

**CHINOOK ENTRANCE CHANNEL  
SEDIMENT QUALITY EVALUATION  
REPORT**



**June 2006**

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## ACRONYMS

Ag	Silver
As	Arsenic
Cd	Cadmium
CoC	Contaminate of concern
Cr	Chromium
CRM	Columbia River Mile
Cu	Copper
DMEF	Dredge Material Evaluation Framework
EPA	Environmental Protection Agency
Hg	Mercury
J	Laboratory estimated value detected between MRL & MDL
MDL	Method Detection Limit
MLLW	Mean Lower Low Water
MRL	Method Reporting Limit
ND	Non-detected at MRL or MDL
NES	Newly Exposed Surface
Ni	Nickel
PAH	Polynuclear Aromatic Hydrocarbon
Pb	Lead
PCB	Polychlorinated Biphenyl
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RMT	Regional Management Team
Sb	Antimony
SL	Screening Level
Tier II	Physical (a) & Chemical (b) analyses
Tier III	Bioassay & Bioaccumulation analyses
TOC	Total Organic Carbon
TVS	Total Volatile Solids
U	Laboratory non-detect at MRL
USFWS	U. S. Fish & Wildlife Service
WDNR	Washington Department of Natural Resources
Zn	Zinc
$\Sigma$	Total value (i.e. DDT + DDE + DDD)

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**ABSTRACT**

Baker Bay is on the north side of the Columbia River and is traversed on the east by the Chinook Channel. The federally maintained navigation Chinook Channel project is located at Columbia River Mile (RM) 5.0 in an area of extreme shoaling (see Figure 1). The existing project at Chinook provides for a channel 10-feet deep and 150-feet wide from deep water in the Columbia River to a turning and mooring basin 10-feet deep, 590-feet long and 500-feet wide at Chinook. The turning and mooring basins are maintained by local interests.

This evaluation was conducted following procedures set forth in the Ocean Testing Manual and Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material. Guidelines used are those developed to implement the Clean Water Act and Marine Protection, Research and Sanctuaries Act. These national guidelines and associated local screening levels are those adopted for use in the regional Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), November 1998.

A total of four (4) surface grab sediment samples were collected along the length of the Chinook Entrance Channel June 28, 2006. All samples were submitted for physical analyses (including total volatile solids), metals (9 inorganic), total organic carbon, pesticides, polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, and polynuclear aromatic hydrocarbon..

Four (4) samples were submitted for physical analyses. Two (2) samples had > 90% sand, one (1) had 67.4% sand, and one had 7.8% sand. Median grain-size ranged from 0.217 mm to 0.008 mm. Volatile solids ranged from 1.04% to 10.8%.

The chemical data collected indicates low levels of metals present. DDT was detected in three samples and Aldrin in one. PCB detection/reporting levels were low, with non-detect (ND) results reported. Phenol and total phthalates were detected in all samples but at low levels. In three samples 4-Methylphenal were ND below 4.6 ppb however at station 0628-BBSS-P-04 it was detected at 2,300 ppb which exceed the DMEF screening level of 670 ppb. No LPAHs and HPAHs were detected in sample 062806-BBCC-P-01 while various LPAHs and HPAHs were detected in the other three samples.

Material from the Chinook Channel have not historically had a problem with the presence of significant levels of chemical of concern. In the present study except for the 4-Methylphenal at station 0628-BBSS-P-04 all chemicals of concern were below their respective DMEF screening levels (SL) and the material is considered suitable for unconfined in-water disposal. Additional testing of the fine grained material above RM 1.5 represented by station 0628-BBSS-P-04 would require additional testing before a suitability determination could be rendered.

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## **INTRODUCTION**

This report characterizes the sediment to be dredged at the Chinook Entrance Channel for the purposes of dredging and disposal. The sampling and analysis objectives are stated in the Sampling and Analysis Plan (SAP May 2006), and are also listed below. This report will outline the procedures used to accomplish these objectives.

### **Sampling and Analysis Objectives**

- To characterize sediments in accordance with the DMEF manual.
- Collect, handle and analyze representative sediment samples, 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 upon disposal.
- Conduct physical and chemical characterization of dredge prism.

## **PREVIOUS STUDIES**

Chinook Entrance Channel sediment quality investigations have been carried out at various yearly intervals since 1973, with the last investigation at Chinook Entrance Channel being done in 2004. In 1987 testing for physical properties, bulk chemistry (including elutriate tests) and bioassays were conducted. Sediments were found to be acceptable for in-water disposal at a dispersive site to avoid any adverse effect that might be derived from ammonia concentrations that were detected during elutriate testing. The subsequent results of the physical and bulk chemical testing done in 1992, 1997, and 2004 showed the materials to be clean sands in the outer entrance and fine-grained inner entrance channel, all of which were determined suitable for unconfined in-water disposal.

## **CURRENT SAMPLING EVENT/DISCUSSION**

A total of four (4) samples were collected from the Chinook Entrance Channel at Baker Bay, June 28, 2006 (see Figure 2). The samples were collected using a Ponar sampling device (P). All samples were submitted for physical analyses (including total volatile solids), metals (9 inorganic), total organic carbon, pesticides, polychlorinated biphenyls, phenols, phthalates, miscellaneous extractables, and polynuclear aromatic hydrocarbon.

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## **RESULTS**

### **Physical and Volatile Solids (ASTM methods)**

Four (4) samples were submitted for physical analyses, with data presented in Table 1. Two (2) samples had > 90% sand, one (1) had 67.4% sand, and one had 7.8% sand. Median grain-size ranged from 0.217 mm to 0.008 mm. Volatile solids ranged from 1.04% to 10.8%.

### **Metals (EPA method 6010/7471), Total Organic Carbon (EPA method 415.1)**

Four (4) samples were submitted for metals and TOC testing, with data presented in Table 2. The TOC analyses ranged from 0.08% to 3.52%. Levels of metals were typical with the highest level found in the fine grained material at station 062806-BBCC-P-04, but did not approach the DMEF screening level (SL). The levels detected are consistent with historical levels of metals detected in the Chinook Entrance Channel.

### **Pesticides/PCBs (EPA method 8080), Phenols, Phthalates and Miscellaneous Extractables (EPA method 8270)**

Four (4) samples were submitted for pesticides/PCBs, phenols, phthalates and miscellaneous extractables. DDT was detected in three samples and Aldrin in one (Table 3). PCB detection/reporting levels were low, with non-detect (ND) results reported. Phenol and total phthalates were detected in all samples but at low levels. In three samples 4-Methylphenol were ND below 4.6 ppb however at station 0628-BBSS-P-04 it was detected at 2,300 ppb which exceed the DMEF screening level of 670 ppb.

### **Polynuclear Aromatic Hydrocarbons (EPA method 8270C)**

Four (4) samples were submitted for PAHs. No LPAHs and HPAHs were detected in sample 062806-BBCC-P-01 (see Table 4 and 5). Various LPAHs and HPAHs were detected in the other three samples. All values, however, were low and well below DMEF marine SLs.

## **CONCLUSION**

This evaluation was conducted following procedures set forth in the Inland Testing Manual, developed jointly by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to assess dredged material and the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF). The DMEF is a regional manual developed jointly with regional EPA, Corps, Oregon Department of Environmental Quality and Washington Departments of Ecology and Natural Resources. This document is a guideline for implementing the Clean Water Act (40 CFR 230), Section 404 (b)(1).

Four (4) samples collected from the Chinook Entrance Channel at Baker Bay were submitted for physical and chemical analyses. Two (2) samples had > 90% sand, one (1) had 67.4% sand, and one had 7.8% sand. Median grain-size ranged from 0.217 mm to 0.008 mm. Volatile solids ranged from 1.04% to 10.8%. The TOC analyses ranged from

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Material below Chinook Channel RM 1.5 represented by 062806-BBCC-P-01 through 062806-BBCC-P-03 is suitable for unconfined in-water disposal based upon the protocols of the DMEF. Material above RM 1.5 would require further testing to determine suitability prior to dredging. Due to limited funding only the outer portion, <RM 1.1 of the project is to be dredged (see Figure 3) in 2006. This area is represented by station 062806-BBCC-P-01 while station 062806-BBCC-P-02 is just outside the upper limit of dredging.

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**Table 1: Physical Analysis and Volatile Solids**

Sample I.D.	Grain Size (mm)	Percent			
	Median	Gravel (Clam Shells)	Sand	Silt/Clay	Volatile Solids
062806-BBCC-P-01	0.217	0	96.7	3.3	1.04
062806-BBCC-P-02	0.117	0	67.4	32.6	3.69
062806-BBCC-P-03*	0.204	0	91.4	8.6	1.63
062806-BBCC-P-04	0.008	0	7.8	92.2	10.8
Minimum	0.008	0	7.8	3.3	1.04
Maximum	0.214	0	96.7	92.2	10.8
* Average of triplicate analyses					

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**Table 2: Inorganic Metals and TOC**

Sample I.D.	As	Cd	Sb	Cu	Pb	Ni	Ag	Zn	Hg	TOC
	mg/kg (ppm)									
062806-BBCC-P-01	2.35	0.05	<0.04	6.10	3.84	7.65	0.062	30.7	0.011	0.08
062806-BBCC-P-02	3.43	0.30	0.06	13.9	7.02	10.8	0.083	49.0	0.048	0.83
062806-BBCC-P-03	2.66	0.12	0.07	6.84	5.78	7.78	0.055	31.2	0.029	0.38
062806-BBCC-P-04	8.18	0.93	0.18	35.7	17.8	16.8	0.236	99.6	0.131	3.52
Maximum	8.18	0.93	0.18	35.7	17.8	16.8	0.236	99.6	0.131	3.52
Screening level (SL)	57	5.1	150	390	450	140	6.1	410	0.41	
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).										

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**Table 3: Pesticides, PCBs, Phenols, & Phthalates**

Sample I.D.	ug/kg (ppb)				
	Phenol	4-Methylphenol	Total Phthalates	Aldrin	Total DDT
062806-BBCC-P-01	5.6	<3.9	14.1	<0.20	<0.16
062806-BBCC-P-02	15	<4.6	22.9	<0.24	0.94
062806-BBCC-P-03	7.4	<4.0	11.9	0.23J	0.24
062806-BBCC-P-04	50	2,300	35.0	<0.45	2.13
Screen level (SL)	420	670	970-8,300	10	6.9

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**Table 4: Polynuclear Aromatic Hydrocarbons (PAHs), Low Molecular Weight Analytes**

Sample I.D.	Acenaphthene	Acenaphthylene	Anthracene	Fluorene	2-Methyl naphthalene	Naphthalene	Phenanthrene	Total Low PAHs
	ug/kg (ppb)							
062806-BBCC-P-01	<1.4	<1.9	<1.9	<2.3	<1.6	<1.8	<1.8	ND
062806-BBCC-P-02	<1.6	<2.2	4.4J	<2.7	<1.9	<2.1	12	16.4
062806-BBCC-P-03	<1.4	7.9	12	3.9J	<1.7	<1.8	45	68.8
062806-BBCC-P-04	<3.0	<4.2	5.1J	<5.1	<3.6	<3.9	19	24.1
Maximum	ND	7.9	12	3.9	ND	ND	45	68.8
Screen level (SL)	500	560	960	540	670	2,100	1,500	5,200
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit) J = Estimated value (reported values are above the MDL, but below the PQL).								

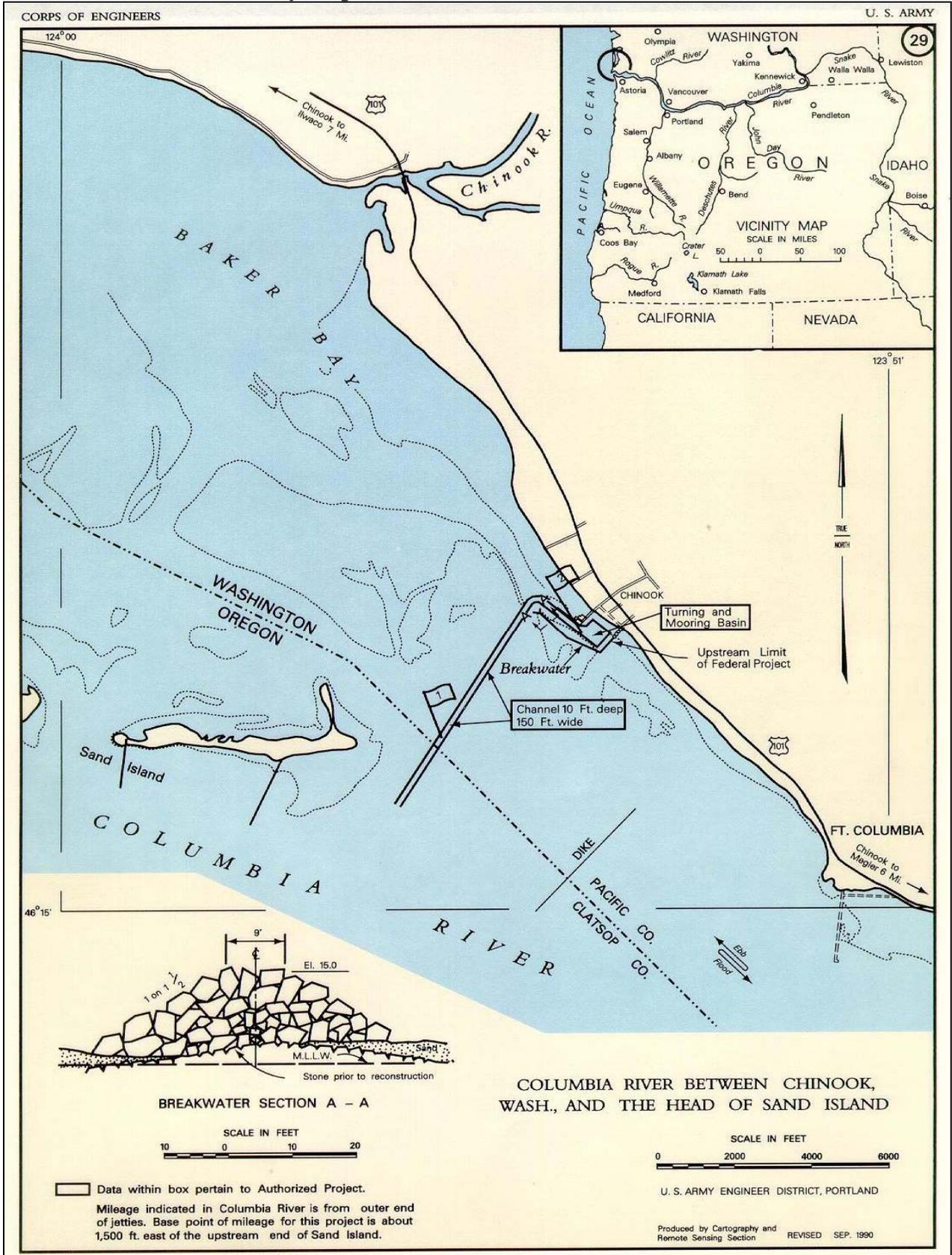
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**Table 5: Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight**

Sample I.D.	Benzo(a)-anthracene	Benzo-fluoranthene	Benzo-(g,h,i)-perylene	Chrysene	Pyrene	Benzo(a)-pyrene	Indeno-(1,2,3-cd)-pyrene	Dibenz(a,h)anthracene	Fluoranthene	Total High PAHs
	ug/kg (ppb)									
062806-BBCC-P-01	<1.9	<3.3	<3.1	<1.9	<1.8	<2.1	<2.5	<2.9	<2.9	ND
062806-BBCC-P-02	12	18.9	8.7	15	37	13	8.3	<3.5	28	140.9
062806-BBCC-P-03	32	42	18	38	86	33	19	3.8J	69	340.8
062806-BBCC-P-04	15	20	12J	22	55	18	13J	<6.6	28	183
Maximum	32	42	18	38	86	33	19	3.8	69	340.8
Screen level (SL)	1,300	3,200	670	1,400	2,600	1,600	600	230	1,700	12,000
<p>J = Estimated value (reported values are above the MDL, but below the PQL).            Symbol (&lt;) = Non-detect (ND) at the value listed (Method Detection Limit).</p>										

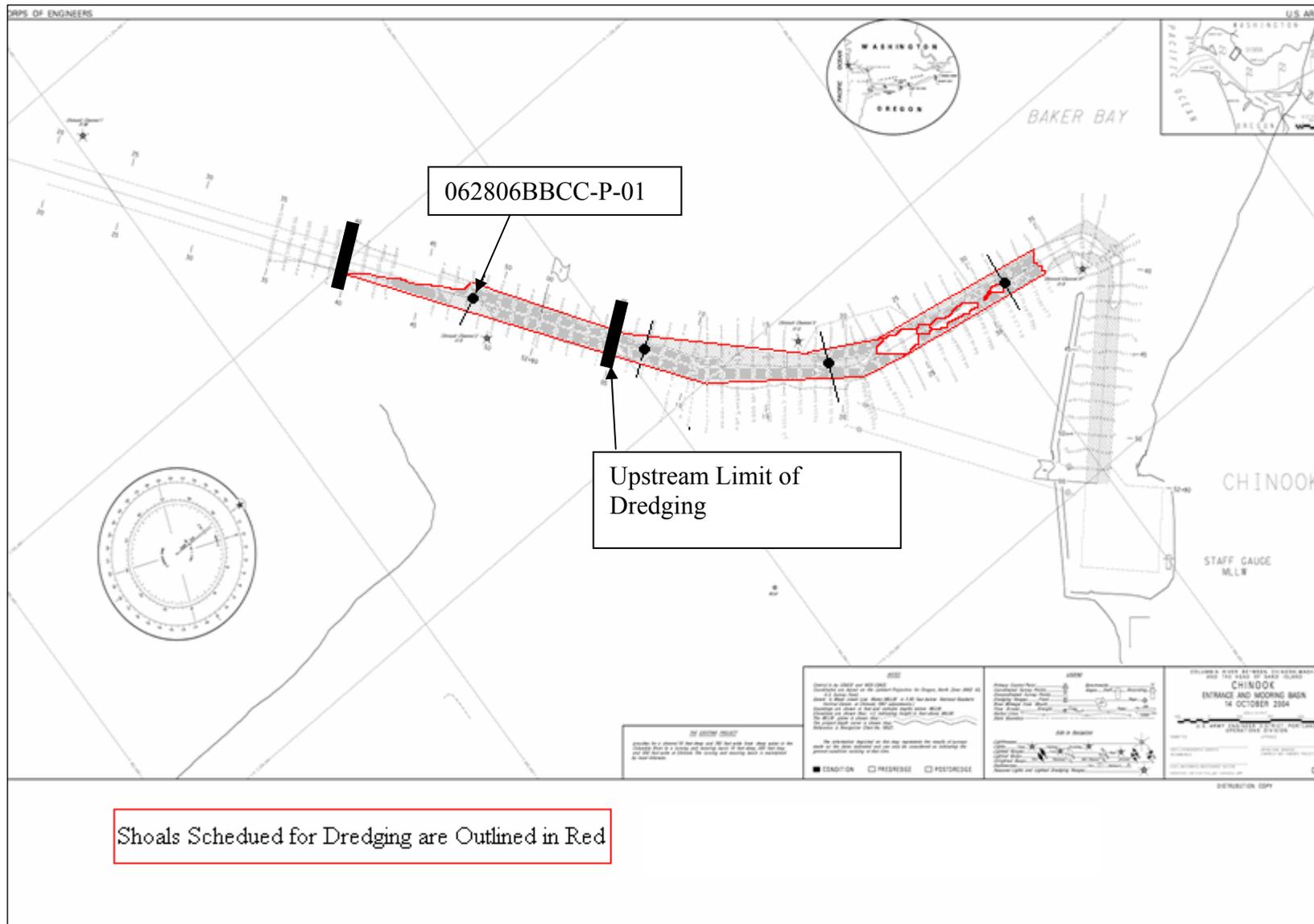
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**Figure 1. Chinook Channel Vicinity Map**



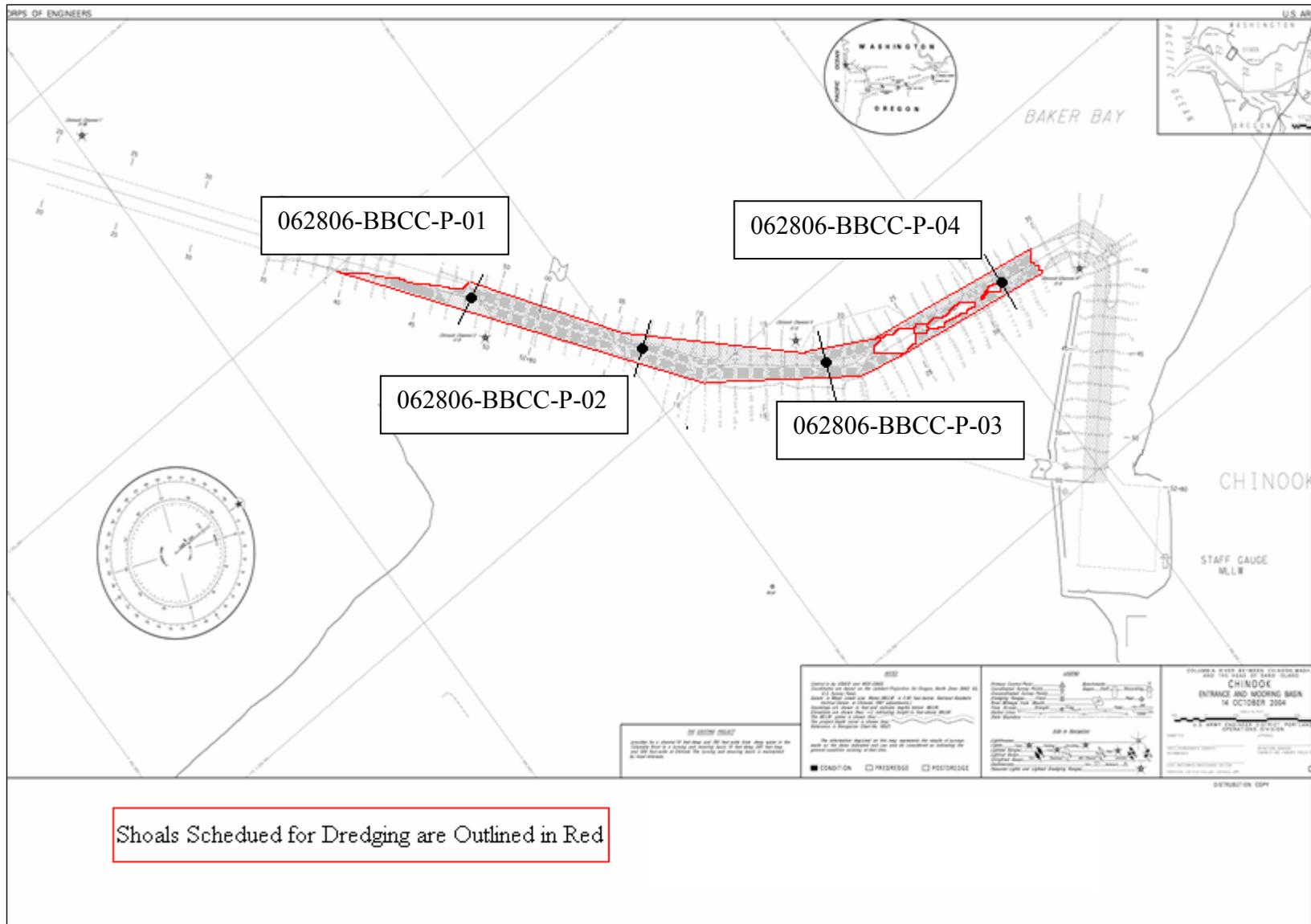
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**Figure 2. Chinook Channel, 2006 Dredging and Sediment Sampling Station Locations**



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**Figure 3. Chinook Channel, Sediment Sampling Station Locations**



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