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Portland District

YAQUINA BAY
AND
SOUTH BEACH MARINA

SEDIMENT QUALITY EVALUATION REPORT

December 2005

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Portland District
Corps of Engineers
CENWP-EC-HR

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EPA	Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
ODEQ	Oregon Department of Environmental Quality
DMEF	Dredge Material Evaluation Framework (1998)
NES	Newly Exposed Surface
QA/QC	Quality Assurance/Quality Control
TOC	Total Organic Carbon
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
MDL	Method Detection Limit
PQL	Practical Quantitation Limit
MRL	Method Reporting Limit
TVS	Total Volatile Solids
ND	non-detect
ppm	parts per million – mg/kg
ppb	parts per billion – ug/kg & ug/L
pptr	parts per trillion – ng/kg
SL	Screening level
As	Arsenic
Cd	Cadmium
Ni	Nickel
Cu	Copper
Sb	Thallium
Cr	Chromium
Pb	Lead
Hg	Mercury
Ni	Nickel
Ag	Silver
Zn	Zinc
RMT	Regional Management Team (Corps-NWP, EPA, ODEQ)
NWP	US Army Corps of Engineers, North Western (Division) Portland District
NOAA	National Oceanic and Atmospheric Administration

K_{ow} The octanol-water partition coefficient (K_{ow}) is the ratio of the concentration of a chemical in octanol and in water at equilibrium and at a specified temperature. Octanol is an organic solvent that is used as a surrogate for natural organic matter. This parameter is used in many environmental studies to help determine the fate of chemicals in the environment. An example would be using the coefficient to predict the extent a contaminant will bioaccumulate in fish. The octanol-water partition coefficient has been correlated to water solubility; therefore, the water solubility of a substance can be used to estimate its octanol-water partition coefficient (ref USGS).

Note: This Yaquina Bay and South Beach Marina Sediment Quality Evaluation Report was reviewed by the Regional (sediment) Management Team (RMT) in accordance with the DMEF (1998). The RMT consists of Portland District Corps of Engineers, EPA and ODEQ personnel. All comments received have been incorporated into the report and was considered final at the end of the review period, February 2006.

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YAQUINA BAY & SOUTH BEACH MARINA
SEDIMENT QUALITY EVALUATION
Sampled September 12, 2005

ABSTRACT

Yaquina Bay is located 115 miles south of the mouth of the Columbia River. The bay forms the fifth largest estuary in Oregon, which is fed by the Yaquina River and other streams, draining an area of 253 square miles. These tributaries deposit approximately 150,000 to 350,000 CY of sediment annually, into the estuary. Some littoral drift also distributes sediment from the ocean to the mouth of the bay.

The entrance to the Federal Channel is 40-feet deep and 400-feet wide from RM –1.2 to RM 0.0. At RM 0.0 to RM 2.0 it is 300 feet wide and gradually reduces from 40 to 30-feet deep. From RM 2.0 to RM 2.4 the channel widens to a pear shaped turning basin, 900-feet by 1,200-feet wide and 1,400-feet long. Also included as part of the federal authorization, is the channel within South Beach Marina that is 10-feet deep by 100-feet wide and 2,035 feet long. The federal channel extends as far upriver as Toledo, Oregon, a distance of about 14 miles (riverine evaluation is not included in this sampling event).

On September 12, a total of 10 samples were collected from shoaling areas at 7 stations within the federally maintained entrance channel and harbor and 3 stations within South Beach Marina channel. All samples were submitted for a full suite of physical and chemical parameters as outlined in the DMMF (1998) Tier II a & b. The federal navigational channel (FNC) samples submitted were classified as "poorly graded sand". Mean grain-size for the FNC samples is 0.18 mm, with 0.2% gravel, 91.6% sand and 8.4% silt/clay and 2.7% volatile solids. Samples from the South Beach Marina channel had a mean grain-size of 0.09mm, with 0.6% gravel, 48.2% sand and 42.8% silt/clay and 8% volatile solids.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels (SLs). Detection levels were sufficiently below the SL to evaluate material proposed for dredging.

Monobutyltin, which does not have an established DMEF SL, was detected in 3 samples within the South Beach Marina federally maintained channel. The levels (0.937ug/L, 0.166ug/L and 0.0644ug/L) are below calculated effects level concentrations*(see Tributyltin under RESULTS section of this report). This data was submitted to the Regional Management Team (RMT) to assist in the evaluation of the material represented by these samples, for suitability of open-water placement. EPA deferred to NOAA fisheries. Jim Meador, of NOAA, provided this statement; the K_{ow}* is very low for monobutyltin, so it would take high environmental concentrations for any significant amounts to be bioaccumulated (ref. NOAA fisheries, J. Meador). No further comments were received from the RMT.

Sediments represented by all samples collected within the federally maintained entrance channel and harbor and stations within South Beach Marina channel are determined to be suitable for unconfined, in-water placement without further characterization, based on referenced toxicity of monobutyltin levels detected and the guidelines provided in the DMEF (1998).

SAMPLING AND ANALYSES OBJECTIVES

- To characterize sediments in accordance with the regional dredge material testing manual protocols, the Dredge Material Evaluation Framework for the Lower Columbia River Management Area (DMEF), 1998, as well as, the Evaluation of Dredged Material Proposed for Disposal at Island, Nearshore, or Upland Confined Disposal Facilities – Testing manual (Upland Testing Manual).

- Collect, handle and analyze representative sediment from Yaquina Bay and Marina entrance in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Analyze for full suite of physical and chemical parameters as outlined in the DMEF (1998) Tier II a & b. DMEF – Table 8.1 contains the list of analytes and methods of analysis (see pgs. 14-16).

PREVIOUS STUDIES

Portland District routinely evaluates sediment from its projects on a 5-year rotation. Physical and chemical evaluation sampling was performed at Yaquina Bay and South Beach Marina in 1980, 1986, 1990, 1991, 1995 and 2000.

Potential sources of contaminants to the Federal Channel are logging, wood processing, fish processing and urban runoff. Over the years sediment studies have shown the bay and river sediment is typically low in concentrations of contaminants of concern (COC). Consequently, sediment from the Navigation Channel has been acceptable for in-water ocean disposal at the local Ocean Dredged Material Disposal Site (ODMDS). Studies of more backwater areas, containing finer grained sediments, such as South Beach Marina and the docks at the city of Newport have shown higher levels of contaminates. Fine-grained sediments from South Beach Marina underwent bioassay analyses, in 1991, for toxicity.

All sediments from previous sampling events were found to be suitable for open in-water placement.

CURRENT SAMPLING EVENT/DISCUSSION

On September 12, a total of 10 samples were collected from shoaling areas at 7 stations within the federally maintained entrance channel and harbor and 3 additional stations within South Beach Marina channel. All samples were submitted for a full suite of physical and chemical parameters as outlined in the DMMF (1998) Tier II a & b. Federal Navigational Channel (FNC) samples submitted were classified as “poorly graded sand”. Mean grain-size for FNC samples is 0.18 mm, with 0.2% gravel (0.0%-1.2% range), 91.6% sand (62.3%-99.3% range) and 8.4% silt/clay (0.7%-37.6% range). Mean volatile solids were 2.7%, with a 0.4% to 13.8% range. Sample from the South Beach Marina channel had a mean grain-size of 0.09mm, with 0.6% gravel (0.0%-1.7% range), 48.2% sand (12.1%-71.7% range) and 42.8% silt/clay (28.3%-86.2% range). Mean volatile solids were 8.0%, with a 5.8% to 9.2% range.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels (SLs). Detection levels were sufficiently below the SL to evaluate material proposed for dredging.

Monobutyltin, which does not have an established DMEF SL, was detected in 3 samples within the South Beach Marina federally maintained channel. The levels (0.937ug/L, 0.166ug/L and 0.0644ug/L) are below calculated effects level concentrations*(see Tributyltin under RESULTS section of this report). This data was submitted to the Regional Management Team (RMT) to assist in the evaluation of the material represented by these samples, for suitability of open-water placement. EPA deferred to NOAA fisheries. Jim Meador, of NOAA, provided this statement; the K_{ow}* is very low for monobutyltin, so it would take high environmental concentrations for any significant amounts to be bioaccumulated (ref. NOAA fisheries, J. Meador). No further comments were received from the RMT.

RESULTS

Physical and Volatile Solids (ASTM methods)

Ten (10) samples were submitted for testing, with data presented in Table 1. Federal Navigational Channel (FNC) samples submitted were classified as “poorly graded sand”. Mean grain-size for FNC samples is 0.18 mm, with 0.2% gravel (0.0%-1.2% range), 91.6% sand (62.3%-99.3% range) and 8.4% silt/clay (0.7%-37.6% range). Mean volatile solids were 2.7%, with a 0.4% to 13.8% range. Sample from the South Beach Marina channel had a mean grain-size of 0.09mm, with 0.6% gravel (0.0%-1.7% range), 48.2% sand (12.1%-71.7% range) and 42.8% silt/clay (28.3%-86.2% range). Mean volatile solids were 8.0%, with a 5.8% to 9.2% range.

Metals (EPA method 6010/7471), Total Organic Carbon (EPA method 9060)

Ten (10) samples were submitted for testing, with data presented in Table 2. The TOC ranged from 900 to 42,000 ug/kg in the samples.

Low levels of As, Cd, Cu, Ni, Pb and Zn were detected in most samples; no Ag, Sb or Hg was detected in any samples, with no levels approaching their respective DMEF SL.

Chlorinated Pesticides/PCBs (EPA method 8080/8082)

Ten (10) samples were submitted for testing, with data presented in Table 3 & 4. No chlorinated pesticides (including DDT) were detected in any of the samples, at sufficiently low detection levels to evaluate data. No PCBs were detected in any of the samples, at sufficiently low detection levels to evaluate data.

Chlorinated Hydrocarbons, Phthalates, Phenols, Miscellaneous Extractables and Polynuclear Aromatic Hydrocarbons (PAH) (EPA method 8270)

Ten (10) samples were submitted for testing, with data presented in Tables 5-8. No samples contained Chlorinated Hydrocarbons, Phthalates, Phenols or Miscellaneous Extractables. Some samples contained low levels of several PAHs, but none approached their respective DMEF SL. All detection levels were sufficiently low enough to evaluated data.

Tributyltin [Total (Bulk) & Pore-Water] (Krone methods)

Four (4) samples were submitted for testing, with data presented in Tables 9. No tributyltin (TBT) was detected in any of the samples for either porewater or whole (bulk) sediment analyses.

Monobutyltin, which does not have an established DMEF SL, was detected in 3 samples within the South Beach Marina federally maintained channel. The levels (0.937ug/L, 0.166ug/L and 0.0644ug/L) are below calculated effects level concentrations*(see the paragraph that follows and reference numbers listed). This data was submitted to the Regional Management Team (RMT) to assist in the evaluation of the material represented by these samples, for suitability of open-water placement. EPA deferred to NOAA fisheries. Jim Meador, of NOAA, provided this statement; the K_{ow}* is very low for monobutyltin, so it would take high environmental concentrations for any significant amounts to be bioaccumulated (ref. NOAA fisheries, J. Meador). No further comments were received from the RMT.

The toxicity (EC_{50}/24-48 hours) of mono- and dibutyltin compounds with the water flea, Daphnia magna, is at concentrations of 1 to 10 mg/L [16, 17, 18], and dibutyltin (EC_{50}/48 hours) with oyster larvae at concentrations of 0.1 to 0.2 mg/L [18].

CONCLUSION

Collection and evaluation of the sediment data was completed using guidelines from the 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 guidance for implementing the Marine Protection, Research, and Sanctuaries Act and Clean Water Act (40 CFR 230), Section 404 (b)(1). The screening levels used are those adopted for use in the DMEF, final November 1998. The DMEF uses a tiered testing approach that requires 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.

The ten (10) samples collected on September 12, 2005, from shoaling areas at 7 stations within the federally maintained entrance channel and harbor and 3 stations within South Beach Marina channel, were submitted for a full suite of physical and chemical parameters as outlined in the DMMF (1998) Tier II a & b. Federal Navigational Channel (FNC) samples submitted were classified as “poorly graded sand”. Mean grain-size for FNC samples is 0.18 mm, with 0.2% gravel, 91.6% sand and 8.4% silt/clay, with 2.7% volatile solids. Sample from the South Beach Marina channel had a mean grain-size of 0.09mm, with 0.6% gravel, 48.2% sand and 42.8% silt/clay, with 8% volatile solids.

The chemical analyses indicated only very low levels of contamination in any of the samples, with all levels well below their respective DMEF screening levels (SLs). Detection levels were sufficiently below the SL to evaluate material proposed for dredging.

Monobutyltin, which does not have an established DMEF SL, was detected in 3 samples within the South Beach Marina federally maintained channel. The levels (0.937ug/L, 0.166ug/L and 0.0644ug/L) are below calculated effects level concentrations*(see Tributyltin under RESULTS section of this report). This data was submitted to the Regional Management Team (RMT) to assist in the evaluation of the material represented by these samples, for suitability of open-water placement. EPA deferred to NOAA fisheries. Jim Meador, of NOAA, provided this statement; the K_{ow}* is very low for monobutyltin, so it would take high environmental concentrations for any significant amounts to be bioaccumulated (ref. NOAA fisheries, J. Meador). No further comments were received from the RMT.

Based on effects level study concentrations and NOAA's referenced K_{ow}* interpretation for monobutyltin and DMEF guidance, the sediments represented by all samples collected in Yaquina Bay FNC and South Beach Marina channel are determined to be suitable for unconfined, in-water placement without further characterization.

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Table 1: Physical Analysis and Volatile Solids

Sample I.D.	Approx. RM	Grain Size (mm)	Percent (%)			
		Mean	Gravel (shell hash)	Sand	Silt/Clay	Volatile Solids
091205YAQB-BC-01	0-15	0.2344	0.0	99.3	0.7	0.4
091205YAQB-BC-02	0+10	0.1922	0.1	99.1	0.8	0.4
091205YAQB-BC-03	1+25	0.1855	0.1	98.4	1.5	0.6
091205YAQB-BC-04	1+40	0.1872	0.0	97.9	2.1	0.5
091205YAQB-BC-05	2+03	0.1479	0.1	87.9	12.0	2.6
091205YAQB-BC-06	2+18	0.1981	1.2	96.0	2.8	0.9
091205YAQB-BC-07	2+18	0.1075	0.1	62.3	37.6	13.8
Mean Values - Bay		0.1790	0.2	91.6	8.4	2.7
091205YAQB-GC-08	Marina +05	0.1549	0.0	71.7	28.3	8.9
091205YAQB-GC-09	Marina +08	0.1097	0.1	60.7	39.2	5.8
091205YAQB-BC-10	Marina +18	0.0148	1.7	12.1	86.2	9.2
Mean Values - Marina		0.0931	0.6	48.2	42.8	8.0

BC = Box Core (Modified Gray O'Hara sampler)
GC = Gravity Core sampler
RM =River Mile

Table 2: Inorganic Metals and TOC

Sample I.D.	As	Cd	Sb	Cu	Pb	Ni	Ag	Zn	Hg	TOC
	mg/kg (ppm)									
0912YAQB-BC-01	3.56	<0.131	<1.08	<0.60	<0.36	<0.60	<0.36	11.7	<0.0404	900
0912YAQB-BC-02	4.45	<0.131	<1.07	<0.60	<0.36	7.79	<0.36	17.0	<0.0424	900
0912YAQB-BC-03	4.98	<0.134	<1.1	<0.61	<0.37	10.8	<0.37	20.6	<0.0435	1000
0912YAQB-BC-04	4.43	<0.142	<1.17	<0.65	<0.39	9.98	<0.39	19.4	<0.0436	1050
0912YAQB-BC-05	6.2	<0.156	<1.28	11.1	4.32	24.9	<0.43	44.9	<0.0511	5300
0912YAQB-BC-06	4.89	<0.131	<1.07	<0.59	<0.36	7.70	<0.35	20.1	<0.0427	1500
0912YAQB-GC-07	8.70	<0.216	<1.77	23.7	7.03	35.5	<0.59	64.6	<0.0728	42000
0912YAQB-GC-08	6.31	0.239	<1.96	18.0	<0.65	27.0	<0.8	51.7	<0.0737	11000
0912YAQB-GC-09	6.41	0.186	<1.51	17.5	5.64	27.1	<0.50	51.5	<0.0573	20500
0912YAQB-GC-10	9.27	0.880	<2.39	39.3	9.39	40.4	<0.8	101	<0.0404	5900
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).

Table 3: Chlorinated Pesticides

Sample I.D.	Method 8080 µg/kg (ppb)								
	4,4'-DDD	4,4'-DDE	4,4'-DDT	Total DDT	Aldrin	Chlordane	Dieldrin	Heptachlor	Gamma-BHC (Lindane)
0912YAQB-BC-01	<0.017	<0.025	<0.010	ND	<0.024	<1.94	<0.022	<0.037	<0.037
0912YAQB-BC-02	<0.018	<0.026	<0.010	ND	<0.026	<2.06	<0.024	<0.039	<0.017
0912YAQB-BC-03	<0.019	<0.027	<0.010	ND	<0.027	<2.14	<0.024	<0.040	<0.018
0912YAQB-BC-04	<0.019	<0.028	<0.011	ND	<0.028	<2.21	<0.025	<0.042	<0.019
0912YAQB-BC-05	<0.022	<0.031	<0.012	ND	<0.031	<2.47	<0.028	<0.047	<0.021
0912YAQB-BC-06	<0.018	<0.026	<0.010	ND	<0.026	<2.09	<0.024	<0.039	<0.017
0912YAQB-GC-07	<0.031	<0.044	<0.017	ND	<0.044	<3.49	<0.040	<0.066	<0.029
0912YAQB-GC-08	<0.033	<0.047	<0.016	ND	<0.046	<3.72	<0.043	<0.070	<0.031
0912YAQB-GC-09	<0.026	<0.037	<0.014	ND	<0.036	<2.90	<0.033	<0.055	<0.024
0912YAQB-BC-10	<0.041	<0.059	<0.023	ND	<0.058	<4.62	<0.053	<0.087	<0.039
Screening Level (SL)	DDD+DDE+DDT = Total 6.9				10	10	10	10	10
Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).									

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Table 4, Polychlorinated Biphenyl (PCBs) as Aroclors

Sample I.D.	Method 8082 µg/kg (ppb)									
	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Aroclor 1262	Aroclor 1268	Total
0912YAQB-BC-01	<2.26	<1.60	<2.51	<1.32	<1.25	<1.23	<1.74	<1.35	<1.99	ND
0912YAQB-BC-02	<2.41	<1.70	<2.66	<1.41	<1.33	<1.31	<1.85	<1.43	<2.11	ND
0912YAQB-BC-03	<2.49	<1.75	<2.75	<1.45	<1.38	<1.35	<1.91	<1.48	<2.18	ND
0912YAQB-BC-04	<2.56	<1.80	<2.83	<1.50	<1.42	<1.39	<1.97	<1.52	<2.25	ND
0912YAQB-BC-05	<2.87	<2.02	<3.17	<1.67	<1.59	<1.56	<2.20	<1.71	<2.52	ND
0912YAQB-BC-06	<2.37	<1.67	<2.62	<1.38	<1.31	<1.29	<1.82	<1.41	<2.08	ND
0912YAQB-GC-07	<4.02	<2.84	<4.45	<2.35	<2.23	<2.19	<3.09	<2.39	<3.54	ND
0912YAQB-GC-08	<4.38	<3.09	<4.85	<2.56	<2.43	<2.38	<3.36	<2.60	<3.85	ND
0912YAQB-GC-09	<3.40	<2.40	<3.76	<1.98	<1.88	<1.85	<2.61	<2.02	<2.99	ND
0912YAQB-BC-10	<5.39	<3.80	<5.96	<3.15	<2.99	<2.93	<4.14	<3.20	<4.73	ND
Screening Level (SL)	Total All Aroclor Compounds in Sample =									130

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

Table 5: Chlorinated Hydrocarbons & Phthalates

Semi-volatiles by Method 8270C µg/kg (ppb)											
	Chlorinated Hydrocarbons					Phthalates					
Sample I.D.	1,3 Dichloro benzene	1,4 Dichloro benzene	1,2 Dichloro benzene	1,2,4 Trichloro benzene	Hexachloro benzene (HCB)	Dimethyl phthalate	Diethyl phthalate	Di-n-butyl phthalate	Butyl benzyl phthalate	Bis(2-ethylhexyl) phthalate	Di-n-octyl phthalate
0912YAQB-BC-01	<2	<2	<1	<2	<2	<2	<2	<2	<2	<3	<2
0912YAQB-BC-02	<2	<2	<1	<3	<2	<3	<3	<2	<3	<3	<3
0912YAQB-BC-03	<2	<2	<1	<3	<2	<3	<3	<2	<3	<3	<3
0912YAQB-BC-04	<2	<2	<1	<3	<2	<3	<3	<2	<3	<3	<3
0912YAQB-BC-05	<2	<2	<2	<3	<2	<3	<3	<2	<3	<3	<3
0912YAQB-BC-06	<2	<2	<1	<3	<2	<3	<3	<2	<3	<3	<3
0912YAQB-GC-07	<3	<3	<2	<4	<3	<4	<4	<3	<4	<5	<4
0912YAQB-GC-08	<3	<3	<2	<5	<3	<5	<5	<3	<5	<6	<5
0912YAQB-GC-09	<3	<3	<2	<4	<3	<4	<3	<3	<4	<5	<4
0912YAQB-BC-10	<4	<4	<3	<6	<4	<6	<6	<4	<6	<7	<6
Screen level (SL)	170	110	35	31	22	1400	1200	5100	970	8300	6200

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

Table 6: Phenols and Miscellaneous Extractables

Semi-volatiles by Method 8270C µg/kg (ppb)											
	Phenols					Miscellaneous Extractables					
Sample I.D.	Phenol	2-Methyl phenol	4-Methyl phenol	2,4-Dimethyl phenol	Penta chloro phenol	Benzyl alcohol	Benzoic acid	Dibenzo furan	Hexa chloro ethane	Hexa chloro butadiene	N-Nitro sodi phenyl amine
0912YAQB-BC-01	<2	<4	<9	<5	<2	<4	<30	<2	<2	<2	<2
0912YAQB-BC-02	<3	<4	<9	<5	<2	<4	<32	<3	<2	<3	<3
0912YAQB-BC-03	<3	<4	<9	<5	<2	<5	<33	<3	<2	<3	<3
0912YAQB-BC-04	<3	<4	<9	<5	<2	<5	<34	<3	<2	<3	<3
0912YAQB-BC-05	<3	<5	<11	<6	<2	<5	<38	<3	<2	<3	<3
0912YAQB-BC-06	<3	<4	<9	<5	<2	<4	<32	<3	<2	<3	<3
0912YAQB-GC-07	<4	<6	<15	<9	<3	<8	<54	<4	<3	<4	<4
0912YAQB-GC-08	<5	<7	<15	<9	<3	<8	<57	<5	<3	<5	<5
0912YAQB-GC-09	<4	<5	<13	<7	<3	<6	<45	<4	<3	<4	<4
0912YAQB-BC-10	<6	<<9	<20	<11	<4	<10	<71	<6	<4	<6	<6
Screen level (SL)	420	63	670	29	400	57	650	540	1400	29	28

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

Table 7: Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight

Polynuclear Aromatic Hydrocarbons (PAHs) Low Molecular Weight Analytes µg/kg (ppb)								
Sample I.D.	**Acenaphthene**	**Acenaphthylene**	**Anthracene**	**Fluorene**	**2-Methyl naphthalene**	**Naphthalene**	**Phen anthrene**	**Total Low PAHs**
0912YAQB-BC-01	<2	<2	<2	<2	<4	<2	<1	ND
0912YAQB-BC-02	<3	<3	<3	<3	<4	<3	<1	ND
0912YAQB-BC-03	<3	<3	<3	<3	<4	<3	<1	ND
0912YAQB-BC-04	<3	<3	<3	<3	<4	<3	<1	ND
0912YAQB-BC-05	<3	<3	<3	<3	<5	<3	<2	ND
0912YAQB-BC-06	<3	<3	<3	<3	<4	<3	<1	ND
0912YAQB-GC-07	<4	<4	<4	<4	<6	<4	<2	ND
0912YAQB-GC-08	<5	<5	<5	<5	<7	<5	**41**	**41**
0912YAQB-GC-09	<4	<4	<4	<4	<5	<4	**54**	**54**
0912YAQB-BC-10	<6	<6	<6	<6	<9	<6	<3	ND
Screen level (SL)	500	560	960	540	670	2100	1500	5200

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

Table 8: Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight

Polynuclear Aromatic Hydrocarbons (PAHs) High Molecular Weight Analytes µg/kg (ppb)										
Sample I.D.	**Benzo(a)-anthracene**	**Benzo-fluro-anthenes**	**Benzo-(g,h,i)-perylene**	**Chrysene**	**Pyrene**	**Benzo(a)-pyrene**	**Indeno-(1,2,3-cd)-pyrene**	**Dibenzo (a,h) anthracene**	**Fluor-anthene**	**Total High PAHs**
0912YAQB-BC-01	<2	<10	<4	<2	<2	<3	<6	<5	<3	ND
0912YAQB-BC-02	<2	<10	<4	<3	<3	<3	<6	<6	<3	ND
0912YAQB-BC-03	<2	<11	<5	<3	<3	<3	<7	<6	<3	ND
0912YAQB-BC-04	<2	<11	<5	<3	<3	<3	<7	<6	<3	ND
0912YAQB-BC-05	**8.1**	<12	<5	**12**	**12**	<4	<8	<7	**43**	**75.1**
0912YAQB-BC-06	<2	<10	<4	<3	<2	<3	<6	<6	<3	ND
0912YAQB-GC-07	<3	<17	<8	<4	<3	<5	<11	<10	<5	ND
0912YAQB-GC-08	<3	<18	<8	<5	**64**	<6	<11	<10	**110**	**174**
0912YAQB-GC-09	**14**	**21.3**	<6	**35**	**99**	<5	<9	<8	**200**	**369.3**
0912YAQB-BC-10	<4	<23	<10	<6	<4	<7	<14	<13	<7	ND
Screen level (SL)	1300	3200	670	1400	2600	1600	600	230	1700	12000

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

Table 9: Total and Pore-water Organotin

Organotin								
	Total (Bulk) ug/kg				Pore-water ug/L			
Sample I.D.	Monobutyltin	Dibutyltin	Tributyltin	Tetrabutyltin	Monobutyltin	Dibutyltin	Tributyltin	Tetrabutyltin
0912YAQB-GC-07	<0.596	<0.676	<0.13	<0.6	<0.0013	<0.0027	<0.0047	<0.0068
0912YAQB-GC-08	<0.546	<0.619	<1.04	<1.46	**0.937**	<0.0043	<0.0075	<0.0108
0912YAQB-GC-09	**4.74**	<0.637	<1.07	<1.51	**0.166**	<0.0036	<0.0063	<0.0090
0912YAQB-BC-10	**6.74**	<0.921	<1.55	<2.18	**0.0644**	<0.0022	<0.0039	<0.0055
Screen level (SL)	-	-	73*	-	-	-	0.15	-

Symbol (<) = Non-detect (ND) at the value listed (Method Detection Limit).
* PSSDA Guideline Value
- No DMEF Screening Level Established

Figure 1, Yaquina Bay and South Beach Marina, Vicinity Map

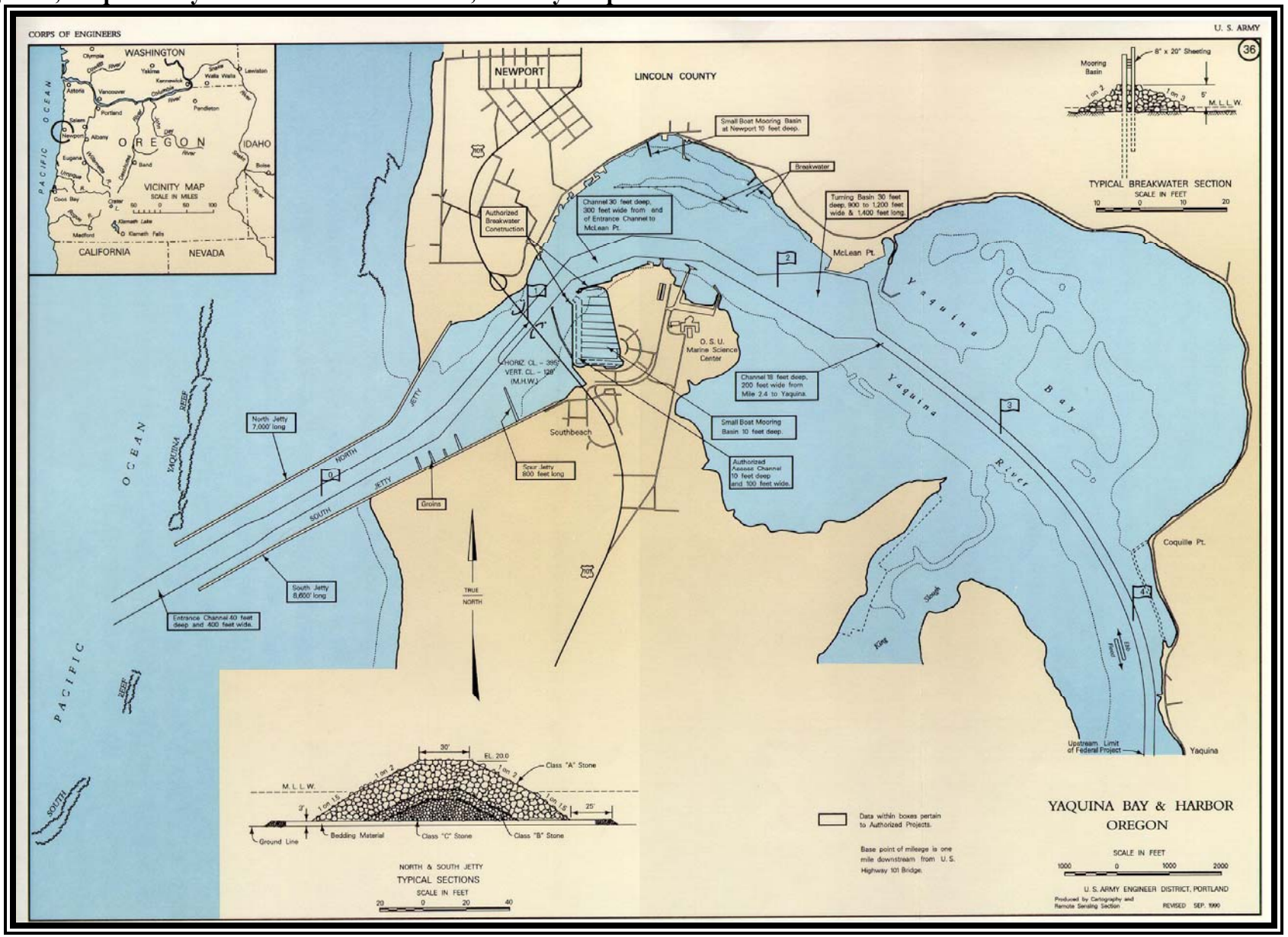

Figure 2: Yaquina Bay Entrance, Sediment Sampling Station Locations

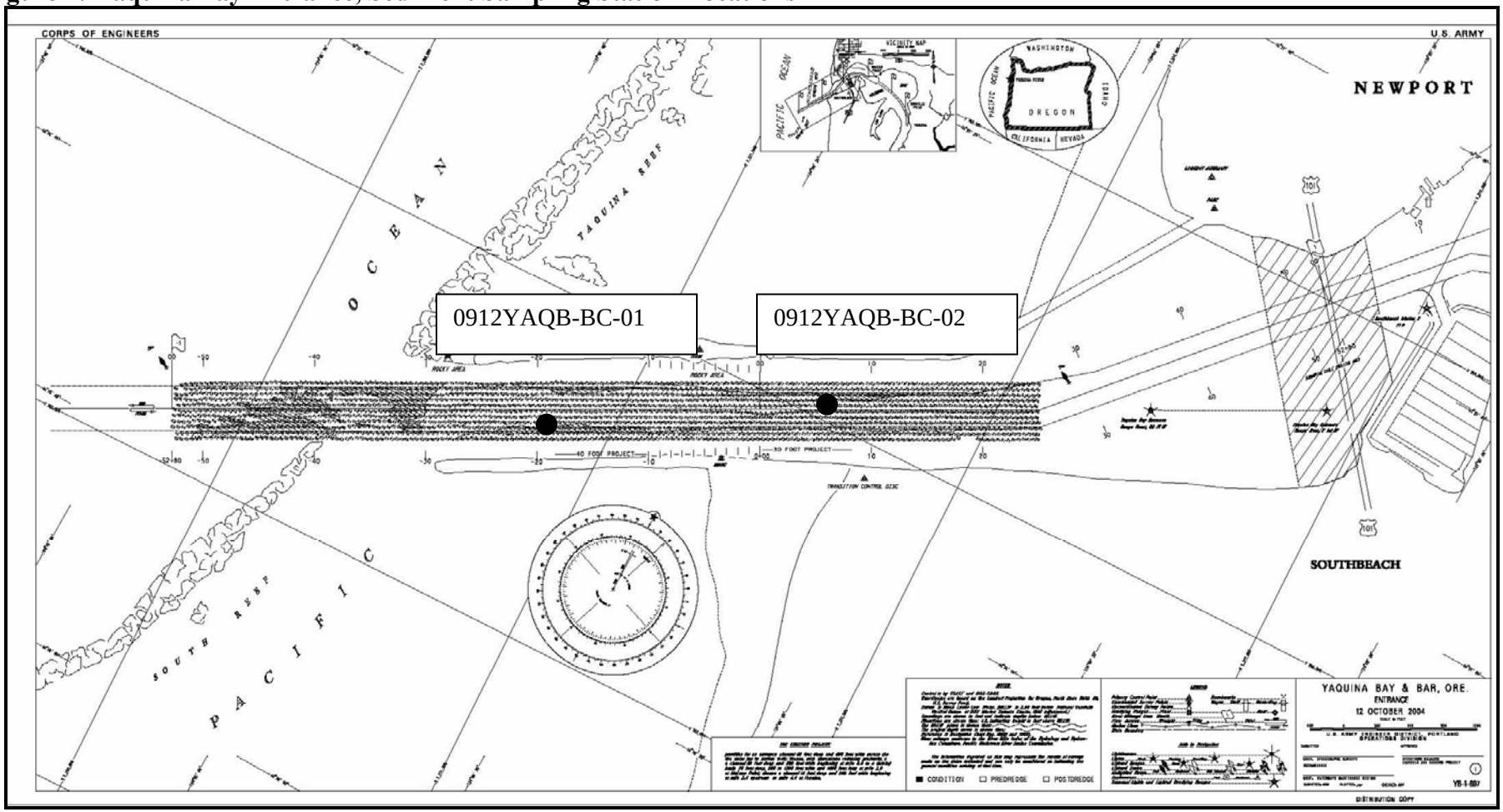

Figure 3: Yaquina Bay and Harbor, Sediment Sampling Station Locations

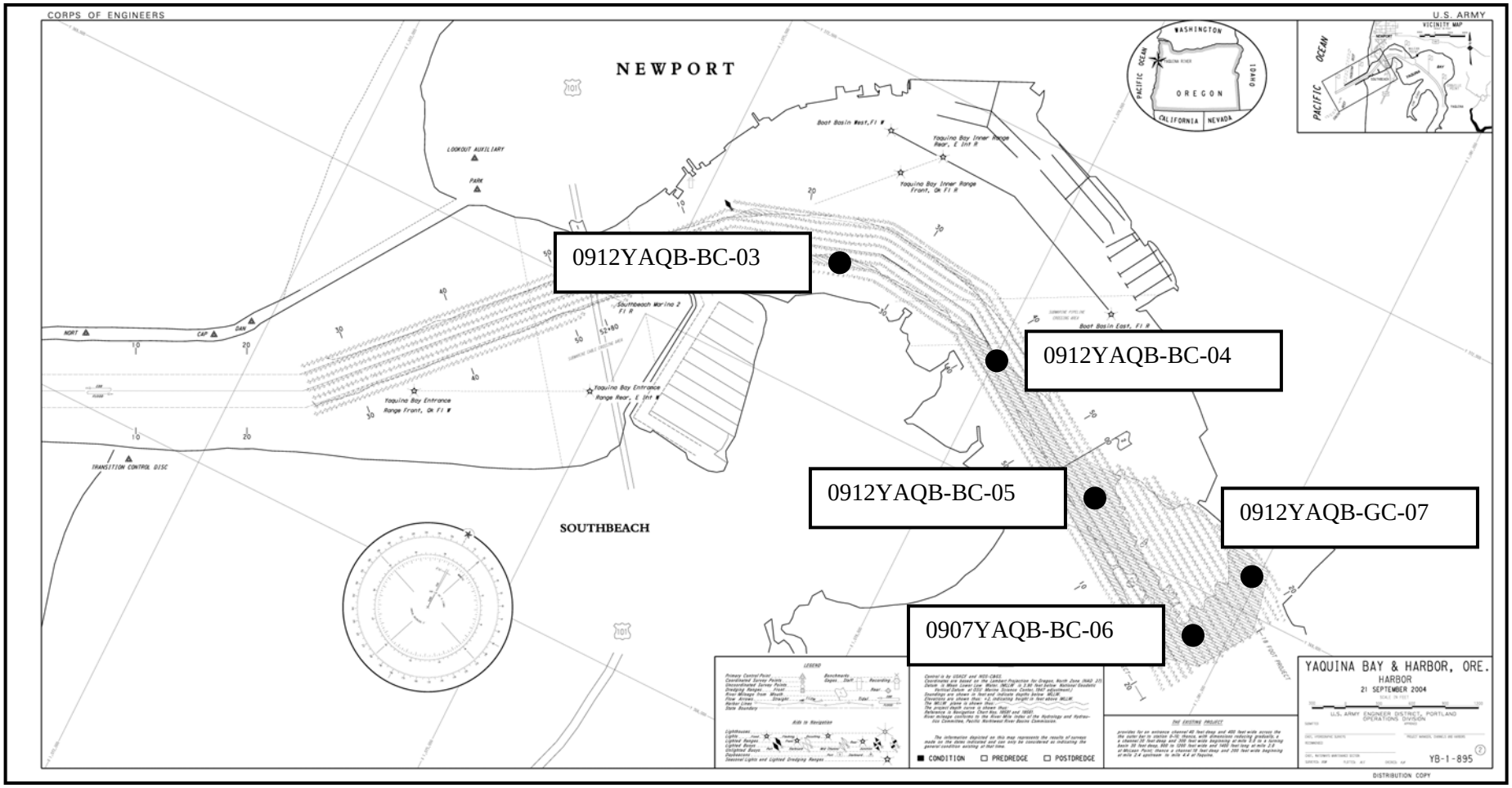

Figure 4: Yaquina Bay and South Beach Marina, Sediment Sampling Station Locations

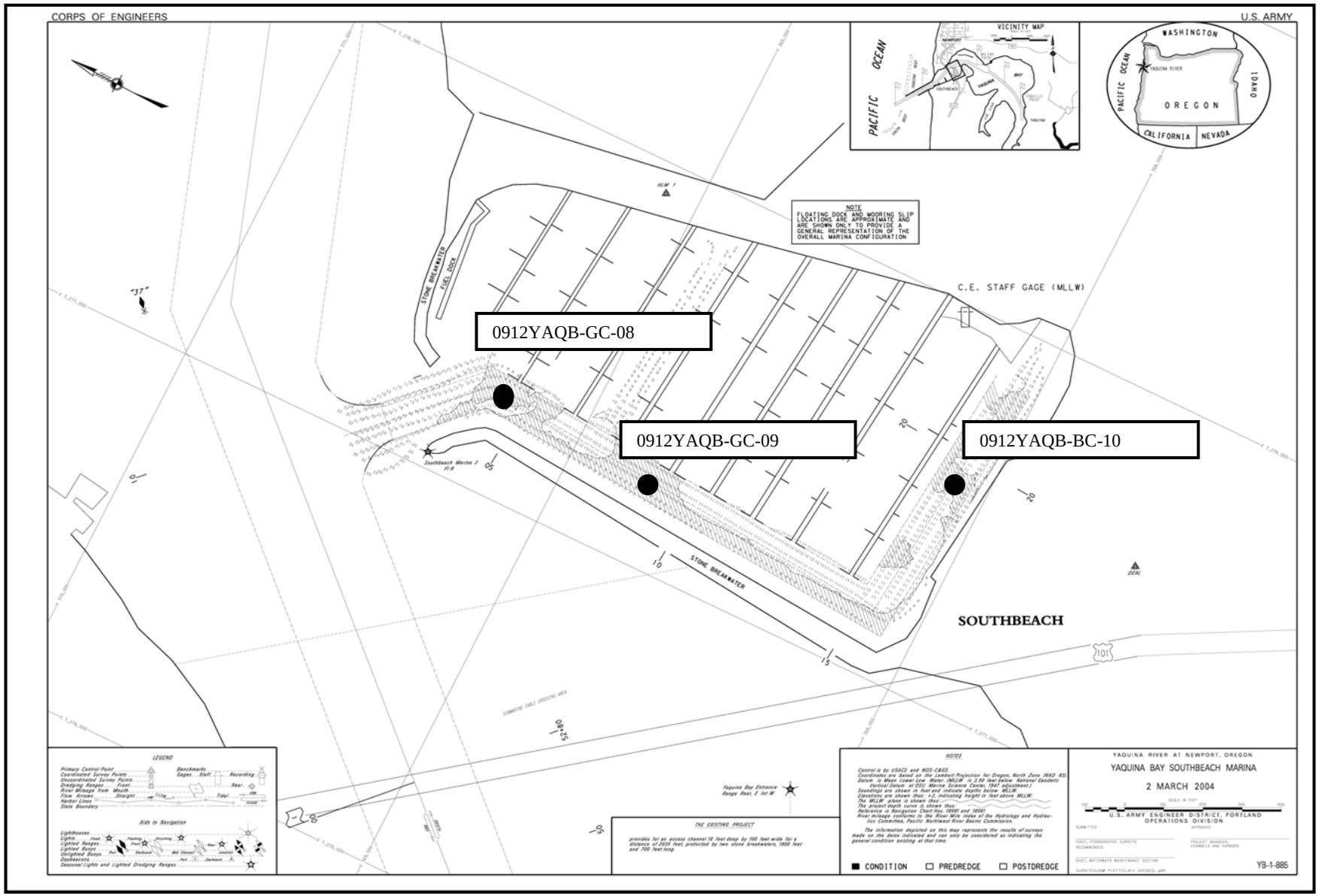

Figure 5: Yaquina Bay & Sediment Sampling Event