

Coos Bay Sediment Sampling Evaluation

Abstract

Sixteen sediment samples were collected in Coos Bay and Isthmus Slough, August 11-12, 1998 (see Figure 1). All 16 samples were sent to Sound Analytical Services, Inc. laboratory in Tacoma, WA, for physical analyses. Eleven samples were selected for the following chemical analyses: metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), phenols, phthalates, chlorinated organic compounds, miscellaneous extractables, and polynuclear aromatic hydrocarbons (PAH). Nine stations were sampled for tributyltin (TBT). The screening levels (SL) used are those adopted for use in the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area (1998). This evaluation was conducted following procedures set forth in the Inland Testing Manual (ITM) and the Ocean Disposal Testing Manual (Green Book), developed jointly by the Corps and EPA to assess dredged material. Guidelines used are those developed to implement the Clean Water Act (CWA) and the Marine Protection, Research and Sanctuary Act (MPRSA).

The proposed dredge material from this project is acceptable for both unconfined in-water and upland disposal. No significant, adverse ecological impacts are expected from such disposal in terms of sediment toxicity.

Introduction

The purpose of this report is to characterize the sediment of shoaling with-in the navigational channel in Coos Bay, including measurement of TBT levels in previously sampled areas. Frequent reference will be made to the project Sampling and Analysis Plan (SAP) attached to this report. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below:

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.
- Collect, handle and analyze representative sediment, of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.

- Conduct physical and chemical characterization of the material proposed to be dredged.

Historical Data

Coos Bay has had extensive TBT sampling events. Significant levels of TBT have been found in many near shore areas and remain a concern. The following historical events include samples collected for operation and maintenance (O&M), channel deepening, TBT studies and permit dredging.

Corps Sampling Events:

1980 September - Sediments were subjected to elutriate and bulk chemical, benthic and physical analyses from the Coos River navigation channel at river mile (RM) 0.0 of its main stem and RM 7.5 on South Fork Coos River. Water from the same locations was collected for use in performing tests and was chemically analyzed for comparison with the sediment elutriates data.

1986 May - Sediment samples (3) from Isthmus Slough were collected using a vibra-corer and subjected to physical analyses.

1987 September - Sediment samples (3) were collected from Isthmus Slough at the same locations sampled in May 1986 using a gravity corer. Sediment samples were subjected to bulk chemical and physical analyses. The bulk chemistry included TOC, metal, PAH and pesticide/PCB analysis. No PAHs or pesticides/PCBs were detected, all metals were below concern levels and the material to be dredged was determined to be suitable for unconfined in-water disposal.

1989 June - Sediment samples were collected from 21 stations from RM 0.0 to RM 15 along the main Coos Bay Federal Channel Deepening Reconnaissance Study. All Samples were subjected to physical analyses while the finer grained sediments collected above RM 10.5 were also analyzed for bulk chemistry. The bulk chemical analyses included TOC, metals, PAHs and pesticide/PCBs. All the material to be dredged was determined to be suitable for unconfined in-water disposal.

1993 April - Sediment samples were collected and analyzed from the main federal navigational channel, a proposed expansion of the RM 12 turning basin, and various locations along the sides of the main channel. These samples were collected and analyzed for three purposes: 1. Sediment quality evaluation of the Isthmus Slough sediments, 2. Sediment quality evaluation of the material to be removed by expanding the RM 12 turning basin as part of the proposed channel deepening, and 3. Project wide TBT evaluation. All project sediments were found to be suitable for unconfined in-water disposal.

1994 July - Sediment samples (10) were collected along two transects and evaluated for metal and TBT contamination to satisfy questions raised by Oregon's DEQ. DEQ had

information on TBT and metal contamination at Hilstrom Marine (RM 13+40) and Mid-coast Marine (RM 15) in the Isthmus Slough Area of the bay. They were concerned that deepening the channel would cause slumping of contaminated material into the channel. At Hilstrom the analyses showed that the TBT contamination dropped dramatically towards the channel. At Mid-coast marine contamination was not as high, but mid-channel sediments were found to contain 150ppb TBT. This was above the bulk sediment screening level of 30 ppb used by EPA, Region 10. Additional evaluation (biological) would be needed prior to the estimated 1200 cy of dredging material at the upper end of the federal project.

1995 May - Three sediment samples were collected from the Federal Channel in the area of TBT contaminated sediment identified in July 1994 (RM 15) for physical, chemical and biological evaluations. Chemical testing included analyses for butyltin (TBT) and PAHs. Two bioassays, the 10 day amphipod *Rhepoxynius abronius* and 48 hour oyster larval *Crassostrea gigas*, were conducted along with a 28 day benthic worm *Nephtys caecoids* bioaccumulation study. Based upon the chemistry and the bioassay; results, the material from the Federal Channel was determined to be suitable for unconfined in-water disposal. Of particular concern in Coos Bay is the presence of TBT in some areas associated with past marine boat repair. DEQ's apparent main concern is that dredging operations are resuspending TBT contaminated sediments and thereby shellfish are being contaminated. After extended discussions with various persons at DEQ the 1,200 cubic yards of material in question was dredged and placed in ODMDS H with the previous 600,000 cubic yards dredged from Isthmus Slough in 1995.

Other Sampling Events and studies (includes joint-Corps and non-Corps projects):

1991 – 1997 Oregon International Port of Coos Bay and Dock Owner Permittees studies have submitted a total of 70 samples for various analyses including a TBT study.

1992 – DEQ on several dates collected 19 (includes QA/QC) samples throughout the Bay for TBT analysis.

1993 – DEQ submits 35 samples (includes QA/QC splits) to different labs for TBT analysis.

1993 – DEQ collected 2 samples from Marshfield Channel Dredge Placement Area.

1993 – A joint effort by COE, EPA, DEQ collected 16 (includes QA/QC) samples which were submitted for TBT analysis.

1994 – COE & DEQ shipped samples to different labs as part of the Channel Deepening Study submitting a total of 17 (includes QA/QC) samples for analysis (TBT, metals, AVS and TOC and Bioassay).

1995 – A joint TBT study by COE & EPA analyzed 17 (includes QA/QC) samples.

1996 – Roy F. Weston, Inc. assessed TBT concentrations at 4 locations in Coos Bay for an EPA sponsored study requested by DEQ.

TBT tissue concentration analyses of various fish and shellfish were conducted by DEQ from 1992 – 1994 at various sites throughout Coos Bay and it's surrounding sloughs and inlets. Bioaccumulation results showed 87.3% of the tissues were non-detect for TBT. Those that showed levels of TBT were less than (<) 2mg TBT/kg body weight (dry). Chronic effects levels for species of concern typically fall within a range of 2-12 mg TBT/kg body weight, with a median value of about 4 ppm (literature cited in the DMEF, page 8A-6).

The Corp of Engineers regularly monitors sediment quality within Coos Bay navigational channel and dredging areas prior to dredging and disposal operations to insure compliance with all Federal and State regulations and guidelines for unconfined in-water disposal. All material discharged in open water has met criteria under these regulations and guidelines (see “Abstract” sec. above).

Current Sampling Events

The Army Corps of Engineers, Portland District personnel, collected 2-gravity core and 14 box core samples on Aug 11-12, 1998. The first and third samples (CB-GC-01&03) were collected using a gravity core sampler. The gravity core required 4 retrievals (due to low penetration) to supply the needed volume of material required for the TBT analysis. It was determined that a box core sampler would better collect the volume of material needed, with similar penetration. The samples were shipped to Sound Analytical laboratory of Tacoma, WA, for physical and chemical analyses; to include metals, total organic carbon (TOC), pesticides/PCBs, phenols, phthalates, chlorinated organic compounds, miscellaneous extractables and polynuclear aromatic hydrocarbons (PAHs). TBT analyses were run on 9 sampling stations (see Discussion details). The median grain size for all sediment was 0.18mm, with 29.2% fines. No chemicals of concern were detected above the established screening level (SL).

Sampling and analyses were performed using proper quality control measures, including proper procedures for chain of custody, preservation (4°C.) and cooler receipt. Two samples were replicated and analyzed for quality control (QC). Replicate sample data correlation with the primary sample results is acceptable. All laboratory QC is acceptable. Some PAH samples showed a small method blank contamination. The composite sample that was run for TBT (CB-BC-08, 09,11&12) showed detection limits at the SL value. Elevated detection limits resulted when a low volume of interstitial water was available for extraction from coarse-grained sediment.

Results/Discussion

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. Seven of 16 samples submitted for analyses exceeded 20% fines and 5% volatile solids. Most samples submitted were classified “silty sand” (SM) with a few, past RM 12, as “silt with sand”. Median grain size for all samples is 0.18mm, with 69.1% sand and 29.2% fines. As would be expected, there was an obvious difference in material sampled from RM 0 to 12 and the material collected above RM 12. This is consistent with past sediment past sediment analysis. The material RM 0 to 12 had a median grain size of 0.27mm with 92.1% sand, 5.5% fines and 2.2% volatile solids. Samples collected above RM 12 had a median grain size of 0.028mm with 27.0% sand, 72.7% fines and 12.0% volatile solids.

Metals and Total Organic Carbon (TOC): Data for these analyses are presented in Table 2. Low levels of 6 metals were found in all of the 11 samples analyzed, but do not approach the SL. One

sample contained a level of Mercury at 43.9% of the SL. Of the other metals detected the highest was for Zinc, which was 11.2 % of the SL.

Pesticide/PCBs, Phenols, Phthalates, Chlorinated Organic Compounds and Misc. Extractables:

Data for these analyses are presented in Table 3. No pesticides, PCBs or chlorinated organic compounds were detected (at the method detection limits) in any of the 16 samples analyzed. One phenol was detected at a very low level in 5 of the samples (<3.0% of the SL). Five phthalates were detected at low levels in 1 or more of the 16 samples (<4.3% of the SL). Dibenzofuran was found in 2 of the 16 samples at low levels (2.6% of the SL).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs are presented in Tables 4 & 5. Low levels of some “low molecular weight” PAHs were found in 10 of 16 samples. The highest level detected was 3.4% of the SL. Low levels of some of the “high molecular weight” PAHs were also found in all samples. The highest level was 21.3% of the SL.

Tributyltin (TBT) - interstitial (pore) water: Data for TBT are presented in Table 2. TBT in this report was analyzed using the interstitial (pore) water extraction method of analysis rather than the bulk TBT analysis used in past studies. This method measures more accurately the TBT that is bioavailable to the organism. It has been adopted as the accepted method in the regional manual (DMEF). Established screening level (SL) is 0.15 ug/L (ppb).

This round of TBT sampling was initiated as an ongoing response to concerns by DEQ that deepening of the channel would cause “slumping” of contaminated material into the channel. The sampling for TBT was designed to target the sights of concern. A cross-section sampling of the Federal Channel (mid-channel and near-shore) was taken at both major sites of concern (Mid-Coast-RM 13+40 and Hilstrom-RM 15). A total of 9 stations were sampled and submitted for TBT. Only 2 (both at Hilstrom) of the 9 stations indicated the presence of a butyltin compound (monobutyltin). The level of the highest concentration of monobutyltin was 43.3% of the SL. The lab reported that there was not enough extract water available from the coarse-grained material from 4 stations sampled in the vicinities of Greenberg Lumber (RM 8) and Charleston Channel and Boat Dock. All of the coarse-grained sediment was composited in an attempt to obtain enough volume of interstitial water extract, to analyze for TBT. Even with the compositing of the material (CB-BC-08, 09,11&12), sufficient water volume to run TBT at low detection limits was not possible on the composite sample. No tributyltin was detected in the composite sample with the method detection limit (MDL) value the same as the SL (0.15 ug/L). The lack of interstitial water is not unexpected considering the nature of the composited material (mean was 93.2% sand, 6.8% fines and 2.5 volatile solids). Coarse-grained material with greater than 80% sand and less than 5.0% volatile solids is not required to be tested under DMEF guidelines. The material represented by this composite is therefore, suitable for unconfined open-water disposal.

Conclusion

Section 102 of the MPRSA requires EPA, in consultation with the Corps, to develop environmental Criteria that must be complied with before any proposed ocean-disposal

activity is allowed to proceed. The Criteria calls for no unacceptable adverse effects. Guidelines for this criterion are set forth in the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual (the Green Book). Similarly, 404 (b)(1) guidelines set forth in 40 CFR 230 developed to implement the Clean Water Act (CWA) apply when dredge material is disposed of in either an aquatic or nearshore environment. It also applies when dredge material will be hydraulically placed in an upland environment and effluent from the disposal will be returned to waters of the U.S. Regional guidance derived from these regulations and national manuals was set forth and is being adopted as the Dredged Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area. The DMEF was developed in cooperation with the regional federal agencies (Corps and EPA) and state agencies (Oregon DEQ, Washington DOE and DNR). The DMEF Tiered testing approach requires that 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. Under the Tiered approach, if the chemical analytical results do not exceed the established screening levels, the material is cleared for unconfined in-water disposal. The analyses for this material show only low level contamination, water quality standards will not be exceeded during dredging and disposal. This material is acceptable for, both upland and unconfined in-water, disposal with no adverse unacceptable ecological consequences expected. No further testing is required.

References

1. U.S. Army Corps of Engineers, Portland District, Seattle District, U.S. Environmental Protection Agency, Region 10, Oregon Department of Environmental Quality, Washington State Department of Natural Resources. April 1998 (draft document). Dredge Material Evaluation Framework Lower Columbia River Management Area.
2. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Ocean Disposal – Testing Manual, (referred to as the “The Green Book”).
3. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1991. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters – Testing Manual, dated (referred to as the “Inland Testing Manual”).
4. Britton, J., U.S. Army Corps of Engineers, Portland District. May 1990. Results of Coos Bay Empire turning basin Sediment Quality Evaluation.
5. Britton, J., U.S. Army Corps of Engineers, Portland District. Aug 1993. Tributyltin levels in Coos Bay Sediment.
6. Britton, J., Siipola, M., U.S. Army Corps of Engineers, Portland District. Oct 1994. Supplemental TBT Data Coos Bay Channel Deepening Project.

Table 1, Coos Bay

Physical Analysis

Sampled Aug. 11-12, 1998

Sample I.D.	Grain Size (mm)		Sand	Silt/Clay	Volitile solids
	Median	Mean			
CB-GC-01	0.01	0.05	13.2	86.8	14.2
CB-GB-02	0.03	0.15	26.6	72.5	12.5
CB-GC-03	0.02	0.13	15.3	84.7	13.0
CB-BC-04	0.03	0.08	24.7	75.1	12.1
CB-BC-05	0.04	0.09	36.5	63.4	11.3
CB-BC-06	0.04	0.06	46.2	53.8	8.9
Average - samples above RM 12					
	0.03	0.09	27.0	72.7	12.0
CB-BC-07	0.15	0.11	96.7	3.3	1.6
CB-BC-08	0.30	0.21	97.4	2.6	1.3
CB-BC-09	0.19	0.20	72.8	26.7	9.5
CB-BC-09 Dup	0.26	0.20	81.5	18.3	3.0
CB-BC-10	0.30	0.20	98.0	2.0	1.0
CB-BC-11	0.19	0.15	98.6	1.4	1.6
CB-BC-12	0.30	0.21	99.5	0.5	0.9
CB-BC-13	0.29	0.22	98.7	1.0	0.8
CB-BC-14	0.31	0.24	99.8	0.2	0.9
CB-BC-15	0.36	0.36	98.6	0.7	1.5
CB-BC-16	0.37	2.90 Rocks & Shells	71.5	3.9	1.8
Average for samples from RM 0-12					
	0.27	0.45 (0.21 w/o #16)	92.1	5.5	2.2
Average for all samples					
	0.18	0.33 (0.17 w/o #16)	69.1	29.2	5.6
Maximum					
	0.37	2.9	99.5	86.8	14.2

Table 2, Coos Bay

Inorganic Metals, TOC and Organotin (TBT)

Sampled Aug. 11-12, 1998

Sample I.D.	As	Cr	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC	TBT ug/kg (ppb)
	mg/kg (ppm)										
CB-GC-01	-	-	-	-	-	-	-	-	-	-	<0.035
CB-GB-02	-	-	-	-	-	-	-	-	-	-	<0.030
CB-GC-03	-	-	-	-	-	-	-	-	-	-	<0.043
CB-BC-04	-	-	-	-	-	-	-	-	-	-	0.051*
CB-BC-05	-	-	-	-	-	-	-	-	-	-	0.065*
CB-BC-06	4.9	36	<0.18	16	8.2	0.18	31	<0.18	46	27000	-
CB-BC-07	3	15	<0.11	3.9	3.7	<0.13	9.2	<0.11	19	2100	-
CB-BC-08	-	-	-	-	-	-	-	-	-	-	<0.15**
CB-BC-09	-	-	-	-	-	-	-	-	-	-	<0.15**
CB-BC-10	3	6.3	<0.1	1.7	1.9	<0.08	4.1	<0.1	8.1	520	-
CB-BC-11	4.1	20	0.13	5.5	8.3	<0.10	16	<0.13	19	2500	-
CB-BC-12	4.4	11	<0.11	2.5	1.9	<0.11	6.8	<0.11	10	960	-
CB-BC-12A	3.8	10	<0.12	2.4	2.4	<0.11	7.4	<0.12	11	850	-
CB-BC-1112	-	-	-	-	-	-	-	-	-	-	<0.15**
CB-BC-13	4.1	12	<0.12	2.3	1.9	<0.09	4.8	<0.12	10	270	-
CB-BC-14	4.8	7.8	<0.12	2.1	2	<0.12	4.7	<0.12	13	480	-
CB-BC-15	3.3	6.1	<0.11	2.6	1.8	<0.09	4.7	<0.11	7.8	890	-
CB-BC-15A	3.5	7	<0.11	3.1	2.2	<0.11	5.2	<0.11	11	840	-
CB-BC-16	3.2	6.1	<0.11	2	3	<0.09	5.7	0.19	9.4	330	-
Screening level (SL)	57	None	5.1	390	450	0.41	140	6.1	410		0.15
Mean	3.8	12.5	<0.13	4	3.4	0.02	9.1	0.02	14.9		0.01
Maximum	4.9	36	0.13	16	8.3	0.18	9.2	0.19	46		0.065
* Monobutyltin detected at this level.											** Detection limit elevated due to limited amount of extract available, (coarse material).
(-) = No analysis requested											

(<) = Non-detect (ND) at method detection limit.

Pesticides/PCBs, Phenols, Phthalates, Chlorinated Organic Comp. and Extractables

Sample I.D.	Phenols	Phthalates						Misc. Extractables
		Dimethyl	Diethyl	Di-n-butyl	Butylbenzyl	bis(2-Ethylhexyl)	Dibenzofuran	
ug/kg (ppb)								
CB-GC-01	<3.0	11	15	32	15	30	14	
CB-GB-02	20	48	4.2	11	<1.5	26	<9.0	
CB-GC-03	14	<1.7	15	18	<1.5	17	<9.0	
CB-BC-04	<3.0	8.7	3.2	<4.7	<1.5	16	9	
CB-BC-05	10	21	5.2	<4.7	<1.5	<1.9	<9.0	
CB-BC-06	7.7	60.0	4.6	<4.7	<1.5	14.0	<9.0	
CB-BC-07	<3.0	36.0	5.6	30.0	<1.5	12.0	<9.0	
CB-BC-08	<3.0	4.3	5.1	16.0	2.5	11.0	<9.0	
CB-BC-09C	<3.0	<1.7	3.9	13	2.1	11	<9.0	
CB-BC-09F	<3.0	<1.7	6.7	17	<1.5	26	<9.0	
CB-BC-10	<3.0	17.0	<1.8	4.8	<1.5	11.0	<9.0	
CB-BC-11	2.9	22.0	<1.8	4.1	<1.5	17.0	<9.0	
CB-BC-12	<3.0	3.4	<1.8	4.2	<1.5	63.0	<9.0	
CB-BC-12A	<3.0	14.0	<1.8	3.4	<1.5	9.0	<9.0	
CB-BC-13	<3.0	8.5	<1.8	3.5	<1.5	8.8	<9.0	
CB-BC-14	<3.0	9.8	<1.8	3.8	<1.5	10.0	<9.0	
CB-BC-15	<3.0	2.3	<1.8	4.2	<1.5	9.4	<9.0	
CB-BC-15A	<3.0	<1.7	<1.8	3.3	<1.5	7.7	<9.0	
CB-BC-16	<3.0	6.8	<1.8	4.7	<1.5	9.0	<9.0	
Screening level (SL)	670	1400	1200	5100	970	8300	540	
Mean	2.9	14.4	3.6	9.1	1.0	16.2	1.2	
Maximum	20.0	60.0	15.0	32.0	15.0	63.0	14	
PCBs = ND (<23ppb, SL = 130) Pesticides = ND (<4.7ppb, SL = 10) Chlorinated Organic Compounds = ND (<2.4 ppb, SL = 13-170)								

(<) = Non-detect (ND) at method detection limit.

Polynuclear Aromatic Hydrocarbons (PAHs)

Sampled Aug. 11-12, 1998

Low Molecular Weight Analytes

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Total Low PAHs
CB-GC-01	17.0	6.9	18	9.1	5.9	28	42	136.9
CB-GB-02	10.0	<2.4	6.3	12	7.9	17	18	66.3
CB-GC-03	6.5	5.8	11	13	6.6	23	28	94.2
CB-BC-04	15.0	<2.4	9.5	8.1	7.8	11	45	100.1
CB-BC-05	7.4	<2.4	7.4	4.6	5	18	25	73.7
CB-BC-06	3.4	<2.4	4.3	<2.4	<4.0	12	16	45.3
CB-BC-07	<1.5	<2.4	<2.2	<2.4	<4.0	4.4	2.5	6.9
CB-BC-08	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	2.3	2.3
CB-BC-09C	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-09F	<1.5	<2.4	<2.2	<2.4	<4.0	8.5	9.9	18.4
CB-BC-10	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-11	<1.5	<2.4	3.1	<2.4	2.9	3.5	5.2	14.7
CB-BC-12	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-12A	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-13	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-14	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-15	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-15A	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
CB-BC-16	<1.5	<2.4	<2.2	<2.4	<4.0	<3.0	<1.5	0
Screening level	500	560	960	540	670	2100	1500	29000
Mean	3.1	0.68	3.1	3.3	2.3	6.6	10.2	
Maximum	17	6.9	18	17	8	28	42	

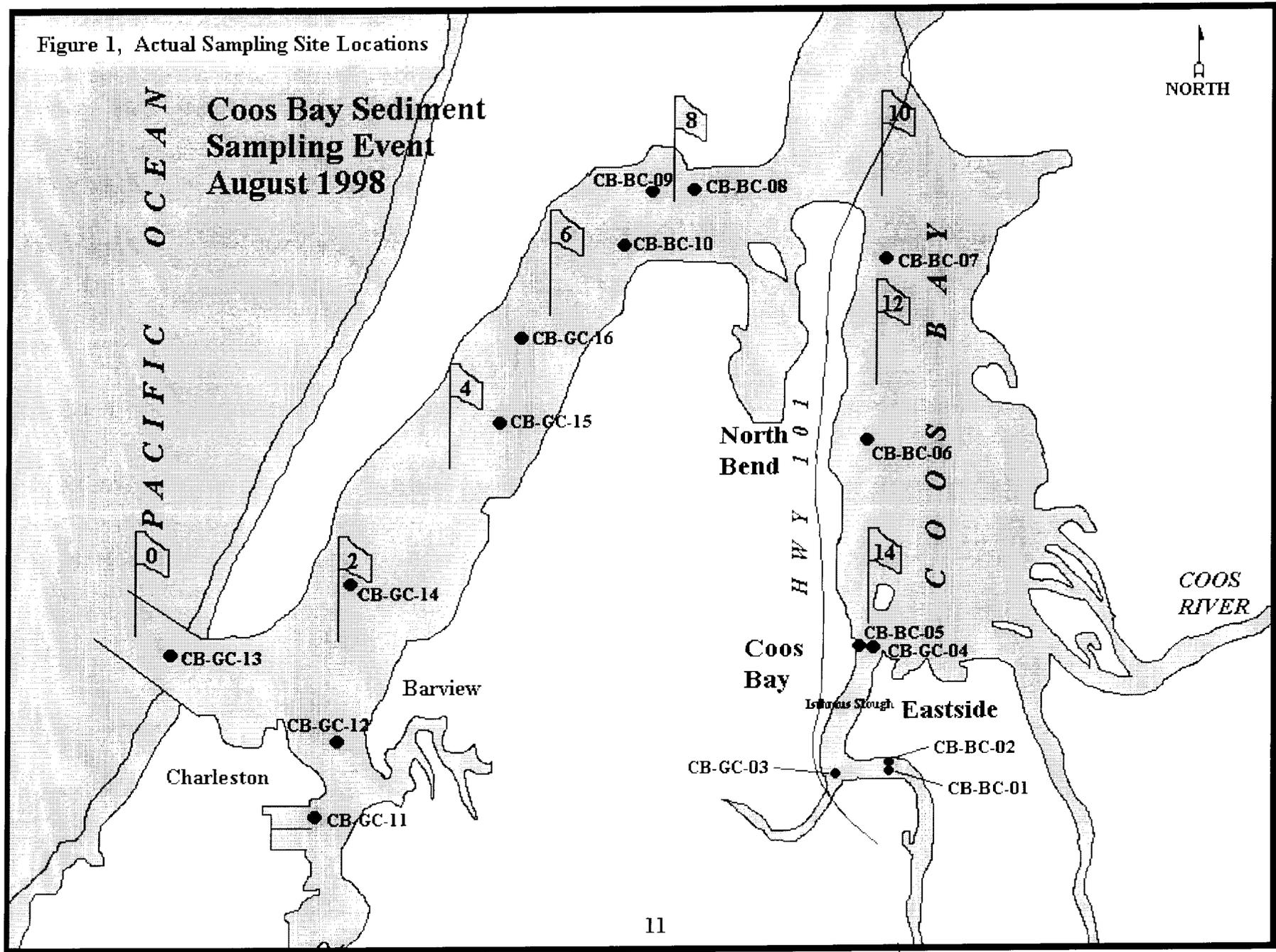
(<) = Non-detect at method detection limit.

Polynuclear Aromatic Hydrocarbons (PAHs)**High Molecular Weight Analytes**

Sample I.D.	Benzo(a)anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Pyrene	Benzo(a)pyrene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	Fluoranthene	Total High PAHs
CB-GC-01	39.0	37	5.5	<3.6	29	91	140	<3.6	<3.6	150	491.5
CB-GB-02	15.0	17	5.9	<3.6	18	48	68	<3.6	<3.6	81	252.9
CB-GC-03	20.0	18	10	<3.6	22	62	340	<3.6	<3.6	110	582.0
CB-BC-04	16.0	18	3.9	<3.6	17	52	44	<3.6	<3.6	80	230.9
CB-BC-05	15.0	10	<3.5	<3.6	19	38	57	<3.6	<3.6	54	193.0
CB-BC-06	7.4	<3.3	<3.5	<3.6	11	28	<1.4	<3.6	<3.6	32	78.4
CB-BC-07	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	4.6	4.6
CB-BC-08	2.1	<3.3	<3.5	<3.6	2.6	11	<1.4	<3.6	<3.6	9.1	24.8
CB-BC-09C	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	2.2	2.2
CB-BC-09F	<2.5	<3.3	<3.5	<3.6	<2.4	8.5	<1.4	<3.6	<3.6	11	11
CB-BC-10	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
CB-BC-11	3.9	3.3	3.5	<3.6	8.1	17	<1.4	<3.6	<3.6	19	54.8
CB-BC-12	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	2.3	2.3
CB-BC-12A	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
CB-BC-13	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
CB-BC-14	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
CB-BC-15	5.5	7.8	4	<3.6	16	9.8	5.4	<3.6	<3.6	12	60.5
CB-BC-15A	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
CB-BC-16	<2.5	<3.3	<3.5	<3.6	<2.4	<1.1	<1.4	<3.6	<3.6	<2.7	0
Screening level	1300	3200	670	1400	2600	1600	230	600	1700	12000	
Mean	6.5	5.8	1.7	<3.6	7.5	19.2	34.4	<3.6	<3.6	29.9	
Maximum	39	37	10	<3.6	29	91	340	<3.6	<3.6	150	

(<) = Non-detect at method detection limit.

Figure 1, Actual Sampling Site Locations



SEDIMENT
SAMPLING & ANALYSIS PLAN
FOR COOS BAY

August 1998

Prepared by:

Portland District
Corps of Engineers

TABLE OF CONTENTS

Section	Page
1.0 Project Description, Site History and Assessment	
1.1 Project Description	1
1.2 Site History	1
1.3 Previous Sediment Sampling	1
2.0 Sampling and Analysis Objectives	1
3.0 Sampling and Analysis Requirements	
3.1 Project Ranking	2
3.2 Sampling and analysis Requirements	2

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1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: Coos Bay is located about 200 miles south of the mouth of the Columbia River. It is the largest estuary, excepting the Columbia River estuary, in the state of Oregon. The bay is shaped like an upside down U (see map) with many side arms and extensions. There are about 30 tributaries, but the major one is the Coos River, which discharges to the bay at a point 12 miles from the estuary mouth. Shoal areas the entire length of Coos Bay will be sampled, from the mouth through river mile (RM) 14. Additional samples will be taken, two samples near RM 8 to check for Tributyltin (TBT) and polynuclear aromatic hydrocarbons (PAHs), four samples will be taken in Isthmus Slough at sites previously sampled for TBT contamination.

1.2 Site History: A Federal navigational channel is authorized for this river and extends into its 2 main branches at RM 5.5, the Millicoma River and South Fork Coos River. The channel across the outer bar (from deepwater to RM 0+40) is 47 feet deep and 700 feet wide. The size of the channel then gradually decreases to 37 feet deep and 300 feet wide at RM 0+40. These dimensions continue to RM 9.0, where it widens to 400 feet and continues to RM 15.0; it then decreases to 22 feet deep and 150 feet wide until RM 17.0. An access channel 17 feet deep and 150 feet wide runs from deep water in Coos Bay, at approximately RM 2 on the main Coos Bay channel, to the mooring basin at Charleston. The Charleston mooring basin is 17 feet deep, 500 feet wide, and 900 feet long. The south slough Channel Extension is 16 feet deep and 150 feet wide; it runs from the mooring basin to the Highway Bridge across the Slough at RM 1.3.

Two shoals typically develop on the entrance reach. The entrance shoal builds from cut lines between April and October to maintain the entrance channel. Patterns of shoaling in the Coos Bay channel occur consistently at various locations along the channel.

1.3 Previous Sediment Sampling: Sediment from the Coos Bay entrance bar is sand with an average in-place density of 1,980 grams/liter. In the bay itself, sediment tends to be mixed: sand, silty sand, silt and organic silt. Silt is found on the upper reaches of the project, from RM 12 to RM 15. The average density is 1,325 grams/liter in Isthmus Slough above RM 14.0.

Material from the upper channel has finer grained characteristics and is therefore subjected to more frequent sampling. Analyses typically include physical characteristics, heavy metals, pesticides/PCBs, and PAHs. TBT has been tested for near boat basins.

The physical analysis of sediments from the lower bay found that the material was predominantly coarse grained and suitable for unconfined in-water disposal without additional testing. Sediments dredged from below RM 12 are placed at ocean sites E and F or at the following in-bay sites. Area G, inside Coos Bay off Coos Head at approximately RM 1.2, is a relief site when conditions prevent crossing the entrance bar. The Port of Coos Bay also uses area G for maintenance material from the Charleston Boat Basin. Site 8.4 is used for sediments dredged between RM 6 and RM 12 to reduce transit times and costs. Capacity of the site is limited, and, if time allows, material is often transported to ocean disposal sites E or F. Sediment dredged from RM 12.0 to RM 15.0 is fine grained and is deposited offshore at Site H.

2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area manual.

- Collect, handle and analyze representative sediment, core and surface samples of the proposed dredging prism and areas of concern, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments sampled for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: Although this area is not a part of the DMEF management area, it will be evaluated using the criteria adopted for this manual. As stated above, the lower bay contains material that is predominantly coarse grained and fits the “exclusionary” criteria. In the bay itself, sediment tends to be mixed: sand, silty sand, silt and organic silt. Silt is found on the upper reaches of the project, from RM 12 to RM 15. Material from the upper channel has finer grained characteristics and has been subjected to more frequent sampling due to concerns of TBT contamination. Analyses typically include physical characteristics, heavy metals, pesticides/PCBs, PAHs and TBT near boat basins and areas of concern. Areas will be ranked based on analyses from this sampling event.

3.2 Sampling and Analysis Requirements: Coos Bay will be sampled using a box corer on coarse grained material and a gravity core sampling devise in areas where the sediments are less than 80 % sand. A gravity coring system collects a continuous profile of sediments below the mudline. All samples more than 20 % fines and/or 5 % volatile solids will be subjected to both physical and chemical analyses. Ten percent (minimum 1 sample) will be Quality Control blind replicate sample(s), submitted for select chemical analysis only.

4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Sampling Locations and Numbering: Figure 1 shows the project area and sample locations. Sampling sites are located for the best characterization of the material within the dredging prism as possible. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Sample identification shall follow the following convention:

CB-XX-YY (Z)

Where, CB denotes samples collected from Coos Bay, "XX" denotes the type of sampling device such as GC - gravity corer or BC for box core; "YY" denotes the numeric sample number and will consist of two digits for all samples (i.e. 01, 05, 15, etc.). For cores an alpha character (i.e. A, B, C, etc.) will be used to denote vertical location as represented here by "Z" (if applicable). The QC replicates will have the same sample number as the primary sample, with an additional "A" added (W-GC-YY-AA). Composite samples, if used, will have a combined number in the "YY" designation (i.e. sample 02 & 03 = 023, etc.).

4.2 Field Sampling Schedule: Sampling is planned for August 11-12, 1998.

4.3 Field Notes: Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Names of the person(s) collecting and logging in the samples.
- Weather conditions.

- Depth of each station sampled as measured from the water surface. This will be accomplished using a leadline or corrected depth recorder.
- Date and time of collection of each sediment sample.
- The sample station number and individual designation numbers assigned for each individual sample.
- Descriptions of sediment or core sections.
- For cores the length of core and the penetration depth of the sampling device.
- Any deviation from the approved sampling plan.

4.4 Positioning: Sampling locations will be recorded in the field using a hand held GPS. Horizontal coordinates will be referenced to the Oregon Coordinate System for proper North or South Zones NAD 83 (North American Datum 1983). Horizontal coordinates will be identified as latitude and longitude to the nearest 0.1 second.

4.5 Decontamination: All sampling devices and utensils will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox soap
- Rinse with distilled water
- Rinse with 10% HCl acid solution
- Rinse with distilled water

Sampling devices such as the gravity core sampler will be washed down before each sampling event or a pre-cleaned plastic tube insert will be used to collect these samples. However, they will not require the cleaning procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All hand work for chemical analyses will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

4.6 Core Logging: Each discrete core section will be inspected and described. For each core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from MLLW.
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratification and lenses
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7 Field Replicates: Blind field replicates will be prepared and submitted along with the rest of the samples to the laboratory. This represents about 10% of the total samples collected. Sample numbers shall be labeled

the same as the primary sample with the last letter duplicated i.e. W-XX-YY (primary), W-XX-YYA (replicate). Replicate sample locations shall be documented in the field log.

4.8 Sample Transport and Chain-of-Custody Procedures: After sample containers have been filled they will be packed on ice in coolers. Chain-of-custody procedures will commence in the field and will track delivery of the samples. Sample holding times and storage requirements are presented in Table 1. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and office name and address) to enable positive identification.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.

Upon transfer of sample possession to the laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers will be inspected and the receiver will record the condition of the samples.

Table 1, Sample Volume and Storage

Sample Type	Holding Time	Sample Size (a)	Temperature (b)	Container	Archive (c)
Particle Size	6 Months	200 g	4°C	1-1 Quart Plastic Bag	
Dioxin/Furan P-450 RGS	30 Days	10g	4°C	8-oz Glass	
Tributyltin (TBT)	14days		4°C	4-Liters	
PAH, Phenol, Phthalate, Ext.	14 Days	10g	4°C	1-Liter Glass (combined)	
Total Volatile Solids	14 Days	125 g	4°C		
Total Organic Carbon	14 Days	125 g	4°C		
Mercury	28 Days	5g	4°C		
Metals (except Mercury)	6 Months	50 g	4°C		
Pest and PCBs	14 Days	10 g	4°C		

- Required sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retest.
- During transport to the lab, samples will be stored on blue ice.
- A minimum 250-ml container is filled and frozen to run any or all of the analyses indicated.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the DNEF. The samples will be analyzed for all the parameters listed in sections 5.1.3 and 5.1.4 as requested on the chain-of-custody record. Private contract analytical chemical laboratories will conduct all physical and chemical analyses.

5.1.1 Chain-of-Custody: A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection: Detection limits of all chemicals of concern must be below screening levels. All reasonable means, including additional cleanup steps and method modifications, will be used to bring all limits-of-detection below the screening levels. In addition, an aliquot of each sediment sample for analysis will be archived and preserved at -18 C for additional analysis if necessary. Sediments or extracts will be kept under proper storage conditions until the chemistry data is deemed acceptable.

5.1.3 Sediment Chemistry: Private analytical laboratories will conduct all chemical analyses. Chemical analyses will include metals (As, Sb, Cd, Cu, Pb, Hg, Ni, Ag and Zn) (6010/7000 or 6020 series, Hg by CVAA). Total organic carbon (TOC) by method 9060. Phenols, phthalates, extractables, and polynuclear aromatic hydrocarbons (PAHs) by method 8270 and Pesticides/PCBs by method 8081. SIM method or other low level detection method to be used, if required to reach requested detection limits. All detection limits must be lower than SL indicated in draft DMEF for the Lower Columbia River Management Area.

5.1.4 Sediment Conventional: The private analytical laboratories will analyze physical parameters. Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. NO. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will use for particle sizes finer than the 230 mesh. Water content will be determined using ASTM D 2216. Sediment classification designation will be made in accordance with U.S. Soil Classification System, ASTM D 2487.

5.1.5 Holding Times: To the maximum extent practicable all chemical results will be provided within 30 days of receipt. All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 1 and analyzed within the holding times shown in the table.

5.1.6 Quality Assurance/Quality Control: The chemistry QA/QC procedures found in Table 2 will be followed.

5.2 Laboratory Written Report: The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

Table 2, Minimum Laboratory QA/QC

Analytical Type	Method Blank ²	Duplicate ²	RM ^{2,4}	Matrix Spikes ²	Surrogates ⁷
Semivolatiles ¹	X	X ³	X ⁵	X	X
Pesticides/PCBs ¹	X	X ³	X ⁵	X	X
Metals	X	X	X ⁶	X	
Total Organic Carbon	X	X	X ⁶		
Total Solids		X			
Total Volatile Solids		X			
Particle Size		X			

1. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.
2. Frequency of Analysis = one per batch
3. Matrix spike duplicate will be run
4. Reference Material
5. Canadian standard SRM-1
6. NIST certified reference material 2704
7. Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

6.0 BIOLOGICAL TESTING

6.1 Biological Testing: No biological testing will be conducted under this study, however the need for biological testing will be assessed per the DMEF.

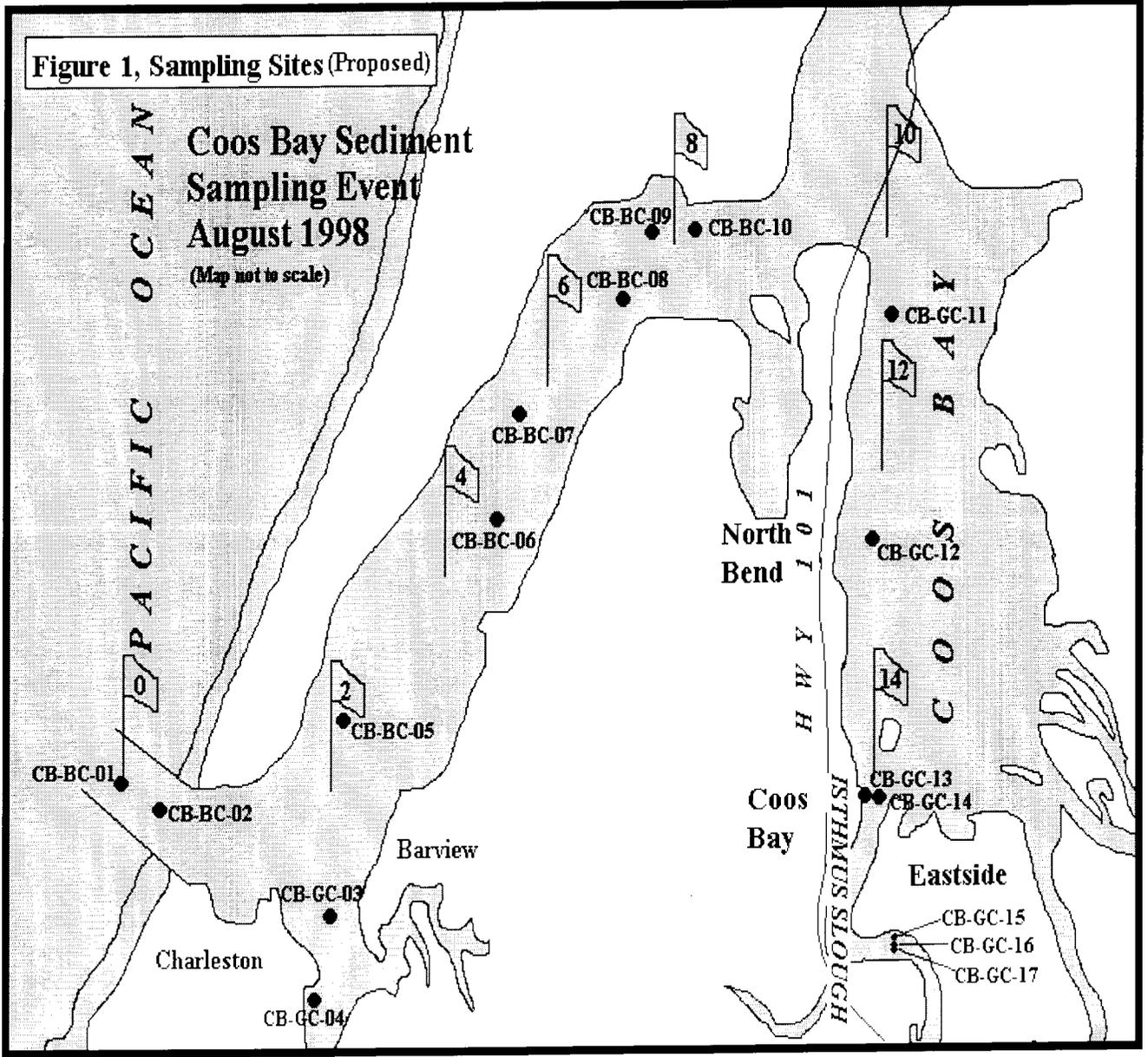
7.0 REPORTING

7.1 QA Report: The laboratory QA/QC reports will be incorporated by reference. This report will identify any laboratory activities that deviated from the approved protocols and will make a statement regarding the overall validity of the data collected.

7.2 Sediment Evaluation Report: A written discussion of findings shall be prepared documenting the physical and chemical character of potential material to be dredged. The physical and chemical reports will be included as reference; individual copies will be furnished as requested. As a minimum, the following will be included in the

- Previous sampling and analyses.
- Locations where the sediment samples were collected.
- A plan view of the project showing the actual sampling location.
- Description of sampling.
- Chemical testing data, with comparisons to screening levels guidelines.

Figure 1, Sampling Sites (Proposed)



APPENDIX A

PARAMETERS AND METHODS

1. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.
2. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Estuary Program, March 1986.
3. Recommended Methods for Measuring TOC in Sediments, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.
4. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.
5. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 3050, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.
6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
8. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 7471, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.
9. Sonication Extraction of Sample Solids - Method 3550 (Modified), SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986. Method is modified to add matrix spikes before the dehydration step rather than after the dehydration step.
10. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
11. Purge and Trap Extraction and GCMS Analysis - Method 8260, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
12. Soxhlet Extraction and Method 8081, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.
13. Total PCBs BT value in mg/kg oc.

QA2 DATA REQUIREMENTS

CHEMICAL VARIABLES

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

A cover letter referencing or describing the procedure used and discussing any analytical problems

Reconstructed ion chromatograms for GC/MS analyses for each sample

Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra

GC/ECD and/or GC/flame ionization detection chromatograms for each sample

Raw data quantification reports for each sample

A calibration data summary reporting calibration range used [and decafluorotriphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]

Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit

Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)

Quantification of all analytes in method blanks (ng/sample)

Method blanks associated with each sample

Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)

Data qualification codes and their definitions.

METALS

For metals, the data report package for analyses of each sample should include the following:

Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager

Any data qualifications and explanation for any variance from the analytical protocols

Results for all of the QA/QC checks initiated by the laboratory

Tabulation of instrument and method detection limits.

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of the

data. The laboratories should be able to supply legible photocopies of original data sheets with sufficient information to unequivocally identify:

Calibration results

Calibration and preparation blanks

Samples and dilutions

Duplicates and spikes

Any anomalies in instrument performance or unusual instrumental adjustments.