

Columbia Slough Sediment Quality Evaluation June 1999

Abstract

The Clean Water Act (CWA) of 1977, as amended regulates dredging activities and requires sediment quality evaluation, including testing, prior to dredging. Guidelines to implement 40 CFR Part 230-Section 404(b)(1) regulations of the CWA, the national Inland Testing Manual (ITM) and the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF) have adopted a tiered testing approach for the evaluation of dredge material. The Tier IIa (physical testing) and Tier IIb (chemical testing) have been completed for this evaluation. The screening levels (SL) used are those adopted in the regional manual.

The US Army Corps of Engineers, Portland District personnel with operator and boat supplied by Multnomah County Drainage District, collected 22 gravity core samples from the Upper Channel of Columbia Slough. The approximately 10-mile long study area of the upper channel of the slough was divided into 8 sampling areas. Samples collected in each area were composited and each divided, with the top representing the dredging prism and the bottom of the core representing the “newly exposed surface” after dredging is completed. The gravity corer penetrated the sediment from 3’- 5’, with retained core lengths from 2.5’ to 4.5’. With few exceptions, the newly exposed surface is cleaner than the material to be dredged. The pesticide DDT (DDD+DDE+DDT) was the only compound found in excess (7.1 to 51.3 ug/kg) of the 6.9 ug/kg SL in 10 out of 16 analyses.

The sediment in areas 1 and 2 are suitable for open in-water disposal. Sample analyses from areas 3 and 4 showed DDT in excess of the SL.

Introduction

The purpose of this report is to characterize the sediment of portions of the Columbia Slough Upper Channel for the purpose of meandering channel creation based on the sampling event described. Objectives from the sampling and analysis plan 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 characterize sediments in accordance with the regional dredge material testing manual, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF).
- 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.
- Conducted physical and chemical characterization only, unless screening levels are exceeded.

Historical Data

Numerous surface samples have been taken in the Upper Channel of the slough on various dates and numerous locations. Most of the analyses were within the SLs of the DMEF. Those analyses exceeding the SLs were 4 heavy metals (Cd, Pb, Zn, and Hg), 3 phenol groups, 2 phthalate groups, 1 alcohol and 1 pesticide.

Table 1, Contaminates Found on Previous Sampling Events - (exceeding SL)

Area	Cd	Pb	Zn	Hg	Total DDT	4-methy phenol	2,4-Dimethyl phenol	2-Methyl phenol	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate	Benzyl Alcohol	Dieldrin
	Mg/kg (ppm)				Ug/kg (ppb)							
1					12.3 8.5 12.2 9 15.6 13.1 13.8			3300 3100				
2					24.3 17.2 9.4 23 44.1 9.1 17.7 25.8 7.4 7.1 9.8						65	
3					18.4 9.2	1400						
4					19 15.5 15 17.5 9.2 8 27.9 17.9 23.1	1200 880 800	1000	460			1300	
5		510	722									
6	36 84	510 520	1320 1310	.51	13.7 36.2 9.3				11000 38000 40000 31000 59000 32000	1100		
7					9.3							
8					9.9 16.6	790			16000			20 20
SL	5.1	450	410	.41	6.9	670	29	670	8300	970	57	10

Current Sampling Event

The US Army Corps of Engineers, Portland District personnel with operator and boat supplied by Multnomah County Drainage District, collected gravity core samples from the Upper Channel of Columbia Slough on May 18-19, 1999. The Upper Channel study area was divided into 8 sampling areas (see figure 1). The eight sampling composite areas were selected to give balanced coverage to the full-length study. Twenty-two individual cores were collected and composited with 3 samples per area (except area 7, one sample only). The eight composite core samples were divided, with the top representing the dredging prism and the bottom 6" to 12", representing the "newly exposed surface" after dredging is completed.

The gravity corer penetrated the sediment from 3' - 5', with retained core lengths from 2.5' to 4.5'. With few exceptions, the newly exposed surface has chemicals of concern at lower levels than the material in the dredging prism. The pesticide DDT was the only compound found in excess of its SL (6.9 ug/kg). Of 16 samples analyzed for DDT, 10 exceeded the SL with levels ranging from 7.1 to 51.3 ug/kg.

Results/Discussion

Physical and Volatile Solids: Data for these analyses are presented in Table 2. Five of 11 samples submitted for analysis exceeded 20% fines with none exceeded 5% volatile solids. Six samples submitted were classified as "silty sand" (SM) and 4 sample was classified as "poorly graded sand with silt" (SP-SM). Median grain size for all samples is 0.15 mm, with 79.1 % sand and 20.6% fines. All samples were dark brown to dark gray in color with very little odor and no sheen. Only 3 samples contained small amounts of gravel, but the shoreline in the area was covered with gravel. It is possible that there is gravel beneath the sediment, as some gravel was caught in the sampler jaws on several occasions.

Metals and Total Organic Carbon (TOC): Data for these analyses are presented in Table 3. Low levels of some metals were found in most of the samples collected, but levels do not approach the SL. The highest level detected was for lead, which is 55.6% of the SL. Zinc was the most frequently found metal, but at levels less than 25% of the SL. Total Organic Carbon was highest in the sample located just east of the wood chip facility dock.

Pesticide/PCBs, Phenols, Phthalates and Misc. Extractables: Data for these analyses are presented in Table 4 & 5. No pesticides or PCBs were found at the method detection limits. Three phenols were detected at low levels (7.3% of SL). Six phthalates were, also, detected at low levels (8.6% of SL). Benzoic Acid and Dibenzofuran were found in 4 of the 11 samples at low levels (highest 2.1% of SL).

Polynuclear Aromatic Hydrocarbons (PAHs): Data for these analyses are presented in Tables 6 & 7. Very low levels of some individual "low molecular weight" PAHs were found in 9 of 11 samples (<2.1% of SL). The highest "Total L-PAH" detected for an individual sample was 0.1% of the SL. Very low levels of some of the "high molecular weight" PAHs were found in 6 of 11 samples (0.4% of the SL). The highest "Total H-PAH" detected for an individual sample was 0.4% of the SL.

Conclusion

Collection and evaluation of the sediment data was completed using guidelines from both the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF-LCRMA) and the Inland Testing Manual (ITM). The DMEF-LCRMA is a regional manual developed jointly with regional EPA, Corps, Oregon Dept. of Environmental Quality and Washington Depts. of Ecology and Natural Resources. The ITM is a national manual developed jointly by EPA and Corps for dredge material evaluation. These documents are guidelines for implementing the Clean Water Act, 40 CFR 230 sec 404 (b)(1).

The screening levels used are those adopted for use in the DMEF. The DMEF-LCRMA 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 suitable for unconfined in-water disposal. If the screening level for any compound of concern is exceeded, the material represented by that sample must be disposed of by either confined in-water placement (suitably capped) or placed upland (at a suitable site) or left undisturbed.

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 and Department of Ecology. 1998 Final. Dredge Material Evaluation Framework for the 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 Discharge in Inland and Near Coastal Waters – Testing Manual, dated (referred to as the “Inland Testing Manual”).
3. The Clean Water Act, 40 CFR 230 (b) (1).

Table 2, Columbia Slough GI Study

Sampled May 18-19, 1999

Physical Analysis

Sample I.D.	Grain Size (mm)			%					
	Median		Mean		Gravel	Sand	Silt/Clay	Volatile solids	
CS-GC-01A	0.07		0.07		0.10	59.3	40.5		4.61
CS-GC-01B	0.05		0.03		0.00	28.3	71.6		5.05
CS-GC-02A	0.06		0.07		0.24	45.1	54.7		3.78
CS-GC-02B	0.05		0.04		0.05	33.97	65.99		4.17
CS-GC-03A	0.07		0.06		0.00	56.3	43.7		4.33
CS-GC-03B	0.06		0.04		0.00	47.66	52.34		2.79
CS-GC-04A	0.06		0.06		0.01	50.76	49.23		4.70
CS-GC-04B	0.05		0.08		0.50	76.60	23.10		5.60
CS-GC-05A	0.04		0.08		0.00	35.66	64.34		5.96
CS-GC-05B	0.04		0.04		0.00	23.33	76.67		4.91
CS-GC-06A	0.04		0.09		0.00	28.87	71.12		5.20
CS-GC-06B	0.08		0.03		0.41	32.77	66.82		3.26
CS-GC-07A	0.03		0.06		0.00	17.27	82.73		7.73
CS-GC-07B	0.03		0.01		0.00	8.05	91.95		7.93
CS-GC-08A	0.06		0.07		0.00	34.65	65.35		9.80
CS-GC-08B	0.05		0.81		7.74	32.15	60.12		5.96
CS-GC-08B (lab dup)	0.05		0.66		9.36	32.49	56.15		6.18
Mean	0.05		0.9		0.62	38.18	61.14		5.37
Minimum	0.03		0.01		0.00	8.05	23.10		2.79
Maximum	0.08		0.81		9.36	76.60	82.73		9.80

Inorganic Metals and Total Organic Carbon

Sample I.D.	As	Sb	Cd	Cu	Pb	Hg	Ni	Ag	Zn	TOC
	mg/kg (ppm)									
CS-GC-01A	3.3	<70	1	33	<11	<.11	13	0.61	110	13000
CS-A (DUP -01A)	3.7	<70	0.74	23	<11	<.11	18	0.29	120	14000
CS-GC-01B	6	<70	0.75	38	<11	<.11	17	0.67	110	13000
CS-GC-02A	3.3	<70	0.49	29	<11	<.11	17	0.39	73	8400
CS-GC-02B	2.1	<70	0.29	29	<11	<.11	17	0.34	59	8600
CS-GC-03A	2.8	<70	0.79	31	<11	<.11	16	0.44	99	15000
CS-GC-03B	2.2	<70	0.47	24	<11	<.11	13	0.27	72	5800
CS-GC-04A	3.1	<70	0.77	30	<11	<.11	23	0.39	130	16000
CS-GC-04B	2	<70	0.4	22	<11	<.11	11	0.27	61	11000
CS-GC-05A	3.8	<70	1.1	53	42	0.31	26	0.41	130	21000
CS-GC-05B	2.8	<70	0.6	45	<11	<.11	18	0.39	79	16000
CS-GC-06A	3.8	<70	0.71	29	<11	<.11	17	0.5	110	15000
CS-GC-06B	2.6	<70	0.33	29	<11	<.11	13	0.35	70	7400
CS-GC-07A	4.3	<70	1.1	43	55	0.16	23	0.54	160	27000
CS-GC-07B	4.9	<70	2.3	38	24	0.21	17	0.59	130	22000
CS-GC-08A	3.1	<70	1.3	38	37	<.11	19	0.53	170	33000
CS-GC-08B	3.6	<70	0.82	33	51	<.11	23	0.49	140	21000
Screening level (SL)	57	150	5.1	390	450	0.41	140	6.1	410	
Mean	3.4	ND	0.82	33.35	12.29	0.04	17.7	0.44	107.2	
Maximum	6.0	ND	2.3	53	55	0.31	26	0.67	170	
Symbol (-) = Indicates analysis not run.										
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)										

Table 4, Columbia Slough GI Study

Sampled May 18-19, 1999

Pesticides/PCBs

Sample I.D.	Pesticides												
	ug/kg (ppb)												
	4,4'- DDD	4,4'- DDE	4,4'- DDT	Total DDT	Aldrin	Dieldrin	Alpha -BHC	Delta- BHC	Endosulfan 1	Endrin	Endrin aldehyde	Hepta chlor	Hepta chlor epoxide
CS-GC-01A	<0.58	<u>2.1</u>	<2.0	<u>2.1</u>	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-A (DUP-01A)	<u>1.8</u>	<u>3.5</u>	<2.0	<u>5.2</u>	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-01B	<0.33	<0.69	<2.4	ND	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-02A	<u>2.8</u>	<u>2.5</u>	<1.8	<u>5.3</u>	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-02B	<0.26	<0.54	<1.9	ND	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-03A	<u>4.3</u>	<u>6.5</u>	<2.2	10.8	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-03B	<u>1.9</u>	<u>2.8</u>	<1.8	4.7	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-04A	<u>5.5</u>	<u>8.9</u>	<2.1	14.4	<0.12	<0.11	<0.12	<0.12	<u>1.2</u>	<0.19	<u>12</u>	<0.16	<0.26
CS-GC-04B	<u>1.7</u>	<u>1.3</u>	<1.7	3.0	<0.12	<0.11	<0.12	<u>0.37</u>	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-05A	<u>14</u>	<u>17</u>	<2.4	31.0	<u>1.6</u>	<u>0.94</u>	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<u>0.46</u>
CS-GC-05B	<u>3.9</u>	<u>7.4</u>	<2.1	11.3	<0.12	<0.11	<0.12	<0.12	<0.51	<0.19	<1.4	<0.16	<0.26
CS-GC-06A	<u>6.3</u>	<u>8.6</u>	<2.4	14.9	<0.12	<0.11	<u>0.39</u>	<0.12	<u>0.72</u>	<0.19	<1.4	<0.16	<0.26
CS-GC-06B	<u>2.8</u>	<u>4.3</u>	<1.7	7.1	<0.12	<0.11	<0.12	<u>0.24</u>	<0.51	<0.19	<1.4	<u>0.17</u>	<0.26
CS-GC-07A	<u>14</u>	<u>29</u>	<3.2	43.0	<0.12	<0.11	<u>0.71</u>	<0.12	<0.51	<0.19	<u>5.1</u>	<0.16	<u>0.58</u>
CS-GC-07B	<u>16</u>	<u>22</u>	<u>3.9</u>	41.9	<0.12	<0.11	<0.12	<0.12	<u>1.1</u>	<0.19	<1.4	<0.16	<0.26
CS-GC-08A	<u>21</u>	<u>25</u>	<u>5.3</u>	51.3	<0.12	<u>1.2</u>	<u>0.47</u>	<0.12	<0.51	<u>1.2</u>	<1.4	<0.16	<u>1.8</u>
CS-GC-08B	<u>12</u>	<u>16</u>	<u>5.5</u>	33.5	<0.12	<u>1.0</u>	<u>0.55</u>	<0.12	<0.51	<u>0.78</u>	<u>2.9</u>	<0.16	<u>1.7</u>
Screen level (SL)	DDD + DDE + DDT =			6.9	10	10	*	*	*	*	*	*	*
Mean	6.4	9.2	0.9	16.5	0.94	0.18	0.04	0.04	0.14	0.07	1.18	0.01	0.26
Maximum	21	25	5.5	51.3	1.6	1.2	0.71	0.37	1.2	1.2	12	0.17	1.8
Values detected for DDT were confirmed with second column.													
PCBs = Non-detect (ND) <19.0 ppb (SL = 130 ppb).													
* SL has not been established.													
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)													

Phenols, Phthalates and Extractables

Sample I.D.	Phenols			Phthalates					Extractables		
	ug/kg (ppb)										
	Penta chloro phenol	3-&4- Methyl phenol	Phenol	bis(2- Ethylhexzyl phthalate	Dimethyl phthalate	Di-n-butyl phthalate	Diethyl phthalate	Butylbenz yl phthalate	Dibenzo furan	Benzoic Acid	Benzyl Alcohol
CS-GC-01A	110	4.8	<9.7	130	4	21	33	<11	<2.9	23	<4.3
CS-A (DUP-01A)	<1.9	3.3	<9.7	59	11	11	14	28	<2.9	26	<4.3
CS-GC-01B	90	8.9	23	6.9	<13	7.9	7.9	<11	<2.9	<7.1	<4.3
CS-GC-02A	41	<1.6	<9.7	23	<13	9.2	22	<11	<2.9	<7.1	<4.3
CS-GC-02B	48	<1.6	14	18	<13	14	34	<11	<2.9	13	<4.3
CS-GC-03A	75	25	17	210	2.7	11	<4.7	14	<2.9	210	4.3
CS-GC-03B	44	3.5	7.8	28	<13	4.7	<4.7	<11	<2.9	370	<4.3
CS-GC-04A	61	3.9	<9.7	310	3.4	40	24	130	<2.9	19	<4.3
CS-GC-04B	34	3.7	10	11	<13	10	14	<11	<2.9	120	4.6
CS-GC-05A	<1.9	<1.6	<9.7	710	14	460	80	<11	7.2	<7.1	<4.3
CS-GC-05B	<1.9	<1.6	<9.7	210	<13	29	11	<11	<2.9	<7.1	<4.3
CS-GC-06A	<1.9	7.7	<9.7	190	3.2	39	29	15	<2.9	16	<4.3
CS-GC-06B	<1.9	<1.6	<9.7	29	<13	29	9	<11	<2.9	12	<4.3
CS-GC-07A	74	<1.6	<9.7	230	3.7	12	<4.7	<11	4.7	16	<4.3
CS-GC-07B	<1.9	<1.6	<9.7	200	<13	<3.5	<4.7	<11	<2.9	8.7	<4.3
CS-GC-08A	<1.9	7.2	<9.7	480	7.5	110	56	<11	<2.9	56	<4.3
CS-GC-08B	<1.9	<1.6	<9.7	230	4.4	25	11	<11	<2.9	<7.1	<4.3
Screen level (SL)	400	670	420	8300	1400	5100	1200	970	540	650	540
Mean	33.9	4	4.2	180.9	3.2	49	20.3	11	0.7	52.3	0.52
Maximum	110	25	23	710	14	460	80	130	7.2	370	4.6

Values detected for DDT were confirmed with second column.

PCBs = Non-detect (ND) <18.0 ppb (SL = 130 ppb).

Chlorinated Herbicides (Method 8151) = Non-detect (ND) <19.0 ppb, (SL has not been set).

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)

Polynuclear Aromatic Hydrocarbons (PAHs)
Low Molecular Weight Analytes
ug/kg (ppb)

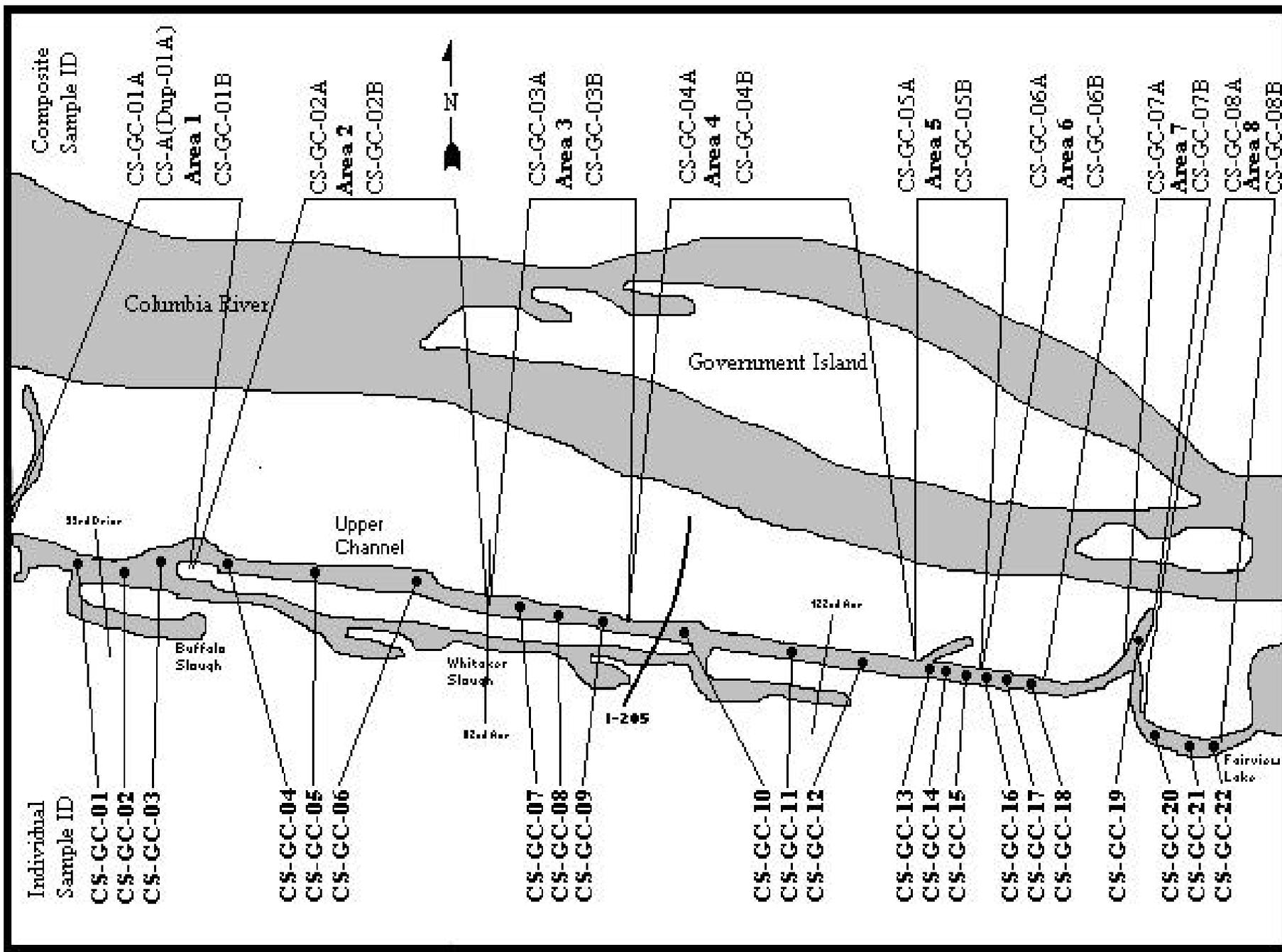
Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phenanthrene	Total Low PAHs
CS-GC-01A	3.3	9.4	7.5	4.4	3.1	7.7	35	70.4
CS-A(DUP-01A)	<1.9	10	7.5	<2.4	<2.3	3.5	32	53
CS-GC-01B	<1.9	13	4.6	<2.4	<2.3	<2.0	19	36.6
CS-GC-02A	11	<2.3	4.5	<2.4	<2.3	<2.0	16	31.5
CS-GC-02B	<1.9	<2.3	<2.3	<2.4	<2.3	<2.0	3.4	3.4
CS-GC-03A	<1.9	9.6	5.9	<2.4	<2.3	3.4	26	44.9
CS-GC-03B	<1.9	<2.4	<2.3	<2.4	<2.3	<2.0	6.5	6.5
CS-GC-04A	<1.9	<2.4	3	<2.4	<2.3	<2.0	9.6	12.6
CS-GC-04B	<1.9	<2.4	<2.3	<2.4	<2.3	<2.0	2.3	2.3
CS-GC-05A	9.3	<2.4	22	23	<2.3	<2.0	61	115.3
CS-GC-05B	<1.9	5	4.1	4.3	<2.3	<2.0	13	26.4
CS-GC-06A	14	130	82	14	<2.3	5.6	360	605.6
CS-GC-06B	<1.9	4.3	<2.3	<2.4	<2.3	<2.0	8	12.3
CS-GC-07A	6.1	11	14	9.4	3.7	18	59	121.2
CS-GC-07B	<1.9	3.6	<2.3	3.6	<2.3	<2.0	13	20.2
CS-GC-08A	5.7	8.8	15	9.1	5.3	7.9	47	98.8
CS-GC-08B	3.6	4.1	9.3	4.4	<2.3	3.3	55	79.7
Screen level (SL)	500	560	960	540	670	2100	1500	29000
Mean	3.1	12.3	0.24	4.2	0.7	2.9	45	
Maximum	11	130	82	23	5.3	18	360	

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)

Polynuclear Aromatic Hydrocarbons (PAHs)
High Molecular Weight Analytes
ug/kg (ppb)

Sample I.D.	Benzo(a) anthracene	Benzo(b) fluoroanthene	Benzo(k) fluoroanthene	Benzo(g,h,i) perylene	Chrysene	Pyrene	Benzo(a) pyrene	Dibenz(a,h) anthracene	Indeno (1,2,3-cd) pyrene	Fluoranthene	Total High PAHs
CS-GC-01A	30	8.8	38	46	59	110	45	<2.2	40	81	457.8
CS-A(DUP-01A)	17	260	88	<2.1	24	63	<2.1	<2.1	<2.1	58	510
CS-GC-01B	9.9	<2.5	11	25	20	48	18	<2.5	15	42	188.9
CS-GC-02A	16	18	9.9	25	19	45	7.3	<1.9	14	46	200.2
CS-GC-02B	<2.1	<2.1	<2.1	<2.1	<2.1	5.2	<2.1	<2.1	2.5	5	12.7
CS-GC-03A	20	37	15	32	34	72	24	<2.3	22	64	320
CS-GC-03B	5.2	14	6.6	9.7	11	15	<1.9	<1.9	8	18	87.5
CS-GC-04A	11	21	6.6	16	19	29	11	<2.3	10	27	150.6
CS-GC-04B	4.1	<1.9	<1.9	4.3	<1.9	19	<1.9	<1.9	<1.9	23	50.4
CS-GC-05A	56	70	31	62	91	130	93	<2.6	45	150	728
CS-GC-05B	14	<2.0	<2.0	<2.0	10	29	24	<2.6	<2.0	28	105
CS-GC-06A	370	440	120	460	490	1300	540	<2.6	300	1100	5120
CS-GC-06B	3.5	10	2.9	9.2	5.1	13	10	<2.0	6.4	18	78.1
CS-GC-07A	28	31	12	42	35	57	36	<3.4	30	99	370
CS-GC-07B	6.6	<3.0	<3.0	14	11	31	<3.0	<3.0	<3.0	27	89.6
CS-GC-08A	47	<3.1	<3.1	48	84	110	57	<3.1	27	120	493
CS-GC-08B	35	47	16	28	58	97	<2.6	<2.6	<2.6	120	401
Screen level (SL)	1300	3200		670	1400	2600	1600	230	600	1700	12000
Mean	39.6	77.3		48.3	57.1	127.8	50.9	ND	30.5	119.2	
Maximum	370	560		460	490	1300	540	ND	300	1100	

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit)



SEDIMENT
SAMPLING & ANALYSIS PLAN
FOR THE
COLUMBIA SLOUGH GI STUDY

May 1999

Prepared by:

Portland District
Corps of Engineers

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1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: The proposed project would improve the ecosystem along the upper Columbia Slough main channel, developing emergent marsh habitat, and a meander channel. This would be accomplished by dredging the main channel, placing the dredged material (if suitable) near shore to create benches at the base of the levee or bank. This construction would be as a confined area disposal (CAD) or as inwater disposal. If dredged sediment is not deemed suitable for inwater or CAD it would have to be disposed of upland, at an appropriate site. This effort would not only create habitat, but would also improve water quality by decreasing water temperature through increased main channel depth and through shade provided by the vegetation.

The proposed modification covers portions of a 10-mile length of the Columbia Slough (from MCDD 1 to MCDD 4 and Fairview Lake) located in Multnomah County north of Portland, Oregon. During this study, up to 150,000 CY of sediment will be dredged. The Dredge Material Evaluation Framework (DMEF) requires 1 sample for every 20,000 CYs of “moderate” ranked “heterogeneous” sediment dredged. This will require 8 sediment cores to be taken from the dredging prism and 1ft below. To have better coverage of the 10-mile length of the study area it was divided into eight areas. Each area will be sampled three times (except #7, only once) the cores from each area will be combined into one composite core. Each composite core will be sampled 2 times, one from the surface to the base of the dredging prism (4’) and the second one-foot below the dredging prism. These two segments of the core will be subjected separately to physical and chemical analyses. Each of the 8 areas, except #7, contains surface samples that exceed the screening levels adopted in the DMEF.

1.2 Site History: The Columbia Slough historically has been a vital part of the Columbia River floodplain water management. It is an 18-mile long complex of narrow and shallow channels located on the southern floodplain of the Columbia River between Fairview Lake and the Willamette River. Levees and flood control measures constructed by the Corps of Engineers enable the land in the floodplain to be more effectively used by eliminating its subjection to annual flooding. These measures reduced the flood threat, eliminated inflow of water from the Columbia River, allowed more intensive land uses to occur but also degraded the natural ecosystem of Columbia Slough. Wetland habitat was lost because annual spring freshets no longer wash over the slough floodplain. Riparian habitat was lost when stream banks were built up as levees and maintained with little vegetation cover. The Slough sediment has become contaminated through misuse from industrial (discharge), agricultural (herbicides, pesticides and fertilizers), municipal (i.e. combined sewer outfalls, airport de-icing) and private (septic system failures) entities.

1.3 Previous Sediment Sampling: The City of Portland Bureau of Environmental Services (BES) has collected numerous surface sediment samples in the upper slough. Contaminates that exceeded the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF-LCRMA) screening levels contained the following list of contaminants: 2,4-Dimethylphenol, 2-Dimethylphenol, 4-Methylphenol, Benzoic Acid, Bis(2-Ethylhexyl) Phthalate, Butylbenzyl Phthalate, Cadmium, Dieldrin, Lead, Mercury, Pentachlorophenol, and Zinc. Values ranged from slightly over screening levels (SL) to five times SL and in a few cases greater than 5 times the SL. There have been no known core samples taken to characterize the subsurface sediments.

2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the DMEF-LCRMA Testing Manual.
- Collect, handle and analyze representative sediment core samples of the proposed dredging prism and below, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted during this sampling event.

3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: While this area has not been ranked under the DMEF-LCRMA, it would most likely fall into the moderate ranking, based on data received from BES. The planned sampling schedule of 8 core samples will meet or exceed that necessary for the moderate ranking (see paragraph 3.2 below).

3.2 Sampling and Analysis Requirements: Material to be dredged from the Columbia Slough will be sampled using a gravity core sampling device. A gravity coring system collects a continuous profile of sediments below the mudline. All areas will be subjected to chemical and physical analyses. The areas to be sampled will correlate with the known surface contamination that exceeded SLs. The purposed volume of dredge material of 150,000 cys, at a moderate ranking, would require 6-8 (depending on soil homogeneity) core samples to be obtained. Two samples will be collected from each core obtained. The first sample for analysis will be from the surface to the dredging prism depth (4'). The second sample, taken from one foot below prism depth, will be analysis to represent the new surface after dredging has been completed.

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. Potential point sources of contamination (i.e. Combined Sewer Overflows, industrial discharge) and past sampling analysis within the study area are factors in sample location. 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:

CS-XX-YYZ

Where, CS denotes samples collected from the Columbia Slough, "XX" denotes the type of sampling device such as VC-vibracore, GC-gravity corer, P-ponar; "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". The core will be sampled in two sections, from the surface to prism depth and one foot below prism depth. The two samples will be analyzed for chemical and physical analysis. The following convention will be followed. The surface section will be labeled CS- XX-YYA, the bottom section CS-XX-YYB.

4.2 Field Sampling Schedule: Sampling is planned for May 19, 1999.

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.

- Core length 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. Horizontal coordinates will be referenced to the Oregon Coordinate System for proper North or South Zones NAD 27 (North American Datum 1927). 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% nitric acid solution
- Rinse with distilled water

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 Columbia River Datum.
- 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: One 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, without the sample number, but with the last letter duplicated i.e. CS-XX-A (primary), CS-XX-AA (replicate). Replicate sample locations and primary duplicate 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 iced 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
Particle Size	6 Months	200 g	4°C	1-1 Quart Plastic Bag
Total Solids	14 Days	125 g	4°C	1-Liter Glass (combined)
Total Organic Carbon	14 Days	125 g	4°C	
Metals (except Mercury)	6 Months	50 g	4°C	
Mercury	28 Days	5 g	4°C	
PAHs, Phthalates, Phenols, Misc. Extractables, Chlorinated Organic Comp.	14 Days until extraction 40 Days after extraction	10 g	4°C	
Pesticides 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 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 Dredge Material Evaluation Framework for the Lower Columbia River Management Area, final November 1998, with recommended protocols except as amended by this sampling plan. The samples will be analyzed for all the parameters requested on the chain-of-custody record. Private contract analytical chemical and physical laboratories will conduct all 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 (6010/7000 or 6020 series), total organic carbon (TOC) method 9060, polynuclear aromatic hydrocarbons (PAHs), chlorinated organic compounds, phthalates, phenols and misc. extractables (listed on back of chain of custody) 8270 SIM method or other low detection method, and pesticides/PCBs by method 8081.

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 28 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 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 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-LCRMA.

7.0 REPORTING

7.1 QC Report: The laboratory 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 report.

- 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.

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.