Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

Lower Duwamish Waterway Surface Sediment Data Report

FINAL

Prepared for

Lower Duwamish Waterway Group

For submittal to

US Environmental Protection Agency

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Maps

Acronyms

Alpha	Alpha Analytical Lab
ALS	ALS Environmental-Kelso
AOC	Administrative Order on Consent
ARI	Analytical Resources, Inc.
Axys	SGS Axys Analytical Services, Ltd.
BEHP	bis(2-ethylhexyl)phthalate
COC	chain of custody
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CRM	certified reference material
CV-AFS	cold vapor-atomic fluorescence spectrometry
DCM	dichloromethane
DQO	data quality objective
dw	dry weight
ECD	electron capture detector
EcoChem	EcoChem, Inc.
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
ENR	enhanced natural recovery
EPA	US Environmental Protection Agency
FD	field duplicate
GC	gas chromatography
HRGC/HRMS	high-resolution gas chromatography / high-resolution mass spectrometry
ICP	inductively coupled plasma
ID	identification
LCS	laboratory control standard
LDW	Lower Duwamish Waterway
MNR	monitored natural recovery
MS	mass spectrometry
MS/MSD	matrix spike / matrix spike duplicate

NAD83	North American Datum of 1983
OC	organic carbon
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PE	polyethylene
PSEP	Puget Sound Estuary Program
QAPP	quality assurance project plan
RAO	remedial action objective
RI	remedial investigation
RM	river mile
ROD	Record of Decision
RPD	relative percent difference
SCO	sediment cleanup objective
SCUM	sediment cleanup user's manual
SDG	sample delivery group
SIM	select ion monitoring
SM	Standard Method
SMS	Washington State Sediment Management Standards
SOP	standard operating procedure
SRM	standard reference material
SVOC	semivolatile organic compound
SWAC	spatially weighted average concentration
TEQ	toxic equivalent
TOC	total organic carbon
UCL	upper confidence limit for the mean
UCT-KED	universal cell technology-kinetic energy discrimination
USACE	US Army Corps of Engineers
Windward	Windward Environmental LLC

1 Introduction

This data report presents the results of chemical analyses of sediment (and associated porewater in a subset of samples) and bank samples collected from the Lower Duwamish Waterway (LDW) from February through June of 2018. These data were collected as part of the third amendment to the Administrative Order on Consent (AOC) (EPA 2016).

Data quality objectives (DQOs) for these samples were presented in the *Pre-Design Studies Work Plan* (Windward and Integral 2017), hereafter referred to as the Work Plan, and in the sediment quality assurance project plan (QAPP) (Windward 2018a). The QAPP—which also includes details regarding project organization, sampling design, analytical methods, and data validation—was approved by the US Environmental Protection Agency (EPA) on February 21, 2018, for the February / March 2018 sampling event (EPA 2018), and on May 31, 2018, for the June sampling event (Windward 2018a).

This sediment data report provides the results of chemical analyses and validation of the following sample types:

- 0–10-cm composite surface sediment samples
- 0–10-cm individual surface sediment samples
- 0-45-cm intertidal sediment samples
- 0-10-cm near-outfall sediment samples
- Bank samples
- Polychlorinated biphenyl (PCB) concentrations in porewater in a subset of the surface sediment samples[1]

Deviations from the QAPP are also summarized in this report.

The remainder of this data report is organized into the following sections:

- Section 2 – Sediment Sampling and Processing
- Section 3 – Analytical Methods
- Section 4 – Results of Chemical Analyses
- Section 5 – References

The text is supported by the following appendices:

- Appendix A – Field Forms, Field Notes, Photos, COCs, and PCB Porewater Forms

[1] The cPAH porewater investigation is addressed in the clam tissue QAPP and associated data report (Windward 2018b, c).

- Appendix B – Memorandum: Dioxins / Furans Analysis of Near-Outfall Sediment, Bank, and Seep Samples
- Appendix C – Data Tables (complete results for all samples)
- Appendix D – Laboratory Reports and Data Validation Report
- Appendix E – Selection of Samples for PCB Porewater Analysis
- Appendix F – Passive Sampler Calculations from the PCB Porewater Investigation

2 Sediment Sampling and Processing

The field methods used in this effort are described in the QAPP (Windward 2018a) and summarized in the following sections. Section 2.1 describes the sample collection methods and sampling locations for the baseline sediment and source (near-outfall sediment and bank) samples. Section 2.2 presents the sample processing, identification, and compositing methods. Section 2.3 describes field deviations from the QAPP.

2.1 Collection Methods and Sampling Locations

2.1.1 Baseline samples

Baseline sediment sampling included the collection of the 0–10-cm surface sediment samples throughout the LDW and the collection of the 0–45-cm sediment samples in the intertidal potential clamming areas and the intertidal beach play areas. Baseline sediment samples for the PCB porewater investigation were also collected. Each of these sample types is described in this section.

2.1.1.1 0–10-cm surface sediment samples

In February / March 2018, a total of 188 0–10-cm baseline surface sediment samples were collected to meet DQOs 1 through 5 described in the QAPP (Windward 2018a) (Map 2-1). Specifically:

- DQOs 1 and 2[2] – To support estimates of site-wide baseline surface sediment concentrations, a total of 168 surface sediment samples were collected from throughout the LDW to form 24 composite samples following a spatially balanced random sampling design.
- DQOs 3 and 4[3] – A total 20 surface sediment samples were collected for individual analysis; these samples, which will be compared to Washington State Sediment Management Standards (SMS) criteria for the protection of benthic organisms, are herein referred to as "SMS sediment samples."[4] Ten of the 20 SMS sediment samples were collected at locations that reoccupied

[2] DQO 1 is: "Establish baseline, site-wide 95% upper confidence limit for the mean (95UCL) concentrations of remedial action objectives (RAOs) 1, 2, and 4 risk drivers" (Windward 2018a). DQO 2 is: "Establish baseline, site-wide spatially weighted average concentration (SWAC) to serve as the foundation for assessing trends from before to after sediment remediation for RAOs 1, 2, and 4 risk drivers."

[3] DQO 3 is: "Compare (on a point-by-point basis) concentrations in baseline samples collected from within MNR areas to the (benthic) cleanup levels presented in ROD Table 20" (Windward 2018a; EPA 2014). DQO 4 is: "Support the evaluation of site-wide trends and comparison of concentrations to predicted natural recovery in MNR areas."

[4] The comparison of these samples to SMS criteria will be presented in the data evaluation report (Task 6 of the Work Plan).

LDW remedial investigation (RI) surface sediment locations in monitored natural recovery (MNR) areas with sediment cleanup objective (SCO) exceedances. The other 10 samples were collected from 10 of the random locations within MNR areas sampled to address DQOs 1 and 2.

- DQO 5[5] – To investigate baseline porewater PCB concentrations in MNR/enhanced natural recovery (ENR) areas to assess the predictability of the relationship between porewater and sediment PCB congener concentrations, 20 locations were sampled: the 10 reoccupied RI locations used in DQO 3, plus an additional 10 reoccupied locations targeted to capture a wider range of PCB concentrations. Passive samplers were deployed *ex situ* for exposure to surface sediments to determine PCB concentrations in porewater (see Section 4.3 and 4.4).

Surface sediment grab sample collection and processing followed standardized procedures for the Puget Sound area that have been developed by the Puget Sound Estuary Program (PSEP) (1997). All but one of these sediment samples were collected with a pneumatic grab sampler deployed from a sampling vessel. Surface sediment location SS-041 was exposed during a lower tide (i.e., not accessible by vessel), so this location was sampled by hand using a pre-cleaned stainless steel spoon.

Target and actual surface sediment location coordinates are provided in Table 2-1 and presented on Maps 2-2 and 2-3. Centroid locations assigned to composite sample data results required for uploading the sediment data to the Washington State Department of Ecology's (Ecology's) Environmental Information Management (EIM) system and Scribe, are shown on Map 2-4.

[5] DQO 5 is: "Estimate baseline porewater concentrations in MNR/ENR areas for PCBs" (Windward 2018a). This DQO is primarily intended to help assess the effect of reduced sediment concentrations on biota exposure and tissue concentrations.

Table 2-1. Surface sediment sampling locations

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
1	02.22.18	1265898	211122	1265927	211128	8.9	01	1266359	211087
2	02.22.18	1266308	211198	1266308	211199	0.3	01	1266359	211087
3	02.22.18	1266484	211200	1266467	211201	5.2	01	1266359	211087
4	02.22.18	1266936	211157	1266937	211156	0.4	01	1266359	211087
5	02.26.18	1266930	210796	1266932	210802	2.0	02	1266514	210493
6	02.22.18	1266734	210776	1266732	210776	0.4	01	1266359	211087
7	02.22.18	1266368	210935	1266368	210935	0.1	01	1266359	211087
8	02.22.18	1266096	211048	1266084	211063	5.6	01	1266359	211087
9	02.26.18	1266122	210482	1266118	210475	2.6	02	1266514	210493
10	02.26.18	1266461	210656	1266463	210659	1.2	02	1266514	210493
11	02.26.18	1266745	210519	1266749	210519	1.1	02	1266514	210493
12	02.26.18	1267024	210662	1267021	210652	3.1	02	1266514	210493
13	03.02.18	1266875	210133	1266874	210134	0.6	03	1266678	209659
14	02.26.18	1266466	210010	1266468	210006	1.2	02	1266514	210493
15	02.26.18	1266201	210156	1266202	210155	0.5	02	1266514	210493
16	03.01.18	1266232	209905	1266238	209906	1.8	03	1266678	209659
17	03.02.18	1266644	209847	1266644	209849	0.8	03	1266678	209659
18	03.02.18	1266889	209622	1266887	209620	0.9	03	1266678	209659
19[c]	03.02.18	1266378	207457	1266405	209611	9.5	03	1266678	209659
20	03.02.18	1266847	209464	1266849	209462	0.8	03	1266678	209659
21	03.02.18	1266550	209331	1266549	209330	0.3	04	1266352	208616
22	03.02.18	1266747	209089	1266747	209089	0.1	03	1266678	209659
23	03.01.18	1266363	208911	1266361	208909	1.1	04	1266352	208616
24	03.02.18	1266579	208918	1266579	208917	0.1	04	1266352	208616
25	02.22.18	1267134	208764	1267134	208763	0.3	05	1267024	208314
26	02.22.18	1267024	208491	1267025	208489	0.6	05	1267024	208314
27	02.22.18	1266802	208602	1266802	208603	0.4	05	1267024	208314

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
28	03.01.18	1266329	208526	1266329	208524	0.4	04	1266352	208616
29	03.01.18	1266042	208466	1266042	208466	0.3	04	1266352	208616
30	03.01.18	1266002	208294	1266003	208297	0.9	04	1266352	208616
31	03.01.18	1266264	208148	1266266	208146	0.8	04	1266352	208616
32	02.22.18	1266644	208081	1266646	208078	1.2	05	1267024	208314
33	02.22.18	1267052	208140	1267051	208138	0.6	05	1267024	208314
34	02.22.18	1267214	208118	1267214	208118	0.1	05	1267024	208314
35	02.22.18	1267256	207737	1267258	207739	0.6	05	1267024	208314
36	02.22.18	1266974	207912	1266974	207913	0.2	06	1266859	207507
37	02.22.18	1266553	207785	1266554	207785	0.4	06	1266859	207507
38	02.23.18	1266280	207918	1266281	207919	0.4	06	1266859	207507
39	02.26.18	1266162	207665	1266165	207665	0.8	07	1266223	207053
40	02.26.18	1266004	207450	1266004	207450	0.1	07	1266223	207053
41	03.02.18	1266368	207458	1266368	207457	0.3	07	1266223	207053
42	02.22.18	1266895	207571	1266902	207587	5.2	06	1266859	207507
43	02.22.18	1267121	207330	1267118	207329	0.7	06	1266859	207507
44	03.02.18	1267607	207351	1267605	207351	0.8	08	1267799	206872
45	02.26.18	1266041	207151	1266043	207146	1.6	07	1266223	207053
46	02.26.18	1266091	206997	1266090	206995	0.5	07	1266223	207053
47	02.26.18	1266488	206523	1266487	206521	0.7	07	1266223	207053
48	02.26.18	1266751	206205	1266759	206207	2.6	07	1266223	207053
49[c]	02.03.18	1267058	206395	1267059	206395	0.1	09	1267596	206185
50	03.01.18	1267297	206453	1267297	206453	0.1	09	1267596	206185
51	02.22.18	1266912	207202	1266915	207202	0.7	06	1266859	207507
52[c]	03.03.18	1267198	207055	1267199	207055	0.4	06	1266859	207507
53	03.02.18	1267406	207198	1267406	207197	0.4	08	1267799	206872
54[c]	03.03.18	1267181	206877	1267182	206877	0.5	08	1267799	206872
55	03.02.18	1267692	206785	1267692	206787	0.7	08	1267799	206872
56[c]	03.02.18	1268110	206782	1268110	206781	0.2	08	1267799	206872

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
57[c]	03.02.18	1268340	206674	1268343	206691	5.2	08	1267799	206872
58[c]	03.02.18	1267938	206574	1267937	206575	0.5	08	1267799	206872
59	03.03.18	1267487	206483	1267486	206483	0.5	09	1267596	206185
60	03.03.18	1267555	206299	1267553	206299	0.5	09	1267596	206185
61	03.03.18	1267893	206373	1267892	206364	3.0	09	1267596	206185
62	03.03.18	1267652	205843	1267651	205843	0.4	09	1267596	206185
63	03.03.18	1268115	205914	1268116	205914	0.4	09	1267596	206185
64	02.22.18	1267854	205272	1267854	205270	0.6	10	1268178	204925
65	02.23.18	1268082	205536	1268082	205537	0.3	10	1268178	204925
66[c]	03.01.18	1268002	204934	1268026	204935	7.4	10	1268178	204925
67	02.23.18	1268140	205193	1268141	205197	1.3	10	1268178	204925
68	02.23.18	1268073	204702	1268074	204701	0.5	10	1268178	204925
69[d]	02.22.18	1268369	204547	1268369	204548	0.3	10	1268178	204925
70[c]	03.01.18	1268362	204272	1268363	204270	0.9	10	1268178	204925
71	03.02.18	1268176	204196	1268173	204191	1.5	11	1268380	203736
72	03.02.18	1268034	203890	1268035	203891	0.7	11	1268380	203736
73	03.02.18	1268462	203887	1268462	203888	0.6	11	1268380	203736
74	03.02.18	1268695	203965	1268694	203963	0.7	11	1268380	203736
75	03.02.18	1268489	203423	1268490	203424	0.6	11	1268380	203736
76	03.02.18	1268728	203668	1268729	203668	0.2	11	1268380	203736
77	03.02.18	1268579	203250	1268580	203249	0.4	11	1268380	203736
78	03.02.18	1268935	203260	1268933	203259	0.9	12	1268986	202832
79[c]	03.02.18	1268705	202804	1268706	202802	0.7	12	1268986	202832
80	03.02.18	1269029	202885	1269031	202886	0.6	12	1268986	202832
81	03.02.18	1269420	203071	1269420	203069	0.7	12	1268986	202832
82[c]	03.02.18	1269246	202851	1269245	202848	1.2	12	1268986	202832
83[c]	03.02.18	1269111	202458	1269112	202458	0.3	12	1268986	202832
84	03.02.18	1268686	202557	1268687	202558	0.2	12	1268986	202832
85	02.28.18	1268959	202210	1268958	202209	0.5	14	1269620	201217

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
86	03.01.18	1269283	202016	1269259	202018	7.2	13	1269989	201497
87	02.28.18	1269122	201791	1269121	201790	0.5	14	1269620	201217
88	03.01.18	1269507	201780	1269487	201777	6.0	13	1269989	201497
89	02.28.18	1269417	201489	1269416	201491	0.6	14	1269620	201217
90	02.28.18	1269724	201445	1269699	201454	8.3	13	1269989	201497
91	02.28.18	1269631	200964	1269633	200965	0.6	14	1269620	201217
92	02.28.18	1269926	201145	1269926	201145	0.2	14	1269620	201217
93	02.27.18	1270676	201561	1270693	201563	5.2	13	1269989	201497
94[c]	03.01.18	1270207	201560	1270205	201560	0.6	13	1269989	201497
95	02.28.18	1270077	201196	1270078	201194	0.6	13	1269989	201497
96[c]	03.01.18	1270066	200700	1270065	200700	0.5	14	1269620	201217
97[c]	03.01.18	1270187	200936	1270188	200936	0.2	13	1269989	201497
98	02.28.18	1270417	200365	1270418	200366	0.5	14	1269620	201217
99[c]	03.01.18	1270552	200561	1270553	200562	0.4	15	1270987	200042
100	02.28.18	1270766	200063	1270766	200062	0.6	15	1270987	200042
101	02.28.18	1270882	200164	1270882	200162	0.6	15	1270987	200042
102	02.28.18	1271153	200301	1271151	200306	1.5	15	1270987	200042
103[c]	03.01.18	1270812	199927	1270813	199925	0.6	15	1270987	200042
104	02.28.18	1271465	199584	1271462	199586	1.2	15	1270987	200042
105	02.28.18	1271190	199632	1271197	199642	3.7	15	1270987	200042
106	02.23.18	1271771	199291	1271773	199290	0.6	16	1272041	198894
107	02.23.18	1271637	199143	1271620	199129	6.9	16	1272041	198894
108	02.23.18	1271805	199040	1271801	199040	1.3	16	1272041	198894
109	02.23.18	1272075	198943	1272072	198945	1.0	16	1272041	198894
110	02.23.18	1272289	198524	1272289	198524	0.1	16	1272041	198894
111	02.23.18	1272408	198862	1272408	198865	0.9	16	1272041	198894
112	02.23.18	1272495	198268	1272496	198266	0.7	16	1272041	198894
113	02.23.18	1273377	198991	1273380	198988	1.3	17	1273054	198242
114	02.23.18	1273308	198798	1273308	198798	0.2	17	1273054	198242

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
115	02.23.18	1272764	198446	1272768	198445	1.3	17	1273054	198242
116[c]	03.01.18	1272747	198211	1272748	198212	0.3	17	1273054	198242
117	02.23.18	1273138	198092	1273138	198076	4.9	17	1273054	198242
118	02.23.18	1273061	197783	1273061	197784	0.3	17	1273054	198242
119	02.23.18	1273404	197864	1273405	197865	0.6	17	1273054	198242
120	02.23.18	1273339	197476	1273339	197476	0.2	18	1274080	197056
121	02.23.18	1273991	197425	1273991	197425	0.1	18	1274080	197056
122	02.23.18	1273879	197159	1273877	197160	0.9	18	1274080	197056
123	02.26.18	1274130	197272	1274128	197270	0.8	18	1274080	197056
124	02.23.18	1274272	196754	1274271	196754	0.4	18	1274080	197056
125	02.23.18	1274746	196687	1274749	196693	1.9	18	1274080	197056
126	02.23.18	1274626	196474	1274627	196472	0.8	18	1274080	197056
127	02.26.18	1275014	196340	1275014	196337	1.0	19	1275310	195922
128	02.26.18	1274828	196306	1274835	196310	2.3	19	1275310	195922
129	02.26.18	1275208	196106	1275210	196106	0.6	19	1275310	195922
130	03.01.18	1275003	196019	1274981	196024	6.9	19	1275310	195922
131	02.26.18	1275656	195800	1275652	195800	1.1	19	1275310	195922
132	02.26.18	1275797	195631	1275804	195638	3.2	19	1275310	195922
133	02.26.18	1275631	195313	1275635	195315	1.3	19	1275310	195922
134	02.28.18	1276003	195042	1276003	195044	0.4	20	1276063	194278
135	02.28.18	1275839	194644	1275837	194644	0.6	20	1276063	194278
136	02.28.18	1276120	194452	1276122	194454	0.7	20	1276063	194278
137	02.28.18	1275935	194525	1275934	194525	0.4	20	1276063	194278
138	02.28.18	1276137	194052	1276137	194052	0.2	20	1276063	194278
139	02.28.18	1275959	193909	1275959	193909	0.0	20	1276063	194278
140	02.28.18	1276224	193542	1276223	193542	0.2	20	1276063	194278
141[c]	03.01.18	1276095	193517	1276096	193518	0.7	21	1276571	193039
142	03.01.18	1276531	193336	1276531	193336	0.2	21	1276571	193039
143	03.01.18	1276205	193099	1276205	193100	0.3	21	1276571	193039

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
144	03.01.18	1276443	193101	1276433	193109	3.8	21	1276571	193039
145	02.27.18	1276137	192780	1276146	192776	2.8	22	1276535	192153
146	03.01.18	1277290	192883	1277301	192879	3.7	21	1276571	193039
147	03.01.18	1276875	192673	1276902	192674	8.3	21	1276571	193039
148	03.01.18	1276648	192704	1276646	192705	0.7	21	1276571	193039
149	02.27.18	1276475	192369	1276478	192369	0.8	22	1276535	192153
150	02.27.18	1276712	192337	1276711	192334	1.2	22	1276535	192153
151	02.27.18	1276553	192135	1276556	192135	0.9	22	1276535	192153
152	02.27.18	1276733	191901	1276735	191902	0.6	22	1276535	192153
153	02.27.18	1276605	191548	1276608	191549	0.8	22	1276535	192153
154	02.27.18	1276842	191610	1276848	191606	2.1	22	1276535	192153
155	02.27.18	1276697	191198	1276696	191197	0.7	23	1276877	190700
156	02.27.18	1276962	191212	1276959	191209	1.0	23	1276877	190700
157	02.27.18	1276780	190739	1276783	190741	1.1	23	1276877	190700
158	02.27.18	1276923	190811	1276924	190810	0.6	23	1276877	190700
159	02.27.18	1276938	190529	1276940	190530	0.7	23	1276877	190700
160	02.27.18	1276639	190539	1276635	190536	1.4	23	1276877	190700
161	02.27.18	1277142	190006	1277140	190006	0.5	23	1276877	190700
162	02.27.18	1277501	190103	1277513	190131	9.0	24	1277878	190216
163	02.27.18	1277409	190229	1277412	190228	0.9	24	1277878	190216
164	02.27.18	1277374	190425	1277371	190426	1.0	24	1277878	190216
165	02.28.18	1277714	190378	1277720	190377	1.7	24	1277878	190216
166	02.28.18	1278097	190240	1278098	190243	1.0	24	1277878	190216
167	02.28.18	1278334	190209	1278332	190211	0.7	24	1277878	190216
168	02.28.18	1278730	189879	1278726	189876	1.3	24	1277878	190216
169[e]	02.23.18	1266890	209821	1266877	209822	3.9	na	na	na
170[e]	03.01.18	1267205	208553	1267207	208553	0.5	na	na	na
171[e]	03.01.18	1266888	208414	1266889	208412	0.7	na	na	na
172[e]	03.01.18	1265998	208009	1266003	208006	1.9	na	na	na

Sampling Location	Date	Target Location[a]		Actual Location[a]		Distance from Target (m)	Composite Number[b]	Composite Centroid[a,b]	
		X	Y	X	Y			X	Y
173[e]	03.01.18	1267053	207802	1267052	207803	0.3	na	na	na
174[e]	03.01.18	1266158	207265	1266157	207267	0.7	na	na	na
175[e]	03.01.18	1267252	207364	1267254	207364	0.5	na	na	na
176[e]	03.01.18	1267698	206352	1267698	206352	0.2	na	na	na
177[e]	03.02.18	1267971	203884	1267971	203884	0.2	na	na	na
178[d,e]	03.01.18	1268747	203540	1268744	203539	1.0	na	na	na
179[e]	02.23.18	1269985	201460	1270002	201480	8.0	na	na	na
180[e]	02.28.18	1270227	200361	1270225	200361	0.6	na	na	na
181[e]	02.28.18	1270186	200341	1270186	200341	0.1	na	na	na
182[e]	03.01.18	1270183	200299	1270188	200310	3.6	na	na	na
183[e,f]	03.03.18	1269242	201623	1269242	201625	0.6	na	na	na
184[e]	02.23.18	1273135	197679	1273143	197695	5.4	na	na	na
185[e]	02.28.18	1276034	194947	1276033	194947	0.2	na	na	na
186[e]	02.28.18	1275959	193974	1275960	193974	0.2	na	na	na
187[e,f]	03.03.18	1275730	194977	1275736	194985	3.0	na	na	na
188[e]	02.28.18	1278792	189794	1278793	189796	0.6	na	na	na

a Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).

b The centroid location of each composite sample was calculated to provide the coordinates required for each sample in order to load the data into EIM and Scribe. The location will be noted as a centroid and the title of this final data report will be included. The centroid locations were calculated based on the centroid of each polygon of the seven contiguous areas sampled for the composite sample. For two irregular composite areas (LDW18-SS-Comp07 and LDW18-SS-Comp17), the calculated centroid fell outside of the polygon and was manually moved to at least 10 ft inside the polygon at the closest polygon boundary point to the calculated centroid. The centroid locations are shown on Map 2-4.

c Targeted location shown in this table is revised from the QAPP-targeted location, as discussed in Section 2.3. Table 2-2 shows QAPP target and revised target locations.

d A field duplicate sample was also collected at this location.

e Sample was collected for the PCB porewater investigation.

f Targeted location, which was a re-occupation of a previous sampling location, was re-located, as discussed in Section 2.3.

EIM – Environmental Information Management
GIS – geographic information system
na – not applicable; sample not included in a composite
NAD83 – North American Datum of 1983
PCB – polychlorinated biphenyl
QAPP – quality assurance project plan

At 19 locations, access to within 10 m of the randomly selected target coordinates was not possible because the location was blocked by moored vessels or structures during the sampling effort, or an acceptable grab sample (as specified in the QAPP) could not be collected; new randomly selected target coordinates were determined after consultation with EPA (see Section 2.3 for QAPP deviations). Table 2-2 and Map 2-5 present the original sample target coordinates from the QAPP and the revised target coordinates. All surface sediment samples were collected from within 10 m of the QAPP or revised target coordinates (Tables 2-1 and 2-2) (Windward 2018a).

Table 2-2. QAPP target coordinates and revised target coordinates

Sampling Location	Original QAPP Target Location[a]		Revised Target Location[a]		Reason
	X	Y	X	Y	
19	1266319	209596	1266378	207457	blocked by vessel
49	1267016	206290	1267058	206395	blocked by vessel
52	1267110	207107	1267198	207055	blocked by vessel
54	1267118	206844	1267181	206877	acceptable grab could not be collected
56	1268139	206923	1268110	206782	blocked by pier
57	1268401	206659	1268340	206674	blocked by vessel
58	1268244	206523	1267938	206574	blocked by vessel
66	1267894	205058	1268002	204934	blocked by vessel
70	1268565	204399	1268362	204272	blocked by vessel
79	1268510	202888	1268705	202804	blocked by vessel
82	1269240	202747	1269246	202851	blocked by vessel
83	1269216	202424	1269111	202458	acceptable grab could not be collected
94	1270278	201326	1270207	201560	blocked by vessel
96	1270025	200739	1270066	200700	blocked by vessel
97	1270241	201060	1270187	200936	blocked by vessel
99	1270602	200609	1270552	200561	blocked by vessel
103	1270932	199850	1270812	199927	blocked by vessel
116	1272726	198037	1272747	198211	blocked by vessel
141	1275992	193564	1276095	193517	blocked by vessel

Note: Target coordinates were based on a random selection process (see Section 2.1.1.1 and the surface sediment QAPP (Windward 2018a)); actual sample locations are listed in Table 2-1.

[a] Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).

NAD83 – North American Datum of 1983

QAPP – quality assurance project plan

2.1.1.2 0–45-cm surface sediment samples

To address DQOs 7 and 8, a total of 204 individual subsamples were collected to form 3 site-wide composite samples, each with 68 samples collected from 16 potential clamming subareas located throughout the LDW intertidal areas (Map 2-6). To address DQOs 9 and 10, 129 samples were collected to form 24 beach play area composite samples with 3 composite samples from each of the 8 beach play areas (Map 2-7).

These intertidal sediment samples were collected in June 2018 from the potential clamming area and the beach play areas using either a shovel or hand core tube, as described in the QAPP (Windward 2018a). Actual sample location coordinates from the potential clamming area are provided in Table 2-3, and actual beach play area sample location coordinates are provided in Table 2-4.

Table 2-3. Sediment sampling locations from the potential clamming area and site-wide composite information

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL01	0.0–0.2 W	A01	06.14.18	1265994	210766	3
		A02	06.14.18	1265927	210595	2
		A03	06.14.18	1265970	210467	3
		A04	06.14.18	1265962	210337	1
		A05	06.14.18	1266066	210230	2
		B01	06.14.18	1265863	210666	1
CL02	0.5–1.0 W	A01	06.14.18	1265947	208580	3
		B01	06.14.18	1265903	207253	1
		B02	06.14.18	1265892	207429	2
		B03	06.14.18	1265939	207593	1
		B04	06.14.18	1265908	207771	2
		B05	06.14.18	1265994	207934	1
		B06	06.14.18	1265920	208098	2
		B07	06.14.18	1265950	208278	1
		C01	06.14.18	1265950	207051	2
		C02	06.14.18	1266012	207219	2
		C03	06.14.18	1265992	207408	3
		C04	06.14.18	1266079	207565	2
		C05	06.14.18	1265996	207771	3
		C07	06.14.18	1265999	208082	3
		D01	06.14.18	1266101	206871	1
		D02	06.14.18	1266085	207038	3
		D03	06.14.18	1266155	207195	3
		D04	06.14.18	1266088	207379	1
		D05	06.14.18	1266181	207535	3
		D06	06.14.18	1266175	207692	1
		D07	06.14.18	1266278	207865	3
		E01	06.14.18	1266163	206706	3
		E02	06.14.18	1266246	206883	2
		E03	06.14.18	1266229	207063	1
		F01	06.14.18	1266326	207545	1
		F02	06.14.18	1266296	207715	2
		F03	06.14.18	1266382	207859	1
		F04	06.14.18	1266330	208040	2
		F05	06.14.18	1266415	208205	1
		G01	06.14.18	1266300	206608	2
		G02	06.14.18	1266291	206746	1
		H02	06.14.18	1266452	207550	2

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL02 (cont.)	0.5–1.0 W	H03	06.14.18	1266412	207697	3
		H04	06.14.18	1266488	207832	2
		H05	06.14.18	1266448	207978	3
		H06	06.14.18	1266505	208116	2
		H07	06.14.18	1266508	208253	3
		I02	06.14.18	1266603	207524	3
		I03	06.14.18	1266538	207678	1
		J01	06.14.18	1266458	206426	1
		J02	06.14.18	1266547	206248	2
		J03	06.14.18	1266768	206181	3
		K01	06.14.18	1266473	206558	3
		L01	06.14.18	1266634	207440	1
		L02	06.14.18	1266750	207231	2
		L03	06.14.18	1266801	206993	3
		M01	06.14.18	1266911	206936	1
		M02	06.14.18	1267158	206814	2
		M03	06.14.18	1267286	206601	3
		M04	06.14.18	1267104	206571	1
		M05	06.14.18	1266771	206520	2
CL03	0.5–0.9 E	A01	06.16.18	1267199	208930	2
		A02	06.16.18	1267291	208611	1
		A03	06.16.18	1267228	208384	3
		A04	06.16.18	1267332	208207	2
		A05	06.16.18	1267340	208000	3
		A06	06.16.18	1267441	207744	2
		B01	06.16.18	1267417	208101	1
		C01	06.13.18	1267606	207339	1
		C02	06.13.18	1267669	207151	3
CL04	1.4–1.5 W	A01	06.12.18	1267996	204156	1
		A02	06.12.18	1267994	203985	2
		A03	06.12.18	1267910	203917	1
		A04	06.12.18	1267912	203805	3
		A05	06.12.18	1267868	203712	2
		A06	06.16.18	1268041	204033	3
CL05	1.4–1.6 E	A01	06.16.18	1268698	203997	1
		A02	06.13.18	1268627	204282	3
		B01	06.13.18	1268711	204089	2
		B02	06.13.18	1268749	203910	3
		B03	06.13.18	1268753	203725	2
		C01	06.13.18	1268824	203584	1

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL06	1.7–1.9 E	A01	06.13.18	1269427	202855	1
		A02	06.13.18	1269287	202570	3
		A03	06.13.18	1269290	202125	2
CL07	2.0–2.1 E	A01	06.13.18	1269533	201102	2
		B01	06.13.18	1269495	201032	3
		B02	06.13.18	1269691	201003	1
		B03	06.13.18	1269655	200864	2
		C01	06.13.18	1269588	200843	1
		C02	06.13.18	1269563	200624	3
CL08	2.1–2.4 W	A01	06.13.18	1270108	200578	3
		B01	06.13.18	1270048	200353	2
		B02	06.13.18	1270261	200323	1
		B03	06.13.18	1270439	200287	3
		B04	06.13.18	1270584	200114	2
		B05	06.13.18	1270753	199972	1
CL09	2.5–2.7 W	A01	06.12.18	1271331	199340	1
		B01	06.12.18	1271392	199177	2
		C01	06.12.18	1271610	199076	3
		C02	06.12.18	1271677	198939	1
		C03	06.12.18	1271821	198804	2
		C04	06.12.18	1271908	198640	3
CL10	2.6–2.8 E	A01	06.16.18	1271851	199356	3
		A02	06.16.18	1272005	199241	2
		A03	06.16.18	1272123	199073	1
		A04	06.16.18	1272295	198962	3
		B01	06.16.18	1272471	198800	2
		B02	06.16.18	1272588	198686	1
CL11	2.8–2.9 W	A01	06.12.18	1272333	198387	3
		A02	06.12.18	1272426	198277	1
		A03	06.12.18	1272572	198148	2
CL12	2.8–4.2 E	C03	06.16.18	1273440	197889	2
		C04	06.16.18	1273483	197771	3
		C05	06.16.18	1273652	197711	1
		C06	06.16.18	1273745	197540	2
		C07	06.16.18	1273907	197456	3
		C08	06.16.18	1274009	197303	1
		C09	06.16.18	1274209	197268	2
		C10	06.16.18	1274264	197060	3
		C11	06.16.18	1274441	196996	1

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL12 (cont.)	2.8–4.2 E	C12	06.16.18	1274560	196902	2
		D01	06.16.18	1274781	196781	3
		D02	06.16.18	1274850	196593	1
		D03	06.16.18	1275044	196533	2
		D04	06.16.18	1275153	196380	3
		D05	06.16.18	1275306	196279	1
		D06	06.16.18	1275412	196131	2
		E01	06.16.18	1275711	195862	3
		E02	06.16.18	1275937	195341	1
		F01	06.16.18	1276047	195024	2
		G01	06.16.18	1276132	194725	3
		G02	06.16.18	1276217	194521	1
		G03	06.16.18	1276226	194216	2
		G04	06.15.18	1276368	193933	3
		G05	06.15.18	1276365	193772	1
		G06	06.15.18	1276439	193625	2
		H01	06.15.18	1276453	193486	3
		H02	06.15.18	1276589	193433	1
		H03	06.15.18	1276533	193295	2
		H04	06.15.18	1276668	193229	3
		H05	06.15.18	1276581	193095	1
		H06	06.15.18	1276653	193008	2
		H07	06.15.18	1276649	192901	3
		H08	06.15.18	1276718	192817	1
CL13	2.9–3.4 W	A01	06.12.18	1272808	197911	1
		A02	06.12.18	1272956	197771	2
		A03	06.12.18	1273120	197648	3
		A04	06.12.18	1273237	197467	1
		A05	06.13.18	1273435	197378	2
		A06	06.13.18	1273578	197237	3
		A07	06.13.18	1273751	197121	1
		A08	06.13.18	1273889	196945	2
		A09	06.13.18	1274065	196855	3
		A10	06.13.18	1274178	196721	1
		A11	06.13.18	1274362	196564	2
		B01	06.15.18	1274594	196357	3

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL14	3.5–4.0 W	A01	06.16.18	1275429	195653	2
		B01	06.16.18	1275524	195497	3
		B02	06.16.18	1275621	195281	1
		B03	06.16.18	1275687	195047	2
		B04	06.16.18	1275764	194816	3
		B05	06.16.18	1275782	194572	1
		B06	06.16.18	1275840	194353	2
		B07	06.16.18	1275864	194105	3
		B08	06.16.18	1275905	193874	1
CL15	4.2–5.0 W	A01	06.15.18	1276270	192299	2
		A02	06.15.18	1276362	192211	1
		A03	06.15.18	1276340	192055	3
		A04	06.15.18	1276484	191939	2
		A05	06.15.18	1276402	191773	1
		A06	06.15.18	1276531	191654	3
		A07	06.15.18	1276463	191495	2
		A08	06.15.18	1276517	191410	1
		B01	06.15.18	1276586	190783	3
		B02	06.15.18	1276617	190671	2
		B03	06.15.18	1276622	190492	1
		B04	06.15.18	1276743	190384	3
		B05	06.15.18	1276746	190201	2
		B06	06.15.18	1276897	190227	1
		B07	06.15.18	1276952	190125	3
		B08	06.15.18	1277074	190125	2
		B09	06.15.18	1277112	189985	3
		B10	06.15.18	1277177	190113	1
		B11	06.15.18	1277326	190012	1
		B12	06.15.18	1277346	190213	3
		B13	06.15.18	1277500	190064	3
		B14	06.15.18	1277514	190252	2
		B15	06.15.18	1277662	190143	1
		B16	06.15.18	1277728	190268	3
		B17	06.15.18	1277923	190164	2
		B18	06.15.18	1278114	190143	1
		B19	06.15.18	1278510	189895	3
		C01	06.15.18	1277178	189897	2
		D01	06.15.18	1277617	189944	2
		D02	06.15.18	1277436	189767	1

Clamming Subarea	Clamming Subarea Location (Approximate RM)	Transect Line and Sample No.	Date	Subsample Location[a]		Site-wide Composite No.[b]
				X	Y	
CL16	4.2–4.8 E	A01	06.15.18	1276749	192399	2
		A02	06.15.18	1276822	192254	1
		A03	06.15.18	1276854	192120	3
		A04	06.15.18	1276884	191983	2
		A05	06.15.18	1276930	191837	1
		A06	06.15.18	1276897	191705	3
		A07	06.15.18	1276877	191610	2
		A08	06.15.18	1276936	191335	1
		A09	06.15.18	1277013	191093	3
		A10	06.15.18	1277101	190850	2
		A11	06.15.18	1277425	190599	1
		A12	06.15.18	1277684	190513	3

Shading indicates the site-wide composite number: green shading indicates site-wide composite number 1; orange shading indicates site-wide composite number 2; and blue shading indicates site-wide composite number 3.

[a] Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).

[b] The centroid location of the composite samples was calculated so that the data can be loaded into EIM and Scribe. The location will be noted as a centroid and the title of this final data report will be included. The centroid location is (1271370, 199550). This location is reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft). The centroid was derived within the GIS by manually placing the centroid at RM 2.5 in the center of the Federal Navigation Channel.

EIM – Environmental Information Management

GIS – geographic information system

NAD83 – North American Datum of 1983

RM – river mile

Table 2-4. Intertidal beach play area sediment sampling locations

Beach Play Area	Beach Play Area Location (Approximate RM)	Transect Line and Location No.	Date	Subsample Location[a]		Beach Play Area-specific Composite No.[b]	Beach Play Area-specific Composite Centroid[a,b]	
				X	Y		X	Y
BP1[c]	0.1–0.3 W	A01	06.14.18	1265993	210767	3	1265930	210485
		A02	06.14.18	1265939	210592	1		
		A03	06.14.18	1265992	210472	2		
		A04	06.14.18	1265946	210335	3		
		A05	06.14.18	1266040	210229	1		
		A06	06.14.18	1266067	210013	2		
		B01	06.14.18	1265773	210762	3		
		B02	06.14.18	1265843	210706	1		
		B03	06.14.18	1265885	210636	2		
BP2	0.5–1.0 W	A01	06.14.18	1265913	208094	1	1265868	207343
		A02	06.14.18	1265952	207863	2		
		A03	06.14.18	1265903	207636	3		
		A04	06.14.18	1265885	207403	1		
		A05	06.14.18	1265890	207171	2		
		A06	06.14.18	1266007	206965	3		
		A07	06.14.18	1266100	206757	1		
		A08	06.14.18	1266252	206577	2		
		A09	06.14.18	1266393	206401	3		
BP3	0.4–0.9 E	A01	06.16.18	1267137	209129	3	1267379	208061
		B01	06.16.18	1267193	208952	1		
		B02	06.16.18	1267287	208768	2		
		B03	06.16.18	1267251	208575	3		
		B04	06.16.18	1267258	208458	1		
		B05	06.16.18	1267212	208348	2		
		B06	06.16.18	1267292	208235	3		
		B07	06.16.18	1267277	208107	1		
		B08	06.16.18	1267368	208009	3		
		B09	06.16.18	1267389	207872	1		
		B10	06.16.18	1267485	207614	2		
		C01	06.16.18	1267411	208113	2		
		D01	06.16.18	1267602	207371	3		
		D02	06.16.18	1267664	207255	1		

Beach Play Area	Beach Play Area Location (Approximate RM)	Transect Line and Location No.	Date	Subsample Location[a]		Beach Play Area-specific Composite No.[b]	Beach Play Area-specific Composite Centroid[a,b]	
				X	Y		X	Y
		D03	06.16.18	1267647	207112	2		
BP4	2.0–2.4 W	A01	06.13.18	1269547	201127	2	1270079	200586
		B01	06.13.18	1269545	201048	1		
		B02	06.13.18	1269601	200999	3		
		B03	06.13.18	1269642	200968	2		
		B04	06.13.18	1269747	200980	1		
		B05	06.13.18	1269677	200855	3		
		C01	06.13.18	1269826	200890	2		
		D01	06.13.18	1270109	200578	1		
		E01	06.13.18	1270051	200334	3		
		E02	06.13.18	1270211	200307	2		
		E03	06.13.18	1270299	200320	1		
		E04	06.13.18	1270394	200274	3		
		E05	06.13.18	1270532	200168	2		
		E06	06.13.18	1270644	200057	1		
		E07	06.13.18	1270744	199932	3		
BP5	2.5–3.4 W	A01	06.13.18	1271160	199451	3	1272925	197833
		B01	06.13.18	1271372	199286	2		
		C01	06.12.18	1271399	199184	1		
		D01	06.12.18	1271600	199066	3		
		D02	06.12.18	1271682	198943	2		
		D03	06.12.18	1271826	198806	1		
		D04	06.12.18	1271921	198643	3		
		E01	06.12.18	1272330	198382	2		
		E02	06.12.18	1272424	198266	1		
		E03	06.12.18	1272572	198148	3		
		F01	06.12.18	1272779	197916	2		
		F02	06.12.18	1272935	197809	1		
		F03	06.12.18	1273075	197686	3		
		F04	06.12.18	1273199	197603	2		
		F05	06.12.18	1273212	197467	1		
		F06	06.13.18	1273336	197461	3		
		F07	06.13.18	1273474	197321	2		
		F08	06.13.18	1273532	197261	1		
		F09	06.13.18	1273643	197180	3		

Beach Play Area	Beach Play Area Location (Approximate RM)	Transect Line and Location No.	Date	Subsample Location[a]		Beach Play Area-specific Composite No.[b]	Beach Play Area-specific Composite Centroid[a,b]	
				X	Y		X	Y
		F10	06.13.18	1273770	197103	2		
		F11	06.13.18	1273837	196976	1		
		F12	06.13.18	1273969	196922	3		
		F13	06.13.18	1274079	196805	2		
		F14	06.13.18	1274168	196759	1		
		F15	06.13.18	1274256	196618	3		
		F16	06.15.18	1274372	196584	2		
		G01	06.13.18	1274569	196336	1		
BP6[c]	2.7–2.8 E	A01	06.16.18	1272373	198868	1	1272475	198778
		A02	06.16.18	1272441	198891	2		
		A03	06.16.18	1272444	198839	3		
		A04	06.16.18	1272488	198846	1		
		A05	06.16.18	1272457	198769	2		
		A06	06.16.18	1272524	198793	3		
		A07	06.16.18	1272504	198701	3		
		A08	06.16.18	1272553	198715	2		
		A09	06.16.18	1272601	198677	1		
BP7	4.2–4.6 W	A01	06.15.18	1276271	192297	3	1276477	191589
		A02	06.15.18	1276356	192300	2		
		A03	06.15.18	1276306	192187	1		
		A04	06.15.18	1276371	192114	3		
		A05	06.15.18	1276332	192022	2		
		A06	06.15.18	1276418	191963	1		
		A07	06.15.18	1276344	191864	3		
		A08	06.15.18	1276436	191811	2		
		A09	06.15.18	1276374	191718	1		
		A10	06.15.18	1276470	191656	3		
		A11	06.15.18	1276380	191534	2		
		A12	06.15.18	1276526	191518	1		
		A13	06.15.18	1276475	191395	3		
		B01	06.15.18	1276630	190830	2		
		B02	06.15.18	1276586	190783	1		
		B03	06.15.18	1276594	190702	3		
		B04	06.15.18	1276485	190605	1		

Beach Play Area	Beach Play Area Location (Approximate RM)	Transect Line and Location No.	Date	Subsample Location[a]		Beach Play Area-specific Composite No.[b]	Beach Play Area-specific Composite Centroid[a,b]	
				X	Y		X	Y
		B05	06.15.18	1276630	190645	2		
BP8	4.6–5.0 W	A01	06.15.18	1276748	190224	2	1277478	190078
		A02	06.15.18	1276883	190289	1		
		A03	06.15.18	1276901	190181	3		
		A04	06.15.18	1276971	190155	2		
		A05	06.15.18	1277021	190093	1		
		A06	06.15.18	1277141	190134	3		
		A07	06.15.18	1277093	189941	2		
		A08	06.15.18	1277191	190035	1		
		A09	06.15.18	1277251	189992	2		
		A10	06.15.18	1277302	190131	1		
		A11	06.15.18	1277418	190045	2		
		A12	06.15.18	1277432	190131	3		
		A13	06.15.18	1277505	190124	1		
		A14	06.15.18	1277550	190179	3		
		A15	06.15.18	1277621	190179	2		
		A16	06.15.18	1277665	190272	3		
		A17	06.15.18	1277737	190117	2		
		A18	06.15.18	1277838	190232	1		
		A19	06.15.18	1277933	190157	3		
		A20	06.15.18	1278087	190133	2		
		A21	06.15.18	1278201	190065	1		
		A22	06.15.18	1278510	189895	3		
		B01	06.15.18	1277178	189899	3		
		C01	06.15.18	1277634	190058	1		
		C02	06.15.18	1277507	189956	3		
		C03	06.15.18	1277479	189793	1		
		C04	06.15.18	1277379	189679	2		

[a] Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).

[b] The centroid location of each composite sample was calculated so that the data can be loaded into EIM and Scribe. The location will be noted as a centroid and the title of this final data report will be included. The centroids were calculated based on the centroid of each polygon (or in the case of Beach Play Areas 5 and 6, multiple polygons). For one beach play area (Beach Play Area 2), the calculated centroid fell outside of the polygon and was manually moved to at least 10 ft inside the polygon at the closest polygon boundary point to the calculated centroid. The centroid locations are shown on Map 2-4.

[c] A field duplicate was collected at each location at these beach play areas.

EIM – Environmental Information Management

GIS – geographic information system

RM – river mile

The QAPP (Windward 2018a) stated that if it was not possible to reach a depth of 45 cm in the potential clamming area subsamples and the beach play area subsamples, the deepest hole that could be sampled after up to three attempts would be collected and the depth of refusal recorded. Following this guidance, intertidal sediment subsamples were collected at less than the target 0–45-cm depth at nine potential clamming area locations and three beach play area locations because of insufficient penetration (due to presence of hard substrate). Table 2-5 presents the intertidal sediment subsample locations where there was less than 45 cm of penetration.

Table 2-5. Intertidal sediment sampling locations with < 45 cm penetration

Location ID	Date	Penetration Depth (cm)	Reason
Clamming Subareas			
CL02-D02	06.14.18	23	hard-packed clay substrate
CL02-D05	06.14.18	40	hard-packed clay substrate
CL04-A05	06.12.18	23	cobble substrate
CL05-A02	06.13.18	40	riprap substrate
CL07-B02	06.13.18	30	rock substrate
CL08-B04	06.13.18	42	hard-packed substrate
CL12-C08	06.16.18	40	hard-packed substrate
CL12-D02	06.18.18	40	hard-packed substrate
CL13-A11	06.13.18	40	hard-packed substrate
Beach Play Areas			
BP2-A09	06.14.18	40	gravel substrate
BP3-B09	06.16.18	38	hard-packed sand
BP4-A07	06.13.18	32	hard-packed clay substrate

ID – identification

2.1.2 Targeted source-related samples

In addition to baseline samples, near-outfall surface sediment and bank samples were collected to address DQO 6 to aid the Ecology in its source control evaluation for the LDW. These samples were collected from a depth of 0–10 cm and were analyzed as individual samples per the QAPP (Windward 2018a).

2.1.2.1 Near-outfall surface sediment samples

Nineteen of the 24 near-outfall sediment sampling locations targeted were sampled. Seventeen locations were sampled by boat in February / March 2018 using the same method that was used for the 0–10-cm baseline sediment samples (i.e., a pneumatic grab sampler, except for DuwSD#3, which [like SS-041] was not accessible by vessel and was sampled by hand at low tide using a pre-cleaned stainless steel spoon). Two locations (near Outfalls 2510 and 2114) were sampled by hand at low tide in May 2018 using a pre-cleaned stainless steel spoon, because the sample locations were not accessible by boat.

Five of the 24 near-outfall sediment sampling locations could not be sampled because there was only rocky substrate (i.e., no sediment) within the target areas (Table 2-6); EPA was consulted regarding these five locations. Six sampling attempts were made at each of these locations.

Table 2-6. Near-outfall locations not sampled due to rocky substrate

Sampling Location			
Outfall ID	Leidos Outfall ID	Approximate RM	Date Attempted
8134	L1503	0.0 W	02.23.18
2226	L1516	0.5 W	02.23.18
2003	L0301	0.7 E	03.02.18
GenBiodiesel	L0604	1.7 E	03.02.18
2215	L2201	3.3 W	02.28.18

ID – identification
RM – river mile

Where there were no physical limitations for the sampling vessel (i.e., outfall blocked by vessels or structures or on land) and there was sufficient sediment (i.e., limited riprap or gravel substrate), samples were collected within 15.2 m (50 ft) or 30.5 m (100 ft) of the outfall, depending on the diameter size of the outfall specified in the QAPP (Windward 2018a).

Target and actual near-outfall sediment location coordinates are provided in Table 2-7 and presented on Map 2-8.[6] Near-outfall sediment samples were collected from within the specified distances for all but three outfalls (2509, 5th Ave S, and T107 Park); see Section 2.3 for a discussion of these three outfalls.

Table 2-7. Near-outfall sediment sampling locations

Sampling Location			Outfall Location[a]		Actual Sample Location[a]		Targeted Maximum Distance from Outfall (m)	Actual Distance from Outfall (m)
Outfall ID	Leidos Outfall ID	Date	X	Y	X	Y		
2100A	L2306	02.28.18	1275994	192704	1276037	192705	30.5	13.1
		02.28.18	1275994	192704	1276081	192705	30.5	26.6
2101	L2304	02.28.18	1275884	193776	1275923	193798	15.2	13.5
2109	L2108	02.23.18	1272860	197836	1272872	197876	15.2	12.6
		02.23.18	1272860	197836	1272902	197845	15.2	13.3
2507	L1904	03.01.18	1269610	200817	1269593	200851	15.2	11.6
2509	L2003	03.02.18	1269739	200752	1269740	200851	15.2	30.2
2510	L1905	05.15.18	1269516	200537	1269518	200557	15.2	6.1
2114	L2011	05.15.18	1270987	199635	1271027	199612	15.2	14.1
5th Ave S	L2012	02.23.18	1271181	199395	1271209	199437	15.2	15.4
CleanScapes B	L0816	02.28.18	1272400	198919	1272370	198900	15.2	11.1
Dawn Foods	L0801	02.28.18	1270819	200495	1270797	200476	15.2	8.8
Delta Marine	L2307	03.08.18	1276263	192375	1276283	192341	15.2	12

[6] As described in the QAPP and shown on Map 2-8, one or two sample locations were targeted for each outfall, depending on the outfall's diameter.

Sampling Location		Date	Outfall Location[a]		Actual Sample Location[a]		Targeted Maximum Distance from Outfall (m)	Actual Distance from Outfall (m)
Outfall ID	Leidos Outfall ID		X	Y	X	Y		
Ditch #2	L2408	02.28.18	1278292	190004	1278326	190038	15.2	14.9
DuwSD#3	L2404	02.28.18	1276366	191540	1276385	191532	15.2	6.2
FedCtrS	L0303	03.01.18	1267516	207621	1267480	207607	15.2	11.7
GlacierNW-CBP	L0602	03.02.18	1269253	203030	1269291	203019	15.2	12
Seattle Dist Ctr	L0704	02.27.18	1270773	201521	1270754	201529	15.2	6.5
T107 Park[b]	L1522	02.23.18	1265894	207963	1265944	207974	15.2	15.7

[a] Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).
[b] A field duplicate sample was also collected at this location.
ID – identification
NAD83 – North American Datum of 1983

2.1.2.2 Bank samples

During the intertidal sediment sampling effort in June 2018, 11 bank samples were collected by hand from 6 target bank areas identified in the QAPP (Windward 2018a). Bank sample location coordinates are provided in Table 2-8 and presented on Map 2-9.[7]

Table 2-8. Bank sampling locations

Bank	Exposed Bank Area (Approximate RM)	Sample No.	Date	Actual Sample Location[a]		Elevation Notes
				X	Y	
1	0.5–0.6 W	1	06.14.18	1265861	208166	sample location within vegetated bank
2	0.9–1.0 W	1	06.14.18	1266563	206233	sample location below outfall on steep slope
3	2.0–2.2 W	1	06.13.18	1269499	200916	sample location near bridge support pilings
		2	06.13.18	1269422	200542	sample location 1–2 ft above creek
		3	06.13.18	1269609	200833	sample location north of bridge, near old pilings
4	2.5–2.7 W	1	06.13.18	1271411	199169	sample location within riprap area
		2	06.13.18	1271664	198960	sample location within riprap with docks above and below sample elevation
		3	06.13.18	1271837	198706	sample collected from upland, adjacent to mudflat

[7] As described in the QAPP (Windward 2018a) and shown on Map 2-9, one to three bank sample locations were targeted for each bank area.

Bank	Exposed Bank Area (Approximate RM)	Sample No.	Date	Actual Sample Location[a]		Elevation Notes
				X	Y	
5	3.0–3.1 W	1[b]	06.12.18	1273211	197408	sample collected from < 1 ft below vegetation line
6	4.6–5.0 W	1	06.15.18	1277459	190049	sample location adjacent to marsh grass
		2	06.15.18	1277552	189860	sample location just west of abandoned boat

a Coordinates reported in NAD83 horizontal datum; X-Y coordinates in Washington State Plane N (US survey ft).

b A field duplicate was collected at this location.

NAD83 – North American Datum of 1983

RM – river mile

2.2 Sample Processing, Identification, and Compositing

Once collected, grab samples were evaluated for acceptability (i.e., not predominately gravel, sediment not extruding from sampler, overlying water present, sediment surface relatively flat, and penetration depth of at least 11 cm (Windward 2018a)). Following this evaluation, acceptable samples were processed, identified, and composited in accordance with the QAPP (Windward 2018a). Copies of field notes, sample collection forms, photos, and chain of custody forms (COCs) are presented in Appendix A.

2.2.1 Sample processing

At each sample location, sediment was obtained from one acceptable (see Section 2.2 criteria) grab sample. Surface sediment, near-outfall sediment, and bank samples were taken from the 0–10-cm interval. Each sample was homogenized in a clean, stainless steel bowl using a stainless steel spoon until texture and color were uniform. Homogenized sediment was then split into appropriate sampling containers, as specified in the QAPP (Windward 2018a). Field duplicate samples were collected for individual surface sediment samples by filling additional containers with the same homogenized sample.

The intertidal samples from the potential clamming area and the beach play areas were taken from the 0–45-cm interval (except as noted in Section 2.1.1.2 and Table 2-5). An equal amount of sediment was collected from three 15-cm-deep subsections along the vertical extent of the hole and placed directly into the appropriate sample containers, as specified in the QAPP (Windward 2018a). Field duplicate samples were collected at two beach play areas. At each sampling location in these areas, two 16-oz jars (rather than one) were collected from each hole.

2.2.2 Sample identification

Unique alphanumeric identification (ID) numbers were assigned to each sample and recorded on the sample collection forms (Appendix A).

The sample IDs for surface sediment samples and bank samples included the following:

- Project area ID and two-digit year
- Sample type:
  - SS for 0–10-cm samples (or SSOT for outfall samples)
  - IT45 for 0–45-cm subsamples
  - BNK for bank samples
- Location number (for the 0–10-cm samples, outfall samples, and bank samples) or location ID (for the 0-45-cm subsamples)

So for example, the surface sediment sample from location 27 was labelled LDW18-SS-027.

The location IDs for the 0–45-cm subsamples included CL for the potential clamming area or BP for a beach play area with the area number, a transect identifier (e.g., A, B, C, etc.), and consecutive numbers for points along the transect line. So for example, the third subsample collected along transect A in clamming subarea 2 was identified as LDW18-IT45-CL2-A03. Similarly, the first sample collected along transect C in beach play area 6 was identified as LDW18-IT45-BP6-C01.

In addition, samples were combined to form composite samples, which required composite IDs that included the following:

- Project area ID and two-digit year
- Sample type:
  - SS for 0–10-cm composites
  - IT45-CL for potential clamming area composites and IT45-B for beach composites for 0–45-cm samples
- Composite number

For example, the surface sediment composite that contained sediment from sample locations 1, 2, 3, 4, 6, 7, and 8 was identified as LDW18-SS-Comp01. The three potential clamming area composites samples were identified as LDW18-IT45-CL-Comp1, LDW18-IT45-CL-Comp2, and LDW18-IT45-CL-Comp3. The three composite samples for beach area 3 were identified as LDW18-IT45-B3-Comp1, LDW18-IT45-B3-Comp2, and LDW18-IT45-B3-Comp3.

For the PCB porewater passive samplers, the sample ID included the following:

- Project area ID and two-digit year
- PWPS (PCB porewater passive sampler results)
- Surface sediment location ID

For example, the passive sampler associated with surface sediment Location 18 was labelled LDW18-PWPS-SS018. The PCB porewater concentrations calculated from the passive sampler results was identified as LDW18-PW-SS018.

2.2.3 Sample compositing

Surface sediment and potential clamming and intertidal beach play area composite samples were processed at Analytical Resources, Inc. (ARI) by Windward Environmental LLC (Windward) staff. The compositing plans were developed with and approved by EPA; the surface sediment compositing plan was included in the QAPP (Windward 2018a; EPA 2018). The intertidal sediment compositing maps were approved by email (Hale 2018a) and are shown on Maps 2-6 and 2-7. Photos of composite samples are presented in Appendix A.

Per the QAPP, the 168 surface sediment samples collected for inclusion in site-wide composites were combined into 24 composite samples for analysis (Windward 2018a). Each composite sample contained seven samples from neighboring grid cells (shown on Map 2-2).

In accordance with the QAPP, three LDW-wide composites were created from 204 intertidal samples to represent the site-wide potential clamming area. Each composite sample contained 68 samples. In addition, 3 composite samples were created for each of the 8 beach play areas. Each composite sample contained from three to nine samples. A total of 129 intertidal samples were collected in the beach play areas.

In compositing surface sediment and intertidal beach play area samples, the contents of the 8- or 16-oz. jars were combined in a stainless steel bowl and stirred with a clean stainless steel spoon until texture and color homogeneity were achieved (PSEP 1997). Homogenized sediment was then split into the appropriate sample containers as described in the QAPP (Windward 2018a).

In compositing potential clamming area samples, the contents of the 68 4-oz. jars were combined in a stainless steel cauldron and homogenized for 20 minutes using a motorized paddle mixer (Windward 2018a). Following homogenization, approximately equal volumes of sediment were transferred into two stainless steel baking trays, as described in the sediment compositing standard operating procedure (SOP) in Appendix D of the QAPP. As specified in the SOP, a 30-square grid was created, and aliquots of homogenized sediment were sampled from each grid to fill the analytical sample jars.

2.3 FIELD DEVIATIONS FROM THE QAPP

Field deviations from the QAPP (Windward 2018a) involved modifications to some target sampling locations. These field deviations did not affect the data quality. EPA was consulted on deviations that involved a change in study design. The deviations were as follows:

- Some of the surface sediment samples could not be collected from within 10 m of the target coordinates because those coordinates were obstructed by vessels or structures during the surface sediment sampling event (17 locations), or because an acceptable grab sample could not be collected (2 locations). Alternative random target coordinates were generated after consulting EPA (Table 2-2). GIS was used to generate three to five additional random locations within that location's sample zone. The additional coordinates were transmitted to the field crew, who attempted to sample each new location in turn until one was found to be accessible. Map 2-5 presents the original and revised target locations for the 19 locations.
- Samples from locations 183 and 187 were not collected at the target locations specified in the QAPP (Windward 2018a). Alternative locations were selected upon consultation with EPA, as follows:
  - Location 183 was relocated because it was blocked by a vessel for the duration of the sampling event, so access to within 10 m was not possible. The target location was a location with an SCO exceedance in an MNR area. The target location had an SCO exceedance for zinc and was also targeted as a PCB porewater investigation location, as it had a PCB concentration of 106 µg/kg. The alternative location had an SCO exceedance for bis(2-ethylhexyl)phthalate (BEHP) and an historical PCB concentration of 18.0 µg/kg. The alternative location was selected because it had an SCO exceedance and provided good spatial distribution.
  - Location 187 was relocated because the original target location was in an area that had been dredged by the US Army Corp of Engineers (USACE) in January 2018. The alternative location was selected because it had the same historical total PCB exceedance concentration as the original location (170 µg/kg).
- Three near-outfall sediment samples were not collected from within 15.2 m of the outfall coordinates. EPA oversight was present during the sampling effort and was consulted in reaching the following approaches.
  - At the T107 Park outfall, a full-depth sample collected 15.7 m from the target coordinates was selected over the 7-cm-penetration sample collected from within 15.2 m of the target.
  - At the 5th Ave S outfall, the sample collected 15.4 m from the target coordinates was accepted because previous attempts to sample closer to the target were unsuccessful.
  - At outfall 2509, the sample was collected 30.2 m from the target (after five attempts had been made closer to the target), because the outfall and 15.2-m sampling radius were on land, even during a higher tide.

3 Analytical Methods

The methods and procedures used to chemically analyze the individual and composite sediment samples are described briefly in this section and in detail in the QAPP (Windward 2018a). This section also discusses laboratory deviations from the QAPP.

3.1 ANALYTICAL METHODS

ARI performed PCB Aroclor, carcinogenic polycyclic aromatic hydrocarbon (cPAH), semivolatile organic compound (SVOC), arsenic, metals, mercury, toxaphene, total organic carbon (TOC), grain size, and percent solids analyses. SGS Axys Analytical Services, Ltd. (Axys) performed PCB congener and dioxin/furan analyses, and Alpha Analytical Lab (Alpha) performed black carbon analyses. Surface sediment samples and *ex situ* passive samplers were analyzed according to the methods presented in Table 3-1. The specific analyses and number of samples analyzed are presented in Table 3-2 for 0–10-cm sediment and bank samples and in Table 3-3 for 0–45-cm intertidal composite samples.

Table 3-1. Analytical methods for sediment and *ex situ* PCB porewater passive sampler analyses

Analyte	Method	Reference	Extraction Solvent	Laboratory
Sediment				
PCB Aroclors	GC/ECD	EPA 3550-C Mod EPA 8082A	hexane/acetone	ARI
cPAHs/SVOCs	GC/MS	EPA 3550-C Mod EPA 8270D-SIM	DCM/acetone	ARI
PCB congeners	HRGC/HRMS	EPA 1668c	DCM Optional: Dean-Stark Soxhlet extraction with toluene, or Soxhlet extraction with 1:1 hexane:acetone	Axys
Dioxins/furans	HRGC/HRMS	EPA 1613B	80:20 toluene:acetone extraction	Axys
SVOCs/PAHs	GC/MS	EPA 3550-C Mod EPA 8270D	DCM/acetone	ARI
Metals	ICP-MS	EPA 3050B EPA 6020A UCT-KED	na	ARI
Mercury	CV-AFS	EPA 7471B	na	ARI
Black carbon	infrared	EPA 9060 with Gustafsson Acadi-Dey black carbon modification	na	Alpha
TOC	high-temperature combustion	EPA 9060	na	ARI
Percent solids	drying oven	SM 2540G	na	ARI
Grain size	pipette/sieve	PSEP (1986)	na	ARI
***Ex situ* porewater passive samplers**				
PCB congeners	HRGC/HRMS	EPA 1668c	DCM	Axys

Alpha – Alpha Analytical Lab
ARI – Analytical Resources, Inc.
Axys – SGS Axys Analytical Services Ltd.
cPAH – carcinogenic polycyclic aromatic hydrocarbon
CV-AFS – cold vapor-atomic fluorescence spectrometry
DCM – dichloromethane
ECD – electron capture detector
EPA – US Environmental Protection Agency
GC – gas chromatography
HRGC/HRMS – high-resolution gas chromatography/high-resolution mass spectrometry
ICP – inductively coupled plasma
MS – mass spectrometry
na – not applicable
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
PSEP – Puget Sound Estuary Program
SIM – select ion monitoring
SM – Standard Method
SVOC – semivolatile organic compound
TOC – total organic carbon
UCT-KED – universal cell technology-kinetic energy discrimination

Table 3-2. Chemical analyses of 0–10-cm sediment grab samples

Sample Type	Total No. of Samples	No. of Samples Analyzed						
		PCB Aroclors	Dioxins/ Furans	cPAHs	Arsenic	SMS Analytes[a]	Black Carbon	Conventionals (TOC, Grain Size, Total Solids)
0–10-cm surface sediment composite	24	24	24	24	24	-	24	24
0–10-cm SMS sediment	20	20	-	-	-	20	10[b]	20
0–10-cm porewater sediment	10	10	-	-	-	-	10	10
0–10-cm near-outfall sediment	19	19	14[c]	-	-	19	-	19
0–10-cm bank	11	11	6[d]	-	-	11	-	11

[a] SMS analytes in this table include analytes listed in ROD Table 20 (EPA 2014), except PCBs, which are listed separately.

[b] Black carbon was analyzed for the 10 SMS sediment samples that were also used for the PCB porewater evaluation.

[c] Seven outfall sediment samples were selected for dioxin/furan analysis based on existing surface sediment data, as discussed in Section 4.1.2.1 in the QAPP (Windward 2018a). Following an evaluation of existing dioxin/furan data and data collected during the Pre-Design Studies, as well as consultation with EPA/Ecology (documented in Appendix B), seven additional near-outfall sediment samples were selected for dioxin/furan analysis. The validated results of these analyses will be included in the final data report.

[d] Per the QAPP, one bank sample was originally selected for dioxin/furan analysis; for all other bank areas, bank samples were archived per Section 4.1.2.2 in the QAPP (Windward 2018a). Based on a review of existing dioxin/furan data and data collected during the Pre-Design Studies, as well as consultation with EPA/Ecology (documented in Appendix B), five additional samples were selected for dioxin/furan analysis. The validated results of these analyses will be included in the final data report.

cPAH – carcinogenic polycyclic aromatic hydrocarbon
Ecology – Washington State Department of Ecology
EPA – US Environmental Protection Agency
PCB – polychlorinated biphenyl
ROD – Record of Decision
QAPP – quality assurance project plan
SMS – Washington State Sediment Management Standards
TOC – total organic carbon

Table 3-3. Chemical analyses of 0–45-cm intertidal sediment composite samples

Sample Type	No. of Samples	PCB Aroclors, Arsenic, cPAHs, and Dioxins/Furans	Toxaphene	Conventionals (TOC, Grain Size, and Total Solids)
0–45-cm intertidal beach play area composite	24	24	24	24
0–45-cm intertidal potential clamming area composite	3	3	3	3

cPAH – carcinogenic polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
TOC – total organic carbon

3.2 LABORATORY DEVIATIONS FROM THE QAPP

There were several laboratory deviations from the QAPP (Windward 2018a), none of which affected data quality.

- There was a modification to the certified reference material (CRM) analyzed for polycyclic aromatic hydrocarbons (PAHs). CRM 172-100G had expired, so it was replaced with CRMs 142 and 143.
- The PCB congener analyses of the PCB porewater investigation sediment samples did not include analysis of the Puget Sound Sediment Reference Material. The sample was lost due to a cracked sample vial. NIST-1493 was processed with the sample batch and used to assess accuracy.
- A matrix spike / matrix spike duplicate (MS / MSD) was not included with PCB Aroclor and PAH / SVOC analyses of the two near-outfall samples (Outfalls 2510 and 5114) collected in May 2018. A laboratory control standard (LCS) and standard reference material (SRM) were used for EPA 8270D and EPA 8082 analyses. An LCS was used for EPA 8270D-select ion monitoring (SIM) analyses. All recoveries were within laboratory control limits.
- Black carbon results were provided by Alpha rather than by ALS Environmental-Kelso (ALS). The initial black carbon results reported by ALS were all non-detects. ALS followed Gustafsson (2001) (chemothermal oxidation pretreatment / combustion by EPA 440.0), and Alpha followed EPA 9060 with Gustafsson Acadi-Dey black carbon modification. The Alpha method provided a lower reporting limit.

4 Results of Chemical Analyses

This section summarizes the results of the chemical analyses and data validation of sediment and passive sampler samples.

Data management practices—including methods used for calculations (e.g., concentrations of total PCBs and toxic equivalents [TEQs])—are presented in the Work Plan (Windward and Integral 2017). Data tables are presented in Appendix C to this report, and laboratory reports and the data validation report are presented in Appendix D.[8] The data evaluation report (Task 6 of the Work Plan) will contain an analysis of the data. Information used in the selection of samples for PCB porewater analysis is included in Appendix E. Appendix F includes the passive sampler calculations from the PCB porewater investigation.

4.1 Chemistry Results for Composite Surface Sediment Samples

Chemistry and conventionals results for each composite sample are summarized in Tables 4-1 and 4-2, respectively.

Table 4-1. Chemistry results for 0–10-cm composite sediment samples

	Total PCB Aroclors		Dioxin/Furan TEQ	cPAH TEQ	Arsenic
Composite ID	(µg/kg dw)	(mg/kg OC)	(ng/kg dw)	(µg/kg dw)	(mg/kg dw)
LDW18-SS-Comp01	429 J	22.2 J	8.68 J	204 J	10.1
LDW18-SS-Comp02	202.2 J	10.4 J	10.5 J	742	9.28
LDW18-SS-Comp03	261	15.6 J	13.2	204	9.49
LDW18-SS-Comp04	261	8.91 J	13.5	219	15.9
LDW18-SS-Comp05	156.9 J	10.7 J	7.45 J	136	7.68
LDW18-SS-Comp06	310 J	16.5 J	22.5 J	241	11.0
LDW18-SS-Comp07	133.5 J	5.91 J	7.70	86.0	11.5
LDW18-SS-Comp08	333	17.6 J	11.8	238	13.7
LDW18-SS-Comp09	243.4	12.5 J	12.5	180	14.3
LDW18-SS-Comp10	179.2 J	8.41 J	10.0 J	152	12.7
LDW18-SS-Comp11	137.1	7.22 J	27.7 J	99.6	12.3
LDW18-SS-Comp12	168.0	8.08 J	8.92 J	132	13.4
LDW18-SS-Comp13	176.0	11.8 J	10.4	189	15.8
LDW18-SS-Comp14	192.8 J	14.4 J	7.78 J	91.7	13.5
LDW18-SS-Comp15	287 J	13.7 J	4.98 J	116	11.5
LDW18-SS-Comp16	113.1 J	7.07 J	3.88 J	118	10.3
LDW18-SS-Comp17	93.4 J	5.05 J	3.09 J	64.3	10.2

[8] As stated in Appendix C of the Work Plan (Windward and Integral 2017), concentrations obtained from the analysis of laboratory duplicates or replicates are presented as an average concentration.

Composite ID	Total PCB Aroclors (µg/kg dw)	Total PCB Aroclors (mg/kg OC)	Dioxin/Furan TEQ (ng/kg dw)	cPAH TEQ (µg/kg dw)	Arsenic (mg/kg dw)
LDW18-SS-Comp18	60.8 J	4.64 J	1.82 J	35.3 J	6.23
LDW18-SS-Comp19	49.0 J	2.82 J	1.97 J	50.5	8.40
LDW18-SS-Comp20	101.2	8.88 J	2.91 J	83.1	27.2
LDW18-SS-Comp21	183.1	7.79 J	3.73 J	41.9	11.2
LDW18-SS-Comp22	13.7 J	0.895 J	2.13 J	60.5	8.68
LDW18-SS-Comp23	25.0 J	1.85 J	2.32 J	26.7 J	7.17
LDW18-SS-Comp24	18.0 J	1.34 J	0.462 J	16.2 J	5.90

cPAH – carcinogenic polycyclic aromatic hydrocarbon
dw – dry weight
ID – identification
J – estimated concentration
OC – organic carbon
PCB – polychlorinated biphenyl
TEQ – toxic equivalent

Table 4-2. Conventionals results for 0–10-cm composite sediment samples

Composite ID	Black Carbon (%)	TOC (%)	Total Solids (%)	Grain size (%)				
				Total Gravel	Total Sand	Total Silt	Total Clay	Total Fines[a]
LDW18-SS-Comp01	0.513 J	1.94 J	60.52	4.1	56.2	25.7	13.9	39.6
LDW18-SS-Comp02	0.205 J	1.94 J	57.97	3.3	47.0	32.7	16.9	49.6
LDW18-SS-Comp03	0.099 J	1.67 J	63.65	14.7	47.4	26.6	11.4	38.0
LDW18-SS-Comp04	0.122 J	2.93 J	45.57	1.4	24.2	49.6	24.9	74.5
LDW18-SS-Comp05	0.010 J	1.47 J	67.10	21.5	39.4	27.3	11.9	39.2
LDW18-SS-Comp06	0.010 U	1.88 J	50.57	0.5	34.2	46.1	19.2	65.3
LDW18-SS-Comp07	0.050 J	2.26 J	51.95	20.5	44.7	25.1	9.8	34.9
LDW18-SS-Comp08	0.094 J	1.89 J	52.44	2.2	39.6	39.4	18.9	58.3
LDW18-SS-Comp09	0.034 J	1.95 J	49.45	0.8	27.6	49.6	22.0	71.6
LDW18-SS-Comp10	0.018 J	2.13 J	54.53	2.1	39.4	41.5	17.2	58.7
LDW18-SS-Comp11	0.044 J	1.90 J	55.45	1.0	43.9	41.3	13.6	54.9
LDW18-SS-Comp12	0.056 J	2.08 J	52.20	7.6	30.8	43.2	18.3	61.5
LDW18-SS-Comp13	0.064 J	1.49 J	48.84	0.7	22.5	56.5	20.4	76.9
LDW18-SS-Comp14	0.016 J	1.34 J	50.46	2	32.8	50.0	15.6	65.7
LDW18-SS-Comp15	0.031 J	2.10 J	48.96	0.8	34.4	51.1	13.8	64.9
LDW18-SS-Comp16	0.038 J	1.60 J	60.64	2.6	54.4	33.5	9.5	43.0
LDW18-SS-Comp17	0.010 UJ	1.85 J	58.79	21.3	42.4	27.1	9.0	36.1
LDW18-SS-Comp18	0.010 UJ	1.31 J	64.00	15.1	53.1	25.0	6.9	31.9
LDW18-SS-Comp19	0.010 UJ	1.74 J	64.34	15.0	49.1	27.7	8.2	35.9
LDW18-SS-Comp20	0.025 J	1.14 J	56.13	0.3	44.0	45.5	10.3	55.8
LDW18-SS-Comp21	0.020 J	2.35 J	46.38	0.1 U	26.4	60.9	12.7	73.6
LDW18-SS-Comp22	0.010 UJ	1.53 J	54.13	0.1	58.9	33 J	8.2	41 J
LDW18-SS-Comp23	0.014 J	1.35 J	56.24	0.4	67.5	25.4	6.8	32.2
LDW18-SS-Comp24	0.010 UJ	1.34 J	72.00	4.3	86.5	7.3	1.9	9.2

[a] Total fines is the sum of the total silt and total clay fractions.

ID – identification
J – estimated concentration
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

4.2 CHEMISTRY RESULTS FOR SMS SEDIMENT SAMPLES

Chemistry and conventional results for the 20 0–10-cm SMS sediment samples are presented in Table 4-3. Organic carbon (OC)-normalized concentrations are presented for those chemicals for which OC-normalized sediment cleanup levels are presented in ROD Table 20 (EPA 2014). PCB Aroclors were not detected in two of the samples (SS-08 and SS-188). These samples were analyzed for PCB congeners, and the results are included in Table 4-3.

Table 4-3. Chemistry and conventionals results for 0–10-cm SMS sediment samples

			Sample ID LDW18-SS																					
Analyte	Unit	DF	-8	-23	-40	-52	-69	-069-FD	-091	-101	-130	-143	-161	-169	-170	-174	-178	-178-FD	-179	-183	-184	-186	-187	-188
Metals																								
Arsenic	mg/kg	22/22	6.02	15.9	9.14	14.9	14.7	15.3	13.5	11.0	13.6	10.8	10.1	9.67	3.58	5.74	18.6	27.2	13.6	14.3	8.32	10.3	18.2	3.89
Cadmium	mg/kg	22/22	0.03 J	0.43	0.21	0.51	0.44	0.39	0.28	0.25	0.20 J	0.14 J	0.21 J	0.48	0.09 J	0.10 J	0.36 J	0.17 J	0.33	0.34	0.10 J	0.07 J	0.07 J	0.07 J
Chromium	mg/kg	22/22	10.9	33.5	22.0	33.0	33.3	32.3	32.9	23.8	28.2	23.7	25.1	33.6	13.1 J	15.7 J	32.3 J	30.7 J	30.8	30.0	19.7	18.2	17.5	16.4
Copper	mg/kg	22/22	19.4	81.2	43.5	67.6	67.4	65.5	48.5	36.0	48.4	29.8	35.8	75.5	22.2	25.1	74.0	35.6	55.2	60.5	27.1	26.9	25.2	11.8
Lead	mg/kg	22/22	17.1	42.8	31.1	43.3	35.1	35.0	60.9	12.2	15.8	9.97	16.6	52.8	11.6	17.3	35.9	20.9	22.8	31.2	19.2	14.2	13.6	4.69
Mercury	mg/kg	18/22	0.0253 U	0.210	0.0945	0.243	0.218	0.262	0.0937	0.0878	0.150	0.104	0.0961	0.225	0.0283	0.0401	0.236	0.0448 U	0.152	0.151	0.0643	0.0391 U	0.0345	0.0257 U
Silver	mg/kg	22/22	0.050 J	0.320 J	0.270 J	0.430 J	0.380 J	0.390 J	0.160 J	0.140 J	0.190 J	0.110 J	0.150 J	0.380	0.120 J	0.150 J	0.375 J	0.200 J	0.280 J	0.260 J	0.140 J	0.100 J	0.160 J	0.050 J
Zinc	mg/kg	22/22	47.8	153	90.9	126	130	130	148	81.4	102	74.5	93.2	149	48.5	49.5	133	95.1	115	123	69.6	71.2	77.1	46.3
PAHs																								
2-Methylnaphthalene	mg/kg OC	13/19	2.78 UJ	0.581 J	1.1 J	1.19 J	0.916 J	0.650 J	--	0.727 J	0.29 J	1.60 UJ	0.990 J	0.808 J	--	2.16 U	2.89	23.8	0.558 J	0.879 UJ	1.18 J	1.53 UJ	1.72 UJ	--
	µg/kg	14/22	19.9 U	13.2 J	9.2 J	25.2	19.6 J	13.4 J	15.1 J	10.9 J	8.0 J	19.7 U	20.2	16.8 J	19.3 U	19.2 U	75.5	726	14.5 J	19.6 U	11.6 J	20.0 U	19.6 U	19.2 U
Acenaphthene	mg/kg OC	14/19	2.75 J	1.02 J	0.69 J	1.74 J	0.907 J	0.534 J	--	1.33 UJ	0.482 J	1.60 UJ	4.58 J	0.740 J	--	2.16 U	11.7	69.8	0.562 J	0.529 J	0.86 J	1.53 UJ	1.72 UJ	--
	µg/kg	16/22	19.7 J	23.2	5.7 J	36.9	19.4 J	11.0 J	15.8 J	20.0 U	13.5 J	19.7 U	93.4	15.4 J	8.9 J	19.2 U	305	2,130	14.6 J	11.8 J	8.4 J	20.0 U	19.6 U	19.2 U
Acenaphthylene	mg/kg OC	15/19	0.84 J	0.965 J	1.47 J	1.17 J	1.01 J	0.767 J	--	1.33 UJ	0.29 J	1.60 UJ	0.907 J	1.58 J	--	0.90 J	0.925	2.31	0.638 J	0.475 J	1.40 J	1.53 UJ	1.72 UJ	--
	µg/kg	17/22	6.0 J	21.9	12.2 J	24.7	21.7	15.8 J	14.9 J	20.0 U	8.0 J	19.7 U	18.5 J	32.9	9.2 J	8.0 J	24.2	70.6	16.6 J	10.6 J	13.7 J	20.0 U	19.6 U	19.2 U
Anthracene	mg/kg OC	19/19	8.12 J	3.20 J	3.52 J	4.76 J	4.11 J	2.27 J	--	1.01 J	1.35 J	1.54 J	2.99 J	3.88 J	--	1.82 J	40.5	48.2	2.16 J	1.92 J	1.65 J	0.61 J	0.65 J	--
	µg/kg	21/22	58.2	72.6	29.2	101	88.0	46.7	57.9	15.2 J	37.9	18.9 J	61.0	80.7	31.6	16.2 J	1,060	1,470	56.1	42.8	16.2 J	8.0 J	7.4 J	19.2 U
Benzo(a)anthracene	mg/kg OC	19/19	12.0 J	8.85 J	9.23 J	10.3 J	8.32 J	4.90 J	--	2.49 J	4.21 J	4.79 J	5.10 J	8.46 J	--	4.12	13	22.2	5.69 J	4.26 J	4.72 J	2.18 J	1.66 J	--
	µg/kg	21/22	86.3	201	76.6	219	178	101	72.1	37.3	118	58.9	104	176	63.0	36.7	350	678	148	94.9	46.3	28.6	18.9 J	19.2 U
Benzo(a)pyrene	mg/kg OC	19/19	11.6 J	8.94 J	9.61 J	12.7 J	8.55 J	5.24 J	--	2.78 J	3.34 J	5.31 J	4.89 J	10.4 J	--	4.99	9.86	10.6	5.0 J	4.28 J	4.59 J	2.56 J	1.57 J	--
	µg/kg	21/22	82.9	203	79.8	269	183	108	100	41.7	93.6	65.3	99.8	217	54.8	44.4	258	322	130	95.4	45.0	33.5	17.9 J	19.2 U
Benzo(g,h,i)perylene	mg/kg OC	19/19	7.70 J	7.0 J	6.94 J	10.7 J	5.6 J	3.39 J	--	2.50 J	3.01 J	5.12 J	5.54 J	8.85 J	--	3.78	7.87	6.69	3.67 J	3.62 J	3.88 J	2.73 J	2.18 J	--
	µg/kg	21/22	55.2	160	57.6	227	120	69.9	132	37.5	84.3	63.0	113	184	42.5	33.6	206	204	95.3	80.7	38.0	35.7	24.8	19.2 U
Total benzofluoranthenes	mg/kg OC	19/19	20 J	22.2 J	28 J	28.9 J	20.9 J	12.9 J	--	6.87 J	10.1 J	11.9 J	11 J	25.1 J	--	15.6	25.3	25.3	10 J	11.6 J	11.0 J	6.21 J	3.69 J	--
	µg/kg	21/22	140	505	230	612	448	266	228	103	284	146	220	522	182	139	661	772	300	259	108	81.3	42.1	38.5 U
Chrysene	mg/kg OC	19/19	13.1 J	15.1 J	20.7 J	19.0 J	15.3 J	7.67 J	--	3.93 J	7.21 J	7.55 J	7.06 J	15.6 J	--	8.58	18	25.6	10.5 J	8.57 J	7.23 J	3.65 J	3.87 J	--
	µg/kg	21/22	94.1	343	172	402	328	158	134	58.9	202	92.9	144	324	121	76.4	470	782	272	191	70.9	47.8	44.1	19.2 U

Analyte	Unit	DF	Sample ID LDW18-SS																					
			-8	-23	-40	-52	-69	-069-FD	-091	-101	-130	-143	-161	-169	-170	-174	-178	-178-FD	-179	-183	-184	-186	-187	-188
Dibenzo(a,h)anthracene	mg/kg OC	15/19	2.16 J	3.57 J	2.13 J	3.33 J	1.69 J	1.50 J	--	1.33 UJ	0.961 J	1.35 J	0.583 J	2.07 J	--	1.84 J	2.72	2.74	1.15 J	1.93 J	1.98 UJ	1.53 UJ	1.72 UJ	--
	µg/kg	17/22	15.5 J	81.1 J	17.7 J	70.7 J	36.2	31.0	37.5 J	20.0 U	26.9 J	16.6 J	11.9 J	43.1	12.1 J	16.4 J	71.3	83.7	30.0	43.1 J	19.4 U	20.0 U	19.6 U	19.2 U
Dibenzofuran	mg/kg OC	14/19	0.93 J	0.797 J	0.84 J	0.986 J	0.916 J	0.43 J	--	1.33 UJ	0.33 J	1.60 UJ	2.82 J	0.577 J	--	2.16 U	8.68	36.4	0.581 J	0.43 J	0.62 J	1.53 UJ	1.72 UJ	--
	µg/kg	15/22	6.7 J	18.1 J	7.0 J	20.9	19.6 J	8.8 J	11.9 J	20.0 U	9.1 J	19.7 U	57.6	12.0 J	19.3 U	19.2 U	227	1,110	15.1 J	9.5 J	6.1 J	20.0 U	19.6 U	19.2 U
Fluoranthene	mg/kg OC	19/19	54.8 J	17.1 J	17.5 J	22.6 J	18 J	9.17 J	--	5.69 J	13.3 J	11 J	18 J	17.7 J	--	14.8	56.2	165	9.92 J	11.3 J	11.0 J	6.04 J	3.43 J	--
	µg/kg	21/22	393	389	145	479	380	189	223	85.4	372	130	360	368	182 J	132	1,470	5,030	258	252	108	79.1	39.1	19.2 U
Fluorene	mg/kg OC	16/19	3.36 J	1.41 J	0.90 J	1.83 J	1.50 J	0.786 J	--	0.54 J	0.618 J	0.78 J	2.59 J	1.03 J	--	0.79 J	0.761 U	77.0	1.00 J	0.726 J	1.31 J	1.53 UJ	1.72 UJ	--
	µg/kg	18/22	24.1	32.1	7.5 J	38.9	32.0	16.2 J	19.8	8.1 J	17.3 J	9.6 J	52.9	21.4	10.5 J	7.0 J	19.9 U	2,350	26.1	16.2 J	12.8 J	20.0 U	19.6 U	19.2 U
Indeno(1,2,3-cd)pyrene	mg/kg OC	19/19	6.96 J	6.6 J	6.63 J	9.62 J	5.42 J	3.24 J	--	2.14 J	2.57 J	3.86 J	4.48 J	7.07 J	--	3.90	6.5	5.84	3.50 J	3.40 J	4.88 J	2.56 J	1.46 J	--
	µg/kg	21/22	49.9	150	55.0	204	116	66.7	96.7	32.1	71.9	47.5	91.4	147	35.0	34.7	170	178	91.0	75.9	47.8	33.5	16.7 J	19.2 U
Naphthalene	mg/kg OC	16/19	4.12 J	0.837 J	1.52 J	2.08 J	1.25 J	1.00 J	--	0.860 J	0.30 J	1.60 UJ	2.70 J	1.60 J	--	1.15 J	2.55	2.68	0.704 J	0.538 J	3.43 J	1.53 UJ	1.72 UJ	--
	µg/kg	18/22	29.5	19.0 J	12.6 J	44.0	26.7	20.7	18.7 J	12.9 J	8.5 J	19.7 U	55.0	33.2	13.8 J	10.2 J	66.8	81.8	18.3 J	12.0 J	33.6	20.0 U	19.6 U	19.2 U
Phenanthrene	mg/kg OC	19/19	25.5 J	11 J	6.36 J	14.1 J	7.10 J	3.54 J	--	3.95 J	5.29 J	5.58 J	8.73 J	8.46 J	--	5.30	75.3	233	4.42 J	3.68 J	5.28 J	2.68 J	2.27 J	--
	µg/kg	22/22	183	250	52.8	298	152	73.0	109	59.2	148	68.6	178	176	105	47.2	1,970	7,120	115	82.0	51.7	35.1	25.9	5.4 J
Pyrene	mg/kg OC	19/19	53.3 J	17.3 J	18.4 J	25.5 J	17.4 J	9.37 J	--	6.01 J	10.1 J	10.5 J	13.7 J	20.0 J	--	10.8	41.7	105	9.00 J	9.78 J	11.7 J	5.34 J	3.50 J	--
	µg/kg	21/22	382	393	153	541	373	193	225	90.2	282	129	279	417	246 J	95.8	1,090	3,210	234	218	115	70.0	39.9	19.2 U
Total HPAHs	mg/kg OC	19/19	181 J	107 J	120 J	143 J	101 J	57.4 J	--	32.4 J	54.8 J	61 J	69.6 J	115 J	--	68.4 J	182	369	62 J	58.7 J	59.1 J	31.3 J	21.4 J	--
	µg/kg	21/22	1,300 J	2,430 J	990 J	3,024 J	2,160	1,183	1,200 J	486	1,535 J	750 J	1,420 J	2,398	938 J	609 J	4,750	11,260	1,600	1,310 J	579	409.5	243.5 J	38.5 U
Total LPAHs	mg/kg OC	19/19	44.8 J	19 J	14.5 J	25.7 J	15.9 J	8.90 J	--	6.36 J	8.32 J	7.89 J	22.5 J	17.3 J	--	9.96 J	131	433	9.50 J	7.87 J	13.9 J	3.29 J	2.92 J	--
	µg/kg	22/22	321 J	420 J	120.0 J	544	340 J	183.4 J	236 J	95.4 J	233 J	97.1 J	459 J	360 J	179 J	88.6 J	3,430	13,220	247 J	175.4 J	136.4 J	43.1 J	33.3 J	5.4 J
cPAH TEQ - mammal (half DL)	µg/kg	21/22	118 J	324 J	125 J	405 J	275	165	200 J	63.5	154 J	98.1 J	148 J	322	88.9 J	72.8 J	409	526	200	158 J	69.8	52.3	30.0 J	17.4 U
Phthalates																								
Bis(2-ethylhexyl)phthalate	mg/kg OC	19/19	4.58 J	9.43 J	14.2 J	11.7 J	14.9 J	16.1 J	--	8.20 J	6.54 J	11 J	5.10 J	29.1 J	--	3.33 J	13.0	11.4	10.7 J	9.10 J	15.4 J	7.50 J	3.29 J	--
	µg/kg	21/22	32.8 J	214	118	248	318	332	802	123	183	140	104	605	86.1	29.6 J	339	347	278	203	151	98.3	37.5 J	48.1 U
Butyl benzyl phthalate	mg/kg OC	6/19	2.78 UJ	2.24 J	2.31 UJ	1.58 J	1.60 J	0.947 UJ	--	1.33 UJ	0.714 UJ	1.60 UJ	0.975 UJ	2.32 J	--	2.16 U	0.761 U	1.96 U	0.742 UJ	1.84 J	1.98 UJ	1.42 J	1.72 UJ	--
	µg/kg	7/22	19.9 U	50.8	19.2 U	33.6	34.3	19.5 U	56.0	20.0 U	20.0 U	19.7 U	19.9 U	48.2	19.3 U	19.2 U	19.9 U	59.9 U	19.3 U	41.1	19.4 U	18.6 J	19.6 U	19.2 U
Dimethyl phthalate	mg/kg OC	0/19	2.78 UJ	0.872 UJ	2.31 UJ	0.939 UJ	0.921 UJ	0.947 UJ	--	1.33 UJ	0.714 UJ	1.60 UJ	0.975 UJ	0.957 UJ	--	2.16 U	0.761 U	1.96 U	0.742 UJ	0.879 UJ	1.98 UJ	1.53 UJ	1.72 UJ	--

Analyte	Unit	DF	Sample ID LDW18-SS																					
			-8	-23	-40	-52	-69	-069-FD	-091	-101	-130	-143	-161	-169	-170	-174	-178	-178-FD	-179	-183	-184	-186	-187	-188
	µg/kg	0/22	19.9 U	19.8 U	19.2 U	19.9 U	19.7 U	19.5 U	19.8 U	20.0 U	20.0 U	19.7 U	19.9 U	19.9 U	19.3 U	19.2 U	19.9 U	59.9 U	19.3 U	19.6 U	19.4 U	20.0 U	19.6 U	19.2 U
Other SVOCs																								
1,2,4-Trichlorobenzene	mg/kg OC	0/19	0.70 UJ	0.22 UJ	0.58 UJ	0.24 UJ	0.23 UJ	0.24 UJ	--	0.33 UJ	0.18 UJ	0.40 UJ	0.25 UJ	0.24 UJ	--	0.54 U	0.19 U	0.492 U	0.18 UJ	0.22 UJ	0.50 UJ	0.38 UJ	0.43 UJ	--
	µg/kg	0/22	5.0 U	5.0 U	4.8 U	5.0 U	4.9 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	5.0 U	5.0 U	4.8 U	4.8 U	5.0 U	15.0 U	4.8 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U
1,2-Dichlorobenzene	mg/kg OC	4/19	0.70 UJ	0.22 UJ	0.58 UJ	0.061 J	0.23 UJ	0.24 UJ	--	0.33 UJ	0.18 UJ	0.40 UJ	0.25 UJ	0.058 J	--	0.15 J	0.046 J	0.492 U	0.18 UJ	0.22 UJ	0.50 UJ	0.38 UJ	0.43 UJ	--
	µg/kg	5/22	5.0 U	5.0 U	4.8 U	1.3 J	4.9 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	5.0 U	1.2 J	1.1 J	1.3 J	1.2 J	15.0 U	4.8 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U
1,4-Dichlorobenzene	mg/kg OC	13/19	0.14 J	0.12 J	0.28 J	0.18 J	0.17 J	0.11 J	--	0.33 UJ	0.036 J	0.40 UJ	0.25 UJ	0.23 J	--	0.18 J	0.14 J	0.492 U	0.069 J	0.085 J	0.29 J	0.38 UJ	0.43 UJ	--
	µg/kg	14/22	1.0 J	2.8 J	2.3 J	3.8 J	3.7 J	2.2 J	5.0 U	5.0 U	1.0 J	4.9 U	5.0 U	4.8 J	2.4 J	1.6 J	3.6 J	15.0 U	1.8 J	1.9 J	2.8 J	5.0 U	4.9 U	4.8 U
2,4-Dimethylphenol	µg/kg	6/22	24.9 U	24.8 U	24.0 U	8.7 J	3.9 J	24.4 U	2.4 J	24.9 U	24.9 U	24.6 U	24.9 U	3.2 J	24.2 U	3.0 J	2.9 J	74.9 U	24.1 U	24.5 U	24.3 U	24.9 U	24.4 U	24.1 U
4-Methylphenol	µg/kg	6/22	19.9 U	19.8 U	19.2 U	16.0 J	18.1 J	19.5 U	19.8 U	26.6	20.0 U	19.7 U	23.2	19.9 U	19.3 U	19.2 U	19.9 U	59.9 U	20.9	19.6 U	25.5	20.0 U	19.6 U	19.2 U
Benzoic acid	µg/kg	16/22	49.6 U	59.3 J	29.9 J	49.8 UJ	59.3	56.6	42.7 J	47.2 J	25.1 J	20.3 J	108 J	41.3 J	48.4 UJ	27.9 UJ	120 J	87.1 J	154	20.1 J	39.7 J	51.2 J	48.9 UJ	47.6 UJ
Benzyl alcohol	µg/kg	20/22	19.9 U	49.6	7.1 J	24.9	75.3	35.3	46.2	111	76.5	42.7	19.7 J	28.9	19.3 U	11.6 J	92.4	91.4	107	62.1	6.2 J	9.6 J	6.5 J	10.1 J
Hexachlorobenzene	mg/kg OC	0/19	0.70 UJ	0.22 UJ	0.58 UJ	0.24 UJ	0.23 UJ	0.24 UJ	--	0.33 UJ	0.18 UJ	0.40 UJ	0.25 UJ	0.24 UJ	--	0.54 U	0.19 U	0.492 U	0.18 UJ	0.22 UJ	0.50 UJ	0.38 UJ	0.43 UJ	--
	µg/kg	0/22	5.0 U	5.0 U	4.8 U	5.0 U	4.9 U	4.9 U	5.0 U	5.0 U	5.0 U	4.9 U	5.0 U	5.0 U	4.8 U	4.8 U	5.0 U	15.0 U	4.8 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U
n-Nitrosodiphenylamine	mg/kg OC	6/19	0.70 UJ	0.22 UJ	0.22 J	0.25 J	0.22 J	0.14 J	--	0.33 UJ	0.18 UJ	0.40 UJ	0.25 UJ	0.30 J	--	0.16 J	0.19 U	0.492 U	0.18 UJ	0.22 UJ	0.50 UJ	0.38 UJ	0.43 UJ	--
	µg/kg	7/22	5.0 U	5.0 U	1.8 J	5.3	4.8 J	2.8 J	6.3	5.0 U	5.0 U	4.9 U	5.0 U	6.2	4.8 U	1.4 J	5.0 U	15.0 U	4.8 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U
PCP	µg/kg	9/22	19.9 UJ	3.1 J	19.2 UJ	4.4 J	5.8 J	2.8 J	3.6 J	20.0 UJ	20.0 UJ	19.7 UJ	19.9 UJ	13.7 J	19.3 UJ	2.6 J	7.8 J	59.9 UJ	2.3 J	19.6 UJ	19.4 UJ	20.0 UJ	19.6 UJ	19.2 UJ
Phenol	µg/kg	17/22	19.9 U	27.3 J	19.2 U	15.9 J	28.8 J	45.8 J	16.0 J	25.5 J	17.3 J	19.7 U	11.8 J	23.3 J	9.4 J	18.7 J	95.0 J	35.6 J	86.0 J	21.1 J	10.1 J	20.0 U	10.7 J	19.2 U
PCBs																								
Total PCBs[b]	mg/kg OC	19/19	1.49 J[b]	9.04 J	20.1 J	14.2 J	11.6 J	9.84 J	--	4.17 J	2.42 J	3.14 J	4.51 J	9.70 J	--	5.52 J	9.26	7.90	4.72 J	8.85 J	10.4 J	4.31 JN	5.73 J	--
	µg/kg	22/22	10.704 J[b]	205.1 J	166.5	302	249.1	202.7	137.6	62.6 J	67.7 J	38.6 J	92.1 J	201.8[c]	56.3 J	49.1 J[c]	242.4	241	122.6[c]	197.3	102.4 J[c]	56.5 JN	65.3[c]	0.3130 J[b]
Grain size																								
Total gravel	%	20/22	28.8	1.5	1.1	1.1	0.1	0.1 U	1.9	0.4	1.2	0.2	0.9	0.5	1.7	1.2	0.2	0.1 U	3 J	2.4	1.1	9.7	42.0	0.2
Total sand	%	22/22	69.3	14.4	45.2	21.2	12.3	13.0	46.7	30.2	16.2	36.0	36.3	38.1	85.8	58.2	5.8	6.5	11.1 J	17.7	62.7	68.0	43.2	99.5
Total silt	%	20/22	1.9 U	60.3	41.6	54.6	63.6	63.1	42.0	55.7	69.1	54.2	53.5	41.3	9.1	34.4	67.1	66.3	67.4	59.6	30.0	18.2	11.5	0.3 U
Total clay	%	20/22	1.9 U	23.9	12.1	23.2	24.0	24.1	9.3	13.7	13.5	9.8	9.1	20.1	3.2	6.1	27.1	27.2	19.1	20.3	6.3	4.1	3.2	0.3 U
Total fines[a]	%	20/22	1.9 U	84.2	53.7	77.8	87.6	87.2	51.3	69.4	82.6	64.0	62.6	61.4	12.3	40.5	94.2	93.5	86.5	79.9	36.3	22.3	14.7	0.3 U
Conventionals																								
TOC	%	22/22	0.717 J	2.27 J	0.830 J	2.12 J	2.14 J	2.06 J	3.67 J	1.50 J	2.80 J	1.23 J	2.04 J	2.08 J	0.410	0.890	2.62	3.05	2.60 J	2.23 J	0.980 J	1.31 J	1.14 J	0.450 J
Total solids	%	22/22	81.11	44.83	53.61	50.02	46.98	47.77	46.31	48.59	41.04	49.18	44.65	56.90	72.23	59.19	45.14	44.64	44.58	48.16	59.79	62.01	64.20	74.32
Black carbon	%	9/11	na	na	na	na	na	na	na	na	na	na	na	0.035 J	0.042 J	0.047 J	0.084 J	0.162 J	0.070 J	1.05 J	0.010 UJ	0.010 UJ	0.031 J	0.020 J

Note: "–" indicates that TOC was out of range for TOC normalization (< 0.5% or > 3.5%) noted in SCUM II (Ecology 2017) for comparison to benthic SCO, so the OC-normalized value was not calculated.

[a] Total fines is the sum of the total silt and total clay fractions.

[b] All of the results are PCB Aroclor sums except for samples SS-008 and SS-188, which had no detected Aroclor results and thus were analyzed for PCB congeners. The total PCB results for these two samples are the sum of congeners.

[c] This sample was also analyzed for PCB congeners, and the results are provided in Table 4-5.

Axys – SGS Axys Analytical Services, Ltd.
cPAH – carcinogenic polycyclic aromatic hydrocarbon
DF – detection frequency
DL – detection limit
FD – field duplicate
J – estimated concentration
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
ID – identification
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
na – not analyzed
N – tentative identification
OC – organic carbon
PCP – pentachlorophenol
PCB – polychlorinated biphenyl
SCO – sediment cleanup objective
SCUM – sediment cleanup user's manual
SVOC – semivolatile organic compound
TEQ – toxic equivalent
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

4.3 PCB Porewater Investigation Results

The chemistry (PCB Aroclors) and conventional parameters for the 20 surface sediment samples initially evaluated as part of the PCB porewater investigation are summarized in Table 4-4. These samples included 10 SMS sediment samples[9] and 10 surface sediment samples collected for the PCB porewater investigation only. Ten of these samples were selected for the PCB porewater investigation (Hale 2018b), the results of which are discussed herein.

[9] These 10 samples were collected for SMS analysis and for inclusion in the PCB porewater investigation. The data for these samples are presented twice in order to present all PCB porewater investigation data together for clarity.

Table 4-4. Total PCB and conventionals results for the 0–10-cm sediment samples considered in the *ex situ* PCB porewater investigation

Analyte	Unit	DF	Sample ID LDW18-SS																				
			-169	-170	-171	-172	-173	-174	-175	-176	-177	-178	-178-FD	-179	-180	-181	-182	-183	-184	-185	-186	-187	-188
PCBs																							
Total PCB Aroclors	mg/kg OC	na	9.70 J	13.7J[a]	11.6	14.9 J[a]	23.4	5.52 J	22.4	30	14 J	9.26	7.90	4.72 J	55.7 J	200 J[a]	160	8.85 J	10.4 J	21.8 J	4.31 JN	5.73 J	4.00 UJ[a]
	µg/kg	20/21	201.8	56.3 J	162.9	743 J	396	49.1 J	354	354	450	242.4	241	122.6	1,420	6,900	5,450	197.3	102.4 J	253 J	56.5 JN	65.3	18.0 U
Grain size																							
Total fines	%	20/21	61.4	12.3	41.9	48.4	73.0	40.5	53.0	59.8	72.7	94.2	93.5	86.5	56.3	57.7	32.0	79.9	36.3	28.0	22.3	14.7	0.3 U
Total gravel	%	20/21	0.5	1.7	9.8	3.5	0.5	1.2	2.1	1.8	1.6	0.2	0.1 U	3 J	3.1	2.2	5.1	2.4	1.1	18.4	9.7	42.0	0.2
Total sand	%	21/21	38.1	85.8	48.3	48.2	26.6	58.2	45.1	38.5	25.6	5.8	6.5	11.1 J	40.6	40.1	62.9	17.7	62.7	53.7	68.0	43.2	99.5
Total silt	%	20/21	41.3	9.1	29.6	37.2	49.8	34.4	34.9	45.2	60.4	67.1	66.3	67.4	45.9	48.1	25.7	59.6	30.0	22.8	18.2	11.5	0.3 U
Total clay	%	20/21	20.1	3.2	12.3	11.2	23.2	6.1	18.1	14.6	12.3	27.1	27.2	19.1	10.4	9.6	6.3	20.3	6.3	5.2	4.1	3.2	0.3 U
Conventionals																							
TOC	%	21/21	2.08 J	0.410	1.40	4.97	1.69	0.890	1.58	1.18	3.19 J	2.62	3.05	2.60 J	2.55 J	3.53 J	3.40	2.23 J	0.980 J	1.16 J	1.31 J	1.14 J	0.450 J
Total solids	%	21/21	56.90	72.23	64.75	40.54	52.36	59.19	57.41	59.73	44.53	45.14	44.64	44.58	46.21	41.42	49.17	48.16	59.79	63.82	62.01	64.20	74.32
Black carbon	%	18/21	0.035 J	0.042 J	0.078 J	0.133 J	0.056 J	0.047 J	0.051 J	0.054 J	0.051 J	0.084 J	0.162 J	0.070 J	0.087 J	0.934 J	0.692 J	1.05 J	0.010 UJ	0.010 UJ	0.010 UJ	0.031 J	0.020 J

[a] Although TOC was out of range for TOC normalization (< 0.5% or > 3.5%) noted in SCUM II (Ecology 2017) for comparison to benthic SCO, OC-normalized values are presented herein for informational purposes only.

DF – detection frequency
FD – field duplicate
ID – identification
J – estimated concentration
N – tentative identification
na – not applicable
OC – organic carbon
PCB – polychlorinated biphenyl
SCO – sediment cleanup objective
SCUM – sediment cleanup user's manual
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

Ten of the 20 sediment samples presented in Table 4-4 were selected for PCB porewater analysis (Appendix E). All of the selected sediment samples were analyzed for PCB congeners; the total PCB concentrations calculated as the sum of Aroclors and sum of congeners are presented in Table 4-5, which also presents the PCB porewater results. The complete congener dataset is provided in Appendix C. The results for the polyethylene (PE) samplers[10] and the supporting documentation for the calculation of freely dissolved PCB porewater concentrations (C_{free}) are provided in Appendix F.

Table 4-5. Total PCBs results in sediment and porewater for samples used in PCB porewater investigation

Sample ID	Total PCBs in Sediment – Sum of Aroclors (µg/kg)	Total PCBs in Sediment – Sum of Congeners (µg/kg)	Sediment TOC (%)	Sediment Black Carbon (%)	Total PCB C_{free} in porewater – Sum of Congeners (ng/L)
LDW18-SS169	201.8	138.93 J	2.08 J	0.035 J	3.082 J
LDW18-SS172	743 J	508.6 J	4.97	0.133 J	7.339 J
LDW18-SS174	49.1 J	32.68 J	0.890	0.047 J	1.6019 J
LDW18-SS175	354	250.6 J	1.58	0.051 J	11.586 J
LDW18-SS177	450	385.5 J	3.19 J	0.051 J	4.134 J
LDW18-SS179	122.6	78.06 J	2.60 J	0.070 J	2.470 J
LDW18-SS180	1,420	1,172.6 J	2.55 J	0.087 J	19.59 J
LDW18-SS184	102.4 J	59.63 J	0.980 J	0.010 UJ	2.468 J
LDW18-SS185	253 J	247.5 J	1.16 J	0.010 UJ	5.780 J
LDW18-SS187	65.3	40.34 J	1.14 J	0.031 J	2.215 J

C_{free} – freely dissolved concentration
ID – identification
J – estimated concentration
PCB – polychlorinated biphenyl
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

4.4 Chemistry Results for the Potential Clamming Area and the Beach Play Area Composite Sediment Samples

Chemistry and conventionals results for the three site-wide potential clamming area composite samples are summarized in Table 4-6. Chemistry and conventionals results for the eight beach play area composite samples are summarized in Table 4-7. Collection of these samples is discussed in Section 2.1.1.2.

[10] The PE samplers were placed in these 10 sediment samples in the laboratory on March 16, 2018, and removed on April 13, 2018.

Table 4-6. Chemistry and conventional results for 0–45-cm potential clamming area composite sediment samples

Composite ID	Total PCB Aroclors (µg/kg dw)	Dioxins/ Furans TEQ (ng/kg dw)	cPAH TEQ (µg/kg dw)	Toxaphene (µg/kg dw)	Arsenic (mg/kg dw)	TOC (%)	Total Solids (%)	Grain Size (%)				
								Total Gravel	Total Sand	Total Silt	Total Clay	Total Fines[a]
LDW18-IT45-CL-Comp1	239	15.3 J	388 J	25.0 U	11.8 J	1.60	68.27	8.7	59.9	24.6	6.9	31.5
LDW18-IT45-CL-Comp2	1,351 JN	69.1 J	693	24.4 U	11.8 J	1.93	68.88	8.9	60.4	23.0	7.6	30.6
LDW18-IT45-CL-Comp3	261 J	16.3 J	61.4	24.9 U	8.35 J	1.41	70.02	8.9	62.3	21.8	7.3	29.1
LDW18-IT45-CL-Comp4[b]	195.0	na	102	na	na	1.17 J	71.91	na	na	na	na	na
LDW18-IT45-CL-Comp5[b]	276	na	83.9	na	na	1.21 J	71.06	na	na	na	na	na

a Total fines is the sum of the total silt and total clay fractions.

b This sample is a composite replicate of LDW18-IT45-CL-Comp1. The composite replicates were created by repeating the compositing procedure multiple times for LDW18-IT45-CL-Comp1. The composite replicates were analyzed for PCBs, cPAHs, TOC, and total solids.

cPAH – carcinogenic polycyclic aromatic hydrocarbon
dw – dry weight
ID – identification
J – estimated concentration
N – tentative identification
na – not applicable
OC – organic carbon
PCB – polychlorinated biphenyl
TEQ – toxic equivalent
TOC – total organic carbon
U – not detected at given concentration

Table 4-7. Chemistry and conventionals results for 0–45-cm beach play area composite sediment samples

Composite ID	Total PCB Aroclors (µg/kg dw)	Dioxins/ Furans TEQ (ng/kg dw)	cPAH TEQ (µg/kg dw)	Toxaphene (µg/kg dw)	Arsenic (mg/kg dw)	TOC (%)	Total Solids (%)	Grain Size				
								Total Gravel	Total Sand	Total Silt	Total Clay	Total Fines[a]
LDW18-IT45-B1-												
Comp1	265	1.39 J	362	24.8 U	4.93 J	0.32	78.41	1.4	96.0	2.7 U	2.7 U	2.7 U
Comp1-FD[b]	352	3.47 J	1,380	24.9 U	16.3 J	0.40	77.91	1.6	93.9	3.3	1.4	4.7
Comp2	78.7 J	1.96 J	111	24.4 U	16.0 J	0.23	73.25	2.8	92.6	2.9	1.7	4.6

Table 4-7. Chemistry and conventionals results for 0–45-cm beach play area composite sediment samples

Composite ID	Total PCB Aroclors (µg/kg dw)	Dioxins/ Furans TEQ (ng/kg dw)	cPAH TEQ (µg/kg dw)	Toxaphene (µg/kg dw)	Arsenic (mg/kg dw)	TOC (%)	Total Solids (%)	Grain Size				
								Total Gravel	Total Sand	Total Silt	Total Clay	Total Fines[a]
Comp2-FD[b]	102.3	2.58 J	84.9	24.8 U	22.7 J	0.45	76.35	3.2	91.4	3.6	1.9	5.5
Comp3	17.0	1.47 J	35.3	24.8 U	23.2 J	0.30	77.92	3.5	90.8	3.8	1.9	5.7
Comp3-FD[b]	24.3 J	1.34 J	44.1	24.8 U	8.79 J	0.24	76.71	5.9	88.9	3.4	1.9	5.3
LDW18-IT45-B2-												
Comp1	120.3 J	27.0 J	272	24.2 U	55.3 J	1.52	60.19	2.4	44.0	42.5	11.1	53.6
Comp2	118.1	11.7 J	445	24.1 U	32.8 J	1.29	70.87	12.6	53.2	29.5	4.6	34.1
Comp3	66.2	8.34 J	111	24.4 U	46.1 J	0.94	71.79	23.9	52.9	17.1	6.2	23.3
LDW18-IT45-B3-												
Comp1	69.7 J	4.62 J	197 J	24.6 U	4.60	2.60 J	71.39	12.8	77.3	6.3	3.7	10.0
Comp2	238.6	8.19 J	83.7	23.9 U	2.96	0.35 J	73.50	17.4	76.3	4.2	2.0	6.2
Comp3	23.0 JN	0.306 J	20.7	24.1 U	4.48	1.01 J	63.64	9.4	38.7	43.3	8.6	51.9
LDW18-IT45-B4-												
Comp1	322 J	12.0 J	57.1	24.9 U	8.51 J	0.29	72.57	10.6	77.6	9.3	2.5	11.8
Comp2	556 JN	73.4 J	55.8	24.5 U	6.14 J	0.96	71.72	5.8	75.4	15.3	3.5	18.8
Comp3	199.5	4.68 J	23.5	25.0 U	4.08 J	0.93	72.43	8.8	68.2	19.4	3.7	23.1
LDW18-IT45-B5-												
Comp1	92.4 JN	4.40 J	357	24.9 U	5.52 J	1.57	74.94	27.2	56.4	11.9	4.6	16.5
Comp2	160.2 J	6.41 J	41.9	24.4 U	12.4 J	1.07	72.15	9.4	63.5	21.3	5.8	27.1
Comp3	90.4 JN	5.07 J	3,050	24.9 U	8.31 J	0.99	67.65	20.2	62.9	12.7	4.2	16.9
LDW18-IT45-B6-												
Comp1	184	8.86 J	1,240	24.2 U	68.1	1.15 J	63.47	14.6	64.5	16.0	4.7	20.7
Comp1-FD[b]	224 J	13.6 J	8,860	25.0 U	51.8	1.01 J	64.22	13.2	65.2	16.8	4.8	21.6

Table 4-7. Chemistry and conventionals results for 0–45-cm beach play area composite sediment samples

Composite ID	Total PCB Aroclors (µg/kg dw)	Dioxins/ Furans TEQ (ng/kg dw)	cPAH TEQ (µg/kg dw)	Toxaphene (µg/kg dw)	Arsenic (mg/kg dw)	TOC (%)	Total Solids (%)	Grain Size				
								Total Gravel	Total Sand	Total Silt	Total Clay	Total Fines[a]
Comp2	990 J	21.7 J	1,480	24.3 U	28.8	1.78 J	66.49	14.0	55.4	25.1	5.5	30.6
Comp2-FD[b]	901 J	15.2 J	657	24.9 U	37.5	1.74 J	64.79	11.9	52.8	28.7	6.6	35.3
Comp3	510	9.16 J	1,310	24.9 U	37.0	6.00 J	62.33	17.1	54.7	22.0	6.2	28.2
Comp3-FD[b]	514	30.7 J	660	24.9 U	17.9	3.94 J	64.31	17.1	51.7	25.8	5.4	31.2
LDW18-IT45-B7-												
Comp1	36.9	1.87 J	38.3	24.9 U	4.95	0.61 J	68.30	5.8	70.6	19.3 J	4.5	23.8 J
Comp2	50.5	2.24 J	38.5	24.8 U	4.78	0.93 J	65.79	1.9	68.0	25.0	5.2	30.2
Comp3	108.2	2.27 J	52.4	24.7 U	6.60	1.41 J	62.24	0.4	62.7	30.8	6.3	37.1
LDW18-IT45-B8-												
Comp1	92.1 J	2.92 J	58.9	24.9 U	6.93	1.27 J	60.49	0.4	60.2	32.0	7.5	39.5
Comp2	204.2	4.08 J	106	24.9 U	10.1	1.25 J	65.88	1.9	60.6	30.8	6.9	37.7
Comp3	71.9	5.15 J	158	24.6 U	6.12	0.76 J	61.81	4.7	55.5	32.0	7.9	39.9

a Total fines is the sum of the total silt and total clay fractions.

b FD samples were collected by filling a second jar at each location included in the composite.

cPAH – carcinogenic polycyclic aromatic hydrocarbon
dw – dry weight
FD – field duplicate
ID – identification
J – estimated concentration
N – tentative identification
OC – organic carbon
PCB – polychlorinated biphenyl
TEQ – toxic equivalent
TOC – total organic carbon
U – not detected at given concentration

4.5 CHEMISTRY RESULTS FOR NEAR-OUTFALL SAMPLES

Chemistry and conventionals results for each near-outfall sample are presented in Table 4-8. OC-normalized concentrations are presented for those chemicals for which OC-normalized sediment cleanup levels are presented in ROD Table 20 (EPA 2014).

Table 4-8. Chemistry and conventionals results for 0–10-cm near-outfall surface sediment samples

Analyte	Unit	DF	Sample ID LDW18-SSOT-																			
			2100A-1	2100A-2	2101	2109-1	2109-2	2114	2507	2509	2510	5thAveS	CleanScapesB	DawnFoods	DeltaMarine	Ditch2	DuwSD3	FedCtrS	GlacierNW-CBP	SeattleDistCtr	T107Park	T107Park-FD
Metals																						
Arsenic	mg/kg	20/20	8.19	7.16	7.23	8.71	9.51	19.2	6.61	5.86	3.53	10.6	12.6	12.6	11.1	10.2	3.17	4.51	14.9	15.0	59.0	10.9
Cadmium	mg/kg	20/20	0.18	0.14 J	0.06 J	0.09 J	0.10 J	0.09 J	0.19 J	0.21	0.05 J	0.17	0.13 J	0.21	0.21 J	0.07 J	0.06 J	0.12 J	0.29	0.37	0.33	0.18 J
Chromium	mg/kg	20/20	44.6	52.1	15.5	17.7	21.5	31.0	17.8 J	20.2	10.3	26.2	21.5	26.9	26.6 J	21.5	11.2	19.9 J	26.4	30.1	20.2	28.6
Copper	mg/kg	20/20	47.5	37.2	22.1	30.7	36.4	41.6	29.2	27.8	11.9	38.7	35.7	46.8	39.2	22.2	11.3	26.4	55.2	65.1	898	92.7
Lead	mg/kg	20/20	20.8	38.3	11.7	23.2	24.0	33.2	30.7	20.8	7.82	29.1	21.9	26.8	13.2 J	9.11	5.02	14.0	28.4	42.0	141	123
Mercury	mg/kg	18/20	0.0558	0.0353	0.0340 U	0.0524	0.0485	0.156	0.0355	0.0752	0.0305 U	0.0736	0.0640	0.0847	0.0910	0.0785	0.0307	0.0411	0.131	0.115	0.469	1.14
Silver	mg/kg	20/20	0.080 J	0.080 J	0.060 J	0.090 J	0.100 J	0.120 J	0.110 J	0.120 J	0.04 J	0.120 J	0.150 J	0.190 J	0.145 J	0.060 J	0.040 J	0.110 J	0.260 J	0.260 J	0.280 J	0.210 J
Zinc	mg/kg	20/20	271	323	47.8	65.4	66.9	120	95.4	111	38.2	113	87.3	108	93.8	55.8	38.3	53.9	106	137	135	134
PAHs																						
2-Methylnaphthalene	mg/kg OC	13/17	1.24 UJ	0.766 UJ	1.85 UJ	1.84 J	0.908 J	0.43 J	0.952 U	1.25 J	--	0.62 J	0.995 J	1.33 J	1.06 J	0.63 J	--	--	0.517 J	1.03 J	3.77 J	5.97 J
	µg/kg	14/20	19.4 U	19.6 U	19.8 U	13.8 J	16.7 J	9.1 J	19.7 U	13.8 J	19.9 U	9.6 J	21.1	17.3 J	25.4	8.5 J	19.4 U	11.7 J	12.0 J	21.2	58.8	87.8
Acenaphthene	mg/kg OC	12/17	1.24 UJ	0.766 UJ	1.85 UJ	1.43 J	0.636 J	0.678 J	0.527 J	1.73 UJ	--	0.940 J	6.23 J	3.22 J	0.805 UJ	0.41 J	--	--	0.690 J	3.92 J	7.31 J	13.1 J
	µg/kg	14/20	19.4 U	19.6 U	19.8 U	10.7 J	11.7 J	14.5 J	10.9 J	19.0 U	6.3 J	14.5 J	132	41.9	19.3 U	5.5 J	19.4 U	9.9 J	16.0 J	80.7	114	192
Acenaphthylene	mg/kg OC	10/17	1.24 UJ	0.766 UJ	1.85 UJ	1.88 J	1.18 J	1.14 J	0.517 J	1.73 UJ	--	1.90 J	1.63 J	16.8 J	0.805 UJ	1.46 UJ	--	--	0.858 UJ	1.82 J	19.0 J	45.7 J
	µg/kg	10/20	19.4 U	19.6 U	19.8 U	14.1 J	21.8	24.3	10.7 J	19.0 U	19.9 U	29.3	34.6	218	19.3 U	19.6 U	19.4 U	19.0 U	19.9 U	37.5	297	672
Anthracene	mg/kg OC	16/17	1.10 J	1.23 J	1.85 UJ	3.89 J	2.35 J	3.53 J	0.990	1.50 J	--	6.36 J	15.4 J	17.2 J	0.776 J	1.68 J	--	--	2.29 J	5.05 J	34.6 J	62.4 J
	µg/kg	17/20	17.1 J	31.4	19.8 U	29.2	43.3	75.6	20.5	16.5 J	19.9 U	98.2	326	223	18.6 J	22.6	19.4 U	25.2	53.1	104	539	917
Benzo(a)anthracene	mg/kg OC	17/17	4.58 J	4.10 J	1.98 J	9.08 J	5.20 J	9.11 J	2.07	3.66 J	--	14 J	71.2 J	113 J	2.12 J	4.83 J	--	--	5.26 J	14.8 J	102 J	164 J
	µg/kg	19/20	71.4	105	21.2	68.1	95.7	195	42.9	40.3	19.9 U	210	1,510	1,470	50.8	65.0	8.9 J	55.4	122	304	1,590	2,410

Table 4-8. Chemistry and conventionals results for 0–10-cm near-outfall surface sediment samples

Analyte	Unit	DF	Sample ID LDW18-SSOT-																		
			2100A-1	2100A-2	2101	2109-1	2109-2	2114	2507	2509	2510	5thAveS	CleanScapesB	DawnFoods	DeltaMarine	Ditch2	DuwSD3	FedCtrS	GlacierNW-CBP	SeattleDistCtr	T107Park	T107Park-FD
Benzo(a)pyrene	mg/kg OC	17/17	4.18 J	4.41 J	2.11 J	13.1 J	5.92 J	8.88 UJ	2.43	3.17 J	--	19.0 J	51.4 J	65.5 J	2.01 J	5.51 J	--	--	5.91 J	18.1 J	117 J	182 J
	µg/kg	19/20	65.2	113	22.6	97.9	109	190	50.3	34.9	19.9 U	294	1,090	852	48.1	74.2	9.2 J	64.2	137	372	1,830	2,680
Benzo(g,h,i)perylene	mg/kg OC	17/17	4.57 J	5.23 J	2.36 J	12.5 J	5.22 J	7.48 J	3.19	3.71 J	--	13.2 J	24.9 J	27.8 J	2.39 J	5.70 J	--	--	5.43 J	17.2 J	78.2 J	127 J
	µg/kg	20/20	71.3	134	25.3	94.0	96.0	160	66.1	40.8	6.3 J	204	528	362	57.4	76.8	9.4 J	67.7	126	355	1,220	1,870
Total benzofluoranthenes	mg/kg OC	17/17	10.1 J	9 J	5.26 J	21.5 J	11.6 J	22.6 J	6.38	10 J	--	36.9 J	100 J	203 J	5.8 J	12.5 J	--	--	16.6 J	43.1 J	185 J	284 J
	µg/kg	19/20	157	230	56.3	161	214	484	132	110	39.8 U	569	2,130	2,640	140	169	23.6 J	171	385	888	2,880	4,180
Chrysene	mg/kg OC	17/17	6.67 J	5.43 J	3.83 J	16 J	8.2 J	15.3 J	4.93	6.12 J	--	31 J	83.0 J	217 J	4.01 J	7.95 J	--	--	9.35 J	27.8 J	124 J	201 J
	µg/kg	19/20	104	139	41.0	120	150	328	102	67.3	19.9 U	480	1,760	2,820	96.0	107	12.5 J	121	217	573	1,940	2,950
Dibenzo(a,h)anthracene	mg/kg OC	14/17	1.74 J	1.08 J	1.85 UJ	3.43 J	1.32 J	2.32 J	1.01	1.73 UJ	--	5.06 J	11.8 J	14 J	1.15 J	1.46 UJ	--	--	1.89 J	8.11 J	23 J	35.6 J
	µg/kg	15/20	27.1 J	27.7	19.8 U	25.7	24.2	49.6	21.0	19.0 U	19.9 U	78.1	251	180 J	27.6	19.6 U	19.4 U	18.8 J	43.8 J	167	360	523
Dibenzofuran	mg/kg OC	11/17	1.24 UJ	0.766 UJ	1.85 UJ	2.64 UJ	0.39 J	0.631 UJ	0.43 J	1.04 J	--	1.29 UJ	3.89 J	1.42 J	0.805 UJ	0.42 J	--	--	0.728 J	0.738 J	4.28 J	10.3 J
	µg/kg	12/20	19.4 U	19.6 U	19.8 U	19.8 U	7.2 J	13.5 J	8.8 J	11.4 J	19.9 U	19.9 U	82.4	18.4 J	19.3 U	5.7 J	19.4 U	9.7 J	16.9 J	15.2 J	66.7	152
Fluoranthene	mg/kg OC	17/17	11.8 J	13.5 J	5.78 J	22.5 J	13 J	17.5 J	5.8	10.8 J	--	20.5 J	150 J	235 J	5.92 J	16 J	--	--	13.3 J	36.0 J	240 J	375 J
	µg/kg	20/20	184	345	61.8	169	230	375	120	119	5.8 J	316	3,200	3,050	142	210	21.7	165	309	741	3,750	5,510
Fluorene	mg/kg OC	14/17	1.24 UJ	0.402 J	1.85 UJ	2.64 UJ	1.04 J	1.04 J	0.681 J	0.85 J	--	1.84 J	6.93 J	3.77 J	0.26 J	0.69 J	--	--	1.07 J	1.33 J	8.27 J	25.9 J
	µg/kg	15/20	19.4 U	10.3 J	19.8 U	19.8 U	19.2 J	22.2	14.1 J	9.4 J	19.9 U	28.4	147	49.0	6.2 J	9.3 J	19.4 U	9.3 J	24.9	27.3	129	381
Indeno(1,2,3-cd)pyrene	mg/kg OC	17/17	3.62 J	3.25 J	1.79 J	9.92 J	4.27 J	6.64 J	2.37	2.84 J	--	11.9 J	25.7 J	31.2 J	1.80 J	5.44 J	--	--	4.66 J	15.3 J	71.2 J	120 J
	µg/kg	19/20	56.4	83.2	19.1 J	74.4	78.5	142	49.0	31.2	19.9 U	184	544	406	43.2	73.2	10.8 J	48.6	108	316	1,110	1,700
Naphthalene	mg/kg OC	14/17	1.24 UJ	0.766 UJ	1.01 J	2.20 J	1.06 J	0.790 J	0.758 J	1.34 J	--	0.61 J	2.11 J	1.65 J	0.905 J	1.46 UJ	--	--	0.608 J	0.942 J	11.9 J	24.7 J
	µg/kg	15/20	19.4 U	19.6 U	10.8 J	16.5 J	19.5 J	16.9 J	15.7 J	14.7 J	19.9 U	9.4 J	44.7	21.5	21.7	19.6 U	19.4 U	20.7	14.1 J	19.4 J	185	363

Table 4-8. Chemistry and conventionals results for 0–10-cm near-outfall surface sediment samples

Analyte	Unit	DF	Sample ID LDW18-SSOT-																			
			2100A-1	2100A-2	2101	2109-1	2109-2	2114	2507	2509	2510	5thAveS	CleanScapesB	DawnFoods	DeltaMarine	Ditch2	DuwSD3	FedCtrS	GlacierNW-CBP	SeattleDistCtr	T107Park	T107Park-FD
Phenanthrene	mg/kg OC	17/17	4.04 J	6.52 J	1.96 J	12.2 J	10.7 J	8.74 J	2.41	4.60 J	--	8.68 J	49.5 J	25.0 J	3.23 J	10.2 J	--	--	4.44 J	12 J	120 J	222 J
	µg/kg	19/20	63.1	167	21.0	91.2	197	187	49.9	50.6	19.9 U	134	1,050	325	77.5	137	11.4 J	90.7	103	240	1,870	3,260
Pyrene	mg/kg OC	17/17	9.55 J	10.4 J	4.75 J	24.3 J	12.7 J	15.0 J	6.33	9.45 J	--	18.4 J	129 J	318 J	6.09 J	13.5 J	--	--	13.7 J	33.4 J	246 J	354 J
	µg/kg	20/20	149	267	50.8	182	233	322	131	104	6.6 J	284	2,740	4,130	146	182	16.1 J	153	318	688	3,840	5,210
Total HPAHs	mg/kg OC	17/17	56.7 J	56.3 J	27.9 J	130 J	66.8 J	105	34	50 J	--	170 J	651 J	1220 J	31 J	71 J	--	--	76.1 J	214 J	1190 J	1840 J
	µg/kg	20/20	885 J	1,440	298.1 J	990	1,230	2,246	710	550	18.7 J	2,620	13,800	15,910 J	750	960	112.2 J	865 J	1,766 J	4,404	18,520	27,000
Total LPAHs	mg/kg OC	17/17	5.14 J	8.16 J	2.97 J	21.6 J	17.0 J	15.9 J	5.88 J	8.29 J	--	20.3 J	81.6 J	67.5 J	5.17 J	12.9 J	--	--	9.09 J	25 J	201 J	394 J
	µg/kg	20/20	80.2 J	209 J	31.8 J	161.7 J	313 J	340 J	121.8 J	91.2 J	6.3 J	314 J	1,730	878	124.0 J	174 J	11.4 J	155.8 J	211 J	510 J	3,130	5,790
cPAHs TEQ - mammal (half DL)	µg/kg	19/20	106 J	167	36.6 J	140	159	295	82.1	58.0	18.0 U	426	1,630	1,400 J	84.0	110	17.5 J	100 J	218 J	595	2,550	3,750
Phthalates																						
Bis(2-ethylhexyl)phthalate	mg/kg OC	17/17	33 J	15.1 J	6.14 J	14.0 J	4.67 J	5.98 J	21.6	14.1 J	--	21.4 J	6.23 J	8.31 J	12.4 J	12.0 J	--	--	12.5 J	25.5 J	10.1 J	6.87 J
	µg/kg	19/20	510	386	65.7	105	85.9	128	447	155	49.8 U	331	132	108	297	161	30.3 J	99.8	291	526	158	101
Butyl benzyl phthalate	mg/kg OC	6/17	4.35 J	1.02 J	1.85 UJ	3.33 J	2.54 J	0.822 UJ	1.83	1.73 UJ	--	1.29 UJ	0.920 UJ	1.52 UJ	0.805 UJ	1.46 UJ	--	--	0.858 UJ	0.966 UJ	1.26 UJ	1.31 UJ
	µg/kg	6/20	67.8	26.2	19.8 U	25.0	46.7	17.6 J	37.8	19.0 U	19.9 U	19.9 U	19.5 U	19.8 U	19.3 U	19.6 U	19.4 U	19.0 U	19.9 U	19.9 U	19.6 U	19.3 U
Dimethyl phthalate	mg/kg OC	3/17	2.51 J	1.74 J	1.85 UJ	2.64 UJ	1.07 UJ	0.902 J	0.952 U	1.73 UJ	--	1.29 UJ	0.920 UJ	1.52 UJ	0.805 UJ	1.46 UJ	--	--	0.858 UJ	1.15 J	1.26 UJ	1.31 UJ
	µg/kg	3/20	39.2	44.6	19.8 U	19.8 U	19.6 U	19.3 U	19.7 U	19.0 U	19.9 U	19.9 U	19.5 U	19.8 U	19.3 U	19.6 U	19.4 U	19.0 U	19.9 U	23.7	19.6 U	19.3 U
Other SVOCs																						
1,2,4-Trichlorobenzene	mg/kg OC	0/17	0.31 UJ	0.19 UJ	0.46 UJ	0.67 UJ	0.27 UJ	0.22 UJ	0.24 U	0.43 UJ	--	0.32 UJ	0.23 UJ	0.38 UJ	0.20 UJ	0.36 UJ	--	--	0.22 UJ	0.24 UJ	0.31 UJ	0.33 UJ
	µg/kg	0/20	4.9 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U	4.9 U	4.7 U	5.0 U	5.0 U	4.9 U	5.0 U	4.8 UJ	4.9 U	4.8 U	4.8 U	5.0 U	5.0 U	4.9 U	4.8 U
1,2-Dichlorobenzene	mg/kg OC	4/17	0.31 UJ	0.19 UJ	0.46 UJ	0.67 UJ	0.27 UJ	0.22 J	0.24 U	0.43 UJ	--	0.32 UJ	0.057 J	0.10 J	0.20 UJ	0.36 UJ	--	--	0.22 UJ	0.24 UJ	0.12 J	0.12 J
	µg/kg	5/20	4.9 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U	4.9 U	4.7 U	5.0 U	5.0 U	1.2 J	1.3 J	4.8 U	4.9 U	1.0 J	4.8 U	5.0 U	5.0 U	1.9 J	1.8 J
1,4-Dichlorobenzene	mg/kg OC	12/17	0.06 J	0.19 UJ	0.07 J	0.67 UJ	0.05 J	0.070 J	0.058 J	0.12 J	--	0.32 UJ	0.11 J	0.38 UJ	0.071 J	0.36 UJ	--	--	0.095 J	0.083 J	0.21 J	0.18 J
	µg/kg	13/20	0.9 J	4.9 U	0.8 J	5.0 U	0.9 J	1.5 J	1.2 J	1.3 J	5.0 U	5.0 U	2.4 J	5.0 U	1.7 J	4.9 U	4.8 U	2.6 J	2.2 J	1.7 J	3.2 J	2.6 J

Table 4-8. Chemistry and conventionals results for 0–10-cm near-outfall surface sediment samples

Analyte	Unit	DF	Sample ID LDW18-SSOT-																			
			2100A-1	2100A-2	2101	2109-1	2109-2	2114	2507	2509	2510	5thAveS	CleanScapesB	DawnFoods	DeltaMarine	Ditch2	DuwSD3	FedCtrS	GlacierNW-CBP	SeattleDistCtr	T107Park	T107Park-FD
2,4-Dimethylphenol	µg/kg	7/20	24.3 U	24.5 U	24.7 U	24.8 U	24.5 U	3.1 J	24.6 U	23.7 U	24.9 U	24.8 U	2.8 J	8.5 J	8.8 J	24.5 U	24.2 U	23.8 U	24.9 U	3.0 J	15.8 J	19.2 J
4-Methylphenol	µg/kg	4/20	19.4 U	19.6 U	19.8 U	19.8 U	19.6 U	19.3 U	19.7 U	19.0 U	19.9 U	19.9 U	14.6 J	19.8 U	25.1	19.6 U	19.4 U	19.0 U	19.9 U	19.9 U	70.5	74.6
Benzoic acid	µg/kg	18/20	28.8 J	18.8 J	15.8 J	53.8	173	181 J	105 J	16.1 J	59.3 J	96.6	63.6 J	34.4 J	849 UJ	23.8 J	15.8 J	47.5 UJ	20.5 J	69.8	164	115
Benzyl alcohol	µg/kg	17/20	29.4	26.7	7.7 J	15.3 J	35.0	19.4	39.4	19.0 U	19.9 U	24.6	65.7	4.4 J	600	21.9	19.4 U	16.3 J	28.9	17.4 J	192	9.9 J
Hexachlorobenzene	mg/kg OC	0/17	0.31 UJ	0.19 UJ	0.46 UJ	0.67 UJ	0.27 UJ	0.22 UJ	0.24 U	0.43 UJ	--	0.32 UJ	0.23 UJ	0.38 UJ	0.20 UJ	0.36 UJ	--	--	0.22 UJ	0.24 UJ	0.31 UJ	0.33 UJ
	µg/kg	0/20	4.9 U	4.9 U	4.9 U	5.0 U	4.9 U	4.8 U	4.9 U	4.7 U	5.0 U	5.0 U	4.9 U	5.0 U	4.8 U	4.9 U	4.8 U	4.8 U	5.0 U	5.0 U	4.9 U	4.8 U
n-Nitrosodiphenylamine	mg/kg OC	6/17	0.17 J	0.090 J	0.46 UJ	0.67 UJ	0.27 UJ	0.22 J	0.25	0.43 UJ	--	0.36 J	0.23 UJ	0.38 UJ	0.20 UJ	0.36 UJ	--	--	0.19 J	0.24 UJ	0.699 J	0.33 UJ
	µg/kg	6/20	2.6 J	2.3 J	4.9 U	5.0 U	4.9 U	4.8 U	5.1	4.7 U	5.0 U	5.6	4.9 U	5.0 U	4.8 U	4.9 U	4.8 U	4.8 U	4.3 J	5.0 U	10.9	4.8 U
PCP	µg/kg	13/20	2.1 J	2.8 J	19.8 UJ	19.8 UJ	2.4 J	4.9 J	2.9 J	19.0 UJ	19.9 UJ	4.7 J	6.3 J	6.6 J	4.6 J	19.6 UJ	19.4 UJ	5.3 J	19.9 UJ	6.5 J	9.2 J	4.2 J
Phenol	µg/kg	17/20	26.9 J	39.9 J	10.0 J	19.8 U	11.9 J	25.1	16.5 J	15.4 J	19.9 U	26.1 J	80.0 J	13.1 J	131 J	16.1 J	11.5 J	19.0 U	24.0 J	15.8 J	164 J	58.0 J
PCBs																						
Total PCB Aroclors	mg/kg OC	16/17	2.37 J	0.418 J	1.21 J	9.52 J	3.63 JN	5.11 J	1.91	15.2 J	--	7.25 JN	21 J	15.0 J	1.51 J	1.37 UJ	--	--	6.56 J	8.14 J	22.1 J	23 J
	µg/kg	17/20	37.0 J	10.7 J	12.9 J	71.4 J	66.7 JN	109.4	39.6	167.2	18.6 U	111.9 JN	440 J	195.4 J	36.1 J	18.5 U	17.9 U	101.2 JN	152.1	167.6 J	345 J	338
Dioxin/furan																						
Dioxin/furan TEQ - mammal (half DL)	ng/kg	8/8	21.7 J	14.0 J	1.37 J	2.19J	na	8.87 J	7.22 J	5.10 J	na	247 J	6.65 J	9.65 J	2.69 J	na	na	3.04 J	na	14.2 J	13.4 J	15.9 J
Grain size																						
Total fines[a]	%	20/20	15.1	11.9	10.5	47.6	35.1	21.9	24.7	46.8	8.3	25.2	36.4	29.0	78.6	40.1	6.7	15.4	51.8	64.4	31.2	28.3
Total gravel	%	19/20	6.6	1.1	12.4	0.1 U	1.9	2.8	1.9	1.1	1.0	30.3	1.8	26.2	1.5	0.3	2.5	14.1	8.2	3.0	6.6	6.2
Total sand	%	20/20	78.2	87.0	77.0	52.5	62.9	75.3	73.4	52.0	90.7	44.5	61.8	44.8	20.0	59.6	91.0	70.4	40.1	32.6	62.1	65.4
Total silt	%	20/20	12.0	9.4	8.4	41.0	29.7	17.0	20.1	42.9	6.4	20.7	30.6	24.1	65.4	34.7	5.4	10.6	35.6	52.1	25.4	22.2
Total clay	%	20/20	3.1	2.5	2.1	6.6	5.4	4.8	4.6	3.9	1.9	4.5	5.8	4.9	13.2	5.4	1.3	4.8	16.2	12.3	5.8	6.1
Conventionals																						
TOC	%	20/20	1.56 J	2.56 J	1.07 J	0.750 J	1.84 J	2.14	2.07	1.10 J	0.40	1.54 J	2.12 J	1.30 J	2.40 J	1.35 J	0.440 J	0.350	2.32 J	2.06 J	1.56 J	1.47 J

Table 4-8. Chemistry and conventionals results for 0–10-cm near-outfall surface sediment samples

Analyte	Unit	DF	Sample ID LDW18-SSOT-																			
			2100A-1	2100A-2	2101	2109-1	2109-2	2114	2507	2509	2510	5thAveS	CleanScapesB	DawnFoods	DeltaMarine	Ditch2	DuwSD3	FedCtrS	GlacierNW-CBP	SeattleDistCtr	T107Park	T107Park-FD
Total solids	%	20/20	68.62	69.12	65.89	67.07	56.97	69.18	59.18	62.50	72.20	67.14	57.30	61.07	45.02	56.56	72.97	77.38	55.04	40.34	50.20	49.95

Note: "–" indicates that TOC was out of range for TOC normalization (< 0.5% or > 3.5%) noted in SCUM II (Ecology 2017) for comparison to benthic SCO, so the OC-normalized value was not calculated.

[a] Total fines is the sum of the total silt and total clay fractions.

cPAH – carcinogenic polycyclic aromatic hydrocarbon
DF – detection frequency
DL – detection limit
EMPC – estimated maximum possible concentration
FD – field duplicate
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
ID – identification
J – estimated concentration
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
N – tentative identification
na – not applicable
OC – organic carbon
PCB – polychlorinated biphenyl
PCP – pentachlorophenol
QAPP – quality assurance project plan
SCO – sediment cleanup objective
SCUM – sediment cleanup user's manual
SVOC – semivolatile organic compound
TEQ – toxic equivalent
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

4.6 Chemistry Results for Bank Samples

Chemistry and conventionals results for each bank sample are presented in Table 4-9.

Table 4-9. Chemistry and conventionals results for 0–10-cm bank samples

Analyte	Unit	DF	Sample ID LDW18-											
			BNK1-1	BNK2-1	BNK3-1	BNK3-2	BNK3-3	BNK4-1	BNK4-2	BNK4-3	BNK5-1	BNK5-1-FD	BNK6-1	BNK6-2
Metals														
Arsenic	mg/kg	12/12	3.98	7.08	6.81	3.34	2.86	15.8	12.3	11.7	2.37	2.41	7.26	7.04
Cadmium	mg/kg	12/12	0.11 J	0.14	0.04 J	0.02 J	0.03 J	0.24	0.14 J	0.23	0.04 J	0.02 J	0.07 J	0.14 J
Chromium	mg/kg	12/12	7.75	22.7	14.8	10.2	9.44	33.4	21.2	16.6	9.3	8.53	15.3	17.9
Copper	mg/kg	12/12	24.3	27.8	12.5	11.2	12.4	226	287	62.1	10.1	10.4	17.0	28.3
Lead	mg/kg	12/12	209 J	13.0 J	46.5 J	2.18 J	4.03 J	132 J	156 J	253 J	2.59 J	3.38 J	18.6	36.4
Mercury	mg/kg	6/12	0.0783	0.0271	0.0273 U	0.0291 U	0.0262 U	0.0197 U	0.0780	0.323	0.0280 U	0.0222 U	0.0532	0.101
Silver	mg/kg	12/12	0.04 J	0.10 J	0.03 J	0.02 J	0.03 J	0.18 J	0.16 J	0.10 J	0.03 J	0.03 J	0.06 J	0.09 J
Zinc	mg/kg	12/12	97.4	62.7	47.1	28.7	25.9	246	216	256	25.0	27.6	48.9	79.4
PAHs														
2-Methylnaphthalene	µg/kg	2/12	18.9 U	8.4 J	19.6 U	19.2 U	19.9 U	19.6 U	19.5 U	18.9 U	19.0 U	19.1 U	19.0 U	12.9 J
Acenaphthene	µg/kg	4/12	18.9 U	19.8 U	19.6 U	19.2 U	13.2 J	19.6 U	14.6 J	18.9 U	19.0 U	19.1 U	20.1	11.4 J
Acenaphthylene	µg/kg	5/12	10.5 J	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	30.1	28.5	19.0 U	19.1 U	6.5 J	16.1 J
Anthracene	µg/kg	6/12	10.7 J	11.3 J	19.6 U	19.2 U	19.9 U	19.6 U	96.2	44.4	19.0 U	19.1 U	40.5	13.1 J
Benzo(a)anthracene	µg/kg	7/12	29.0	25.0	19.6 U	19.2 U	19.9 U	30.7	401	63.8	19.0 U	19.1 U	128	57.1
Benzo(a)pyrene	µg/kg	7/12	34.7	22.0	19.6 U	19.2 U	19.9 U	30.1	321	89.9	19.0 U	19.1 U	103	41.2
Benzo(g,h,i)perylene	µg/kg	7/12	41.6	21.4	19.6 U	19.2 U	19.9 U	36.9	305	122	19.0 U	19.1 U	92.9	58.9
Total benzofluoranthenes	µg/kg	7/12	119	61.7	39.3 U	38.5 U	39.8 U	70.2	816	228	37.9 U	38.3 U	261	164
Chrysene	µg/kg	8/12	72.2	62.6	19.6 U	19.2 U	8.6 J	37.0	555	110	19.0 U	19.1 U	188	139
Dibenzo(a,h)anthracene	µg/kg	5/12	18.9 U	7.6 J	19.6 U	19.2 U	19.9 U	19.6 U	109	29.8	19.0 U	19.1 U	32.5	13.9 J
Dibenzofuran	µg/kg	2/12	18.9 U	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	14.2 J	18.9 U	19.0 U	19.1 U	11.9 J	19.7 U
Fluoranthene	µg/kg	8/12	89.4	59.1	19.6 U	19.2 U	7.5 J	46.8	927	111	19.0 U	19.1 U	317	415
Fluorene	µg/kg	4/12	18.9 U	10.2 J	19.6 U	19.2 U	19.9 U	19.6 U	22.4	18.9 U	19.0 U	19.1 U	26.0	15.1 J
Indeno(1,2,3-cd)pyrene	µg/kg	7/12	36.8	16.4 J	19.6 U	19.2 U	19.9 U	27.7	267	103	19.0 U	19.1 U	93.6	54.0

Table 4-9. Chemistry and conventionals results for 0–10-cm bank samples

Analyte	Unit	DF	Sample ID LDW18-											
			BNK1-1	BNK2-1	BNK3-1	BNK3-2	BNK3-3	BNK4-1	BNK4-2	BNK4-3	BNK5-1	BNK5-1-FD	BNK6-1	BNK6-2
Naphthalene	µg/kg	6/12	18.9 U	12.9 J	19.6 U	19.2 U	6.1 J	19.6 U	15.1 J	6.5 J	19.0 U	19.1 U	9.5 J	16.1 J
Phenanthrene	µg/kg	10/12	22.0	56.0	5.1 J	19.2 U	10.5 J	14.5 J	271	73.3	19.0 U	6.7 J	263	353
Pyrene	µg/kg	8/12	85.3	59.3	19.6 U	19.2 U	6.2 J	40.5	786	119	19.0 U	19.1 U	282	315
Total HPAHs	µg/kg	8/12	508	335.1 J	39.3 U	38.5 U	22.3 J	319.9	4,487	976	37.9 U	38.3 U	1,498	1,258 J
Total LPAHs	µg/kg	10/12	43.2 J	90.4 J	5.1 J	19.2 U	29.8 J	14.5 J	449 J	152.7 J	19.0 U	6.7 J	366 J	425 J
cPAHs TEQ - mammal (half DL)	µg/kg	8/12	57.7	36.0 J	17.7 U	17.4 U	18.0 J	47.3	519	142	17.2 U	17.3 U	166	75.7 J
Phthalates														
Bis(2-ethylhexyl)phthalate	µg/kg	8/12	31.3 J	49.5 U	49.1 U	36.5 J	84.2	32.7 J	45.6 J	77.9	47.4 U	47.8 U	47.9	51.0
Butyl benzyl phthalate	µg/kg	1/12	18.9 U	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	19.5 U	10.5 J	19.0 U	19.1 U	19.0 U	19.7 U
Dimethyl phthalate	µg/kg	0/12	18.9 U	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	19.5 U	18.9 U	19.0 U	19.1 U	19.0 U	19.7 U
Other SVOCs														
1,2,4-Trichlorobenzene	µg/kg	0/12	4.7 U	5.0 U	4.9 U	4.8 U	5.0 U	4.9 U	4.9 U	4.7 U	4.7 U	4.8 U	4.8 U	4.9 U
1,2-Dichlorobenzene	µg/kg	0/12	4.7 U	5.0 U	4.9 U	4.8 U	5.0 U	4.9 U	4.9 U	4.7 U	4.7 U	4.8 U	4.8 U	4.9 U
1,4-Dichlorobenzene	µg/kg	0/12	4.7 U	5.0 U	4.9 U	4.8 U	5.0 U	4.9 U	4.9 U	4.7 U	4.7 U	4.8 U	4.8 U	4.9 U
2,4-Dimethylphenol	µg/kg	1/12	23.7 U	24.8 U	24.6 U	24.1 U	24.8 U	24.6 U	3.7 J	23.6 U	23.7 U	23.9 U	23.8 U	24.6 U
4-Methylphenol	µg/kg	1/12	18.9 U	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	19.5 U	18.9 U	19.0 U	19.1 U	19.0 U	23.9 J
Benzoic acid	µg/kg	5/12	47.3 U	43.9 J	49.1 U	48.1 U	49.7 U	49.1 U	74.6	19.3 J	47.4 U	47.8 U	104	159 J
Benzyl alcohol	µg/kg	4/12	18.9 U	9.5 J	19.6 U	19.2 U	19.9 U	19.6 U	19.5 U	21.9	19.0 U	19.1 U	33.9	43.3
Hexachlorobenzene	µg/kg	0/12	4.7 U	5.0 U	4.9 U	4.8 U	5.0 U	4.9 U	4.9 U	4.7 U	4.7 U	4.8 U	4.8 U	4.9 U
n-Nitrosodiphenylamine	µg/kg	0/12	4.7 U	5.0 U	4.9 U	4.8 U	5.0 U	4.9 U	4.9 U	4.7 U	4.7 U	4.8 U	4.8 U	4.9 U
PCP	µg/kg	3/12	18.9 U	19.8 U	19.6 U	19.2 U	19.9 U	19.6 U	5.1 J	3.1 J	19.0 U	19.1 U	19.0 U	2.1 J
Phenol	µg/kg	2/12	18.9 UJ	189 J	19.6 UJ	19.2 UJ	19.9 UJ	19.6 UJ	23.6 J	18.9 UJ	19.0 UJ	19.1 UJ	19.0 UJ	19.7 U
PCBs														
Total PCB Aroclors	µg/kg	10/12	60.6	19.9 J	6.5 J	4.0 U	3.8 U	6.7 J	66.7	66.5 JN	26.6	22.4	3,180	39.6 JN

Table 4-9. Chemistry and conventionals results for 0–10-cm bank samples

Analyte	Unit	DF	Sample ID LDW18-											
			BNK1-1	BNK2-1	BNK3-1	BNK3-2	BNK3-3	BNK4-1	BNK4-2	BNK4-3	BNK5-1	BNK5-1-FD	BNK6-1	BNK6-2
Dioxin/furan														
Dioxin/furan TEQ - mammal (half DL)	ng/kg	1/1	3.46 J	1.37 J	na	na	na	1.94 J	6.16 J	10.4 J	na	na	5.52 J	na
Grain size														
Total fines[a]	%	10/12	4.8	19.9	2.9 U	9.1	11.6	1.6 U	9.8	5.8	6.4	6.1	16.0	33.6
Total gravel	%	12/12	2.1	37.2	11.7	17.4	10.6	21.8	20.1	48.4	0.6	0.8	2.3	0.5
Total sand	%	12/12	93.1	42.8	85.4	73.6	77.8	76.7	70.1	45.9	93.0	93.0	81.7	65.8
Total silt	%	10/12	4.0	14.2	2.9 U	7.4	10.9	1.6 U	7.4	4.8	6.1	5.5	12.8	25.9
Total clay	%	10/12	0.8	5.7	2.9 U	1.7	0.7	1.6 U	2.4	1.0	0.3	0.6	3.2	7.7
Conventionals														
TOC	%	12/12	1.16 J	0.78 J	0.21 J	0.43 J	0.27 J	0.18 J	1.10 J	0.80 J	0.18 J	0.23 J	2.44	1.73
Total solids	%	12/12	84.56	76.21	85.22	76.53	75.79	90.00	73.93	83.40	73.09	78.88	69.19	58.30

[a] Total fines is the sum of the total silt and total clay fractions.

cPAH – carcinogenic polycyclic aromatic hydrocarbon
DF – detection frequency
DL – detection limit
EMPC – estimated maximum possible concentration
FD – field duplicate
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
ID – identification
J – estimated concentration
JN – tentative estimated concentration
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
N – tentative identification
na – not applicable
PCB – polychlorinated biphenyl
PCP – pentachlorophenol
SVOC – semivolatile organic compound
TEQ – toxic equivalent
TOC – total organic carbon
U – not detected at given concentration
UJ – not detected at estimated concentration

4.7 DATA VALIDATION RESULTS

Independent data validation was performed on all results by EcoChem, Inc. Full validation was performed on a minimum of 10% of the data or a single sample delivery group (SDG), as specified in the QAPP (Windward 2018a). A summary-level validation review was conducted on the remaining data. All data presented in this report were determined to be acceptable for use as qualified.

Benzoic acid had to be re-analyzed in six samples, because the benzoic acid recovery in the laboratory control sample for SDG 18B0338 was below the lower control limit. All samples from this SDG were re-analyzed by the laboratory. Results from the re-analysis are reported in Sections 4.3 and 4.5.

The data validation report, which is presented in Appendix D, includes detailed information regarding all data qualifiers. The issues that resulted in the highest number of qualified results are summarized below.

- Seven Aroclor-1248 and four Aroclor-1254 results were qualified as tentatively identified (N-qualified) due to an elevated relative percent difference (RPD) between the results from the analytical column and the confirmatory column. This may indicate the presence of an interference resulting in a high bias in the reported results.
- TOC results for SDGs 18B0338 (19 samples), 18C0109 (11 samples), 18F0314 (15 samples), and 18F0174 (10 samples) were qualified as estimated (J-qualified) with a potential low bias in the reported results due to MS/MSD recoveries below the laboratory lower control limit.
- Black carbon results were qualified as estimated (J-qualified) due to laboratory duplicate and MS/MSD RPDs above the control limit in SDG L1828580 (6 samples) and SDG L1828594 (38 samples).
- Arsenic results for SDG 18F0280 (18 results) were qualified as estimated (J-qualified) due to a laboratory duplicate RPD greater than the control limit.

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