HORIZONTAL COORDINATE SYSTEM WASHINGTON STATE PLANE SOUTH, VERTICAL TIDAL DATUM NOS MLLW EPOCH 1960-1978, US FOOT.
3. *BASE MAP DRAWING INFORMATION PROVIDED BY* USACE.

LEGEND

- PROPOSED SAMPLE LOCATION
- C-x ACTUAL SAMPLE LOCATION (8/4-6/2014)
- X DMMU
- NAVIGATION CHANNEL
- CONTOUR MAJOR (5')
- CONTOUR MINOR (1')
- SLOPE
- EXISTING SHORELINE

U.S. ARMY CORPS OF ENGINEERS

SEATTLE DISTRICT MATOC
SEATTLE, WASHINGTON

WESTHAVEN COVE FEDERAL NAVIGATION CHANNEL DMMUs AND ACTUAL SEDIMENT SAMPLING LOCATIONS

DALTON OLMSTED FUGLEVAND

FIGURE 2

OCTOBER 13, 2014

PLOT TIME: 11/4/2014 12:58 PM MOD TIME: 11/4/2014 12:58 PM USER: Lee Barnes DWG: D:\Projects\Seattle District MATOC\4 Westhaven Cove 2014\CAD\Figures\2014-11\2014-11-4 MATOC WESTPORT Actual Samp Locs.dwg

Table 2 - Westhaven Cove Sampling Data (from DOF/SEE, 2014b)

DMMU	Core	Attempt	Date	Time	Latitude	Longitude	Mudline Elevation [1]	Penetration (ft)	Acquisition (ft)	% Recovery	Acquired Elevation
					NAD 1983		(MLLW)				(MLLW) [2]
DMMU 1	1	1	8/6/2014	9:05:07	46 54.49319 N	124 06.41346 W	-14.0	9.0	7.3	81.1%	-21.3
	2	1	8/6/2014	10:35:34	46 54.49559 N	124 06.38556 W	-14.6	7.0	5.6	80.0%	-20.2
	15 [(3)]	1	8/6/2014	9:59:33	46 54.49348 N	124 06.41343 W	-13.5	9.0	6.9	76.7%	-20.4
	16 [(3)]	1	8/6/2014	11:26:43	46 54.49520 N	124 06.38480 W	---	Rejected; insufficient recovery			
	16 [(3)]	2	8/6/2014	11:49:03	46 54.49504 N	124 06.38502 W	-15.2	7.0	5.6	80.0%	-20.8
DMMU 2	3	1	8/4/2014	8:01:39	46 54.41293 N	124 06.35947 W	-14.1	7	5.9	84.5%	-20.0
	4	1	8/4/2014	10:25:33	46 54.38871 N	124 06.33817 W	-13.8	9	6.3	70.0%	-20.1
	5	1	8/4/2014	9:05:38	46 54.37966 N	124 06.30401 W	-14.4	7	5.5	78.6%	-19.9
	6	1	8/4/2014	9:44:30	46 54.35648 N	124 06.28325 W	-14.7	7	5.6	79.8%	-20.3
DMMU 3	7	1	8/6/2014	12:57:39	46 54.30780 N	124 06.27878 W	-15.1	7.0	6.6	94.3%	-21.7
	8	1	8/6/2014	13:31:29	46 54.30618 N	124 06.23994 W	-15.8	7.0	5.8	82.9%	-21.6
	9	1	8/6/2014	14:55:20	46 54.28012 N	124 06.28307 W	-14.0	9.0	6.8	75.6%	-20.8
	10	1	8/6/2014	14:06:35	46 54.28387 N	124 06.23969 W	-15.2	7.0	5.3	75.7%	-20.5
DMMU 4	11	1	8/4/2014	11:10:25	46 54.34854 N	124 06.26259 W	-14.8	7	5.0	71.4%	-19.8
	12	1	8/4/2014	11:43:38	46 54.30420 N	124 06.19953 W	-15.5	7	6.0	85.7%	-21.5
	13	1	8/4/2014	13:43:06	46 54.35103 N	124 06.16109 W	-15.1	7	5.9	84.3%	-21.0
	14	1	8/4/2014	15:18:15	46 54.35078 N	124 06.05565 W	-12.4	11	7.6	69.1%	-20.0
									Average	78.7%	

Notes:

1. Tide-corrected
2. Acquired elevation = mudline elevation – length of acquired core; the target acquisition elevation was -20 ft MLLW; sediment collected deeper than this elevation was discarded during processing.
3. Two additional cores were collected at DMMU WSTH 01 in order to provide sufficient volume for analytical and biological testing. These cores were numbered 15 and 16.

Station Coordinates in NAD 1983

ft - feet

MLLW - mean lower low water

Table 3 - Westhaven Cove Compositing Data (from DOF/SEE, 2014b)

DMMU	Core	Attempt	Dredged Material Sampling			Z-layer Sampling			Dredged Material Samples			Z-layer Samples	
			Mudline Elevation [1] (ft MLLW)	Design Elevation [2] (ft MLLW)	Sampling Interval (ft)	Design Elevation [2] (ft MLLW)	Bottom Z-layer (ft MLLW)	Sampling Interval (ft)	Composite	Individual Archive	Sulfide	Composite	Individual Archive
DMMU 1	1	1	-14.0	-18.0	4.0	-18.0	-20.0	2.0	✓	✓	✓	✓	✓
	2	1	-14.6	-18.0	3.4	-18.0	-20.0	2.0	✓	✓		✓	✓
	15 [3]	1	-13.5	-18.0	4.5	-18.0	-20.0	2.0	✓	✓		✓	✓
	16 [3]	2	-15.2	-18.0	2.8	-18.0	-20.0	2.0	✓	✓		✓	✓
DMMU 2	3	1	-14.1	-18.0	3.9	-18.0	-20.0	2.0	✓	✓	✓	✓	✓
	4	1	-13.8	-18.0	4.2	-18.0	-20.0	2.0	✓	✓		✓	✓
	5	1	-14.4	-18.0	3.6	-18.0	-20.0	2.0	✓	✓		✓	✓
	6	1	-14.7	-18.0	3.3	-18.0	-20.0	2.0	✓	✓		✓	✓
DMMU 3	7	1	-15.1	-18.0	2.9	-18.0	-20.0	2.0	✓	✓	✓	✓	✓
	8	1	-15.8	-18.0	2.2	-18.0	-20.0	2.0	✓	✓		✓	✓
	9	1	-14.0	-18.0	4.0	-18.0	-20.0	2.0	✓	✓		✓	✓
	10	1	-15.2	-18.0	2.8	-18.0	-20.0	2.0	✓	✓		✓	✓
DMMU 4	11	1	-14.8	-18.0	3.2	-18.0	-20.0	2.0	✓	✓	✓	✓	✓
	12	1	-15.5	-18.0	2.5	-18.0	-20.0	2.0	✓	✓		✓	✓
	13	1	-15.1	-18.0	2.9	-18.0	-20.0	2.0	✓	✓		✓	✓
	14	1	-12.4	-18.0	5.6	-18.0	-20.0	2.0	✓	✓		✓	✓

Notes:

1. Tide-corrected
2. Design elevation = authorized federal navigation depth (-16 ft) + over-dredge (1 ft) + advanced maintenance (1 ft)
3. Two additional cores were collected at DMMU WSTH 01 in order to provide sufficient volume for analytical and biological testing. These cores were numbered 15 and 16.

ft - feet

MLLW - mean lower low water

Table 4 - Analytical Results Compared to the DMMP Guidelines (from DOF/SEE, 2014b)

Chemical	CAS[1] Number	DMMP Marine Guidelines			Dredged Material Management Unit							
					DMMU 1		DMMU 2		DMMU 3		DMMU 4	
		SL	BT	ML	Value	VQ	Value	VQ	Value	VQ	Value	VQ
Conventionals												
Gravel (%)					0.1		1.6		0.1		3.7	
Sand (%)					64.3		26.5		32.6		43.1	
Silt (%)					31.3		56.2		53.7		42.2	
Clay (%)					4.5		15.7		13.5		11	
Total Solids (%)					69.0		52.8		51.8		60.1	
Total Volatile Solids (%)					2.9		6.5		6.8		5.0	
Total Organic Carbon (%)					0.8		1.91		3.32		2.03	
Metals (mg/kg)												
Antimony	7440-36-0	150	---	200	6	UJ	9	UJ	9	UJ	8	UJ
Arsenic	7440-38-2	57	507.1	700	6	U	9	U	9	U	8	U
Cadmium	7440-43-9	5.1	11.3	14	0.5		0.9		0.7		0.7	
Chromium	7440-47-3	260	260	---	22.1		37.1		33.3		29.1	
Copper	7440-50-8	390	1027	1300	16.8		47.6		37.7		29.8	
Lead	7439-92-1	450	975	1200	4		7		7		6	
Mercury	7439-97-6	0.41	1.5	2.3	0.03		0.08		0.06		0.05	
Nickel	7440-02-0	---	---	---	17		26		24		21	
Selenium [2]	7782-49-2	---	3	---	0.7	U	0.9	U	0.9	U	0.8	U
Silver	7440-22-4	6.1	6.1	8.4	0.4	U	0.5	U	0.5	U	0.5	U
Zinc	7440-66-6	410	2783	3800	51		94		82		69	
Organotin Compounds (µg/L)												
Tributyltin (interstitial water)	56573-85-4	---	0.15	---	0.005	U	0.005	U	0.005	U	0.005	U
Polycyclic Aromatic Hydrocarbons (µg/kg)	130498-29-2	---	---	---								
Total LPAH	---	5200	---	29000	*48*		*154*		*77*		*95*	
Naphthalene	91-20-3	2100	---	2400	48	U	26	J	32	J	32	J
2-Methylnaphthalene [3]	91-57-6	670	---	1900	48	U	48	U	47	U	46	U
Acenaphthylene	208-96-8	560	---	1300	48	U	48	U	47	U	46	U
Acenaphthene	83-32-9	500	---	2000	48	U	48	U	47	U	46	U
Fluorene	86-73-7	540	---	3600	48	UJ	48	UJ	47	UJ	46	UJ
Phenanthrene	85-01-8	1500	---	21000	48	UJ	97	J	45	J	63	J
Anthracene	120-12-7	960	---	13000	48	UJ	31	J	47.0	UJ	46	UJ
Total HPAH	---	12000	---	69000	*57*		*652*		*335*		*281*	
Fluoranthene	206-44-0	1700	4600	30000	26	J	190		87		110	
Pyrene	129-00-0	2600	11980	16000	31	J	220	J	130	J	100	J
Benz(a)anthracene	56-55-3	1300	---	5100	48	UJ	43	J	29	J	46	UJ
Chrysene	218-01-9	1400	---	21000	48	U	61		32	J	34	J

Table 4 - Analytical Results Compared to the DMMP Guidelines (from DOF/SEE, 2014b)

Chemical	CAS[1] Number	DMMP Marine Guidelines			Dredged Material Management Unit							
					DMMU 1		DMMU 2		DMMU 3		DMMU 4	
		SL	BT	ML	Value	VQ	Value	VQ	Value	VQ	Value	VQ
Benzo(b)fluoranthene	205-99-2	---	---	---	48	U	45	J	29	J	23	J
Benzo(k)fluoranthene	205-82-3	---	---	---	48	U	48	U	47	U	46	U
Benzo(j)fluoranthene	207-08-9	---	---	---	48	U	20	J	47	U	46	U
Benzofluoranthenes (b, j ,k)		3200	---	9900	*48*	*U*	*84*		*57*		*37*	*J*
Benzo(a)pyrene	50-32-8	1600	---	3600	48	U	27	J	47	U	46	U
Indeno(1,2,3-c,d)pyrene	193-39-5	600	---	4400	48	U	48	U	47	U	46	U
Dibenz(a,h)anthracene	53-70-3	230	---	1900	48	UJ	48	UJ	47	UJ	46	UJ
Benzo(g,h,i)perylene	191-24-2	670	---	3200	48	U	27	J	47	U	46	U
Chlorinated Hydrocarbons (µg/kg)												
1,4-Dichlorobenzene	106-46-7	110	---	120	19	U	19	U	19	U	20	U
1,2-Dichlorobenzene	95-50-1	35	---	110	19	U	19	U	19	U	20	U
1,2,4-Trichlorobenzene	120-82-1	31	---	64	19	U	19	U	19	U	20	U
Hexachlorobenzene (HCB)	118-74-1	22	168	230	0.96	U	4.1	U	5.3	U	0.99	U
Phthalate Esters (µg/kg)												
Dimethyl phthalate	131-11-3	71	---	1400	19	U	19	U	19	U	20	U
Diethyl phthalate	84-66-2	200	---	1200	160		19	U	66		18	J
Di-n-butyl phthalate	84-74-2	1400	---	5100	19	U	19	U	19	U	20	U
Butyl benzyl phthalate	85-68-7	63	---	970	19	U	19	U	19	U	20	U
Bis(2-ethylhexyl) phthalate	117-81-7	1300	---	8300	48	U	47	U	47	U	49	U
Di-n-octyl phthalate	117-84-0	6200	---	6200	19	U	19	U	19	U	20	U
Phenols and Substituted Phenols (µg/kg)												
Phenol	108-95-2	420	---	1200	15	J	74		35		24	
2-Methylphenol	95-48-7	63	---	77	19	U	19	U	19	U	20	U
4-Methylphenol	106-44-5	670	---	3600	15	J	39		61		32	
2,4-Dimethylphenol	105-67-9	29	---	210	24	U	24	U	23	U	24	U
Pentachlorophenol	87-86-5	400	504	690	97	U	94	U	94	U	98	U
Miscellaneous Extractables (µg/kg)												
Benzyl alcohol	100-51-6	57	---	870	19	U	19	U	19	U	20	U
Benzoic acid	65-85-0	650	---	760	190	U	360		100	J	200	U
Dibenzofuran	132-64-9	540	---	1700	19	U	19	U	10	J	20	U
Hexachlorobutadiene	87-68-3	11	---	270	0.96	U	0.99	U	1.0	U	0.99	U
N-Nitrosodiphenylamine	86-30-6	28	---	130	19	U	19	U	19	U	20	U
Organochlorine Pesticides/SVOCs (µg/kg)												
4,4'-DDE	72-54-8	16	---	---	0.96	U	0.99	U	1.0	U	0.99	U
4,4'-DDD	72-55-9	9	---	---	0.96	U	0.99	U	1.0	U	0.99	U
4,4'-DDT	50-29-3	12	---	---	0.96	U	2.3	U	1.0	U	0.99	U
sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT		---	50	69	*0.96*	*U*	*2.3*	*U*	*1.0*	*U*	*0.99*	U
Aldrin	309-00-2	9.5	---	---	0.5	U	0.48	U	0.74	U	1.3	U

Table 4 - Analytical Results Compared to the DMMP Guidelines (from DOF/SEE, 2014b)

Chemical	CAS[1] Number	DMMP Marine Guidelines			Dredged Material Management Unit							
					DMMU 1		DMMU 2		DMMU 3		DMMU 4	
		SL	BT	ML	Value	VQ	Value	VQ	Value	VQ	Value	VQ
Total Chlordane	5103-71-9	2.8	37	---	*0.96*	*U*	*1.2*	*U*	*2.2*	*U*	*2.2*	*U*
trans-Chlordane	5103-73-1				0.8	U	1.2	U	2.2	U	2.2	U
cis-Chlordane	5103-74-2				0.48	U	0.5	U	0.5	U	0.49	U
oxy Chlordane	53494-70-5				0.96	U	0.99	U	1.0	U	0.99	U
cis-Nonachlor	39765-80-5				0.96	U	0.99	U	1.0	U	0.99	U
trans-Nonachlor	27304-13-8				0.96	U	1.1	UJ	1.0	U	0.99	U
Dieldrin	60-57-1	1.9	---	1700	0.96	U	0.99	U	1.0	U	0.99	U
Heptachlor	76-44-8	1.5	---	270	0.48	U	1.4	UJ	1.3	UJ	1.0	UJ
PCBs Aroclors (µg/kg)	---	130	38 [4]	3100	*9.8*	U	*7.3*	J	*8.1*	J	*5.6*	J
Aroclor 1016	5103-73-1				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1242	53469-21-9				9.8	U	27.0	U	14	U	18	U
Aroclor 1248	12672-29-6				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1254	11097-69-1				9.8	U	7.3	J	8.1	J	5.6	J
Aroclor 1260	11096-82-5				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1221	11104-28-2				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1232	11141-16-5				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1262	37324-23-5				9.8	U	8.9	U	9.1	U	8.9	U
Aroclor 1268	11100-14-4				9.8	U	8.9	U	9.1	U	8.9	U
Dioxins/Furans (ng/kg)	---		5/15 [5]	---	*See Table 4-3*							

Notes:

[1] Chemical Abstract Service Registry Number

[2] As no SL value exists to trigger toxicity testing, this chemical will only be evaluated for its bioaccumulative potential.

[3] 2-Methylnaphthalene is not included in the summation for total LPAH for the Marine SLs.

[4] This value is normalized to total organic carbon, and is expressed in mg/kg carbon.

[5] For dispersive sites in Grays Harbor, the 5 ng/kg 2,3,7,8-TCDD concentration or 15 ng/kg TEQ will be used as a trigger for the requirement to perform bioaccumulation testing.

Validation Qualifiers (VQ):

J - The reported concentration is an estimated value.
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Table 5 - Dioxin/Furan Results (from DOF/SEE, 2014b)

Chemical Name	TEF	Dredged Material Management Unit															
		DMMU 1				DMMU 2				DMMU 3				DMMU 4			
		Value (ng/kg)	VQ	TEQ (U = 0)	TEQ (U=1/2 EDL)	Value (ng/kg)	VQ	TEQ (U = 0)	TEQ (U=1/2 EDL)	Value (ng/kg)	VQ	TEQ (U = 0)	TEQ (U=1/2 EDL)	Value (ng/kg)	VQ	TEQ (U = 0)	TEQ (U=1/2 EDL)
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1	0.531	U	0	0.2655	1.2		1.2	1.2	1.02	U	0	0.51	0.867	U	0	0.4335
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1	0.623	J	0.623	0.623	1.86		1.86	1.86	1.67		1.67	1.67	1.22	U	0	0.61
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.224	U	0	0.0112	1.31		0.131	0.131	0.923	J	0.0923	0.0923	0.596	U	0	0.0298
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	0.992		0.0992	0.0992	5.42		0.542	0.542	4.9		0.49	0.49	2.55		0.255	0.255
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1	1.460		0.146	0.146	5.5		0.55	0.55	4.76		0.476	0.476	3.33		0.333	0.333
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01	16.300		0.163	0.163	113		1.13	1.13	101		1.01	1.01	48.9		0.489	0.489
Octachlorodibenzo-p-dioxin (OCDD)	3E-04	114		0.0342	0.0342	933		0.2799	0.2799	932		0.2796	0.2796	398		0.1194	0.1194
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1	0.505	U	0	0.02525	1.24	U	0	0.062	1.55		0.155	0.155	0.84	J	0.084	0.084
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03	0.112	J	0.00336	0.00336	0.434	J	0.013	0.01302	0.454	J	0.01362	0.01362	0.293	U	0	0.004395
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3	0.157	U	0	0.02355	0.442	J	0.1326	0.1326	0.414	U	0	0.0621	0.256	J	0.0768	0.0768
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.258	J	0.0258	0.0258	0.965	J	0.0965	0.0965	0.922	J	0.0922	0.0922	0.557	U	0	0.02785
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.224	U	0	0.0112	0.757	J	0.0757	0.0757	0.663	J	0.0663	0.0663	0.419	J	0.0419	0.0419
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1	0.251	J	0.0251	0.0251	1.03	J	0.103	0.103	0.518	U	0	0.0259	0.446	J	0.0446	0.0446
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1	0.0852	U	0	0.00426	0.376	J	0.0376	0.0376	0.297	U	0	0.01485	0.169	J	0.0169	0.0169
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01	3.76		0.0376	0.0376	14.5		0.145	0.145	15.1		0.151	0.151	7.42		0.0742	0.0742
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01	0.159	U	0	0.000795	0.647	U	0	0.003235	0.68	J	0.0068	0.0068	0.351	J	0.0035	0.00351
Octachlorodibenzofuran (OCDF)	3E-04	5		0.0015	0.0015	21.6		0.0065	0.00648	35.2		0.01056	0.01056	11.4		0.0034	0.00342
Total TEQ				1.16	1.50			6.30	6.37			4.51	5.13			1.54	2.65

Note: For dispersive sites in Grays Harbor, 5 ng/kg 2,3,7,8-TCDD concentration or 15 ng/kg TEQ is used as a trigger for the requirement to perform bioaccumulation testing.

EDL = Estimated Detection Limit
TEQ = Toxicity Equivalent

Validation Qualifiers (VQ):

J - The reported concentration is an estimated value
U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.
UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.

Table 6 - Analytical Results Compared to the Washington State Sediment Management Standards (from DOF/SEE, 2014b)

Chemical	CAS[1] Number	SMS - Marine Benthic		Dredged Material Management Unit											
				DMMU 1			DMMU 2			DMMU 3			DMMU 4		
		SQS[2]	CSL[3]	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ
Conventionals															
Gravel (%)		---	---	0.1			1.6			0.1			3.7		
Sand (%)				64.3			26.5			32.6			43.1		
Silt (%)				31.3			56.2			53.7			42.2		
Clay (%)				4.5			15.7			13.5			11		
Total Solids		---	---	69.0			52.76			51.8			60.1		
Total Organic Carbon (%)	---	---	---	0.8			1.91			3.32			2.03		
Metals (mg/kg)															
Arsenic	7440-38-2	57	93	6	---	U	9	---	U	9	---	U	8	---	U
Cadmium	7440-43-9	5.1	6.7	0.5	---		0.9	---		0.7	---		0.7	---	
Chromium	7440-47-3	260	270	22.1	---		37.1	---		33.3	---		29.1	---	
Copper	7440-50-8	390	390	16.8	---		47.6	---		37.7	---		29.8	---	
Lead	7439-92-1	450	530	4	---		7	---		7	---		6	---	
Mercury	7439-97-6	0.41	0.59	0.03	---		0.08	---		0.06	---		0.05	---	
Silver	7440-22-4	6.1	6.1	0.4	---	U	0.5	---	U	0.5	---	U	0.5	---	U
Zinc	7440-66-6	410	960	51	---		94	---		82	---		69	---	
Polycyclic Aromatic Hydrocarbons (mg/kg OC)	130498-29-2														
Total LPAH	---	370	780	*48*	*6.0*	*U*	*154*	*8.1*		*77*	*2.3*	J	*95*	*4.7*	J
Naphthalene	91-20-3	99	170	48	6.0	U	26	1.4	J	32	1.0	U	32	1.6	U
2-Methylnaphthalene [3]	91-57-6	38	64	48	6.0	U	48	2.5	U	47	1.4	U	46	2.3	U
Acenaphthylene	208-96-8	66	66	48	6.0	U	48	2.5	U	47	1.4	U	46	2.3	U
Acenaphthene	83-32-9	16	57	48	6.0	U	48	2.5	U	47	1.4	UJ	46	2.3	UJ
Fluorene	86-73-7	23	79	48	6.0	UJ	48	2.5	UJ	47	1.4	J	46	2.3	J
Phenanthrene	85-01-8	100	480	48	6.0	UJ	97	5.1	J	45	1.4	UJ	63	3.1	UJ
Anthracene	120-12-7	220	1200	48	6.0	UJ	31	1.6	J	47	1.4		46	2.3	
Total HPAH	---	960	5300	*57*	*7.1*		*652*	*34.1*		*335*	*10.1*		*327*	*16.1*	
Fluoranthene	206-44-0	160	1200	26	3.3	J	190	9.9		87	2.6	J	110	5.4	J
Pyrene	129-00-0	1000	1400	31	3.9	J	220	11.5	J	130	3.9	J	100	4.9	J
Benz(a)anthracene	56-55-3	110	270	48	6.0	UJ	43	2.3	J	29	0.9	J	46	2.3	J
Chrysene	218-01-9	110	460	48	6.0	U	61	3.2		32	1.0	J	34	1.7	J
Benzofluoranthenes (b, j ,k)		230	450	*48*	6.0	*U*	*84*	4.4		*57*	1.7	U	37	1.8	J
Benzo(a)pyrene	50-32-8	99	210	48	6.0	U	27	1.4	J	47	1.4	U	46	2.3	U
Indeno(1,2,3-c,d)pyrene	193-39-5	34	88	48	6.0	U	48	2.5	U	47	1.4	UJ	46	2.3	U
Dibenz(a,h)anthracene	53-70-3	12	33	48	6.0	UJ	48	2.5	UJ	47	1.4	U	46	2.3	UJ
Benzo(g,h,i)perylene	191-24-2	31	78	48	6.0	U	27	1.4	J	47	1.4	U	46	2.3	U

Table 6 - Analytical Results Compared to the Washington State Sediment Management Standards (from DOF/SEE, 2014b)

Chemical	CAS[1] Number	SMS - Marine Benthic		Dredged Material Management Unit											
				DMMU 1			DMMU 2			DMMU 3			DMMU 4		
		SQS[2]	CSL[3]	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ	Value (dw)	Value (OC-norm)	VQ
Chlorinated Hydrocarbons (mg/kg OC)															
1,4-Dichlorobenzene	106-46-7	3.1	9	19	2.4	U	19	1.0	U	19	0.6	U	20	1.0	U
1,2-Dichlorobenzene	95-50-1	2.3	---	19	2.4	U	19	1.0	U	19	0.6	U	20	1.0	U
1,2,4-Trichlorobenzene	120-82-1	0.81	1.8	19	2.4	U	19	1.0	U	19	0.6	U	20	1.0	U
Hexachlorobenzene (HCB)	118-74-1	0.38	2.3	0.96	0.1	U	4.1	0.2	U	5.3	0.2		0.99	0.05	
Phthalate Esters (mg/kg OC)												U			U
Dimethyl phthalate	131-11-3	53	53	19	2.4	U	19	1.0	U	19	0.6		20	1.0	U
Diethyl phthalate	84-66-2	61	110	160	20		19	1.0	U	66	2.0	U	18	0.9	J
Di-n-butyl phthalate	84-74-2	220	1700	19	2.4	U	19	1.0	U	19	0.6	U	20	1.0	U
Butyl benzyl phthalate	85-68-7	4.9	64	19	2.4	U	19	1.0	U	19	0.6	U	20	1.0	U
Bis(2-ethylhexyl) phthalate	117-81-7	47	78	48	6.0	U	47	2.5	U	47	1.4	U	49	2.4	U
Di-n-octyl phthalate	117-84-0	58	4500	19	2.4	U	19	1.0	U	19	0.6		20	1.0	U
Phenols and Substituted Phenols (µg/kg dw)															
Phenol	108-95-2	420	1200	15	---	J	74	---		35	---	U	24	---	
2-Methylphenol	95-48-7	63	63	19	---	U	19	---	U	19	---		20	---	U
4-Methylphenol	106-44-5	670	670	15	---	J	39	---		61	---	U	32	---	
2,4-Dimethylphenol	105-67-9	29	29	24	---	U	24	---	U	23	---	U	24	---	U
Pentachlorophenol	87-86-5	360	690	97	---	U	94	---	U	94	---		98	---	U
Miscellaneous Extractables (µg/kg dw)												U			
Benzyl alcohol	100-51-6	57	73	19	---	U	19	---	U	19	---	J	20	---	U
Benzoic acid	65-85-0	650	650	190	---	U	360	---		100	---		200	---	U
Miscellaneous Extractables (mg/kg OC)												J			
Dibenzofuran	132-64-9	15	58	19	2.4	U	19	1.0	U	10	0.3	U	20	1.0	U
N-Nitrosodiphenylamine	86-30-6	11	11	19	2.4	U	19	1.0	U	19	0.6		20	1.0	U
PCBs Aroclors (mg/kg OC)	---	12	65	*9.8*	1.2	U	*7.3*	0.4	J	*8.1*	0.2	U	5.6	0.3	J

Notes:

[1] Chemical Abstract Service Registry Number

[2] Sediment Quality Standard

[3] Cleanup Screening Level

[4] OC-norm - The dry weight value is normalized to total organic carbon, and is expressed in mg/kg carbon.

Validation Qualifiers (VQ):

J - The reported concentration is an estimated value.

U - The analyte was analyzed for, but was considered not detected at the reporting limit or reported value.

UJ - The analyte was analyzed for, and the associated quantitation limit was an estimated value.