CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD November 9, 2006

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE PORT OF SEATTLE T-91 IN SMITH COVE, SEATTLE, WASHINGTON (FILE # 200601091) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT THE ELLIOTT BAY DMMP DISPOSAL SITE.

1. Introduction. The following summary reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) on the suitability of approximately 9.4 thousand cubic yards (cy) of dredged material from two berthing areas adjacent to Port of Seattle's Pier 91 in Smith Cove in Seattle, Washington. Disposal of suitable material is planned for placement at the Elliott Bay open water disposal site.

   This project was ranked high for testing purposes, and the dredging is required to achieve a project depth of -35 ft MLLW with one foot of allowable overdepth (to –36 ft. MLLW).

   This determination of suitability for open-water disposal is based on the acceptability of the sampling conducted by Port of Seattle contractors in early June of 2006 (Table 1). All relevant test data from this sampling event is contained in a report submitted by Anchor Environmental dated October, 2006. These data were considered sufficient and acceptable for decision-making by the DMMP agencies using best-professional judgement.

Table 1. Regulatory Tracking Dates

SAP's received	May 1, 2006
SAP's approved	June 5, 2006
Sampling dates	June 7 and 8, 2006
Sampling Equipment	Vibra Corer
Data report submitted	October 19, 2006
Recency Determination: High (2 years)	June 2008*
DAIS Tracking number	POS91-1-B-F-231

* This recency determination only applies to the specific limited areas of T-91 that were sampled during the June sampling event since the majority of T-91 was not sampled.

Table 2. Project Synopsis

Proposed disposal site	Elliott Bay open water non-dispersive site
Sediment ranking	High
Predicted maximum dredge volume	9400* cubic yards
Project last dredged	1992

* An additional 2100 cubic yards of riprap and possibly smaller rock is to be removed from the east berth and disposed or re-used in an upland area.

2. Background. The history surrounding dredging of Pier 91 is not clear. What is known is that acquisition and development of T-91 was one of the first projects undertaken by the newly formed Port of Seattle (Port) in 1911. It was owned and operated by the U.S. Navy from 1941 to 1975.

   The last dredging episode at Pier 91 was in 1992, in conjunction with expansion of the concrete apron on the west side of the pier. For this dredging project, three samples were collected along the western side of Pier 91 in 19991. Mercury and multiple PAH's exceeded SQS and CSL at each location. In addition, as part of the Elliott Bay Action Program, three samples were collected in the northernmost portions of Piers 90 and 91. Several chemicals of concern, including PAH's and mercury, were detected at concentrations exceeding SQS and CSL values.

   The proposed dredging project will establish adequate depth to accommodate calling cruise ships at two berths approximately 1200 ft long by 185 ft wide. The western portions of DMMU's 1 and 2 are mostly side slope material that is likely native material. The cut slope in these areas was designed to match the existing slope grade.

3. Sampling. Figure 1 shows the general vicinity map of the project area, whereas Figures 2 and 3 depict bathymetry, cross sections, and the sampling locations of the three DMMU's.

   Sampling of Pier 91 took place on June 7 and 8, 2006. In general, the agencies' Sampling and Analysis Plan (SAP) was followed. Refusal was encountered in almost all cores collected in DMMU 1, and only one core used in the composite was collected to a depth of -37 feet MLLW (comprising a design depth of -35 feet MLLW, 1 foot of allowable overdredge, plus 1 foot for collection of a Z-layer). The other core only reached a depth of -30.2 feet MLLW. The maximum depth of sediment samples collected from DMMU 2 was -34.9 feet MLLW. Consequently no z-sample was collected for DMMU 2. Sediment samples were not collected in DMMU 3 due to hard rocky substrate or riprap that refused penetration of the coring device on all attempts.

   Sampling at Pier 91 required two cores from DMMU-1 and DMMU-2 although six cores were collected from DMMU-1 and five from DMMU-2. Only two cores from each DMMU were composited to form a single sample.

4. Chemical Analysis The Agencies' approved sampling and analysis plan was followed, and quality assurance/quality control guidelines specified by PSEP and the DMMP program was generally complied

with. Chemical analyses were performed by Analytical Resources Incorporated (ARI) of Tukwila, Washington.

Conventional results are presented in Table 3. Chemical analytical results (Table 4) indicated that all chemicals of concern were detected or had detection limits that were below screening levels. None of the detection limits or detected values was above DMMP screening levels of the Dredged Material Management Program except Total DDT concentration in DMMU 2 of 11 ppb. The sample was subjected to further cleanup (acid) to try to eliminate PCB's, thought to be interfering with the analysis, and re-analyzed. While total DDT fell to 6.6 ppb, the concentration of 4, 4'-DDT had a detection limit of 7.6 ppb exceeding the DDT SL of 6.9 ppb. Based on these testing results, bioassay testing was required for this DMMU. The bioassay toxicity testing was conducted by Weston Inc. on DMMU 2.

5. Bioassay Results. The detection limit exceedance of the screening level for Total DDT triggered the requirement to conduct bioassays for DMMU 2. There were no screening level exceedances for DMMU 1; therefore no bioassays were conducted for this DMMU.

The amphipod 10-day acute toxicity test, bivalve sediment larval combined mortality and abnormality test, and the 20-day juvenile infaunal growth test were conducted for DMMU 2 by Weston Solutions. All bioassays were started within the 56-day holding time limit. However, the initial test organism used for the sediment larval test – the bivalve *Mytilus galloprovincialis* – failed to perform in three successive attempts. The bivalve *Crassostrea gigas* was substituted for *M. galloprovincialis* in a fourth attempt (this time successful), but by the time this fourth attempt was initiated, the holding time limit had been exceeded. But because the sediment had been stored in the dark at 4 degrees C under a nitrogen atmosphere, and the chemical triggering the bioassays – total DDT – is of low volatility and unlikely to have been biodegraded during the holding period, the DMMP agencies used best professional judgment in accepting the *C. gigas* test results for decision-making, despite the holding time exceedance.

In the juvenile infaunal bioassay (*Neanthes arenaceodentata*), the control sediment exceeded the performance standard of 20 percent mortality. The cause of this exceedance is unknown, but the mean individual growth rate of the remaining organisms in the control sediment was far above the minimum standard of 0.38 mg/individual/day. In addition, the mortality rates in the reference and test sediments were both below 20 percent, providing additional evidence that the overall test was valid. Based on these mitigating factors, the DMMP agencies accepted the results as adequate for decision-making.

PSDDA interpretation guidelines, as modified by changes made at annual review meetings, were used to evaluate the bioassay data (see Table 2b for the current interpretation guidelines). A summary of the bioassay results is presented in Table 5. There were no hits in any of the bioassays. As a result, DMMU 2 passed biological testing.

6. Suitability. This memo documents the suitability of proposed dredged sediments within Port of Seattle T-91 project area for open water disposal. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

DMMUs 1&2: Based on the results of the previously described testing, the DMMP agencies concluded that the 9,400 cubic yards of material to be dredged from the west side of Pier 91 (DMMU's 1 and 2) is suitable for disposal at the Elliott Bay non-dispersive open-water disposal site.

DMMU 3: Proposed dredging in DMMU 3 would occur along the toe of slope at the east face of Terminal 91. The dredge area extends the length of the berth (1200 ft long) but has a very thin width (from 0 ft to a maximum width of 20 ft). The remaining berth width (to the full 185 feet width) is already below the required dredge elevation. The dredge material is rock from prior slope stabilization or slope construction activities; rock material is not considered suitable for unconfined open water disposal. Since no testing has been conducted on the east side of Pier 91 (DMMU 3), no material from DMMU 3, including riprap and smaller rock, is approved for open-water disposal at the Elliott Bay site.

If riprap and rock are removed from this area, post-dredge testing of the newly exposed sediment (Z-sample) will be required. Four discrete 0-10cm samples will be obtained as soon as possible (within a few days) after completing the riprap/rock removal and analyzed for the complete suite of DMMP COCs. The analysis results will be evaluated by comparing the sediment quality of representative 0-10cm grab samples to Sediment Management Standards (SMS) for compliance with the DMMP and Washington State antidegradation policy. Note that this comparison may need to include results of bioassay testing (http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/dmmo/Antidegradation_Clarif.pdf). The applicant has stated that they intend to collect pre-dredge samples from the rip-rap area using divers. If this information is available it will also be considered in the DMMP's antidegredation determination.

It should be noted that the DMMP's determination of compliance with antidegredation will likely be based on Best Professional Judgment (BPJ) due to the number of chemicals potentially involved (which may express themselves differently in pre-dredge surface versus the post-dredge surface) In addition, if the post-dredge environment differs greatly from the pre-dredge conditions (riprap versus sediment with little or no riprap), the resulting change in exposure routes to organisms will also factor into the antidegradation determination. In summary, several lines of information, including pre-dredge, post-dredge chemistry, and possibly bioassays, may be considered by the DMMP agencies in making this determination.

If the DMMP determines that the post-dredge surface is degraded relative to the pre-dredge condition, the Port will conduct a contingency action by dredging an additional one foot of material and backfilling with 6-12 inches of clean material. Additional dredging would add approximately 1,300 cy of dredged material (increasing the total dredge volume at T91 from 11,500 cy to 12,800 cy); backfilling would include placing approximately the same quantity of clean backfill material (1,300 cy). Any additional material dredged under a contingency measure would be disposed of at an upland location. Backfill material likely will consist of some combination of sands, gravels and small rock. Contingency dredging is limited to one foot due to a concern that a deeper cut may result in slope instability and failure due to the steep slopes at T91.

This post-construction evaluation and possible contingency action will be required as a special condition to the Corps Section 404/10 permit.

This suitability determination does not constitute final agency approval of the project. A final decision on project approval will be made after full consideration of agency input, and after an alternatives analysis is done under Section 404(b)(1) of the Clean Water Act.

7. Reference.

Anchor 2006. Sediment Characterization Report, Port of Seattle terminal 91. Report to Port of Seattle.

Concur:

11/9/06 — Sandra Lemlich

Date — Sandra Lemlich, Seattle District Corps of Engineers

11/9/06 — Erika Hoffman

Date — Erika Hoffman, Environmental Protection Agency

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Nov 9th 2006 — Sarah Dzinbal

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Table 3. Sediment conventional results, Port of Seattle Pier 91

	Rank	*H*	*H*
	DMMU	1	2
	Maximum Sampling depth (ft) [a, b]	5	4
	Mean Sampling depth (ft) [a, b]	4	3.5
	Volume (cubic yards)	4,533	4,739
Grain Size	% Gravel	43	48
	% Sand	46	34
	% Silt	8	13
	% Clay	3	5
	% Fines (clay+silt)	11	18
	Total Solids (%)	87	82
	Total Volatile Solids (%)	1	2
	Total Organic Carbon, %	0.5	0.7
	Total Ammonia, mg/kg	4	16
	Total Sulfides, mg/kg	230	160

[a] Includes z-sample which was not analyzed
[b] Feet below mud-line

Table 4. Results of chemical analysis compared to DMMP criteria.

Location ID Sample ID Sample Date	DMMP			T91-1 T91-1-CS 06/08/2006	T91-2 T91-2-CS 06/07/2006	T91-2-CS Re-analysis for DDD, DDE,
Depth Interval	SL	BT	ML	0-4 feet	0-4 feet	and DDT
Metals (mg/kg)						
Antimony	150	--	200	6 UJ	7 UJ	--
Arsenic	57	507.1	700	6 U	7 U	--
Cadmium	5.1	11.3	14	0.2 U	0.4	--
Chromium	--	267	--	22.7	32.5	--
Copper	390	1027	1300	18.7	29.7	--
Lead	450	975	1200	10	27	--
Mercury	0.41	1.5	2.3	0.13	0.3	--
Nickel	140	370	370	26	34	--
Selenium	--	3	--	0.2 U	0.3 U	--
Silver	6.1	6.1	8.4	0.4 U	0.5	--
Zinc	410	2783	3800	38.2	59.4	--
Organometalics (µg/L)						
Tributyltin (as ion)	0.15	0.15	--	0.09 JB	0.10JB	--
PCBs (µg/kg)						
Aroclor 1016	--	--	--	9.9 U	9.7 U	--
Aroclor 1221	--	--	--	9.9 U	9.7 U	--
Aroclor 1232	--	--	--	9.9 U	9.7 U	--
Aroclor 1242	--	--	--	9.9 U	9.7 U	--
Aroclor 1248	--	--	--	9.9 U	9.7 U	--
Aroclor 1254	--	--	--	19	39	--
Aroclor 1260	--	--	--	15J	42J	--
Total PCBs	130	--	3100	34	81	--
Pesticides (µg/kg)						
4,4'-DDD	--	--	--	2.0 U	6.8 UYJ	6.6
4,4'-DDE	--	--	--	2.0 U	2.0 UJ	1.9 U
4,4'-DDT	--	--	--	2.0 U	11J	**7.6 UY**
Total DDT	6.9	50	69	2.0 U	**11J**	6.6
Aldrin	10	--	--	.98 U	.98 UJ	--
gamma-BHC (Lindane)	10	--	--	.98 U	.98 UJ	--
alpha-Chlordane	10	37	--	.98 U	.98 UJ	--
gamma-Chlordane	--	--	--	.98 U	1.4 UYJ	--
Total chlordane[1]			--	.98 U	2.0 UJ	--
Dieldrin	10	--	--	2.0 U	2.0 UJ	--
Heptachlor	10	--	--	.98 U	.98 UJ	--
cis-Nonachlor	--	--	--	2.0 U	2.0 UJ	--
trans-Nonachlor	--	--	--	2.0 U	2.0 UJ	--
LPAH (µg/kg)						
Naphthalene	2100	--	2400	20 U	52	--
Acenaphthylene	560	--	1300	20 U	17 J	--
Acenaphthene	500	--	2000	20 U	20 J	--

Fluorene	540	--	3600	20 U	16 J	--
Phenanthrene	1500	--	21000	23	86	--
Anthracene	960	--	13000	26	85	--
2-Methylnaphthalene	670	--	1900	20 U	20 U	--
Total LPAH	5200	--	29000	49	276	--
HPAH (µg/kg)						
Fluoranthene	1700	4600	30000	120	210	--
Pyrene	2600	11980	16000	120	450	--
Benzo(a)anthracene	1300	--	5100	39	130	--
Chrysene	1400	--	21000	60	250	--
Benzo(b)fluoranthene	--	--	--	93	330	--
Benzo(k)fluoranthene	--	--	--	61	260	--
benzo(b+k)fluoranthene	3200		9900	154	590	
Benzo(a)pyrene	1600	--	3600	73	310	--
Indeno(1,2,3-cd)pyrene	600	--	4400	42	130	--
Dibenzo(a,h)anthracene	230	--	1900	11 J	39	--
Benzo(g,h,i)perylene	670	--	3200	50	160	--
Total HPAH	12000	--	69000	669	2269	--
Chlorinated Hydrocarbons (µg/kg)						
1,3-Dichlorobenzene	170	--	--	20 U	20 U	--
1,4-Dichlorobenzene	110	--	120	1.2 U	1.3 U	--
1,2-Dichlorobenzene	35	--	110	1.2 U	1.3 U	--
1,2,4-Trichlorobenzene	31	--	64	6.1U	6.6UJ	--
Hexachlorobenzene	22	168	230	0.98U	0.98UJ	--
Phthalates (µg/kg)						
Dimethylphthalate	71	--	1400	20 U	20 U	--
Diethylphthalate	200	--	1200	20 U	20 U	--
Di-n-butylphthalate	1400	--	5100	20 U	20 U	--
Butylbenzylphthalate	63	--	970	20 U	20 U	--
bis(2-Ethylhexyl)phthalate	1300	--	8300	20 U	80	--
Di-n-octylphthalate	6200	--	6200	20 U	20 U	--
Phenols (µg/kg)						
Phenol	420	--	1200	20 U	20 U	--
2-Methylphenol	63	--	77	20 U	20 U	--
4-Methylphenol	670	--	3600	20 U	20 U	--
2,4-Dimethylphenol	29	--	210	20 U	20 U	--
Pentachlorophenol	400	504	690	99 U	99 U	--
Miscellaneous (µg/kg)						
Benzyl alcohol	57	--	870	20 U	20 U	--
Benzoic acid	650	--	760	200 U	200 U	--
Dibenzofuran	540	--	1700	20 U	20 U	--
Hexachloroethane	1400	--	14000	20 U	20 U	--
Hexachlorobutadiene	29	--	270	0.98U	0.98UJ	--
n-Nitrosodiphenylamine	28	--	130	20 U	20 U	--
VOC (µg/kg)						
Ethylbenzene	10	--	50	1.2 U	1.3 U	--
Tetrachloroethene	57	--	210	1.2 U	1.3 U	--
Trichloroethene	160	--	1600	1.2 U	1.3 U	--
o-Xylene	--	--	--	1.2 U	1.3 U	--

m,p-Xylenes	--	--	--	1.2 U	1.3 U	--
Xylene (total)	40		160	1.2 U	1.3 U	--
Organic Carbon Normalized (mg/kg-OC)						
Total PCBs	--	38	--	6.6	11.1	--

Notes:

1- Total chlordane includes all chlordane isomers including cis-chlordane, trans-chlordane, cis-nonaclor, trans-nonaclor, alpha chlordane, gamma chlordane, and heptachlor.

U- The analyte was analyzed for, but not detected above the sample reporting limit.

J- The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UY- The analyte was analyzed for, but not detected with elevated reporting limit due to chromatograph interference.

SL- Screening Level

BT- Bioaccumluation Trigger

ML- Maximum Level

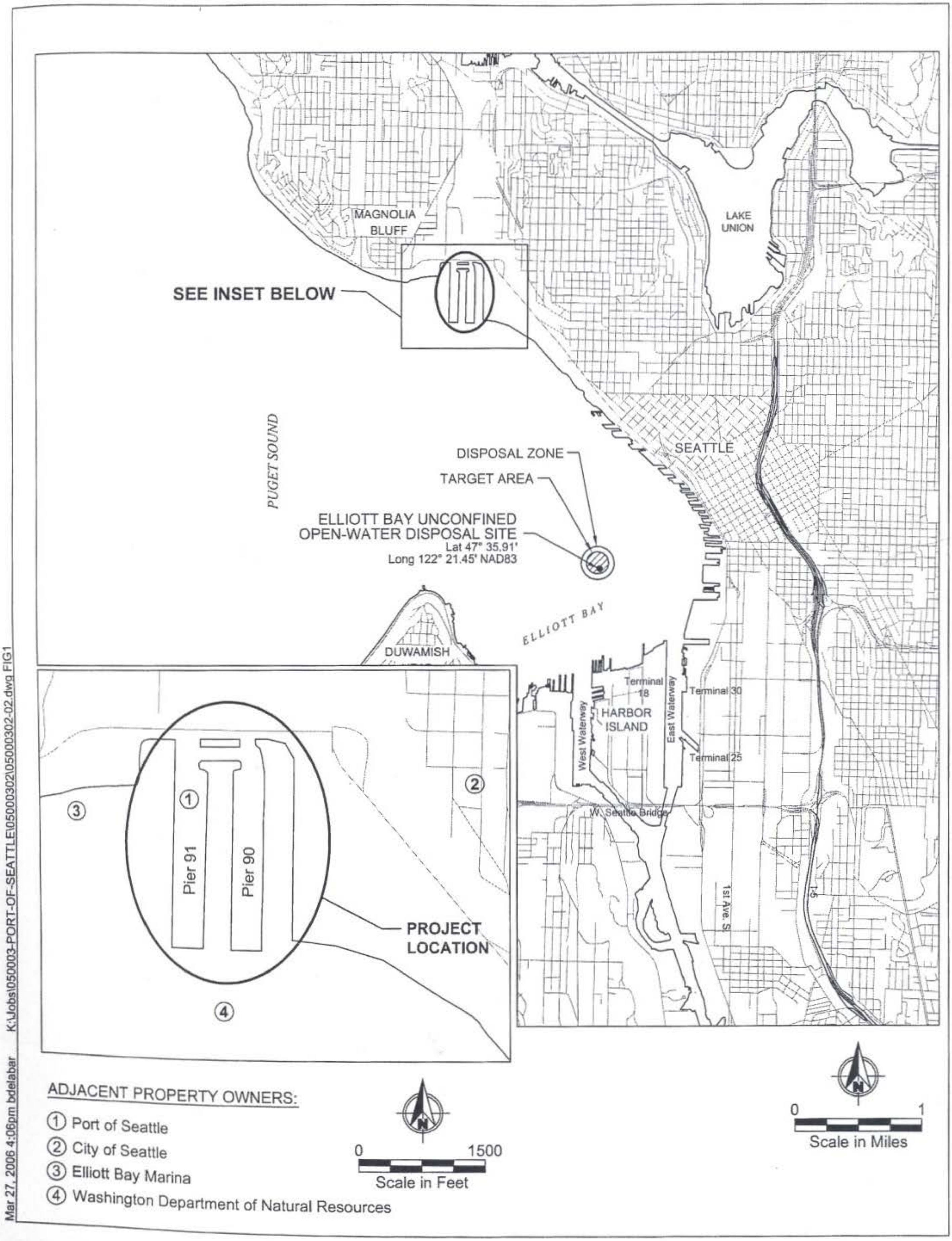
Note: Analytes with detections or detection limits above SL's are bolded.

Table 5. Solid Phase Bioassay Results for Port of Seattle Terminal 91

Dredged Material Management Units	Amphipod Mortality (%) (*E. estuarius)*	Sediment Larval Combined Mortality and Abnormality[1](%) (*C. gigas*)	Juvenile Infaunal Growth (mg/ind/day) (*N. arenaceodenta*)	DMMU Suitability (non-dispersive)
Negative Control[2]	0	0	1.05 mortality = 32%[3]	NA
Carr Inlet Reference	12	16.5	0.95 mortality = 16%	NA
T91-2-CS	14	8.3	0.72 mortality = 16%	suitable
Ref. Toxicant: LC50/EC50: DAIS Mean ± SD	$CdCl_2$ 4.4 mg/L 4.4 ± 2.8 (n =32)	$CuSO_4$ 12.8 ug/L none available	$CdCl_2$ 2.8 mg/L 8.8 ± 3.8 (n = 65)	

[1]normalized to negative control (the negative control non-normalized combined mortality and abnormality was 14.5%)
[2]negative control sediment for the amphipod and Neanthes bioassays came from the amphipod collection site at Yaquina Bay, OR.
[3]failed to meet performance standard

DAIS = Dredged Analysis Information System



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 1
Vicinity Map
Terminal 91
Port of Seattle

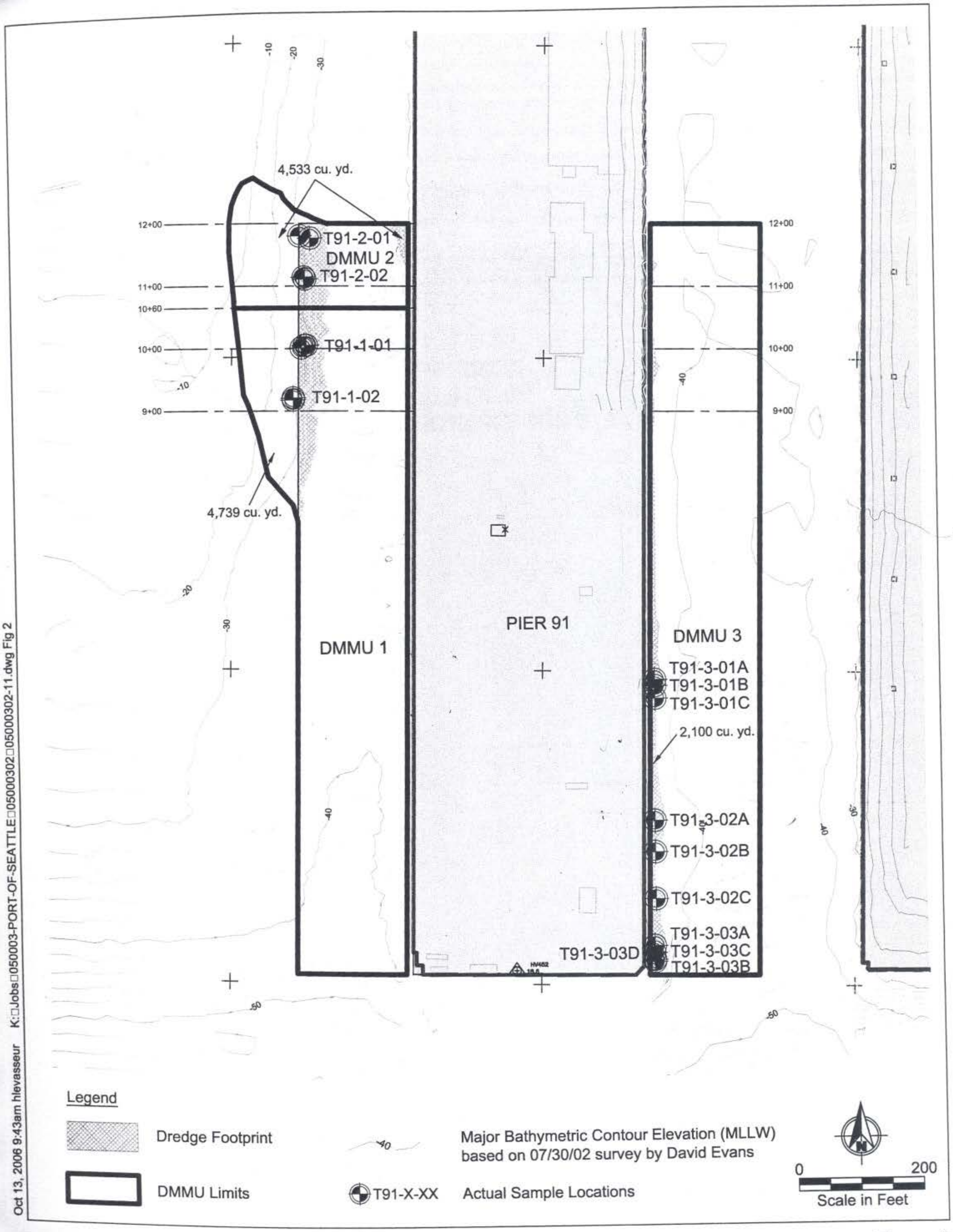


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Figure 2
Actual Sample Locations
Terminal 91
Port of Seattle

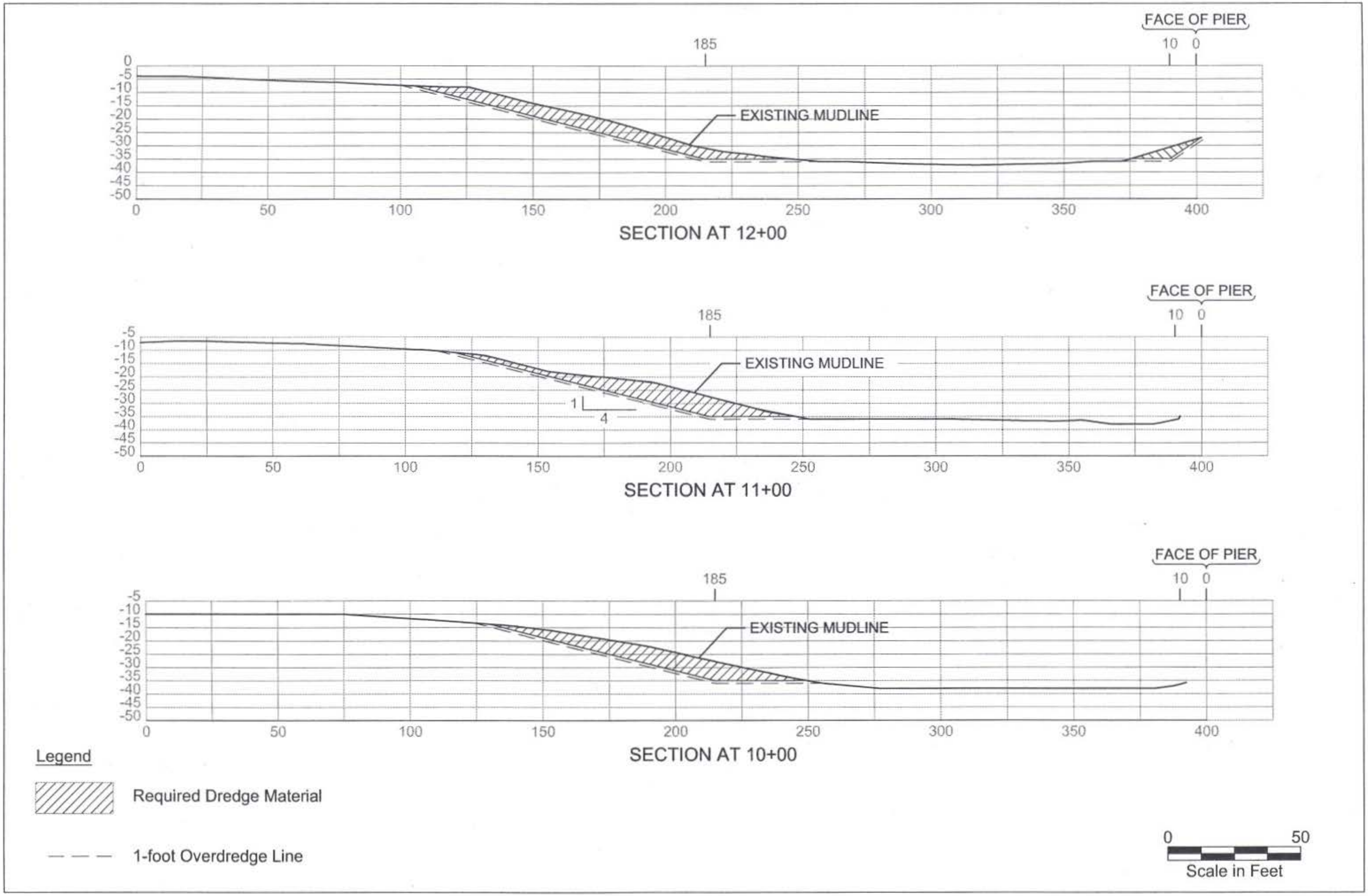

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Figure 3
Pier 91
Selected Cross Sections of Dredge Areas in DMMUs 1 and 2