CENWS-OD-TS-DM

MEMORANDUM FOR RECORD January 29, 2010

SUBJECT: DETERMINATION ON THE EVALUATION OF SEDIMENT QUALITY RESULTS REQUIRED AS SPECIAL CONDITIONS TO CORPS PERMIT (NWS-2005-00969-WRD) WITHIN MTCA CLEANUP FOOTPRINT FOR SOUTH LAKE UNION PARK AS EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT.

1. The purpose of this memorandum is to evaluate sediment quality testing results of surface sediments at the South end of Lake Union in Waterways 3 and 4 and reflects the consensus determination of the Agencies that comprise the regional Dredged Material Management Program (DMMP) for the State of Washington. The agencies include the Corps of Engineers, Department of Ecology, Department of Natural Resources, and the Environmental Protection Agency. These testing results were also fully coordinated with the Ecology Toxics Cleanup Program (TCP) Manager for the Model Toxics Control Act (MTCA) cleanup site for the South Lake Union Park.

2. Relevant dates for regulatory tracking purposed are included in **Table 1**.

Table 1. Regulatory Tracking Information and Dates

FEDERAL PERMIT #: (Permit Issueance Date: March 23, 2007)	**NWS-2005-00969-WRD**
Phase 1 SAP submittal date:	August 19, 2005
Phase 1 SAP Approval letter date:	September 2, 2005
Sampling date(s): Pre-Phase II sediment quality characterization (WW3: barge-mounted, hollow-stem auger rig; 2.5-inch inside diameter: WW4: Wildco® sediment sampler)	WW-3: November 2, 2007 WW-4: November 8, 12, 2007
Surface Sediment Quality Data characterization report submittal date:	March 19, 2008
Phase 2 SAP submittal date:	February 23, 2009
Phase 2 SAP Approval date:	March 16, 2009
Sampling date(s): Toxicity testing of WW3-5	October 2 & 5, 2009
Toxicity Testing Report submittal date:	December 21, 2009
DAIS Tracking Number: pre-Phase 2 sediment quality evaluation Phase 2 Toxicity testing	**SLUP1-1-A-F-284** **SLUP2-1-B-F-285**
Recency Determination Date: High = 2 years	November 2009 (sediments) October 2011 (toxicity testing)

3. **Background.** The sediment quality (e.g., Nature and Extent) testing results summarized in this memorandum for record were performed at the request of the DMMP and Ecology's Toxics Cleanup Program (TCP) to evaluate Phase I and II work by the City of Seattle Parks and Recreation Department to redevelop South Lake Union Park area along Waterway Number's 3 and 4. This work is being accomplished under Model Toxics Control Act (MTCA) cleanup authority and oversight. The proposed park is approximately 12 acres in size, and is located at least 500 feet north of the former shoreline of Lake Union, on a former U.S. Naval Reserve site. The Park has two Washington State Department of Natural Resources waterways (Waterway Nos. 3 and 4), which extend into and border the Park (**Figure 1**). The historical southern shoreline along South Lake Union was gradually filled in during the turn of the

century (e.g., early 1900s). The early site industrial use included saw mill, wood burner operation, and U.S. Navy armory, an asphalt company, and glass company, which all contributed to potential sediment quality degradation concerns. The pre-Phase II in-water work required the "nature and extent" and DMMP evaluation documented in this testing data summary memorandum.

4. **Phase I Sampling Approach.** The applicant submitted a SAP for the Phase I sediment characterization effort on August 19, 2005, and approved by the DMMP agencies and TCP on September 2, 2005. Sampling was initiated on November 2, 2007, and samples were collected within Waterway No.3 at five stations with a barge mounted hollow-stem auger rig (2.5 inch inside diameter)(**Figure 1**). Due to the configuration of the permanent structures, ships, floats, and the surface topography surrounding Waterway No. 4, the use of a drill rig was precluded. Therefore, samples at two stations within Waterway No. 4 were collected manually on November 8 and 12, 2007 with a Wildco® sediment sampler (**Figure 1**). The characterization report summarizing these results was submitted to the DMMP and TCP for review on March 19, 2008. The DMMP agencies concluded that the quality assurance/quality control guidelines specified by the DMMP were generally complied with, and these data were deemed acceptable for decision-making using best-professional-judgment.

5. **Phase I Nature and Extent Sediment Quality Results.** The summary of results of the sediment testing conducted in Waterways Nos. 3 and 4 are depicted in **Tables 2 – 3, and Figures 2 - 3**. The initial results utilized incorrect interpretative guidelines, and were subsequently reinterpreted with the proper Sediment Management Standards (**SMS**) guidelines, which are the Freshwater screening level (**SL1**) and screening level (**SL2**) guidelines, and for chemicals with no Freshwater guidelines, the SMS Marine Guidelines: Sediment Quality Standards (SQS) and Cleanup Screening Levels (CSL) were used. Comparison of the testing results for Waterway 3 (**Table 2**) and Waterway 4 (**Table 3**) show that these results demonstrate that there are exceedances (detected and/or undetected) at **every** tested location in both Waterways (see **Figures 1** and **2**). Our reanalysis of these data showed that detected chemicals exceeding guidelines in Waterway 3 are Hg, Zn, **TBT**, **Bis(2,ethyl,hexyl)phthalate**, and in Waterway 4 are Cu, Hg, **Zn**, Ag, **TBT**, Benzo(b,k)fluoranthenes, **total LPAHs**, **Bis(2,ethyl,hexyl)-phthalate, PCBs** (note: **all detected SL2/CSL exceedances are bolded**).

6. Based on this review, the Corps Regulatory Branch following Ecology/DMMP review required special conditions to Corps Permit (**NWS-2005-00969-WRD)** as required actions before the project dredging/excavation begins, and will require follow-up sampling and testing of the exposed sediment surface after cleanup excavation/dredging is completed, and before Phase II work commences, as described in **Attachment 1**.

7. A SAP for Phase 2 work was submitted to DMMP agencies for review on February 23, 2009, and approved by DMMP agencies on March 16, 2009. **Table 4** summarizes the sampling and testing requirements for the Phase 2 construction.

8. Subsequent to SAP approval the Seattle Parks and Recreation Department notified the DMMP agencies that the Phase 2 shoreline work below OHWL (Ordinary High Water Line) would be limited with only one station (WW3-5) in Waterway No. 3, and no work in Waterway No. 4.

Table 2. Sediment Characterization Analytical Results Waterway No. 3, South Lake Union Park

Sample Designated ID		SMS (SL1)	SMS (SL2)	WW3-01-ss		WW3-02-ss		WW3-03-ss		WW3-04-ss		WW3-05-ss			WW3-06-ss (dup of WW3-5) Diluted*		
Sample Station		Freshwater	Freshwater	WW3-1		WW3-2		WW3-3		WW3-4		WW3-5			WW3-5		WW3-5
Depth of Water (feet)	TARGET DETECTION			8		8		8		8		8			8		
Sample Interval (feet)	LIMITS			0 - 5		0 - 5		0 - 5		0 - 5		0 - 5			0 - 5		
Date of Sample Collection				11/02/2007		11/02/2007		11/02/2007		11/02/2007		11/02/2007			11/02/2007		
		SL1	SL2	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight		mg/kg-ocn	dry weight		mg/kg-ocn
SVOCS/PAHS (ug/kg)																	
Acenaphthene 330		1100	1300	20 U		**230**		20 U		20 U		**61**	J		**1100**	*	
Acenaphthylene	330	470	640	20 U		59 U		20 U		20 U		**160**	J		**5200**	*	
Anthracene 330		1200	1600	20 U		**65**		**34**		20 U		**580**	J		**10000**	*	
Benzo(a)anthracene 330		4300	5800	20 U		**92**		**76**		20 U		**480**	J		**7900**	*	
Benzo(b,k)fluoranthene 330		600	4000	20 U		**188**		**186**		**21**		**810**	J		**10200**	*	
Benzo(g,h,i)perylene	330	4000	5200	20 U		59 UJ		20 U		20 U		**33**	J		**890**	*	
Benzo(a)pyrene 330		3300	4800	20 U		**110**		**98**		20 U		**410**	J		**5600**	*	
Benzyl alcohol (SQS, CSL)	330	57	73	20 U		59 U		20 U		20 U		20 U			590 U		
Bis(2-chloroethoxy)methane	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
Bis(2-chloroethyl)ether	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
Bis(2-ethylhexyl)phthalate 330		220	320	**36**		**2400**		**50**		**45**		**160**	J		590 U	*	
4-Bromophenyl phenyl ether	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
Butyl benzyl phthalate	330	260	370	20 U		59 U		20 U		20 U		20 U			590 U		
Carbazole	330	NA	NA	20 U		59 U		20 U		20 U		**79**	J		**2000**	*	
4-Chloroaniline	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
2-Chloronaphthalene	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
4-Chlorophenyl phenyl ether	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
Chrysene 330		5900	6400	20 U		**120**		**100**		**27**		**50**	J		**7200**	*	
Dibenz(a,h)anthracene	330	800	840	20 U		59 U		20 U		20 U		**36**	J		590 U		
Dibenzofuran 330		400	440	20 U		**69**		20 U		20 U		**200**	J		**6400**	*	
Di-n-butylphthalate	330	220	1700	20 U		59 U		20 U		20 U		20 U			590 U		
1,2-Dichlorobenzene (SQS, CSL)	330	2.3	2.3	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
1,3-Dichlorobenzene (SQS, CSL)	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
1,4-Dichlorobenzene (SQS, CSL)	330	3.1	9	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
3,3'-Dichlorobenzidine	1600	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
Diethyl phthalate (SQS, CSL)	330	61	110	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
Dimethyl phthalate	330	46	440	20 U		59 U		20 U		20 U		20 U			590 U		
2,4-Dinitrotoluene	330	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
2,6-Dinitrotoluene	330	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
Di-n-octyl phthalate (SQS, CSL)	330	58	4500	20 U	7.9	**290**	**9.32**	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
Fluoranthene 330		11000	15000	20 U		**290**		**220**		**50**		**1300**	J		**21000**	*	
Fluorene 330		1000	3000	20 U		**190**		20 U		20 U		**380**	J		**10000**	*	
Hexachlorobenzene (SQS, CSL)	330	0.38	2.3	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
Hexachlorobutadiene (SQS, CSL)	330	3.9	6.2	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
Hexachlorocyclopentadiene	1600	NA	NA	98 U		98 U		98 U		98 U		98 U			3000 U		
Hexachloroethane	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
Indeno(1,2,3-cd) pyrene	330	4100	5300	20 U		59 U		**30**		20 U		**89**	J		**2400**	*	
Isophorone	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
1-Methylnaphthalene	330	NA	NA	20 U		59 U		20 U		20 U		**76**	J		**2000**	*	
2-Methylnaphthalene	330	470	560	20 U		59 U		**27**		20 U		**140**	J		**4300**	*	
Naphthalene	330	500	1300	20 U		59 U		**42**		20 U		**98**			**1300**	*	
2-Nitroaniline	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
3-Nitroaniline	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
4-Nitroaniline	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
Nitrobenzene	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
N-Nitrosodiphenylamine (SQS, CSL)	330	11	11	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
N-Nitrosodipropylamine	330	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		

Sample Designated ID		SMS (SL1)	SMS (SL2)	WW3-01-ss		WW3-02-ss		WW3-03-ss		WW3-04-ss		WW3-05-ss			WW3-06-ss (dup of WW3-5) Diluted*		
Sample Station		Freshwater	Freshwater	WW3-1		WW3-2		WW3-3		WW3-4		WW3-5			WW3-5		WW3-5
Depth of Water (feet)	TARGET DETECTION			8		8		8		8		8			8		
Sample Interval (feet)	LIMITS			0 - 5		0 - 5		0 - 5		0 - 5		0 - 5			0 - 5		
Date of Sample Collection				11/02/2007		11/02/2007		11/02/2007		11/02/2007		11/02/2007			11/02/2007		
		SL1	SL2	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight	mg/kg-ocn	dry weight		mg/kg-ocn	dry weight		mg/kg-ocn
Phenanthrene 330		6100	7600	20 U		440		140		38		1600	J		31000	*	
Pyrene 330		8800	16,000	20 U		290		220		50		1000	J		15000	*	
1,2,4-Trichlorobenzene (SQS, CSL)	330	0.81	1.8	20 U	7.9	59 U	1.90	20 U	0.87	20 U	3.30	20 U		1.4	590 U		41.8
Benzoic acid (SQS, CSL)	1700	650	650	20 U		59 U		20 U		20 U		20 U			590 U		
4-Chloro-3-methylphenol	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
2-Chlorophenol	330	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
2,4-Dichlorophenol	330	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
2,4-Dimethylphenol (SQS, CSL)	330	29	29	20 U		59 U		20 U		20 U		20 U			590 U		
4,6-Dinitro-2-methylphenol	1700	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
2,4-Dinitrophenol	670	NA	NA	20 U		59 U		20 U		20 U		20 U			590 U		
2-Methylphenol (o-Cresol) (SQS, CSL)	330	63	63	20 U		59 U		20 U		20 U		20 U			590 U		
4-Methylphenol (p-Cresol) (SQS, CSL)	330	670	670	20 U		76		22		20 U		20 U			590 U		
2-Nitrophenol	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
4-Nitrophenol	1700	NA	NA	98 U		300 U		98 U		98 U							
Pentachlorophenol (SQS, CSL)	1000	360	690	98 U		300 U		98 U		98 U		98 U			3000 U		
Phenol (SQS, CSL)	330	420	1200	20 U		300 U		20 U		20 U		20 U			590 U		
2,4,5-Trichlorophenol	1700	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
2,4,6-Trichlorophenol	330	NA	NA	98 U		300 U		98 U		98 U		98 U			3000 U		
LPAHsc		6600	9200	20 U		925		216		38		2879			58600	*	
HPAHsd		31000	55000	20 U		1090		930		98		2875			69300	*	
METALS (mg/kg)																	
Arsenic 5		20	51	6		7		6		8		8			8		
Barium 5		NA	NA	67.4		98		66.2		80.7		56.3			50.4		
Cadmium 5.1		1.1	1.5	0.2 U		0.3		0.2 U		0.2 U		0.3 U			0.2 U		
Chromium 0.5		95	100	36.9		27.5		25.8		42.2		24.8			23.8		
Copper 0.5		80	830	21.8		38.7		24.5		26.7		39.3	J		25	*	
Lead 2		340	430	23		82		115		27		38	J		21	*	
Mercury 0.1		0.28	0.75	0.4 U		0.09		0.17		0.09		0.06			0.06		
Nickel 1		60	70	43		34		43		42		28			25		
Selenium	1	NA	NA	0.2 U		0.2 U		0.2 U		0.2 U		0.3 U			0.3 U		
Silver	1	2	2.5	0.3 U		0.4 U		0.4 U		0.4 U		0.4 U			0.4 U		
Zinc 1		130	400	49		173		93		90		94	J		77	*	
Total PCBs (ug/kg)		130	1000														
Total PCBs	0.5	60	120	20 U		20 U		50		20 U		44	J		24	*	
SEM METALS (mg/kg)																	
Cadmium 5		1.1	1.5	0.1 U		0.39		0.47		0.15		0.2 U			0.2 U		
Copper 5		80	830	11.7		19.7		12.9		14.9		17.6	J		11.2	*	
Lead 2		340	430	8		152		47.6		26.6		18			17		
Mercury 0.1		0.28	0.75	0.008		0.004 U		0.005 U		0.003 U		0.005			0.005		
Nickel 0.5		60	70	16.1		7.6		13.1		11.6		33	J		7.1	*	
Zinc 0.5		130	400	24.2		139		46.1		46.5		39			39		
CONVENTIONALS																	
Tributylin (bulk-ppm-dry wgt)	0.05	75	75	3.6 U		12		7		80		8.1	J		6.7	*	
TOC (%)	200	9.82	NA	0.252		3.11		2.3		0.606		1.48			1.41		
Total Sulfides	1	702	941	1.85		65.7		1.08 U		7.65		1.29 U			1.15 U		
Total Solids	0.10%	NA	NA	81.8		80.8		79.8		84.5		78.3			72.2		

Chemicals not on SMS COC List

SL1 / SQS Exceedance

SL2 / CSL Exceedance

Note marine SQS/CSL criteria were used when no Freshwater Guidelines

Table 3. Sediment Characterization Analytical Results Waterway No. 4, South Lake Union Park

Sample Designated ID		SMS (SL1)	SMS (SL2)	WW4-01-IS-0-5			WW4-02-IS-5-10			WW4-3 (RINSATE BLANK)
Sample Station		Freshwater	Freshwater	WW4-1			WW4-2			NA
Depth of Water (feet)	TARGET DETECTION			4			5			NA
Sample Interval (feet)	LIMITS			0 - 5			10-May			NA
Date of Sample Collection				11/08/2007		SQS/CSL	11/12/2007		SQS/CSL	11/12/2007
		SL1	CSL	dry weight		mg/kg-ocn	dry weight		mg/kg-ocn	dry weight
SVOCS/PAHS (ug/kg)										
Acenaphthene 330		1100	1300	930			150			1 U
Acenaphthylene 330		470	640	110	J		72	J		1 U
Anthracene 330		1200	1600	1000			350			1 U
Benzidine	3300	4300	5800	190 U			73 U			1 U
Benzo(a)anthracene 330		4300	5800	1200			530			1 U
Benzo(b,k)fluoranthene	330	600	4000	2200			940			1 U
Benzo(g,h,i)perylene 330		4000	5200	280			220			1 U
Benzo(a)pyrene 330		3300	4800	1100			470			1 U
Benzyl alcohol (SQS, CSL)	330	57	73	190 U		3.9	73 U		1.4	5 U
Bis(2-chloroethoxy)methane	330	NA	NA	190 U			73 U			1 U
Bis(2-chloroethyl)ether	330	220	320	190 U			73 U			1 U
Bis(2-ethylhexyl)phthalate 330		220	320	580			220			1 U
4-Bromophenyl phenyl ether	330	NA	NA	190 U			73 U			1 U
Butyl benzyl phthalate	330	260	370	190 U		3.9	73 U		1.4	1 U
Carbazole 330		NA	NA	190 U			74			1 U
4-Chloroaniline	330	NA	NA	190 U			73 U			5 U
2-Chloronaphthalene	330	NA	NA	190 U			73 U			1 U
4-Chlorophenyl phenyl ether	330	5900	6400	190 U			73 U			1 U
Chrysene 330		5900	6400	1500			940			1 U
Dibenz(a,h)anthracene	330	800	840	190 U			73 U			1 U
Dibenzofuran 330		400	440	210			50	J		1 U
Di-n-butylphthalate (SQS, CSL)	330	220	1700	190 U		3.9	73 U		1.4	1 U
1,2-Dichlorobenzene (SQS, CSL)	330	2.3	2.3	190 U		3.9	73 U		1.4	1 U
1,3-Dichlorobenzene	330	NA	NA	960 U			370 U			1 U
1,4-Dichlorobenzene (SQS, CSL)	330	3.1	9	190 U		3.9	73 U		1.4	1 U
3,3'-Dichlorobenzidine	1600	NA	NA	190 U			73 U			1 U
Diethyl phthalate (SQS, CSL)	330	61	110	960 U		19.7	73 U		1.4	5 U
Dimethyl phthalate	330	46	440	960 U			370 U			5 U
2,4-Dinitrotoluene	330	NA	NA	190 U			73 U			1 U
2,6-Dinitrotoluene	330	NA	NA	190 U			73 U			1 U
Di-n-octyl phthalate	330	58	4500	190 U			73 U			1 U
Fluoranthene 330		11000	15000	6000			2200			1 U
Fluorene 330		1000	3000	1000			180			1 U
Hexachlorobenzene (SQS, CSL)	330	0.38	2.3	960 U		19.7	370 U		7.2	5 U
Hexachlorobutadiene (SQS, CSL)	330	3.9	6.2	190 U		3.9	73 U		1.4	1 U
Hexachlorocyclopentadiene	1600	NA	NA	190 U			73 U			1 U
Hexachloroethane	330	NA	NA	190 U			73 U			1 U
Indeno(1,2,3-cd) pyrene	330	4100	5300	260			180			1 U
Isophorone	330	NA	NA	190 U			73 U			1 U
1-Methylnaphthalene 330		NA	NA	160	J		51	J		1 U
2-Methylnaphthalene 330		470	560	140	J		87			1 U
Naphthalene 330		500	1300	150	J		220			5 U
2-Nitroaniline	1700	NA	NA	960 U			370 U			5 U
3-Nitroaniline	1700	NA	NA	960 U			370 U			5 U
4-Nitroaniline	1700	NA	NA	190 U			73 U			1 U
Nitrobenzene	330	NA	NA	190 U			73 U			1 U
N-Nitrosodiphenylamine	330	11	11	960 U			370 U			5 U
N-Nitrosodipropylamine	330	NA	NA	960 U			370 U			1 U
Phenanthrene 330		6100	7600	5600			1200			1 U
Pyrene 330		8800	16,000	4800			1400			1 U
1,2,4-Trichlorobenzene (SQS, CSL)	330	0.81	1.8	960 U		19.7	370 U		7.2	5 U
Benzoid acid	1700	650	650	190 U			73 U			10 U
4-Chloro-3-methylphenol	1700	NA	NA	960 U			370 U			5 U
2-Chlorophenol	330	NA	NA	190 U			73 U			1 U
2,4-Dichlorophenol	330	NA	NA	190 U			73 U			5 U

Sample Designated ID		SMS (SL1)	SMS (SL2)	WW4-01-IS-0-5			WW4-02-IS-5-10			WW4-3 (RINSATE BLANK)
Sample Station		Freshwater	Freshwater	WW4-1			WW4-2			NA
Depth of Water (feet)	TARGET DETECTION			4			5			NA
Sample Interval (feet)	LIMITS			0 - 5			10-May			NA
Date of Sample Collection				11/08/2007		SQS/CSL	11/12/2007		SQS/CSL	11/12/2007
		SL1	CSL	dry weight		mg/kg-ocn	dry weight		mg/kg-ocn	dry weight
2,4-Dimethylphenol	330	29	29	190 U			73 U			1 U
4,6-Dinitro-2-methylphenol	1700	NA	NA	190 U			73 U			10 U
2,4-Dinitrophenol	670	NA	NA	190 U			73 U			10 U
2-Methylphenol (o-Cresol) (SQS, CSL)	330	63	63	960 U			370 U			5 U
4-Methylphenol (p-Cresol) (SQS, CSL)	330	670	670	960 U			370 U			5 U
2-Nitrophenol	1700	NA	NA	960 U			370 U			5 U
4-Nitrophenol	1000	NA	NA	190 U			73 U			1 U
Pentachlorophenol (SQS, CSL)	1700	360	690	960 U			370 U			5 U
Phenol	330	420	1200	960 U			370 U			1 U
2,4,5-Trichlorophenol	1700	NA	NA	190 U			73 U			1 U
2,4,6-Trichlorophenol	330	NA	NA	190 U			73 U			1 U
LPAHs[c]	NA 6600		9200	**12750**			**1992**			0.005 U
HPAHs[d]	NA 31000		55000	**12060**			**6880**			0.005 U
METALS[b] (mg/kg)										
Arsenic 5		20	51	**15**			**8**			0.05 U
Barium 5		NA	NA	**120**			**144**			0.003 U
Cadmium 0.5		1.1	1.5	**1.0**			**0.3**			0.002 U
Chromium 0.5		95	100	**29.8**			**30.2**			0.005 U
Copper 0.5		80	830	**74.7**			**89.9**			0.002 U
Lead 2		340	430	**261**			**110**			0.2 U
Nickel 1		60	70	**29**			**39**			0.01 U
Mercury 0.1		0.28	0.75	**0.4**			**0.37**			0.0001 U
Selenium	1..0	NA	NA	0.3 U			0.3 U			0.002 U
Silver 1		2	2.5	**10.7**			**0.8**			0.003 U
Zinc 1		130	400	**438**			**208**			0.01 U
Total PCBs[b] (ug/kg)										
Total PCBs	0.5	60	120	**252**			**34**			0.01 U
AVS/SEM METALS (mg/kg)[b]										
Cadmium 0.5		1.1	1.5	**0.5**			**0.4**			NA
Copper 0.5		80	830	**26.5**			**40.4**			NA
Lead 2		340	430	**135**			**72**			NA
Mercury	0.1	0.28	0.75	0.006 U			0.006 U			NA
Nickel 1		60	70	**7**			**11.4**			NA
Zinc 1		130	400	**239**			**221**			NA
CONVENTIONALS[b]										
Tributylin 0.05		75	75	**100**			**28**			0.19 U
Acid Volatile Sulfide	0.5	NA	NA	**141**			**140**			NA
Ammonia 0.5		NA	NA	**4.3**			**4.83**			**0.011**
TOC 200		9.82	NA	**4.87**			**5.12**			1.5 U

Chemicals not on SMS COC List

SL1 / SQS Exceedance

SL2 / CSL Exceedance

Note marine SQS/CSL criteria were used when no Freshwater Guidelines

Table 4. South Lake Union Sediment Sampling Approach prior to Excavation

Samples to be collected	Type of sample	Analysis to be performed prior to excavation starting	Sample Archived
5 previous sample location from Waterway 3 and 2 previous sample locations from Waterway 4	Grab Sample of top 10 cm of soil	No immediate analysis	Yes, Hold for 1 year for potential dioxin/furans analysis
After Excavation			
Samples to be collected	**Type of sample**	**Analysis to be performed**	**Sample Archived**
5 previous sample location from Waterway 3 and 2 previous sample locations from Waterway 4	Grab Sample of top 10 cm of soil	Sediment conventional analysis (*total solids, total volatile solids, total organic carbon, and grain size*)	Yes, Hold for 1 year for potential dioxin/furans analysis
		*Freshwater toxicity testing (*10-day Hyalella Mortality and 20-day Chironomous mortality/growth test*)	
Previous Sample Location W3-4	Grab Sample of top 10 cm of soil	No immediate analysis	Yes for TBT
Previous Sample Location W4-1	Grab Sample of top 10 cm of soil	No immediate analysis	Yes for PCB and TBT

* freshwater toxicity testing will be performed after sediment conventional analysis has been completed

9. Due to the reduced scope of inwater work, grab samples of post-excavation surface sediment (e.g., 0-10 cm) were only collected and archived at WW3-5, which included a non-archived sample for freshwater toxicity testing to evaluate the surface sediment quality, as specified as a Permit Condition requirements (**Attachment 1, Table 4**) as part of the Phase 2 construction. As specified in the permit, if no toxicity is expressed the archived sediment sample would be analyzed for dioxin.

10. **Toxicity testing**. On October 2, 2009 samples were collected from WW3-5 for toxicity testing with *Chironomus dilutus* 20-day survival and growth bioassay (USEPA 2000 and ASTM 2000), and the *Hyalella azteca* 10-day survival bioassay (USEPA 2000 and ASTM 2000). Reference samples were collected from Lake Washington on November 2, 2009, and Reference 3 was selected for testing with WW3-5 samples based on grain size similarity. Test chambers were aerated one day prior to test initiation after allowing sediments to settle in testing chambers. All tests met positive and negative control criteria. The bioassay test acceptability and test interpretation guidelines are summarized in **Table 5**. Tests were initiated on November 20, 2009 within the 8-week holding time requirement. The reference sediment met RSET acceptability criteria summarized in **Table 5** for both test species. The results of the testing are

summarized in Table 6, and demonstrate that test sample WW3-05 failed the RSET 1-Hit test interpretation guidelines for **survival** for the *Chironomus dilutus* test. The testing results for the *Hyalla azteca* 10-day survival test demonstrated a no-hit response, with no significant difference in mortality expressed between test sediment and reference and control sediment.

Table 5. Freshwater Bioassay Quality Control/Assurance and Test Interpretation Guidelines.

Test Type	*Chironomus dilutus*	*Hyalella azteca*
Endpoint	Survival and Growth	Survival
Source	RSET 2009	RSET 2009
Test Interpretation Guidelines	**1-Hit Failure**: mortality > reference mortality +25% and/or biomass <60% of reference biomass & significant difference **2-Hit Failure**: mortality > reference mortality + 15% &/or biomass <75% of reference biomass & significant difference	**1-Hit failure**: mortality > reference mortality + 25% & significant difference **2-Hit failure**: mortality > reference mortality + 10% & significant difference
Reference criteria	≤35% mortality and ≥80% of final control growth	≤25% mortality
Control criteria	**Negative Control**: ≤32% mortality & growth ≥0.48 mg/ind. Ash-free dry weight **Positive Control**: LC_{50} within 2 standard deviations of historical mean	**Negative Control**: <20% mortality **Positive Control**: LC_{50} within 2 standard deviations of historical mean

Legend: LC_{50} = Lethal Concentration for 50% of test organism

Table 6. Toxicity Testing Summary

Sample	*Chironomus dilutus*		*Hyalella aztecus*
	Percent Mortality (Mean ± SD)	Weight per Org. (mg) (Mean ± SD)	Percent Mortality (Mean ± SD)
Control	24 ± 12.1	1.51 ± 0.29	7.5 ± 7.1
Reference	38.5 ± 22.7	2.0 ± 0.55	5 ± 7.6
WW3-5	65.6 ± 12.9 (**1-Hit**)	2.49 ± 0.38	3.8 ± 5.2
Positive Control	761 ug/L (Cu) Acceptable range: 335-1138 ug/L (Cu)		333 ug/L (Cu) Acceptable range: 0 – 1419 ug/L (Cu)

11. As depicted in **Attachment 1**, "if the bioassay results show **toxicity** being expressed, at some or all of stations, those stations showing toxicity will be subject to placement of a CAP under the direction of Ecology Toxics Cleanup Program". Therefore, Waterway Station W3-5 will require the placement of a CAP under TCP direction. The applicant will be required to submit a plan for capping at this location to Ecology TCP and Corp's Regulatory Branch for review and approval. After approving the Capping plan, Ecology TCP will provide oversight on the placement of the CAP, as required by the special condition to the Corps permit.

SUBJECT: DETERMINATION ON THE EVALUATION OF SEDIMENT QUALITY RESULTS REQUIRED AS SPECIAL CONDITIONS TO CORPS PERMIT (NWS-2005-00969-WRD) WITHIN MTCA CLEANUP FOOTPRINT FOR SOUTH LAKE UNION PARK AS EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT.

Concur:

2/1/2010 David R. Kendall
Date David Kendall, Ph.D., Seattle District Corps of Engineers

1/29/2010 Laura Inouye
Date Laura Inouye, Washington Department of Ecology

2/1/10 Erika Hoffman
Date Erika Hoffman, Environmental Protection Agency, Region 10

1/29/2010 Dave Vagt
Date Dave Vagt, Washington Department of Natural Resources

Copies Furnished:
Ann Uhrich, Regulatory Project Manager
Alisa Ralph, Regulatory Project Manager
Grant Yang, Ecology/Toxics Cleanup Program
Rebekah Padgett, Ecology Northwest Regional Office
Laura Inouye, Ph.D., Ecology
Erika Hoffman, EPA
Dave Vagt, DNR
DMMO File

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LEGEND

ww3-03 — Approximate sediment sample location and designation

0 50 100 200 Feet

N W E S

South Lake Union Redevelopment Project
Waterways Nos. 3 & 4
Seattle, Washington

SEDIMENT SAMPLE LOCATIONS

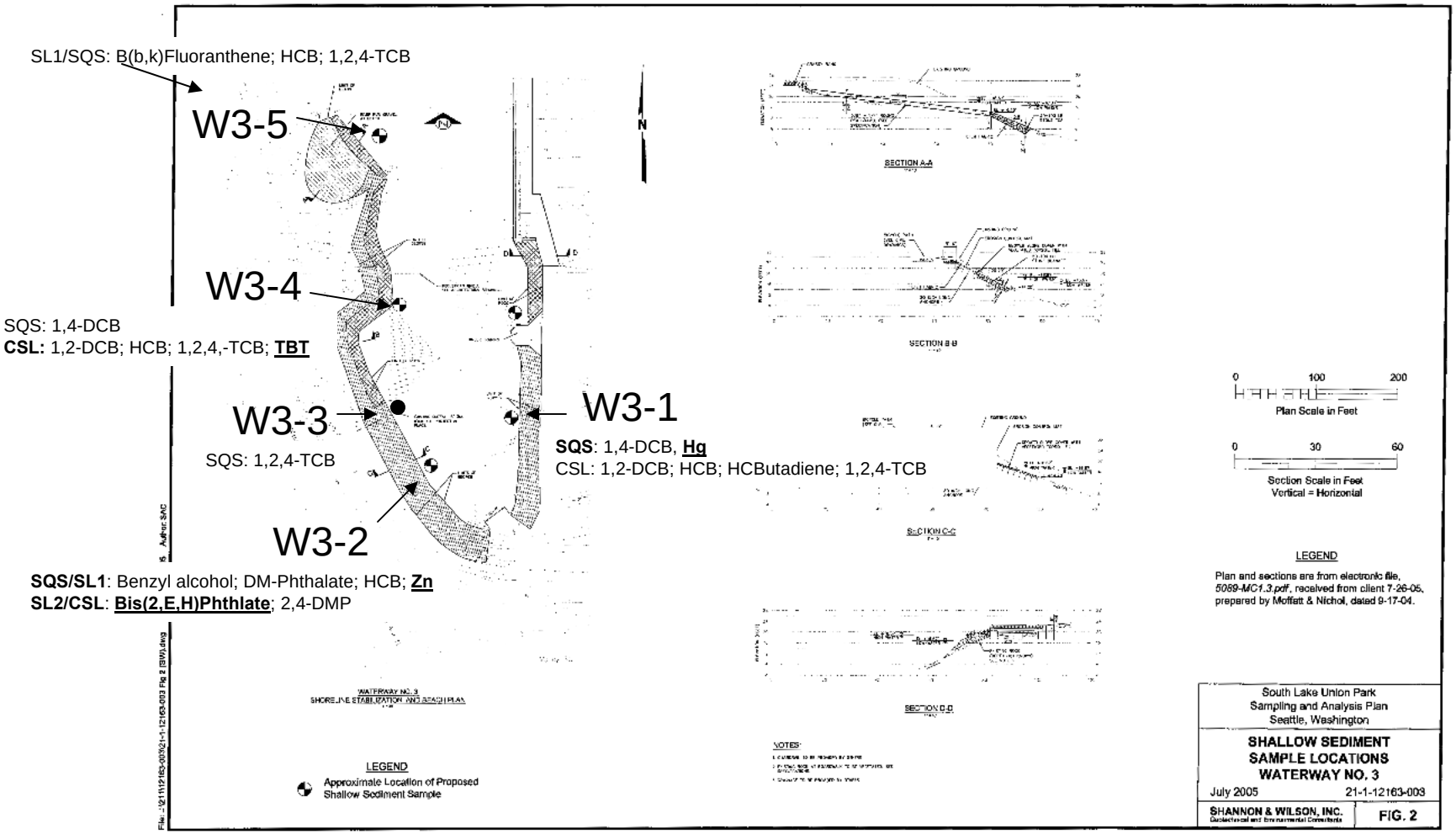
February 2009 | 21-1-12163-030

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

Figure 1

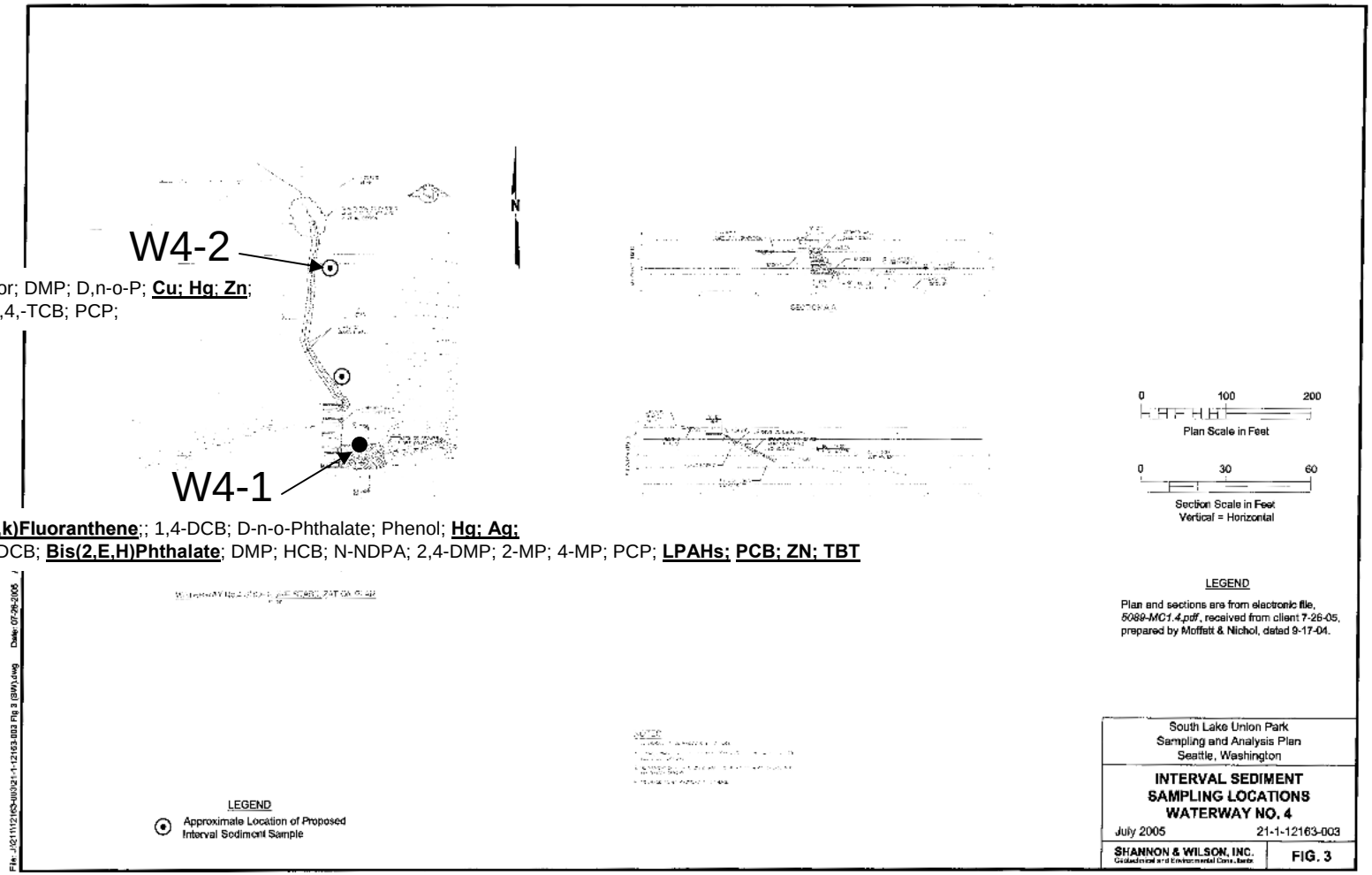
Filename: T:\Project\21-1\12163_South_Lake_Union\AV_mxd\21-1-12163-030_Explorations.mxd Date: 11/26/2008 BXE

Figure 2. Waterway 3 Data Summary by Station



Bolded chemicals detected, all others are detection limit exceedances

Figure 3. Waterway 4 Data Summary by Station



SL1: B(b,k)Fluor; DMP; D,n-o-P; **Cu; Hg; Zn**;
CSL: HCB; 1,2,4,-TCB; PCP;

SL1/SQS: **B(b,k)Fluoranthene**;; 1,4-DCB; D-n-o-Phthalate; Phenol; **Hg; Ag;**
CSL/SL2: 1,2,DCB; **Bis(2,E,H)Phthalate**; DMP; HCB; N-NDPA; 2,4-DMP; 2-MP; 4-MP; PCP; **LPAHs; PCB; ZN; TBT**

Bolded chemicals detected, all others are detection limit exceedances

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Attachment 1

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Oct 22 2008

Regulatory Branch

Seattle Parks and Recreation
Attn: Toby Ressler
800 Maynard Avenue South, 3rd Floor
Seattle, Washington 98134-1336

Reference: NWS-2005-00969-WRD
Seattle Parks and Recreation
(South Lake Union Park)

Dear Mr. Ressler:

This correspondence is to follow up on two of the Special Conditions in the Department of the Army (DA) permit issued to Seattle Parks and Recreation (SPR) on March 23, 2007, for construction in Lake Union, at South Lake Union Park (tracking number 2005-00969). These conditions were for aquatic sediment testing, which typically is conducted by an applicant before a DA permit is issued. During project review, SPR advised us that this testing would only be necessary if they were to proceed with Phase 2 of the project, and there was some uncertainty that funding would be obtained for the construction of Phase 2. Thus, SPR requested that their agency be allowed to defer sediment testing to a later date. We concurred, as did the Washington State Department of Ecology (Ecology). Both agencies then added similar special conditions to our respective project approvals (State Water Quality Certification and DA Individual Permit). Specifically, we added the following Special Conditions to the DA permit:

f. Implementation of the sediment sampling and analysis plan, entitled "*Draft Sampling and Analysis Plan, South Lake Union Park Development Project, Phase 1 Shoreline Stabilization, Seattle, Washington*" [SAP], dated August 12, 2005, shall occur before construction of Phase 2, and copies of the resulting data report shall be submitted to the U.S. Army Corps of Engineers (Corps), Attn: Regulatory Branch, and to the Services (National Marine Fisheries Service, Attn: Jim Muck and U.S. Fish and Wildlife Service, Attn: Jim Muck). The Corps may require additional measures for this work, to protect threatened or endangered species, based upon the results of sediment sampling and subsequent consultation with the Services. [Note: The Corps recommends that the permittee finalize the draft SAP no less than 3 months prior to when the sampling and other work will begin in Phase 2.]

g. The permittee shall request a permit modification from the U.S. Army Corps of Engineers if additional excavation or fill activities are determined to be necessary as a result of the sediment sampling detailed in Special Condition "f" above.

You transmitted results of the sediment testing to us on March 18, 2008. These results were reviewed by the interagency Dredged Material Management Program (DMMP), which includes Ecology, the Corps of Engineers (Corps), and other agencies. Because the site was/is under review for possible clean-up under the State Model Toxic Cleanup Act (MTCA), a coordinated review was done through Ecology TCP. This was complete earlier this year, and transmitted to you electronically in mid-June, 2008. As we indicated in June, our collective deliberations are summarized below:

The DMMP agencies re-evaluated the "nature and extent" data using the proper Ecology guidelines, which are the Freshwater "Sediment Evaluation Framework" (SEF) Guidelines: Screening Level 1 (SL1) and Screening Level 2 (SL2), and for chemicals with no Freshwater Guidelines, the SMS Marine Guidelines: Sediment Quality Standards (SQS) and Cleanup Standard Levels (CSL) were used. Comparison of the testing results for Waterway 3 (Table 2) and Waterway 4 (Table 3) show that these results demonstrate that there are exceedances (detected and/or undetected) at **every** tested location in both Waterways (see Figures 1 and 2). Our reanalysis of these data showed that detected chemicals exceeding guidelines in Waterway 3 are Hg, Zn, **TBT**, **Bis(2,ethyl,hexyl)phthalate**, and in Waterway 4 are Cu, Hg, **Zn**, Ag, **TBT**, Benzo(b,k)fluoranthenes, **total LPAHs**, **Bis(2,ethyl,hexyl)phthalate,** **PCBs** (note: **all detected SL2/CSL exceedances are bolded and underlined**). Based on this review, Ecology/DMMP will require the following actions before the project dredging/excavation begins, and will require follow-up sampling and testing of the exposed sediment surface after cleanup excavation/dredging is completed, as follows:

1. Before dredging/excavation during Phase 2 construction begins surface grab samples will be collected at each of the five previous sampling stations in Waterway 3 and two previous sampling stations in Waterway 4 to evaluate Washington State antidegradation compliance. These samples will be **archived** for **up to one year** for potential dioxin/furans analysis, pending toxicity testing results of the exposed sediment surface in both waterways. Phase 2 in-water excavation and debris removal can then commence.

2. After dredging/excavation, grab samples of the top 10-cm of the exposed sediment surface will be collected at all five previous sediment stations in Waterway 3 and two in Waterway 4 for **Freshwater toxicity testing**. Each Station will be evaluated using 10-day *Hyalella* mortality, and 20-day *Chironomous* mortality/growth test. Additionally, sediment conventional analyses (including grain size analysis) will be required on sub-samples from all the exposed sediment surface stations, prior to conducting toxicity tests, to evaluate potential reference sediment collection requirements prior to testing. Please note that it is critical to get the sediment conventional data analyzed in a timely manner (e.g. well within the 8-week holding time constraint for toxicity testing), so the applicant's AE can coordinate the selection of an appropriate grain size range for reference sediment collection with the DMMP agencies. The DMMP agencies and Ecology TCP will coordinate the reference site collection location with the Applicant's AE prior to initiating testing. Additional details on freshwater toxicity testing and the interpretation framework can be found in Chapter 8 (pages 8-1 to 8-12) of the Interim Final Sediment Evaluation Framework Manual at:

http://www.nws.usace.army.mil/publicmenu/DOCUMENTS/DMMO/RSET_Interim_Final.pdf.

Please note that sediment holding times are 8 weeks for toxicity testing, which means that toxicity testing must be initiated within eight weeks of sediment sampling. Potential testing labs for conducting these bioassays are:

Northwest Aquatic Sciences
3814 Yaquina Bay Road
Newport, Oregon 97363
* Dick Caldwell (541-265-7225) rcaldwell@nwaquatic.com

Nautilus - Washington
5009 Pacific Highway East, Suite 2
Tacoma, Washington 98424
* Karen Tobiason (253-922-4296) karen@nautilusenvironmental.com
* Mary Ann Rempeo-Hester (253-922-4296) mary.ann@nautilusenvironmental.com

3. After dredging/excavation, grab samples of the top 10-cm of the exposed sediment surface will be collected at all five stations in Waterway 3 and 2 stations in Waterway 4. Sub-samples will be **archived** from all pre-excavation and post-excavation stations for dioxin/furans. Additional sub-samples will be **archived** from Waterway 3, Station W3-4 for TBT, and Waterway 4, Station W4-1 for PCBs, and TBT.

4. If the bioassay testing results show **toxicity** being expressed, at some or all of stations, those stations showing toxicity will be subject to placement of a CAP under the direction of Ecology Toxics Cleanup Program.

5. If the results show **no-toxicity** being expressed, the archived sediments will be analyzed for dioxin/furans (pre-excavation and post-excavation), and selected stations will be analyzed for TBT and PCB (e.g., Station W3-4 for TBT; W4-1 for TBT and PCBs). For dioxins/furans analysis, we recommend EPA Method 1613B (http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/DMMP_DIOXIN_CLARIFICATION.pdf; http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/dioxin_QAPP.pdf). For TBT and PCBs, the methods specified and approved in the 2005 SAP are appropriate.

6. If the results of the post-excavation chemistry show that the **sediment surface is degraded** relative to overlying sediment removed, those stations where antidegradation compliance has been exceeded will be subject to placement of a CAP under the direction of Ecology TCP.

7. **All testing results will be submitted to** the Corp's Dredged Material Management Office (Dr. David Kendall) and copies furnished to Ecology (Rebekah Padgett, Dr. Laura Inouye, and Grant Yang/Ecology TCP Manager), Environmental Protection Agency (EPA) (Erika Hoffman), and Washington Department of Natural Resources (WDNR) (Courtney Wassen).

Please let us know if you have any questions about our review and requirements for additional testing. Please contact Dr. David Kendall, Chief, Dredged Material Management Office, Seattle District Corps of Engineers, Post Office Box 3755, Seattle, Washington, 98124-3755, via telephone at (206) 764-3768, via FAX at (206) 764-6602, or via e-mail at david.r.kendall@nws02.usace.army.mil.

If you have any other questions concerning our permit program you may contact project manager Ann Uhrich, at telephone (206) 764-6748, or via e-mail at ann.r.uhrich@usace.army.mil.

Sincerely,

Michelle Walker
Chief, Regulatory Branch