CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD March 14, 2012

SUBJECT: DETERMINATION ON THE SUITABILITY OF PROPOSED MAINTENANCE DREDGED MATERIAL FROM THE LAFARGE NORTH AMERICA MAINTENANCE DREDGING PROJECT IN SEATTLE, WASHINGTON (APPLICATION NO. **NWS-2009-616**) EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT FOR OPEN-WATER DISPOSAL AT A DMMP NON-DISPERSIVE OPEN-WATER DISPOSAL SITE AND ANTIDEGRADATION EVALUATION.

1. The following summary reflects the suitability determination memorandum on the characterization conducted at the Lafarge North America Seattle Plant on the Duwamish Waterway. This 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 an estimated 24,000 cy of maintenance dredged material at the Lafarge facility dock evaluated for open-water unconfined disposal at the Elliott Bay non-dispersive open-water disposal site in Seattle, Washington.

Table 1. Project DMMP Tracking Details

JARPA APPLICATION NO.	NWS-2009-616
SAP submitted:	August 25, 2009
SAP approved	September 17, 2009
Sampling dates: Vibracore sampler (12 sampling locations, 6 DMMUs)	October 28-29, 2009 (6-surface DMMUs, 12 stations)
Characterization Report received by DMMP	November 10, 2011
Recency Determination: High Concern (2 years)	October 2011
DAIS reference number:	LAFNA-1-A-F-321

2. Background. This project is located in a High Concern area on the eastern side of the Lower Duwamish Waterway (LDW) Superfund Site in Seattle, Washington. The Lafarge plant is located at 5400 West Marginal Way SW, Seattle, Washington. The facility occupies approximately twenty-two acres and adjoins the Duwamish River along the east and north boundaries. West Marginal Way SW and Chemithon Corporation share the east boundary along with the Burlington Northern railway. The southern boundary is bordered by Alaska Marine Lines (see Figure 1, Vicinity map, Figure 2, Site Map).

3. The subject property was undeveloped prior to 1964. Ideal Basic Industries then constructed the 1200 foot long east wharf and cement storage silos. Construction of the existing cement manufacturing facility began in 1965. The property was sold to the cement company, Holnam in 1986. Lafarge purchased the property and continued operation in October 1998.

4. Up until October 2010, the facility manufactured Portland cement in a single wet process kiln. The plant had the capacity to produce 460,000 tons of cement annually, operating continuously 24 hours per day throughout the year except for short periods of shutdown for scheduled maintenance and repairs.

5. The raw materials used in slurry preparation for processing in the kiln included limestone, sand, iron bearing byproducts, aluminum silicates, contaminated soils, boiler slag, gypsum, and other materials containing calcium, silica, iron, and alumina. In general, feed stocks containing high concentrations of alkali, organic materials, and metals were avoided. Fuels burned in the kiln included natural gas, coal, petroleum coke, whole tire derived fuel, and used oils. No material regulated as hazardous waste under the Resource Conservation and Recovery Act

(CCRA) or as a toxic substance regulated under the Toxic Substances Control Act (TSCA) or any material designated as dangerous waste under the Washington Administrative Code (WAC) were accepted as feed material or fuel. The East Wharf (Figure 2) is the primary barge and ship unloading location for the plant. Solid fuel and raw materials including limestone, shale, gypsum, and granulated blast furnace slag used in the manufacture of cement were unloaded using the McDowell-Wellman unloading tower crane. The crane is a mobile crane that moves north and south on rails with a clam shell bucket.

6. Project Purpose. Lafarge is contracted to provide safe berth for at least six cargo ships carrying slag each year with a minimum of 24 feet of draft at mean lower low water (MLLW).

7. Proposed dredging and repairs would include:

    a. Remove accumulated sediment adjacent to the face of the wharf decreasing the water depth, approximately 24,000 cy, which is the subject of this characterization effort.

    b. Remove the remaining creosote-treated, fender piles and replace them with 12-inch diameter by 65-feet long, half-inch thick, steel piles.

8. Sampling and Analysis Plan. The sampling and analysis plan (SAP) was submitted for DMMP agency review on August 25, 2009, and was subsequently approved by the DMMP agencies on September 17, 2009 with minor revisions.

9. Sampling. The sampling was completed between October 28-29, 2009. utilizing a Vibracore sampler, at twelve core stations. Table 2 and Figures 3-6 depicts the twelve sampling stations, and dredged material management unit (DMMU) compositing strategy for the six DMMUs, which consisted of two composited samples from the upper 4-ft interval for each of the six DMMUs (C1 – C6) and Z-samples underlying each DMMU. The data characterization report was provided to the DMMP agencies for review and data quality assurance/control review on November 10, 2011. Analytical results were incomplete for the Z-sample analyses (e.g. Dioxin and TBT), although analytical results were adequate for the overlying proposed dredged material, and the data provided were acceptable for decision-making using best professional judgment.

10. Standard Chemicals of Concern Testing Summary. The Agencies' approved sampling and analysis plan was generally followed and quality assurance/quality control guidelines specified by PSEP and DMMP were generally complied with for the data provided, although as noted in Table 3, some of the analytical data were not accomplished for the Z-sample analyses (TBT and Dioxins). A summary of analyzed results of the chemicals analyzed is provided in Table 3, and demonstrates that PCBs exceeded the SL in all six DMMUs, with concentrations of total PCBs ranging from 231 ppb (C2) to 980 ppb (C6), which also exceeded the bioaccumulation trigger (BT) at C6 (49.2 ppm-oc-normalized). Additionally, undetected detection limit exceedances of SLs were noted for Total Chlordane, Dieldrin, Heptachlor, 4,4'-DDE, and 4,4'-DDT in one or more DMMUs as depicted in Table 3. Other than dioxins, the remaining analytes were below the Screening Levels in the six DMMUs. No toxicity testing or bioaccumulation testing was conducted to assess the DMMU's with SL exceedances and the BT exceedance.

11. Table 2. Summary of DMMU Sampling Stations at Lafarge North America Dock

DMMU ID	Vibracore Station ID#	Latitude, N	Longitude, W	Water Depth, feet MLLW	Approximate Mudline Elevation, feet MLLW	Approximate core depth, feet	DMMU design dredge volume, cubic yards
C1	S1-1	47 33.30516	122 20.62194	37	27	7.2	4,000
	S1-2	47 33.30768	122 20.6136	39	29	7.2	
C2	S2-1	47 33.28554	122 20.60922	36	25.4	8.3	4,000
	S2-2	47 33.29106	122 20.59266	39	28.4	7.2	
C3	S3-1	47 33.2516	122 20.5874	35	26.9	8	4,000
	S3-2	47 33.25750	122 20.5651	40.6	31	3.6	
C4	S4-1	47 33.1983	122 20.56092	29	24.8	2	4,000
	S4-2	47 33.20634	122 20.52858	32	25.5	7.9	
C5	S5-1	47 33.18342	122 20.55144	36	27.2	3	4,000
	S5-2	47 33.19242	122 20.5188	41	31.4	2.6	
C6	S6-1	47 33.16866	122 20.54436	35	26.9	5.1	4,000
	S6-2	47 33.177	122 20.51154	40	29.7	4.8	
Totals:							**24,000**

12. Dioxin Testing Results Summary. Table 4 provides the results of dioxin/furan testing. The results for the six surface DMMUs, were as follows: DMMU-C1 = 26.2 pptr-TEQ, and DMMU-C2 = 20.2 pptr-TEQ, DMMU-C3 = 24.8 pptr-TEQ (22.3 pptr-TEQ for duplicate analysis), DMMU-C4 = 25.1 pptr-TEQ, DMMU-C5 = 23.6 pptr-TEQ, and DMMU-C6 = 48.0 pptr-TEQ (U = ½ detection limit), all of which were above the DMMP BT of 10 pptr-TEQ.

13. Dioxin Interim Interpretative Framework. The DMMP implemented new interim guidelines for interpreting dioxin data implemented on December 6, 2010, and are summarized below for non-dispersive disposal sites (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/New_Interim_Guidelines_for_Dioxins.pdf):

    a. Nondispersive Screening Levels. DMMUs with dioxin concentrations below 10 pptr TEQ will be allowed for open-water disposal as long as the volume-weighted average concentration of dioxins in material from the entire dredging project does not exceed the Disposal Site Management Objective of 4 pptr TEQ.

14. Dioxin Interpretation on Suitability for Unconfined-Open-Water Disposal. As summarized in paragraph 12 above, all six DMMU's were quantitated above the 10 pptr-TEQ upper dioxin guideline limit, which also exceeds the bioaccumulation trigger. Moreover, the volume-weighted average for the six DMMUs (C1, C2, C3, C4, C5, and C6) totaling 24,000 cy of characterized material is 27.8 pptr-TEQ, which is well above the 4-pptr-TEQ site management objective (Table 5). Therefore, on the basis of dioxin, all six DMMUs are unsuitable for open-water disposal at the Elliott Bay disposal site.

15. Antidegradation Evaluation of Z-samples underlying DMMU's. As noted in paragraph 11 above, TBT and dioxin analyses results were missing from the Z-sample results summary. Based on the overlying elevated dioxin results, dioxin results are critical for the antidegradation evaluation. Assessing PCB concentrations in Z-samples noted SL/SQS exceedances in C2Z through C6Z (C2Z = 490 ppb/32.7 ppm-oc-norm; C3Z = 1520 ppb/95.0-

ppm-oc-norm; C4Z = 820 ppb/59.4 ppm-oc-norm; C5Z = 285 ppb/32.5 ppm-oc-norm; C6Z = 304 ppb/20 ppm-oc-norm), with C3Z and C4Z exceeding the PCB BT (38 ppm-oc-norm). Additionally, PCB concentrations in four of the six Z-samples (C2, C3, C4, and C5) exceeded surface PCB concentrations. Only C1Z exhibited PCB concentrations below the SL and SQS (16.3 ppb/3 ppm-oc-norm.). Elevated Zinc concentrations were noted in C6Z (491 ppm), exceeding the SL/SQS. Similar to the overlying DMMUs, a number of undetected detection limit exceedances of SQS were noted for 1,2-Dichlorobenzene, 1,4-Dichlorobenzene, and 1,2,4-Trichlorobenzene as depicted in Table 3.

16. Based on the PCBs and absence of Dioxin testing results for the six DMMUs, the DMMP has concluded that the z-sample results for all six DMMUs are not in compliance with the antidegradation standard. At a minimum, the following actions will be required to remedy the exposed surface after maintenance dredging is completed although a final design would need to be coordinated with the EPA's CERCLA program:

    a. Dredge an additional one-foot of material beyond the required maintenance depth (-17 ft to -18 ft MLLW).
    b. Place a one-foot clean sand cover over the exposed surface.

17. Suitability for Unconfined-Open Water Disposal. Based on the testing results for the six DMMUs summarized in Table 3, all 24,000 cy of proposed dredged material is unsuitable for unconfined open-water disposal, and will have to be dredged and placed at an Ecology approved upland confined disposal site.

18. This memorandum documents the suitability determination for the characterized dredged material at the LaFarge North America maintenance dredging area for unconfined-open-water disposal at the Elliott Bay non-dispersive disposal site. It also documents the requirements to evaluate the exposed post-dredge surface to assess antidegradation compliance, and proposed remedy to address this concern. However, this suitability determination does not constitute final agency approval of the project. A dredging plan for this project must be completed as part of the final project approval process. 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.

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Signed SDM on file in DMMO Project File

Concur:

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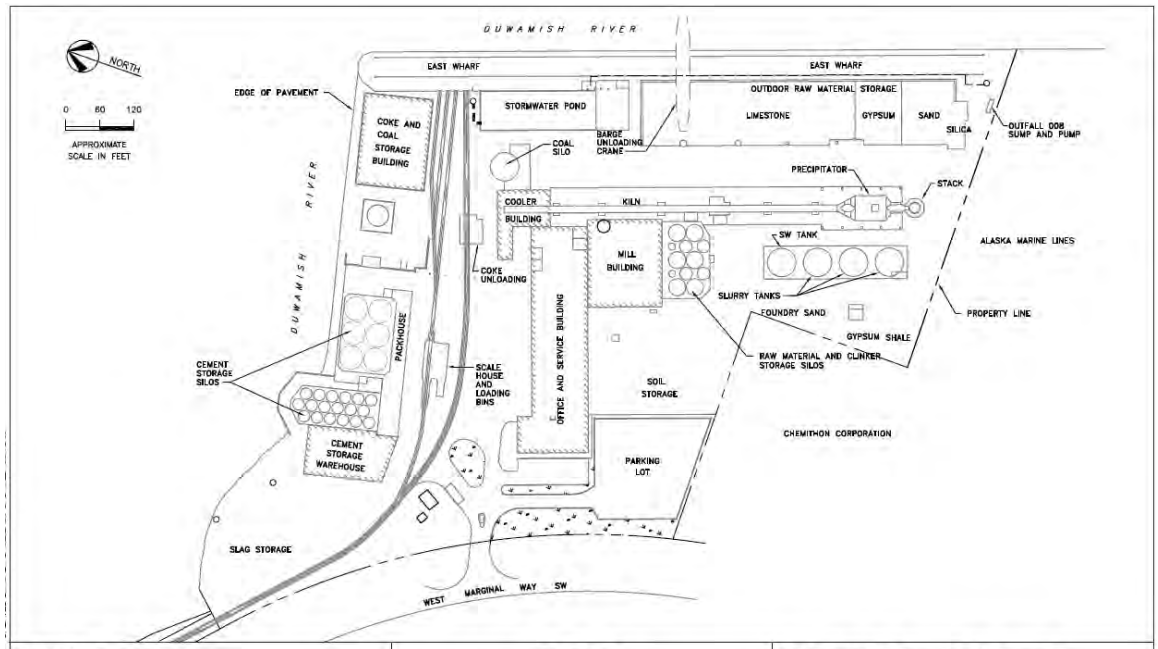
PURPOSE: Wharf repair and maintenance **DATUM:** NAD 1983 **ADJACENT PROPERTY OWNERS:** 1. Chemithon Corp. 2. Alaska Marine Lines 3. Port of Seattle	**VICINITY MAP** **NAME:** Lafarge East Wharf **REFERENCE #:** **SITE LOCATION ADDRESS:** 5400 Marginal Way SW Seattle, WA 98106	**IN:** Section 19; Township 24N; Range 4E **COUNTY:** King **STATE**: WA **SHEET:** 1 of 4 **DATE:** June 2009

Figure 1. Vicinity Map



PURPOSE: Wharf repair and maintenance **DATUM:** NAD 1983 **ADJACENT PROPERTY OWNERS:** 1. Chemithon Corp. 2. Alaska Marine Lines 3. Port of Seattle	**SITE MAP** **NAME:** Lafarge East Wharf Repair **REFERENCE #:** **SITE LOCATION ADDRESS:** 5400 Marginal Way SW Seattle, WA 98106	**IN:** Section 19; Township 24N; Range 4E **COUNTY:** King **STATE:** WA **SHEET:** 2 of 4 **DATE:** June 2009

Figure 2. Site Map

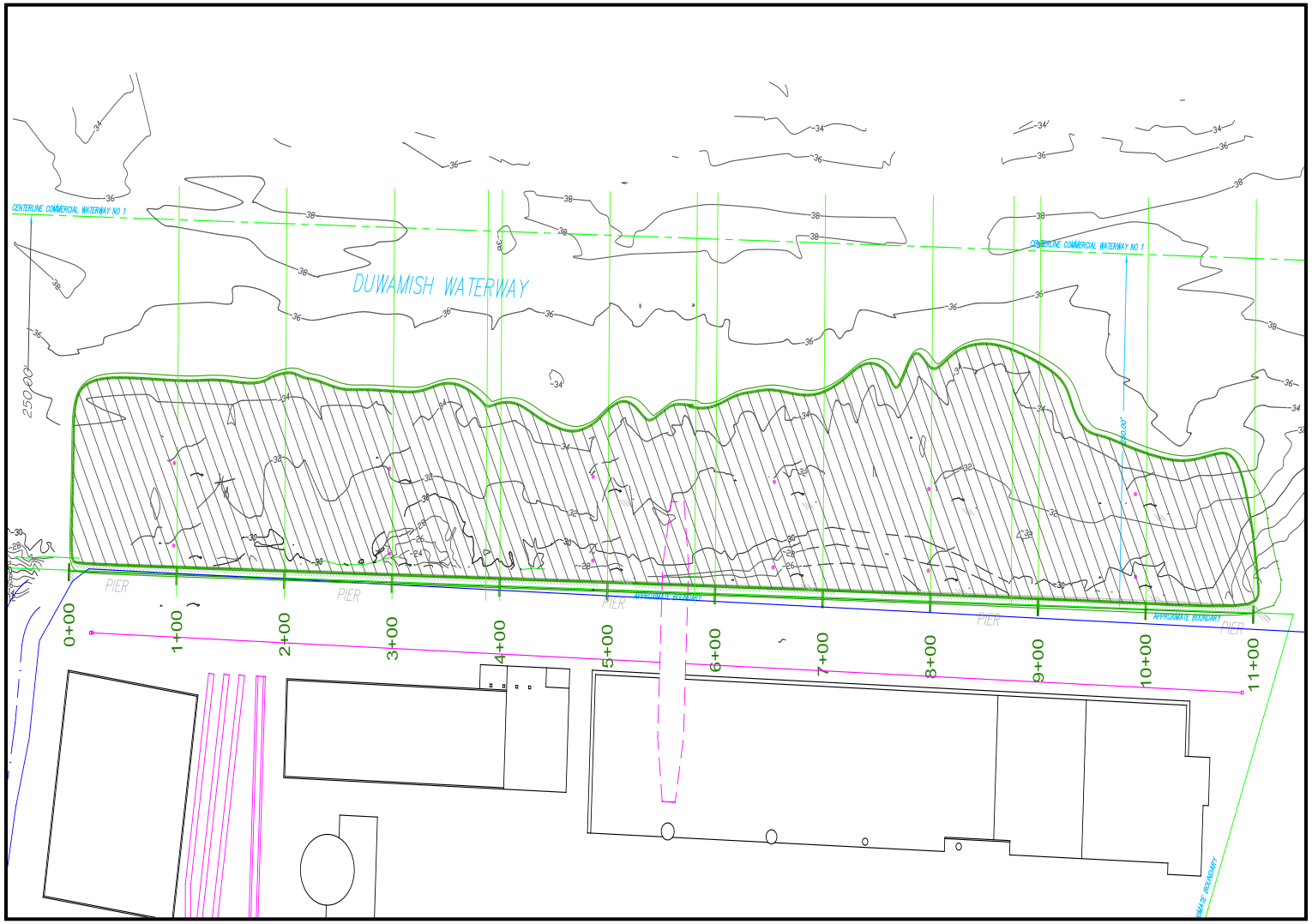


Figure 3. Proposed Phase 2 Dredging Area

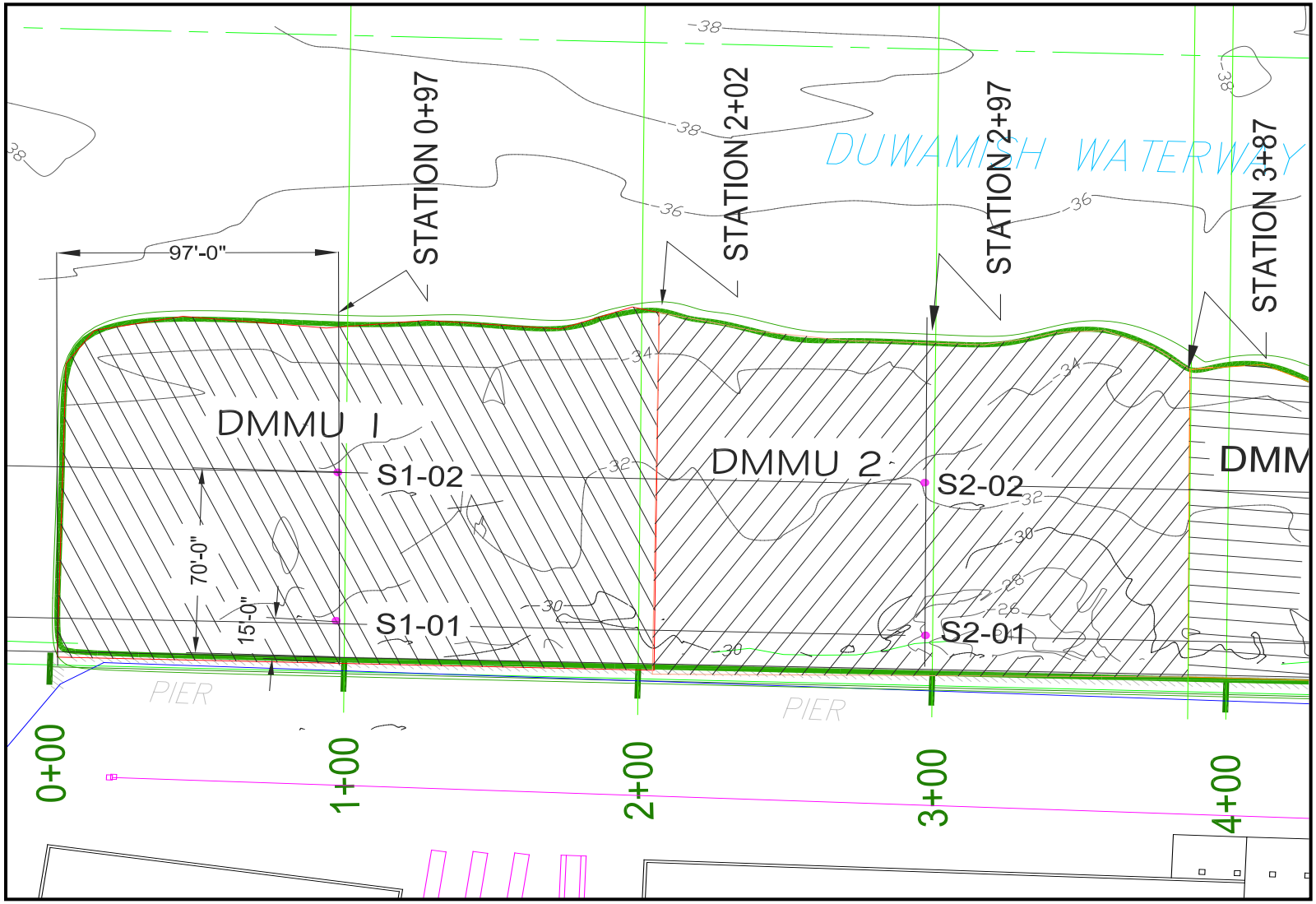


Figure 4. Proposed Phase 2 DMMU – Locations 1 and 2

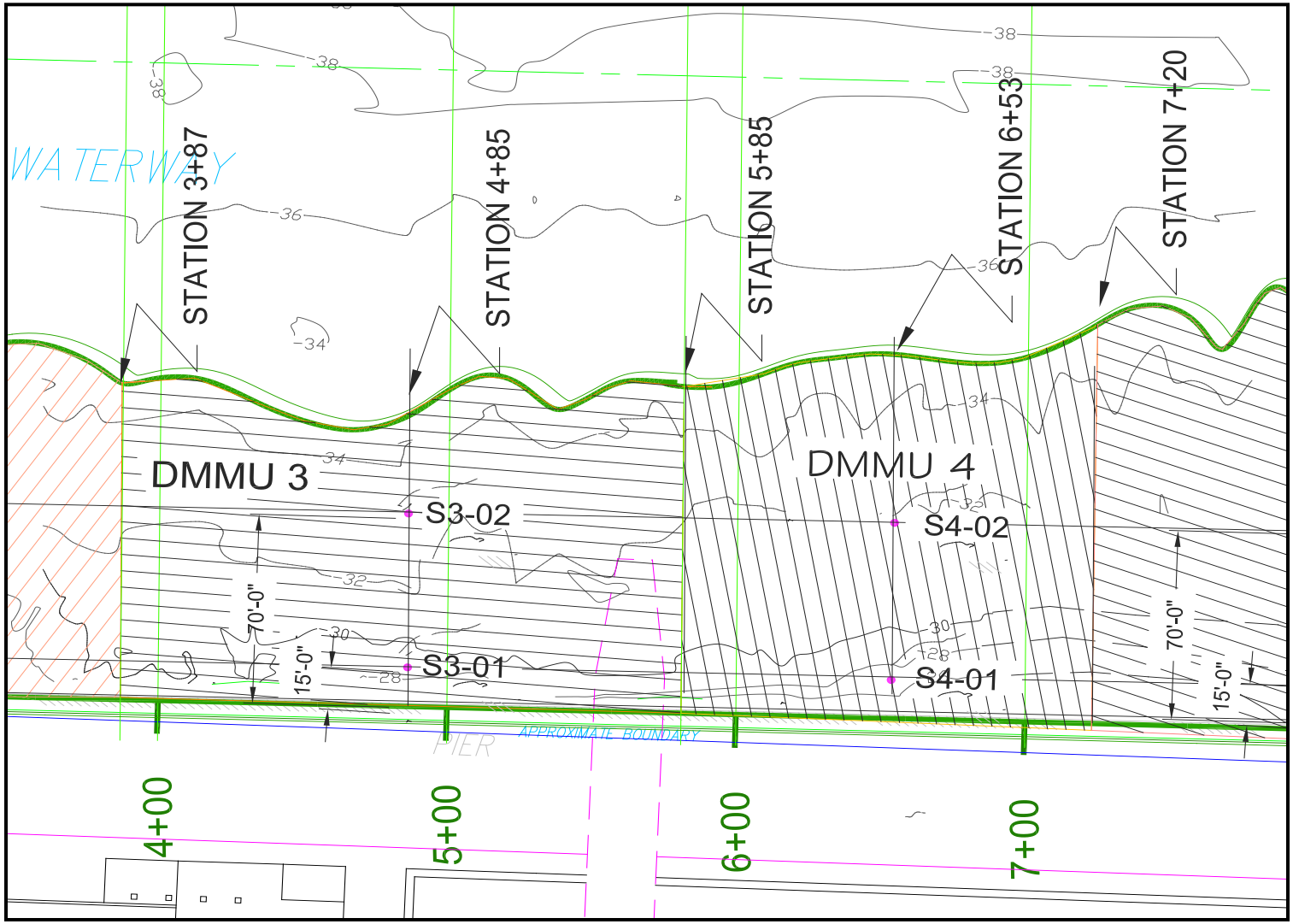


Figure 5. Proposed Phase 2 DMMU – Locations 3 and 4

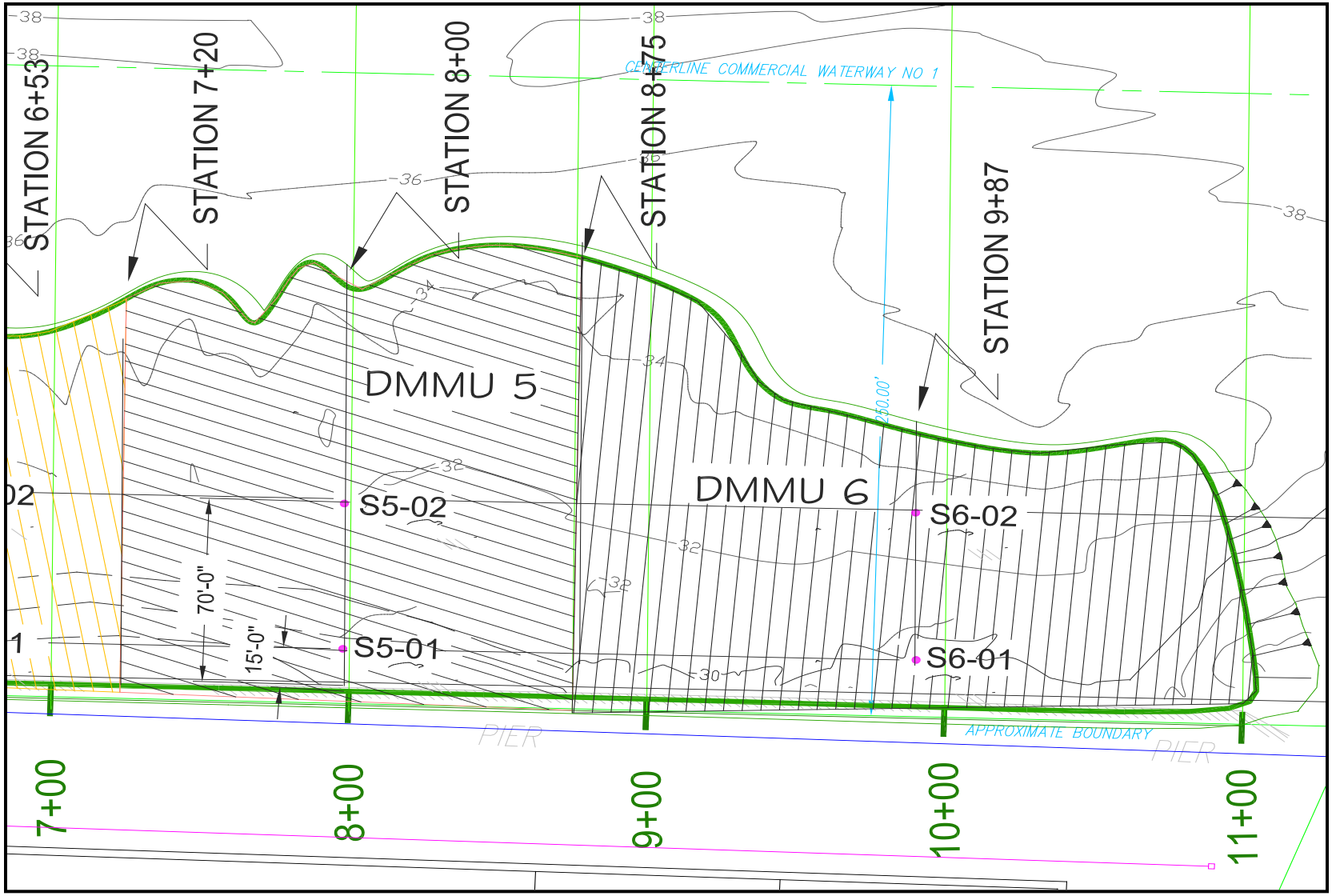


Figure 6. Proposed Phase 2 DMMU – Locations 5 and 6

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C1			DMMU-C1-Z			DMMU-C2			DMMU-C2-Z		
	Vibracore ID: (Mudline elevation, ft. MLLW)							S1-01, S1-02 (7.2 ft)		VQ			VQ	S2-01, S2-02 (7.2-8.3 ft)		VQ			VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--	9		UJ	7		UJ	9		UJ	7		UJ
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93	**27**			7		U	**40**			**49**		
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7	**0.6**			0.3		U	**0.4**			**0.6**		
Chromium	mg/kg dw	260	-	260	mg/kg	260	270	**36.5**			**13.3**			**37.2**			**33.9**		
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390	**99**			**18.4**			**103**			**120**		
Lead	mg/kg dw	450	1200	975	mg/kg	450	530	**78**			**3**			**63**			**113**		
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59	**0.27**			0.03		U	**0.21**			**0.2**		
Selenium	mg/kg dw	-	-	3	mg/kg	--	--	0.9		U	0.7		U	0.8		U	0.8		U
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1	**1**			0.4		U	1		U	**0.7**		
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960	**169**			**30**			**188**			**201**		
Tributyltin (porewater - ion)	ug/L	0.15	--	0.15				**0.056**		J				**.046**		J			
PAHs																			
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57	20	0.95	U		3.70	U	20	0.90	U		1.30	U
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66	20	0.95	U		3.7	U	20	0.90	U		1.30	U
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200	**25**	**1.18**			3.70	U	**28**	**1.26**			**1.00**	J
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270	**66**	**3.13**			3.70	U	**74**	**3.32**			**3.3**	
Total Benzofluoranthene	µg/kg dw	3200	9900	-	mg/kg/OC	230	450	**100**	**4.74**			**3.7**		**78**	**3.50**			**4.5**	
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78	**34**	**1.61**			3.70	U	**26**	**1.17**			**1.6**	
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210	**100**	**4.74**			3.70	U	**78**	**3.50**			**4.8**	
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460	**98**	**4.64**			3.70	U	**92**	**4.13**			**4.4**	
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33	**15**	**0.71**	J		3.70	U	**14**	**0.63**	J		0.80	U
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200	**160**	**7.58**			**2.0**	J	**210**	**9.42**			**8.7**	
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79	20	0.95	U		3.70	U	10	0.45	U		1.30	U
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88	**36**	**1.71**			3.70	U	**28**	**1.26**			**1.8**	
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64	20	0.95	U		3.70	U	20	0.90	U		1.30	U
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170	20	0.95	U		3.70	U	20	0.90	U		1.30	U
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480	**75**	**3.55**			3.7	U	**58**	**2.60**			**3.6**	
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400	**250**	**11.85**			**3.5**	J	**230**	**10.31**			**15.3**	
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300	**959**	**45.45**			**6.9**		**908**	**40.72**			**50.0**	
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780	**96**	**4.55**			**9.2**		**360**	**16.14**			**4.6**	
Phthalates																			
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64	20	0.95	U		3.70	U	20	0.90	U		1.3	U
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700	20	0.95	U		20	U	20	0.90	U		20	U
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500	20	0.95	U		3.7	U	20	0.90	U		1.3	U
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110	20	0.95	U		3.7	U	20	0.90	U		1.3	U
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0	20	0.95	U		3.7	U	20	0.90	U		1.3	U
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78	**150**	**7.11**			**3.2**	J	**87**	**3.90**			**8.0**	
Phenols																			
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29	20		U	20		U	20		U	20		U
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63	20		U	20		U	20		U	20		U
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670	20		U	20		U	20		U	20		U
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690	98		U	99		U	99		U	98		U
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200	**22**			20		U	**22**			20		U
Other SVOCs																			
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58	20		U		3.7	U	20	0.90	U		1.3	U
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650	200		U	200		U	200		U	200		U
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73	20		U	20		U	20		U	20		U
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3	20	0.95	U		3.7	U	20	0.90	U		1.3	U
1,3-Dichlorobenzene	µg/kg dw	170	-	-	mg/kg-OC	--	--	20	0.95	U		20	U	20	0.90	U		20	U
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0	20	0.95	U		3.7	U	20	0.90	U		1.3	U
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3	1	0.05	U		0.2	U	1	0.04	U		0.1	U
Hexachlorobutadiene	µg/kg dw	29	270	-	mg/kg-OC	3.9	6.2	1	0.05	U		0.2	UJ	1	0.04	U		0.1	UJ
Hexachloroethane	µg/kg dw	1400	14000	-	mg/kg-OC	--	--	20	0.95	U		20	U	20	0.90	U		20	U
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11	20	0.95	U		3.7	U	20	0.90	U		1.3	U
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8	20	0.95	U		3.7	U	20	0.90	U		1.3	U

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C1			DMMU-C1-Z			DMMU-C2			DMMU-C2-Z		
PCB Aroclors																			
Aroclor 1016	µg/kg dw	-	-	-		--	--	16		U	0.8		U	4		U	16		U
Aroclor 1221	µg/kg dw	-	-	-		--	--	16		U	0.8		U	4		U	16		U
Aroclor 1232	µg/kg dw	-	-	-		--	--	16		U	0.8		U	4		U	16		U
Aroclor 1242	µg/kg dw	-	-	-		--	--	16		U	0.8		U	4		U	16		U
Aroclor 1248	µg/kg dw	-	-	-		--	--	**160**			**6.6**			**49**			**130**		
Aroclor 1254	µg/kg dw	-	-	-		--	--	**220**			**6.2**			**99**			**210**		
Aroclor 1260	µg/kg dw	-	-	-		--	--	**140**			**3.5**			**83**			**150**		
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**	**520**	**24.6**		**16.3**	**3.0**		**231**	**10.4**	J	**490**	**32.7**	
Pesticides																			
Aldrin	µg/kg dw	9.5	-	-		--	--	0.99		U	1.0		U	0.99		U	1.0		U
gamma-BHC (Lindane)	µg/kg dw	-	-	-		--	--	**10**			1.0		U	1		U	1.0		U
cis-Chlordane	µg/kg dw	-	-	-		--	--	**2**		U				2		U			
trans-nonachlor	µg/kg dw	-	-	-		--	--	3.9		Y	2		U	2		U	3.7		Y
Total chlordane	µg/kg dw	2.8	-	-		--	--	3.9		U	2		U	2		U	2		U
Dieldrin	µg/kg dw	1.9	-	-		--	--	2.0		U	2.0		U	2.0		U	2.0		U
Heptachlor	µg/kg dw	1.5	-	-		--	--	1.0		U	1		U	1.0		U	1.7		U
4,4'-DDD	µg/kg dw	16	-	-		--	--	3.9		Y	2		U	2		U	3		Y
4,4'-DDE	µg/kg dw	9	-	-		--	--	2		U	2		U	2		U	2		U
4,4'-DDT	µg/kg dw	12	-	-		--	--	2		U	2		U	2		U	2		U
Total DDTs	µg/kg dw	-	69	50		--	--	3.9		U	2		U	2.0		U	3		U
Dioxin (TEQ: see Table 4 for detailed congener results)	**mg/kg**							**26.2**						**20.2**					
Sediment Conventionals																			
Total Solids	ng/kg						%	55.2						43.5					
Total Volatile Solids	%						%	6.53						12.17					
Total Organic Carbon	%						%	2.11						2.23					
Total Ammonia	mg/kg						mg/kg												
Total Sulfides	mg/kg						mg/kg	1980						2320					
Gravel	%						%	0.9						3.2					
Sand	%						%	24.1						9.9					
Silt	%						%	54.8						60.1					
Clay	%						%	20.2						26.7					
Fines (percent silt + clay)	%						%	**75.1**						**86.8**					
Bioassay Determination: **(P/F)**								NA						NA					
BTs exceeded: **Y/N**								Y						Y					
Bioaccumulation conducted: **Y/N**								N						N					
Bioaccumulation Determination: **(P/F)**																			
ML Rule exceeded: **Y/N**								N						N					
PSDDA Determination: (Suitable/Unsuitable)								**Unsuitable**			**Failed (AD)**			**Unsuitable**			**Failed (AD)**		
DMMU Volume: (cy)								4,000						4,000					
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**H**						**H**					
Maximum Vibracore depth (ft) (includes 2 ft Z sample)	ft						ft	7.2						8.3					
Mean core sampling depth (ft)	ft						ft	7.2						7.75					
DMMU ID:								**DMMU-C1**			**DMMU-C1-Z**			**DMMU-C2**			**DMMU-C2-Z**		

Legend:

Bold = detected results

J = Estimated value

U = Undetected at reporting limit

Y = The reporting limit is elevated due to interference. The result is not detected

NA = Not analyzed

SL / SQS exceedance

SL/BT exceedance

CSL exceedance

Unsuitable (open-water-disposal)

Failed Antidegradation (AD)

No data provided

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C3			DMMU-C3 (dup)			DMMU-C3-Z		
	Vibracore ID: (Mudline elevation, ft. MLLW)							S3-01, S3-02 (3.6 - 8 ft)		VQ			VQ			VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--	9		UJ	9		UJ	8		UJ
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93	**26**			**21**			**49**		
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7	**0.4**			0.4		U	**0.8**		
Chromium	mg/kg dw	260	-	260	mg/kg	260	270	**39.9**			**31.1**			**40.9**		
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390	**99**			85			**103**		
Lead	mg/kg dw	450	1200	975	mg/kg	450	530	**59**			**49**			**88**		
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59	**0.25**			**0.23**			**0.26**		
Selenium	mg/kg dw	-	-	3	mg/kg	--	--	0.9		U	0.9		U	0.8		U
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1	1		U	**1**			1.3		
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960	**171**			**141**			**233**		
Tributyltin (porewater - ion)	ug/L	0.15	--	0.15				**0.085**		J	**0.067**		J			
PAHs																
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57	70	4.35	U	**160**	**9.94**			**2.3**	
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66	20	1.24	U	**27**	**1.68**			**0.80**	J
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200	**54**	**3.35**		**120**	**7.45**			**4.30**	
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270	**140**	**8.70**		**400**				**26.3**	
Total Benzofluoranthene	µg/kg dw	3200	9900	-	mg/kg/OC	230	450	**130**	**8.07**		**440**	**27.3**			**16.3**	
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78	**27**	**1.68**		**86**	**5.34**			**3.90**	
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210	**110**	**6.83**		**380**	**23.6**			**15.60**	
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460	**180**	**11.2**		**540**	**33.5**			**25.0**	
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33	**16**	**0.99**	J	**59**	**3.66**			**2.60**	
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200	**290**	**18.0**		**1000**	**62.1**			**48.1**	
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79	**53**	**3.29**		**140**	**8.70**			**3.10**	
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88	**34**	**2.11**		**110**	**6.83**			**4.50**	
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64	20	1.24	U	**29**	**1.80**			1.30	U
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170	**33**	**2.05**		**68**	**4.22**			1.30	U
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480	**150**	**9.32**		**590**	**36.6**			**13.1**	
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400	**380**	**23.6**		**1000**	**62.1**			**35.6**	
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300	**1437**	**89.3**		**4455**	**276.7**			**194.0**	
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780	**231**	**14.3**		**1105**	**68.6**			**24.0**	
Phthalates																
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64	20	1.24	U	20	1.24	U		1.30	U
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700	20	1.24	U	20	1.24	U		20	U
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500	20	1.24	U	20	1.24	U		1.30	U
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110	20	1.24	U	20	1.24	U		1.3	U
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0	20	1.24	U	20	1.24	U		1.30	U
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78	**260**	**16.1**		**160**	**9.94**			**8.1**	
Phenols																
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29	20		U	20		U	20		U
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63	20		U	20		U	20		U
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670	20		U	20		U	20		U
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690	98		U	98		U	98		U
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200	**50**			**53**			**11**		J
Other SVOCs																
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58	**36**	**2.24**		**90**	**5.59**			**1.3**	
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650	200		U	200		U	200		U
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73	20		U	20		U	20		U
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3	20	1.24	U	20	1.24	U		1.3	U
1,3-Dichlorobenzene	µg/kg dw	170	-	-	mg/kg-OC	--	--	20	1.24	U	20	1.24	U		20	U
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0	20	1.24	U	20	1.24	U		1.3	U
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3	1	0.06	U	1	0.06	U		0.1	U
Hexachlorobutadiene	µg/kg dw	29	270	-	mg/kg-OC	3.9	6.2	1	0.06	U	1	0.06	U		1.3	UJ
Hexachloroethane	µg/kg dw	1400	14000	-	mg/kg-OC	--	--	20	1.24	U	20	1.24	U		20	U
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11	20	1.24	U	20	1.24	U		1.3	U
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8	20	1.24	U	20	1.24	U		1.3	U

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C3			DMMU-C3 (dup)			DMMU-C3-Z		
PCB Aroclors																
Aroclor 1016	µg/kg dw	-	-	-		--	--	3.9		U	3.9		U			
Aroclor 1221	µg/kg dw	-	-	-		--	--	3.9		U	3.9		U	21		U
Aroclor 1232	µg/kg dw	-	-	-		--	--	3.9		U	3.9		U	21		U
Aroclor 1242	µg/kg dw	-	-	-		--	--	3.9		U	3.9		U	21		U
Aroclor 1248	µg/kg dw	-	-	-		--	--	**57**			**54**			**540**		
Aroclor 1254	µg/kg dw	-	-	-		--	--	**100**			**110**			**620**		
Aroclor 1260	µg/kg dw	-	-	-		--	--	**90**			**87**			**360**		
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**	**247**	**15.3**		**251**	**15.6**		**1520**	**95.0**	
Pesticides																
Aldrin	µg/kg dw	9.5	-	-		--	--	0.98		U	0.98		U	1.0		U
gamma-BHC (Lindane)	µg/kg dw	-	-	-		--	--	1		U	1		U	1.0		U
cis-Chlordane	µg/kg dw	-	-	-		--	--			U	2		U	2		U
trans-nonachlor	µg/kg dw	-	-	-		--	--			Y	8.1		Y	4.3		Y
Total chlordane	µg/kg dw	2.8	-	-		--	--	8.1		U	8.1		U	4.3		U
Dieldrin	µg/kg dw	1.9	-	-		--	--	2.0		U	2		U	2.0		U
Heptachlor	µg/kg dw	1.5	-	-		--	--	1.6		U	1.4		U	7.0		U
4,4'-DDD	µg/kg dw	16	-	-		--	--	2		U	2		U	4.5		Y
4,4'-DDE	µg/kg dw	9	-	-		--	--	2		U	2		U	47		Y
4,4'-DDT	µg/kg dw	12	-	-		--	--	14		Y	11		Y	41		Y
Total DDTs	µg/kg dw	-	69	50		--	--	14		U	11		U	47		U
Dioxin (TEQ: see Table 4 for detailed congener results)	**mg/kg**							**24.8**			**22.3**					
Sediment Conventionals																
Total Solids	ng/kg						%	48.9								
Total Volatile Solids	%						%	7.09								
Total Organic Carbon	%						%	1.61								
Total Ammonia	mg/kg						mg/kg									
Total Sulfides	mg/kg						mg/kg	4100								
Gravel	%						%	1.6								
Sand	%						%	14.4								
Silt	%						%	61.4								
Clay	%						%	22.8								
Fines (percent silt + clay)	%						%	**84.1**								
Bioassay Determination: **(P/F)**								NA								
BTs exceeded: **Y/N**								Y								
Bioaccumulation conducted: **Y/N**								N								
Bioaccumulation Determination: **(P/F)**																
ML Rule exceeded: **Y/N**								N								
PSDDA Determination: (Suitable/Unsuitable)								**Unsuitable**						**Failed (AD)**		
DMMU Volume: (cy)								4,000								
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**H**								
Maximum Vibracore depth (ft) (includes 2 ft Z sample)	ft						ft	8								
Mean core sampling depth (ft)	ft						ft	5.8								
DMMU ID:								**DMMU-C3**			**DMMU-C3 (dup)**			**DMMU-C3-Z**		

Legend:

Bold = detected results

J = Estimated value

U = Undetected at reporting limit

Y = The reporting limit is elevated due to interference. The result is not detected

NA = Not analyzed

SL / SQS exceedance

SL/BT exceedance

CSL exceedance

Unsuitable (open-water-disposal)

Failed Antidegradation (AD)

No data provided

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C4			DMMU-C4-Z			DMMU-C5			DMMU-C5-Z		
	Vibracore ID: (Mudline elevation, ft. MLLW)							S4-01, S4-02 (2 - 7.9 ft)		VQ			VQ	S5-01, S5-02 (2.6 - 3 ft)		VQ			VQ
								DMMP	SMS		DMMP	SMS		DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--	9		UJ	8		UJ	**35**		J	8		UJ
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93	**40**			**65**			**162**			**68**		
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7	**0.5**			**0.6**			**0.8**			**0.4**		
Chromium	mg/kg dw	260	-	260	mg/kg	260	270	**35.3**			**32.9**			**31.6**			**22.6**		
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390	**114**			**112**			**189**			**78.1**		
Lead	mg/kg dw	450	1200	975	mg/kg	450	530	**92**			**117**			**165**			**67**		
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59	**0.26**			**0.53**			**0.15**			**0.21**		
Selenium	mg/kg dw	-	-	3	mg/kg	--	--	0.9		U	0.9		U				0.8		U
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1	**1**			**0.8**			**1**			0.5		U
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960	**186**			**244**			**539**			**204**		
Tributyltin (porewater - ion)	ug/L	0.15	--	0.15				**0.12**		J				**0.14**		J			
PAHs																			
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57	**13**	**0.85**	J		1.40	U	19	1.05	U		2.20	U
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66	**12**	**0.78**	J		1.40	U	19	1.05	U		2.20	U
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200	**61**	**3.99**			**1.80**		**20**	**1.10**			**1.70**	J
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270	**150**	**9.80**			**6.30**		**68**	**3.76**			**5.3**	
Total Benzofluoranthene	µg/kg dw	3200	9900	-	mg/kg/OC	230	450	**190**	**12.4**			**6.8**		**76**	**4.20**			**6.7**	
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78	**82**	**5.36**			**2.80**		**37**	**2.04**			**2.9**	
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210	**180**	**11.8**			**7.20**		**79**	**4.36**			**6.8**	
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460	**230**	**15.0**			**8.70**		**91**	**5.03**			**6.6**	
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33	**114**	**7.45**			**1.40**		**189**	**10.4**			**1.3**	J
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200	**340**	**22.2**			**13.8**		**180**	**9.94**			**16.0**	
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79	**15**	**0.98**	J		1.40	U	**19**	**1.05**	J		2.20	U
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88	**90**	**5.88**			**3.10**		**37**	**2.04**			**3.10**	
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64	20	1.31	U		1.40	U	19	1.05	U		2.20	U
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170	**10**	**0.65**	J		1.40	U	19	1.05	U		2.20	U
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480	**120**	**7.84**			**5.90**		**57**	**3.15**			**6.30**	
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400	**480**	**31.4**			**18.1**		**210**	**11.6**			**19.4**	
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300	**1975**	**129.1**			**75.0**		**871**	**48.1**			**75.0**	
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780	**231**	**15.1**			**7.70**		**77**	**4.25**			**8.00**	
Phthalates																			
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64	20	1.31	U		1.40	U	20	1.10	U		2.20	U
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700	20	1.31	U		20.0	U	19	1.05	U		19.0	U
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500	20	1.31	U		1.4	U	19	1.05	U		2.2	U
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110	20	1.31	U		1.4	U	19	1.05	U		2.2	U
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0	20	1.31	U		1.4	U	20	1.10	U		2.2	U
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78	**200**	**13.1**			**9.4**		**130**	**7.18**			**10.7**	
Phenols																			
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29	20		U	20		U	19		U	19.0		U
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63	20		U	20		U	19		U	19.0		U
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670	20		U	20		U	19		U	19.0		U
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690	98		U	98		U	97		U	96		U
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200	**57**			**26**		J	19		U	**43**		
Other SVOCs																			
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58	20	1.31	U		1.4	U	19	1.05	U		2.2	U
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650	200		U	200		U	190		U	190		U
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73	20		U	20		U	19		U	19		U
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3	20	1.31	U		1.4	U	19	1.05	U		2.2	U
1,3-Dichlorobenzene	µg/kg dw	170	-	-	mg/kg-OC	--	--	20	1.31	U		20	U	19	1.05	U		19	U
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0	20	1.31	U		1.3	U	19	1.05	U		2.2	U
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3	1	0.07	U		0.1	U	1	0.06	U		0.2	U
Hexachlorobutadiene	µg/kg dw	29	270	-	mg/kg-OC	3.9	6.2	1	0.07	U		0.1	UJ	1	0.06	U		2.2	UJ
Hexachloroethane	µg/kg dw	1400	14000	-	mg/kg-OC	--	--	20	1.31	U		20	U	19	1.05	U		19	U
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11	20	1.31	U		1.4	U	19	1.05	U		2.2	U
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8	20	1.31	U		1.4	U	19	1.05	U		2.2	U

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C4			DMMU-C4-Z			DMMU-C5			DMMU-C5-Z		
PCB Aroclors																			
Aroclor 1016	µg/kg dw	-	-	-		--	--	3.8		U	18		U	3.9		U	3.6		U
Aroclor 1221	µg/kg dw	-	-	-		--	--	3.8		U	18		U	3.9		U	3.6		U
Aroclor 1232	µg/kg dw	-	-	-		--	--	3.8		U	18		U	3.9		U	3.6		U
Aroclor 1242	µg/kg dw	-	-	-		--	--	3.8		U	18		U	3.9		U	3.6		U
Aroclor 1248	µg/kg dw	-	-	-		--	--	**85**			**230**			**99**			**88**		
Aroclor 1254	µg/kg dw	-	-	-		--	--	**130**			**340**			**160**			**120**		
Aroclor 1260	µg/kg dw	-	-	-		--	--	**88**			**250**			**120**			**77**		
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**	**303**	**19.8**		**820**	**59.4**		**379**	**20.9**		**285**	**32.5**	
Pesticides																			
Aldrin	µg/kg dw	9.5	-	-		--	--	0.99		U	1.0		U	0.98		U	1.0		U
gamma-BHC (Lindane)	µg/kg dw	-	-	-		--	--	1		U	1.0		U	1		U	1.0		U
cis-Chlordane	µg/kg dw	-	-	-		--	--	2		U	2		U	2		U	2		U
trans-nonachlor	µg/kg dw	-	-	-		--	--	3.6		Y	3		Y	3.6		Y	2		U
Total chlordane	µg/kg dw	2.8	-	-		--	--	3.6		U	3		U	3.6		U	2		U
Dieldrin	µg/kg dw	1.9	-	-		--	--	2.0		U	2.0		U	2.0		U	2.0		U
Heptachlor	µg/kg dw	1.5	-	-		--	--	2.0		U	3.3		U	1.0		U	2.6		U
4,4'-DDD	µg/kg dw	16	-	-		--	--	4.2		Y	7.3		Y	2		U	2		U
4,4'-DDE	µg/kg dw	9	-	-		--	--	23		Y	35		Y	28		Y	20		Y
4,4'-DDT	µg/kg dw	12	-	-		--	--	21		Y	2		U	23		Y	2		U
Total DDTs	µg/kg dw	-	69	50		--	--	23		U	35		U	28		U	20		U
Dioxin (TEQ: see Table 4 for detailed congener results)	**mg/kg**							**25.1**						**23.6**					
Sediment Conventionals																			
Total Solids	ng/kg						%	53.3						60.9					
Total Volatile Solids	%						%	7.1						6.84					
Total Organic Carbon	%						%	1.53						1.81					
Total Ammonia	mg/kg						mg/kg												
Total Sulfides	mg/kg						mg/kg	2180						1350					
Gravel	%						%	9.1						3.2					
Sand	%						%	13.9						31.5					
Silt	%						%	53.5						45.1					
Clay	%						%	23.6						20.1					
Fines (percent silt + clay)	%						%	**77**						**65.3**					
Bioassay Determination: **(P/F)**								NA						NA					
BTs exceeded: **Y/N**								Y						Y					
Bioaccumulation conducted: **Y/N**								N						N					
Bioaccumulation Determination: **(P/F)**																			
ML Rule exceeded: **Y/N**								N						N					
PSDDA Determination: (Suitable/Unsuitable)								**Unsuitable**			**Failed (AD)**			**Unsuitable**			**Failed (AD)**		
DMMU Volume: (cy)								4,000						4,000					
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**H**						**H**					
Maximum Vibracore depth (ft) (includes 2 ft Z sample)	ft						ft	7.9						3					
Mean core sampling depth (ft)	ft						ft	4.95						2.8					
DMMU ID:								**DMMU-C4**			**DMMU-C4-Z**			**DMMU-C5**			**DMMU-C5-Z**		

Legend:

Bold = detected results

J = Estimated value

U = Undetected at reporting limit

Y = The reporting limit is elevated due to interference. The result is not detected

NA = Not analyzed

SL / SQS exceedance

SL/BT exceedance

CSL exceedance

Unsuitable (open-water-disposal)

Failed Antidegradation (AD)

No data provided

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C6			DMMU-C6-Z		
	Vibracore ID: (Mudline elevation, ft. MLLW)							S6-01, S6-02 (4.8 - 5.1 ft)		VQ			VQ
								DMMP	SMS		DMMP	SMS	
Metals								dry wgt	mg-oc-norm		dry wgt	mg-oc-norm	
Antimony	mg/kg dw	150	200	-		--	--	**12**		J	18		J
Arsenic	mg/kg dw	57	700	507.1	mg/kg	57	93	**71**			**136**		
Cadmium	mg/kg dw	5.1	14	11.3	mg/kg	5.1	6.7	**0.9**			**0.7**		
Chromium	mg/kg dw	260	-	260	mg/kg	260	270	**42.2**			**35**		
Copper	mg/kg dw	390	1300	1027	mg/kg	390	390	**158**			**201**		
Lead	mg/kg dw	450	1200	975	mg/kg	450	530	**132**			**157**		
Mercury	mg/kg dw	0.41	2.3	1.5	mg/kg	0.41	0.59	**0.28**			**0.23**		
Selenium	mg/kg dw	-	-	3	mg/kg	--	--				0.8		U
Silver	mg/kg dw	6.1	8.4	6.1	mg/kg	6.1	6.1	**1**			**0.8**		
Zinc	mg/kg dw	410	3800	2783	mg/kg	410	960	**335**			**491**		
Tributyltin (porewater - ion)	ug/L	0.15	--	0.15				**0.11**		J			
PAHs													
Acenaphthene	µg/kg dw	500	2000	-	mg/kg-OC	16	57	**27**	**1.36**			**1.30**	
Acenaphthylene	µg/kg dw	560	1300	-	mg/kg-OC	66	66	**22**	**1.11**			**1.40**	
Anthracene	µg/kg dw	960	13000	-	mg/kg-OC	220	1,200	**100**	**5.03**			**8.60**	
Benzo(a)anthracene	µg/kg dw	1300	5100	-	mg/kg-OC	110	270	**270**	**13.6**			**21.1**	
Total Benzofluoranthene	µg/kg dw	3200	9900	-	mg/kg/OC	230	450	**360**	**18.1**			**20.4**	
Benzo(g,h,i)perylene	µg/kg dw	670	3200	-	mg/kg-OC	31	78	**160**	**8.04**			**7.90**	
Benzo(a)pyrene	µg/kg dw	1600	3600	-	mg/kg-OC	99	210	**360**	**18.1**			**21.1**	
Chrysene	µg/kg dw	1400	21000	-	mg/kg-OC	110	460	**420**	**21.1**			**36.8**	
Dibenzo(a,h)anthracene	µg/kg dw	230	1900	-	mg/kg-OC	12	33	**158**	**7.94**			**3.70**	
Fluoranthene	µg/kg dw	1700	30000	4600	mg/kg-OC	160	1,200	**750**	**37.7**			**105.3**	
Fluorene	µg/kg dw	540	3600	-	mg/kg-OC	23	79	**31**	**1.56**			**2.00**	
Indeno(1,2,3-cd)pyrene	µg/kg dw	600	4400	-	mg/kg-OC	34	88	**180**	**9.05**			**8.60**	
2-Methylnaphthalene	µg/kg dw	670	1900	-	mg/kg-OC	38	64	**11**	**0.55**	J		1.30	U
Naphthalene	µg/kg dw	2100	2400	-	mg/kg-OC	99	170	**11**	**0.55**	J		1.30	U
Phenanthrene	µg/kg dw	1500	21000	-	mg/kg-OC	100	480	**260**	**13.1**			**16.4**	
Pyrene	µg/kg dw	2600	16000	11980	mg/kg-OC	1,000	1,400	**850**	**42.7**			**64.5**	
Total HPAHs	µg/kg dw	12000	69000	-	mg/kg-OC	960	5,300	**3789**	**190.4**			**310.0**	
Total LPAHs	µg/kg dw	5200	29000	-	mg/kg-OC	370	780	**451**	**22.7**			**30.0**	
Phthalates													
Butyl benzyl phthalate	µg/kg dw	63	970	-	mg/kg-OC	4.9	64	20	1.01	U		1.30	U
Di-n-butyl phthalate	µg/kg dw	-	-	-	mg/kg-OC	220	1,700	20	1.01	U		20.0	U
Di-n-octyl phthalate	µg/kg dw	6200	6200	-	mg/kg-OC	58	4,500	20	1.01	U		1.3	U
Diethyl phthalate	µg/kg dw	200	1200	-	mg/kg-OC	61	110	20	1.01	U		1.3	U
Dimethyl phthalate	µg/kg dw	71	1400	-	mg/kg-OC	53.0	53.0	20	1.01	U		1.3	U
Bis(2-ethylhexyl) phthalate	µg/kg dw	1300	8300	-	mg/kg-OC	47	78	**430**	**21.6**			**25.0**	
Phenols													
2,4-Dimethylphenol	µg/kg dw	29	210	-	ug/kg	29	29	20		U	20.0		U
2-Methylphenol	µg/kg dw	63	77	-	ug/kg	63	63	20		U	20		U
4-Methylphenol	µg/kg dw	670	3600	-	ug/kg	670	670	20		U	20		U
Pentachlorophenol	µg/kg dw	400	690	504	ug/kg	360	690	100		U	99.0		U
Phenol	µg/kg dw	420	1200		ug/kg	420	1,200	**43**			**64**		
Other SVOCs													
Dibenzofuran	µg/kg dw	540	1700	-	mg/kg-OC	15	58	**14**	**0.70**	J		**0.8**	J
Benzoic Acid	µg/kg dw	650	760	-	ug/kg	650	650	200		U	200		U
Benzyl Alcohol	µg/kg dw	57	870	-	ug/kg	57	73	20		U	20		U
1,2-Dichlorobenzene	µg/kg dw	35	110	-	mg/kg-OC	2.3	2.3	20	1.01	U		1.3	U
1,3-Dichlorobenzene	µg/kg dw	170	-	-	mg/kg-OC	--	--	20	1.01	U		20	U
1,4-Dichlorobenzene	µg/kg dw	110	120	-	mg/kg-OC	3.1	9.0	20	1.01	U		1.3	U
Hexachlorobenzene	µg/kg dw	22	230	168	mg/kg-OC	0.38	2.3	1	0.05	U		0.1	U
Hexachlorobutadiene	µg/kg dw	29	270	-	mg/kg-OC	3.9	6.2	1	0.05	U		0.1	UJ
Hexachloroethane	µg/kg dw	1400	14000	-	mg/kg-OC	--	--	20	1.01	U		20	U
N-Nitrosodiphenylamine	µg/kg dw	28	130	-	mg/kg-OC	11	11	20	1.01	U		1.3	U
1,2,4-Trichlorobenzene	µg/kg dw	31	64	-	mg/kg-OC	0.81	1.8	20	1.01	U		1.3	U

Table 3. LaFarge North America Maintenance Dredging and Dock Replacement Characterization, Seattle, Washington.

Chemical Name	DMMP Guidelines				SMS Guidelines			DMMU-C6			DMMU-C6-Z		
PCB Aroclors													
Aroclor 1016	µg/kg dw	-	-	-		--	--	20		U	3.7		U
Aroclor 1221	µg/kg dw	-	-	-		--	--	20		U	3.7		U
Aroclor 1232	µg/kg dw	-	-	-		--	--	20		U	3.7		U
Aroclor 1242	µg/kg dw	-	-	-		--	--	20		U	3.7		U
Aroclor 1248	µg/kg dw	-	-	-		--	--	**300**			**88**		
Aroclor 1254	µg/kg dw	-	-	-		--	--	**420**			**130**		
Aroclor 1260	µg/kg dw	-	-	-		--	--	**260**			**86**		
Total PCBs	µg/kg dw	130	3100	-	mg/kg/OC	**12.0**	**65.0**	**980**	**49.2**		**304**	**20.0**	
Pesticides													
Aldrin	µg/kg dw	9.5	-	-		--	--	1		U	1.0		U
gamma-BHC (Lindane)	µg/kg dw	-	-	-		--	--	1.3		U	1.0		U
cis-Chlordane	µg/kg dw	-	-	-		--	--	2		U	2		U
trans-nonachlor	µg/kg dw	-	-	-		--	--	3.9		Y	3.6		Y
Total chlordane	µg/kg dw	2.8	-	-		--	--	3.9		U	3.6		U
Dieldrin	µg/kg dw	1.9	-	-		--	--	3.0		U	2.0		U
Heptachlor	µg/kg dw	1.5	-	-		--	--	4.4		U	1.9		U
4,4'-DDD	µg/kg dw	16	-	-		--	--	2		U	2		U
4,4'-DDE	µg/kg dw	9	-	-		--	--	34		Y	28		Y
4,4'-DDT	µg/kg dw	12	-	-		--	--	2		U	23		Y
Total DDTs	µg/kg dw	-	69	50		--	--	34		U	28		U
Dioxin (TEQ: see Table 4 for detailed congener results)	**mg/kg**							**48.0**					
Sediment Conventionals													
Total Solids	ng/kg						%	52.2					
Total Volatile Solids	%						%	6.73					
Total Organic Carbon	%						%	1.99					
Total Ammonia	mg/kg						mg/kg						
Total Sulfides	mg/kg						mg/kg	2610					
Gravel	%						%	0.7					
Sand	%						%	20.3					
Silt	%						%	55.2					
Clay	%						%	23.8					
Fines (percent silt + clay)	%						%	**78.9**					
Bioassay Determination: **(P/F)**								NA					
BTs exceeded: **Y/N**								Y					
Bioaccumulation conducted: **Y/N**								N					
Bioaccumulation Determination: **(P/F)**													
ML Rule exceeded: **Y/N**								N					
PSDDA Determination: (Suitable/Unsuitable)								**Unsuitable**			**Failed (AD)**		
DMMU Volume: (cy)								4,000					
Rank (Low = L, Moderate = M, Low-Moderate =LM, High = H)								**H**					
Maximum Vibracore depth (ft) (includes 2 ft Z sample)	ft						ft	5.1					
Mean core sampling depth (ft)	ft						ft	4.95					
DMMU ID:								**DMMU-C6**			**DMMU-C6-Z**		

Legend:

Bold = detected results

J = Estimated value

U = Undetected at reporting limit

Y = The reporting limit is elevated due to interference. The result is not detected

NA = Not analyzed

SL / SQS exceedance

SL/BT exceedance

CSL exceedance

Unsuitable (open-water-disposal)

Failed Antidegradation (AD)

No data provided

Table 4. LaFarge North America Maintenance Dredging Dioxin Testing Results Summary

Analyte	WHO (05) TEF	DMMU-C1			DMMU-C2			DMMU-C3			DMMU-C3 (dup)			DMMU-C4			DMMU-C5			DMMU-C6		
		ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ	ng/kg-dw	LQ	TEQ
2,3,7,8-TCDD	1	0.928	U	0.464	0.752		0.752	0.682		0.682	0.784		0.784	0.894		0.894	0.918		0.918	1.83		1.83
1,2,3,7,8-PeCDD	1	3.45		3.45	2.5		2.5	2.36		2.36	2.76		2.76	3.5		3.5	2.88		2.88	6.04		6.04
1,2,3,4,7,8-HxCDD	0.1	4.99		0.499	3.83		0.383	4.46		0.446	7.36	U	0.368	3.99		0.399	4.12		0.412	5.65		0.565
1,2,3,6,7,8-HxCDD	0.1	24.8		2.48	19.1		1.91	20		2	19.5		1.95	25.4		2.54	20.8		2.08	51.1		5.11
1,2,3,7,8,9-HxCDD	0.1	12.2		1.22	9.39		0.939	8.94		0.894	9.75		0.975	11.4		1.14	10.7		1.07	23.3		2.33
1,2,3,4,6,7,8-HpCDD	0.01	736		7.36	678		6.78	940		9.4	687		6.87	755		7.55	635		6.35	1600		16
OCDD	0.0003	7100		2.13	6470		1.941	7000		2.1	6900		2.07	7350		2.205	10100		3.03	13700		4.11
2,3,7,8-TCDF	0.1	2.88		0.288	2.09		0.209	2.37		0.237	2.29		0.229	2.42		0.242	2.26		0.226	3.93		0.393
1,2,3,7,8-PeCDF	0.03	2.19		0.0657	1.53		0.0459	1.68		0.0504	1.7		0.051	1.9		0.057	1.71		0.0513	3.07		0.0921
2,3,4,7,8-PeCDF	0.3	9.18		2.754	5.28		1.584	6.86		2.058	6.68		2.004	7.06		2.118	7.06		2.118	12.3		3.69
1,2,3,4,7,8-HxCDF	0.1	20		2	11.3		1.13	16.6		1.66	16.3		1.63	15.6		1.56	16		1.6	26.9		2.69
1,2,3,6,7,8-HxCDF	0.1	5.52		0.552	3.75		0.375	4.75		0.475	4.2	U	0.21	5.02		0.502	4.86		0.486	7.61		0.761
2,3,4,6,7,8-HxCDF	0.1	8.16		0.816	5.26		0.526	6.48		0.648	6.44		0.644	6.88		0.688	6.72		0.672	10.7		1.07
1,2,3,7,8,9-HxCDF	0.1	3.94		0.394	1.86	U	0.093	2.87		0.287	2.88		0.288	2.61		0.261	3.17		0.317	4.66		0.466
1,2,3,4,6,7,8-HpCDF	0.01	144		1.44	90.3		0.903	123		1.23	121		1.21	116		1.16	112		1.12	231		2.31
1,2,3,4,7,8,9-HpCDF	0.01	13.2		0.132	7.81		0.0781	10.6		0.106	11.4		0.114	9.98		0.0998	10.1		0.101	19.6		0.196
OCDF	0.0003	556		0.1668	308		0.0924	428		0.1284	474		0.1422	477		0.1431	413		0.1239	1080		0.324
Total TEQ (u = 1/2):				26.2			20.2			24.8			22.3			25.1			23.6			48.0
Total TEQ (u=0):				25.7			20.1			24.8			22.3			25.1			23.6			48.0
TOC (%)				2.1			2.2			1.6						1.5			1.8			2.0

Legend:
U = Undetected

Table 5. Selective Volume Weighted Average (VWA) Dioxin Concentrations for LaFarge North America,Corp.

DMMU ID:	Volume (CY)	TCDD/F TEQ	ng/kg-dw	Product (Vol x TEQ)	ng x cy/kg x	Prod./total	Proportional contribution/Suitable DMMU
C1	4,000	26.2	ng/kg-dw	104,800	ng x cy/kg	15.7%	% of Total DMMU
C2	4,000	20.2	ng/kg-dw	80,800	ng x cy/kg	12.1%	% of Total DMMU
C3*	4,000	23.6	ng/kg-dw	94,200	ng x cy/kg	14.1%	% of Total DMMU
C4	4,000	25.1	ng/kg-dw	100,400	ng x cy/kg	15.1%	% of Total DMMU
C5	4,000	23.6	ng/kg-dw	94,400	ng x cy/kg	14.2%	% of Total DMMU
C6	4,000	48.0	ng/kg-dw	192,000	ng x cy/kg	28.8%	% of Total DMMU
Totals (Volume):	24,000	27.8	ng/kg-dw	666,600	ng x cy/kg	27.8	ng/kg-dw/Project (VWA)

*** Average concentration (24.8 and 22.3 pptr-TEQ)**