

CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD

August 14, 2008

SUBJECT: DMMP SUPPLEMENTAL DETERMINATION ON THE SEDIMENT QUALITY OF THE EXPOSED SEDIMENT SURFACE AFTER DREDGING TO VERIFY COMPLIANCE WITH THE WASHINGTON STATE ANTIDEGRADATION POLICY FOR THE PORT OF SEATTLE T-91 (T-91), SEATTLE, WASHINGTON MAINTENANCE DREDGING PROJECT (200601091)

1. This memorandum 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) regarding the quality of the sediment surface remaining after maintenance dredging of T-91 in late fall/early winter 2008. Post-dredge sampling and testing of the exposed sediment after dredging was required because post-dredge bathymetric survey data indicated that the Port of Seattle's contractor had dredged deeper than the permitted allowable over-depth elevation in portions of the dredge footprint. In addition, the 2006 sampling and analysis of the material to be dredged did not include data from sediment dredged below the allowable over-depth (z-layer). Thus, the characteristics of the newly exposed sediment surface are not known. The initial suitability determination, dated November 9, 2006, found all 9,400 cy of proposed maintenance dredged material suitable for unconfined open-water disposal at the Elliott Bay non-dispersive open-water site.
2. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	High
SAP Addendum Submittal Date:	April 22, 2008
SAP Addendum Approval Date	April 30, 2008
Sampling date	May 7, 2008
Sampling Equipment	Power Grab
Data report submitted	July 8, 2008
DAIS Tracking number	POS91-1-B-F-231
USACE Permit Application Number	200601091
Recency Determination (high rank = 2 yr)	June, 2008*

* This Recency determination only applies to the specific limited areas of T-91 that were sampled during the June, 2006 sampling event since the majority of T-91 was not sampled.

3. Sampling and analysis of the top 10 centimeters of the post-dredge surface was required since the Port of Seattle's contractor over-dredged T-91 and the original sampling of the project area did not include sampling and analysis of the z-layer. Therefore, on May 7, 2008 three surface 10-cm grab samples were successfully collected from areas that were over-dredged. Figure 1 presents the location of these surface grab samples. The Agencies' approved addendum sampling and analysis plan was followed. Chemical analysis results of the three individual grab samples presented in Tables 2 and 3 are compared with DMMP chemical guidelines (screening level, bioaccumulation level, maximum level) and Sediment management Standards guidelines (sediment quality standards, cleanup screening level) and indicated that there were no detected or detection limit exceedances of either DMMP or SMS guidelines. Therefore, these results indicate that the newly exposed surface exposed after dredging meets the State of Washington antidegradation policy.

4. References.

Anchor, 2008. *Amendment to Sampling and Analysis Plan for Characterization of Sediment at Port of Seattle Terminal 91, Seattle, Washington.*

Anchor, 2008. *Chemical Analytical Results for Post-dredge Surface Grab Samples at Port of Seattle Pier 91.*

5. Agency Signatures.

Concur:

8/14/08

Date

Sandra Lemlich

Sandra Lemlich - Seattle District Corps of Engineers

8/14/08

Date

Erika Hoffman

Erika Hoffman - Environmental Protection Agency

08/14/08

Date

Laura Inouye

Laura Inouye, Ph.D. - Washington Department of Ecology

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Date

Courtney Wasson

Courtney Wasson - Washington Department of Natural Resources

Copies furnished:

DMMP signatories

Kristina Tong , COE Regulatory

DMMO file

Table 2
Summary of Sediment Chemistry Results Compared to DMMP Evaluation Criteria

Location Sample Sample Date Depth	Dredged Material Management Program Criteria			T91-PD-01 T91-PD-01-SS-080507 5/7/08 0-10 cm	T91-PD-02 T91-PD-02-SS-080507 5/7/08 0-10 cm	T91-PD-03 T91-PD-03-SS-080507 5/7/08 0-10 cm
	Screening Level	Bioaccumulation Trigger	Maximum Level			
	--	--	--	3.88 J	2.46 J	39.3 J
Conventionals (mg/kg)						
Sulfide	--	--	--	3.88 J	2.46 J	39.3 J
Conventionals (mg-N/kg)						
Ammonia	--	--	--	2.89 J	2.83 J	13.2 J
Conventionals (%)						
Total organic carbon	--	--	--	0.614	0.438	0.722
Total Solids	--	--	--	83.2	85.2	70
Total solids (preserved)	--	--	--	75.2	81.3	65.5
Total volatile solids	--	--	--	1.35	0.98	2.73
Grain Size (%)						
Clay	--	--	--	1.8	2.5	9.1
Fines	--	--	--	5.1	6.3	31.7
Gravel	--	--	--	65.2	68.2	13.8
Sand	--	--	--	29.7	25.6	54.5
Silt	--	--	--	3.2	3.8	22.6
Metals (mg/kg)						
Antimony	150	--	200	6 UJ	6 UJ	7 UJ
Arsenic	57	507.1	700	6 U	6 U	7 U
Cadmium	5.1	11.3	14	0.2 U	0.2 U	0.5
Chromium	--	267	--	19.8	18.9	30.5
Copper	390	1027	1300	13	13.3	13.5
Lead	450	975	1200	4	2 U	3 U
Mercury	0.41	1.5	2.3	0.05 U	0.06 U	0.05 U
Nickel	140	370	370	23	35	30
Selenium	--	3	--	0.2 U	0.2 U	0.3 U
Silver	6.1	6.1	8.4	0.4 U	0.4 U	0.4 U
Zinc	410	2783	3800	26	32	28
Metals Organic (µg/L)						
Butyltin (ion)	--	--	--	0.026 U	0.042 U	0.034 UJ
Dibutyltin (ion)	--	--	--	0.029 U	0.029 U	0.029 U
Tributyltin (ion)	0.15	0.15	--	0.019 U	0.036	0.019 U
PAHs (µg/kg)						
Total LPAH ⁽¹⁾	5200	--	29000	49	20 UJ	20 UJ
Naphthalene	2100	--	2400	20 UJ	20 UJ	20 UJ
Acenaphthylene	560	--	1300	20 UJ	20 UJ	20 UJ
Acenaphthene	500	--	2000	20 UJ	20 UJ	20 UJ
Fluorene	540	--	3600	20 UJ	20 UJ	20 UJ
Phenanthrene	1500	--	21000	32 J	20 UJ	20 UJ
Anthracene	960	--	13000	17 J	20 UJ	20 UJ
2-Methylnaphthalene	670	--	1900	20 UJ	20 UJ	20 UJ
Total HPAH	12000	--	69000	464	95	20 UJ
Fluoranthene	1700	4600	30000	73 J	14 J	20 UJ
Pyrene	2600	11980	16000	86 J	14 J	20 UJ
Benzo(a)anthracene	1300	--	5100	27 J	20 UJ	20 UJ
Chrysene	1400	--	21000	49 J	19 J	20 UJ
Benzo(b)fluoranthene	--	--	--	80 J	22 J	20 UJ
Benzo(k)fluoranthene	--	--	--	64 J	14 J	20 UJ
Total Benzofluoranthenes (b, j, k) ⁽²⁾	3200	--	9900	144 J	36 J	20 UJ
Benzo(a)pyrene	1600	--	3600	56 J	12 J	20 UJ
Indeno(1,2,3-cd)pyrene	600	--	4400	14 J	20 UJ	20 UJ
Dibenzo(a,h)anthracene	230	--	1900	20 UJ	20 UJ	20 UJ
Benzo(g,h,i)perylene	670	--	3200	15 J	20 UJ	20 UJ
Chlorinated Hydrocarbons (µg/kg)						
1,2,4-Trichlorobenzene	31	--	64	4.7 U	4.3 U	5.3 U
1,2-Dichlorobenzene	35	--	110	0.9 U	0.9 U	1.1 U
1,3-Dichlorobenzene	170	--	--	0.9 U	0.9 U	1.1 U
1,4-Dichlorobenzene	110	--	120	0.9 U	0.9 U	1.1 U
Hexachlorobenzene	22	168	230	2 U	0.97 U	2 U
Phthalates (µg/kg)						
Dimethylphthalate	71	--	1400	20 UJ	20 UJ	20 UJ
Diethylphthalate	200	--	1200	20 UJ	20 UJ	20 UJ
Di-n-butylphthalate	1400	--	5100	20 UJ	20 UJ	20 UJ
Butylbenzylphthalate	63	--	970	20 UJ	20 UJ	20 UJ
bis(2-Ethylhexyl)phthalate	1300	--	8300	16 J	20 UJ	20 UJ
Di-n-octylphthalate	6200	--	6200	20 UJ	20 UJ	20 UJ
Phenols (µg/kg)						
Phenol	420	--	1200	20 UJ	20 UJ	20 UJ

Table 2
Summary of Sediment Chemistry Results Compared to DMMP Evaluation Criteria

Location Sample Sample Date Depth	Dredged Material Management Program Criteria			T91-PD-01 T91-PD-01-SS-080507 5/7/08 0-10 cm	T91-PD-02 T91-PD-02-SS-080507 5/7/08 0-10 cm	T91-PD-03 T91-PD-03-SS-080507 5/7/08 0-10 cm
	Screening Level	Bioaccumulation Trigger	Maximum Level			
2-Methylphenol	63	--	77	20 UJ	20 UJ	20 UJ
4-Methylphenol	670	--	3600	20 UJ	20 UJ	20 UJ
2,4-Dimethylphenol	29	--	210	20 UJ	20 UJ	20 UJ
Pentachlorophenol	400	504	690	99 UJ	98 UJ	99 UJ
Miscellaneous Extractables (µg/kg)						
Benzyl alcohol	57	--	870	20 UJ	R	20 UJ
Benzoic acid	650	--	760	200 UJ	200 UJ	200 UJ
Dibenzofuran	540	--	1700	20 UJ	20 UJ	20 UJ
Hexachloroethane	1400	--	14000	20 UJ	20 UJ	20 UJ
Hexachlorobutadiene	29	--	270	20 UJ	20 UJ	20 UJ
n-Nitroso-di-phenylamine	28	--	130	20 UJ	20 UJ	20 UJ
Volatile Organics (µg/kg)						
Trichloroethene	160	--	1600	0.9 U	0.9 U	1.1 U
Tetrachloroethene	57	--	210	0.9 U	0.9 U	1.1 U
Ethylbenzene	10	--	50	0.9 U	0.9 U	1.1 U
m,p-Xylene	--	--	--	0.9 U	0.9 U	1.1 U
o-Xylene	--	--	--	0.9 U	0.9 U	1.1 U
Total Xylene ⁽³⁾	40	--	160	0.9 U	0.9 U	1.1 U
Pesticides (µg/kg)						
Total DDT ⁽⁴⁾	6.9	50	69	4 U	1.9 U	3.9 U
4,4'-DDD	--	--	--	4 U	1.9 U	3.9 U
4,4'-DDE	--	--	--	4 U	1.9 U	3.9 U
4,4'-DDT	--	--	--	4 U	1.9 U	3.9 U
Aldrin	10	--	--	2 U	0.97 U	2 U
Total Chlordane ⁽⁵⁾	10	37	--	4 U	1.9 U	3.9 U
alpha-Chlordane (cis-Chlordane)	--	--	--	2 U	0.97 U	2 U
gamma-Chlordane (trans, beta-Chlordane)	--	--	--	2 U	0.97 U	2 U
cis-Nonachlor	--	--	--	4 U	1.9 U	3.9 U
Oxychlordane	--	--	--	4 U	1.9 U	3.9 U
trans-Nonachlor	--	--	--	4 U	1.9 U	3.9 U
Dieldrin	10	--	--	4 U	1.9 U	3.9 U
Heptachlor	10	--	--	2 U	0.97 U	2 U
gamma-BHC (Lindane)	10	--	--	2 U	0.97 U	2 U
Hexachlorobutadiene	29	--	270	2 U	0.97 U	2 U
PCBs (µg/kg)						
Total PCB	130	--	3100	9.9 U	9.8 U	9.9 U
PCBs (µg/kg)						
Aroclor 1016	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1221	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1232	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1242	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1248	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1254	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1260	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1262	--	--	--	9.9 U	9.8 U	9.9 U
Aroclor 1268	--	--	--	9.9 U	9.8 U	9.9 U

Notes:

-- = No criteria

Bold = Detected result

J = Estimated value

R = Rejected

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

⁽¹⁾2-Methylnaphthalene is not included in the sum of LPAHs

⁽²⁾Benz(j)fluoranthene is included in the total of benzo(b&k)fluoranthenes

⁽³⁾Total xylene is the sum of o-, m-, p- isomers

⁽⁴⁾Total DDT consists of the sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

⁽⁵⁾Total Chlordane includes alpha-chlordane (cis-chlordane), beta-chlordane (trans-chlordane), cis-nonaclor, trans-nonaclor and oxychlordane.

Table 3
Summary of Sediment Chemistry Results Compared to SMS Evaluation Criteria
(Organic Carbon-Normalized)

Location Sample Sample Date Depth	Sediment Management Standards		T91-PD-01 T91-PD-01-SS-080507 5/7/08 -32.5 feet	T91-PD-02 T91-PD-02-SS-080507 5/7/08 -32.1 feet	T91-PD-03 T91-PD-03-SS-080507 5/7/08 -32.5 feet
	SQS SL	SQS CSL			
	Grain Size (%)	--	--	65.2	68.2
Gravel	--	--	65.2	68.2	13.8
Sand	--	--	29.7	25.6	54.5
Silt	--	--	3.2	3.8	22.6
Clay	--	--	1.8	2.5	9.1
Fines (Silt + Clay)	--	--	5.1	6.3	31.7
Conventional Parameters (%)					
Total organic carbon	--	--	0.614	0.438	0.722
Total Solids	--	--	83.2	85.2	70
Metals (mg/kg)					
Antimony	--	--	6 UJ	6 UJ	7 UJ
Arsenic	57	93	6 U	6 U	7 U
Cadmium	5.1	6.7	0.2 U	0.2 U	0.5
Chromium	260	270	19.8	18.9	30.5
Copper	390	390	13	13.3	13.5
Lead	450	530	4	2 U	3 U
Mercury	0.41	0.59	0.05 U	0.06 U	0.05 U
Nickel	--	--	23	35	30
Silver	6.1	6.1	0.4 U	0.4 U	0.4 U
Zinc	410	960	26	32	28
PCB Aroclors (mg/kg-OC)					
Aroclor 1016	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1221	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1232	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1242	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1248	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1254	--	--	1.612 U	2.237 U	1.371 U
Aroclor 1260	--	--	1.612 U	2.237 U	1.371 U
Total PCB	12	65	1.612 U	2.237 U	1.371 U
Aromatic Hydrocarbons (mg/kg-OC)					
Total LPAH	370	780	7.98	4.566 UJ	2.77 UJ
Naphthalene	99	170	3.257 UJ	4.566 UJ	2.77 UJ
Acenaphthylene	66	66	3.257 UJ	4.566 UJ	2.77 UJ
Acenaphthene	16	57	3.257 UJ	4.566 UJ	2.77 UJ
Fluorene	23	79	3.257 UJ	4.566 UJ	2.77 UJ
Phenanthrene	100	480	5.212 J	4.566 UJ	2.77 UJ
Anthracene	220	1200	2.769 J	4.566 UJ	2.77 UJ
2-Methylnaphthalene	38	64	3.257 UJ	4.566 UJ	2.77 UJ
Total HPAH	960	5300	75.57	21.689	2.77 UJ
Total PAH	--	--	83.55	21.689	2.77 UJ
Fluoranthene	160	1200	11.889 J	3.196 J	2.77 UJ
Pyrene	1000	1400	14.007 J	3.196 J	2.77 UJ
Benzo(a)anthracene	110	270	4.397 J	4.566 UJ	2.77 UJ
Chrysene	110	460	7.98 J	4.338 J	2.77 UJ
Benzo(b)fluoranthene	--	--	13.029 J	5.023 J	2.77 UJ
Benzo(k)fluoranthene	--	--	10.423 J	3.196 J	2.77 UJ
Total Benzofluoranthenes	230	450	23.453 J	8.219 J	2.77 UJ
Benzo(a)pyrene	99	210	9.121 J	2.74 J	2.77 UJ
Indeno(1,2,3-c,d)pyrene	34	88	2.28 J	4.566 UJ	2.77 UJ
Dibenzo(a,h)anthracene	12	33	3.257 UJ	4.566 UJ	2.77 UJ
Benzo(g,h,i)perylene	31	78	2.443 J	4.566 UJ	2.77 UJ
Chlorinated Benzenes (mg/kg-OC)					
1,2-Dichlorobenzene	2.3	2.3	0.147 U	0.205 U	0.152 U
1,4-Dichlorobenzene	3.1	9	0.147 U	0.205 U	0.152 U
1,2,4-Trichlorobenzene	0.81	1.8	0.765 U	0.982 U	0.734 U
Hexachlorobenzene	0.38	2.3	0.326 U	0.221 U	0.277 U
Phthalate Esters (mg/kg-OC)					
Dimethyl phthalate	53	53	3.257 UJ	4.566 UJ	2.77 UJ
Diethyl phthalate	61	110	3.257 UJ	4.566 UJ	2.77 UJ
Di-n-butyl phthalate	220	1700	3.257 UJ	4.566 UJ	2.77 UJ
Butylbenzyl phthalate	4.9	64	3.257 UJ	4.566 UJ	2.77 UJ
Bis(2-ethylhexyl) phthalate	47	78	2.606 J	4.566 UJ	2.77 UJ
Di-n-octyl phthalate	58	4500	3.257 UJ	4.566 UJ	2.77 UJ
Miscellaneous (mg/kg-OC)					
Dibenzofuran	15	58	3.257 UJ	4.566 UJ	2.77 UJ
Hexachlorobutadiene	3.9	6.2	3.257 UJ	4.566 UJ	2.77 UJ
N-Nitrosodiphenylamine	11	11	3.257 UJ	4.566 UJ	2.77 UJ
Ionizable Organic Compounds (µg/kg)					
Phenol	420	1200	20 UJ	20 UJ	20 UJ

Table 3
Summary of Sediment Chemistry Results Compared to SMS Evaluation Criteria
(Organic Carbon-Normalized)

Location Sample Sample Date Depth	Sediment Management Standards		T91-PD-01	T91-PD-02	T91-PD-03
	SQS SL	SQS CSL	T91-PD-01-SS-080507 5/7/08 -32.5 feet	T91-PD-02-SS-080507 5/7/08 -32.1 feet	T91-PD-03-SS-080507 5/7/08 -32.5 feet
2-Methylphenol (o-Cresol)	63	63	20 UJ	20 UJ	20 UJ
4-Methylphenol (p-Cresol)	670	670	20 UJ	20 UJ	20 UJ
2,4-Dimethylphenol	29	29	20 UJ	20 UJ	20 UJ
Pentachlorophenol	360	690	99 UJ	98 UJ	99 UJ
Benzyl alcohol	57	73	20 UJ	R	20 UJ
Benzoic acid	650	650	200 UJ	200 UJ	200 UJ
Btex (µg/kg)					
Ethylbenzene	--	--	0.9 U	0.9 U	1.1 U
m,p-Xylene	--	--	0.9 U	0.9 U	1.1 U
o-Xylene	--	--	0.9 U	0.9 U	1.1 U
Conventionals (mg/kg)					
Sulfide	--	--	3.88 J	2.46 J	39.3 J
Conventionals (mg-N/kg)					
Ammonia	--	--	2.89 J	2.83 J	13.2 J
Conventionals (%)					
Total solids (preserved)	--	--	75.2	81.3	65.5
Total volatile solids	--	--	1.35	0.98	2.73
Metals Organic (µg/L)					
Butyltin (ion)	--	--	0.026 U	0.042 U	0.034 UJ
Dibutyltin (ion)	--	--	0.029 U	0.029 U	0.029 U
Tributyltin (ion)	--	--	0.019 U	0.036	0.019 U
Pesticides (µg/kg)					
4,4'-DDD (p,p'-DDD)	--	--	4 U	1.9 U	3.9 U
4,4'-DDE (p,p'-DDE)	--	--	4 U	1.9 U	3.9 U
4,4'-DDT (p,p'-DDT)	--	--	4 U	1.9 U	3.9 U
Aldrin	--	--	2 U	0.97 U	2 U
alpha-Chlordane (cis-Chlordane)	--	--	2 U	0.97 U	2 U
cis-Nonachlor	--	--	4 U	1.9 U	3.9 U
Dieldrin	--	--	4 U	1.9 U	3.9 U
gamma-Chlordane (trans, beta-Chlordane)	--	--	2 U	0.97 U	2 U
Heptachlor	--	--	2 U	0.97 U	2 U
Hexachlorocyclohexane-gamma (Lindane)	--	--	2 U	0.97 U	2 U
Oxychlordane	--	--	4 U	1.9 U	3.9 U
trans-Nonachlor	--	--	4 U	1.9 U	3.9 U
Total Chlordane	--	--	2 U	0.97 U	2 U
Total DDT	--	--	4 U	1.9 U	3.9 U
Semi-Volatile Organics (µg/kg)					
Hexachloroethane	--	--	20 UJ	20 UJ	20 UJ
Volatile Organics (µg/kg)					
1,3-Dichlorobenzene	--	--	0.9 U	0.9 U	1.1 U
Tetrachloroethylene	--	--	0.9 U	0.9 U	1.1 U
Trichloroethylene	--	--	0.9 U	0.9 U	1.1 U
Total Xylene	--	--	0.9 U	0.9 U	1.1 U

Notes:

-- = No criteria

Bold = Detected result

J = Estimated value

R = Rejected

U = Compound analyzed, but not detected above detection limit

UJ = Compound analyzed, but not detected above estimated detection limit

CSL = Cleanup Screening Level

SL = screening level

SMS = Washington State Sediment Management Standards (WAC 173-204)

SQS = Sediment Quality Standards

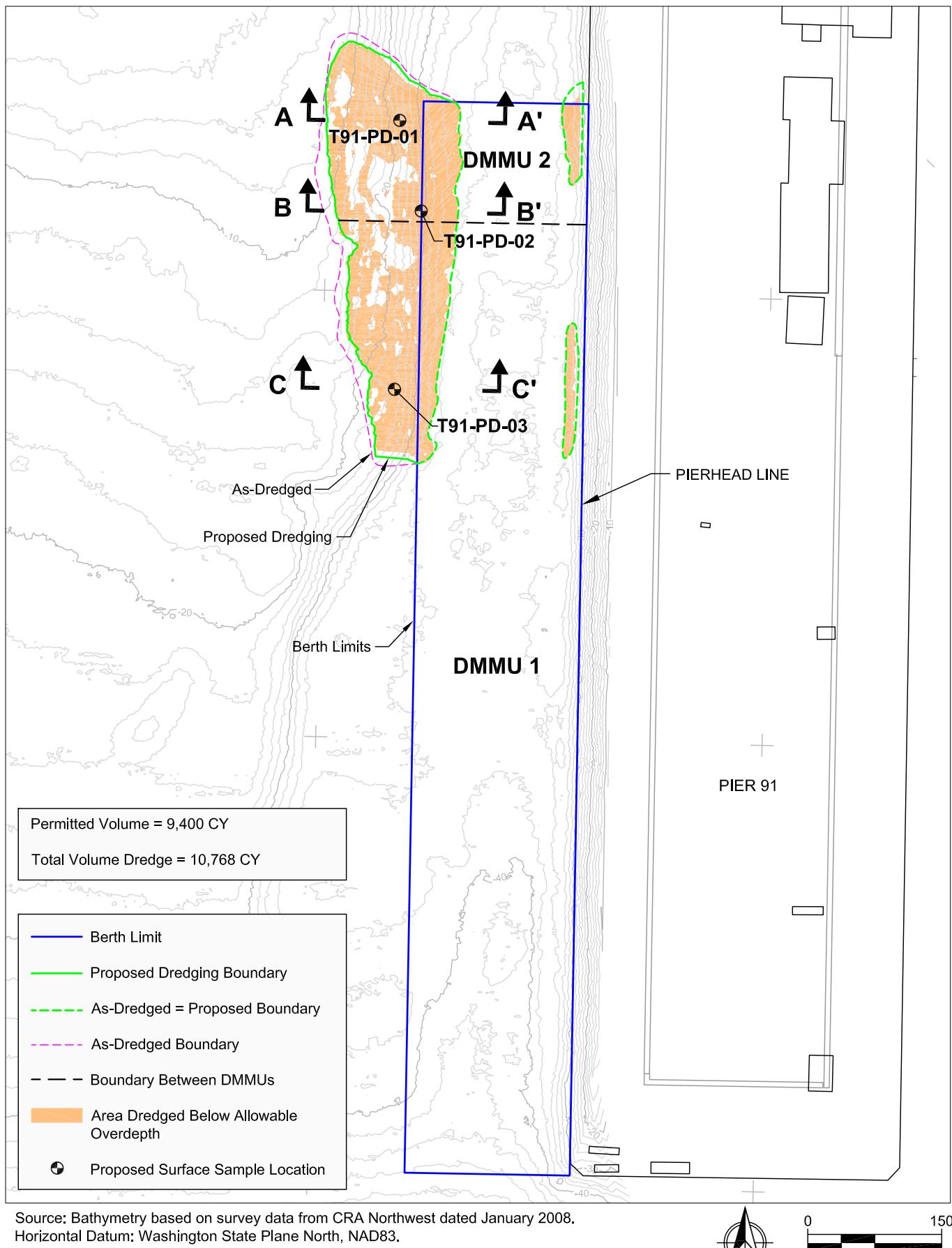
LPAH (SMS) = sum of naphthalene, acenaphthylene, fluorene, phenanthrene and anthracene

HPAH (SMS) = sum of fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-cd)pyrene,

dibenzo(a,h)anthracene, and benzo(g,h,i)perylene

Total benzofluoranthenes = sum of b,j,k isomers; j isomer co-elutes and is quantified with the b or k isomer

Totals are calculated by including zero for nondetected values, unless all totaled results are not detected, where the maximum nondetected value is used



Source: Bathymetry based on survey data from CRA Northwest dated January 2008.

Horizontal Datum: Washington State Plane North, NAD83.

Vertical Datum: Mean Lower Low Water (MLLW).

Figure 1
Plan View
Pier 91 - Port of Seattle