CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD January 22, 2010

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM BOYER TOWING, DUWAMISH RIVER, SEATTLE, KING COUNTY, FOR UNCONFINED OPEN-WATER DISPOSAL AT THE ELLIOTT BAY NONDISPERSIVE SITE.

1. Introduction. 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 suitability of up to 3,900 cubic yards (cy) of dredged material from Boyer Towing for disposal at the Elliott Bay nondispersive open-water site.

2. Background. Boyer Towing, located on the Duwamish River (see Figure 1), was previously characterized in 1999. All material was found suitable for open-water disposal and the project was dredged in 2000.

3. Project Summary. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	High
Proposed dredging volume	3,900 cubic yards
Proposed dredging depth	-10 feet MLLW plus 1 foot overdepth
SAP received	August 28, 2009
SAP approved	September 14, 2009
Sampling date	November 4, 2009
Draft data report received	December 16, 2009
z-sample analysis requested	December 21, 2009
Final data report received	January 19, 2010
DAIS Tracking number	BOYER-1-A-F-282
USACE Permit Application Number	NWS-2009-1252
Recency Determination (high rank = 2 years)	November 2011

4. Project Ranking and Sampling Requirements. In a high-ranked area the number of samples and analyses are calculated using the following guidelines (DMMP, 2008a):
   - Maximum volume of sediment represented by each field sample = 4,000 cubic yards
   - Maximum volume of sediment represented by each analysis in the upper 4-feet of the dredging prism (surface sediment) = 4,000 cubic yards
   - Maximum volume of sediment represented by each analysis in the subsurface portion of the dredging prism = 12,000 cubic yards

The dredging prism consists entirely of surface sediment, so all 3,900 cubic yards were included in a single dredged material management unit (DMMU), represented by a single core sample.

5. Sampling. Sampling took place November 4, 2009 using a vibracore sampler. Sediment from -6 to -11 ft MLLW was collected to represent the dredge prism and overdepth. The z-sample was collected from -11 to -12 ft MLLW and archived. Figure 2 includes the coordinates of the sampling location.

6. Chemical Analysis. The approved sampling and analysis plan (DOF, 2009) was followed and quality control guidelines specified by the PSEP and DMMP programs were generally met. The sediment conventional results can be found in Table 2. The grain-size data show that the proposed dredged material is predominantly sand. The total organic carbon concentration (TOC) was 1.70 percent. The chemical results (see Table 3) indicated that there were no exceedances of DMMP screening levels, so bioassays were not required. The dioxin results can be found in Table 4. The dioxin concentration was 5.16 parts per trillion (pptr) toxicity equivalents (TEQ, with undetects = ½ detection limit).

7. Sediment Exposed by Dredging. Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) (Ecology, 1995) or the State's antidegradation standard (DMMP, 2008b). Comparison of the proposed dredged material to SQS serves as a first-tier indicator for this purpose. Table 5 shows that there was a single detected exceedance of SQS. The concentration of bis(2-ethylhexyl)phthalate was 1,000 parts per billion (ppb) on a dry-weight basis, which equals 58.8 parts per million when organic-carbon normalized (ppm oc). The SQS is 47 ppm oc.

   The DMMP antidegradation guidelines (DMMP, 2008b) state that chemical analysis of the z-sample is required if the testing results for the overlying sediment are a) found to be unsuitable for unconfined aquatic disposal, or b) if any other project in the same waterbody has shown evidence of subsurface sediments with greater contamination than surface sediments, or c) if there is any other site-specific reason to believe that the SED may fail to meet the antidegradation policy. Other projects on the Duwamish River (DMMP, 2009a; DMMP, 2009b) have provided evidence of greater contamination in subsurface sediments than surface sediments. Therefore, the DMMP agencies agreed that the z-sample should be analyzed for bis(2-ethylhexyl)phthalate.

   Analysis of the z-sample resulted in a bis(2-ethylhexyl)phthalate concentration of 520 ug/kg on a dry weight basis (see Table 6), approximately one-half the concentration found in the proposed dredged material. The z-sample was predominantly sand, with a TOC of only 0.13%. Carbon-normalization is not recommended when the TOC is less than 0.5%, so the DMMP agencies agreed to use the dry-weight concentrations to form the basis for a decision. On the basis of the dry-weight concentrations, the agencies determined that the surface to be exposed by dredging will not be degraded relative to the existing surface sediment. Therefore, the project is in compliance with the State of Washington anti-degradation policy.

8. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from Boyer Towing for open-water disposal. The approved sampling and analysis plan was followed. The data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

   There were no SL exceedances for standard DMMP chemicals of concern. Therefore, with respect to these chemicals, the dredged material is suitable for open-water disposal. With regard to dioxin, in 2007 the DMMP agencies formulated interim disposal guidelines for each of the nondispersive disposal sites in Puget Sound. The interim guidelines included a maximum concentration for each site. Any DMMU with a concentration above this maximum value is considered unsuitable for open-water disposal. The interim guidelines also include a mean concentration for each site. The mean concentration of all DMMUs proposed for disposal from a project must be less than the site mean. For the Elliott Bay site, the maximum concentration is 12.2 pptr TEQ and the mean concentration is 8.7 pptr TEQ. The TEQ of 5.16 pptr for the Boyer DMMU was below both the mean and maximum concentration for the Elliott Bay site. Therefore, with respect to dioxin, the dredged material is suitable for disposal at the Elliott Bay site.

   In summary, based on the results of the previously described testing, the DMMP agencies conclude that all 3,900 cubic yards are suitable for open-water disposal at the Elliott Bay non-dispersive site.

   This suitability determination does ***not*** constitute final agency approval of the project. During the public comment period that follows a public notice, the resource agencies will provide input on the overall project. A final decision 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.

   A pre-dredge meeting with DNR, Ecology and the Corps of Engineers is required. A dredging quality control plan must be developed and submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 7 days prior to the pre-dredge meeting. A DNR site use authorization must also be acquired.

9. References.

DOF, 2009. *Sediment Sampling and Analysis Plan, Boyer Towing Berthing Area Dredging, Duwamish River, Seattle, Washington*. Prepared by Dalton, Olmstead and Fuglevand, Silverdale, Washington for Boyer Towing, Inc. August 2009.

DOF, 2010. *Boyer Towing Chemical Characterization Report, Boyer Towing Berthing Area Dredging*. Prepared by Dalton, Olmstead and Fuglevand, Silverdale, Washington for Boyer Towing, Inc. January 2010.

DMMP, 2008a. *Dredged Material Evaluation and Disposal Procedures (Users Manual)*. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, July 2008.

DMMP, 2008b. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.

DMMP, 2009a. *Determination on the Suitability of Proposed Maintenance Dredged Material from the Port of Seattle Terminal 115 Berth-1 Maintenance Dredging Project (NWS-2008-01496) in Duwamish River, Seattle, Washington Evaluated under Section 404 of the Clean Water Act for Unconfined Open-Water Disposal at a DMMP Non-Dispersive Open-Water Disposal Site and Evaluating Compliance with WA Antidegradation Policy.* Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program Agencies, January 2009.

DMMP, 2009b. *Determination Regarding the Suitability of Federal Operation and Maintenance Dredged Material from the Duwamish River, Seattle, King County, Washington (Public Notice CENWS-OD-TS-NS-26) Evaluated under Section 404 of the Clean Water Act for Beneficial Use or Unconfined Open-Water Disposal at the Elliott Bay Nondispersive Disposal Site.* Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program Agencies, October 2009.

Ecology, 1995. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, December 1995.

10. Agency Signatures.

Concur:

2/1/10 — David F. Fox
Date — David Fox - Seattle District Corps of Engineers

2/1/10 — [signature]
Date — Erika Hoffman - Environmental Protection Agency

1/29/2010 — [signature]
Date — Laura Inouye, Ph.D. - Washington Department of Ecology

1/28/2010 — [signature]
Date — David Vagt - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Jacalen Printz - Seattle District Regulatory
Nancy Case O'Bourke - Dalton, Olmstead and Fuglevand

Table 2. Sediment Conventional Data.

		001	101 (dup)	z-sample
DAIS ID:		S1	---	S2
GRAIN SIZE	% Gravel:	2.6	0.4	0
	% Sand:	77.8	82.0	92.7
	% Silt:	12.4	11.5	4.2
	% Clay:	5.3	6.2	3.1
	% Fines (clay+silt):	17.7	17.7	7.3
Total Solids (%):		73.2	75.2	77.4
Volatile Solids (%):		2.3	2.1	---
Total Organic Carbon (%):		1.70	1.22	0.13
Total Sulfides (mg/kg):		309	347	---
Total Ammonia (mg N/kg):		10.3	9.86	---

Table 3. Chemical Analysis Results (from DOF, 2010)

Chemical	DMMO Limits				Boyer Towing sample results			
	CAS[1] Number	SL	BT	ML	001		101 (dup)	
METALS (mg/kg)[8]								
Antimony	7440-36-0	150	---	200	6	U	7	U
Arsenic	7440-38-2	57	507.1	700	8		9	
Cadmium	7440-43-9	5.1	11.3	14	0.3	U	0.3	U
Chromium[2]	7440-47-3	---	267	---	19		25.2	
Copper	7440-50-8	390	1,027	1,300	28.9		32.6	
Lead	7439-92-1	450	975	1,200	18		20	
Mercury	7439-97-6	0.41	1.5	2.3	0.03		0.04	
Nickel	7440-02-0	140	370	370	11		13	
Selenium[2]	7782-49-2	---	3	---	0.6	U	0.6	U
Silver	7440-22-4	6.1	6.1	8.4	0.4	U	0.4	U
Zinc	7440-66-6	410	2,783	3,800	68		77	
ORGANOMETALLIC COMPOUNDS (ug/L)[8]								
Tributyltin (interstitial water)	56573-85-4	0.15	0.15	---	0.008	U	0.008	U
ORGANICS (ug/kg)[8]								
PAHs								
Total LPAH		5,200	---	29,000	262		885	
Naphthalene	91-20-3	2,100	---	2,400	<19	U	<20	U
Acenaphthylene	208-96-8	560	---	1,300	<19	U	<20	U
Acenaphthene	83-32-9	500	---	2,000	12	J	57	
Fluorene	86-73-7	540	---	3,600	17	J	58	
Phenanthrene	85-01-8	1,500	---	21,000	130		580	
Anthracene	120-12-7	960	---	13,000	46		130	
2-Methylnaphthalene[3]	91-57-6	670	---	1,900	<19	U	<20	U
Total HPAH		12,000	---	69,000	1,398		3,295	
Fluoranthene	206-44-0	1,700	4,600	30,000	270		780	
Pyrene	129-00-0	2,600	11,980	16,000	300		650	
Benzo(a)anthracene	56-55-3	1,300	---	5,100	120		290	
Chrysene	218-01-9	1,400	---	21,000	160		360	
Benzofluoranthenes (b,j,k)[9]		3,200	---	9,900	240		520	
Benzo(b)fluoranthene	205-99-2				120		260	
Benzo(j)fluoranthene[9]	205-82-3				---		---	

Chemical	DMMO Limits				Boyer Towing sample results			
	CAS[1] Number	SL	BT	ML	001		101 (dup)	
Benzo(k)fluoranthene	207-08-9				120		260	
Benzo(a)pyrene	50-32-8	1,600	---	3,600	130		320	
Indeno(1,2,3-c,d)pyrene	193-39-5	600	---	4,400	81		170	
Dibenzo(a,h)anthracene	53-70-3	230	---	1,900	29		65	
Benzo(g,h,i)perylene	191-24-2	670	---	3,200	68		140	
CHLORINATED HYDROCARBONS								
1,3-Dichlorobenzene	541-73-1	170	---	---	<19	U	<20	U
1,4-Dichlorobenzene	106-46-7	110	---	120	<19	U	<20	U
1,2-Dichlorobenzene	95-50-1	35	---	110	<19	U	<20	U
1,2,4-Trichlorobenzene	120-82-1	31	---	64	<19	U	<20	U
Hexachlorobenzene (HCB)	118-74-1	22	168	230	<19	U	<20	U
PHTHALATES[4]								
Dimethyl phthalate	131-11-3	71	---	1,400	<19	U	<20	U
Diethyl phthalate	84-66-2	200	---	1,200	<19	U	18	J
Di-n-butyl phthalate	84-74-2	1,400	---	5,100	<19	U	<20	U
Butyl benzyl phthalate	85-68-7	63	---	970	<19	U	<20	U
Bis(2-ethylhexyl)phthalate	117-81-7	1,300	---	8,300	1,000		140	
Di-n-octyl phthalate	117-84-0	6,200	---	6,200	<19	U	<20	U
PHENOLS								
Phenol	108-95-2	420	---	1,200	<19	U	<20	U
2 Methylphenol	95-48-7	63	---	77	<19	U	<20	U
4 Methylphenol	106-44-5	670	---	3,600	<19	U	15	J
2,4-Dimethylphenol	105-67-9	29	---	210	<19	U	<20	U
Pentachlorophenol	87-86-5	400	504	690	<96	U	<98	U
MISCELLANEOUS EXTRACTABLES								
Benzyl alcohol	100-51-6	57	---	870	<19	U	<20	U
Benzoic acid	65-85-0	650	---	760	79	J	49	J
Dibenzofuran	132-64-9	540	---	1,700	<19	U	30	
Hexachloroethane	67-72-1	1,400	---	14,000	<19	U	<20	U
Hexachlorobutadiene	87-68-3	29	---	270	<19	U	<20	U
N-Nitrosodiphenylamine	86-30-6	28	---	130	<19	U	<20	U
VOLATILE ORGANICS[5]								
Trichloroethene	79-01-6	160	---	1,600	<1.0	U	<1.0	U
Tetrachloroethene	127-18-4	57	---	210	<1.0	U	<1.0	U

Chemical	DMMO Limits				Boyer Towing sample results			
	CAS[1] Number	SL	BT	ML	001		101 (dup)	
Ethylbenzene	100-41-4	10	---	50	<1.0	U	<1.0	U
Total Xylene (sum of o-, m-, p-)		40	---	160	<1.0	U	<1.0	U
o-Xylene	95-47-6				<1.0	U	<1.0	U
m-Xylene	108-38-3				<1.0	U	<1.0	U
p-Xylene	106-42-3				<1.0	U	<1.0	U
PESTICIDES & PCBs								
Total DDT (sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT)		6.9	50	69	<1.9	U	<1.9	U
4,4'-DDD	72-54-8				<1.9	U	<1.9	U
4,4'-DDE	72-55-9				<1.9	U	<1.9	U
4,4'-DDT	50-29-3				<1.9	U	<1.9	U
Aldrin	309-00-2	10	---	---	<.97	U	<.97	U
Total Chlordane[7] (sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane)		10	---	---	<.97	U	<.97	U
cis-chlordane	5103-71-9				<.97	U	<.97	U
trans-chlordane	5103-74-2				<.97	U	<.97	U
cis-nonachlor	5103-73-1				<1.9	U	<1.9	U
trans-nonachlor	39765-80-5				<1.9	U	<1.9	U
oxychlordane	27304-13-8				<1.9	U	<1.9	U
Dieldrin	60-57-1	10	---	---	<1.9	U	<1.9	U
Heptachlor	76-44-8	10	---	---	<.97	U	<.97	U
Gamma-BHC (Lindane)	58-89-9	10	---	---	<.97	U	<.97	U
Total PCBs	---	130	38[6]	3,100	84		93	

(1) Chemical Abstract Service Registry Number
(2) As no SL value exists to trigger toxicity testing, this chemical will only be evaluated for its bioaccumulative potential.
(3) 2-Methylnaphthalene is not included in the summation for total LPAH.
(4) Based on 1998 LAET/HAET's; see http://www.nws.usace.army.mil/PublicMenu/Doc_list.cfm?sitename=dmmo&pagename=17th_ARM_MAy_5_2004
(5) Volatiles organics are not required to be analyzed for dredging projects in Grays Harbor and Willapa Bay.
(6) This value is normalized to total organic carbon, and is expressed in mg/kg carbon.
(7) Components of benzofluoranthenes and chlordane were clarified at the 2007 SMARM.
(8) units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.
(9) Benzo(j)fluoranthene was not reported

Table 4. DMMU Dioxin/Furan TEQ (from DOF, 2010)

	Cogeners / Isomers	Equivalency Factor	001					101 (dup)				
			Concentration (ng/kg)		TEQ (U=0)	RL	TEQ (U=1/2DL)	Concentration (ng/kg)		TEQ (U=0)	RL	TEQ (U=1/2DL)
Dioxins	2,3,7,8-TCDD	1	0.25	J	0.25			0.289	J	0.289		
	1,2,3,7,8-PeCDD	1	0.978	J	0.978			1.05	J	1.05		
	1,2,3,4,7,8-HxCDD	0.1	1.66	J	0.166			1.56	J	0.156		
	1,2,3,6,7,8-HxCDD	0.1	5.52		0.552			5.31		0.531		
	1,2,3,7,8,9-HxCDD	0.1	4.02		0.402			4		0.4		
	1,2,3,4,6,7,8-HpCDD	0.01	149		1.49			127		1.27		
	OCDD	0.0003	1260		0.378			990		0.297		
Furans	2,3,7,8-TCDF	0.1	0.453	J	0.045			0.419	J	0.042		
	1,2,3,7,8-PeCDF	0.03	0.528	J	0.016			0.516	J	0.015		
	2,3,4,7,8-PeCDF	0.3	0.691	J	0.207			0.629	J	0.189		
	1,2,3,4,7,8-HxCDF	0.1	2.06	J	0.206			2.26	J	0.226		
	1,2,3,6,7,8-HxCDF	0.1	1.06	J	0.106			1.08	J	0.108		
	2,3,4,6,7,8-HxCDF	0.1	1.29	J	0.129			1.26	J	0.126		
	1,2,3,7,8,9-HxCDF	0.1	0.419	J	0.042			0.605	J	0.061		
	1,2,3,4,6,7,8-HpCDF	0.01	16.4		0.164			15.7		0.157		
	1,2,3,4,7,8,9-HpCDF	0.01	1.02	J	0.01			1.05	J	0.011		
	OCDF	0.0003	45.7		0.014			46		0.014		
Total TEQ					5.16		5.16			4.94		4.94

J Analyte concentration is below calibration range

Table 5. Chemical results compared to SMS regulatory guidelines.

CHEMICAL	SQS	CSL	001		101 (dup)	
METALS (mg/kg dry)			conc	QL	conc	QL
Arsenic	57	93	8		9	
Cadmium	5.1	6.7	0.3	U	0.3	U
Chromium	260	270	19		25.2	
Copper	390	390	28.9		32.6	
Lead	450	530	18		20	
Mercury	0.41	0.59	0.03		0.04	
Silver	6.1	6.1	0.4	U	0.4	U
Zinc	410	960	68		77	
LPAH (mg/kg OC)						
2-Methylnaphthalene	38	64	1.1	U	1.2	U
Acenaphthene	16	57	0.7	J	3.4	
Acenaphthylene	66	66	1.1	U	1.2	U
Anthracene	220	1200	2.7		7.6	
Fluorene	23	79	1.0	J	3.4	
Naphthalene	99	170	1.1	U	1.2	U
Phenanthrene	100	480	7.6		34.1	
Total LPAH	370	780	15.4		52.1	
HPAH (mg/kg OC)						
Benzo(a)anthracene	110	270	7.1		17.1	
Benzo(a)pyrene	99	210	7.6		18.8	
Benzo(g,h,i)perylene	34	88	4.0		8.2	
Benzofluoranthenes	230	450	14.1		30.6	
Chrysene	110	460	9.4		21.2	
Dibenzo(a,h)anthracene	12	33	1.7		3.8	
Fluoranthene	160	1200	15.9		45.9	
Indeno(1,2,3-c,d)pyrene	34	88	4.8		10.0	
Pyrene	1000	1400	17.6		38.2	
Total HPAH	960	5300	82.2		193.8	
CHLORINATED HYDROCARBONS (mg/kg OC)						
1,2,4-Trichlorobenzene	0.81	1.8	1.1	U	1.2	U
1,2-Dichlorobenzene	2.3	2.3	1.1	U	1.2	U
1,4-Dichlorobenzene	3.1	9	1.1	U	1.2	U
Hexachlorobenzene	0.38	2.3	1.1	U	1.2	U
PHTHALATES (mg/kg OC)						
Bis(2-ethylhexyl)phthalate	47	78	58.8		8.2	
Butyl benzyl phthalate	4.9	64	1.1	U	1.2	U
Di-n-butyl phthalate	220	1700	1.1	U	1.2	U
Di-n-octyl phthalate	58	4500	1.1	U	1.2	U
Diethyl phthalate	61	110	1.1	U	1.1	J
Dimethyl phthalate	53	53	1.1	U	1.2	U

CHEMICAL	SQS	CSL	001		101 (dup)	
PHENOLS (ug/kg dry)						
2 Methylphenol	63	63	19	U	20	U
2,4-Dimethylphenol	29	29	19	U	20	U
4 Methylphenol	670	670	19	U	15	J
Pentachlorophenol	360	690	96	U	98	U
Phenol	420	1200	19	U	20	U
MISCELLANEOUS EXTRACTABLES (ug/kg dry)						
Benzoic acid	650	650	79	J	49	J
Benzyl alcohol	57	73	19	U	20	U
MISCELLANEOUS EXTRACTABLES (mg/kg OC)						
Dibenzofuran	15	58	1.1	U	1.8	
Hexachlorobutadiene	3.9	6.2	1.1	U	1.2	U
N-Nitrosodiphenylamine	11	11	1.1	U	1.2	U
PCBs (mg/kg OC)						
Total PCBs (mg/kg carbon)	12	65	4.9		5.5	

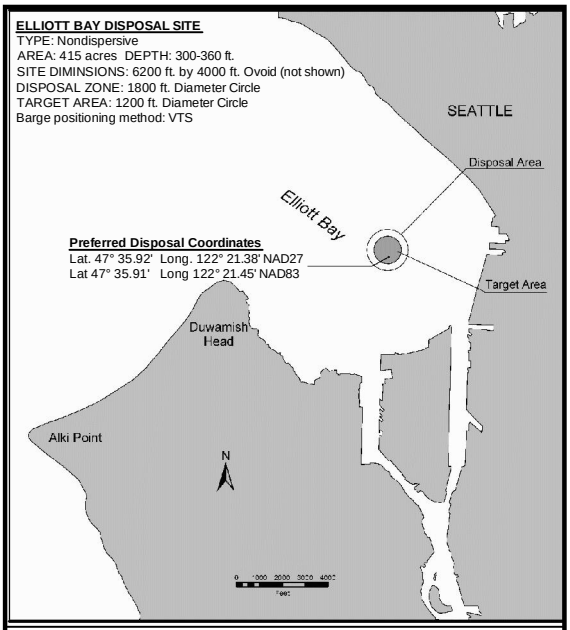
U = undetected
QL = laboratory qualifier
OC = organic carbon
SMS = Sediment Management Standards
SQS = sediment quality standard
CSL = cleanup screening level

Table 6. Z-sample Results

Chemical	DMMP Limits				Boyer Towing sample results			
	CAS[(1)] Number	SL	BT	ML	001		z-sample	
ORGANICS (ug/kg)								
PAHs								
Total LPAH		5,200	---	29,000	262		<19	U
Naphthalene	91-20-3	2,100	---	2,400	<19	U	<19	U
Acenaphthylene	208-96-8	560	---	1,300	<19	U	<19	U
Acenaphthene	83-32-9	500	---	2,000	12	J	<19	U
Fluorene	86-73-7	540	---	3,600	17	J	<19	U
Phenanthrene	85-01-8	1,500	---	21,000	130		<19	U
Anthracene	120-12-7	960	---	13,000	46		<19	U
2-Methylnaphthalene	91-57-6	670	---	1,900	<19	U	<19	U
Total HPAH		12,000	---	69,000	1,398		<19	U
Fluoranthene	206-44-0	1,700	4,600	30,000	270		<19	U
Pyrene	129-00-0	2,600	11,980	16,000	300		<19	U
Benzo(a)anthracene	56-55-3	1,300	---	5,100	120		<19	U
Chrysene	218-01-9	1,400	---	21,000	160		<19	U
Benzofluoranthenes (b,k)		3,200	---	9,900	240		<19	U
Benzo(b)fluoranthene	205-99-2				120		<19	U
Benzo(k)fluoranthene	207-08-9				120		<19	U
Benzo(a)pyrene	50-32-8	1,600	---	3,600	130		<19	U
Indeno(1,2,3-c,d)pyrene	193-39-5	600	---	4,400	81		<19	U
Dibenzo(a,h)anthracene	53-70-3	230	---	1,900	29		<19	U
Benzo(g,h,i)perylene	191-24-2	670	---	3,200	68		<19	U
CHLORINATED HYDROCARBONS								
1,3-Dichlorobenzene	541-73-1	170	---	---	<19	U	<19	U
1,4-Dichlorobenzene	106-46-7	110	---	120	<19	U	<19	U
1,2-Dichlorobenzene	95-50-1	35	---	110	<19	U	<19	U
1,2,4-Trichlorobenzene	120-82-1	31	---	64	<19	U	<19	U
Hexachlorobenzene (HCB)	118-74-1	22	168	230	<19	U	<19	U

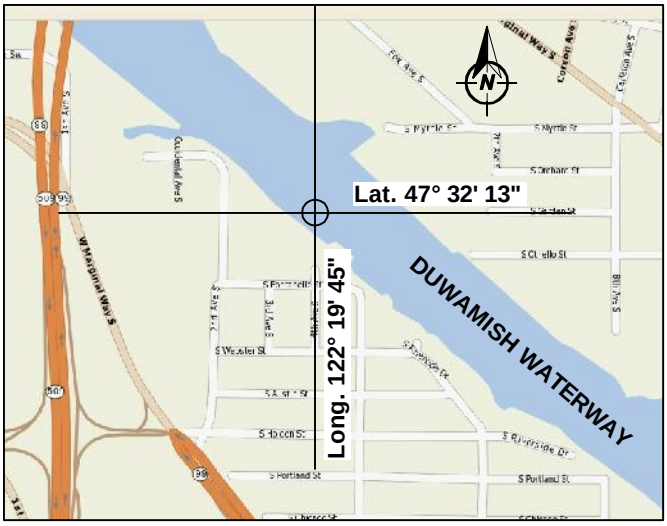
PHTHALATES								
Dimethyl phthalate	131-11-3	71	---	1,400	<19	U	<19	U
Diethyl phthalate	84-66-2	200	---	1,200	<19	U	<19	U
Di-n-butyl phthalate	84-74-2	1,400	---	5,100	<19	U	<19	U
Butyl benzyl phthalate	85-68-7	63	---	970	<19	U	<19	U
Bis(2-ethylhexyl)phthalate	117-81-7	1,300	---	8,300	1,000		520	B
Di-n-octyl phthalate	117-84-0	6,200	---	6,200	<19	U	<19	U
PHENOLS								
Phenol	108-95-2	420	---	1,200	<19	U	<19	U
2 Methylphenol	95-48-7	63	---	77	<19	U	<19	U
4 Methylphenol	106-44-5	670	---	3,600	<19	U	<19	U
2,4-Dimethylphenol	105-67-9	29	---	210	<19	U	<19	U
Pentachlorophenol	87-86-5	400	504	690	<96	U	<97	U
MISCELLANEOUS EXTRACTABLES								
Benzyl alcohol	100-51-6	57	---	870	<19	U	<19	U
Benzoic acid	65-85-0	650	---	760	79	J	<190	U
Dibenzofuran	132-64-9	540	---	1,700	<19	U	<19	U
Hexachloroethane	67-72-1	1,400	---	14,000	<19	U	<19	U
Hexachlorobutadiene	87-68-3	29	---	270	<19	U	<19	U
N-Nitrosodiphenylamine	86-30-6	28	---	130	<19	U	<19	U

(1) Chemical Abstract Service Registry Number



DISPOSAL SITE

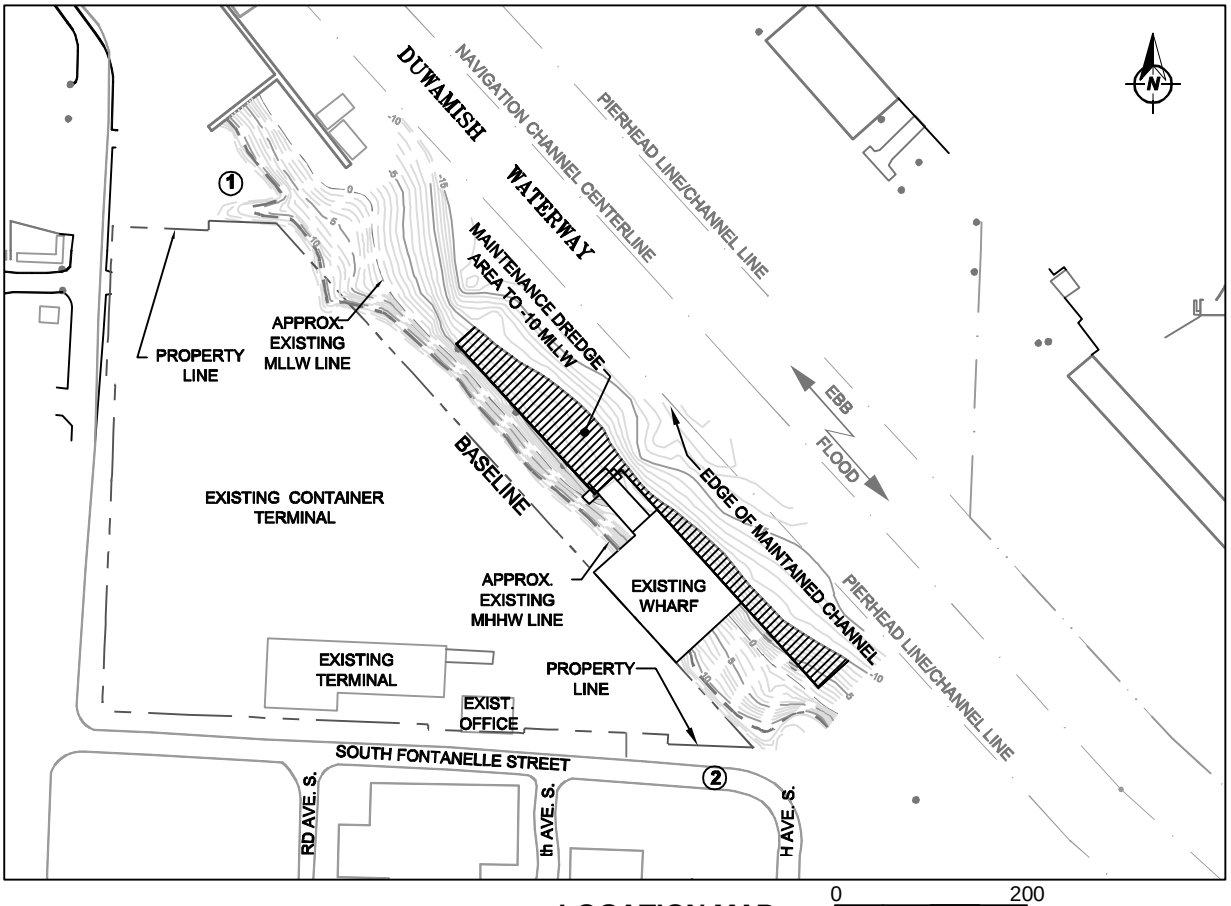
SOURCE: USACE SEATTLE DIST.



VICINITY MAP

NOT TO SCALE

SOURCE: MAPQUEST



LOCATION MAP

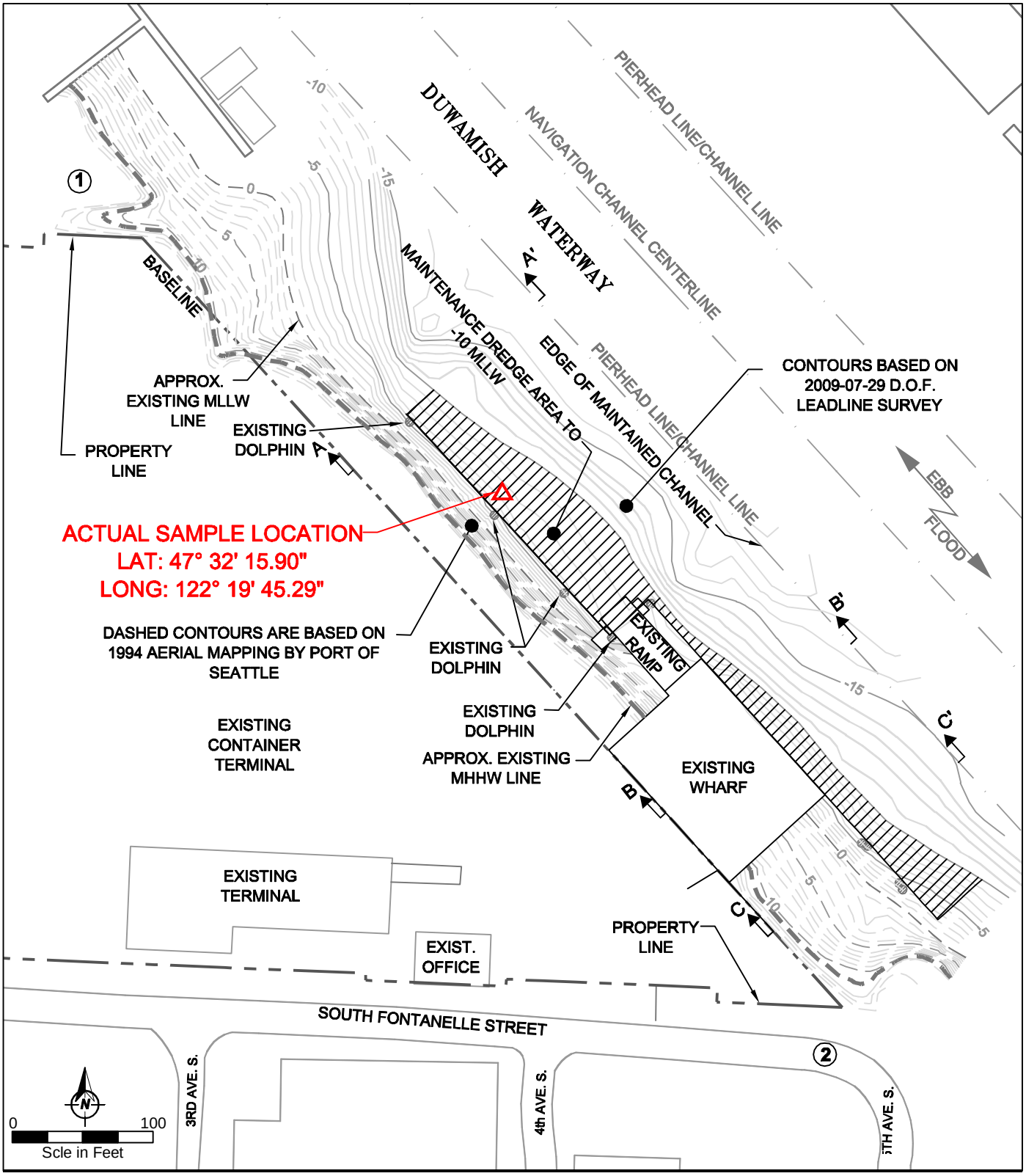
NOTE:

1. **DATUM:** 0.0' MLLW (N.O.S.)

Boyer Towing Inc. Duwamish Waterway - Seattle, WA		
DISPOSAL, LOCATION AND VICINITY MAPS		**FIGURE 1**
Dalton, Olmsted & Fuglevand, Inc.		December 08, 2009

PLOT TIME: 12/8/2009 4:32 PM MOD TIME: 12/8/2009 4:31 PM USER: Lee Barras DWG: D:\Projects\Boyer Towing\Figures\2009-12\2009-12-08 Boyer Samping Figures.dwg

NO UPLAND ACTIVITY



NOTE:
1. **DATUM:** 0.0' MLLW (N.O.S.)

Boyer Towing Inc. Duwamish Waterway - Seattle, WA	
ACTUAL SAMPLE LOCATION	**FIGURE** 2
Dalton, Olmsted & Fuglevand, Inc.	December 08, 2009