US Army Corps of Engineers ®
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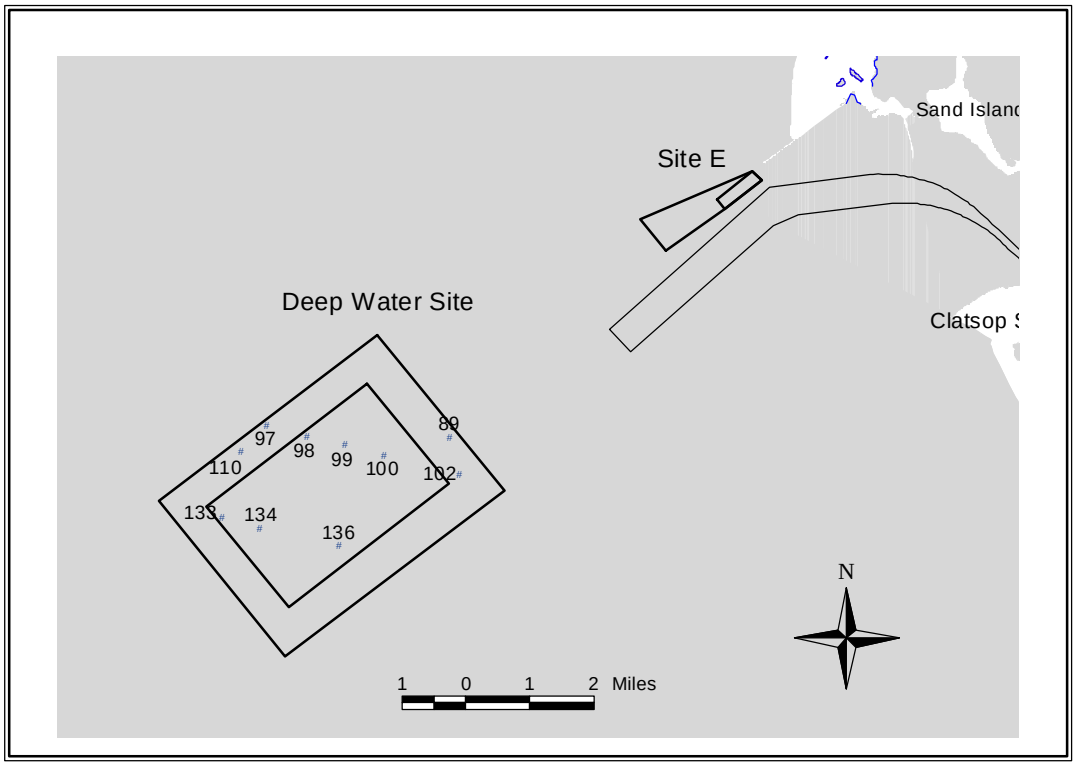
MCR ODMDS DEEP WATER SITE BASELINE SEDIMENT CHARACTERIZATION STUDY



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CHARACTERIZATION STUDY

Portland District

U.S. ARMY CORPS OF ENGINEERS

DRAFT REPORT

By Laura Hamilton, Environmental Engineer

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INTRODUCTION:

Sediment and water quality analyses of ocean dredge material disposal sites (ODMDS) are required to adequately address general criterion (b) and specific factors 4, 9, and 10 of 40 CFR 228.5 and 228.6. The lack of adequate baseline data for the MCR Deep Water Site was noted in Appendix H, Volume I: Ocean Dredged Material Disposal Sites Main Report and Technical Exhibits Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia and Lower Willamette River Federal Navigation Channel (USACE, 8/99), pg H-5. To supply this lack, ten samples were collected on September 12, 2000 in the Deep Water Site and physical and chemical analyses are performed to establish baseline conditions. Using these analyses, this report provides the baseline conditions for the MCR Deep Water Site, which is being considered as a possible ODMDS site for Columbia River dredge materials. The sediment and water quality analyses of the proposed dredge material are not addressed in this report, since this information is available in other studies.

The Marine Protection, Research and Sanctuaries Act (MPRSA) require that five general criteria and eleven specific factors be addressed during the designation process (40CFR 228.5 and 228.6). These criteria and factors have been interpreted as 27 different "areas of consideration" that cover the proposed ODMDS site and the dredged material it receives. These areas of consideration are listed in an ODMDS conflict matrix, which is used to evaluate each candidate site on its compliance with the requirements for disposal site designation. The conflict matrix is listed in Tables 4-12 of Appendix H of the Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia and Lower Willamette River (USACE, 8/99), pg H45-55. The results of the candidate ODMDS conflict matrixes are compared with each other, and are used to select the best ODMDS. The areas of consideration involving sediment baseline characterization in this study are:

1. Physical and chemical sediment compatibility,
2. Influence of past disposal,
3. Degraded areas

This report only discusses in detail the physical and chemical baseline sediment character of the Deep Water Site. No past disposal of dredge material has occurred within the boundaries of the Deep Water Site. No degraded areas were identified.

BASELINE SEDIMENT QUALITY INFORMATION:

The baseline sediment quality data for the MCR Deep Water Site was collected from seven studies offshore of the Mouth of the Columbia River area spanning from 1974 to September 2000 (See Table 1). All seven studies covered various locations offshore, such as ODMDS Areas A, B, E, F and Southwestern Washington Inner Continental Shelf.

The September 1, 2000 sampling event was conducted specifically to establish baseline physical and chemical conditions at the MCR Deep Water Site. There were ten sample stations strategically located across the Deep Water Site to gain the best coverage of the site, as shown on Figure 3. The samples were subjected to physical sediment analysis and chemical analysis for metals and organics. The organic analyses include chlorinated hydrocarbons, phthalates, phenols, pesticides, polynuclear aromatic hydrocarbons (PAHs), miscellaneous extractables, and other organics. The September 1, 2000 samples' physical and chemical analyses data are shown on Tables 2 through 10.

The October/November 1995 and June 1996 studies were conducted to identify the benthic infauna and sediment characteristics offshore from the Columbia River (Hinton, S., 1998). There were a total of 39 stations, each sampled twice for physical analyses and biological analyses.

The August 1994 and July 1993 studies were conducted to identify the benthic infauna and sediment characteristics offshore from the Columbia River (Hinton, S., 1996) There were a total of 30 stations, each sampled twice for physical analyses and biological analyses.

The Tongue Point 1989 – 1992 monitoring program study (Siipola, M., 1993) was performed to assess environmental impacts of placing dissimilar sediments on the coarser ambient sediments at disposal site F. As shown on Figure 1, disposal site F is very close to the Deep Water Site. The Tongue Point samples at Site F were collected over four years at depths ranging from 100 to 170 ft. Physical analysis was conducted on all samples collected with chemical analyses conducted on selected samples.

The July 1992 study (Siipola, M, 1992) was conducted to identify benthic invertebrate and sediment characteristics over a large area offshore of the Columbia River. Fifty one stations were sampled from approximated 10 mile north and south of the mouth of the Columbia River. All were subjected to benthic infauna, physical, and chemical analysis for methals. Thirty-two were analyzed for pesticides and PCBs, six four PAHs and 11 for dioxins/furans.

The earliest and most extensive sampling event was the 1974-1976 Aquatic Disposal Field Investigations of the Columbia River Disposal conducted as part of the US Army Engineers Dredged Material Research Program (Holton, R. 1978). This study was performed as part of a comprehensive nationwide study to provide more definitive information on the environmental impact of dredging and dredge material disposal operations and to develop new or improved dredged material disposal practices. This multidisciplinary study also was to characterize the baseline physical, chemical, and biological aspects of the nearshore zone. According to Table C-IA from Appendix C of the study, a total of 391 stations were sampled during the field study. Samples were

collected at each station and analyzed for physical analyses of the sediments, chemical analyses of the water column and/or biological analyses.

A summary of tests results for the seven studies are shown on Tables 2 through 10 and will be discussed in the following section. Figures 1 shows a general overview of the MCR ODMDS disposal sites. Figure 2 shows the sample locations for various studies at or near MCR ODMDSs. Figures 3-9 show the sampling station locations for the seven individual studies with stations in or near the Deep Water Site. Basic information about these studies and their maps are listed in summary Table 1 shown below.

TABLE 1
SUMMARY OF STUDIES
AT THE DEEP WATER SITE

DATE	SAMPLE NAMES in this report	TOTAL # OF SAMPLES	WHO PERFORMED	NAME OF REPORT	MAP
9/1/00	89, 97-100, 102, 110, 133-4, 136	10	USACE	This report.	Figure 3
1997-8	67-8; 46	Attempted 100 stations, but obtained only 95.	USGS; WDOE	Sidescan-sonar Surface Sidement Samples, and Surficial Geologic Interpretation of the SW WA. Inner Continental Shelf Based on Data Collected During Corliss Cruises 97007 and 98014	Figure 4
6/96	32-36	39	USACE and NMFS	Benthic infauna and Sediment Characteristics offshore from the Columbia River, Oct/Nov. 1995 and June 1996 by NMFS.	Figure 5
10-11/ 95	32-36	39	USACE and NMFS	Benthic infauna and Sediment Characteristics offshore from the Columbia River, Oct/Nov. 1995 and June 1996 by NMFS.	Figure 5
8/94	52-60; A4 A7& B2	30	USACE and NMFS	Benthic Infauna and Sediment Characteristics offshore from the Columbia River, Aug. 1994 By NMFS.	Figure 6
7/93	52-60; A4 A7& B2	30	USACE and NMFS	Benthic Infauna and Sediment Characteristics offshore from the Columbia River, Aug. 1994 By NMFS.	Figure 6
7/92	40-42, 44-46	51	USACE and USEPA	Reconnaissance Level Benthic Infaunal, Sediment, and Fish Study offshore of the Columbia River, July, 1992	Figure 7
1989-92	A1, A4, A7; B2, B3, B5 and B6	29	USACE and NMFS	Tongue Point Monitoring Program 1989-1992 Final Report	Figure 8
1974-76	12-19, 47, 54-56, 69-70	391*	USACE – Waterways Experiment Station	Aquatic Disposal Field Investigations Columbia River Disposal Site, Oregon.	Figure 9

*Based on Table C-IA “Station Data for Smith-McIntyre Grab Samples” from Appendix C

SEDIMENT QUALITY PARAMETERS:
In order to adequately assess the areas of consideration, seven sediment studies were reviewed that had been performed over 17 years in the various locations offshore of the Columbia River and MCR ODMDS. These sediment studies provided information that can be used to establish the baseline sediment characterization for the Deep Water Site. The sediment analytical data covers nine general categories:

1. Physical Analyses
2. Metals
3. Phenols
4. Pesticides and Insecticides
5. Low Polynuclear Aromatic hydrocarbons
6. High Polynuclear Aromatic hydrocarbons
7. Chlorinated hydrocarbons
8. Miscellaneous extractables
9. Phthalates

The sediment analytical data is summarized in nine tables (Tables 2 through 10). Screening levels (SL) and bioaccumulation triggers (BT) as established in the 1998 DMEF (USACE/USEPA/WDNR/WDOE, 1998) are provided in the tables for references. The nine general categories that cover ODMDS baseline sediment analytical data will be discussed below.

PHYSICAL BASELINE:

Physical Analyses:
There is a considerable amount of sediment physical analyses data at the Deep Water Site as Table 2 shows. All seven studies have physical analyses of the sediments, which assist in establishing baseline conditions for the site.

1. September 1, 2000 Data:
The September 1, 2000 sediment physical analyses at the Deep Water Site shows a mean grain size between 0.11 and 0.13 mm, with an average of 0.120 mm (Table 2). The median grain size ranges from 0.14 to 0.31mm, with an average median grain size of 0.19 mm. This is slightly larger than the estimated 0.15 mm median grain size for in native situ materials at existing ODMDSs described in the Appendix H, Integrated Feasibility Report of Channel Improvements and Environmental Impact Statement (USACE, 8/99).

The September 1, 2000 average mean and median grain size vary from the other six studies' average mean and median grain sizes. The other six studies' shows mean grain sizes between 0.10 and 0.23 mm, with an overall average mean grain size of 0.16 mm. This shows a wider distribution of grain size and a larger mean grain size than the 0.120 mm associated with the Deep Water Site. The smaller grain size seen in the September 1, 2000 samples reflect an increase in percent fines with greater sample depths. Figure 11

shows the relationship of the mean grain size to depth for five studies. As this graphic shows, there is a strong correlation between the mean grain size and the depth. The graphic mean grain size becomes smaller with greater depths. All five studies showed the same trend. Figure 12 shows the relationship of the median grain size to depth for five studies showing the trend of smaller grain size with increasing depth. Figure 10 shows the relationship between the sample depth and the percent fines for five studies. As this graph shows, there is a strong correlation between sample depth and percent fines. Figure 10 also shows that at about 225 ft, the percent fines significantly increase with the greater depth.

The data on the Deep Water Site shows the site to have fine to medium marine sand, with a percent of silts and clays, varying from station to station, as shown in Table 2. The percent fines increased with the increased distance from shore and depth, as shown on Figure 10. This is understandable since wave action exerts a decreasing influence from shore to 250 ft, depending on the median grain size and extent of the storm. According to Appendix H, Integrated Feasibility Report of Channel Improvements and Environmental Impact Statement (USACE, 8/99 pg 42), the extreme seaward limit for wave-induced sediment motion with a median sediment grain size of 0.15 mm is 250 ft and 200 ft for 0.25 mm grain size. At depths less than 59 ft, the wave current action can transport sediments easily. Wave actions working with ocean currents can wash the sand; suspend fines, carry them away and deposit them in places with calmer, deeper waters.

Previous studies also document these conclusions. The Continental Shelf Study the USGS (USGS, 1997) performed in 1997 found that the amount of silt, clay and very fine sand increased as the distance from shore increased. The report states “The sediment samples, by contrast, show a progressive offshore fining of the surface sediments. On the lower beach face, surface sediments are primarily fine sand. On the inner shelf, the very fine sand fraction increases from 45% in 59 ft to 62% in 58 water depth.” (Twichell, D., 2000). This is logical since the beach receives constant wave action, causing fines to go into suspension and carried them toward sea. Once the fines reach the more tranquil water offshore, the fines fall out of suspension and are deposited in various locations. This accounts for areas of progressive higher percent fines from shore, which is documented in Appendix H, Integrated Feasibility Report of Channel Improvements and Environmental Impact Statement (USACE, 8/99 pg H-58, Figure 17), which is included as Figure 13 of this report. Figure 13 shows the percent fines increase with distance from shore and from southern to northern direction.

SEPTEMBER 1, 2000 CHEMICAL BASELINE:

1. Elemental Metals: Concentrations of arsenic, cadmium, copper, lead, nickel, zinc and silver were detected in all ten September 1, 2000 samples. Mercury was detected in only sample C110 at a concentration of 0.038 ppm. C133 had the highest detected arsenic (7.2 ppm) and the highest nickel (25ppm). C110 had the highest detected copper (15 ppm), lead (8.0 ppm) mercury (0.038) and cadmium (0.89 ppm). It is significant that these two samples have the highest concentrations of all available samples collected from the Deep Water Site. Both are among the deepest samples collected during the September 1, 2000 study and represent finer sediment.

2. Phenols: Phenols analyses were performed on the Deep Water Site samples and the results are shown on Table 4. Sample C97 showed a concentration of 20 ppb of phenol and 12 ppb of 4-methylphenol. Sample C133 showed a concentration of 140 ppb of phenol and 37 ppb of 4-methylphenol. Sample C110 showed a concentration of 6.2 ppb of 4-methylphenol. Samples C97, C133 and C110 are located in the deepest area of the Deep Water Site. Phenols occur naturally in bark and are associated with decaying vegetation, log rafting and forest product wastes. When these materials degrade, they commonly become part of the fines found in rivers and harbors. From this perspective, rivers and harbors typically have more of these materials than the ocean. But with the higher percent fines, phenols could appear as seen on Table C-4.

3. Pesticides and PCBs: Pesticides and PCBs analyses were performed on Deep Water Site. As shown on Table 5, no pesticides or PCBs were detected.

4. Low Polynuclear Aromatic hydrocarbons(LPAH): A concentration of 7.0 ppb of phenanthrene was detected in sample C133 as shown on Table 6. This is the only LPAH detected and sample C133 was the only sample with a concentration above the 0.9 ppb detection limit. Sample C133 was collected at a depth of 295 ft. These results agree with the 1989-1992 Tongue Point (Siipola, M.1993) samples, which had no LPAHs detected in "native" sediment.

5. High Polynuclear Aromatic hydrocarbons(HPAH): Sample C133 had concentrations of fluoranthene (9.8 ppb), pyrene (11 ppb), benz(a) anthracene (3.8 ppb), chrysene (3.2 ppb), benzo(a) pyrene (5.2 ppb) and benzo(g,h,I) perylene (4.3 ppb). It had the most detected LPAHs of all the September 2000 samples, with C100 the second most as shown on Table 7. Sample C100 had concentrations of fluoranthene (6.5 ppb), pyrene (8.1 ppb), benz(a) anthracene (4.3 ppb), benzofluoranthenes (b+k) (6.2 ppb), and benzo(a) pyrene (3.8 ppb). Sample C110 had a 3.5 ppb concentration of pyrene. All of these samples were taken at depths between 219 and 295 ft.

6. Chlorinated Hydrocarbons: As shown on Table 8, none were detected.

7. Miscellaneous Extractables: As shown on Table 9, none were detected.

8. Phthalate Compounds: All samples had concentrations of at least one phthalate compound. Bis(2-ethylhexyl) phthalate was detected in all ten samples, with concentrations varying from 27 ppb to 64 ppb are shown on Table 10. Sound Analytical Labs flagged these results with the B1 qualifier, which means, "This analyte was detected in the associated method blank and is a commonly found laboratory contaminant at these low levels of detection. The analyte concentration was determined not to be significantly higher than the associated method blank (less than ten times the concentration reported in the blank)." The same qualifier flagged the Di-nbutyl phthalate concentrations, which ranged between 18 to 27 ppb on seven samples. The Di-nbutyl phthalate concentrations were also flagged with the J qualifier, which means, "The analyte was analyzed for and positively identified, but the associated numerical value is an estimated quantity." Since the Di-nbutyl phthalate and Bis(2-ethylhexyl) phthalate concentrations are estimated and/or qualified, a clear conclusion can not be drawn from these results. As stated, these are common laboratory contaminates.

BIBLIOGRAPHY:

1. Hinton, S, A., 1998. Benthic Infauna and Sediment Characteristics Offshore From the Columbia River, October/November 1995 and June 1996. U.S. Army Corps of Engineers, Portland District, Portland, Oregon and U.S. National Marine Fisheries Services
2. Hinton, S, A. and R.L. Emmett, 1996. Benthic Infauna and Sediment Characteristics Offshore From the Columbia River, August 1994. U.S. Army Corps of Engineers, Portland District, Portland, Oregon and U.S. National Marine Fisheries Services
3. Holton, R, N. Cutshall, L. Gordon, and L. Small, 1978. Aquatic Disposal Field Investigations Columbia River Disposal Site, Oregon. U.S. Army Engineers, Dredged Material Research Program, Waterways Experiment Station.
4. Siipola, M, 1992. Reconnaissance Level Benthic Infaunal, Sediment and Fish Study Offshore from the Columbia River, July 1992. U.S. Army Corps of Engineers, Portland District, Portland, Oregon and U.S. Environmental Protection Agency, Region 10.
5. Siipola, M, R. Emmett and S. Hinton, 1993. Tongue Point Monitoring Program 1989 – 1992, September 1993. U.S. Army Corps of Engineers and U.S. National Marine Fisheries Services
6. Twichell, D, A. VeeAnn, K. Parolski, 2000. Sidescan-sonar Imagery, Surface Sediment Samples, and Surficial Geologic Interpretation of the Southwestern Washington Inner Continental Shelf Based on Data Collected During Corliss Cruises 97007 and 98014. US Geological Survey and Washington Department of Ecology
7. USACE, 7/93. Mouth of the Columbia River sampling during July 1993 and August 1994 , no formal report, information is from raw data file. U.S. Army Corps of Engineers, Portland District, Portland, Oregon Aug. 1994". U.S. Army
8. USACE, 10/95. Mouth of the Columbia River sampling during October-November, 1995, no formal report, information is from raw data file. U.S. Army Corps of Engineers, Portland District, Portland, Oregon
9. USACE, 6/96. Mouth of the Columbia River sampling during October-November, 1995, no formal report, information is from raw data file. U.S. Army Corps of Engineers, Portland District, Portland, Oregon.
10. USACE, 8/99. Appendix H, Volume I: Ocean Dredged Material Disposal Sites Main Report and Technical Exhibits Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement Columbia and Lower Willamette River Federal Navigation Channel. U.S. Army Corps of Engineers, Portland District, Portland, Oregon
11. USACE, 9/00. Mouth of the Columbia River sampling during September 2000, no formal report, and information is from raw data file. U.S. Army Corps of Engineers, Portland District, Portland, Oregon
12. USACE/USEPA/WDNR/WDOE, 1998. Dredged Material Evaluation Framework, Corp of Engineers, Portland District, Portland, Oregon