

July 1999

Coos Bay Sediment Sampling Evaluation

Abstract

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 screening levels (SL) used are those adopted for use in the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area, November 1998.

Fifteen sediment samples were collected in Coos Bay, from Charleston and the entrance channel, to the confluence of Coos River (see Figure 1) on July 1, 1999. This round of samples was collected as a follow-up to the 1998-sampling event after the petroleum spill from the ship, New Carrissa, north of the entrance channel. All 15 samples were sent to Sound Analytical Services, Inc. laboratory in Tacoma, WA, for physical analyses and a Total Petroleum Hydrocarbon – Hydrocarbon Identification (TPH-HCID) screen. The TPH-HCID analysis was selected to detect free petroleum product, in the form of “tar balls”, that might have migrated into the bay. If any free petroleum product was detected, a follow-up Polynuclear Aromatic Hydrocarbon (PAH) analysis was to be carried out. No hydrocarbons were detected; indicating no free product was present in the sample. The median grain size for all sediment was 0.23mm, with 93.2% sand, 6.1% fines and 1.47% volatile solids.

This sampling event confirms the determination made following the 1998-sampling event is still valid and that the proposed dredge material from this project continues to be 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 supplement the 1998 characterization of the sediment shoaling with-in the navigational channel in Coos Bay following the release of petroleum product from the ship, New Carrissa, north of Coos Bay entrance channel. The sampling and analysis objectives are listed below. 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 supplement the characterization of sediments done in 1998. To detect any changes in that characterization as a result of the petroleum releases from the ship, the New Carrissa. If any

petroleum products are detected, the sediment will be further analyzed for PAHs, using guidelines from the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.

- Collect, handle and analyze representative sediment, of the proposed 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 supplement the previous chemical evaluation in 1998 by screening for possible petroleum product contamination in the entrance channel, Charleston channel and the main navigational channel of the bay.

Historical Data

Coos Bay has had extensive sediment evaluation sampling events. 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. DEQ was 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.

1998 August – Sixteen sediment samples were collected in Coos Bay and Isthmus Slough, August 11-12, 1998. 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 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).

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 its 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).

1998 - 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 sites 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. All material was acceptable for unconfined open water disposal.

The Corp of Engineers regularly monitors sediment quality within Coos Bay navigational channel 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.

Current Sampling Events

The Corps of Engineers, Portland District personnel, collected 15-box core surface samples in the entrance, Charleston Channel and the main navigational channel and the confluence of Coos River. The samples were shipped to Sound Analytical laboratory of Tacoma, WA, for physical and total petroleum hydrocarbon – hydrocarbon identification (TPH-HCID). To be followed up with polynuclear aromatic hydrocarbon (PAH) analysis if any petroleum was detected. Median grain size for all samples was 0.23 mm, with 93.2% sand and 6.1% fines and 1.47% volatile solids. No petroleum was detected in the TPH-HCID analyses.

Sample CB-BC-14 and CB-BC-15 were located with input of local crab and oyster fisherman (Jerry Hampel), as areas of interest. He had experienced 80-90% loss in one oyster bed and had not determined why. Tissue analysis run on the oysters did not indicate petroleum to be at toxic levels in samples tested.

Sampling and analyses were performed using proper quality control measures, including proper procedures for chain of custody, preservation (4°C.) and cooler receipt.

Results/Discussion

Physical: Data for these analyses are presented in Table 1. Thirteen of the 15 samples submitted were classified “poorly graded sand”, with 1 sample being “silty sand” (CB-BC-01) and the remaining sample as “poorly graded sand with silt” (CB-BC-14). Median grain size for all samples was 0.23 mm, with 93.2% sand and 6.1% fines and 1.47% volatile solids. This is consistent with past sediment analysis.

Total Petroleum Hydrocarbon – Hydrocarbon Identification (TPH-HCID): The purpose of this analysis is to be able to determine if high concentrations of petroleum are present in the sediment. This is not a test method that is normally used in evaluating dredge material, but due to the free petroleum product (hydrocarbons) released from the ship, New Carrissa, it was determined to be the best screening analysis to detect the presence of crude oil. In the event hydrocarbons were detected, follow-up PAH analyses were scheduled. No hydrocarbons were detected by TPH-HCID or by visual inspection of the collected sample material.

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 has been adopted as the Dredged Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area, November 1998. The DMEF was developed in cooperation with the regional federal agencies (Corps and EPA) and state agencies (Oregon Department of Environment Quality, Washington Department Of Ecology and Department of Natural Resources). The DMEF guidelines have implemented a Tiered testing approach for compliance to the regulation criteria. Under the Tiered approach, if the chemical analytical results do not exceed the established screening levels, the material is determined suitable for unconfined in-water placement. The 1998 analyses showed only low level contamination and that water quality standards would not be exceeded during dredging and disposal. This supplemental, 1999, sampling event upholds previous assessments of the dredge material. This material continues to be acceptable for, both upland and unconfined in-water, disposal with no adverse unacceptable ecological consequences expected, following the spill event of the ship, New Carrissa. No further testing is required prior to dredging.

References

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Table 1, Coos Bay

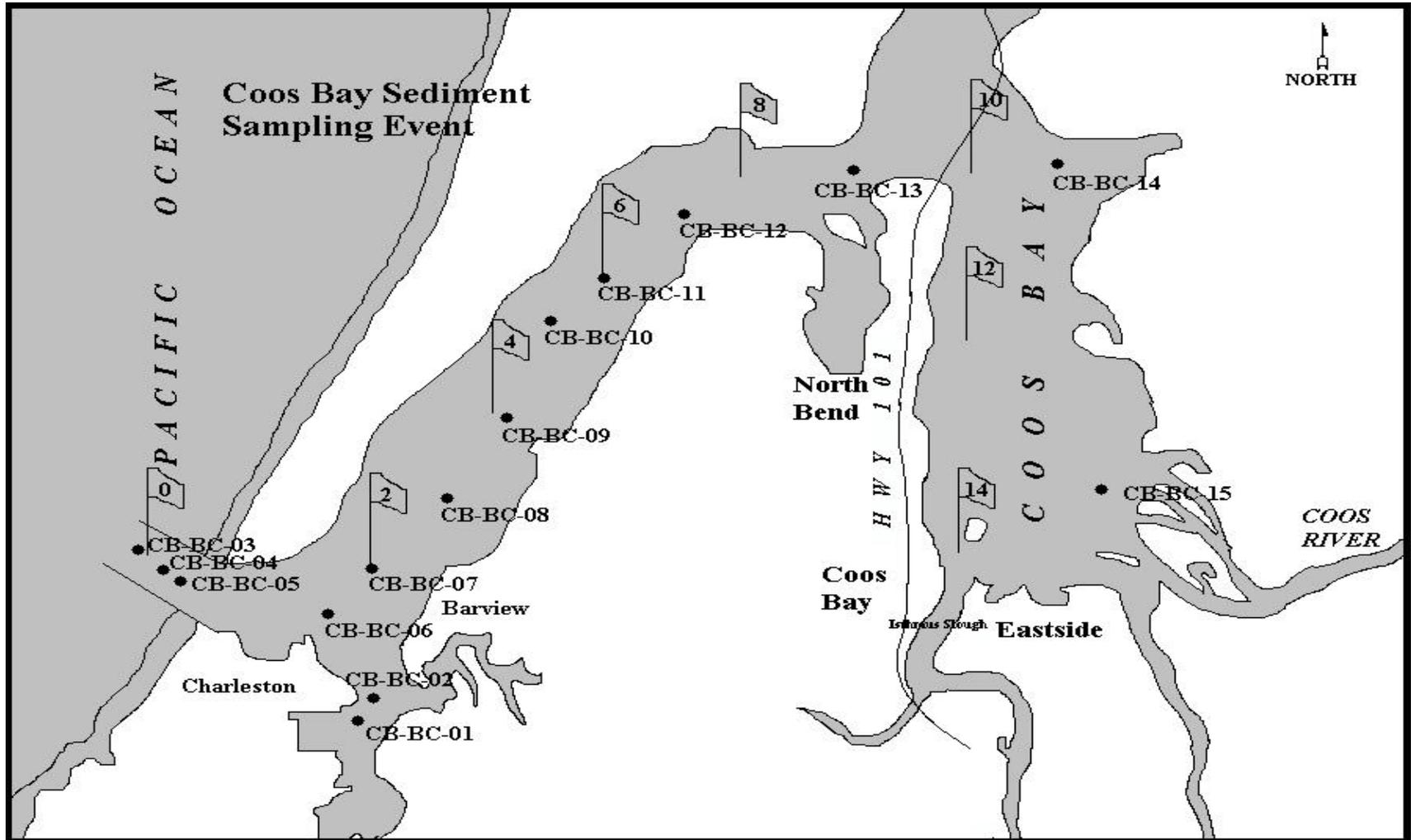
Sampled July 1, 1999

Physical Analytical

Sample I.D.	Grain Size (mm)				%					
	Median		Mean		Gravel	Sand	Silt/Clay	Volatile solids		
CB-BC-01	0.14		0.06		0.0	84.7	15.3		3.89	
CB-BC-02	0.17		0.29		0.0	98.7	1.3		0.66	
CB-BC-03	0.13		0.12		0.0	97.3	2.7		0.74	
CB-BC-04	0.20		0.21		0.0	96.7	3.3		0.49	
CB-BC-05	0.31		0.24		0.0	99.2	0.8		0.58	
CB-BC-06	0.30		0.23		0.0	98.5	1.5		0.50	
CB-BC-07	0.32		0.25		0.0	99.9	0.1		0.66	
CB-BC-08	0.30		1.16		8.7	89.3	2.0		1.04	
CB-BC-09	0.30		0.21		0.0	95.7	4.3		0.59	
CB-BC-10	0.32		0.28		0.0	99.6	0.4		0.64	
CB-BC-11	0.29		0.16		0.0	96.8	3.2		0.71	
CB-BC-12	0.27		0.15		0.0	94.4	5.6		0.85	
CB-BC-13	0.21		0.33		1.9	96.3	1.8		0.96	
CB-BC-14	0.07		0.08		0.0	54.7	45.3		8.46	
CB-BC-15	0.19		0.07		0.0	95.6	4.4		1.34	
CB-BC-15 LAB DUP	0.20		0.80		0.0	96.1	3.9		1.49	
Mean	0.23		0.26		0.7	93.2	6.1		1.47	
Minimum	0.07		0.06		0.0	54.7	0.4		0.49	
Maximum	0.32		1.16		8.7	99.9	45.3		8.46	

WTPH-HCID (Hydrocarbon Identification)

	Gasoline (Toluene-nC12)		Diesel (>nC12-NC24)		Motor Oil (>nC24-nC32)	
Sample I.D.	Mg/kg					
CB-BC-01		<24			<61	<120
CB-BC-02		<23			<57	<110
CB-BC-03		<24			<60	<120
CB-BC-04		<23			<58	<120
CB-BC-05		<23			<58	<120
CB-BC-06		<23			<57	<110
CB-BC-07		<24			<60	<120
CB-BC-08		<24			<59	<120
CB-BC-09		<22			<56	<120
CB-BC-10		<24			<60	<120
CB-BC-11		<23			<58	<120
CB-BC-12		<24			<59	<120
CB-BC-13		<23			<58	<120
CB-BC-14		<38			<96	<190
CB-BC-15		<25			<62	<120
<p>No hydrocarbons were detected at method detection limits. The WTPH-HCID hydrocarbon test is not meant to be a low level detection test. This test was conducted to determine the presence of "bulk" oil that might have entered the Bay in the form of "tar balls" and easily detected with this hydrocarbon screen test.</p>						



SEDIMENT
SAMPLING & ANALYSIS PLAN
FOR COOS BAY

July 1999

Prepared by:

Portland District
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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 14 miles from the estuary mouth. Sample site selection at Charleston and the main entrance channel are based on recent shoaling activity. The samples to be taken upstream from the entrance channel, from river mile (RM) 1 to RM 10 will be taken at random 1-mile intervals back and forth across the main navigational channel, with possible additional samples taken with input from local crab and oyster fisherman.

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 supplement the characterization of sediments done in 1998. To detect any changes in that characterization as a result of the petroleum releases from the ship, the New Carrissa. If any petroleum products are detected, the sediment will be further analyzed for PAHs, using guidelines from 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 supplement the previous chemical evaluation in 1998 by screening for possible petroleum product contamination in the entrance channel, Charleston channel and the main navigational channel of the bay.

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. Analyses typically include physical characteristics, heavy metals, pesticides/PCBs, PAHs and TBT near boat basins and areas of concern.

1.3 3.2 Sampling and Analysis Requirements: Coos Bay will be sampled using a box core surface grab sampler. Each sample will be subjected to physical analysis and total petroleum hydrocarbon identification (TPH-HCID) screen to determine the possibility of “free product”, introduced into the main channel by tidal action from the release of petroleum from the ship, New Carrissa. If petroleum products are detected in the samples collected a follow-up analysis for polynuclear aromatic hydrocarbon (PAH) will be run.

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

Where, CB denotes samples collected from Coos Bay, "XX" denotes the type of sampling device, 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.).

4.2 Field Sampling Schedule: Sampling is planned for July 1, 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 boat mounted or 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: No cores will be collected.

4.7 Field Replicates: Blind field replicates will not be prepared or submitted along with the rest of the samples to the laboratory.

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	
PAH	14 Days	10g	4°C	1-Liter Glass (combined)	
Total Volatile Solids	14 Days	125 g	4°C		
TPH-HCID	14 Days	125 g	4°C		

- a. 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.
- b. During transport to the lab, samples will be stored on ice or blue ice.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the DMEF. 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. 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 Total Petroleum Hydrocarbon – Hydrocarbon Identification (TPH-HCID) with a follow-up of polynuclear aromatic hydrocarbon (PAH) if any petroleum is detected with the hydrocarbon screen test. 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
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.

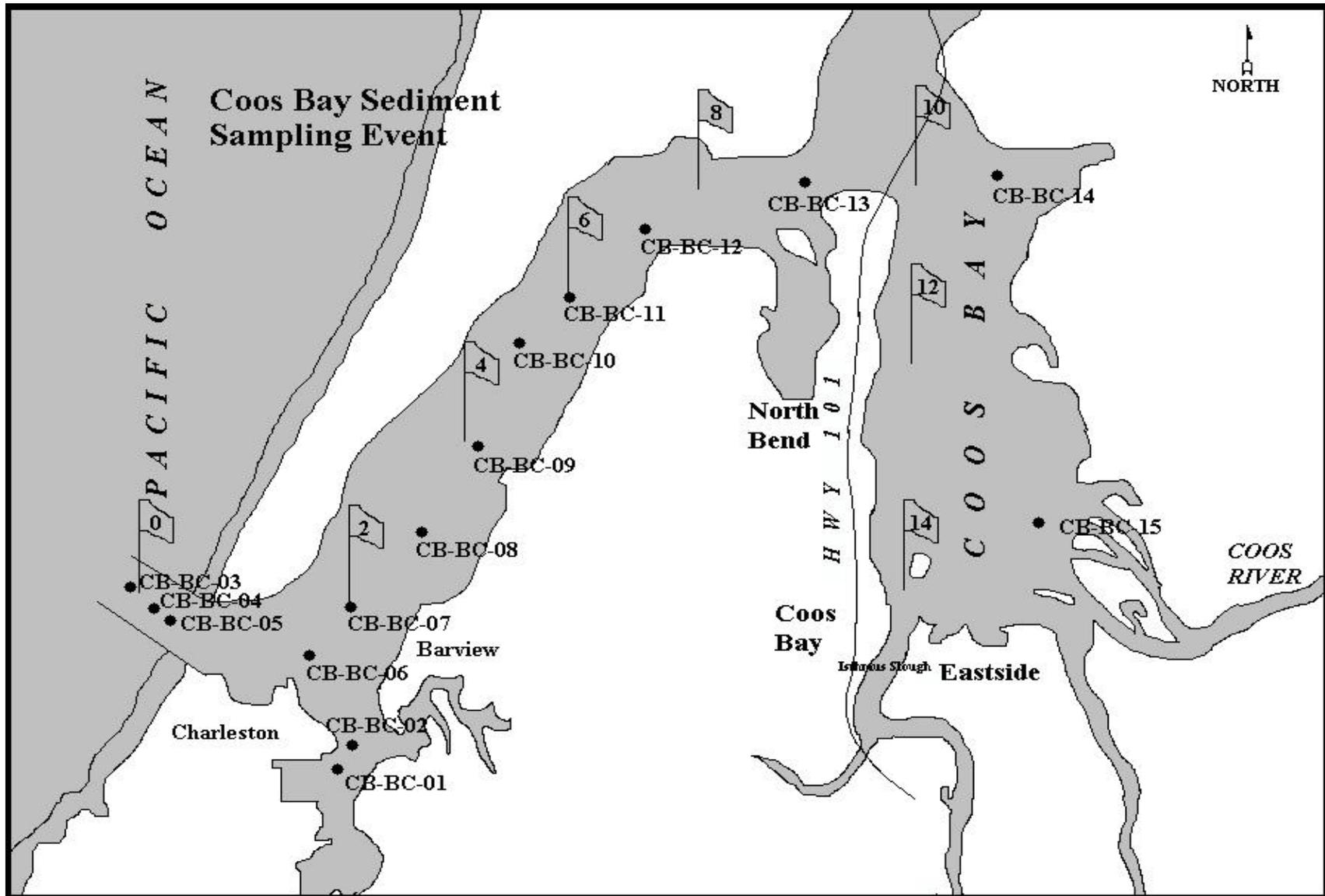
7.0 REPORTING

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



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. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.
4. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

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.