



East Waterway Harbor Island Superfund Site

**EAST WATERWAY OPERABLE UNIT
PHASE 1 REMOVAL ACTION
COMPLETION REPORT**

**APPENDIX C: EAST WATERWAY PHASE 1 REMOVAL
POST-DREDGE MONITORING DATA REPORT**

For submittal to

The U.S. Environmental Protection Agency
Region 10
Seattle, WA

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Acronyms

ARI	Analytical Resources, Incorporated
CSL	State of Washington cleanup screening level
DMMP	Dredged Material Management Program
DMMU	Dredged Material Management Unit
DQO	data quality objectives
dw	dry weight
EPA	Environmental Protection Agency
FC	field coordinator
HPAH	high-molecular-weight polycyclic aromatic hydrocarbon
LPAH	low-molecular-weight polycyclic aromatic hydrocarbon
ML	DMMP maximum level
MLLW	Mean lower low water
NCMA	normalized combined percent mortality and abnormality
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Port	Port of Seattle
PSEP	Puget Sound Estuary Program
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
SMS	State of Washington Sediment Management Standards
SQS	State of Washington Sediment Quality Standards
SVOC	semivolatile organic compound
TBT	tributyltin
TOC	total organic carbon
VOC	volatile organic compound
ww	wet weight

1.0 Introduction

This data report describes the results of sediment sampling activities conducted in the East Waterway (EWW) Operable Unit (OU) of the Harbor Island Superfund site to assess the quality of the new sediment surface after the removal of existing contaminated surface sediment to a depth of at least -51 ft mean lower low water (MLLW). Post-dredge monitoring (PDM) data were used to evaluate compliance with the cleanup standards identified in the Phase 1 Removal Action EE/CA (Windward 2003b). Attainment of the cleanup standards ensures that the post-dredge sediment surface satisfies anti-degradation provisions specified in WAC 173-204-120.

Sediment samples were collected in two sampling events. The first event will be referred to as the PDM sampling. PDM samples were collected after dredging to -52ft MLLW was completed, to evaluate the new surface sediment. The results of the PDM sampling were used by the US Environmental Protection Agency (EPA) in consultation with the Port of Seattle (Port) and the Washington Department of Ecology (Ecology) to identify an area that required contingency dredging of one foot of additional material followed by the placement of a clean sand layer. Each sample was located within a PDM area, and the results of the analysis of that sample determined whether the area associated with the sample was identified for contingency dredging and placement of a sand layer. The field procedures used to collect the sediment samples were described in the Quality Assurance Project Plan (QAPP; Windward 2003a).

The pre-sand placement (PSP) sampling occurred after the contingency dredging was conducted at in the areas identified by EPA as requiring placement of a clean sand layer. The placement of the sand layer was identified as an interim remedy and it is not an engineered cap. EPA requested the PSP sampling to document the sediment surface below the sand layer. The collection of PSP samples is not described in the QAPP. However, the field procedures used to collect the sediment samples were consistent with those described in the QAPP.

Fifty PDM samples were collected throughout the project area to identify areas that required contingency dredging and the addition of a sand layer. PDM sampling was conducted over two sampling periods due to timing constraints and dredging activity. Round 1a samples were collected while dredging was occurring, at stations at least 200 m from dredging activity. Round 1b samples were collected once initial dredging was completed. PDM sediment samples were analyzed for a full SMS suite of chemicals with a 72-hr analytical turnaround time. Porewater tributyltin (TBT) concentrations could not be determined in this timeframe. Therefore, porewater TBT concentrations were not considered in the identification of contingency dredge areas. Twenty-three samples were collected for TBT porewater analysis during the PDM sampling. All of the TBT samples were archived until the areas requiring additional dredging were identified. The PDM TBT samples collected in areas that did not require additional dredging were analyzed.

Chemical concentrations measured in PDM samples were compared to the corresponding Washington State Sediment Quality Standards/Screening Level (SQS/SL) and Cleanup Screening Level/Maximum Level (CSL/ML). EPA, in conjunction with the Port and Ecology, determined the area that required contingency dredging and placement of the sand layer. PSP samples were collected at sampling locations within the contingency dredge area and analyzed for PCBs, organochlorine pesticides, chlorobenzenes, and mercury as well as any analytes that were detected in the PDM sample and that exceeded the SQS/SL. . In addition, the PDM locations that were identified for TBT porewater samples that were within the contingency dredge area were resampled for TBT porewater as part of the PSP sampling effort.

This report is organized into sections addressing field methods, laboratory methods, results, and references. The text is supported by the following appendices:

- ◆ Attachment A – data tables
- ◆ Attachment B – data management
- ◆ Attachment C – data validation
- ◆ Attachment D – raw laboratory data
- ◆ Attachment E – field forms, logs and notes
- ◆ Attachment F – chain of custody forms

2.0 Sediment Collection Methods

2.1 SEDIMENT COLLECTION

Surface sediment (0-15 cm depth) was collected using a van Veen grab sampler. Fifty samples and two field duplicates were collected during the PDM sampling January 25th and February 2nd, 2005 and 38 samples and one field duplicate were collected during the PSP sampling February 25th and March 1st, 2005. The field procedures used to collect the sediment samples is described in the Quality Assurance Project Plan (Windward 2003a). The targeted and actual sample locations are presented in Map 1 for the PDM sampling event and Map 2 for the PSP sampling event.

2.2 FIELD DEVIATIONS FROM THE QAPP

The target coordinates for station EW-PDM-38 were entered incorrectly into the boat navigation system for both rounds of sampling. Therefore the sample locations for PDM-38 in the PDM and PSP sampling were not consistent with the targeted location. However, the same location was occupied in both sampling events and the station location is within the area associated with PDM-38.

3.0 Laboratory Methods

The methods used to chemically analyze sediment samples are described briefly in this section and in detail in the surface sediment QAPP (Windward 2005). This section also summarizes any laboratory deviations from the QAPP.

3.1 ANALYTICAL METHODS

Analytical Resources Inc. (ARI) conducted chemical analyses of all the samples. PDM sediment samples were analyzed for metals, total PCBs, organochlorine pesticides semi-volatile organic compounds (SVOCs), total organic carbon (TOC), total solids and grain size. A subset of samples was analyzed for chlorobenzenes using the volatile organic compound (VOC) method (EPA Method 8260) due to elevated chlorobenzene RLs associated with nondetected results. The analyses are summarized by sample location in Table 3-1. Porewater was extracted in the laboratory from sediment samples and analyzed for TBT ($\mu\text{g/L}$ as TBT_{ion}). Sample results were averaged with laboratory duplicates.

Table 3-1. Sediment chemical analyses by location

LOCATION	PDM ANALYSES			PSP ANALYSES			
	SMS CHEMICALS	TBT POREWATER	VOC ^a ANALYSIS	PCBs, Hg, CHLOROBENZENES	SVOCs	METALS	PESTICIDES
EW-PDM-1	X		X				
EW-PDM-2	X		X				
EW-PDM-3	X	X	X				
EW-PDM-4	X		X	X			
EW-PDM-5	X		X				
EW-PDM-6	X	X ^b		X			
EW-PDM-7	X		X	X	X		
EW-PDM-8	X	X ^b		X			
EW-PDM-9	X			X			
EW-PDM-10	X	X ^b		X			
EW-PDM-11	X		X				
EW-PDM-12	X	X	X				
EW-PDM-13	X		X				
EW-PDM-14	X	X ^b	X	X			
EW-PDM-15	X		X	X			
EW-PDM-16	X	X ^b	X	X			
EW-PDM-17	X	X	X				
EW-PDM-18	X		X	X			
EW-PDM-19	X	X ^b		X	X		
EW-PDM-20	X			X	X		
EW-PDM-21	X			X			
EW-PDM-22	X	X ^b		X			

LOCATION	PDM ANALYSES			PSP ANALYSES			
	SMS CHEMICALS	TBT POREWATER	VOC ^a ANALYSIS	PCBs, Hg, CHLOROBENZENES	SVOCs	METALS	PESTICIDES
EW-PDM-23	X			X	X		
EW-PDM-24	X			X			
EW-PDM-25	X			X			
EW-PDM-26	X	X ^b		X		X	
EW-PDM-27	X			X			
EW-PDM-28	X			X			
EW-PDM-29	X	X ^b		X	X		
EW-PDM-30	X			X			
EW-PDM-31	X			X	X		
EW-PDM-32	X			X	X		
EW-PDM-33	X	X ^b		X			
EW-PDM-34	X			X			X
EW-PDM-35	X			X			
EW-PDM-36	X	X ^b		X			
EW-PDM-37	X			X	X		
EW-PDM-38	X	X ^b		X			
EW-PDM-39	X			X	X		X
EW-PDM-40	X			X			
EW-PDM-41	X	X ^b		X	X		
EW-PDM-42	X			X			
EW-PDM-43	X			X	X		
EW-PDM-44	X	X ^b		X	X		
EW-PDM-45	X	X ^b					
EW-PDM-46	X	X ^b					
EW-PDM-47	X						
EW-PDM-48	X	X ^c					
EW-PDM-49	X						
EW-PDM-50	X	X ^c					

^a VOC analysis for chlorobenzenes only due to elevated RL in SVOC analysis

^b PDM sample for porewater TBT was discarded and porewater sample collected during PSP sampling was analyzed

^c PDM sample for porewater TBT was discarded and no PSP sample was collected so no porewater data available for this location

All chemical analyses were conducted at ARI. Analytical methods are presented in Table 3-2.

Table 3-2. Chemical analysis methods

PARAMETER	LABORATORY	METHOD	REFERENCE
PCBs as Aroclors	ARI	GC/ECD	EPA 8082
Organochlorine pesticides ^a	ARI	GC/ECD	EPA 8081A
SVOCs (including PAHs) ^b	ARI	GC/MS	EPA 8270
VOCs (chlorobenzenes)	ARI	GC/MS	EPA 8260
Mercury	ARI	CVAA	EPA 7471A
Other metals ^c	ARI	ICP-AES and ICP-MS	EPA 6010B and EPA 200.8
Porewater -TBT, DBT, MBT (as ions) ⁱ	ARI	GC/FPD	Krone et al. (1989)
Grain size	ARI	sieve/pipette	PSEP (1986)
TOC	ARI	combustion	Plumb (1981)
Total solids	ARI	oven-dried	PSEP (1986)

^a Target pesticides include: 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, 2,4'-DDT, 2,4'-DDE, 2,4'-DDD, aldrin, alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, oxychlordane, alpha- and gamma-chlordane, cis- and trans-nonachlor, dieldrin, endosulfan, endosulfan sulfate, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, methoxychlor, mirex, and toxaphene

^b Target PAHs include: anthracene, pyrene, dibenzofuran, benzo(g,h,i)perylene, benzo(e)pyrene, indeno(1,2,3-cd)pyrene, perylene, benzo(b)fluoranthene, fluoranthene, benzo(k)fluoranthene, acenaphthylene, chrysene, benzo(a)pyrene, dibenz(a,h)anthracene, benz(a)anthracene, acenaphthene, phenanthrene, fluorene, 1-methylnaphthalene, naphthalene, and 2-methylnaphthalene

^c Arsenic, antimony, and thallium were analyzed by EPA 200.8 using ICP-MS. Cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, vanadium, and zinc were analyzed by EPA 6010B using ICP-AES.

CVAA – cold vapor atomic absorption

GC/ECD – gas chromatograph-electron capture detection

GC/FPD – gas chromatograph-flame photometric detection

GC/MS – gas chromatograph-mass spectrometry

TBT, DBT, MBT – tributyltin, dibutyltin and monobutyltin

3.3 LABORATORY DEVIATIONS FROM THE QAPP

The PDM TBT porewater samples collected at two locations (EW-PDM-S48 and EW-PDM-S50) were inadvertently discarded and these locations were not reoccupied in the PSP sampling, so no TBT porewater data were obtained at these locations.

4.0 Results

4.1 PDM SEDIMENT CHEMISTRY RESULTS

4.1.1 PDM sediment chemistry results

This section presents a summary of the results of the PDM. Data tables containing the results for each sample from this sampling event are presented in Attachment A. The PDM results are summarized by analyte in Table 4-1. In addition, the organic carbon-normalized data is summarized in Table 4-2 for those analytes with organic carbon-normalized SQS.

Table 4-1. Summary of PDM results

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Metals							
Antimony	mg/kg dw	0/52	nd	nd	nd	7	10
Arsenic	mg/kg dw	46/52	8	20	10	7	8
Cadmium	mg/kg dw	49/52	0.3	4.9	2	0.3	0.3
Chromium	mg/kg dw	52/52	10.8	78.7	38	na	na
Copper	mg/kg dw	52/52	15.5	196	68.9	na	na
Lead	mg/kg dw	52/52	8	339	90	na	na
Mercury	mg/kg dw	51/51 ^c	0.06	12	0.9	na	na
Nickel	mg/kg dw	52/52	8	48	20	na	na
Silver	mg/kg dw	42/52	0.5	5.3	2	0.4	0.5
Zinc	mg/kg dw	52/52	27.2	493	180	na	na
Organometals							
Tributyltin as ion	µg/L	0/7	nd	nd	nd	0.022	0.022
PAHs							
2-Methylnaphthalene	µg/kg dw	31/52	36	1,400	200	20	190
Acenaphthene	µg/kg dw	28/52	25	660	180	20	190
Acenaphthylene	µg/kg dw	0/52	nd	nd	nd	20	190
Anthracene	µg/kg dw	41/52	26	260	110	20	190
Benzo(a)anthracene	µg/kg dw	48/52	34	370	170	20	99
Benzo(a)pyrene	µg/kg dw	48/52	33	400	150	20	99
Benzo(b)fluoranthene	µg/kg dw	50/52	21	610	180	26	99
Benzo(g,h,i)perylene	µg/kg dw	22/52	34	120 J	65	20	190
Benzo(k)fluoranthene	µg/kg dw	44/52	24	330	150	20	170
Total benzofluoranthenes (calc'd)	µg/kg dw	50/52	21	940	320	na	na
Chrysene	µg/kg dw	51/52	28	680	250	99	99
Dibenzo(a,h)anthracene	µg/kg dw	0/52	nd	nd	nd	20	190
Dibenzofuran	µg/kg dw	17/52	40	550	180	20	190
Fluoranthene	µg/kg dw	52/52	60	1,400	560	na	na
Fluorene	µg/kg dw	34/52	31	690	180	20	190
Indeno(1,2,3-cd)pyrene	µg/kg dw	24/52	33 J	120 J	62	20	190
Naphthalene	µg/kg dw	28/52	29	1,400	280	20	190
Phenanthrene	µg/kg dw	51/52	32	2,200	420	99	99
Pyrene	µg/kg dw	52/52	49	1,400	530	na	na
Total HPAH (calc'd)	µg/kg dw	52/52	139	5,100 J	2,000	na	na
Total LPAH (calc'd)	µg/kg dw	51/52	32	5,200	880	na	na
Total PAH (calc'd)	µg/kg dw	52/52	143 J	8,600	2,900	na	na

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Phthalates							
Bis(2-ethylhexyl)phthalate	µg/kg dw	52/52	44	2,400	670	na	na
Butyl benzyl phthalate	µg/kg dw	0/52	nd	nd	nd	20	190
Diethyl phthalate	µg/kg dw	0/52	nd	nd	nd	20	190
Dimethyl phthalate	µg/kg dw	0/52	nd	nd	nd	20	190
Di-n-butyl phthalate	µg/kg dw	3/52	45	560	250	20	190
Di-n-octyl phthalate	µg/kg dw	0/52	nd	nd	nd	20	190
Other SVOCs							
1,2,4-Trichlorobenzene	µg/kg dw	9/52	8.2	1,100	180	4.5	190
1,2-Dichlorobenzene	µg/kg dw	1/52	32	32	32	0.90	190
1,3-Dichlorobenzene	µg/kg dw	4/52	1.5 J	240	71	0.90	190
1,4-Dichlorobenzene	µg/kg dw	21/52	1.7 J	880	120	0.90	190
2,4-Dimethylphenol	µg/kg dw	0/52	nd	nd	nd	20	190
2-Methylphenol	µg/kg dw	0/52	nd	nd	nd	20	190
4-Methylphenol	µg/kg dw	6/52	34 J	78 J	58	20	190
Benzoic acid	µg/kg dw	0/52	nd	nd	nd	200	1,900
Benzyl alcohol	µg/kg dw	0/52	nd	nd	nd	20	190
Hexachlorobenzene	µg/kg dw	0/52	nd	nd	nd	0.96	30
Hexachlorobutadiene	µg/kg dw	0/52	nd	nd	nd	0.96	30
N-Nitrosodiphenylamine	µg/kg dw	1/52	83	83	83	20	190
Pentachlorophenol	µg/kg dw	0/52	nd	nd	nd	98	970
Phenol	µg/kg dw	1/52	35	35	35	20	190
Polychlorinated biphenyls							
Aroclor-1016	µg/kg dw	0/52	nd	nd	nd	19	3,200
Aroclor-1221	µg/kg dw	0/52	nd	nd	nd	19	3,200
Aroclor-1232	µg/kg dw	0/52	nd	nd	nd	19	3,200
Aroclor-1242	µg/kg dw	22/52	19 J	900	250	19	3,200
Aroclor-1248	µg/kg dw	0/52	nd	nd	nd	19	3,200
Aroclor-1254	µg/kg dw	35/52	29	2,500	540	58	3,200
Aroclor-1260	µg/kg dw	52/52	36	26,000	1,300	na	na
Total PCBs (calc'd)	µg/kg dw	52/52	65	26,000	1,800	na	na
Pesticides							
4,4'-DDD	µg/kg dw	0/52	nd	nd	nd	1.9	60
4,4'-DDE	µg/kg dw	0/52	nd	nd	nd	1.9	60
4,4'-DDT	µg/kg dw	2/52	41	49	45	1.9	160
Total DDTs (calc'd)	µg/kg dw	2/52	41	49	45	na	na
Aldrin	µg/kg dw	0/52	nd	nd	nd	0.96	30
Dieldrin	µg/kg dw	0/52	nd	nd	nd	1.9	920

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Total aldrin/dieldrin (calc'd)	µg/kg dw	0/52	nd	nd	nd	na	na
alpha-BHC	µg/kg dw	0/52	nd	nd	nd	0.96	30
beta-BHC	µg/kg dw	0/52	nd	nd	nd	0.96	30
delta-BHC	µg/kg dw	0/52	nd	nd	nd	0.96	30
gamma-BHC	µg/kg dw	0/52	nd	nd	nd	0.96	30
alpha-Chlordane	µg/kg dw	0/52	nd	nd	nd	0.96	30
gamma-Chlordane	µg/kg dw	0/52	nd	nd	nd	0.96	55
alpha-Endosulfan	µg/kg dw	0/52	nd	nd	nd	0.96	30
beta-Endosulfan	µg/kg dw	0/52	nd	nd	nd	1.9	60
Endosulfan sulfate	µg/kg dw	0/52	nd	nd	nd	1.9	60
Endrin	µg/kg dw	0/52	nd	nd	nd	1.9	320
Endrin aldehyde	µg/kg dw	0/52	nd	nd	nd	1.9	430
Endrin ketone	µg/kg dw	0/52	nd	nd	nd	1.9	60
Heptachlor	µg/kg dw	0/52	nd	nd	nd	0.96	30
Heptachlor epoxide	µg/kg dw	0/52	nd	nd	nd	0.96	330
Methoxychlor	µg/kg dw	0/52	nd	nd	nd	9.6	300
Total chlordane (calc'd)	µg/kg dw	0/52	nd	nd	nd	na	na
Sediment grain size							
Total rocks (calc'd)	% dw	21/52	0.1	3.9	0.5	na	na
Total sand (calc'd)	% dw	52/52	5.3	89.7	40	na	na
Total silt (calc'd)	% dw	52/52	7.4	60.6	40	na	na
Total clay (calc'd)	% dw	52/52	2.8	34.7	20	na	na
Fines (percent silt+clay)	% dw	52/52	10.2	94.9	60	na	na
Conventionals							
Total organic carbon (TOC)	% dw	52/52	0.585	4.00	1.60	na	na
Total solids	% dw	52/52	43.50	68.90	56.27	na	na

^a RL range for nondetect samples

^b Reported mean concentrations are the average of the detected concentrations only; RLs were not included in calculation of the mean concentration

^c Sample count does not include rejected results

na – not applicable

nc – not calculated

nd – not detected

Table 4-2. Summary of organic carbon-normalized results for PDM samples

PARAMETER	SQS	CSL	UNIT	DETECTED COMPARISON VALUE			NON-DETECTED COMPARISON VALUE	
				MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM
PAHs								
2-Methylnaphthalene	38	64	mg/kg OC-dry	2.2	35 J	11	1.9	9.1
Acenaphthene	16	57	mg/kg OC-dry	1.7	51 J	12	1.6	11
Acenaphthylene	66	66	mg/kg OC-dry	nd	nd	nd	1.4	11
Anthracene	220	1200	mg/kg OC-dry	1.9	20 J	7.1	2.4	9.1
Benzo(a)anthracene	110	270	mg/kg OC-dry	3.2	22 J	10	2.6	6.9
Benzo(a)pyrene	99	210	mg/kg OC-dry	2.7	18 J	9.1	2.6	6.9
Benzo(g,h,i)perylene	31	78	mg/kg OC-dry	1.5 J	6.1 J	3.7	1.7	11
Total benzofluoranthenes (calc'd)	230	450	mg/kg OC-dry	2.7	42 J	18	4.3	6.9
Chrysene	100	460	mg/kg OC-dry	3.6	44 J	16	6.9	6.9
Dibenzo(a,h)anthracene	12	33	mg/kg OC-dry	nd	nd	nd	1.4	11
Dibenzofuran	15	58	mg/kg OC-dry	1.6	42	12	1.6	11
Fluoranthene	160	1200	mg/kg OC-dry	4.7 J	110 J	35	na	na
Fluorene	23	79	mg/kg OC-dry	1.7	54 J	12	1.9	9.2
Indeno(1,2,3-cd)pyrene	34	88	mg/kg OC-dry	1.6 J	6.7 J	3.5	1.7	11
Naphthalene	99	170	mg/kg OC-dry	2.0	97 J	20	1.6	11
Phenanthrene	100	480	mg/kg OC-dry	4.2	180	28	6.9	6.9
Pyrene	1000	1400	mg/kg OC-dry	5.2 J	74 J	32	na	na
Total HPAH (calc'd)	960	5300	mg/kg OC-dry	9.9 J	300 J	120	na	na
Total LPAH (calc'd)	370	780	mg/kg OC-dry	4.2	380 J	59	6.9	6.9
Phthalates								
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dry	2.9	110 J	36	na	na
Butyl benzyl phthalate	4.9	64	mg/kg OC-dry	nd	nd	nd	1.4	11
Diethyl phthalate	61	110	mg/kg OC-dry	nd	nd	nd	1.4	11
Dimethyl phthalate	53	53	mg/kg OC-dry	nd	nd	nd	1.4	11
Di-n-butyl phthalate	220	1700	mg/kg OC-dry	1.8	38 J	16	1.4	11
Di-n-octyl phthalate	58	4500	mg/kg OC-dry	nd	nd	nd	1.4	11
Other SVOCs								
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dry	0.67	74	14	0.36	11
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dry	2.2	2.2	2.2	0.073	11
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dry	0.16 J	59 J	8.4	0.079	11
Hexachlorobenzene	0.38	2.3	mg/kg OC-dry	nd	nd	nd	0.048	3.0
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dry	nd	nd	nd	0.048	3.0
N-Nitrosodiphenylamine	11	11	mg/kg OC-dry	3.7	3.7	3.7	1.4	11

PARAMETER	SQS	CSL	UNIT	DETECTED COMPARISON VALUE			NON-DETECTED COMPARISON VALUE	
				MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM
Polychlorinated biphenyls								
Total PCBs (calc'd)	12	65	mg/kg OC-dry	8.4	2,600 J	120	na	na

na – not applicable

nd – not detected

4.1.2 Comparison to SQS and CSL

The results of the comparison of PDM sediment chemistry results to the corresponding SQS and CSLs are summarized in Table 4-3. The locations that are shaded represent areas that were identified for contingency dredging by EPA in consultation with the Port and Ecology. The chemicals most commonly detected at concentrations above the Cleanup Screening Level (CSL) were PCBs and mercury. The chemicals that were most commonly not detected with reporting limits above the CSL were SVOCs, particularly 2,4-dimethyl phenol and 1,2,4-trichlorobenzene. Map 3 presents the greatest exceedance at each location for all analytes. The results for PCBs and mercury are presented in Maps 4 and 5, respectively. The highest PCB concentrations were reported at PDM locations 21 (2,600 mg/kg OC) and 23 (320 mg/kg OC). The highest mercury concentration was reported at PDM location 24 (12 mg/kg dw). Contingency dredging was then performed to remove additional unsuitable material in the area identified for sand layer placement to ensure that the sediment depth throughout the area was -52-ft MLLW after the placement of sand cover material.

Table 4-3. Post-dredge monitoring results that exceeded the corresponding SQS/SL and CSL/ML

MONITORING LOCATION	CHEMICALS > SQS/SL, ≤ CSL/ML		CHEMICALS > CSL/ML	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
1	PCBs	none	none	none
2	PCBs	dieldrin	none	none
3	PCBs	total DDTs, dieldrin, hexachlorobenzene	none	none
4	1,4-dichlorobenzene, PCBs	hexachlorobenzene, DDTs, dieldrin	1,2,4-trichlorobenzene	2,4-dimethylphenol
5	PCBs	dieldrin, 1,2,4-trichlorobenzene	none	
6	none	hexachlorobenzene, dieldrin	PCBs	1,2-dichlorobenzene, 1,2,4-trichlorobenzene, DDTs
7	1,4-dichlorobenzene, acenaphthene, dibenzofuran, fluorene, PCBs, phenanthrene	hexachlorobenzene, DDTs, dieldrin	none	2,4-dimethylphenol
8	none	hexachlorobenzene, DDTs, dieldrin	mercury, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene
9	mercury, PCBs	hexachlorobenzene, DDTs, dieldrin	none	2,4-dimethylphenol, 1,2,4-trichlorobenzene
10	PCBs	total DDTs, dieldrin	mercury	1,2,4-trichlorobenzene, 2,4-dimethylphenol
11 ^a	PCBs	hexachlorobenzene, DDTs, dieldrin	none	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene
12	PCBs	hexachlorobenzene, DDTs, dieldrin	none	2,4-dimethylphenol
13	PCBs	hexachlorobenzene, DDTs, 1,2,4-trichlorobenzene	none	2,4-dimethylphenol
14	PCBs	total DDTs, dieldrin	none	2,4-dimethylphenol
15	PCBs	hexachlorobenzene, total DDTs	none	2,4-dimethylphenol
16	bis(2-ethylhexyl) phthalate, PCBs	hexachlorobenzene, total DDTs, dieldrin, butylbenzyl phthalate	none	2,4-dimethylphenol, 2-methylphenol, benzoic acid, benzyl alcohol, pentachlorophenol
17	1,4-dichlorobenzene, PCBs	hexachlorobenzene, total DDTs, dieldrin	none	2,4-dimethylphenol

MONITORING LOCATION	CHEMICALS > SQS/SL, ≤ CSL/ML		CHEMICALS > CSL/ML	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
18	1,4-dichlorobenzene	hexachlorobenzene, total DDTs, dieldrin	PCBs	2,4-dimethylphenol
19	acenaphthene, dibenzofuran, fluorene, phenanthrene	hexachlorobenzene, aldrin, dieldrin, gamma-BHC, alpha-chlordane, heptachlor	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, mercury, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene, total DDTs
20	1,4-dichlorobenzene, acenaphthene, dibenzofuran, fluorene, mercury, phenanthrene	total DDTs, hexachlorobenzene, aldrin, dieldrin, gamma-BHC, alpha-chlordane, heptachlor	1,2,4-trichlorobenzene, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene
21	none	total DDTs, aldrin, dieldrin, gamma-BHC, alpha-chlordane, heptachlor	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene, hexachlorobenzene
22	1,4-dichlorobenzene	hexachlorobenzene, total DDTs, dieldrin	1,2,4-trichlorobenzene, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene
23	acenaphthene, bis(2-ethylhexyl)phthalate, mercury, 1,3-dichlorobenzene	DDTs, dieldrin	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, PCBs	none
24	none	DDTs, dieldrin	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, mercury, PCBs	2,4-dimethylphenol
25	1,4-dichlorobenzene, PCBs, 1,2,4-trichlorobenzene	none	mercury, 2,4-dimethylphenol	none
26	1,4-dichlorobenzene, zinc, 1,2,4-trichlorobenzene	benzyl alcohol, total DDTs, dieldrin	mercury, PCBs	2,4-dimethylphenol
27	1,4-dichlorobenzene, dieldrin	hexachlorobenzene, total DDTs	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene
28	PCBs	1,4-dichlorobenzene, total DDTs, dieldrin, butyl benzyl phthalate	mercury	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol
29	PCBs	hexachlorobenzene, dieldrin, butyl benzyl phthalate	bis(2-ethylhexyl)phthalate, mercury	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol, total DDTs

MONITORING LOCATION	CHEMICALS > SQS/SL, ≤ CSL/ML		CHEMICALS > CSL/ML	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
30	mercury, PCBs	hexachlorobenzene, pentachlorophenol, total DDTs, dieldrin, butyl benzyl phthalate	none	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol
31	none	hexachlorobenzene, total DDTs, dieldrin, butyl benzyl phthalate	bis(2-ethylhexyl)phthalate, mercury, PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol
32	bis(2-ethylhexyl)phthalate, mercury	total DDTs, dieldrin, butyl benzyl phthalate	PCBs	2,4-dimethylphenol, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol, nitrosodiphenylamine
33	PCBs	dieldrin	mercury	2,4-dimethylphenol, 1,2,4-trichlorobenzene
34	DDTs	dieldrin	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene
35	mercury, PCBs	dieldrin	none	2,4-dimethylphenol, 1,2,4-trichlorobenzene
36	none	1,3-dichlorobenzene, 1,4-dichlorobenzene, total DDTs, dieldrin, butyl benzyl phthalate	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol
37 ^b	bis(2-ethylhexyl)phthalate, PCBs	1,3-dichlorobenzene, 1,4-dichlorobenzene, total DDTs, dieldrin, butyl benzyl phthalate	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol
38	mercury	1,4-dichlorobenzene, pentachlorophenol, butyl benzyl phthalate	none	2,4-dimethylphenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol

MONITORING LOCATION	CHEMICALS > SQS/SL, ≤ CSL/ML		CHEMICALS > CSL/ML	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
39	DDTs	1,2,4-trichlorobenzene, dieldrin	bis(2-ethylhexyl)phthalate, mercury, PCBs	2,4-dimethylphenol
40 ^c	PCBs	1,2,4-trichlorobenzene, dieldrin, DDTs	mercury	dieldrin, DDTs, 2,4-dimethylphenol
41	bis(2-ethylhexyl)phthalate, PCBs	dieldrin, DDTs	mercury, 1,2,4-trichlorobenzene, 2,4-dimethylphenol	none
42	mercury, PCBs	none	none	1,2,4-trichlorobenzene, 2,4-dimethylphenol
43	bis(2-ethylhexyl)phthalate	1,4-dichlorobenzene, hexachlorobenzene, butyl benzyl phthalate, dieldrin	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol, DDTs
44	bis(2-ethylhexyl)phthalate	total DDTs, aldrin, dieldrin, gamma-BHC, alpha-chlordane, heptachlor, hexachlorobenzene, butyl benzyl phthalate	mercury, PCBs	2,4-dimethylphenol, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,4-dichlorobenzene 2-methyl phenol, benzoic acid, benzyl alcohol, pentachlorophenol
45 ^d	1,4-dichlorobenzene, bis(2-ethylhexyl)phthalate, zinc	dieldrin, DDTs, 1,2,4-trichlorobenzene	mercury, PCBs	2,4-dimethylphenol
46 ^d	PCBs	dieldrin, DDTs, 1,2,4-trichlorobenzene	mercury	2,4-dimethylphenol
47 ^d	1,4-dichlorobenzene, bis(2-ethylhexyl)phthalate, zinc	dieldrin, DDTs, 1,2,4-trichlorobenzene	mercury, PCBs	2,4-dimethylphenol

^a EPA discretionary sample (PDM-48) also sampled in this area. Summary includes results from both samples.

^b EPA discretionary sample (PDM-50) also sampled in this area. Summary includes results from both samples.

^c EPA discretionary sample (PDM-49) also sampled in this area. Summary includes results from both samples.

^d Sample located on the mound and contingency dredging not performed: cover material was placed.

Shading: Areas that were identified for contingency dredging by EPA following consultation with the Port and Ecology.

4.2 PRE-SAND PLACEMENT CHEMISTRY RESULTS

Following contingency dredging, the areas that were dredged were resampled prior to the placement of the sand layer. The results are summarized in Table 4-4. In addition, the organic carbon-normalized data is summarized in Table 4-5 for those analytes with organic carbon-normalized SQS. Data tables containing the complete results for each sample are presented in Attachment A.

Table 4-4. Summary of PSP results

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Metals							
Antimony	mg/kg dw	0/1	nd	nd	nd	8	8
Arsenic	mg/kg dw	1/1	10	10	10	na	na
Cadmium	mg/kg dw	1/1	0.9	0.9	0.9	na	na
Chromium	mg/kg dw	1/1	35.8	35.8	35.8	na	na
Copper	mg/kg dw	1/1	50.3	50.3	50.3	na	na
Lead	mg/kg dw	1/1	46	46	46	na	na
Mercury	mg/kg dw	37/37	0.09	10.9	0.8	na	na
Nickel	mg/kg dw	1/1	31	31	31	na	na
Silver	mg/kg dw	1/1	0.6	0.6	0.6	na	na
Zinc	mg/kg dw	1/1	115	115	115	na	na
Organometals							
Tributyltin as ion	µg/kg dw	0/16	nd	nd	nd	0.022	0.074
PAHs							
2-Methylnaphthalene	µg/kg dw	3/13	51	370	210	19	20
Acenaphthene	µg/kg dw	3/13	21	7,800	2,700	19	22
Acenaphthylene	µg/kg dw	0/13	nd	nd	nd	19	120
Anthracene	µg/kg dw	6/13	24	2,600	650	19	20
Benzo(a)anthracene	µg/kg dw	9/13	20	1,900	260	19	20
Benzo(a)pyrene	µg/kg dw	9/13	21	610	100	19	20
Benzo(b)fluoranthene	µg/kg dw	10/13	21	900	130	20	20
Benzo(g,h,i)perylene	µg/kg dw	3/13	26	240	99	19	22
Benzo(k)fluoranthene	µg/kg dw	6/13	21	560	120	19	22
Total benzofluoranthenes (calc'd)	µg/kg dw	10/13	21	1,460	200	na	na
Chrysene	µg/kg dw	11/13	22	2,000	280	20	20
Dibenzo(a,h)anthracene	µg/kg dw	0/13	nd	nd	nd	19	120
Dibenzofuran	µg/kg dw	2/13	200	5,700	3,000	19	22
Fluoranthene	µg/kg dw	13/13	35	12,000	1,000	na	na
Fluorene	µg/kg dw	4/13	24	8,300	2,200	19	20
Indeno(1,2,3-cd)pyrene	µg/kg dw	3/13	28	270	110	19	22

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
Naphthalene	µg/kg dw	4/13	26	680	320	19	22
Phenanthrene	µg/kg dw	11/13	21	24,000	2,300	20	20
Pyrene	µg/kg dw	13/13	30	5,900	540	na	na
Total HPAH (calc'd)	µg/kg dw	13/13	65	24,000	2,200	na	na
Total LPAH (calc'd)	µg/kg dw	11/13	21	43,000	4,300	na	na
Total PAH (calc'd)	µg/kg dw	13/13	65	68,000	5,900	na	na
Phthalates							
Bis(2-ethylhexyl)phthalate	µg/kg dw	10/13	26	1,800	250	20	20
Butyl benzyl phthalate	µg/kg dw	0/13	nd	nd	nd	19	120
Diethyl phthalate	µg/kg dw	0/13	nd	nd	nd	19	120
Dimethyl phthalate	µg/kg dw	0/13	nd	nd	nd	19	120
Di-n-butyl phthalate	µg/kg dw	1/13	140	140	140	19	22
Di-n-octyl phthalate	µg/kg dw	0/13	nd	nd	nd	19	120
Other SVOCs							
1,2,4-Trichlorobenzene	µg/kg dw	13/37	5.8 J	1,800 J	150	5.3	7.6
1,2-Dichlorobenzene	µg/kg dw	7/37	1.5 J	16 J	5.2	1.1	1.5
1,3-Dichlorobenzene	µg/kg dw	13/37	1.1 J	140	15	1.1	1.9
1,4-Dichlorobenzene	µg/kg dw	24/37	2.2 J	390	32	1.1	1.5
2,4-Dimethylphenol	µg/kg dw	0/13	nd	nd	nd	19	120
2-Methylphenol	µg/kg dw	0/13	nd	nd	nd	19	120
4-Methylphenol	µg/kg dw	0/13	nd	nd	nd	19	120
Benzoic acid	µg/kg dw	0/13	nd	nd	nd	190	1,200
Benzyl alcohol	µg/kg dw	0/13	nd	nd	nd	19	120
Hexachlorobenzene	µg/kg dw	0/14	nd	nd	nd	0.98	120
Hexachlorobutadiene	µg/kg dw	0/14	nd	nd	nd	0.98	120
N-Nitrosodiphenylamine	µg/kg dw	0/13	nd	nd	nd	19	120
Pentachlorophenol	µg/kg dw	0/13	nd	nd	nd	96	610
Phenol	µg/kg dw	0/13	nd	nd	nd	19	120
Polychlorinated biphenyls							
Aroclor-1016	µg/kg dw	0/37	nd	nd	nd	19	970
Aroclor-1221	µg/kg dw	0/37	nd	nd	nd	19	970
Aroclor-1232	µg/kg dw	0/37	nd	nd	nd	19	970
Aroclor-1242	µg/kg dw	6/37	59	500	250	19	970
Aroclor-1248	µg/kg dw	8/37	26 J	280	140	19	970
Aroclor-1254	µg/kg dw	1/37	43	43	43	39	1,900
Aroclor-1260	µg/kg dw	37/37	44	5,600	800	na	na
Total PCBs (calc'd)	µg/kg dw	37/37	61	5,600	870	na	na
Pesticides							
4,4'-DDD	µg/kg dw	0/3	nd	nd	nd	2.0	7.1

ANALYTE	UNIT	DETECTION FREQUENCY	DETECTED CONCENTRATION			REPORTING LIMIT ^a	
			MINIMUM	MAXIMUM	MEAN ^b	MINIMUM	MAXIMUM
4,4'-DDE	µg/kg dw	0/3	nd	nd	nd	2.0	7.1
4,4'-DDT	µg/kg dw	0/3	nd	nd	nd	2.0	12
Total DDTs (calc'd)	µg/kg dw	0/3	nd	nd	nd	na	na
Aldrin	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
Dieldrin	µg/kg dw	0/3	nd	nd	nd	2.0	50
Total aldrin/dieldrin (calc'd)	µg/kg dw	0/3	nd	nd	nd	na	na
alpha-BHC	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
beta-BHC	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
delta-BHC	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
gamma-BHC	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
alpha-Chlordane	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
gamma-Chlordane	µg/kg dw	0/3	nd	nd	nd	3.3	28
alpha-Endosulfan	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
beta-Endosulfan	µg/kg dw	0/3	nd	nd	nd	2.0	7.1
Endosulfan sulfate	µg/kg dw	0/3	nd	nd	nd	2.0	7.1
Endrin	µg/kg dw	0/3	nd	nd	nd	2.0	19
Endrin aldehyde	µg/kg dw	0/3	nd	nd	nd	2.0	7.1
Endrin ketone	µg/kg dw	0/3	nd	nd	nd	2.0	7.1
Heptachlor	µg/kg dw	0/3	nd	nd	nd	0.98	3.5
Heptachlor epoxide	µg/kg dw	0/3	nd	nd	nd	0.98	26
Methoxychlor	µg/kg dw	0/3	nd	nd	nd	9.8	35
Total chlordane (calc'd)	µg/kg dw	0/3	nd	nd	nd	na	na
Conventionals							
Total organic carbon (TOC)	% dw	37/37	0.638	3.22	1.66	na	na
Total solids	% dw	37/37	48.20	70.00	58.72	na	na

^a RL range for non-detect samples

^b Reported mean concentrations are the average of the detected concentrations only; RLs were not included in calculation of the mean concentration

Table 4-5. Summary of organic carbon-normalized results for PSP samples

PARAMETER	SQS	CSL	UNIT	DETECTED COMPARISON VALUE			NON-DETECTED COMPARISON VALUE	
				MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM
PAHs								
2-Methylnaphthalene	38	64	mg/kg OC-dry	1.6	16	11	0.96	3.0
Acenaphthene	16	57	mg/kg OC-dry	2.1	340	120	0.68	3.0
Acenaphthylene	66	66	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Anthracene	220	1200	mg/kg OC-dry	0.75	110	35	0.96	3.0
Benzo(a)anthracene	110	270	mg/kg OC-dry	0.93	82	13	0.96	1.4
Benzo(a)pyrene	99	210	mg/kg OC-dry	1.1	26	5.5	0.96	1.4

PARAMETER	SQS	CSL	UNIT	DETECTED COMPARISON VALUE			NON-DETECTED COMPARISON VALUE	
				MINIMUM	MAXIMUM	MEAN	MINIMUM	MAXIMUM
Benzo(g,h,i)perylene	31	78	mg/kg OC-dry	1.3	10	4.9	0.68	3.0
Total benzofluoranthenes (calc'd)	230	450	mg/kg OC-dry	1.1	63	10	1.0	1.4
Chrysene	100	460	mg/kg OC-dry	1.1	86	15	1.0	1.4
Dibenzo(a,h)anthracene	12	33	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Dibenzofuran	15	58	mg/kg OC-dry	15	250	130	0.68	3.0
Fluoranthene	160	1200	mg/kg OC-dry	1.9	520	48	na	na
Fluorene	23	79	mg/kg OC-dry	0.75	360	97	0.96	3.0
Indeno(1,2,3-cd)pyrene	34	88	mg/kg OC-dry	1.4	12	5.4	0.68	3.0
Naphthalene	99	170	mg/kg OC-dry	3.1	41	19	0.68	1.4
Phenanthrene	100	480	mg/kg OC-dry	1.1	1,000	100	1.4	1.4
Pyrene	1000	1400	mg/kg OC-dry	2.0	250	26	na	na
Total HPAH (calc'd)	960	5300	mg/kg OC-dry	3.9	1,000	110	na	na
Total LPAH (calc'd)	370	780	mg/kg OC-dry	1.1	1,900	200	1.4	1.4
Phthalates								
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dry	1.3	78	13	1.0	1.4
Butyl benzyl phthalate	4.9	64	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Diethyl phthalate	61	110	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Dimethyl phthalate	53	53	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Di-n-butyl phthalate	220	1700	mg/kg OC-dry	6.0	6.0	6.0	0.68	3.0
Di-n-octyl phthalate	58	4500	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Other SVOCs								
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dry	0.36 J	160 J	13	0.21	0.91
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dry	0.087 J	1.4 J	0.37	0.043	0.19
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dry	0.11 J	34 J	2.5	0.067	0.19
Hexachlorobenzene	0.38	2.3	mg/kg OC-dry	nd	nd	nd	0.064	5.2
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dry	nd	nd	nd	0.064	5.2
N-Nitrosodiphenylamine	11	11	mg/kg OC-dry	nd	nd	nd	0.68	5.2
Polychlorinated biphenyls								
Total PCBs (calc'd)	12	65	mg/kg OC-dry	3.1	860 J	64	na	na

na – not applicable

nd – not detected

It should be noted that the PSP samples were analyzed for only those chemicals with SQS and CSL exceedances in the initial post-dredge monitoring sampling. A summary of chemicals with detected concentrations greater than SQS as well as chemicals reported as not detected with RLs above the SQS is presented for each location in Table 4-4. In general, there were fewer CSL exceedances in the PSP results than there were in

the PDM sample results. Two exceptions to this trend are PDM locations 4 and 7. The only chemical detected above the CSL in the PDM sample from PDM location 4 was 1,2,4-trichlorobenzene. The PSP sample at this location contained 1,2,4-trichlorobenzene, 1,2-dichlorobenzene and PCBs at concentrations above the corresponding CSLs. Area 7 had no detected concentrations above the CSL in the PDM sample. However, the PSP sample contained PAH concentrations above the CSL as well as mercury and PCB concentrations above the corresponding CSLs. Map 6 presents a summary of the maximum exceedance at each location for all analytes. PCBs and mercury were the chemicals most commonly detected at concentrations above the corresponding CSL, and the results for these chemicals are presented in Maps 7 and 8 respectively. The highest PCB concentrations were reported for monitoring area 23 (860 mg/kg OC) and monitoring area 4 (260 mg/kg OC). The highest mercury concentration was reported for monitoring area 24 (10.9 mg/kg). Hexachlorobenzene was the chemical most commonly not detected with an RL above the corresponding SQS. The chlorobenzenes were analyzed by the VOC method for the PSP samples. This method has lower reporting limits than the SVOC method used for the PDM samples therefore there were fewer SQS exceedances due to reporting limits associated with nondetected results for these compounds.

Table 4-6. Results of SQS comparison for the results of the pre-sand placement sampling

MONITORING LOCATION	CHEMICALS > SQS, ≤ CSL		CHEMICALS > CSL	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
4	1,3-dichlorobenzene	none	1,2,4-trichlorobenzene, 1,4-dichlorobenzene, PCBs	none
6	PCBs	1,2,4-trichlorobenzene	none	none
7	Fluoranthene, total HPAH	butyl benzyl phthalate, hexachlorobutadiene, pentachlorophenol	mercury, acenaphthene, dibenzofuran, fluorene, phenanthrene, total LPAH, bis(2-ethylhexyl)phthalate, PCBs	2,4-dimethyl phenol, 2-methyl phenol, benzoic acid, benzyl alcohol, hexachlorobenzene
8	mercury, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene	none	PCBs	none
14	mercury, PCBs	none	none	none
15	mercury, PCBs	none	none	none
16	mercury, PCBs	none	none	none
18	PCBs	none	none	none
19	none	PCBs, hexachlorobenzene	none	none
20	acenaphthene, fluorene, PCBs	hexachlorobenzene	none	none
21	1,4-dichlorobenzene, PCBs	none	1,2,4-trichlorobenzene	none
22	none	none	mercury, PCBs	none
23	1,2,4-trichlorobenzene 1,4-dichlorobenzene	hexachlorobenzene	PCBs	none
24	1,2,4-trichlorobenzene, PCBs	none	mercury	none
25	PCBs	none	mercury	none
26	mercury, PCBs	none	none	none
27	PCBs	none	mercury	none
28	mercury, PCBs	none	none	none
29	mercury, PCBs	hexachlorobenzene	none	none
30	mercury, PCBs	none	none	none



MONITORING LOCATION	CHEMICALS > SQS, ≤ CSL		CHEMICALS > CSL	
	DETECTED	NONDETECTED	DETECTED	NONDETECTED
31	PCBs	hexachlorobenzene	mercury	none
32	mercury, 1,2,4-trichlorobenzene, PCBs	hexachlorobenzene	none	none
33	mercury, PCBs	none	none	none
34	PCBs	none	none	none
35	PCBs	none	none	none
36	PCBs	none	1,2,4-trichlorobenzene	none
37	mercury, PCBs	hexachlorobenzene	none	none
38	mercury	none	none	none
39	mercury, PCBs,	total DDTs, dieldrin	none	none
40	mercury, 1,2,4-trichlorobenzene, PCBs	none	none	none
41	PCBs	hexachlorobenzene	mercury	none
42	mercury, PCBs	none	none	none
43	none	hexachlorobenzene	mercury	none
44	PCBs	hexachlorobenzene	mercury	none

4.3 COMBINED SEDIMENT CHEMISTRY RESULTS COMPARED TO SQS/CSL

The new sediment surface within the Phase 1 Removal Area can be characterized by a combination of PDM and PSP chemistry results. Areas within the Phase 1 Removal Area that were not identified for contingency dredging or sand layer placement are characterized by the PDM results. These areas were not sampled as part of the PSP sampling. Areas that were subject to contingency dredging and sand layer placement are characterized by the PSP chemistry results for all analytes that were analyzed in the PSP analysis. The original PDM results were retained for analytes that were not analyzed for in the PSP sampling.

The new sediment surface as it was characterized prior to the placement of the sand layer is summarized in Map 9 and Tables 4-7 and 4-8. Map 9 summarizes the exceedances at each location for all analytes including exceedances due to reporting limits associated with nondetected results. Approximately 25% of the total project surface area is currently characterized by a sample with a detected chemical concentration that exceeds the corresponding CSL. Table 4-7 presents the combined PDM and PSP results for each location for all analytes that were either detected at a concentration above the SQS or were not detected with an RL above the SQS. Mercury and total PCBs are the chemicals most commonly detected at concentrations above the SQS. The values in the shaded cells of Table 4-7 represent PSP results that have replaced the PDM results for that sample. In addition, Table 4-8 presents the PDM results for the EPA discretionary samples located on the mound. This area was covered with a layer of clean material. However, no contingency dredging occurred on the mound so no PSP sampling was conducted at these locations.

**Table 4-7a. Combined PDM and PSP sample results for all locations for all analytes that exceeded SQS:
EW-PDM-S1 through EW-PDM-S11**

CHEMICAL	SQS	CSL	UNIT	EW-PDM-S1	EW-PDM-S2	EW-PDM-S3	EW-PDM-S4	EW-PDM-S5	EW-PDM-S6	EW-PDM-S7	EW-PDM-S8	EW-PDM-S9	EW-PDM-S10	EW-PDM-S11
Mercury	0.41	0.59	mg/kg dw	0.13	0.06	0.24	0.32	0.10	0.09	0.64	0.43	0.53	0.58	0.19 J
Zinc	410	960	mg/kg dw	45.2	27.2	38.1	66.3	40.0	60.8	98	260	127	254	73.0
Acenaphthene	16	57	mg/kg OC-dw	3.5 U	3.4 U	2.0	6.4	4.3 U	2.9	340	6.5	2.3 U	2.2 U	2.4 U
Fluoranthene	160	1,200	mg/kg OC-dw	10	15	12	37	9.9	25	520	45	15	28	10
Fluorene	23	79	mg/kg OC-dw	3.5 U	3.4 U	2.6	7.4	4.3 U	4.2	360	7.1	2.3 U	2.2 U	2.4 U
Phenanthrene	100	480	mg/kg OC-dw	6.6	6.5	9.8	29	6.8	21	1,000	29	5.7	4.5	5.2
Total HPAH (calc'd)	960	5,300	mg/kg OC-dw	28	59	38	160	23	75	1,000	140	51	120 J	37
Total LPAH (calc'd)	370	780	mg/kg OC-dw	6.6	6.5	19	72	6.8	36	1,900	54	8.1	8.5	5.2
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dw	6.1	9.9	8.0	7.9	7.2	21	78	23	2.9	40	7.9
Butyl benzyl phthalate	4.9	64	mg/kg OC-dw	3.5 U	3.4 U	2.0 U	3.2 U	4.3 U	2.4 U	5.2 U	2.6 U	2.3 U	2.2 U	2.4 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dw	0.61 U	0.77 U	0.67	160 J	0.82 U	0.91 U	0.29 U	0.86 J	0.36 U	0.43 U	0.40 U
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dw	0.12 U	0.15 U	0.090 U	1.4 J	0.16 U	0.19 U	0.056 U	0.086 U	0.073 U	0.083 U	0.079 U
1,3-Dichlorobenzene	170	nv	µg/kg dw	1.0 U	0.90 U	1.5 J	140	1.0 U	1.2 U	1.3 U	2.5 J	1.5 U	1.4 U	1.0 U
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dw	0.12 U	0.15 U	2.9	34	0.16 U	0.19 U	0.38	3.2	0.11 J	0.083 U	0.079 U
2,4-Dimethylphenol	29	29	µg/kg dw	28 U	20 U	24 U	30 U	26 U	28 U	120 U	43 U	38 U	49 U	30 U
2-Methylphenol	63	63	µg/kg dw	28 U	20 U	24 U	30 U	26 U	28 U	120 U	43 U	38 U	49 U	30 U
Benzoic acid	650	650	µg/kg dw	280 U	200 U	240 U	300 U	260 U	280 U	1,200 U	430 U	380 U	490 U	300 U
Benzyl alcohol	57	73	µg/kg dw	28 UJ	20 UJ	24 UJ	30 UJ	26 UJ	28 UJ	120 U	43 UJ	38 UJ	49 UJ	30 UJ
Hexachlorobenzene	0.38	2.3	mg/kg OC-dw	0.36 U	0.17 U	0.55 U	0.80 U	0.23 U	0.58 U	5.2 U	0.46 U	0.53 U	0.18 U	0.56 U
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dw	0.36 U	0.17 U	0.55 U	0.80 U	0.23 U	0.58 U	5.2 U	0.46 U	0.53 U	0.18 U	0.56 U
N-Nitrosodiphenylamine	11	11	mg/kg OC-dw	3.5 U	3.4 U	2.0 U	3.2 U	4.3 U	2.4 U	5.2 U	2.6 U	2.3 U	2.2 U	2.4 U
Pentachlorophenol	360	690	µg/kg dw	140 U	98 U	120 U	150 U	130 U	140 U	610 U	210 U	190 U	240 U	150 U
Total PCBs (calc'd)	12	65	mg/kg OC-dw	19	36	20	260	43	14	91	91	37	61	13
Total DDTs (calc'd)	6.9	69	µg/kg dw	5.8 U	4.2 U	13 U	15 U	5.7 U	77 U	38 U	37 U	18 U	69 U	14 U
Aldrin	10	nv	µg/kg dw	2.9 U	0.99 U	6.7 U	7.5 U	1.4 U	6.9 U	7.4 U	7.8 U	8.8 U	4.0 U	7.0 U
Dieldrin	10	nv	µg/kg dw	5.8 U	11 U	13 U	15 U	18 U	56 U	38 U	63 U	18 U	31 U	14 U
gamma-BHC	10	nv	µg/kg dw	2.9 U	0.99 U	6.7 U	7.5 U	1.4 U	6.9 U	7.4 U	7.8 U	8.8 U	4.0 U	7.0 U
Total chlordane (calc'd)	10	nv	µg/kg dw	2.9 U	0.99 U	6.7 U	7.5 U	1.4 U	6.9 U	7.4 U	7.8 U	8.8 U	4.0 U	7.0 U
Heptachlor	10	nv	µg/kg dw	2.9 U	0.99 U	6.7 U	7.5 U	1.4 U	6.9 U	7.4 U	7.8 U	8.8 U	4.0 U	7.0 U

^a Samples located on the mound; no pre-sand placement samples were collected

nv – no value available for this chemical

Shaded cells indicate values obtained from the pre-sand placement sample that have replaced the PDM result

Bold indicates an SQS exceedance

Underline indicates a CSL exceedance

Italics indicate a value that is the mean of laboratory replicates

**Table 4-7b. Combined PDM and PSP sample results for all locations for all analytes that exceeded SQS:
EW-PDM-S12 through EW-PDM-S22**

CHEMICAL	SQS	CSL	UNIT	EW-PDM-S12	EW-PDM-S13	EW-PDM-S14	EW-PDM-S15	EW-PDM-S16	EW-PDM-S17	EW-PDM-S18	EW-PDM-S19	EW-PDM-S20	EW-PDM-S21	EW-PDM-S22
Mercury	0.41	0.59	mg/kg dw	0.24 J	0.20 J	0.44	0.43	0.47	0.28	0.10	0.13	0.20	0.25	0.85
Zinc	410	960	mg/kg dw	79	55.8	85	93	147	74.0	67.2	104	97	77.3	87.2
Acenaphthene	16	57	mg/kg OC-dw	3.2 U	4.8 U	3.5 U	4.3	11 U	3.7	4.6	2.1	21	15	16
Fluoranthene	160	1,200	mg/kg OC-dw	18	19	22	31	58	21	24	15	44	50	57
Fluorene	23	79	mg/kg OC-dw	3.2 U	4.8 U	3.5 U	5.2	5.6 J	4.6	5.7	3.3	26	16	18
Phenanthrene	100	480	mg/kg OC-dw	13	8.4	11	19	24	15	19	9.9	74	56	59
Total HPAH (calc'd)	960	5,300	mg/kg OC-dw	76	62	85	100	230 J	65	71	60	130	130	160
Total LPAH (calc'd)	370	780	mg/kg OC-dw	19	8.4	15	38	38 J	30	38	22	250	120	140
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dw	11	8.1	11	27	56	15	13	7.0	3.7	13	13
Butyl benzyl phthalate	4.9	64	mg/kg OC-dw	3.2 U	4.8 U	3.5 U	3.3 U	11 U	2.9 U	3.1 U	2.0 U	1.5 U	3.2 U	2.9 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dw	0.50 U	0.81 U	0.34 U	0.42 U	0.43 U	0.48 U	0.78 U	0.52 U	0.74	2.3	0.39 J
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dw	0.10 U	0.16 U	0.067 U	0.086 U	0.085 U	0.093 U	0.16 U	0.11 U	0.11 U	0.10 U	0.045 U
1,3-Dichlorobenzene	170	nv	µg/kg dw	1.1 U	1.0 U	1.3 U	1.4 U	1.5 U	1.0 U	1.1 U	1.1 J	2.5 J	7.1 J	9.4 J
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dw	0.10 U	0.16 U	0.067 U	0.086 U	0.085 U	3.9	0.16 U	2.1	0.53	3.1	1.8
2,4-Dimethylphenol	29	29	µg/kg dw	34 U	31 U	38 U	38 U	180 U	31 U	32 U	20 U	20 U	32 U	32 U
2-Methylphenol	63	63	µg/kg dw	34 U	31 U	38 U	38 U	180 U	31 U	32 U	20 U	20 U	32 U	32 U
Benzoic acid	650	650	µg/kg dw	340 U	310 U	380 U	380 U	1,800 U	310 U	320 U	200 U	200 U	320 U	320 U
Benzyl alcohol	57	73	µg/kg dw	34 UJ	31 UJ	38 UJ	38 UJ	180 UJ	31 UJ	32 UJ	20 U	20 U	32 UJ	32 UJ
Hexachlorobenzene	0.38	2.3	mg/kg OC-dw	0.73 U	0.47 U	0.31 U	0.46 U	0.54 U	0.69 U	0.73 U	2.0 U	1.5 U	3.0 U	0.67 U
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dw	0.73 U	0.47 U	0.31 U	0.46 U	0.54 U	0.69 U	0.73 U	2.0 U	1.5 U	3.0 U	0.67 U
N-Nitrosodiphenylamine	11	11	mg/kg OC-dw	3.2 U	4.8 U	3.5 U	3.3 U	11 U	2.9 U	3.1 U	2.0 U	1.5 U	3.2 U	2.9 U
Pentachlorophenol	360	690	µg/kg dw	170 U	160 U	190 U	190 U	880 U	150 U	160 U	100 U	100 U	160 U	160 U
Total PCBs (calc'd)	12	65	mg/kg OC-dw	17	42	16	18	28	18	28	33	15	54	180
Total DDTs (calc'd)	6.9	69	µg/kg dw	15 U	15 U	39 U	32 U	25 U	15 U	15 U	160 U	30 U	60 U	15 U
Aldrin	10	nv	µg/kg dw	7.7 U	3.0 U	3.3 U	5.3 U	8.8 U	7.5 U	7.4 U	15 U	15 U	30 U	7.3 U
Dieldrin	10	nv	µg/kg dw	15 U	5.9 U	41 U	10 U	18 U	15 U	95 U	120 U	140 U	920 U	74 U
gamma-BHC	10	nv	µg/kg dw	7.7 U	3.0 U	3.3 U	5.3 U	8.8 U	7.5 U	7.4 U	15 U	15 U	30 U	7.3 U
alpha-Chlordane	10	nv	µg/kg dw	7.7 U	3.0 U	3.3 U	5.3 U	8.8 U	7.5 U	7.4 U	15 U	15 U	30 U	7.3 U
Heptachlor	10	nv	µg/kg dw	7.7 U	3.0 U	3.3 U	5.3 U	8.8 U	7.5 U	7.4 U	15 U	15 U	30 U	7.3 U

^a Samples located on the mound; no pre-sand placement samples were collected

nv – no value available for this chemical

Shaded cells indicate values obtained from the pre-sand placement sample that have replaced the PDM result

Bold indicates an SQS exceedance

Underline indicates a CSL exceedance

Italics indicate a value that is the mean of laboratory replicates

**Table 4-7c. Combined PDM and PSP sample results for all locations for all analytes that exceeded SQS:
EW-PDM-S23 through EW-PDM-S33**

CHEMICAL	SQS	CSL	UNIT	EW-PDM-S23	EW-PDM-S24	EW-PDM-S25	EW-PDM-S26	EW-PDM-S27	EW-PDM-S28	EW-PDM-S29	EW-PDM-S30	EW-PDM-S31	EW-PDM-S32	EW-PDM-S33
Mercury	0.41	0.59	mg/kg dw	<i>0.12</i>	10.9	0.64	0.45	0.82	0.56	0.59	0.52	0.73	0.51	0.58
Zinc	410	960	mg/kg dw	102	186	152	<i>115</i>	281	340	260	147	250	177	134
Acenaphthene	16	57	mg/kg OC-dw	3.0 U	4.5	1.8 U	3.5	4.0	6.3 U	1.0 U	6.6 J	0.96 U	1.1 U	3.2
Fluoranthene	160	1,200	mg/kg OC-dw	16	27	11	19	22	11	1.9	58	2.8	4.6	13
Fluorene	23	79	mg/kg OC-dw	3.0 U	6.0	1.8	5.8	5.4	6.3 U	1.0 U	8.4 J	0.96 U	1.1 U	3.5
Phenanthrene	100	480	mg/kg OC-dw	9.4	21	8.2	22	19	8.4	1.1	29	1.4	2.6	8.1
Total HPAH (calc'd)	960	5,300	mg/kg OC-dw	55	110 J	46 J	88 J	110 J	46 J	3.9	190	7.4	23	66 J
Total LPAH (calc'd)	370	780	mg/kg OC-dw	13	43	15	43	39	8.4	1.1	59 J	1.4	3.9	19
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dw	14	43	13	53	59	30	1.3	41	1.5	4.7	29
Butyl benzyl phthalate	4.9	64	mg/kg OC-dw	3.0 U	1.9 U	1.8 U	1.5 U	1.8 U	6.3 U	1.0 U	9.9 U	0.96 U	1.1 U	2.1 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dw	1.2 J	0.84 J	0.36 J	0.48 U	0.33 U	0.40 U	0.55 J	0.37 U	0.34 U	1.2 J	0.40 U
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dw	0.19 U	0.17 J	0.21 J	0.24 J	0.087 J	0.078 U	0.37 J	0.076 U	0.066 U	0.082 U	0.079 U
1,3-Dichlorobenzene	170	nv	µg/kg dw	7.1 J	4.6 J	5.6 J	2.2 J	1.5 U	1.4 U	3.0 J	1.4 U	1.3 U	1.5 U	1.4 U
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dw	5.3	2.1 J	1.7 J	1.0 J	0.24 J	0.13 J	0.65 J	0.12 J	0.11 J	0.30 J	0.079 U
2,4-Dimethylphenol	29	29	µg/kg dw	19 U	32 U	30 U	58 U	41 U	150 U	20 U	130 U	19 U	20 U	31 U
2-Methylphenol	63	63	µg/kg dw	19 U	32 U	30 U	58 U	41 U	150 U	20 U	130 U	19 U	20 U	31 U
Benzoic acid	650	650	µg/kg dw	190 U	320 U	300 U	580 U	410 U	1,500 U	200 U	1,300 U	190 U	200 U	310 U
Benzyl alcohol	57	73	µg/kg dw	19 U	32 U	30 U	58 U	41 U	150 U	20 U	130 U	19 U	20 U	31 U
Hexachlorobenzene	0.38	2.3	mg/kg OC-dw	3.0 U	0.30 U	0.056 U	0.12 U	0.45 U	0.20 U	1.0 U	0.47 U	0.96 U	1.1 U	0.065 U
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dw	3.0 U	0.30 U	0.13 U	0.12 U	0.45 U	0.20 U	1.0 U	0.47 U	0.96 U	1.1 U	0.065 U
N-Nitrosodiphenylamine	11	11	mg/kg OC-dw	3.0 U	1.9 U	1.8 U	1.5 U	3.7	6.3 U	1.0 U	9.9 U	0.96 U	1.1 U	2.1 U
Pentachlorophenol	360	690	µg/kg dw	96 U	160 U	150 U	290 U	210 U	760 U	98 U	660 U	97 U	100 U	150 U
Total PCBs (calc'd)	12	65	mg/kg OC-dw	860	36 J	48	22 J	48	24	17	31	32	30 J	16
Total DDTs (calc'd)	6.9	69	µg/kg dw	9.7 U	9.8 U	4.3 U	60 U	20 U	24 U	89 U	12 U	57 U	33 UJ	2.8 U
Aldrin	10	nv	µg/kg dw	4.9 U	4.9 U	0.96 U	4.9 U	9.9 U	4.8 U	10 U	6.2 U	9.5 U	8.9 UJ	0.97 U
Dieldrin	10	nv	µg/kg dw	550 U	58 U	10 U	94 U	64 U	22 U	53 U	38 U	91 U	18 UJ	17 U
gamma-BHC	10	nv	µg/kg dw	4.9 U	4.9 U	0.96 U	4.9 U	9.9 U	4.8 U	10 U	6.2 U	9.5 U	8.9 UJ	0.97 U
alpha-Chlordane	10	nv	µg/kg dw	4.9 U	4.9 U	0.96 U	8.1 U	9.9 U	4.8 U	37 U	6.2 U	55 U	8.9 UJ	0.97 U
Heptachlor	10	nv	µg/kg dw	4.9 U	4.9 U	0.96 U	9.9 U	9.9 U	4.8 U	10 U	6.2 U	9.5 U	8.9 UJ	2.3 U

^a Samples located on the mound; no pre-sand placement samples were collected

nv – no value available for this chemical

Shaded cells indicate values obtained from the pre-sand placement sample that have replaced the PDM result
Bold indicates an SQS exceedance
Underline indicates a CSL exceedance
Italics indicate a value that is the mean of laboratory replicates

**Table 4-7d. Combined PDM and PSP sample results for all locations for all analytes that exceeded SQS:
EW-PDM-S34 through EW-PDM-S44**

CHEMICAL	SQS	CSL	UNIT	EW-PDM-S34	EW-PDM-S35	EW-PDM-S36	EW-PDM-S37	EW-PDM-S38	EW-PDM-S39	EW-PDM-S40	EW-PDM-S41	EW-PDM-S42	EW-PDM-S43	EW-PDM-S44
Mercury	0.41	0.59	mg/kg dw	0.38	<i>0.31</i>	0.32	0.47	0.54	0.45	0.45	<u>0.94</u>	0.57	<u>1.93</u>	<u>1.09</u>
Zinc	410	960	mg/kg dw	174	127	283	281	150	248	390	309	148	237	173
Acenaphthene	16	57	mg/kg OC-dw	2.1 U	2.2 U	7.9 U	1.4 U	6.9 U	1.2 U	5.6	0.68 U	1.9 U	1.0 U	1.4 U
Fluoranthene	160	1,200	mg/kg OC-dw	18	15	19	2.6	4.7 J	3.5	34	3.1	17	5.0	5.1
Fluorene	23	79	mg/kg OC-dw	2.1 U	2.2 U	7.9 U	1.4 U	6.9 U	1.2 U	6.9	0.75	1.9 U	1.0 U	1.4 U
Phenanthrene	100	480	mg/kg OC-dw	6.5	9.8	10	1.4 U	6.9 U	1.3	13	2.2	5.6	2.2	1.7
Total HPAH (calc'd)	960	5,300	mg/kg OC-dw	93 J	70 J	85 J	8.8	9.9 J	11	140 J	11	81	28	21
Total LPAH (calc'd)	370	780	mg/kg OC-dw	10	13	10	1.4 U	6.9 U	1.3	35	3.7	9.1	3.4	1.7
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dw	39	12	39	1.4 U	3.8 J	5.2	56	5.6	16	1.0 U	5.9
Butyl benzyl phthalate	4.9	64	mg/kg OC-dw	2.1 U	2.2 U	7.9 U	1.4 U	6.9 U	1.2 U	1.4 U	0.68 U	1.9 U	1.0 U	1.4 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dw	0.38 J	0.52 U	3.5	0.47 U	0.43 U	0.39 U	1.3 J	0.21 U	0.36 U	0.34 U	0.55 U
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dw	0.078 U	0.11 U	0.11 J	0.096 U	0.085 U	0.075 U	0.082 U	0.043 U	0.072 U	0.070 U	0.11 U
1,3-Dichlorobenzene	170	nv	µg/kg dw	1.2 U	1.9 U	8.4 J	1.4 U	1.4 U	1.2 U	3.4 J	1.4 U	1.5 U	1.4 U	1.5 U
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dw	0.16 J	0.47 J	2.2	0.096 U	0.085 U	0.075 U	0.70 J	0.11 J	0.072 U	0.070 U	0.22 J
2,4-Dimethylphenol	29	29	µg/kg dw	35 U	32 U	190 U	20 U	99 U	20 U	35 U	22 U	32 U	20 U	20 U
2-Methylphenol	63	63	µg/kg dw	35 U	32 U	190 U	20 U	99 U	20 U	35 U	22 U	32 U	20 U	20 U
Benzoic acid	650	650	µg/kg dw	350 U	320 U	1,900 U	200 U	990 U	200 U	350 U	220 U	320 U	200 U	200 U
Benzyl alcohol	57	73	µg/kg dw	35 U	32 U	190 U	20 U	99 U	20 U	35 U	22 U	32 U	20 U	20 U
Hexachlorobenzene	0.38	2.3	mg/kg OC-dw	0.064 U	0.069 U	0.20 U	1.4 U	0.069 U	0.22 U	0.20 U	0.68 U	0.059 U	1.0 U	1.4 U
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dw	0.064 U	0.069 U	0.20 U	1.4 U	0.069 U	0.22 U	0.20 U	0.68 U	0.059 U	1.0 U	1.4 U
N-Nitrosodiphenylamine	11	11	mg/kg OC-dw	2.1 U	2.2 U	7.9 U	1.4 U	6.9 U	1.2 U	1.4 U	0.68 U	1.9 U	1.0 U	1.4 U
Pentachlorophenol	360	690	µg/kg dw	170 U	160 U	950 U	98 U	490 U	98 U	170 U	110 U	160 U	98 U	98 U
Total PCBs (calc'd)	12	65	mg/kg OC-dw	20	29	53	12 J	12	32	19	27	16	3.1	41 J
Total DDTs (calc'd)	6.9	69	µg/kg dw	2.0 U	6.1 U	26 U	25 U	5.5 U	7.1 U	25 U	34 U	2.0 U	93 U	44 U
Aldrin	10	nv	µg/kg dw	0.98 U	0.98 U	4.9 U	4.9 U	0.99 U	3.5 U	4.9 U	4.8 U	0.98 U	10 U	18 U
Dieldrin	10	nv	µg/kg dw	16 U	15 U	56 U	22 U	4.1 U	50 U	48 U	42 U	5.4 U	62 U	37 U
gamma-BHC	10	nv	µg/kg dw	0.98 U	0.98 U	4.9 U	4.9 U	0.99 U	3.5 U	4.9 U	4.8 U	0.98 U	10 U	18 U
alpha-Chlordane	10	nv	µg/kg dw	5.2 U	0.98 U	4.9 U	4.9 U	0.99 U	28 U	4.9 U	4.8 U	0.98 U	43 U	18 U
Heptachlor	10	nv	µg/kg dw	0.98 U	0.98 U	4.9 U	4.9 U	0.99 U	3.5 U	4.9 U	8.6 U	0.98 U	10 U	18 U

^a Samples located on the mound; no pre-sand placement samples were collected

nv – no value available for this chemical

Shaded cells indicate values obtained from the pre-sand placement sample that have replaced the PDM result

Bold indicates an SQS exceedance

Underline indicates a CSL exceedance

Italics indicate a value that is the mean of laboratory replicates

Table 4-8. PDM results for EPA discretionary samples located on the mound

CHEMICAL	SQS	CSL	UNIT	EW-PDM-S45 ^a	EW-PDM-S46 ^a	EW-PDM-S47 ^a
Mercury	0.41	0.59	mg/kg dw	<u>1.07 J</u>	<u>1.09 J</u>	<u>1.18 J</u>
Zinc	410	960	mg/kg dw	435	357	444
Acenaphthene	16	57	mg/kg OC-dw	14	3.9	6.5
Fluoranthene	160	1,200	mg/kg OC-dw	52	21	45
Fluorene	23	79	mg/kg OC-dw	13	4.7	8.1
Phenanthrene	100	480	mg/kg OC-dw	35	17	20
Total HPAH (calc'd)	960	5,300	mg/kg OC-dw	190 J	79 J	170 J
Total LPAH (calc'd)	370	780	mg/kg OC-dw	77	37	47
Bis(2-ethylhexyl)phthalate	47	78	mg/kg OC-dw	61	29	85
Butyl benzyl phthalate	4.9	64	mg/kg OC-dw	1.7 U	1.7 U	1.7 U
1,2,4-Trichlorobenzene	0.81	1.8	mg/kg OC-dw	1.7 U	1.7 U	1.7 U
1,2-Dichlorobenzene	2.3	2.3	mg/kg OC-dw	1.7 U	1.7 U	1.7 U
1,3-Dichlorobenzene	170	nv	µg/kg dw	40 U	35 U	42 U
1,4-Dichlorobenzene	3.1	9	mg/kg OC-dw	3.4	1.7 U	3.7
2,4-Dimethylphenol	29	29	µg/kg dw	40 U	35 U	42 U
2-Methylphenol	63	63	µg/kg dw	40 U	35 U	42 U
Benzoic acid	650	650	µg/kg dw	400 U	350 U	420 U
Benzyl alcohol	57	73	µg/kg dw	40 U	35 U	42 U
Hexachlorobenzene	0.38	2.3	mg/kg OC-dw	0.21 U	0.049 U	0.20 U
Hexachlorobutadiene	3.9	6.2	mg/kg OC-dw	0.21 U	0.049 U	0.20 U
N-Nitrosodiphenylamine	11	11	mg/kg OC-dw	1.7 U	1.7 U	1.7 U
Pentachlorophenol	360	690	µg/kg dw	200 U	170 U	210 U
Total PCBs (calc'd)	12	65	mg/kg OC-dw	<u>90 J</u>	31 J	<u>100</u>
Total DDTs (calc'd)	6.9	69	µg/kg dw	30 U	19 U	20 U
Aldrin	10	nv	µg/kg dw	4.9 U	0.98 U	4.9 U
Dieldrin	10	nv	µg/kg dw	51 U	21 U	26 U
gamma-BHC	10	nv	µg/kg dw	4.9 U	0.98 U	4.9 U
alpha-Chlordane	10	nv	µg/kg dw	4.9 U	2.8 U	4.9 U
Heptachlor	10	nv	µg/kg dw	9.9 U	0.98 U	4.9 U

^a Samples located on the mound; no pre-sand placement samples were collected

Bold indicates an SQS exceedance
Underline indicates a CSL exceedance

nv – no value available for this chemical

4.4 POREWATER TBT AND SEDIMENT CONVENTIONALS

4.4.1 Tributyltin

Tributyltin (TBT) was undetected in all porewater samples, the reporting limits ranged from 0.022µg/L to 0.072µg/L which are all below the DMMP SL for TBT in porewater (0.15 µg/L).

4.4.2 Sediment conventionals

Each PDM sediment sample was analyzed for apparent grain size (Table 4-9). The results are consistent with the sediment descriptions in Attachment A. The raw laboratory results for grain size are presented in Attachment D.

Table 4-9. Sediment grain size results

SAMPLE ID	% ROCKS	% SAND	% SILT	% CLAY	% FINES ^a
EW-PDM-S1	0.1 U	55.8	37.2	6.9	44.1
EW-PDM-S2	0.1 U	84.7	12.2	3.1	15.3
EW-PDM-S3	0.1	80.8	15.0	4.2	19.2
EW-PDM-S4	0.1 U	52.2	36.9	10.9	47.8
EW-PDM-S5	0.1 U	43.1	49.4	7.5	56.9
EW-PDM-S6	3.9	75.7	14.3	6.3	20.6
EW-PDM-S7	0.1 U	53.7	37.3	9.1	46.4
EW-PDM-S8	0.1 U	58.9	32.1	9.0	41.1
EW-PDM-S9	0.1 U	10.9	59.8	29.3	89.1
EW-PDM-S10	0.1 U	19.2	52.0	28.8	80.8
EW-PDM-S11	0.2	70.0	20.8	9.1	29.9
EW-PDM-S12	0.1 U	49.2	38.4	12.4	50.8
EW-PDM-S13	0.2 ^b	49.8 ^b	40.4 ^b	9.7 ^b	50.1 ^b
EW-PDM-S14	0.1 U	47.1	38.9	14.0	52.9
EW-PDM-S15	0.1 U	58.3	32.0	9.6	41.6
EW-PDM-S16	0.2	50.6	35.7	13.6	49.3
EW-PDM-S17	0.1 U	54.5	37.6	8.1	45.7
EW-PDM-S18	0.1 U	53.7	37.4	8.8	46.2
EW-PDM-S19	0.1 U	53.1	36.0	10.8	46.8
EW-PDM-S20	0.1 U	57.2	34.1	8.7	42.8
EW-PDM-S21	0.1 U	62.1	30.8	7.1	37.9
EW-PDM-S22	0.1 U	60.4	31.1	8.5	39.6
EW-PDM-S23	0.8	65.4	26.6	7.0	33.6
EW-PDM-S24	0.6	25.7	49.0	24.7	73.7
EW-PDM-S25	0.1 U	15.8	51.6	32.6	84.2
EW-PDM-S26	0.1	35.7	41.4	22.9	64.3
EW-PDM-S27	0.1	25.6	45.1	29.1	74.2
EW-PDM-S28	0.2	27.4	50.0	22.4	72.4



SAMPLE ID	% ROCKS	% SAND	% SILT	% CLAY	% FINES ^a
EW-PDM-S29	0.1U	23.2	54.4	22.5	76.9
EW-PDM-S30	0.1U	14.1	57.5	28.4	85.9
EW-PDM-S31	0.1U	30.8	50.5	18.6	69.1
EW-PDM-S32	0.4	37.1	41.8	20.5	62.3
EW-PDM-S33	1.1	35.1	40.0	23.7	63.7
EW-PDM-S34	0.1	33.1	42.7	23.9	66.6
EW-PDM-S35	0.1U	16.7	49.4	34.0	83.4
EW-PDM-S36	0.2	30.3	51.5	18.0	69.5
EW-PDM-S37	0.1	12.7	54.9	32.5	87.4
EW-PDM-S38	0.1U	7.7	60.6	31.6	92.2
EW-PDM-S39	0.1	18.1	53.7	28.3	82.0
EW-PDM-S40	0.1U	21.7	57.4	20.6	78.0
EW-PDM-S41	0.1	21.9	55.8	22.0	77.8
EW-PDM-S42	0.1U	5.3	60.2	34.7	94.9
EW-PDM-S43	0.1U	24.0	56.6	19.3	75.9
EW-PDM-S44	0.1U	23.0	53.4	23.6	77.0
EW-PDM-S45	0.6	33.5	44.6	21.3	65.9
EW-PDM-S46	0.1U	15.0	51.2	33.8	85.0
EW-PDM-S47	0.2	38.9	51.2	18.5	69.7
EW-PDM-S48	0.1U	89.7	42.3	2.8	45.1
EW-PDM-S49	0.1	18.6	7.4	26.8	34.2
EW-PDM-S50	0.1U	21.5	54.5	26.2	80.7

^a percent fines is calculated from the sum of percent silt and percent clay

^b results averaged with laboratory replicate(s)

Each sample was analyzed for total solids and TOC (Tables 4-10 and 4-11).

Table 4-10. Percent solids and TOC results for PDM sampling

SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)	SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)
EW-PDM-S1	61.40	0.801	EW-PDM-S26	43.50	4.00
EW-PDM-S2	68.90	0.585	EW-PDM-S27	48.80	2.22
EW-PDM-S3	65.60 ^a	1.22 ^a	EW-PDM-S28	48.10	2.37
EW-PDM-S4	63.40	0.940	EW-PDM-S29	47.50	1.89
EW-PDM-S5	66.40	0.607	EW-PDM-S30	52.80	1.31
EW-PDM-S6	64.90	1.18	EW-PDM-S31	52.00	1.72
EW-PDM-S7	63.40	1.23	EW-PDM-S32	56.30	1.44
EW-PDM-S8	61.10	1.68	EW-PDM-S33	57.20	1.49
EW-PDM-S9	56.80	1.67	EW-PDM-S34	54.30	1.69
EW-PDM-S10	49.60	2.23	EW-PDM-S35	52.40	1.43
EW-PDM-S11	64.6 ^a	1.15 ^a	EW-PDM-S36	46.03 ^a	2.40 ^a
EW-PDM-S12	61.00	1.06	EW-PDM-S37	49.67 ^a	2.31 ^a
EW-PDM-S13	66.80	0.641	EW-PDM-S38	53.40	1.44



SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)	SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)
EW-PDM-S14	60.50	1.08	EW-PDM-S39	48.10	2.54
EW-PDM-S15	59.10	1.16	EW-PDM-S40	47.40	2.48
EW-PDM-S16	56.50	1.64	EW-PDM-S41	49.30	1.85
EW-PDM-S17	62.00	1.08	EW-PDM-S42	53.50 ^a	1.67
EW-PDM-S18	63.10	1.02	EW-PDM-S43	48.90	2.25
EW-PDM-S19	60.60 ^b	1.39 ^b	EW-PDM-S44	54.30	1.74
EW-PDM-S20	62.40	1.22	EW-PDM-S45	49.70	2.31
EW-PDM-S21	63.90	0.997	EW-PDM-S46	50.40	2.02
EW-PDM-S22	62.30	1.09	EW-PDM-S47	48.90	2.46
EW-PDM-S23	58.70	1.48	EW-PDM-S48	68.10	0.771
EW-PDM-S24	52.40	1.65 ^a	EW-PDM-S49	49.40	2.05
EW-PDM-S25	54.90	1.71	EW-PDM-S50	52.75 ^b	1.74 ^b

^a results averaged with laboratory replicate(s)

^b results averaged with field duplicate

dw - dry weight basis

Table 4-11. Percent solids and TOC results for PSP sampling

SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)	SAMPLE ID	TOTAL SOLIDS (%)	TOC (% DW)
EW-PDM-S4b	63.97 ^a	1.18 ^a	EW-PDM-S27b	52.70	2.29
EW-PDM-S6b	69.10	0.638	EW-PDM-S28b	55.20	1.80
EW-PDM-S7b	59.40	2.32	EW-PDM-S29b	54.60	1.99
EW-PDM-S8b	63.70	1.52	EW-PDM-S30b	55.80	1.85
EW-PDM-S9b	51.70	2.06	EW-PDM-S31b	54.50	1.98
EW-PDM-S10b	56.87 ^a	1.69 ^a	EW-PDM-S32b	53.20	1.84
EW-PDM-S14b	58.20	1.94	EW-PDM-S33b	55.80	1.78
EW-PDM-S15b	59.80	1.62	EW-PDM-S34b	59.40	1.53
EW-PDM-S16b	58.80	1.76	EW-PDM-S35b	61.77 ^a	1.35 ^a
EW-PDM-S18b	68.50	0.702	EW-PDM-S36b	62.00	1.40
EW-PDM-S19b	69.10	1.01	EW-PDM-S37b	55.00	1.46
EW-PDM-S20b	62.60	1.35	EW-PDM-S38b	55.40	1.65
EW-PDM-S21b	65.80	1.18	EW-PDM-S39b	55.80 ^b	1.52 ^b
EW-PDM-S22b	56.40	3.08	EW-PDM-S40b	55.20	1.71
EW-PDM-S23b	67.50	0.641	EW-PDM-S41b	48.20	3.22
EW-PDM-S24b	70.00	0.890	EW-PDM-S42b	54.70	2.09
EW-PDM-S25b	56.80	2.03	EW-PDM-S43b	53.90	2.00
EW-PDM-S26b	58.80	1.44	EW-PDM-S44b	56.60	1.38

^a results averaged with laboratory replicate(s)

^b results averaged with field duplicate

dw - dry weight basis

4.5 DATA VALIDATION RESULTS

The combined PDM and PSP datasets were validated by EcoChem Inc. The data validation was conducted in accordance with the data validation requirements in the QAPP. The validation results are summarized below by analyte. The complete data validation report is presented in Attachment C. The data validation report includes sample index tables that identify the specific samples contained in each sample delivery group (SDG).

All analyses were conducted within the specified holding times with the exception of TBT porewater analyses of 13 porewater samples, analyzed two days after the seven-day holding time. The cooler temperatures were reviewed and were determined to be acceptable.

4.5.1 Organochlorine pesticides

Surrogate recoveries were less than the lower control limit in EW-PDM-S32. No pesticides were reported as detected in this sample and all reporting limits were UJ qualified. The recovery of endrin aldehyde was less than the lower control limit of 30% in the LCS associated with SDG HQ39. Endrin aldehyde was not detected in any of the sediment samples in this SDG; the reporting limits were therefore UJ qualified due to potential low bias.

4.5.2 PCB (Aroclors)

The %R value for Aroclor 1260 in the MSD performed on the PSP sample EW-PDM - S24b was greater than the upper control limit. In addition, the relative percent difference (RPD) value for Aroclor 1260 was greater than the upper control limit. The Aroclor 1260 result in the parent sample was qualified as estimated (J-qualified).

The values reported for Aroclor 1260 in samples EW-PDM-S40 and EW-PDM-S45 were greater than the linear range of the instrument. No dilution analyses were reported. The Aroclor 1260 results in these samples were qualified as estimated (J-qualified).

4.5.3 Porewater tributyltin

The porewater TBT concentration in EW-PDM-S41b was qualified as estimated due to poor spectral match that may have resulted from analytical interference. The TBT result for this sample was UJ-qualified.

The initial results for all surrogates and spikes in samples in SDG HU26 (13 porewater samples) were below control limits for samples extracted on March 8, 2005. The laboratory re-extracted the entire batch on March 11, 2005, 9 days after extraction (two days beyond the 7-day holding time for these samples). All results for this SDG were nondetected and UJ-qualified as a result.



4.5.4 Chlorobenzenes by VOC method (EPA Method 8260)

Chlorobenzene results in several samples were qualified as estimated (J-qualified) due to poor spectral match. In addition, the MS/MSD %Rs for 1,2,4-trichlorobenzene were 28.5% and 26.9%, which are below the control limit of 30%. The 1,2,4-trichlorobenzene reporting limit in the parent sample was qualified as estimated (UJ-qualified) for potential low bias.

4.5.5 Semivolatile organic compounds

Di-*n*-butyl phthalate was detected in one method blank sample associated with SDG HQ 46. The sample concentrations were compared to an action level of 10 times the blank concentration and the reported di-*n*-butyl phthalate concentration in one sample, EW-PDM-S100 was qualified as not detected due to potential blank contamination.

Percent difference values greater than control limits were observed in the continuing calibration for benzoic acid and benzyl alcohol. The benzoic acid reporting limits were qualified as estimated (J-qualified) for two rinsate blank samples. There were no detected results for benzyl alcohol and reporting limits for samples in SDG HR20 were qualified as estimated due to potential low bias.

The detected results for 4-methyl phenol were qualified as estimated due to poor spectral matches.

The internal standard results for perylene-d12 were less than the control limit for all samples except EW-PDM-S42 in SDG HQ39 and one sample in SDG HR19 (EW-PDM-S10). All samples with outlying internal standard results were re-analyzed at a 5 times dilution that resulted in acceptable internal standard areas. Both analyses were reported. Only the results associated with the perylene-d12 internal standard were evaluated from the dilution analysis. To provide the lowest possible RL and most usable data for the analytes associated with the perylene-d12 internal standard, the following rules were used to select results:

- ◆ If the analyte was detected in both the initial and dilution analysis, the result from the dilution analysis result was selected
- ◆ If the analyte was not detected in either analysis, the reporting limit from the initial analysis was selected and qualified as estimated (UJ-qualified)
- ◆ If the analyte was detected in the initial analysis and not detected in the dilution, the value from the initial analysis was selected and qualified as estimated (J-qualified)

4.5.6 Metals and mercury

One nondetected result for mercury (EW-PDM-S48) was rejected due to a MS recovery less than 30%.

The recoveries of antimony in the MS samples were less than the control limit of 30% in most cases. The laboratory did not originally analyze post-digestion spikes; the analysis of these samples was requested following the initial validation review. All post-digestion spike recoveries were within the control limits of 75-125%. Because the post-digestion recoveries were acceptable, nondetected antimony results were qualified as estimated due to possible low bias. All the antimony results were nondetected.

The laboratory duplicate results for mercury were greater than control limits for two samples (EW-PDM-S42 and EW-PDM-S34). The mercury results for these samples were qualified as estimated (J-qualified).

4.5.7 Conventionals (total organic carbon, grain size, and total solids)

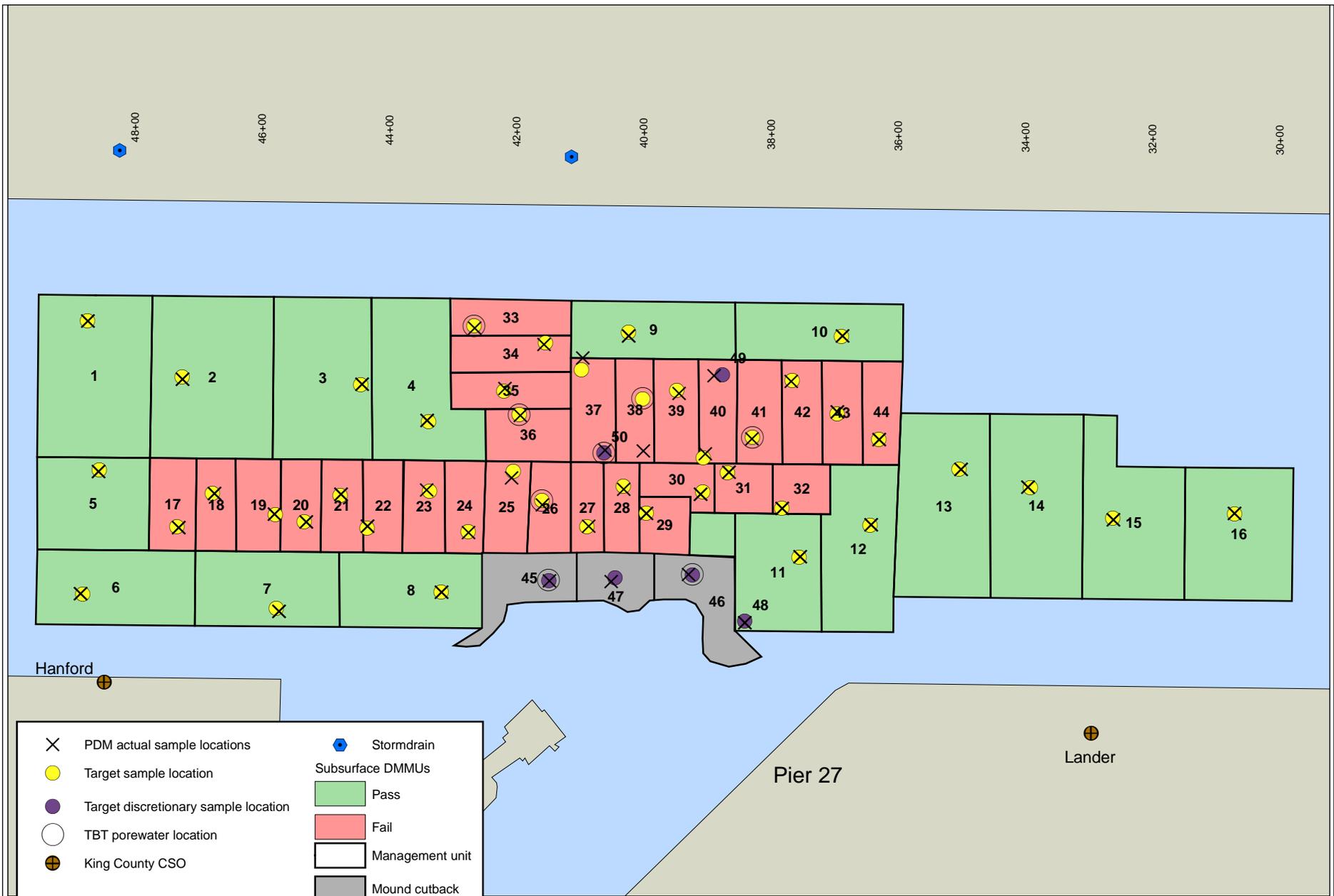
There were no validation qualifiers for the total organic carbon, grain size and total solids results.

5.0 References

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- Plumb R, Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples. Waterways Experiment Station, US Army Corps of Engineers, Vicksburg, MS.
- PSEP. 1986. Recommended protocols for measuring conventional sediment variables in Puget Sound. Prepared for the Puget Sound Estuary Program. US Environmental Protection Agency, Region 10, Seattle, WA.
- Windward. 2003a. East Waterway Operable Unit, Phase 1 removal action: Post dredge monitoring quality assurance project plan. Prepared for Port of Seattle. Windward Environmental LLC, Seattle, WA.
- Windward. 2003b. East Waterway, Harbor Island Superfund site: Nature and extent of contamination. Engineering evaluation/cost analysis for East Waterway. Prepared for the Port of Seattle. Windward Environmental LLC, Seattle, WA.
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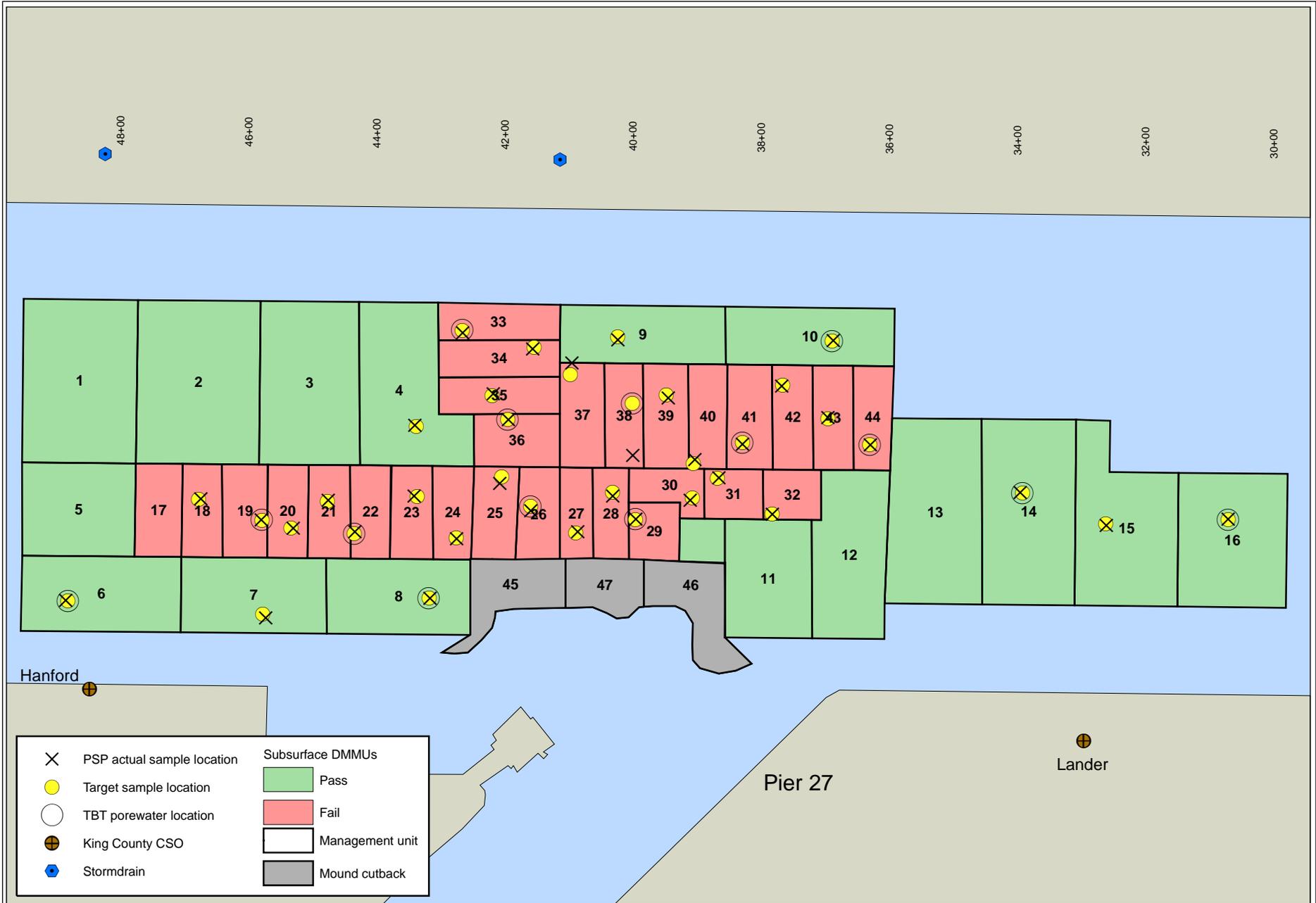
Maps





✕	PDM actual sample locations	◆	Stormdrain
●	Target sample location	■	Subsurface DMMUs
●	Target discretionary sample location	■	Pass
○	TBT porewater location	■	Fail
⊕	King County CSO	□	Management unit
		■	Mound cutback

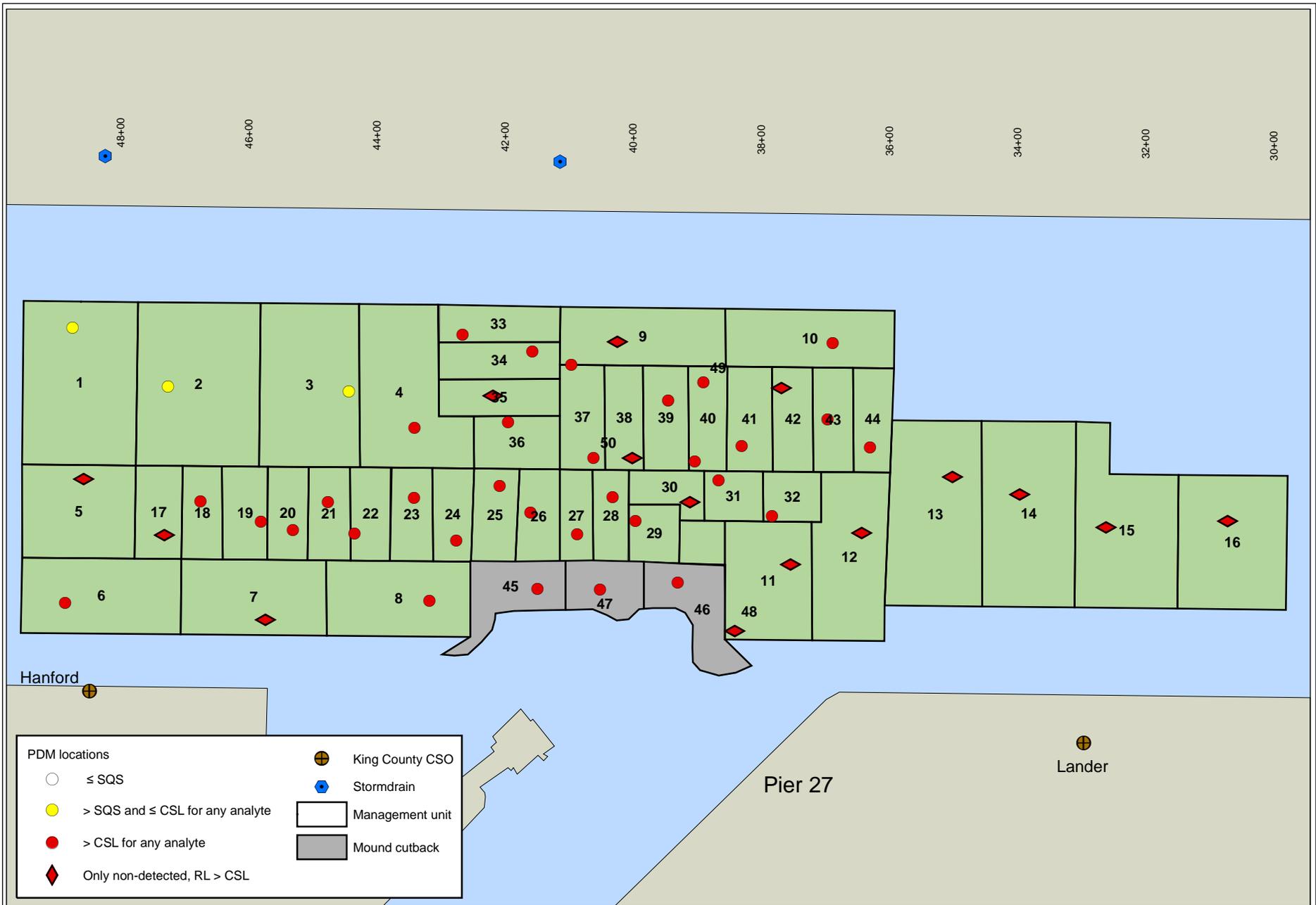
Map 1. PDM locations



✕	PSP actual sample location		Subsurface DMMUs
●	Target sample location		Pass
○	TBT porewater location		Fail
⊕	King County CSO		Management unit
◆	Stormdrain		Mound cutback

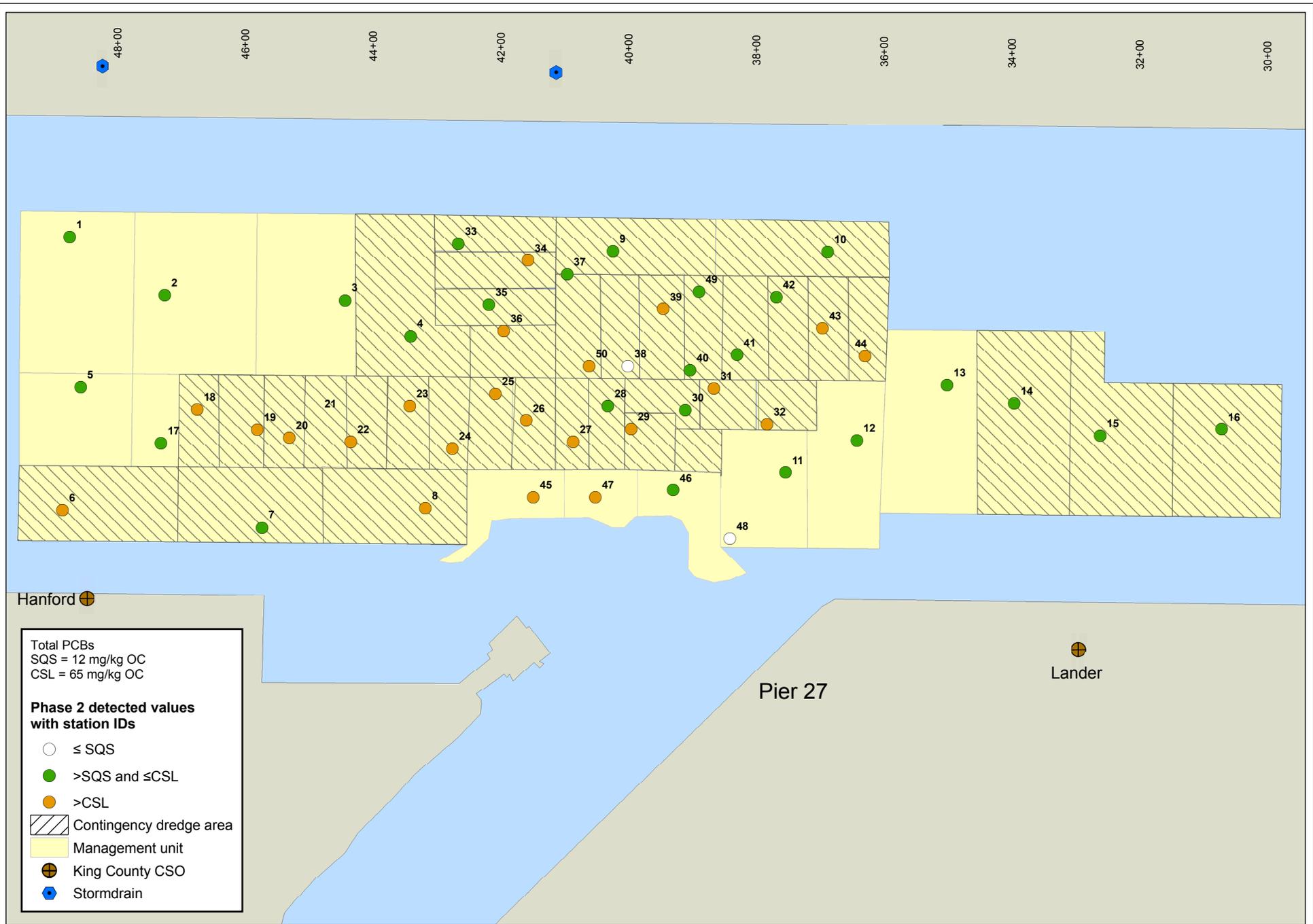
Map 2. PSP locations





Map 3. PDM sample results (detected values and non-detected RLs) compared to SQS and CSL





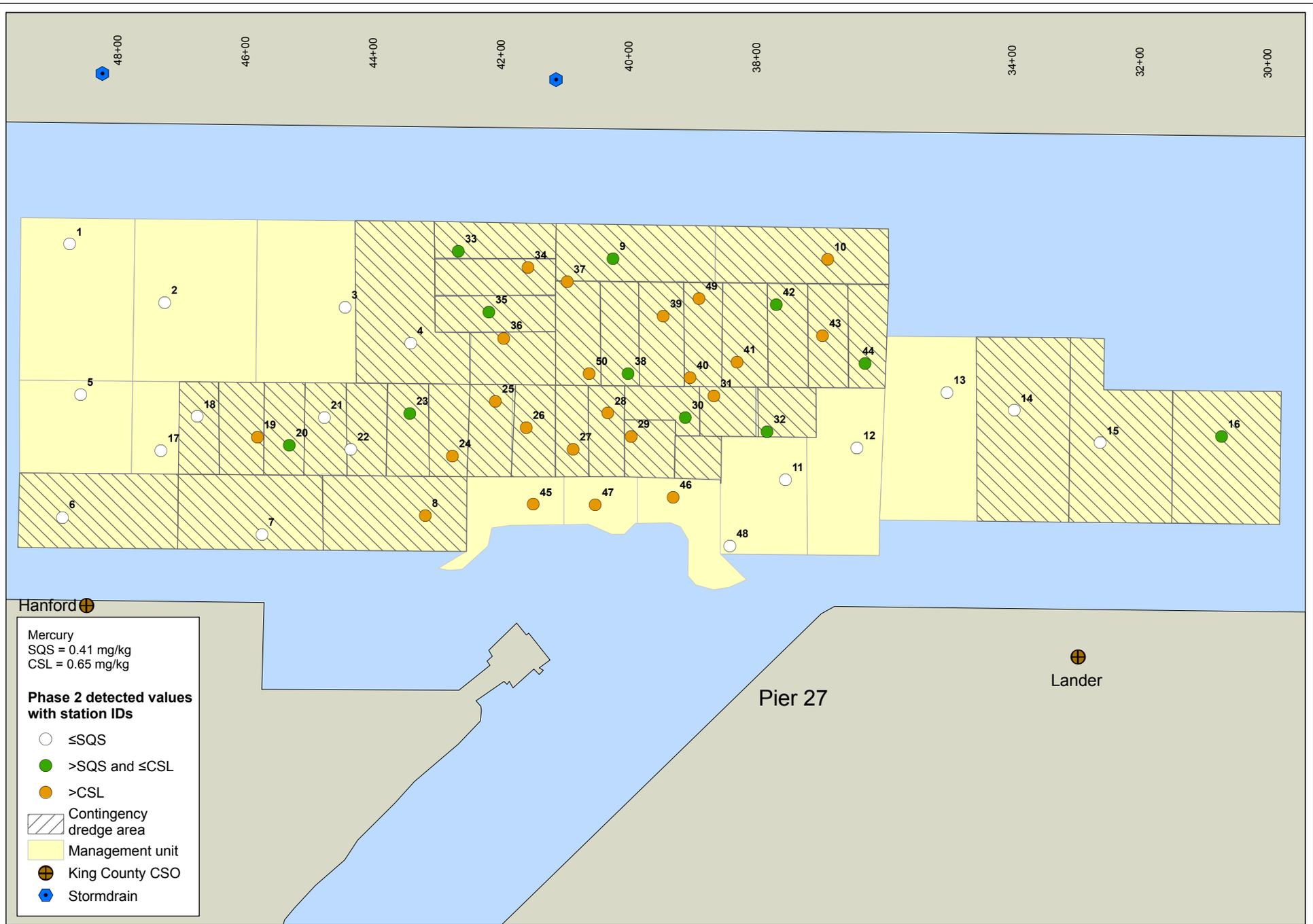
Total PCBs
 SQS = 12 mg/kg OC
 CSL = 65 mg/kg OC

Phase 2 detected values with station IDs

- \leq SQS
- $>$ SQS and \leq CSL
- $>$ CSL
- ▨ Contingency dredge area
- Management unit
- ⊕ King County CSO
- ⊕ Stormdrain

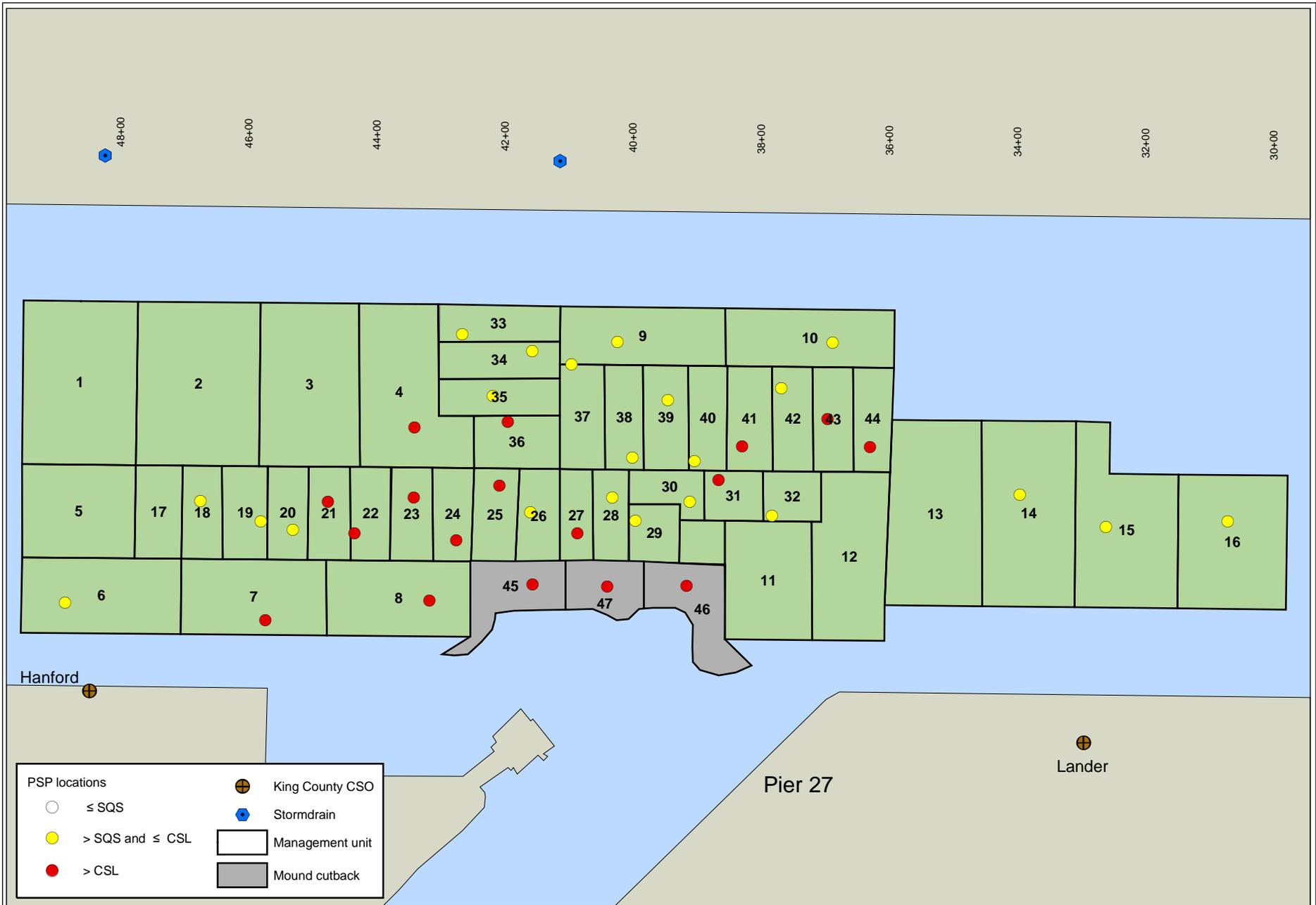
Map 4. PDM PCB results





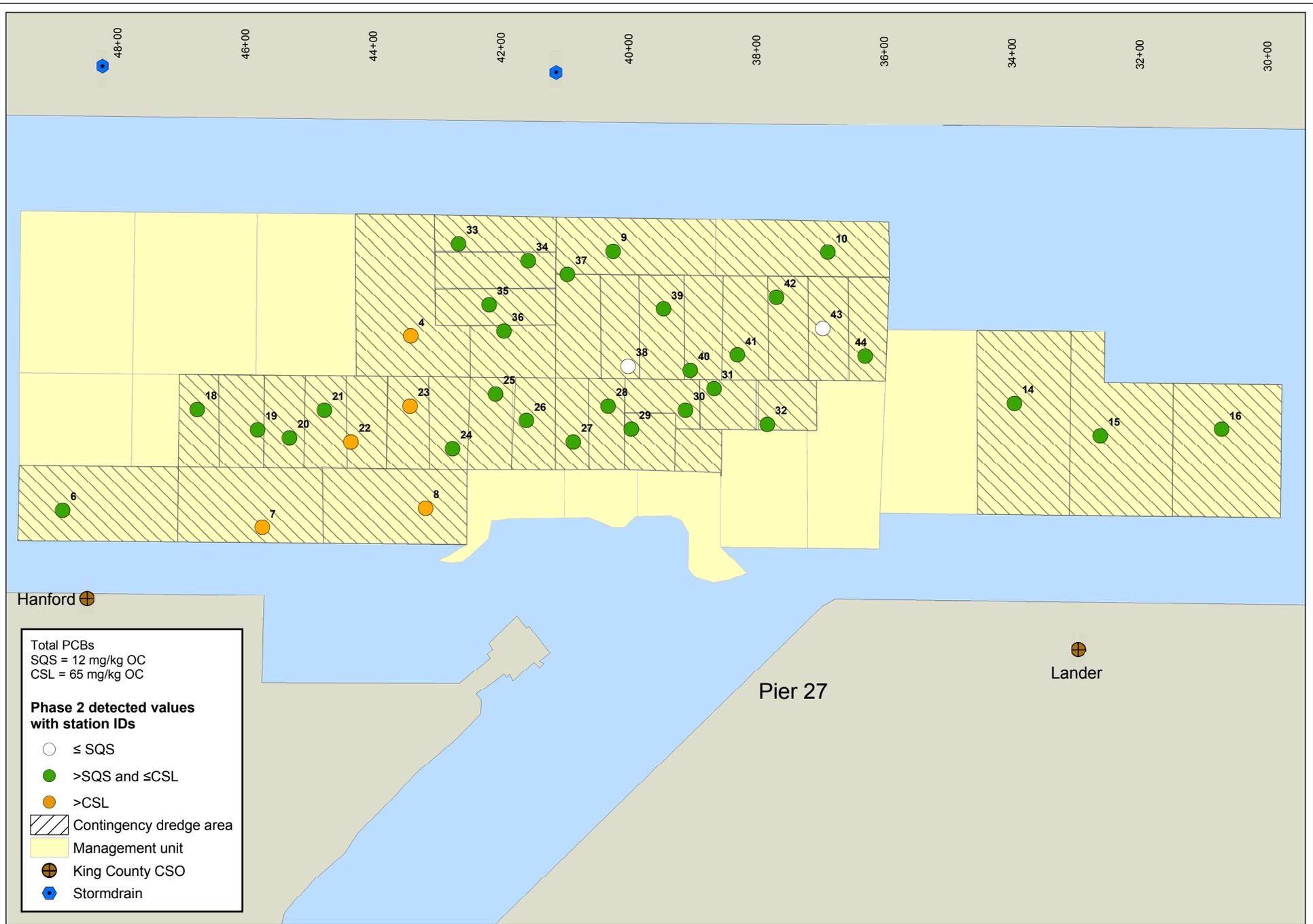
Map 5. PDM Hg results



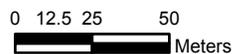


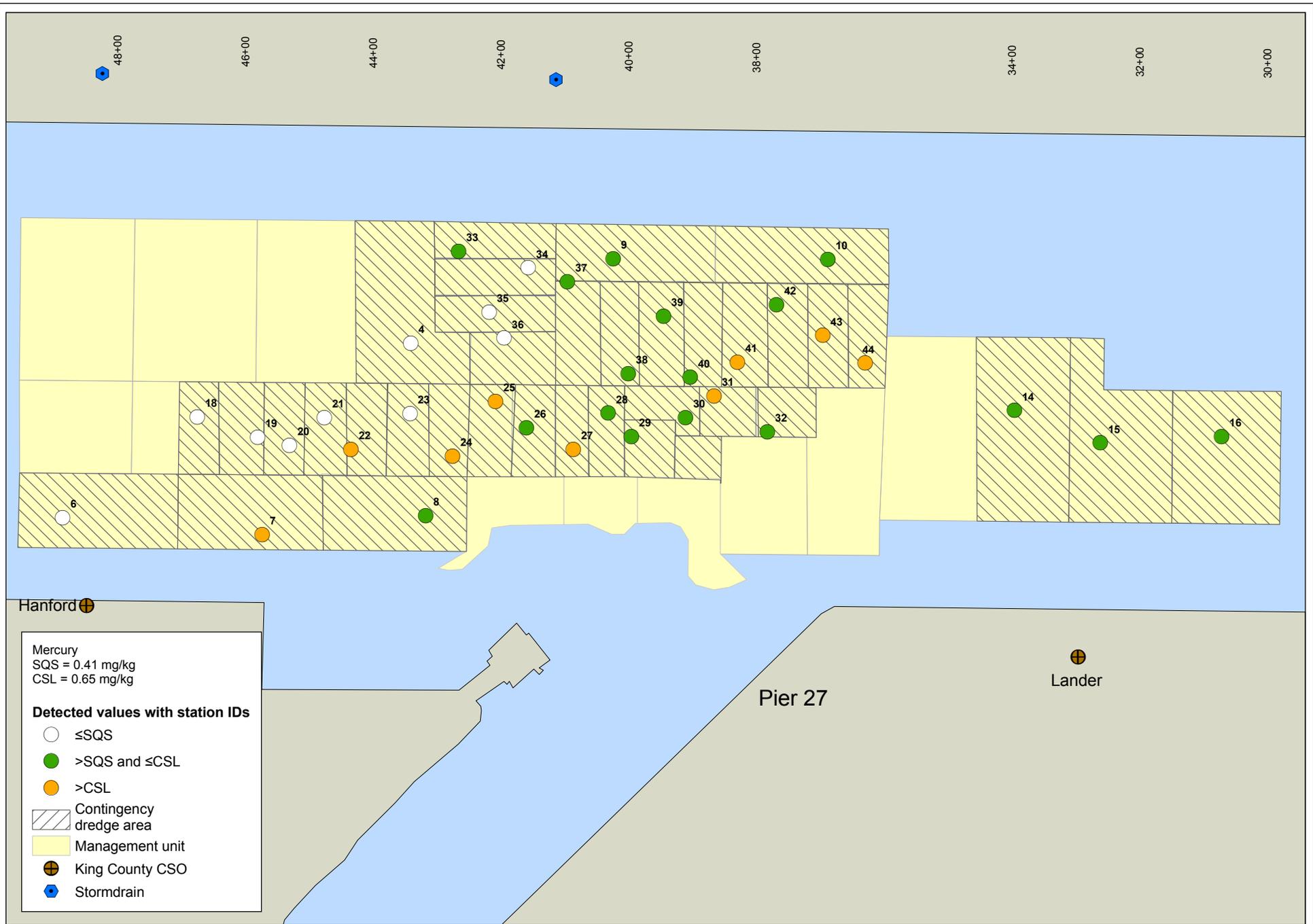
Map 6. PSP sample results (detected values and non-detected RLs) compared to SQS and CSL





Map 7. PSP PCB results





Hanford ⊕

Mercury
 SQS = 0.41 mg/kg
 CSL = 0.65 mg/kg

Detected values with station IDs

- ≤SQS
- >SQS and ≤CSL
- >CSL

▨ Contingency dredge area

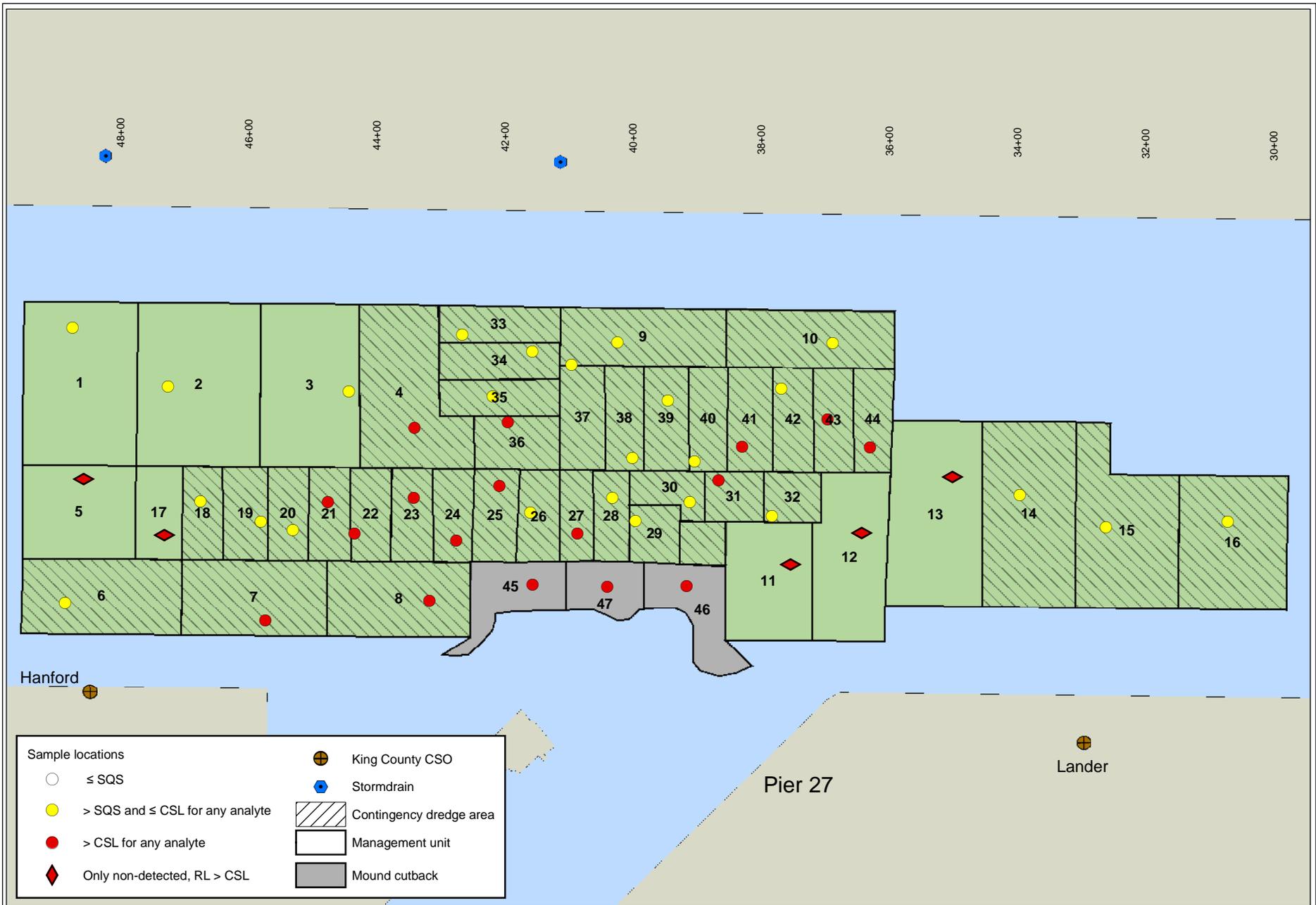
■ Management unit

⊕ King County CSO

⬠ Stormdrain

Map 8. PSP Hg results





Map 9. Combined PDM and PSP results

