



**US Army Corps
of Engineers®**
Portland District

DEPOE BAY SEDIMENT QUALITY EVALUATION REPORT



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CENWP-EC-HR**

EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
ODEQ	Oregon Department of Environmental Quality
DMEF	Dredge Material Evaluation Framework
NES	Newly Exposed Surface
QA/QC	Quality Assurance/Quality Control
TOC	Total Organic Carbon
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
ND	non-detect
ppm	parts per million – mg/kg
ppb	parts per billion – ug/kg & ug/L
pptr	parts per trillion – ng/kg
SL	Screening level
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Thallium
Cr	Chromium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc
ID	Identification Number
P	Ponar (sediment surface grab sampler)
HC	Hand Core (hand push tube sediment sampler)
RMT	Regional Management Team (Corps-NWP, EPA, ODEQ)
NWP	US Army Corps of Engineers, North Western (Division) Portland District

Note: This Depoe Bay Sediment Quality Evaluation Report was reviewed by the Regional (sediment) Management Team (RMT) in accordance with the DMEF (1998). The RMT consists of Portland District Corps of Engineers, EPA and ODEQ personnel. All comments received have been incorporated into the report and was considered final at the end of the review period, April 8, 2005.

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ABSTRACT

Depoe Bay is a small inlet 100 miles south of the mouth of the Columbia River. Two small streams called North and South Depoe Bay Creek feed the bay. A check dam is located a few hundred feet upstream of the mouth of South Depoe Creek into the bay. The check dam helps to collect sediment before it enters the bay. Water and sediment quality is more affected by tidal movement of water into and out of the bay than stream flows in the two creeks.

The authorized project includes two concrete breakwaters that lie north of the rocky entrance. The entrance channel is 8 feet deep and 50 feet wide. A 390-by-750 foot boat basin is located within the bay. Both the boat basin and the channel are federally authorized for a depth of 8-foot, which is maintained by the US Army Corps of Engineers.

Historically the majority of the material has been hydraulically removed, with the discharge point located on the rocky intertidal shoreline of the outer bay, approximately 200-feet south of the entrance to the inner bay. Material from the check dam catch basin is typically dredged with a clam shell dredge, with upland disposal.

This evaluation was conducted following procedures set forth in the Upland Testing Manual Ocean Testing Manual and Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and Marine Protection, Research and Sanctuaries Act. These national guidelines and associated local screening levels are those adopted for use in the regional Dredge Material Evaluation Framework (DMEF), November 1998.

On February 2-3, 2005 a total of ten (10) samples were submitted for physical analyses including total volatile solids and were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbon, with three (3) samples selected for both total sediment (bulk) and pore-water organotin. Several samples submitted to the lab for analyses represented composite samples (see Figure 2). Sample 0202DB-HC-07, collected from material behind the sediment retention dam on South Depoe Bay Creek, represented three (3) hand core samples composited for one analytical data set. Sample identification (ID) numbers 8 and 9 were not used in sample ID scheme.

The physical analyses resulted in mean values of 2.6% gravel (shell hash - 0.0%-17.3% range), 62.8% sand (21.7%-97.1% range), and 34.9% silt/clay (2.8%-78.3% range), with 9.83% volatile solids (2.1%-16.3% range). Mean grain-size for all the samples is 0.150mm (0.044mm-0.422mm range). This material is classified as: sandy silt in the center of the boat basin, poorly graded sand near the basin entrance, with the north and south areas being primarily silty sand. The material behind the dam is poorly graded sand with silt. Several surface grabs were attempted within the Coast Guard Boathouse, but only 2"-minus angular gravel was collected; it was not submitted for analyses.



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The chemical analyses indicated only low levels of contamination in any of the samples, with all levels below their respective DMEF screening levels (SLs). No pesticides, PCBs, or tributyltin were detected in any of the samples. Several PAHs and phthalates were detected, but at low levels. Detection levels were sufficiently low enough to evaluate material proposed for dredging. The analytical results of this characterization are consistent with historical data.

Sediments represented by all samples in this sampling event are determined to be suitable for unconfined, in-water or upland placement without further characterization.

INTRODUCTION

The March 2004 hydrographic survey was the latest available to determine the depth of the dredging prism within Depoe Bay at the time of this sampling event; go to the following link to view the February 2, 2005 survey <https://www.nwp.usace.army.mil/op/n/wh/coastal/dbint.pdf>. Sample target locations and the compositing scheme have been selected, based on hydrosurvey results, from select locations within Depoe Bay, with one additional, 3 sample composite sample, collected behind the sediment retention dam (see Figure 2). Where the dredging prism was determined to be <3-feet in depth a Ponar boxcoring sampler was used. In areas where the dredging prism was >3-feet, a core sample was attempted. Sample 0202DB-HC-01 and 0202DB-HC-07 were the only core samples collected, penetration of the coring tube was limited to 12" to 16" these areas were primarily sand with silt. The ability to characterize the sections of the dredging prism that exceeded the penetration of the coring device is considered adequate based on the sandy nature of the samples collected and the homogenous source of shoaling material.

The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP January 2005), and are, also, listed below. This report will characterize the sediment to be dredged and outline the procedures used to accomplish these objectives.

Sampling and Analysis Objectives

- To characterize sediments in accordance with the regional dredge material testing manual protocols, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), as well as, the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or upland Confined Disposal Facilities – Testing manual (Upland Testing Manual).
- Collect, handle and analyze representative sediment from Depoe Bay in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Analyze for full suite of physical and chemical parameters as outlined in the DMEF (1998) Tier II a & b. DMEF – Table 8.1 contains the list of analytes and methods of analysis.

PREVIOUS STUDIES



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Material has been removed from the inner bay at various times and in varying amounts. From 1939 to 1950 a total of 56,143 CY were dredged, with 39,336 CY removed during 1951 to 1970 and 46,707 CY from 1971 to 1988. Dredging continued in 1989, with removal of 10,000 CY and continued in 1994, with an additional 7,000 CY of material being dredged. In 1996 - 2,000 CY were removed from the check dam catch basin. The majority of the material has been hydraulically removed, with the discharge point located on the rocky intertidal shoreline of the outer bay, approximately 200-feet south of the entrance to the inner bay. Material from the check dam catch basin is typically dredged with a clam shell dredge, with upland disposal.

Evaluations of Depoe Bay sediment were conducted in 1980, 1989, 1994 and 1998. In 1998 physical data collected classified 4 samples as "sandy silt" (ML), with 1 sample classified as "sandy elastic silt" (MH). Median grain size for all samples was 0.14 mm, with 73.4.0 % sand and 25.8 % fines. The finer material was located in areas sampled within and around boat docks. The sediments from all evaluations were found to be acceptable for unconfined in-water placement.

CURRENT SAMPLING EVENT/DISCUSSION

On February 2-3, 2005 a total of nine (9) sediment samples were collected within the boat basin at Depoe Bay and one (1) from sediment behind the dam at South Depoe Bay Creek. All samples were submitted for physical analyses including total volatile solids and were, also, analyzed for metals (9 inorganic), total organic carbon, pesticides and polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbon and three (3) samples for both total and pore-water tributyltin.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels below their respective DMEF screening levels (SLs). No pesticides, PCBs, or tributyltin were detected in any of the samples. Several PAHs and phthalates were detected, but at low levels. Detection levels were sufficiently low enough to evaluate material proposed for dredging. The organotin porewater laboratory detection levels were elevated, but with sufficiently low total (bulk) organotin laboratory results, there is no organotin available to leach into the surrounding porewater. The analytical results of this characterization are consistent with historical data.

RESULTS

Physical and Volatile Solids (ASTM methods)

Ten (10) samples were submitted for testing, with data presented in Table 1. The physical analyses resulted in mean values of 2.6% gravel (shell hash - 0.0%-17.3% range), 62.8% sand (21.7%-97.1% range), and 34.9% silt/clay (2.8%-78.3% range), with 9.83% volatile solids (2.1%-16.3% range). Mean grain-size for all the samples is 0.150mm (0.044mm-0.422mm range). This material is classified as: sandy silt in the center of the boat basin, with poorly graded sand near the basin entrance and the north and south areas being silty sand. The material behind the dam is poorly graded sand with silt.



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Metals (EPA method 6010/7471), Total Organic Carbon (EPA method 9060)

Ten (10) samples were submitted for testing, with data presented in Table 2. The TOC ranged from 0.63 to 6.1% in the samples.

Low levels of As, Cd, Cu, Ni, Pb, Sb and Zn were detected in all samples, no Ag or Hg was detected in any samples, with no levels approach their respective DMEF SL.

Pesticides/PCBs (EPA method 8080), Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270)

Ten (10) samples were submitted for testing, with data presented in Table 3. No PCBs were found at the MDL in any of the samples. No pesticides (including DDT) were detected in any of the samples. Phthalate compound, Bis(2-Ethylhexyl) was detected, at very low levels in 7 of the 10 samples, with Butyl benzyl phthalate detected in 2 samples, also at very low levels. The values were well below their respective DMEF SLs.

Polynuclear Aromatic Hydrocarbons (EPA method 8270C)

Ten (10) samples were submitted for testing, with data presented in Table 4. All samples contained low levels of most of the “low molecular weight” PAHs and “High molecular weight” PAHs. One (1) sample (0202DB-P-11) contained fluoranthene at the 1700 ug/kg SL.

Tributyltin [Total (Bulk) & Pore-Water]

Ten (10) samples were submitted for testing, with data presented in Table 4. No organotin was detected at detection levels reported. Several of the pore water detection levels were elevated slightly above the 0.15 ug/L SL due to lack of porewater in the sample submitted, likely do to sand content of 30-90%. Sandy material lacks the ability to retain porewater. However, with no total (bulk) organotin detected, at sufficiently low detection levels in the sediment tested, there would be no organotin available to leach into the porewater and full characterization is possible.

CONCLUSION

Collection and evaluation of the sediment data was completed using guidelines from the DMEF. The DMEF is a regional manual developed jointly with regional EPA, Corps, Oregon Department of Environmental Quality and Washington Departments of Ecology and Natural Resources. This document is guidance for implementing the Marine Protection, Research, and Sanctuaries Act and Clean Water Act (40 CFR 230), Section 404 (b)(1). The screening levels used are those adopted for use in the DMEF, final November 1998. The DMEF uses a tiered testing approach that requires material in excess of 20% fines and greater than 5% volatile solids, as well as any material with prior history or is suspected (“reason to believe”) of being contaminated, be subjected to chemical as well as physical analyses.

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Table 1: Physical Analysis and Volatile Solids

Sample I.D.	Grain Size (mm)	Percent (%)			
	Mean	Gravel (shell hash)	Sand	Silt/Clay	Volatile Solids
0202DB-HC-01	0.1094	0.0	73.6	26.4	3.6
0202DB-P-02	0.1489	0.8	76.5	22.7	15.9
0202DB-P-03	0.0916	0.6	60.4	39.0	9.8
0202DB-P-04	0.1939	0.1	97.1	2.8	2.1
0202DB-P-05	0.0440	0.0	21.7	78.3	16.3
0202DB-P-06	0.0623	0.1	43.2	56.7	7.6
0203DB-HC-07	0.1222	1.6	73.0	25.4	8.5
0203DB-P-10	0.4218	5.9	90.9	3.2	15.1
0203DB-P-11	0.0550	0.2	32.1	67.7	14.6
0203DB-P-12	0.2305	17.3	56.4	26.3	4.8
Mean	0.1480	2.7	62.5	34.9	9.8
Minimum	0.0440	0.0	21.7	2.8	2.1
Maximum	0.2305	17.3	97.1	78.3	16.3

HC = Hand Core (sampler) P = Ponar (surface grab sampler)



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Table 2: Inorganic Metals and TOC

Sample I.D.	As	Cd	Sb	Cu	Pb	Ni	Ag	Zn	Hg	TOC
	mg/kg (ppm)									%
0202DB-HC-01	4.1	0.297	<0.274	11.3	4.2	13.7	<0.052	62.7	<0.06	0.87
0202DB-P-02	10.6	0.803	1.84	21.2	7.1	23.4	<0.069	159	<0.07	6.1
0202DB-P-03	9.26	0.557	1.42	18.0	7.10	22.0	<0.066	124	<0.07	2.8
0202DB-P-04	3.46	0.186	0.824	7.0	7.39	10.3	<0.0431	66.5	<0.05	4.7
0202DB-P-05	14.8	1.03	1.98	39.3	11.8	28.9	<0.109	205	<0.11	0.63
0202DB-P-06	6.17	0.428	1.49	18.3	5.62	18.6	<0.070	110	<0.07	5.3
0203DB-HC-07	3.83	0.167	0.794	9.91	3.38	13.8	<0.057	39.9	<0.07	1.8
0203DB-P-10	9.06	0.426	0.971	13.7	5.66	15.5	<0.056	68.4	<0.06	1.9
0203DB-P-11	10.8	0.683	<0.34	31.9	257	24.8	<0.101	184	<0.10	2.7
0203DB-P-12	7.91	0.668	1.06	30.2	98.1	23.8	<0.053	173	<0.06	2.5
Screening level (SL)	57	5.1	150	390	450	140	6.1	410	0.41	

J = Estimated value (reported values are above the MDL, but below the PQL).
 Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).



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Table 3: Pesticides, PCBs, Phenols, Phthalates & Misc. Extractable

Sample I.D.	Pesticides				Phthalates	
	µg/kg (ppb)					
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	bis(2-Ethylhexyl) phthalate	Butyl benzyl-phthalate
0202DB-HC-01	<0.7	<0.3	<0.7	ND	<26	<25
0202DB-P-02	<0.78	<0.36	<0.82	ND	17 J	<30
0202DB-P-03	<0.78	<0.36	<0.82	ND	23 J	<30
0202DB-P-04	<0.55	<0.25	<0.57	ND	<22	<21
0202DB-P-05	<2	<1	<2	ND	73 J	<50
0202DB-P-06	<0.78	<0.36	<0.82	ND	16 J	<30
0203DB-HC-07	<0.7	<0.3	<0.7	ND	<29	<28
0203DB-P-10	<0.7	<0.3	<0.7	ND	1500	26
0203DB-P-11	<2	<1	<2	ND	44 J	<50
0203DB-P-12	<0.7	<0.3	<0.7	ND	92	160
Screening Level (SL)	+	+	+	= 6.9	8300	970

J = Estimated value (reported values are above the MDL, but below the PQL).
 Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).
 No PCB Aroclors detected at method reporting limit (MRL) - SL of 130 total PCBs.



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Table 4: Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight

Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes µg/kg (ppb)								
Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phen- anthrene	Total Low PAHs
0202DB-HC-01	<0.9	<0.7	3.6 J	5.2 J	<15	<1.1	8.4 J	17.2
0202DB-P-02	110	37	96	120	<20	37	560	960
0202DB-P-03	38	18	150	51	<20	22	210	489
0202DB-P-04	<0.8	<0.6	<0.6	<0.9	<12	<1.0	3.0 J	3.0 J
0202DB-P-05	10 J	19 J	49	18 J	<30	8.9 J	68	172.9
0202DB-P-06	8.4 J	19	180	24	<20	38	90	366.4
0203DB-HC-07	<1	<1	<1	<1	<1	<1	4.1 J	4.1 J
0203DB-P-10	<1	<1	5.3 J	<1	<16	<1	15	20.3
0203DB-P-11	110	41	170	89	<30	72	420	902
0203DB-P-12	22	25	130	40	15	19	180	416
Screen level (SL)	500	560	960	540	670	2100	1500	5200
J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).								



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Table 4 (cont'd): Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight

Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes µg/kg (ppb)										
Sample I.D.	Benzo(a)- anthracene	Benzo- fluro- anthenes	Benzo- (g,h,i)- perylene	Chrysene	Pyrene	Benzo(a)- pyrene	Indeno- (1,2,3-cd)- pyrene	Dibenzo(a, h) anthracene	Fluor- anthehe	Total High PAHs
0202DB-HC-01	9.9 J	9.2 J	3.5 J	12	21	5.0 J	2.5 J	<1.3	19	82.1
0202DB-P-02	230	251	47	240	690	100	44	12	1000	2614
0202DB-P-03	140	141	40	160	270	69	32	8.4 J	490	1349.4
0202DB-P-04	<0.6	<0.8	<1.4	<0.6	2.8 J	<0.6	<0.8	<1.2	3.8 J	6.6 J
0202DB-P-05	120	146	44	170	160	72	37	10 J	230	989
0202DB-P-06	190	252	47	290	260	110	46	14	250	1459
0203DB-HC-07	<1	2.8 J	<2	4.3 J	3.6 J	<1	<3	<2	4.2 J	14.9
0203DB-P-10	14	7.2 J	2.7 J	17	26	<7	<3	<2	38	234.9
0203DB-P-11	440	369	68	420	1200	160	66	21 J	1700	4444
0203DB-P-12	220	248	50	340	380	110	49	15	360	1412
Screen level (SL)	1300	3200	670	1400	2600	1600	600	230	1700	12000
<p>J = Estimated value (reported values are above the MDL, but below the PQL). Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).</p>										



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Table 5: Total and Pore-water Organotin

Organotin								
	Total (Bulk) ug/kg				Pore-water ug/L			
Sample I.D.	Monobutyltin	Dibutyltin	Tributyltin	Tetrabutyltin	Monobutyltin	Dibutyltin	Tributyltin	Tetrabutyltin
0202DB-P-10	<3.1	<4.1	<4.7	<5.3	<0.12	<0.15	<0.18	<0.20
0202DB-P-11	<1.9	<2.4	<2.8	<3.2	<0.11	<0.14	<0.16	<0.19
0202DB-P-12	<1.8	<2.4	<2.8	<3.1	<0.11	<0.14	<0.16	<0.18
Screen level (SL)	73				0.15			
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).								

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Figure 2: Depoe Bay, Sediment Sampling Station Locations

<https://www.nwp.usace.army.mil/op/n/wh/coastal/dbint.pdf> (Link to latest hydrosurvey map.)

