

Hammond Boat Basin Sediment Evaluation

September 1994

Abstract

The material was evaluated using the Tiered Testing Procedure outlined in the Draft Inland Testing Manual developed to implement Section 404 (b)(1) requirements of the Clean Water Act. Hammond Boat Basin Federal Project sediment is acceptable for in-water and upland disposal according to the guidelines in the manual. Disposal operations should not result in unacceptable violations of State water quality standards and State water quality certification should be obtainable. The sediment is sandy, clayey silt. The organic content is around 2 percent. Metals, pesticides, PCBs, PAHs and TBT are below established concern levels. No unacceptable adverse environmental impacts associated with the toxicity of these chemicals is expected.

Introduction

1. Hammond Boat Basin is located 8.7 miles from the mouth of the Columbia River on the Oregon side. It was constructed in 1982. The channel leading into the boat basin is 10 feet deep, 100 feet wide and 1,300 feet long. The basin was last dredged in 1990 when a pipeline dredge removed 15,300 cubic yards of material (1). Disposal occurred at a Corps owned upland site adjacent to the project. It is anticipated that permission for in-water disposal will be sought for the next round of dredging. Disposal would occur either at a flow lane site adjacent to the boat basin, at Area D near RM 6.0, or in the upland site next to the boat basin.

2. Sediment physical and chemical data were collected from Federal channel samples in 1987. The material was primarily sandy, clayey silt. The material was 80 to 96 percent fines. The sample closest to the outlet was the sandiest sample (18 % sand). Chemical analyses revealed the samples to be below concern levels for both metals and PAHs, which were the only contaminants sought (2).

Methods

3. Seven sediment samples were taken at Hammond Boat Basin on 15 September 1994 (Figures 1, 2). Four of the samples were taken using a 0.95 m² modified Gray O'Hare box corer. These samples were taken at the request of the EPA, Region 10 to provide background data on regional sediment quality. Three samples were obtained from the Federal channel using a Benthos gravity corer. Subsamples of all seven samples were sent to the U. S. Army Corps of Engineers, North Pacific Division, Materials Testing Laboratory located in Troutdale, Oregon for physical analysis. Physical analysis included determining resuspended density, void ratio, specific gravity, particle roundness grading, volatile solids content and sediment grain size distribution. For the purposes of this report only the latter two measures are considered. Chemical analyses were conducted on all seven samples. Analyses included TOC, AVS, metals, pesticides/PCBs, and PAHs. Three samples were analyzed for TBT and two samples for dioxins/furans. Chemical analyses were performed by Columbia Analytical Services, Kelso, Washington. All sampling procedures and analyses were performed according to EPA/USACE approved methods (3).

Results

Physical

4. The samples were sandy, clayey, silts (Table 1). They averaged 10 percent sand, 18 percent clay and 72 percent silt. The median grain size of the samples varied from medium to coarse silt. Samples near the entrance to the boat basin were more sandy than those near the boat launch. The organic content, as measured by volatile solids, ranged from 5 to 21 percent with an average of 9 percent. There was no obvious difference in any physical measure between Federal channel and EPA samples.

5. Field observations of the samples noted that those near the boat launch and moorage facilities were black, with a thin oxidized surface layer of about 1/8 to 1 1/2 inches. These samples had a sulfury, "rotten egg" smell. Samples nearest the entrance to the boat basin, HBB-BC-3 and 4, contained clams and worms to a depth of about 2 inches from the surface. They did not appear to have a rotten egg odor. These were also the most sandy of the 7 samples and their median grain size was roughly 3 times larger than the other samples (0.037 mm vs. 0.014 mm).

Chemical

Metals

6. Metals concentrations are below established concern levels except for cadmium (Table 2). Cadmium equaled the concern level in one Federal channel sample (HBB-GC-6) and exceeded the concern level in one EPA sample (HBB-BC-1). It is not unusual to find slightly elevated cadmium in lower Columbia River marinas (4). Usually, concurrent with the cadmium is an elevated zinc concentration, and this is the case for Hammond Boat Basin (Table 2). There is a correlation between the concentration of cadmium and zinc in sediment in the lower river.

AVS

7. The AVS levels found are typical of boat basins with fine-grained, organically enriched sediment (Table 1). AVS is routinely measured in fine grained sediment because its presence can serve to protect sediment from toxic effects of metals. AVS represents a fraction of sulfur that forms insoluble metal-sulfides. This reduces the potential for toxicity to aquatic organisms due to metals. Samples close to the boat ramp and mooring facilities were highest in AVS in both the EPA and Federal channel samples. The sandy sample (HBB-BC-3), near the mouth of the boat basin, was the lowest in AVS.

TOC

8. The TOC range in silty harbor sediments is usually 1 to 4 percent. Roughly 2 percent of the Hammond Boat Basin sediment was organic carbon (Table 2, TOC). Fine-grained sediment is typically enriched in organic carbon and the level observed in these samples is in line with other boat basins in the lower Columbia River, such as Ilwaco Boat Basin and Chinook Marina (6,7).

9. TOC consists mainly of decayed plant material. In sediment it is the main storage compartment in the aquatic environment for neutral organic compounds such as pesticides, PCBs, dioxins and PAHs (8). It acts as a competitor with the lipids of organisms for neutral organic chemicals (8). Thus, for a given neutral organic contaminant, a low TOC favors bioaccumulation of the contaminant in aquatic organisms while a high TOC does not. The moderately high TOC in Hammond Boat Basin sediment relative to the low level of organic contaminants should result in low bioaccumulation potential for aquatic organisms.

Organics

10. Concentrations of organic contaminants, if detected, were very low in both Federal channel and EPA samples (Table 3). Pesticides and PCBs were not detected (detection limits usually less than 2.0 ppb). Total and individual PAHs were well below established concern levels.

11. The pattern and level of dioxin/furan concentrations in the EPA samples were similar to what has been observed in other lower Columbia River boat basins sampled by the Army Corps of Engineers, Portland District (6,7). The most toxic dioxin congener 2,3,7,8 TCDD was undetected in the samples (Table 3). Its much less toxic furan counterpart, 2,3,7,8 TCDF was detected in small quantities, 3.5 to 4.6 parts per trillion (ppt). Other dioxin and furan congeners were detected in low concentrations (see raw data attached).

12. TBT data from the original analysis was not acceptable because of inaccurate matrix spike recoveries and because the method blank contained trace amounts of TBT. Consequently, the samples were reanalyzed by the analytical company (CAS). The reanalysis detected TBT (14 to 30 ppb) in all three samples (Table 3). The sample with the highest TBT concentration was from the EPA sample near the boat launch and moorings facilities (HBB-BC-1, 30 ppb). The Federal channel samples were below the concern level. Hammond Boat Basin is small and infrequently used relative to other boat basins in the area. There are no boat works facilities in the basin. For these reasons TBT contamination is not expected to increase in the area.

Quality Control

13. Overall, the quality of the data was acceptable except for the initial TBT analysis (see attached raw data QC/QA report). Relative percent differences for duplicates of samples were within limits. Matrix spike, duplicate matrix spike and surrogate recoveries were acceptable. Analysis of laboratory control samples were acceptable. For TBT there were problems with the matrix spike, laboratory control and method blank samples that raised doubts about the accuracy of sediment results. Subsequent reanalysis brought the quality control into acceptable limits for TBT.

Clean Water Act Evaluation

14. Section 404 of the CWA requires that dredged material be evaluated, prior to dredging and disposal, using Section 404 (b)(1) Guidelines. Sections 230.60 and 230.61 of the Guidelines provide a basis for making factual determinations regarding the potential for contaminant-related impacts associated with the discharge of dredged material in inland waters. The Corps and EPA jointly developed a Draft Inland Testing Manual that utilizes a

tiered testing procedure for making factual determinations based on requirements of Sections 230.60 and 230.61 of the Guidelines (9).

15. In the Inland Testing Manual Tier I allows for factual determinations to be made provided sufficient information exists that would satisfy testing needs of higher Tiers. Existing information regarding Hammond Boat Basin sediment is sufficient to determine that the sediment is acceptable for both in-water and upland disposal.

16. Existing data shows that the sediment is below established concern levels for all contaminants. Since the last evaluation, conducted in 1987, the sediment has changed little in terms of metals and PAHs. It is unlikely that unacceptable water column, benthic toxicity or benthic bioaccumulation impacts will result from in-water or upland disposal of the sediment. Acute water column toxicity should not result because previous elutriate tests of similar lower Columbia River sediments have shown that acute (or chronic) water quality criteria are rarely exceeded (4). Since contaminants of concern in the sediment do not exceed screening levels, unacceptable benthic toxicity should not occur. Unacceptable bioaccumulation should also not result from exposure to this sediment. PAHs and TBT were the only contaminants detected, and they were below levels that would trigger bioaccumulation concerns (i.e., EPA screening levels). The low level of PAHs compared to the relatively high TOC level favors low bioaccumulation by benthics. Normalization of individual PAHs to TOC shows them to be far below concern levels. For instance, normalizing benzo(g,h,i)perylene to TOC yields 3.1 mg/Kg organic carbon compared to the State of Washington's marine sediment quality standard (Oregon has none) of 31 mg/Kg organic carbon.

17. In-water and upland disposal may result in a localized, temporary increase in ammonia and turbidity, a temporary decrease in dissolved oxygen and an aesthetically displeasing turbidity plume. Any contaminants released from resuspension of the sediment would be rapidly diluted by receiving water.

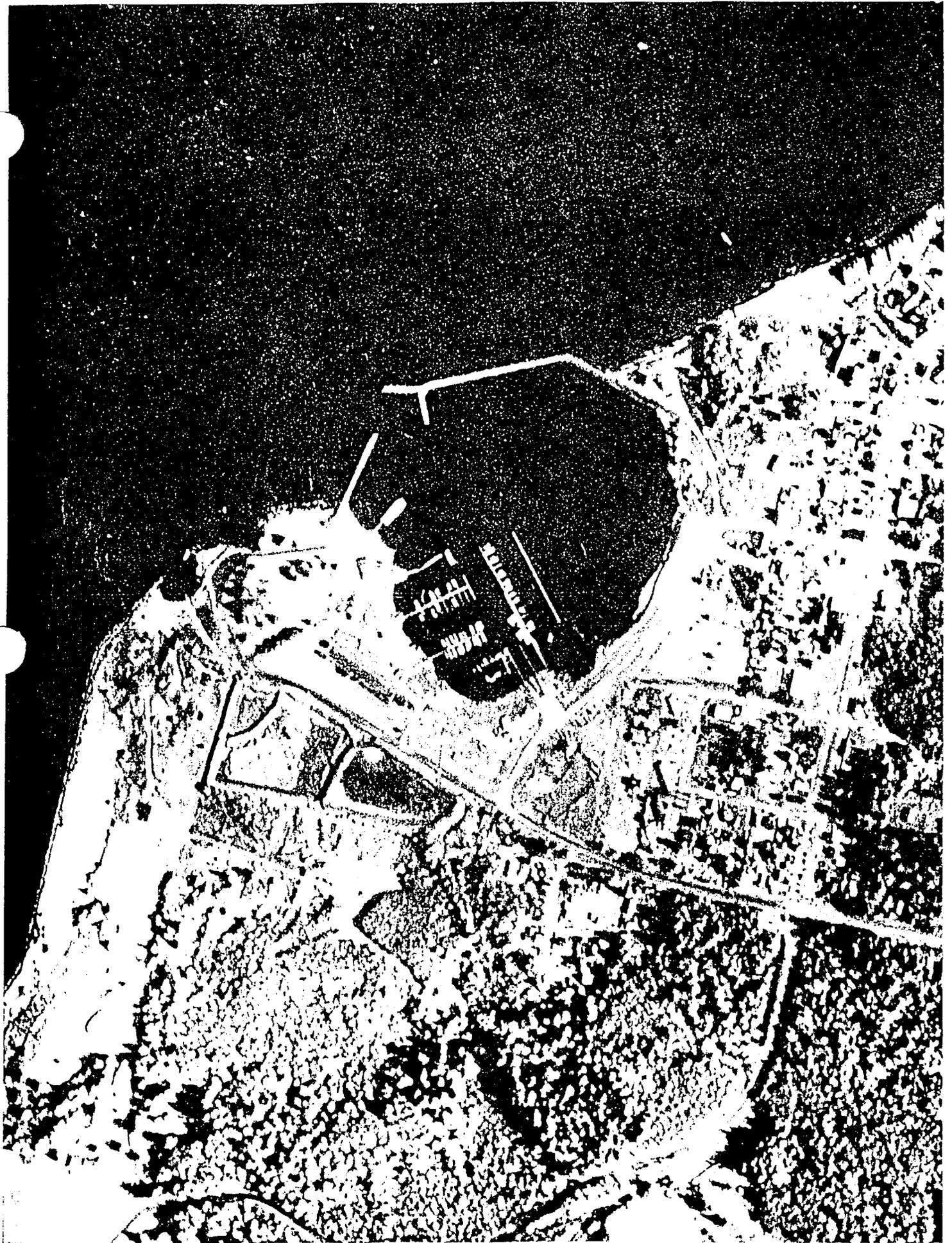
State Water Quality Certification

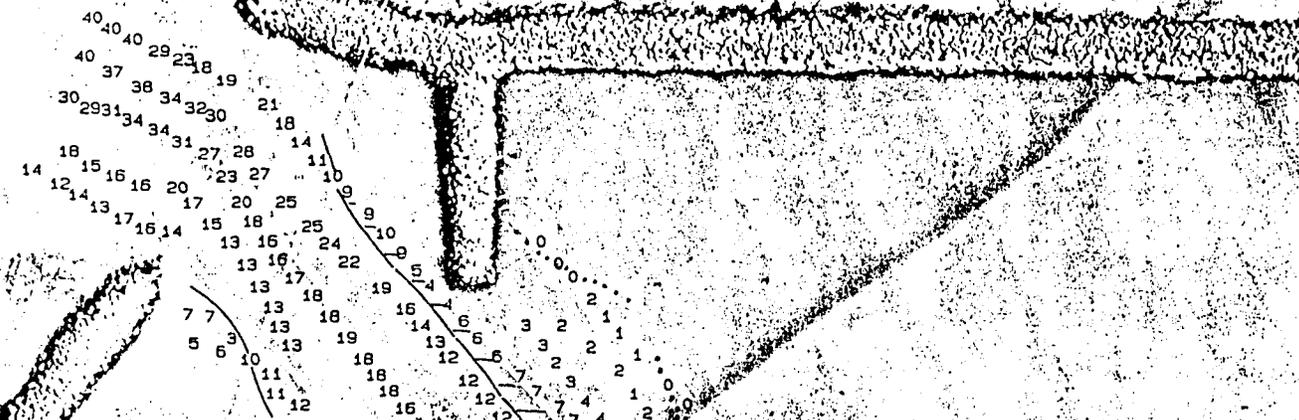
18. Hammond Boat Basin sediment should not cause state water quality standards to be exceeded as a result of in-water or upland disposal. Numerous elutriate tests, conducted by the Corps over the years, on sediment similar in concentrations of metals and organic contaminants, show that very low concentrations of contaminants are released to the water column and that water quality criteria are rarely exceeded (4). Thus, Section 401 CWA water quality certification should be obtainable.

References

1. Navigation Branch, Operations Division, U. S. Army Corps of Engineers, Portland District. September 1991. Federal Navigation Projects: Columbia River Maintenance Disposal Plan. (Prepared by Mandaville Associates, 600 S. W. Tenth #418, Portland, Oregon 92205).
2. U. S. Army Corps of Engineers, Portland District. Data from collected in 1987 and entered in District database. No formal written sediment evaluation was produced.
3. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1991. Evaluation of Dredged Material Proposed for Ocean Disposal (Testing Manual).
4. Fuhrer, G. and Rinella F. U. S. Geological Survey. 1983. Analyses of elutriates, native water, and bottom material in selected rivers and estuaries in Western Oregon and Washington (open file report 82-922).
5. Britton J. U. S. Army Corps of Engineers, Portland District. 20 July 1992. Evaluation of Sediment at U. S. Coast Guard Station Ilwaco, Washington.
6. Britton J., Siipola M. and Malek J. December 1992. Characteristics of Chinook Marina sediment in Baker Bay, Washington. Prepared by the U. S. Army Corps of Engineers, Portland District for EPA, Region 10, Seattle, Washington.
7. Britton J., Siipola M. and Malek J. December 1992. Characteristics of Ilwaco Boat Basin sediment in Baker Bay, Washington. Prepared by the U. S. Army Corps of Engineers, Portland District for EPA, Region 10, Seattle, Washington.
8. Clarke, J. and McFarland V. U. S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MI. July 1991. Assessing bioaccumulation in aquatic organisms exposed to contaminated sediments. Miscellaneous paper D-91-2.
9. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. May 1993. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters - Testing Manual (Draft).

Figure 1. Hammond Boat Basin, aerial view.





HBB-BC-3

HBB-BC-4

HBB-GC-7

HBB-GC-6

HBB-BC-2

HBB-GC-5

HBB-BC-1

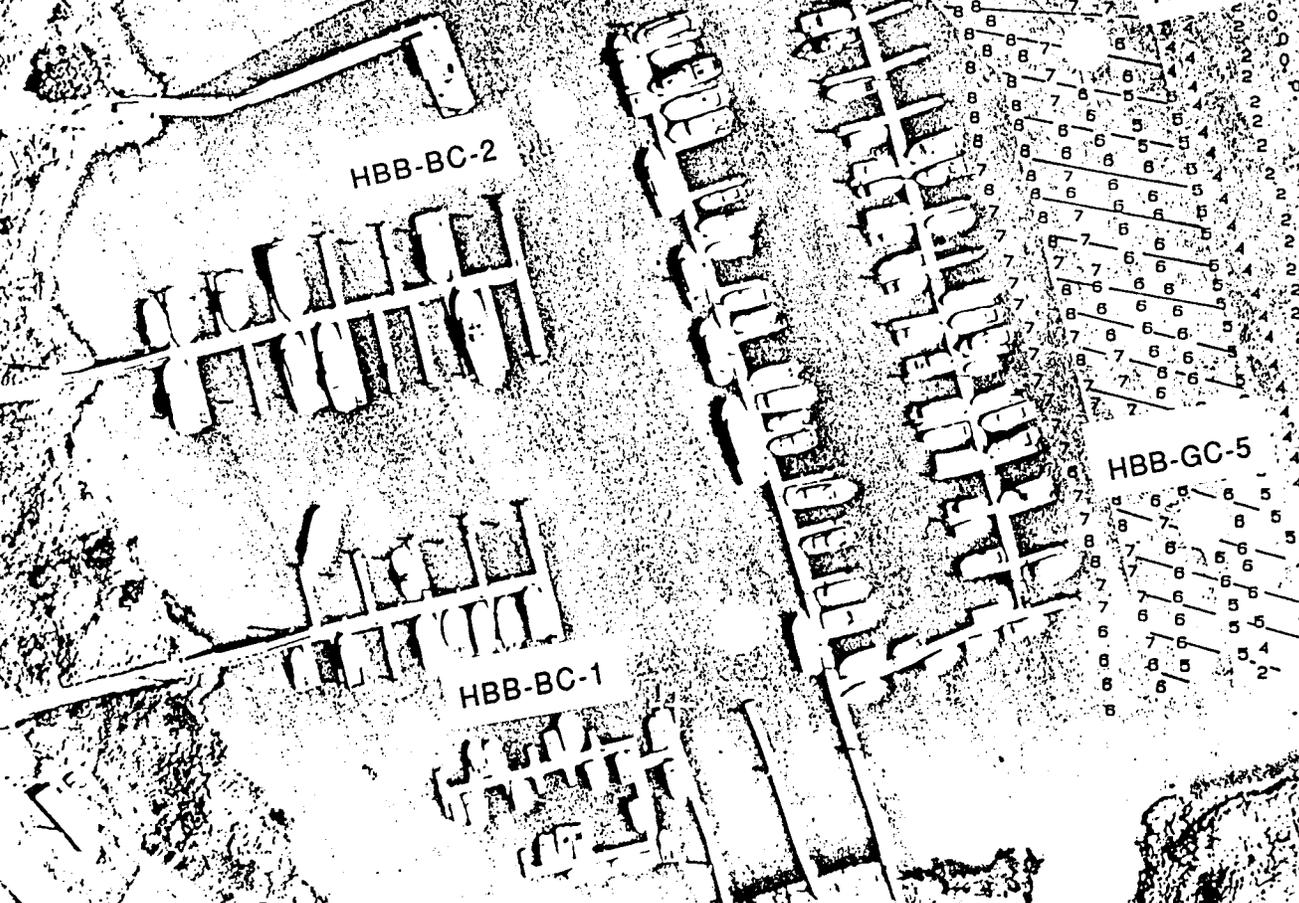


Table 1. Results of physical analyses of Hammond Boat Basin sediment samples.

sample	median grain size mm	sand	silt	clay	volatile solids
			%		
EPA					
HBB-BC-1	0.013	3.6	74.8	21.6	7.4
HBB-BC-2	0.018	5.9	76.2	17.9	7.3
HBB-BC-3	0.040	28	60.1	11.9	4.5
HBB-GC-7	0.017	8.9	71.5	19.6	5.8
Federal chl					
HBB-BC-4	0.033	15.2	68.9	16.0	6.4
HBB-GC-5	0.012	3.3	76.1	20.6	21.3
HBB-GC-6	0.013	4.4	73.8	21.8	6.6
mean	0.021	9.9	71.6	18.5	8.5

Table 2. Concentrations of metals, AVS and TOC in Hammond Boat Basin sediment.

sample	(ppm)										AVS	TOC (%)
	As	Cd	Cr	Cu	Pb	Hg	Ni	Ag	Zn			
EPA												
HBB-BC-1	7.9	1.01	22.7	43.0	19.2	0.12	18.6	0.30	137.0	7900	2.59	
HBB-BC-2	7.2	0.90	21.0	36.0	16.3	0.11	17.1	0.22	120.0	5300	2.29	
HBB-BC-3	5.1	0.57	15.5	23.8	10.8	0.06	13.8	0.13	85.6	2100	1.51	
HBB-GC-7	5.5	0.75	19.8	34.1	14.0	0.12	15.7	0.17	110.0	2700	1.62	
Federal chl												
HBB-BC-4	5.8	0.72	18.3	30.3	13.9	0.09	15.3	0.18	105.0	3900	3.70	
HBB-GC-5	6.3	0.93	20.4	40.3	17.3	0.11	16.6	0.21	133.0	4600	1.93	
HBB-GC-6	6.9	0.96	23.1	41.4	17.6	0.11	18.2	0.24	132.0	5100	2.32	
mean	6.4	0.83	20.1	35.6	15.6	0.10	16.5	0.21	117.5	4514	2.28	
SL*	57.0	0.96	180.0	81.0	66.0	0.21	140.0	1.20	160.0	NA	NA	

* EPA, Region 10 screening level for marine waters.

Table 3. Concentrations of organics in Hammond Boat Basin sediment samples.

samples	pesticides [^]	PCBs [^]	total PAHs	TBT#	dioxin	furan
					(2,3,7,8 TCDD)	(2,3,7,8 TCDD)
				ppb	ppt~	
EPA						
HBB-BC-1	ND	ND	333	24	<0.56	4.6
HBB-BC-2	ND	ND	391	-	-	-
HBB-BC-3	ND	ND	273	-	-	-
HBB-GC-7	ND	ND	601	-	<0.52	3.5
Federal chl						
HBB-BC-4	ND	ND	383	-	-	-
HBB-GC-5	ND	ND	387	5	-	-
HBB-GC-6	ND	ND	563	6	-	-
SL*	6.9-10	130	610-1800	30	NA	NA

* EPA, Region 10 screening levels for marine waters.

~ parts per trillion

ND non detected

NA not applicable

- not analyzed for in the sample

[^] detection limits

pesticides	PCBs	PAHs	TBT
ppb			
2-30	10	20-40	3

TBT values are probably overestimates as 5 ppb was found in the method blank.