Terminal 117 Cleanup
Port of Seattle and City of Seattle

FINAL

2019 (YEAR 4) ANNUAL MONITORING AND MAINTENANCE REPORT

Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

Port of Seattle

City of Seattle

June 30, 2020

2019 ANNUAL MONITORING AND MAINTENANCE REPORT

Lower Duwamish Waterway Superfund Site
Terminal 117 Early Action Area

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ACRONYMS AND ABBREVIATIONS

17th Ave S SD	17th Avenue S. Storm Drain
cm	centimeter
City	City of Seattle
COC	contaminant of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
DU1	Dredge Unit 1
dw	dry weight
EAA	Early Action Area
HDPE	high-density polyethylene
HPAH	high molecular weight polycyclic aromatic hydrocarbons
HpCDD	heptachlorinated dibenzo-p-dioxins
HpCDF	heptachlorinated dibenzofurans
HxCDD	hexachlorinated dibenzo-p-dioxins
HxCDF	hexachlorinated dibenzofurans
LDW	Lower Duwamish Waterway
LPAH	low molecular weight polycyclic aromatic hydrocarbons
LTMMP	Long-Term Monitoring and Maintenance Plan
µg/kg	microgram per kilogram
mg/kg	milligram per kilogram
µg TEQ/kg	micrograms toxicity equivalent per kilogram
MS4	municipal separate storm sewer systems
ng/kg	nanogram per kilogram
NPDES	National Pollutant Discharge Elimination System
OC	organic carbon
OCDD	octachlorinated dibenzo-p-dioxins
OCDF	octachlorinated dibenzofurans
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl

ACRONYMS AND ABBREVIATIONS (Continued)

PeCDD	pentachlorinated dibenzo-p-dioxins
PeCDF	pentachlorinated dibenzofurans
PSEP	Puget Sound Estuary Program methodology
QA/QC	quality assurance and quality control
QAPP	Quality Assurance Project Plan
Port	Port of Seattle
RAL	remedial action level
ROD	Record of Decision
RSS	Research Support Services
RvAL	removal action level
SM	Standard Method
SPU	Seattle Public Utilities
T-117	Terminal 117
TCDD	tetrachlorinated dibenzo-p-dioxins
TCDF	tetrachlorinated dibenzofurans
TEQ	toxicity equivalent
TOC	total organic carbon
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

This annual monitoring and maintenance report presents the results of the Year 4 (2019) monitoring and maintenance conducted at the Terminal 117 (T-117) Early Action Area (EAA) of the Lower Duwamish Waterway (LDW) Superfund site in Seattle, Washington (Figure 1-1). This report summarizes the monitoring and maintenance period from January 1 through December 31, 2019. All activities were completed in accordance with the final Long-Term Monitoring and Maintenance Plan (LTMMP) (AECOM and Integral Consulting, Inc. 2018a) that was developed jointly by the City of Seattle (City) and Port of Seattle (Port) and approved by the United States Environmental Protection Agency (USEPA).

1.1 BACKGROUND

The LDW Superfund site consists of a 5-mile-long engineered waterway located in Seattle, Washington. It was listed on the National Priorities List on September 13, 2001, and later added to the Washington State Department of Ecology's Hazardous Site List on February 26, 2002. The T-117 site was named an EAA within the LDW Superfund site in 2003. Consistent with 40 CFR 300.415, USEPA named the T-117 site as one of several EAAs because it is part of a Superfund site identified as having significant risks (e.g., highly elevated polychlorinated biphenyl [PCB] concentrations) and expediting cleanup on an accelerated schedule was needed to reduce these risks. In 2007/2008, USEPA expanded the T-117 EAA boundary to include three areas referred to as: the T-117 Sediment Study Area (Sediment Area); the T-117 Upland Study Area (Upland Area); and the Adjacent Streets and Residential Yards Study Area (Adjacent Streets and Residential Yards Area).

Removal activities at the T-117 EAA were completed in phases starting in 2013 and ending in 2015, as described in removal action completion reports prepared for the City of Seattle and Port of Seattle (AECOM 2016, Integral 2017).

Phase 1 encompassed the T-117 Upland and Sediment Areas and was completed by the Port of Seattle in 2015 (AECOM 2016). It encompasses a 3.3-acre Upland Area and a 2.1-acre in-water Sediment Area (Figure 1-1). The Upland Area includes bank and adjacent upland areas.

Phase 2 of the Removal Action, Adjacent Streets and Residential Yards, was completed by the City of Seattle in two parts. Part 1, completed in 2013, is referred to as the Residential Yards Area. Part 2, completed in 2015, is referred to as the Adjacent Streets and Stormwater (Figure 1-1).

Removal action levels (RvALs) developed in the engineering evaluation/cost analysis for soil, sediment, and groundwater (Windward et al. 2010) were finalized in the Action Memorandum (USEPA 2010). The T-117 RvALs for sediment are equal to or lower than the corresponding

remedial action levels (RALs) in the LDW Record of Decision (ROD; USEPA 2014), which are included in in Appendix F.

Except for one area, a portion of Dredge Unit 1 (DU1), the Phase 1 and Phase 2 removal actions achieved the RvALs after dredging. To address the area in DU1 where PCB sediment concentrations were suspected to exceed the RvALs[1], USEPA issued an amendment (USEPA 2016) to the Action Memorandum, allowing for the placement of a cap in this area of DU1. The DU1 cap is approximately 20 feet by 50 feet (0.02 acre). To protect the integrity of the DU1 cap, the amendment required institutional controls in the form of an environmental covenant for the DU1 cap (Ecology, 2017)

Monitoring and maintenance activities are being performed according to the schedule outlined in the LTMMP, which is included in Tables 1-1 and 1-2. The objectives for the long-term monitoring, as identified in the LTMMP are as follows:

1. Sediment monitoring to determine if recontamination of the clean post-construction sediment surface is occurring; and

2. Stormwater monitoring to ensure any water released to the LDW will not result in recontamination of sediment or harmful exposure to benthic organisms.

Monitoring and maintenance activities completed in 2019 (Year 4) are highlighted in Table 1-1. The frequency of inspections for the components of the Adjacent Streets and Stormwater system (i.e., catch basin, outfall, bioretention cells and Filterra® tree box), maintenance trigger/threshold and actions are summarized in Table 1-2. As described in Section 4 of this report, the monitoring and maintenance activities completed in 2019 achieved the objectives identified in the LTMMP.

1.2 REPORT ORGANIZATION

This report satisfies requirements set forth in the Administrative Settlement Agreement and Order on Consent (USEPA 2011) between the City, the Port, and the USEPA regarding the site, and is organized as follows:

- **Section 1. Introduction**—Introduction and overview.

[1] Multiple rounds of excavation were conducted in the DU1 cap area. Due to the impending closure of the in-water work window and the need to backfill, confirmation samples were unable to be collected following the final round of excavation. Out of an abundance of caution, a cap was placed in this area. Additional details are provided in Section 2.2.3.

- **Section 2. Monitoring Activities**—Description of the monitoring activities completed in 2019.
- **Section 3**. **Maintenance Activities**—Description of the maintenance activities completed in 2019.
- **Section 4. Conclusions and Recommendations**—Conclusions and recommendations based on the results of the 2019 monitoring and maintenance activities.
- **Section 5. References.**

Supporting information is provided in the appendices:

- Appendix A – Analytical Laboratory Reports for Sediment Trap Sample Collected in 2019;
- Appendix B – Visual Inspection Log;
- Appendix C – Visual Inspection Photographs;
- Appendix D – Sediment Sampling Documentation and Analytical Results;
- Appendix E – Seattle Public Utilities (SPU) Adjacent Streets and Stormwater Inspection; and Checklist; and
- Appendix F – Supporting Documentation.

Source: Integral 2017

AECOM

T-117 Annual Monitoring and Maintenance Report			T-117 Early Action Cleanup Site Overview	
Date: 8/27/19	DRWN: ACC	Revision:	Project No: 60599719	**Figure 1-1**

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Table 1-1 Long-Term Monitoring and Maintenance Schedule

Activity	EAA Phase	Monitoring Year (Post-construction)										
		2015[a] Year 0	2016 Year 1	2017 Year 2	2018 Year 3	2019 Year 4	2020 Year 5	2021 Year 6	2022 Year 7	2023 Year 8	2024 Year 9	2025 Year 10
Monitoring												
T-117 Upland Area Municipal Stormwater Monitoring	Phase 1 – T-117 Upland Area				X	X	X	X	X	X	X	X
Visual Inspection of DU1 Cap, Shoreline Bank and Upland Area[b,c]	Phase 1 – T-117 Sediment and Upland Areas				X	X	X	X	X	X	X	X
T-117 Sediment Area Sampling	Phase 1 – T-117 Sediment Area					X		X		X		X
Collect storm drain solids from trap in last maintenance hole prior to outfall	Phase 2, Part 2 – Adjacent Streets and Stormwater				X	X	X	X	X	X	X	X
Collect storm drain solids from select catch basins	Phase 2, Part 2 – Adjacent Streets and Stormwater				X[d]	X[d]	X[d]	X[d]	X[d]	X[d]	X[d]	X[d]
Maintenance												
Inspect catch basins	Phase 2, Part 2 – Adjacent Streets and Stormwater				X	X	X	X	X	X	X	X
Inspect bioretention cells	Phase 2, Part 2 – Adjacent Streets and Stormwater				X (4/yr)	X (4/yr)	X (4/yr)	X (4/yr)	X (4/yr)	X (4/yr)	X (4/yr)	X (4/yr)
Inspect Filterra ® tree box units	Phase 2, Part 2 – Adjacent Streets and Stormwater				X (2/yr)	X (2/yr)	X (2/yr)	X (2/yr)	X (2/yr)	X (2/yr)	X (2/yr)	X (2/yr)
Sample underdrains for stormwater treatment system media maintenance	Phase 2, Part 2 – Adjacent Streets and Stormwater				X[e]		X[f]	X		X[g]	X[f]	X[g]
Verify DU1 cap institutional controls and environmental covenant are still in place	Phase 1 – T-117 Sediment and Upland Areas						X					
Sheet pile wall removal[h]	Phase 1 – T-117 Sediment and Upland Areas						X					

Notes:

Activities completed in 2019 (Year 4) are highlighted in grey.

Sampling of solids from the City's drainage system in the right-of-way will be conducted and reported as part of the City's NPDES MS4 permit annual report. The monitoring program discussed in Section 2 will be evaluated in the 2021-2026 Source Control Implementation Plan for the LDW.

[a] Year 0 is considered substantial completion for T-117 cleanup.
[b] Additional visual inspections will be performed after high flow event, significant seismic event, or other significant disturbance per evaluation and coordination with USEPA, should these occur.
[c] Including any DU1 cap, shoreline bank and Upland Area maintenance, as needed.
[d] Catch basin samples will be collected if necessary, to trace sources.
[e] Baseline sampling
[f] Sampling to occur only if PCBs are detected in two or more of the samples collected at a sampling location during previous sample year.
[g] Sampling to occur only if mean PCB concentration at a sampling location consistently increases over 3 successive sample years.
[h] In the event that the habitat restoration project is not constructed by 2020, the sheet pile wall will be cut down to sediment depth or completely removed.

DU1 = Dredge Unit 1
EAA = Early Action Area
T-117 = Terminal 117
Source: Table 2-3 of the Final LTMMP (AECOM and Integral Consulting, Inc. 2018a)

Table 1-2 Adjacent Streets and Stormwater System Operation and Maintenance Requirements

System Component	Inspection Frequency	Maintenance Trigger/Threshold	Action	City Reference/Guidance Document
Catch basins	Annual	Accumulated storm drain solids reaches 60 percent of the sump capacity or is within 18 inches of any pipe entering/exiting the structure	Remove accumulated storm drain solids[a]	Seattle (2017)
		Sheen or other evidence of contaminants observed[b]	Clean catch basin	Seattle (2017)
		Observed structural damage (e.g., holes, cracks)	Repair damage	Seattle (2017)
Outfall	Annual	Pipe obstructed by >25 percent	Remove obstruction	Seattle (2017)
Bioretention cells	4 times per year	See Table 3-2		
Filterra® tree box	2 times per year[c]	Small amount of dead, damaged, or unruly branches	Remove/prune	Contech (no date)
		Tree dead	Replace tree[d]	Contech (no date)
		Sediment/debris accumulation on surface of mulch	Remove and replenish mulch. Maintain 3" mulch depth	Contech (no date)
		Evidence of frequent overflow[e]	Inspect/replace media	Contech (no date)

Notes:

[a] Storm drain solids will be sampled if samples from the inline traps installed in the first maintenance hole upstream of the outfall exceed the cleanup screening level/second lowest apparent effects threshold.

[b] Visible staining, unusual odors or debris (e.g., paint chips, metal filings, or other evidence of illegal dumping)

[c] Manufacturer's recommendation; given that roads will be paved and subject to low traffic use, SPU believes that this frequency is appropriate for the T-117 site.

[d] SPU contracts with Contech to replace trees and media.

[e] Heavy silt coverage on mulch (>50 percent covered) or high water mark in unit.

SPU = Seattle Public Utilities
T-117 = Terminal 117

Source: Table 3-1 of the Final LTMMP (AECOM and Integral Consulting, Inc. 2018a)

2 MONITORING ACTIVITIES

Monitoring activities associated with the Phase 1 – T-117 Upland and Sediment Areas and the Phase 2, Part 2 – Adjacent Streets and Stormwater Area are described below. As required by the LTMMP and shown in Table 1-1, monitoring activities completed in 2019 included:

- Municipal Stormwater monitoring (Phase 1 – T-117 Upland Area);
- Visual inspection of DU1 cap, shoreline bank and Upland Area (Phase 1 – T-117 Sediment and Upland Areas);
- Sediment Area Sampling (Phase 1 – T-117 Sediment Area); and
- Inspect storm drain solids trap in last maintenance hole prior to outfall (Phase 2 Adjacent Streets and Stormwater).

2.1 STORMWATER SYSTEM MONITORING

2.1.1 Adjacent Streets and Stormwater

Storm drain solids monitoring in the Adjacent Streets and Stormwater is conducted as part of SPU's source control program in the LDW and is completed in accordance with the Source Control Implementation Plan (Seattle 2016) and the LTMMP. SPU monitors one sediment trap located in the downstream-most maintenance hole in the 17th Ave S drainage system (17th-ST1) (Figure 2-1). The trap is retrieved, and if sufficient material is present, samples are collected annually (typically in May/June) and analyzed for metals (arsenic, copper, lead, mercury, zinc), semi-volatile organic compounds, total petroleum hydrocarbons (TPH) and PCBs. Results are compared to the screening levels listed in Table 2-1.

SPU retrieved the sediment trap from the 17th Avenue S. Storm Drain (17th Ave S SD) in May 2019. Over the course of two years, less than 1 cm of material had accumulated. The last sample was collected in 2017. In 2018, not enough material had accumulated in the sediment trap to collect a sample In 2019, enough material had accumulated in the sediment trap to collect a sample but there was only enough material to conduct PCBs analysis. The accumulated material appeared to be light organic material with very little mineral content. The PCB concentration (685 micrograms per kilogram [µg/kg] dry weight [dw]) in the sample collected from the sediment trap retrieved from the 17th Ave S SD was below the 1,000 µg/kg dw screening level that requires source tracing.

Since 2003, more than 400 sediment trap samples have been collected from storm drains in the LDW basin. PCB concentrations range from <10 to 800,000 µg/kg dw, with a median concentration of about 150 µg/kg dw. The highest concentrations have been found in traps

installed on storm drains serving North Boeing Field. PCBs in the 17th Ave S SD are in the highest 15 to 20 percent of all samples collected.

Although the lack of solids accumulation indicates that the stormwater treatment system installed during Phase 2, Part 2 – Adjacent Streets and Stormwater removal action is functioning as designed, SPU conducted additional source tracing in the basin in April 2020. Samples were collected from: (1) the pre-settling cell on bioretention cell F, (2) the alley between S. Donovan St & S. Cloverdale at 16 Ave S, and (3) Dallas Ave S. between 14th Ave S and 16th Ave S. Samples were collected in accordance with the SCIP (Section 5, Appendix B of the LTMMP) and no source of PCBs was discovered. Validated sample results ranged from non-detect to 86.6 µg/kg.

Legend

Sample_locations

- Sediment trap
- Storm drain solids
- Street dirt
- Underdrain
- Bioretention cell
- Filterra tree box unit

Structures

- Other Mainline End Point
- Maintenance hole

Utilities

- Storm drain
- Sanitary sewer
- Combined sewer

Locations where samples were collected in 2017-2018 are highlighted in yellow

N W E S

0 50 100 Feet

City of Seattle

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AECOM

T-117 Annual Monitoring and Maintenance Report			Adjacent Streets and Storm Drain Sampling Locations	
Date: 3/12/2020	DRWN: ACC	Revision:	Project No: 60591759	Figure 2-1

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Table 2-1 Screening Levels Used for Storm Drain Solids

Chemical	Screening Level[a]
Metals (mg/kg)	
Arsenic	93
Copper	390
Lead	530
Mercury	0.59
Zinc	960
Total Petroleum Hydrocarbons (mg/kg)	
TPH-diesel	2,000[b]
TPH-oil	2,000[b]
LPAH (µg/kg dw)	
Acenaphthene	500
Acenaphthylene	1,300
Anthracene	960
Fluorene	540
Naphthalene	2,100
Phenanthrene	1,500
LPAH	5,200
HPAH (µg/kg dw)	
Benzo(a)anthracene	1,600
Benzo(a)pyrene	1,600
Benzo(g,h,i)perylene	720
Chrysene	2,800
Dibenz(a,h)anthracene	230
Fluoranthene	2,500
Indeno(1,2,3-cd)pyrene	690
Pyrene	3,300
Total benzofluoranthenes	3,600
HPAH	17,000
cPAH (µg TEQ/kg)	1,000[c]

Chemical	Screening Level[a]
Phthalates (µg/kg dw)	
Bis(2-ethylhexyl)phthalate	1,900
Butyl benzyl phthalate	900
Diethyl phthalate	200
Dimethyl phthalate	160
Di-n-butylphthalate	1,400
Di-n-octylphthalate	6,200
Total PCBs (µg/kg dw)	
Total PCBs	1,000
Other organics (µg/kg dw)	
1,2,4-Trichlorobenzene	51
1,2-Dichlorobenzene	50
1,4-Dichlorobenzene	110
2,4-Dimethylphenol	29
2-Methylnaphthalene	670
2-Methylphenol	63
4-Methylphenol	670
Benzoic acid	650
Benzyl alcohol	73
Dibenzofuran	540
Hexachlorobenzene	70
Hexachlorobutadiene	120
N-Nitrosodiphenylamine	40
Pentachlorophenol	690
Phenol	1,200

Notes:

[a] Dry weight equivalent of the Sediment Management Standard cleanup screening levels
[b] MTCA Method A soil cleanup level for unrestricted use
[c] LDW sediment remedial action level

cPAH = carcinogenic polycyclic aromatic hydrocarbon
dw = dry weight
HPAH = high molecular weight polycyclic aromatic hydrocarbons
LPAH = low molecular weight polycyclic aromatic hydrocarbons
µg/kg = microgram per kilogram
mg/kg = milligram per kilogram
µg TEQ/kg = micrograms toxicity equivalent per kilogram
PCB = polychlorinated biphenyl
TPH = Total Petroleum Hydrocarbons

2.1.2 Upland Area Municipal Stormwater Monitoring

Monitoring of the Upland Area stormwater controls was conducted as part of the visual inspections completed on June 18, 2019. Monitoring parameters that were evaluated during the visual inspections are detailed in Table 2-1 of the LTMMP (AECOM and Integral Consulting Inc, 2018a, which is included in Appendix B) and on the Visual Inspection Log included in Appendix B to this report. Each monitoring parameter includes a data evaluation and decision criteria. The condition of each parameter was documented with a yes or no answer. The completed log is included in Appendix B. Photographs taken during the visual inspections are included in Appendix C and the location of the photographs are shown on Figure 2-2.

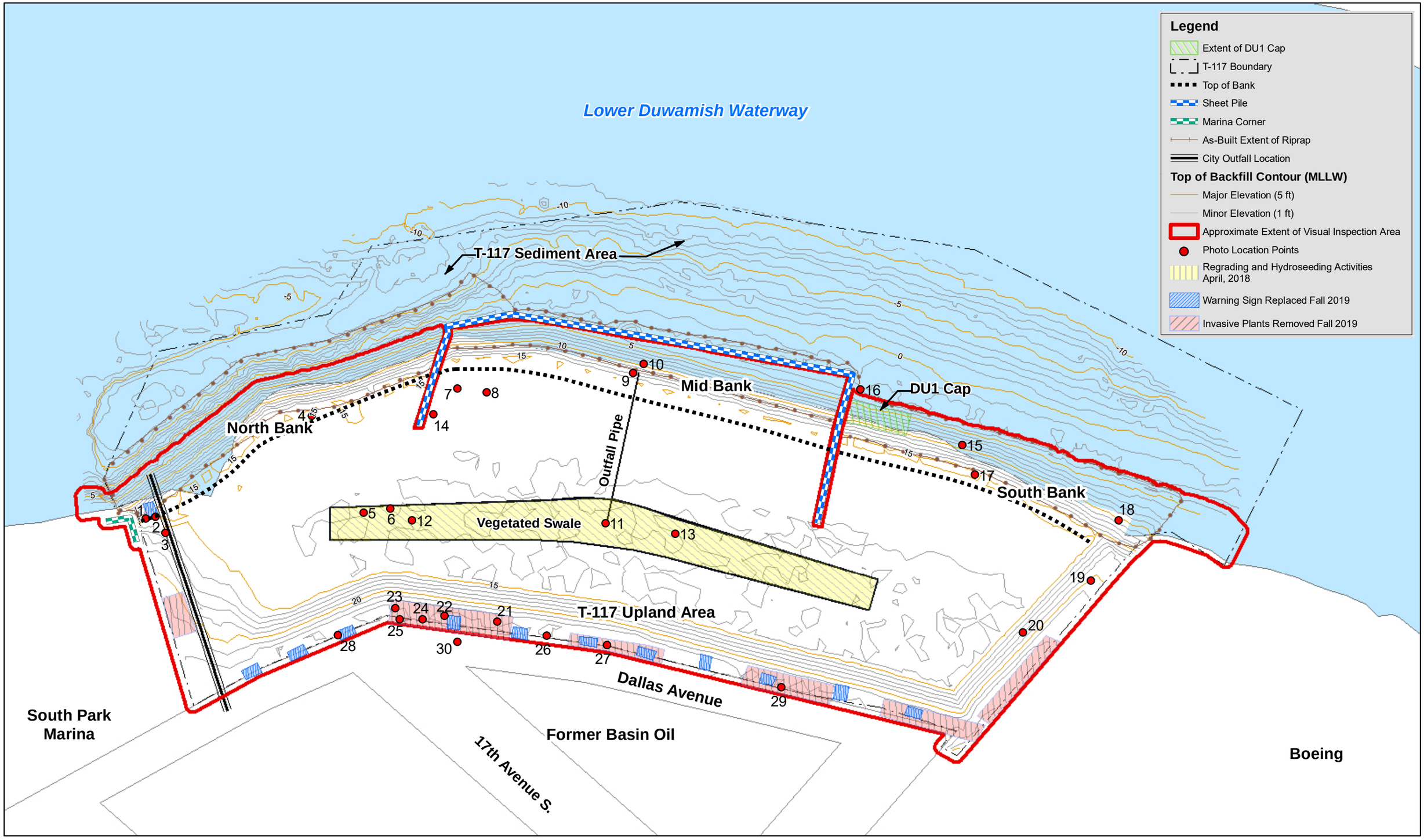
The swale is located in the middle of the Upland Area (Figure 2-2). The swale drains into a 4-inch pipe, which conveys water from the swale to the adjacent waterway. Sediment accumulation was not observed in the swale or in the outlet pipe. There was no standing water or evidence of erosion or scour observed in the swale. Vegetation coverage in the swale was sparse in places and the bare area exceeded 10 percent of the bottom of the swale. Despite low vegetation coverage, stabilization of the swale (i.e., no sedimentation or erosion) was achieved in October 2018 (Port 2018) and erosion rills or channels have not been observed. The swale and much of the area it drains will be excavated as part of the habitat restoration and public access construction work scheduled for 2021.

2.2 VISUAL INSPECTIONS OF THE UPLAND AND SEDIMENT AREAS

The visual inspections of the Phase 1 – T-117 Upland and Sediment Areas were conducted on June 18, 2019 to document the general condition of the Upland Area, which includes the shoreline bank, and to assess the long-term stability of the EAA and the integrity of the DU1 cap, which is located within the Sediment Area. As shown on Figure 2-2, the shoreline bank is subdivided into three areas referred to as the North Bank, Mid Bank and South Bank. Monitoring parameters that were evaluated during the visual inspections are detailed in Table 2-1 of the LTMMP and on the Visual Inspection Log included, which are both provided in Appendix B to this report. AECOM was joined during the visual inspection by representatives from the Port, the City, and the United States Army Corps of Engineers representing USEPA Region 10.

The visual inspection of the Upland and Sediment Areas was conducted to identify apparent changes due to erosion or slope instability; identify seeps and determine whether any seep had a sheen; and to identify any visible breaches of the DU1 cap. The visual inspection was conducted during a low tide condition when the shoreline bank, nearshore sediments, and seeps could be directly observed.

AECOM completed the Visual Inspection Log during the visual inspections. The Visual Inspection Log includes three sections (Upland Area, shoreline bank and DU1 cap), with a total of 23 monitoring parameters. Each monitoring parameter includes a data evaluation and decision criteria. The condition of each parameter was documented with a yes or no answer.



AECOM

0 25 50 100 Feet

T-117 Annual Monitoring and Maintenance Report			Visual Inspection Area, Annual Maintenance Areas, and Photographic Locations	
Date: 12/5/2019	DRWN:mps/sea	Revision: 0	Project No: 60599719	Figure 2-2

Path: J:\DCS\Projects\ENV\PROJECTS\W\Port of Seattle\T-117 Cleanup Oversight\900-CAD-GIS\AECOM\MXD\RACR\Removal Completion Report\Fig_2_2_VI_Maintenance_Photo_2018_V10_5.mxd

The completed log is included in Appendix B. Photographs taken during the visual inspections are included in Appendix C and the location of the photographs are shown on Figure 2-2. A summary of the findings made during the inspection are presented in the following sections. Findings related to the Upland Area stormwater controls are summarized above in Section 2.1.2.

2.2.1 Upland Area

The Upland Area encompasses the majority of the site, from the fence line to the rip-rap covered shoreline. No trash or debris was identified within the Upland Area, with the exception of a few small pieces of trash, thrown over the perimeter fence and disposed on the site. A large high-density polyethylene (HDPE) pipe, located near the sheet pile wall, which was left at the site following construction, was also observed. Inspectors did not find evidence of trespassing or vandalism. Likewise, no visual evidence of contaminants or pollution (e.g., oil sheen) was observed at the site. Invasive plants including blackberries were observed growing along the fence lines, particularly along Dallas Avenue. No recent evidence of erosion was observed in the Upland Area. Inspection of the fence revealed that some warning signs placed by the Port along the Dallas Avenue fence had been damaged or removed. The signs have been replaced. The fence will be removed following completion of the habitat restoration and public access work.

2.2.2 Shoreline Bank and Seeps

Erosion was not noted on or around the shoreline bank, including the rip-rap slope. The armor stone along the bank appeared to be in good condition and was not displaced. The inspection was completed at low tide to check for the presence of seeps, and several apparent seeps were initially noted. The seeps stopped flowing during the visual inspection and likely reflect bank storage temporarily discharging back into the waterway (i.e., tidal seeps), rather than shallow groundwater discharge. No sheen was observed on any of the tidal seeps. The slope on the shoreline bank continues to be stable.

2.2.3 DU1 Cap Area

The DU1 cap covers a portion of the Sediment Area where PCB concentrations in sediments were suspected to exceed the RvALs[2] (AECOM 2016). Clean backfill with an approximate thickness of 4 to 11 feet was installed during construction activities, which functions as a cap in

[2] Sampling conducted after dredge to design depth indicated remaining contamination in this area. Two additional rounds (R3 and R4) of over-excavation were completed. Sediment sampling after R3 excavation continued to indicate total PCB concentrations greater than the RvAL at two sample locations. R4 excavation removed an additional 0.4 to 1.3 feet below the depth of these samples. Additional confirmation samples were not collected after final R4 excavation because the in-water work window closed. It is possible that remaining sediments in this area are below these concentrations and are below the PCB RvAL. With EPA approval, the area was backfilled. With no confirmation that all contaminated material had been removed, an analysis to determine if backfill would perform the functions of a cap was performed and documented in a memorandum (Crete 2014) approved by EPA on August 21, 2014, indicating that the backfill placed in this area could meet the requirements for a cap.

this area. The cap is topped with a layer approximately 1-foot thick of armor stone (i.e., riprap) typical of the rest of the shoreline bank. There was no evidence of erosion during inspection of the DU1 cap and the armor stone was in good condition. The cap was installed at a slope of 3H:1V measured (on top of the armor stone) to match existing grade. A slope steeper than 3H:1V could indicate potential erosion of the cap. The slope of the DU1 Cap was determined by measuring the change in elevation (rise) over a horizontal distance (run) using a measuring tape and level. These measurements indicate that the slope remains stable.

2.3 SEDIMENT AREA MONITORING

The Sediment Area sampling was completed on March 28, 2019 in accordance with the LTMMP and the Quality Assurance Project Plan, Upland and Sediment Areas Long-Term Monitoring (QAPP; AECOM and Integral Consulting Inc. 2018b), which was included as Appendix B of the LTMMP. Sample collection forms, photographs, data quality review memoranda, and analytical laboratory reports are included in Appendix D. The sediment sample collection, sample analysis methods, and sample results are summarized below.

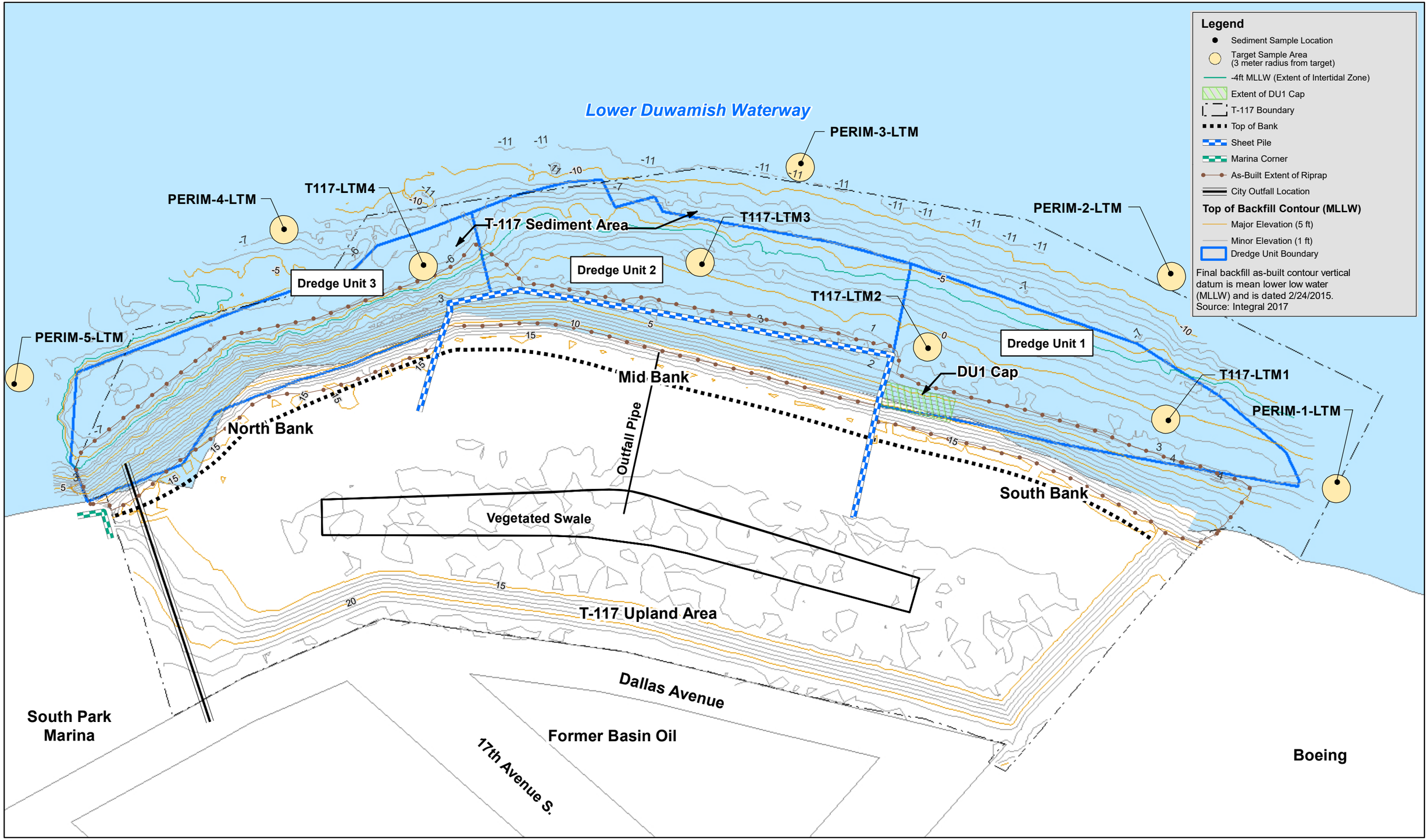
2.3.1 Sample Collection

Sampling was conducted aboard a vessel operated by Research Support Services (RSS). RSS provided equipment and field support during sampling. The vessel was equipped with a custom-made power grab sampler which was used to collect the sediment samples at nine predetermined locations identified in the LTMMP (Figure 2-3). The sampling was conducted on March 28, 2019 during a high tide condition when the sample locations could be accessed by a vessel.

Discrete surface sediment samples (0 to 10 cm) were collected at four stations within the Sediment Area (T117-LTM1 through T117-LTM4) and five perimeter stations (PERIM-1-LTM through PERIM-5-LTM) (Figure 2-3). Using pre-determined coordinates, the vessel navigated to the target sample location. Samples were collected, as required, from within three meters of the target locations specified in the QAPP. If the sediment sample volume was inadequate or if the power grab sampler penetrated more than 10 cm, the sample was considered unacceptable and another sediment sample was collected within three meters of the target location.

During sample collection, observations of the sediment profile were documented to assess material, odors, and possible sheen. An olive brown surface layer of silt was observed at all sample locations. This surface layer thickness ranged from 0.1 to 1 cm. Samples collected at perimeter locations PERIM-2-LTM through PERIM-4-LTM were comprised entirely of grey silty material. Trace amounts of organic matter (woody debris) were observed at all sample locations except for sample PERIM-5-LTM. This sample was composed of silty sediment with trace amounts of fine sand. Sheen was not observed at any of the sample locations. A slight organic odor was detected while processing the sample collected at station PERIM-4-LTM; no odors were documented for the remaining samples.

Path: J:\DCS\Projects\ENV\PROJECTSW\Port of Seattle\T-117 Cleanup Oversight\900-CAD-GIS\AECOM\MXD\RACR\Removal Completion Report\Figure_2_T117_JoinLongTermMonitoringandMaintenancePlan.mxd



AECOM

T-117 Annual Monitoring and Maintenance Report			T117 Sediment Area Long-Term Monitoring Locations	
Date: 1/28/2020	DRWN:mvi/sea	Revision: 0	Project No: 60599719	Figure 2-3

2.3.2 Sample Analysis

Sediment samples were delivered to Analytical Resources, Inc., and analyzed for the following:

- Polycyclic aromatic hydrocarbons (individual carcinogenic PAHs [cPAHs] and 2-methylnaphthalene, acenaphthene, anthracene, dibenzofuran, fluoranthene, fluorene, phenanthrene),
- PCBs,
- Phenol,
- Dioxins/furans (T117-LTM2 and PERIM-5-LTM only, per the QAPP),
- Arsenic,
- Total organic carbon (TOC), and
- Total solids and grain size.

The sediment sampling matrix indicates sample identification and analyses completed on each sample, including quality assurance/quality control samples (Table 2-2). The analyte list and RvALs are included in Table 2-3.

Sediment analytical data were validated and tabulated by AECOM. All planned sediment samples were collected, processed and analyzed in accordance with the QAPP (AECOM and Integral Consulting Inc. 2018b). As detailed in the data validation reports, laboratory results for some analytes were qualified as not detected above the reporting limit or estimated. All analytical data are considered acceptable for use as qualified (i.e., no data were rejected during validation); therefore, the completeness of the sediment samples is 100 percent. Data validation reports and a summary table including results for all analytes for the sediment sampling event are provided in Appendix D. Calculations of toxicity equivalents (TEQs) and total PCB Aroclors, and TOC normalization were completed as described in Section 2.7.3 of the QAPP (AECOM and Integral Consulting Inc. 2018b). A compact disc containing the analytical laboratory reports is also included in Appendix D.

2.3.3 Sample Results

Sediment analytical results (in dry weight and organic carbon normalized when applicable) are summarized in Table 2-4. Per Washington State Department of Ecology Sediment Cleanup User's Manual II (Ecology 2019), sample results can only be carbon normalized if TOC content is greater than 0.5 percent and less than 3.5 percent. The RvALs for PCBs and PAHs are included as both dry weight and organic carbon normalized values, because the organic content of sediments affects the bioavailability and toxicity of these analytes. Therefore, PCBs and PAHs results are presented in both dry-weight and carbon-normalized concentrations for comparison to the relevant RvALs.

In accordance with the LTMMP, sediment analytical results were compared to the T-117 RvALs in Table 2-3. The results were also compared against applicable LDW criteria included in the ROD (USEPA 2014) in Appendix F as Table 27.

Table 2-2 Sample Matrix for T-117 Sediment Area Long-Term Monitoring Sampling

Sample Station	Sample ID	Date	Time	Sample Type	Phenol by USEPA 8270D	PAHs [a] by USEPA 8270D-SIM	PCBs by USEPA 8082A	Dioxins/Furans by USEPA 1613	Arsenic by USEPA 6020A	TOC by Plumb 1981	Total Solids by SM 2540 G-97	Grain Size by PSEP 1986
T117-LTM1	T117-LTM1-20190328	3/28/2019	8:35	Normal	X	X	X	—	X	X	X	X
T117-LTM2	T117-LTM2-20190328	3/28/2019	9:05	Normal	X	X	X	X	X	X	X	X
T117-LTM3	T117-LTM3-20190328	3/28/2019	9:30	Normal	X	X	X	—	X	X	X	X
T117-LTM4	T117-LTM4-20190328	3/28/2019	9:50	Normal	X	X	X	X	X	X	X	X
PERIM-1-LTM	T117-P1-20190328	3/28/2019	10:15	Normal	X	X	X	X	X	X	X	X
PERIM-2-LTM	T117-P2-20190328	3/28/2019	10:45	Normal	X	X	X	—	X	X	X	X
PERIM-3-LTM	T117-P3-20190328	3/28/2019	11:05	Normal	X	X	X	—	X	X	X	X
PERIM-4-LTM	T117-P4-20190328	3/28/2019	11:30	Normal	X	X	X	—	X	X	X	X
PERIM-5-LTM	T117-P5-20190328	3/28/2019	12:20	Normal	X	X	X	X	X	X	X	X
T117-LTM1	T117-DUP1-20190328	3/28/2019	—	Normal	X	X	X	—	X	X	X	—
NA	T117-FWSP-20190328	3/28/2019	13:00	QA/QC [c]	X	X	X	X	X	—	—	—
NA	T117-FWB-20190328	3/28/2019	13:05	QA/QC [c]	X	X	X	X	X	—	—	—
NA	T117-FWR-20190328 [b]	3/28/2019	13:10	QA/QC [c]	—	—	—	—	—	—	—	—
NA	T117-FB-20190328	3/28/2019	13:15	QA/QC [c]	X	X	X	X	X	—	—	—

Notes:

[a] 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene

[b] Sample identification T117-FWR-20190328 was assigned to a wipe blank; however, the equipment was not used during sampling. No analyses were performed in association with this sample.

[c] Results for QA/QC samples can be found in the analytical laboratory report located in Appendix A. Evaluation of the QA/QC samples is discussed in the Summary Data Quality Review Memos located in Appendix D.

— = not analyzed
NA = Not applicable
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PSEP = Puget Sound Estuary Program methodology (PSEP 1986)
QA/QC = quality assurance and quality control
SM = Standard Method
TOC = total organic carbon
USEPA's Test Methods for Evaluating Solid Waste (SW-846)

Table 2-3 Sediment Analytes and Removal Action Levels

Analyte	Removal Action Level (RvAL)[a]	
	OC	dw
Polycyclic Aromatic Hydrocarbons		
2-Methylnaphthalene [b]	38 mg/kg OC	670 µg/kg
Acenaphthene [b]	16 mg/kg OC	500 µg/kg
Anthracene [b]	220 mg/kg OC	960 µg/kg
Dibenzofuran [b]	15 mg/kg OC	540 µg/kg
Fluoranthene [b]	160 mg/kg OC	1,700 µg/kg
Fluorene [b]	23 mg/kg OC	540 µg/kg
Phenanthrene [b]	100 mg/kg OC	1,500 µg/kg
Benzo(a)anthracene [c]	NE	NE
Chrysene [c]	NE	NE
Benzo(b)fluoranthene [c]	NE	NE
Benzo(k)fluoranthene [c]	NE	NE
Benzo(a)pyrene [c]	NE	NE
Indeno(1,2,3-cd)pyrene [c]	NE	NE
Dibenz(a,h)anthracene [c]	NE	NE
Benzo(g,h,i)perylene [c]	NE	NE
cPAH TEQ [b]	NE	90 µg/kg
Semivolatile Organic Compound		
Phenol [b]	NE	420 µg/kg
PCBs		
Aroclor 1016	NE	NE

Analyte	Removal Action Level (RvAL)[a]	
	OC	dw
Sediment Analytes and Removal Action	NE	NE
Aroclor 1232	NE	NE
Aroclor 1242	NE	NE
Aroclor 1248	NE	NE
Aroclor 1254	NE	NE
Aroclor 1260	NE	NE
Aroclor 1262	NE	NE
Aroclor 1268	NE	NE
Total PCBs [b, d]	12 mg/kg OC	NE
Dioxins/Furans		
2,3,7,8-TCDF	NE	NE
2,3,7,8-TCDD	NE	NE
1,2,3,7,8-PeCDF	NE	NE
2,3,4,7,8-PeCDF	NE	NE
1,2,3,7,8-PeCDD	NE	NE
1,2,3,4,7,8-HxCDF	NE	NE
1,2,3,6,7,8-HxCDF	NE	NE
2,3,4,6,7,8-HxCDF	NE	NE
1,2,3,7,8,9-HxCDF	NE	NE
1,2,3,4,7,8-HxCDD	NE	NE

Analyte	Removal Action Level (RvAL)[a]	
	OC	dw
1,2,3,6,7,8-HxCDD	NE	NE
1,2,3,7,8,9-HxCDD	NE	NE
1,2,3,4,6,7,8-HpCDF	NE	NE
1,2,3,4,7,8,9-HpCDF	NE	NE
1,2,3,4,6,7,8-HpCDD	NE	NE
OCDF	NE	NE
OCDD	NE	NE
Total TCDF	NE	NE
Total TCDD	NE	NE
Total PeCDF	NE	NE
Total PeCDD	NE	NE
Total HxCDF	NE	NE
Total HxCDD	NE	NE
Total HpCDF	NE	NE
Total HpCDD	NE	NE
Dioxins/Furans TEQ [b]	NE	13 ng/kg
Metals		
Arsenic [b]	NE	12 mg/kg
General Chemistry		
Total Organic Carbon (% dry)	NE	NE
Total Solids (%)	NE	NE

Notes:

[a] Nonpolar organic contaminants of concern concentrations in sediment samples are normalized to each sample-specific TOC concentration. To normalize the reported result to TOC, the dry weight concentration for the analyte is divided by the decimal fraction representing the percent TOC content (e.g., 0.01 means 1%). If the TOC concentration for a sample is <0.5% or >3.5%, then the reported results will be compared to the dry-weight corrected criteria, as described in the Sediment Cleanup User's Manual (Ecology 2019). RvALs are normalized to TOC because the organic content of sediments affects the bioavailability and toxicity of the analytes.

[b] Contaminant of concern

[c] cPAH; Results incorporated into cPAH TEQ.

[d] Sum of detected aroclors

cPAH = Carcinogenic Polycyclic Aromatic Hydrocarbon
dw = dry weight
% = percent
HpCDD = heptachlorinated dibenzo-p-dioxins
HpCDF = heptachlorinated dibenzofurans
HxCDD = hexachlorinated dibenzo-p-dioxins
HxCDF = hexachlorinated dibenzofurans
mg/kg = milligram per kilogram
NE = not established; analyte is not a contaminant of concern for the T-117 Early Action Area.
ng/kg = nanogram per kilogram
OC = organic carbon normalized
OCDD = octachlorinated dibenzo-p-dioxins
OCDF = octachlorinated dibenzofurans
PCB = polychlorinated biphenyl
PeCDD = pentachlorinated dibenzo-p-dioxins
PeCDF = pentachlorinated dibenzofurans
RvAL = removal action level
TCDD = tetrachlorinated dibenzo-p-dioxins
TCDF = tetrachlorinated dibenzofurans
TEQ = toxicity equivalent
TOC = total organic carbon
µg/kg = microgram per kilogram

Table 2-4 Sediment Sample Results

Sample Station	Removal Action Levels (RvAL) [a,b]	T117-LTM1		T117-LTM2	T117-LTM3	T117-LTM4	PERIM-1-LTM	PERIM-2-LTM	PERIM-3-LTM	PERIM-4-LTM	PERIM-5-LTM
Sample Depth (cm):		**10**		**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Sample Date:		**3/28/19**		**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**
Other Sample Information:			**(DUP)**								
Organic Carbon-Normalized [c]											
Polycyclic Aromatic Hydrocarbons USEPA 8270D-SIM (mg/kg OC)											
2-Methylnaphthalene	38	0.836	0.614 U	NC	NC	0.634	0.748 U	0.626	0.690	0.527	0.282
Acenaphthene	16	0.753 U	0.614 U	NC	NC	0.333	0.748 U	0.428	0.342	0.288	0.232
Anthracene	220	0.780	0.747	NC	NC	1.127	0.635 J	1.461	0.874	0.586	0.461
Dibenzofuran	15	0.389 J	0.263 J	NC	NC	0.442	0.272 J	0.486	0.433	0.365	0.248
Fluoranthene	160	4.955	5.013	NC	NC	6.594	6.923	6.626	4.845	4.975	4.375
Fluorene	23	0.753 U	0.614 U	NC	NC	0.428	0.748 U	0.556	0.303	0.321	0.205
Phenanthrene	100	2.379	1.886	NC	NC	2.808	2.954	3.436	2.086	2.074	1.690
Polychlorinated Biphenyls by USEPA 8082A (mg/kg OC)											
Total PCBs as Aroclors [d]	12	5.076	4.165	NC	NC	4.120	5.800	2.918	2.741	2.350	1.634
Dry Weight [e]											
Polycyclic Aromatic Hydrocarbons USEPA 8270D-SIM (µg/kg)											
2-Methylnaphthalene	670	5.52	4.85 U	4.78 U	4.81 U	17.5	4.86 U	15.2	12.0	10.7	9.47
Acenaphthene	500	4.97 U	4.85 U	4.78 U	4.81 U	9.20	4.86 U	10.4	5.95	5.85	7.79
Anthracene	960	5.15	5.90	1.06 J	1.50 J	31.1	4.13 J	35.5	15.2	11.9	15.5
Dibenzofuran	540	2.57 J	2.08 J	4.78 U	4.81 U	12.2	1.77 J	11.8	7.54	7.40	8.33
Fluoranthene	1,700	32.7	39.6	7.46	7.26	182	45.0	161	84.3	101	147
Fluorene	540	4.97 U	4.85 U	4.78 U	4.81 U	11.8	4.86 U	13.5	5.27	6.51	6.88
Phenanthrene	1,500	15.7	14.9	4.78 U	4.81 U	77.5	19.2	83.5	36.3	42.1	56.8
cPAH TEQ [f]	90	22.7	26.2	6.68	6.22	**130**	25.5	**111**	50.2	48.4	67.8
Phenol	420	17.5 J	12.0 U	17.1 U	20.5 J	179 J	8.8 J	96.5 J	28.1 J	41.0 J	36.0 J
Polychlorinated Biphenyls USEPA 8082A (µg/kg)											
Total PCBs as Aroclors [d]	130 (upper 10 cm)	33.5	32.9	5.5 J	11.8 J	113.7	37.7	54.9	70.9	47.7	54.9
Dioxins/Furans USEPA 1613B (ng/kg)											
Dioxin/Furan TEQ [g]	13	NA	NA	1.545	NA	5.257	2.655	NA	NA	NA	3.974
Metals USEPA 6030A (mg/kg)											
Arsenic	12	6.27	7.47	3.39	2.89	**14.1**	9.21	**14.8**	7.03	8.13	**15.9**
General Chemistry											
Total Organic Carbon by Plumb, 1981 (%)	NE	0.66	0.79	0.23	0.16	2.76	0.65	2.43	1.74	2.03	3.36
Total Solids by SM 2540G-97 (%)	NE	70.84	—	79.64	79.68	42.60	68.58	47.27	58.13	50.95	40.94
Grain Size by PSEP(PSEP 1986)											
PhiSize < -1 Gravel	NE	1.6 %	2.2 %	8.4 %	9.1 %	0.1 %	26.7 %	0.1 %	0.3 %	0.4 %	0.1 %

Sample Station	Removal Action Levels (RvAL) [a,b]	**T117-LTM1**		**T117-LTM2**	**T117-LTM3**	**T117-LTM4**	**PERIM-1-LTM**	**PERIM-2-LTM**	**PERIM-3-LTM**	**PERIM-4-LTM**	**PERIM-5-LTM**
Sample Depth (cm):		**10**		**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Sample Date:		**3/28/19**		**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**	**3/28/19**
Other Sample Information:			**(DUP)**								
PhiSize -1 to 0 Very Coarse Sand	NE	5.9 %	5.9 %	12 %	19.3 %	1.7 %	13.9 %	1.9 %	0.7 %	0.9 %	2.8 %
PhiSize 0 to 1 Coarse Sand	NE	20.4 %	20.6 %	24.3 %	28.4 %	1.5 %	15.7 %	3.8 %	1.2 %	1.6 %	3.0 %
PhiSize 1 to 2 Medium Sand	NE	28.1 %	29 %	33.5 %	27.8 %	2.0 %	16.4 %	3.9 %	1.7 %	2.9 %	5.0 %
PhiSize 2 to 3 Fine Sand	NE	12.3 %	12.8 %	13.3 %	8.2 %	3.0 %	10.1 %	9.5 %	19.8 %	10.2 %	2.6 %
PhiSize 3 to 4 Very Fine Sand	NE	8.8 %	8.9 %	2.7 %	2.3 %	10.9 %	6.0 %	18.8 %	29.1 %	31.7 %	9.7 %
PhiSize 4 To 5 Coarse Silt	NE	6.5 %	5.8 %	1.0 %	1.0 %	13.2 %	1.7 %	13.1 %	10.3 %	14.7 %	10.6 %
PhiSize 5 to 6 Medium Silt	NE	4.8 %	5.6 %	1.2 %	1.0 %	30.9 %	2.5 %	16.7 %	12.7 %	19.4 %	26 %
PhiSize 6 to 7 Fine Silt	NE	4.0 %	3.8 %	1.2 %	1.0 %	17 %	2.0 %	13.4 %	9.9 %	7.3 %	18.9 %
PhiSize 7 to 8 Very Fine Silt	NE	2.9 %	1.7 %	0.9 %	0.7 %	6.6 %	1.7 %	6.2 %	4.8 %	2.9 %	7.1 %
PhiSize 8 to 9 Coarse Clay	NE	1.5 %	1.0 %	0.6 %	0.4 %	3.3 %	1.1 %	3.4 %	2.7 %	2.0 %	4.5 %
PhiSize 9 to 10 Medium Clay	NE	1.2 %	0.9 %	0.4 %	0.3 %	2.6 %	0.8 %	2.5 %	2.00 %	1.2 %	2.4 %
PhiSize > 10 Fine Clay	NE	2.1 %	1.9 %	0.6 %	0.7 %	7.2 %	1.5 %	6.7 %	4.7 %	4.7 %	7.4 %
PSEP Percent Fines (Silt + Clay)	NE	23 %	20.8 %	5.8 %	4.9 %	80.8 %	11.1 %	62 %	47.1 %	52.3 %	76.9 %

Notes:

[a] Action levels as presented in Quality Assurance Project Plan, Upland and Sediment Areas Long-Term Monitoring.
[b] The alternate RvAL, based on apparent effects threshold dry weight value, is used for sediment screening only when TOC is <0.5% or >3.5%. Otherwise, sediment samples are compared to oc-normalized values as appropriate.
[c] The concentrations for nonpolar organic contaminants of concern in sediment samples are normalized to the TOC concentration. To normalize the reported result to TOC, the dry weight concentration for the analyte is divided by the decimal fraction representing the percent TOC content (e.g., 0.01 means 1%). If the TOC concentration for a sample is <0.5% or >4%, then the reported results will be compared to the dry-weight criteria.
[d] Sum of detected aroclors
[e] The concentrations for nonpolar organic contaminants of concern in sediment samples are dry-weight corrected by multiplying the laboratory's raw instrument result by the decimal fraction representing the sample dry weight. Results are reported by the laboratory dry weight corrected.
[f] The TEQs for cPAHs were calculated using the 2005 California Environmental Protection Agency mammalian toxicity equivalency factors (TEFs) for the seven individual PAHs included in the analysis.
[g] TEQs for dioxins/furans were calculated using 2005 World Health Organization mammalian TEFs

- Highlighted values in **bold** font indicate that the result reported exceeds the RvAL.
- Highlighted dry weight values are provided for information only. When applicable, the oc- normalized result is used for comparison to RvAL

% = percent
cm = centimeter
cPAH = carcinogenic polycyclic aromatic hydrocarbon
DUP = field duplicate
J = estimated value
LDW = Lower Duwamish Waterway
mg/kg = milligram per kilogram
µg/kg = microgram per kilogram

NA = not analyzed
NC = not calculated; TOC concentration for sample is <0.5% or >4% and the reported result was compared to the dry-weight corrected criteria.
NE = not established; analyte is not a contaminant of concern for the T-117 Early Action Area.
ng/kg = nanogram per kilogram
PSEP = Puget Sound Estuary Program methodology (PSEP 1986)
RvAL = removal action level
SM = Standard Method
TEQ = toxicity equivalent
U = Compound was analyzed for but not detected above the method detection limit. USEPA = Environmental Protection Agency

There were no RvAL exceedances at three of the four onsite sample stations: T117-LTM1, T117-LTM2, and T117-LTM3. Onsite sample stations are located within the area where dredging occurred during the removal action (i.e., remediated area). There were RvAL exceedances at sample station T117-LTM4. An exceedance of the RvAL for arsenic (12 milligrams per kilogram [mg/kg] dw) was observed at sample T117-LTM4 (14.1 mg/kg dw). The cPAH TEQ also exceeded the RvAL (90 µg/kg dw) at sample station T117-LTM4 (130 µg/kg dw).

Perimeter sample stations are outside the area where dredging occurred during the removal action. There were no exceedances of the RvALs for any of the COCs at three of the five perimeter sample stations: PERIM-1-LTM, PERIM-3-LTM, and PERIM-4-LTM. There were RvAL exceedances at perimeter sample stations: PERIM-2-LTM and PERIM-5-LTM. Arsenic concentrations exceeded the RvAL (12 mg/kg) at PERIM-2 -LTM (14.8 mg/kg dw) and PERIM-5-LTM (15.9 mg/kg dw). The cPAH TEQ also exceeded the RvAL (90 µg/kg dw) at sample station PERIM-2-LTM (111 µg/kg dw). During construction of the removal action[3], the same perimeter locations were sampled pre- and post-construction (as shown in Appendix F Figure 7). Arsenic concentrations in PERIM-5-LTM are similar to concentrations in perimeter samples collected pre- and post-construction (SG-PERIM-5-PRE at 15.8 mg/kg and SG-PERIM-5-POST at 15 mg/kg, respectively as shown in Appendix F Table 5-5).

Sample location PERIM-5-LTM is located in an unremediated area to the north of T-117 near South Park Marina and the City outfall. PERIM-2-LTM is also in an unremediated area southeast of T-117. T117-LTM4 is located onsite in Dredge Unit 3, which is the northernmost dredge unit. Although these sample are geographically distant, they have similar properties. These three samples have the highest percent fines, higher TOC content, highest cPAH TEQ and PCB concentrations, as compared to other monitoring sample locations. The arsenic concentrations are also similar among these three locations, ranging from 14.8 to 15.9 mg/kg. Sediment deposition rates are known to be higher in the northern third of the Sediment Area (Figure 2 of the LDW ROD; USEPA 2014, which is included in Appendix F). The estimated net sedimentation rate in this area is > 3 cm/year. Sample locations T117-LTM4 and PERIM-5 LTM are both located in this area The field notes for T117-LTM4 indicated that silty materials were encountered throughout the 28 cm core interval, with no indication that the original backfill was reached indicating that finer sediment particles have settled on top of the clean backfill at T117-LTM4. PERIM-2-LTM also appears to be in an area with estimated net sedimentation rate > 3 cm/year. A memo will be prepared comparing post-remediation bathymetry data with 2019 bathymetry data collected as part of remedial design for the upper reach of LDW to further

[3] Total PCBs was the most prevalent COC, and the PCB RvAL is primarily responsible for determining the delineation of the removal boundary (Windward et al. 2010). T-117 was identified as an EAA that required cleanup as a result of risks to human health and the environment from high PCB concentrations in the sediments (USEAP 2010).

evaluate the sediment accumulation. The 2019 LDW bathymetry was not in a format to perform a sediment evaluation at the time this report was finalized.

Although there are RvAL exceedances for arsenic at sample station T117-LTM4, the concentrations are similar to or less than sediment concentrations found in this portion of the LDW. Composite sediment samples collected during the LDW baseline sediment investigation (Windward Environmental LLC 2019) reported arsenic concentrations of 8.4 mg/kg in the vicinity of T-117 (river mile [RM] 3.35 -3.7) and 27.2 mg/kg just upstream of T-117(RM 3.7-4.0). The upstream sediment could be a potential source of recontamination to the T-117 sediment because the upstream sediment could be re-suspended and re-settle downstream.

The cPAH TEQ RvAL exceedances at T117- LTM4 and PERIM-2-LTM at a concentration of 130 µg/kg and 111 mg/kg TEQ, respectively, are higher than the LDW baseline cPAH composite TEQ of 50.5 and 83.1 mg/kg TEQ reported in this area of the LDW. Therefore, LDW sediment does not appear to be likely a source of recontamination to T-117 EAA sediment. However, the LDW is a dynamic riverine system and the redistribution of contaminated sediments within the LDW does occur. Sedimentation in areas of T-117 is evident based on the physical characteristics of T117-LTM4 and PERIM-2-LTM. The cPAH exceedance appears to be isolated with no apparent spatial relationship or association with the City outfall, and there are no known or suspected upland sources within the T-117 Upland Area. These cPAH exceedances may be anomalous and the sediment will be re-evaluated in future monitoring events, as some natural recovery would be expected due to the cPAH concentrations in the vicinity of T-117 being below the RvALs. If cPAH RvAL exceedances persist, additional evaluations may be necessary to identify the potential source of cPAHs to the T-117 sediment in the vicinity of T117-LTM4 and PERIM-2-LTM.

None of the onsite or perimeter sample locations exceeded the remedial action levels (RALs) in the LDW ROD (USEPA 2014), which are included in Appendix F.

3 MAINTENANCE ACTIVITIES

The maintenance program includes the Phase 2, Part 2 – Adjacent Streets and Stormwater system, and the Phase 1 – T117 Upland and Sediment Areas of the EAA removal action. As required by the LTMMP and shown in Table 1-1, maintenance activities completed in 2019 included:

- Inspect catch basins (Phase 2, Part 2 – Adjacent Streets and Stormwater);
- Inspect Bioretention Cells (Phase 2, Part 2 – Adjacent Streets and Stormwater); and
- Inspect Filterra® tree box units (Phase 2, Part 2 – Adjacent Streets and Stormwater).

Table 1-1 of the LTMMP does not include any maintenance activities for Phase 1 – T117 Upland and Sediment Area in 2019, but maintenance was performed in response to the conditions observed during visual inspections.

3.1 ADJACENT STREETS AND STORMWATER

The Adjacent Streets and Stormwater stormwater system is maintained by SPU in accordance with standard operating procedures and the City Stormwater Code and accompanying technical manual (Seattle 2017) as required under the City's NPDES MS4 permit. Catch basins and the 17th Ave S SD outfall are inspected on an annual basis; bioretention cells are inspected four times per year; and Filterra™ tree boxes are inspected semi-annually. Routine maintenance includes watering, weeding, mulch replenishment/replacement, removal of fines/debris, and maintenance of associated structures. A summary of maintenance activities performed during this monitoring and maintenance period is included below.

3.1.1 Routine Inspections and Maintenance

The Adjacent Streets and Stormwater stormwater system was inspected on the following dates: March 16, May 1, June 19, July 16, and August 1, 2019. Inspectors inspected the entire area, including the bioretention cells, Filterra™ tree box units and associated structures, as well as landscaped areas, and checked for sediment accumulation in the bioretention cells, plant health, weed growth, and trash/illegal dumping. The September 25 inspection was conducted with SPU and contractor landscape maintenance staff to identify where additional plantings were needed and to identify plant species that would be suitable in these areas. Drought-tolerant and sun-loving plants were added in areas where plant coverage was thin. Locations of additional plantings are shown in Figure 3-1. Plantings occurred over several days in October 2019. Typical plantings are shown in Figures 3-2 through 3-4.

Legend

- Storm drain
- Sanitary sewer
- Combined sewer

Additional plantings to fill in gaps with drought tolerant, sun-loving plants

N
W E
S

0 50 100 Feet

City of Seattle

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AECOM

T-117 Annual Monitoring and Maintenance Report			Adjacent Streets and Stormwater Additional Plantings December 2018	
Date: 3/12/2020	DRWN: ACC	Revision:	Project No: 60591759	Figure 3-1

\\Seattle\Seattle\DCS\Resources\GRFX\Projects\60591759 T-117\60591759_01.ai

Maintenance activities are summarized in Table 3-1. Inspection checklists are provided in Appendix E.

Table 3-1 Adjacent Streets and Stormwater SPU Maintenance Activities in 2019

Date	Activity	Action
May 1, June 19, July 16, and August 1	Weeding	Weeding, mulching, and garbage collection each month as needed
October	Planting	Planted 125 new plants to fill in areas where plants had died or where additional plant density needed to deter weed growth

Figure 3-2 Cell A Plantings

Figure 3-3 Cell H1 Plantings

Figure 3-4 Donovan Hillside Plantings

3.1.2 Maintenance Monitoring

Monitoring of treated stormwater flowing out the bottom of the bioretention cells (i.e. underdrain samples) and Filterra™ tree box units was not required in 2019 (see Table 1-1). In accordance with the LTMMP, the next monitoring to determine when the treatment capacity of the media has declined and assist in determining when the media needs to be replaced will occur in 2021.

3.2 UPLAND AND SEDIMENT AREAS

The visual inspection on June 18, 2019 identified an HDPE pipe that was used during the construction of the sheet pile wall and is no longer needed at the site, invasive plants such as blackberries along the north and west fence lines, and damaged warning signs along Dallas Avenue. In response, the Port removed the invasive vegetation along the north and west fence lines and replaced the damaged signs along Dallas Avenue in the fall of 2019. Photographs taken in October 2019 showing the vegetation removal and new signs are included in Appendix C. The HDPE pipe was removed from the site by the Port in December 2019.

4 CONCLUSIONS AND RECOMMENDATIONS

As stated in the Action Memorandum (USEPA 2010), monitoring objectives focus on verifying the effectiveness and performance of the remedy. Overall monitoring objectives associated with site sediment and stormwater are:

1. Sediment monitoring to determine if recontamination of the clean post construction sediment surface is occurring;

2. Stormwater monitoring to ensure any water released to the LDW will not result in recontamination of sediment or harmful exposure to benthic organisms.

4.1 CONCLUSIONS

The objectives of the monitoring program for the T-117 EAA were achieved in 2019. The monitoring results indicated that the T-117 EAA is stable, the integrity of the DU1 cap is sound, and the stormwater systems are working as designed. Specific conclusions related to the sediment and stormwater monitoring objectives are presented below.

4.1.1 Sediment

Results of the sediment monitoring indicate some recontamination of arsenic and cPAHs above the RvAL in the remediated area at sample location T117-LTM4. Concentrations of arsenic and/or cPAHs also exceeded RvALs at two perimeter monitoring stations PERIM-2-LTM and PERIM-5-LTM. Arsenic concentrations exceeding RvALs were similar in all three samples, ranging from 14.1 to 15.9 mg/kg dw. The cPAH TEQ concentrations exceeding RvALs were also similar in the onsite sample (130 µg/kg dw at T117-LTM4) compared to the perimeter sample (111 µg/kg dw at PERIM-2_LTM). The sediment at the three locations with RvAL exceedances is comprised of predominantly silt and clay size particles, indicative of depositional material. Although there were RvAL exceedances for two COCs as discussed here, none of the sediment sample results exceeded the LDW RALs for any of the COCs.

It is likely that the RvAL exceedances at T117-LTM4 are associated with the redistribution and deposition of contaminated sediments from within the LDW. This is because all of the T-117 Upland Area soils exceeding soil RvALs were removed, contaminated sediments in the dredge units were removed (except for the DU1 cap) and replaced with backfill, T117-LTM4 is located in an area known to have sedimentation rates > 3 cm/yr, and it was noted that silty materials are at least as deep as 28 cm at that sample location, which indicates that finer sediment particles from have settled on top of the clean backfill at T117-LTM4.

4.1.2 Stormwater

Upland Area. Visual inspections of the Upland Area stormwater system are discussed in Section 2.1.2, Table 2-1, and documented in Appendix B. Visual inspections of the Upland Area, including the stormwater swale, did not indicate evidence of any contaminant releases to the LDW.

Adjacent Streets. In 2019, SPU retrieved the sediment traps installed in the first maintenance hole upstream of the outfall on the 17th Ave S SD and analyzed the accumulated sediment for PCBs. As discussed in Section 2.1.1, the sample did not exceed the 1,000 µg/kg dw screening level used to trigger source tracing.

4.2 RECOMMENDATIONS

The findings from the ongoing sediment monitoring do not warrant significant changes to the monitoring plan at this time. However, some possible modifications to the sampling event will be evaluated and discussed with EPA prior to the next sediment monitoring event in March 2021. For example: a) collect a duplicate sample at T117-LTM-4; b) use cores or other tools to assess bathymetric changes; and, c) evaluate where and how much deposition is occurring off shore of T-117.

In May 2020, Port Commission approved construction funding for the T-117 habitat restoration project, with groundbreaking expected in July or August 2020 (Port 2020). Construction activities within the footprint of the Sediment and Upland Areas are scheduled for summer 2021 (after the March 2021 sampling event). Associated changes to the shoreline and vegetation may affect depositional patterns in the T-117 Sediment Area. In addition, LDW remedial design for the upper reach of LDW is underway and may indicate a need for future remedial action nearby. Before the LTMMP sediment monitoring scheduled in March 2023, it may be appropriate to review the need for bathymetric measurements, additional samples, or other changes.

In 2020, the Port and City will continue to implement the monitoring program set forth in the LTMMP (AECOM and Integral Consulting, Inc. 2018a) and other work, as follows:

- Stormwater monitoring of the Upland Area stormwater controls will be completed;
- Visual inspection of the Upland Area will be performed;
- The status of the DU1 cap institutional controls and environmental covenant will be verified;
- The solids trap in the last maintenance hole prior to outfall will be inspected and if storm drain solids are present, a sample will be collected;

- Storm drain solids will be collected from select catch basins, if sediment trap does not contain enough material for analysis;
- Catch basins will be inspected;
- Bioretention cells will be inspected;
- Filterra® tree box units will be inspected; and
- Seed the swale with native plant seeds.

5 REFERENCES

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APPENDIX A

ANALYTICAL LABORATORY REPORTS FOR SEDIMENT TRAP SAMPLE COLLECTED IN 2019

Analytical Resources, Incorporated
Analytical Chemists and Consultants

17th-ST1 is sediment trap sample from T117.
Other samples in this report were not collected from T117.

05 June 2019

Beth Schmoyer
Seattle Public Utilities
700 5th Ave Suite 4900
Seattle, WA 98124

RE: Lower Duwamish Waterway

Please find enclosed sample receipt documentation and analytical results for samples from the project referenced above.

Sample analyses were performed according to ARI's Quality Assurance Plan and any provided project specific Quality Assurance Plan. Each analytical section of this report has been approved and reviewed by an analytical peer, the appropriate Laboratory Supervisor or qualified substitute, and a technical reviewer.

Should you have any questions or problems, please feel free to contact us at your convenience.

Associated Work Order(s)	Associated SDG ID(s)
19E0222	N/A

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed in the enclose Narrative. ARI, an accredited laboratory, certifies that the report results for which ARI is accredited meets all the requirements of the accrediting body. A list of certified analyses, accreditations, and expiration dates is included in this report.

Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or his/her designee, as verified by the following signature.

Analytical Resources, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Shelly Fishel, Project Manager

Cert# 100006-012

PJLA Testing
Accreditation # 66169

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

1960222 19E0119

Chain of Custody Record & Laboratory Analysis Request

MTC Project Number:		Date: 5-16-19	Are samples hazardous? Yes ☐ No ☐	4.5°C	Page: 1 of: 1
Company Name: SPU			If yes, list hazard(s):		
Address:			If YES or No is not checked, samples will be assumed hazardous and hazardous disposal fees will be applied.		
Project Manager:					
Phone #:	Email:				
Project Name: Lower Duwamish Waterway					

Sample ID	Date	Time	Matrix	# of Containers	Analysis Requested									Notes:	Lab #:
ST10-050819	5-8-19	1040	S	1											
ST10-050819	5-8-19	1040	H2O	1											
ST09-050819	5-8-19	1100	S	1											
ST09-050819	5-8-19	1100	H2O	1											
17th-ST1-050819	5-8-19	1135	S	1											
17th-ST1-050819	5-8-19	1135	H2O	1											

Custody Seals Intact?:	Relinquished By: Ray Grant II	Received By:	Relinquished By:	Received By:
Ice Present?:				
# of Coolers:	Printed Name: Ray Grant II	Printed Name: Erin Salle	Printed Name:	Printed Name:
Cooler Temps:				
Therm. #:	Company: MTC	Company: ARI	Company:	Company:
Delivered by:				
Tracking #:	Date & Time: 5/16/19 1305	Date & Time: 5/16/19 1305	Date & Time:	Date & Time:

Corporate ~ 777 Chrysler Drive • Burlington, WA 98233 • Phone (360) 755-1990 • Fax (360) 755-1980
Regional Offices: Olympia ~ 360.534.9777 Bellingham ~ 360.647.6061 Silverdale ~ 360.698.6787 Tukwila ~ 206.241.1974
Visit our website: www.mtc-inc.net

19E0222

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: 19E0119	Turn-around Requested: Standard	Date: 05-08-19	
ARI Client Company: Seattle Public Utilities	Phone: (206) 386-1199	Page: 1 of 1	
Client Contact: Beth Schmoyer		No. of Coolers: 1	Cooler Temps: 3.8°C
Client Project Name: Lower Duwamish Waterway	East Waterway Other		
Client Project #:	Samplers: NH, AB		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample No.	Date	Time	Matrix	No. Containers	Metals (As[1], Cu, Pb, Hg, Zn), EPA 6010	SVOC (EPA 8270C)	PCBs (EPA 8082)	NWTPH-Dx (ASG cleanup)	TOC (Plumb 1981)	Grain size (PSEP 1986)			Notes/Comments
ST10-050819	05-08-19	1040	sed	4	X	X	X	X	X	X			
ST09-050819	05-08-19	1100	sed	3	X	X	X	X	X	X			
17th-ST1-050819	05-08-19	1135	sed	2	X	X	X	X	X	X			

Comments/Special Instructions
1 If As not detected with detection limit ≥10 mg/kg, reanalyze by GFAA

Sediment Trap Standard priority ↑

Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by:
Printed Name: Nathan Hart	Printed Name: Jacob Walter	Printed Name:	Printed Name:
Company: Seattle Public Utilities	Company: ARI	Company:	Company:
Date & Time: 05-08-19 12:37	Date & Time: 05/08/19 1237	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: Unless specified by workorder or contract, all water/soil samples submitted to ARI will be discarded or returned, no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer. Sediment samples submitted under PSDDA/PSEP/SMS protocol will be stored frozen for up to one year and then discarded.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Cooler Receipt Form

ARI Client: MTC

Project Name: Lower Duwamish waterway

COC No(s): _____ (NA)

Delivered by: Fed-Ex UPS Courier Hand Delivered Other: _____

Assigned ARI Job No: 19E0222

Tracking No: _____ (NA)

Preliminary Examination Phase:

Were intact, properly signed and dated custody seals attached to the outside of the cooler?	YES	NO
Were custody papers included with the cooler?	YES	NO
Were custody papers properly filled out (ink, signed, etc.)	YES	NO

Temperature of Cooler(s) (°C) (recommended 2.0-6.0 °C for chemistry)

Time 1305 4.5 ___ ___ ___ ___ ___

If cooler temperature is out of compliance fill out form 00070F

Temp Gun ID#: DOO 7565

Cooler Accepted by: [signature] Date: 5/16/19 Time: 1305

Complete custody forms and attach all shipping documents

Log-In Phase:

Was a temperature blank included in the cooler?		YES	NO
What kind of packing material was used? ... Bubble Wrap Wet Ice Gel Packs Baggies Foam Block Paper Other: _____			
Was sufficient ice used (if appropriate)?	NA	YES	NO
How were bottles sealed in plastic bags?	Individually	Grouped	Not
Did all bottles arrive in good condition (unbroken)?		YES	NO
Were all bottle labels complete and legible?		YES	NO
Did the number of containers listed on COC match with the number of containers received?		YES	NO
Did all bottle labels and tags agree with custody papers?		YES	NO
Were all bottles used correct for the requested analyses?		YES	NO
Do any of the analyses (bottles) require preservation? (attach preservation sheet, excluding VOCs) ...	NA	YES	NO
Were all VOC vials free of air bubbles?	NA	YES	NO
Was sufficient amount of sample sent in each bottle?		YES	NO
Date VOC Trip Blank was made at ARI	NA	_____	

Were the sample(s) split by ARI? NA YES Date/Time: _____ Equipment: _____ Split by: _____

Samples Logged by: JBu Date: 05/16/19 Time: 1334 Labels checked by: JBu

*** Notify Project Manager of discrepancies or concerns ***

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Additional Notes, Discrepancies, & Resolutions:

very limited sample volume.

By: JBu Date: 05/16/19

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Seattle Public Utilities	Project:	Lower Duwamish Waterway	
700 5th Ave Suite 4900	Project Number:	[none]	**Reported:**
Seattle, WA 98124	Project Manager:	Beth Schmoyer	06/05/2019 10:43

ANALYTICAL REPORT FOR SAMPLES

Laboratory ID	Sample ID	Matrix	Date Sampled	Date Received
19E0222-01	ST10-050819	Solid	05/08/19 10:40	05/16/19 13:05
19E0222-02	ST10-050819	Solid	05/08/19 10:40	05/16/19 13:05
19E0222-03	ST09-050819	Solid	05/08/19 11:00	05/16/19 13:05
19E0222-04	ST09-050819	Solid	05/08/19 11:00	05/16/19 13:05
19E0222-05	17th-ST1-050819	Solid	05/08/19 11:35	05/16/19 13:05
19E0222-06	17th-ST1-050819	Solid	05/08/19 11:35	05/16/19 13:05

Seattle Public Utilities	Project: Lower Duwamish Waterway	
700 5th Ave Suite 4900	Project Number: [none]	**Reported:**
Seattle WA, 98124	Project Manager: Beth Schmoyer	05-Jun-2019 10:43

Case Narrative

Sample receipt

Samples as listed on the preceding page were received May 8, 2019 under ARI work order 19E0119. The samples were primarily water. The samples were subcontracted to Materials Testing and Consulting to centrifuge to separate liquids from solids. The samples were returned May 16, 2019 and were logged under work order 19E0222. There was very limited volume.

Samples 19E0222-03 and 19E0222-05 volume was consumed in preparing for PCB analysis. All other analyses were cancelled.

Sample 19E0222-01 had sufficient volume to perform PCB, Metals, Mercury and Semivolatiles before being consumed. All other analyses were cancelled. For details regarding sample receipt, please refer to the Cooler Receipt Form.

PCB Aroclors - EPA Method SW8082A

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements except Aroclors 1254 and 1248 which failed low on column zb-35 in the ICV. Data reported from passing column zb-5. All samples which contain analyte have been flagged with a "Q" qualifier.

Internal standard areas were within limits except Hexabromobiphenyl which was out of control low on column zb-5 for sample 19E0222-01. Data reported from passing column zb-35. Additionally, Hexabromobyphenyl was out of control low on both columns for samples 19E0222-03 and 19E0222-05. The samples were reanalyzed at a 1:5 dilution to minimize matrix effects. Sample 19E0222-03RE was within control limits on both columns with this dilution. However, 19E0222-05RE was still out on column zb-5. Data reported from passing column zb-35. Both original and reanalysis were reported.

The surrogate percent recoveries were within control limits except Tetachlorometaxylene which was out of control low on samples 19E0222-01 and 19E0222-05 on column zb-35 and is flagged within this report.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Semivolatiles - EPA Method SW8270D

The sample(s) were extracted and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements except 4-Nitroaniline which was out of control high and Pentachlorophenol which was out of control low. All samples which contain analyte have been flagged with a "Q" qualifier.

Internal standard areas were within limits.

The surrogate percent recoveries were within control limits.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits except 4-Nitroaniline which was out of control high and is flagged within the QC section of this report.

Total Metals - EPA Method 6010C

The sample(s) were digested and analyzed within the recommended holding times.

Seattle Public Utilities	Project: Lower Duwamish Waterway	
700 5th Ave Suite 4900	Project Number: [none]	**Reported:**
Seattle WA, 98124	Project Manager: Beth Schmoyer	05-Jun-2019 10:43

Case Narrative

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Total Hg - EPA Method 7470/7471

The sample(s) were digested and analyzed within the recommended holding times.

Initial and continuing calibrations were within method requirements.

The method blank(s) were clean at the reporting limits.

The LCS percent recoveries were within control limits.

Seattle Public Utilities	Project: Lower Duwamish Waterway	
700 5th Ave Suite 4900	Project Number: [none]	**Reported:**
Seattle WA, 98124	Project Manager: Beth Schmoyer	05-Jun-2019 10:43

Case Narrative

QUALIFIERS AND NOTES

Qualifier	Definition
Y1	Raised reporting limit due to interference
U	This analyte is not detected above the reporting limit (RL) or if noted, not detected above the limit of detection (LOD).
Q	Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)
P1	The reported value is greater than 40% difference between the concentrations determined on two GC columns where applicable.
NRS	This surrogate not reported due to chromatographic interference
M	Estimated value for a GC/MS analyte detected and confirmed by an analyst but with low spectral match parameters.
J	Estimated concentration value detected below the reporting limit.
H	Hold time violation - Hold time was exceeded.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL)
D	The reported value is from a dilution
B	This analyte was detected in the method blank.
*	Flagged value is not within established control limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST10-050819

Form I
ORGANIC ANALYSIS DATA SHEET
EPA 8270D
Semivolatiles (20 ug/kg - 0.2 ug/L SepF)

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/29/19 14:00	File ID:	NT1019060306.D
% Solids:	35.69	Preparation:	EPA 3546 (Microwave)	Analyzed:	06/03/19 14:29
Batch:	BHE0712	Sequence:	SHF0027	Initial/Final:	16.07 g Wet / 5 mL
Instrument:	NT10	Column:	ZB-5MSi	Calibration:	CE00049
Cleanups:	GPC				

CAS NO.	COMPOUND	DILUTION	CONC. (ug/kg dry)	Q	DL	RL
108-95-2	Phenol	1	545	H	71.7	174
111-44-4	bis(2-chloroethyl) ether	1	174	H, U	59.1	174
95-57-8	2-Chlorophenol	1	174	H, U	56.4	174
541-73-1	1,3-Dichlorobenzene	1	174	H, U	44.2	174
106-46-7	1,4-Dichlorobenzene	1	174	H, U	38.3	174
95-50-1	1,2-Dichlorobenzene	1	174	H, U	40.6	174
100-51-6	Benzyl Alcohol	1	174	H, U	130	174
108-60-1	2,2'-Oxybis(1-chloropropane)	1	174	H, U	49.4	174
95-48-7	2-Methylphenol	1	174	H, U	68.3	174
67-72-1	Hexachloroethane	1	174	H, U	49.3	174
621-64-7	N-Nitroso-di-n-Propylamine	1	174	H, U	94.1	174
106-44-5	4-Methylphenol	1	147	H, J	128	174
98-95-3	Nitrobenzene	1	174	H, U	69.3	174
78-59-1	Isophorone	1	174	H, U	67.6	174
88-75-5	2-Nitrophenol	1	174	H, U	60.3	174
105-67-9	2,4-Dimethylphenol	1	872	H, U	234	872
111-91-1	Bis(2-Chloroethoxy)methane	1	174	H, U	55.3	174
120-83-2	2,4-Dichlorophenol	1	872	H, U	279	872
120-82-1	1,2,4-Trichlorobenzene	1	174	H, U	52.0	174
91-20-3	Naphthalene	1	317	H	45.8	174
65-85-0	Benzoic acid	1	2200	H	515	1740
106-47-8	4-Chloroaniline	1	872	H, U	294	872
87-68-3	Hexachlorobutadiene	1	174	H, U	43.7	174
59-50-7	4-Chloro-3-Methylphenol	1	872	H, U	252	872
91-57-6	2-Methylnaphthalene	1	195	H	49.4	174
77-47-4	Hexachlorocyclopentadiene	1	872	H, U	360	872
88-06-2	2,4,6-Trichlorophenol	1	872	H, U	221	872
95-95-4	2,4,5-Trichlorophenol	1	872	H, U	234	872
91-58-7	2-Chloronaphthalene	1	174	H, U	38.7	174
88-74-4	2-Nitroaniline	1	872	H, U	263	872
208-96-8	Acenaphthylene	1	110	H, J	41.6	174
131-11-3	Dimethylphthalate	1	117	H, J	56.1	174
606-20-2	2,6-Dinitrotoluene	1	872	H, U	233	872
83-32-9	Acenaphthene	1	174	H, U	44.7	174

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST10-050819

Form I
ORGANIC ANALYSIS DATA SHEET
EPA 8270D
Semivolatiles (20 ug/kg - 0.2 ug/L SepF)

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/29/19 14:00	File ID:	NT1019060306.D
% Solids:	35.69	Preparation:	EPA 3546 (Microwave)	Analyzed:	06/03/19 14:29
Batch:	BHE0712	Sequence:	SHF0027	Initial/Final:	16.07 g Wet / 5 mL
Instrument:	NT10	Column:	ZB-5MSi	Calibration:	CE00049
Cleanups:	GPC				

CAS NO.	COMPOUND	DILUTION	CONC. (ug/kg dry)	Q	DL	RL
99-09-2	3-Nitroaniline	1	872	H, U	329	872
51-28-5	2,4-Dinitrophenol	1	1740	H, U	360	1740
132-64-9	Dibenzofuran	1	100	H, J	40.2	174
100-02-7	4-Nitrophenol	1	872	H, U	387	872
121-14-2	2,4-Dinitrotoluene	1	872	H, U	200	872
86-73-7	Fluorene	1	133	H, J	43.1	174
7005-72-3	4-Chlorophenylphenyl ether	1	174	H, U	60.7	174
84-66-2	Diethyl phthalate	1	174	H, U	154	174
100-01-6	4-Nitroaniline	1	872	H, U	304	872
534-52-1	4,6-Dinitro-2-methylphenol	1	1740	H, U	440	1740
86-30-6	N-Nitrosodiphenylamine	1	174	H, U	83.4	174
101-55-3	4-Bromophenyl phenyl ether	1	174	H, U	52.9	174
118-74-1	Hexachlorobenzene	1	174	H, U	41.3	174
87-86-5	Pentachlorophenol	1	872	H, U	273	872
85-01-8	Phenanthrene	1	1240	H	40.9	174
120-12-7	Anthracene	1	157	H, J	51.7	174
86-74-8	Carbazole	1	130	H, J	64.2	174
84-74-2	Di-n-Butylphthalate	1	174	H, U	46.3	174
206-44-0	Fluoranthene	1	1950	H	39.4	174
129-00-0	Pyrene	1	2500	H	48.4	174
85-68-7	Butylbenzylphthalate	1	191	H	70.2	174
56-55-3	Benzo(a)anthracene	1	565	H	45.2	174
91-94-1	3,3'-Dichlorobenzidine	1	872	H, U	272	872
218-01-9	Chrysene	1	1440	H	45.5	174
117-81-7	bis(2-Ethylhexyl)phthalate	1	10500	H	251	436
117-84-0	Di-n-Octylphthalate	1	558	H	76.0	174
	Benzofluoranthenes, Total	1	1250	H	88.9	349
50-32-8	Benzo(a)pyrene	1	486	H	56.5	174
193-39-5	Indeno(1,2,3-cd)pyrene	1	264	H	52.2	174
53-70-3	Dibenzo(a,h)anthracene	1	84.7	H, J	53.7	174
191-24-2	Benzo(g,h,i)perylene	1	549	H	50.7	174
90-12-0	1-Methylnaphthalene	1	174	H, U	51.9	174

SURROGATES	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST10-050819

Form I
ORGANIC ANALYSIS DATA SHEET
EPA 8270D
Semivolatiles (20 ug/kg - 0.2 ug/L SepF)

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/29/19 14:00	File ID:	NT1019060306.D
% Solids:	35.69	Preparation:	EPA 3546 (Microwave)	Analyzed:	06/03/19 14:29
Batch:	BHE0712	Sequence:	SHF0027	Initial/Final:	16.07 g Wet / 5 mL
Instrument:	NT10	Column:	ZB-5MSi	Calibration:	CE00049
Cleanups:	GPC				

SURROGATES	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
2-Fluorophenol	1307.5	716	54.7	27 - 120	
Phenol-d5	1307.5	747	57.1	29 - 120	
2-Chlorophenol-d4	1307.5	834	63.8	31 - 120	
1,2-Dichlorobenzene-d4	871.69	560	64.3	32 - 120	
Nitrobenzene-d5	871.69	546	62.6	30 - 120	
2-Fluorobiphenyl	871.69	597	68.5	35 - 120	
2,4,6-Tribromophenol	1307.5	881	67.4	24 - 134	
p-Terphenyl-d14	871.69	724	83.1	37 - 120	

INTERNAL STANDARDS	AREA	RT	REF AREA	REF RT	Q
1,4-Dichlorobenzene-d4	29884	8.684	30554	8.684	
Naphthalene-d8	118199	11.123	109539	11.123	
Acenaphthene-d10	57987	14.675	57015	14.667	
Phenanthrene-d10	113157	17.665	106610	17.657	
Chrysene-d12	79108	22.711	109041	22.688	
Di-n-Octylphthalate-d4	177530	23.764	252184	23.733	
Perylene-d12	72759	25.134	115140	25.08	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Batch:	BHE0712	Batch Matrix:	Solid	Preparation:	EPA 3546 (Microwave)

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	NT1019060306.D	05/29/19 14:00	
Blank	BHE0712-BLK1	NT1019060304.D	05/29/19 14:00	
LCS	BHE0712-BS1	NT1019060305.D	05/29/19 14:00	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Cleanup Batch:	CHE0256	Cleanup Type:	GPC
Cleanup Method:	EPA 3640A GPC Cleanup	Analysis:	EPA 8270D

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
LCS	BHE0712-BS1	NT1019060305.D	05/30/2019	
Blank	BHE0712-BLK1	NT1019060304.D	05/30/2019	
ST10-050819	19E0222-01	NT1019060306.D	05/30/2019	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
METHOD BLANK DATA SHEET
EPA 8270D

Blank

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Solid	Laboratory ID:	BHE0712-BLK1	File ID:	NT1019060304.D
Sampled:	N/A	Prepared:	05/29/19 14:00	Analyzed:	06/03/19 13:15
Solids:		Preparation:	EPA 3546 (Microwave)	Initial/Final:	10 g / 1 mL
Batch:	BHE0712	Sequence:	SHF0027	Calibration:	CE00049
Instrument:	NT10	Column:	ZB-5MSi	Cleanups:	GPC

CAS NO.	COMPOUND	DILUTION	CONC. (ug/kg wet)	Q	DL	RL
108-95-2	Phenol	1	20.0	U	8.2	20.0
111-44-4	bis(2-chloroethyl) ether	1	20.0	U	6.8	20.0
95-57-8	2-Chlorophenol	1	20.0	U	6.5	20.0
541-73-1	1,3-Dichlorobenzene	1	20.0	U	5.1	20.0
106-46-7	1,4-Dichlorobenzene	1	20.0	U	4.4	20.0
95-50-1	1,2-Dichlorobenzene	1	20.0	U	4.7	20.0
100-51-6	Benzyl Alcohol	1	20.0	U	14.9	20.0
108-60-1	2,2'-Oxybis(1-chloropropane)	1	20.0	U	5.7	20.0
95-48-7	2-Methylphenol	1	20.0	U	7.8	20.0
67-72-1	Hexachloroethane	1	20.0	U	5.7	20.0
621-64-7	N-Nitroso-di-n-Propylamine	1	20.0	U	10.8	20.0
106-44-5	4-Methylphenol	1	20.0	U	14.7	20.0
98-95-3	Nitrobenzene	1	20.0	U	8.0	20.0
78-59-1	Isophorone	1	20.0	U	7.8	20.0
88-75-5	2-Nitrophenol	1	20.0	U	6.9	20.0
105-67-9	2,4-Dimethylphenol	1	100	U	26.8	100
111-91-1	Bis(2-Chloroethoxy)methane	1	20.0	U	6.3	20.0
120-83-2	2,4-Dichlorophenol	1	100	U	32.0	100
120-82-1	1,2,4-Trichlorobenzene	1	20.0	U	6.0	20.0
91-20-3	Naphthalene	1	20.0	U	5.3	20.0
65-85-0	Benzoic acid	1	200	U	59.1	200
106-47-8	4-Chloroaniline	1	100	U	33.7	100
87-68-3	Hexachlorobutadiene	1	20.0	U	5.0	20.0
59-50-7	4-Chloro-3-Methylphenol	1	100	U	28.9	100
91-57-6	2-Methylnaphthalene	1	20.0	U	5.7	20.0
77-47-4	Hexachlorocyclopentadiene	1	100	U	41.3	100
88-06-2	2,4,6-Trichlorophenol	1	100	U	25.4	100
95-95-4	2,4,5-Trichlorophenol	1	100	U	26.9	100
91-58-7	2-Chloronaphthalene	1	20.0	U	4.4	20.0
88-74-4	2-Nitroaniline	1	100	U	30.2	100
208-96-8	Acenaphthylene	1	20.0	U	4.8	20.0
131-11-3	Dimethylphthalate	1	20.0	U	6.4	20.0
606-20-2	2,6-Dinitrotoluene	1	100	U	26.7	100
83-32-9	Acenaphthene	1	20.0	U	5.1	20.0
99-09-2	3-Nitroaniline	1	100	U	37.7	100
51-28-5	2,4-Dinitrophenol	1	200	U	41.3	200
132-64-9	Dibenzofuran	1	20.0	U	4.6	20.0

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
METHOD BLANK DATA SHEET
EPA 8270D

Blank

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Solid	Laboratory ID:	BHE0712-BLK1	File ID:	NT1019060304.D
Sampled:	N/A	Prepared:	05/29/19 14:00	Analyzed:	06/03/19 13:15
Solids:		Preparation:	EPA 3546 (Microwave)	Initial/Final:	10 g / 1 mL
Batch:	BHE0712	Sequence:	SHF0027	Calibration:	CE00049
Instrument:	NT10	Column:	ZB-5MSi	Cleanups:	GPC

CAS NO.	COMPOUND	DILUTION	CONC. (ug/kg wet)	Q	DL	RL
100-02-7	4-Nitrophenol	1	100	U	44.4	100
121-14-2	2,4-Dinitrotoluene	1	100	U	22.9	100
86-73-7	Fluorene	1	20.0	U	5.0	20.0
7005-72-3	4-Chlorophenylphenyl ether	1	20.0	U	7.0	20.0
84-66-2	Diethyl phthalate	1	20.0	U	17.7	20.0
100-01-6	4-Nitroaniline	1	100	U	34.9	100
534-52-1	4,6-Dinitro-2-methylphenol	1	200	U	50.5	200
86-30-6	N-Nitrosodiphenylamine	1	20.0	U	9.6	20.0
101-55-3	4-Bromophenyl phenyl ether	1	20.0	U	6.1	20.0
118-74-1	Hexachlorobenzene	1	20.0	U	4.7	20.0
87-86-5	Pentachlorophenol	1	100	U	31.3	100
85-01-8	Phenanthrene	1	20.0	U	4.7	20.0
120-12-7	Anthracene	1	20.0	U	5.9	20.0
86-74-8	Carbazole	1	20.0	U	7.4	20.0
84-74-2	Di-n-Butylphthalate	1	20.0	U	5.3	20.0
206-44-0	Fluoranthene	1	20.0	U	4.5	20.0
129-00-0	Pyrene	1	20.0	U	5.6	20.0
85-68-7	Butylbenzylphthalate	1	20.0	U	8.1	20.0
56-55-3	Benzo(a)anthracene	1	20.0	U	5.2	20.0
91-94-1	3,3'-Dichlorobenzidine	1	100	U	31.2	100
218-01-9	Chrysene	1	20.0	U	5.2	20.0
117-81-7	bis(2-Ethylhexyl)phthalate	1	50.0	U	28.8	50.0
117-84-0	Di-n-Octylphthalate	1	20.0	U	8.7	20.0
	Benzofluoranthenes, Total	1	40.0	U	10.2	40.0
50-32-8	Benzo(a)pyrene	1	20.0	U	6.5	20.0
193-39-5	Indeno(1,2,3-cd)pyrene	1	20.0	U	6.0	20.0
53-70-3	Dibenzo(a,h)anthracene	1	20.0	U	6.2	20.0
191-24-2	Benzo(g,h,i)perylene	1	20.0	U	5.8	20.0
90-12-0	1-Methylnaphthalene	1	20.0	U	6.0	20.0

SURROGATES	ADDED (ug/kg wet)	CONC (ug/kg wet)	% REC	QC LIMITS	Q
2-Fluorophenol	750.00	428	57.1	27 - 120	
Phenol-d5	750.00	434	57.8	29 - 120	
2-Chlorophenol-d4	750.00	499	66.5	31 - 120	
1,2-Dichlorobenzene-d4	500.00	317	63.5	32 - 120	
Nitrobenzene-d5	500.00	291	58.2	30 - 120	
2-Fluorobiphenyl	500.00	338	67.6	35 - 120	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
METHOD BLANK DATA SHEET
EPA 8270D

Blank

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Solid	Laboratory ID:	BHE0712-BLK1	File ID:	NT1019060304.D
Sampled:	N/A	Prepared:	05/29/19 14:00	Analyzed:	06/03/19 13:15
Solids:		Preparation:	EPA 3546 (Microwave)	Initial/Final:	10 g / 1 mL
Batch:	BHE0712	Sequence:	SHF0027	Calibration:	CE00049
Instrument:	NT10	Column:	ZB-5MSi	Cleanups:	GPC

SURROGATES	ADDED (ug/kg wet)	CONC (ug/kg wet)	% REC	QC LIMITS	Q
2,4,6-Tribromophenol	750.00	482	64.2	24 - 134	
p-Terphenyl-d14	500.00	435	87.0	37 - 120	

INTERNAL STANDARDS	AREA	RT	REF AREA	REF RT	Q
1,4-Dichlorobenzene-d4	31123	8.684	30554	8.684	
Naphthalene-d8	117800	11.116	109539	11.123	
Acenaphthene-d10	57274	14.667	57015	14.667	
Phenanthrene-d10	112392	17.65	106610	17.657	
Chrysene-d12	103273	22.68	109041	22.688	
Di-n-Octylphthalate-d4	228003	23.733	252184	23.733	
Perylene-d12	107759	25.08	115140	25.08	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LCS / LCS DUPLICATE RECOVERY
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	06/03/19 13:52
Batch:	BHE0712	Laboratory ID:	BHE0712-BS1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	LCS
Initial/Final:	10 g / 1 mL		

COMPOUND	SPIKE ADDED (ug/kg wet)	LCS CONCENTRATION (ug/kg wet)	Q	LCS % REC. #	QC LIMITS REC.
Phenol	500	378		75.6	34 - 120
bis(2-chloroethyl) ether	500	358		71.7	36 - 120
2-Chlorophenol	500	434		86.8	39 - 120
1,3-Dichlorobenzene	500	385		77.1	40 - 120
1,4-Dichlorobenzene	500	390		78.0	39 - 120
1,2-Dichlorobenzene	500	392		78.3	40 - 120
Benzyl Alcohol	500	281		56.1	19 - 120
2,2'-Oxybis(1-chloropropane)	500	363		72.6	32 - 120
2-Methylphenol	500	399		79.7	28 - 120
Hexachloroethane	500	383		76.6	38 - 120
N-Nitroso-di-n-Propylamine	500	313		62.7	34 - 120
4-Methylphenol	500	415		83.1	29 - 120
Nitrobenzene	500	362		72.5	36 - 120
Isophorone	500	267		53.4	37 - 120
2-Nitrophenol	500	447		89.4	30 - 120
2,4-Dimethylphenol	1500	915		61.0	10 - 120
Bis(2-Chloroethoxy)methane	500	347		69.5	39 - 120
2,4-Dichlorophenol	1500	1170		78.1	28 - 120
1,2,4-Trichlorobenzene	500	389		77.7	35 - 120
Naphthalene	500	389		77.8	43 - 120
Benzoic acid	2750	1290		46.9	10 - 120
4-Chloroaniline	1500	749		50.0	11 - 120
Hexachlorobutadiene	500	400		80.0	37 - 120
4-Chloro-3-Methylphenol	1500	1190		79.3	32 - 120
2-Methylnaphthalene	500	366		73.3	43 - 120
Hexachlorocyclopentadiene	1500	975		65.0	10 - 120
2,4,6-Trichlorophenol	1500	1300		86.4	30 - 120
2,4,5-Trichlorophenol	1500	1350		89.7	28 - 120
2-Chloronaphthalene	500	434		86.9	40 - 120
2-Nitroaniline	1500	1110		74.3	31 - 126
Acenaphthylene	500	427		85.4	42 - 120
Dimethylphthalate	500	478		95.6	43 - 120
2,6-Dinitrotoluene	1500	1450		96.4	33 - 123

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LCS / LCS DUPLICATE RECOVERY
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	06/03/19 13:52
Batch:	BHE0712	Laboratory ID:	BHE0712-BS1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	LCS
Initial/Final:	10 g / 1 mL		

COMPOUND	SPIKE ADDED (ug/kg wet)	LCS CONCENTRATION (ug/kg wet)	Q	LCS % REC. #	QC LIMITS REC.
Acenaphthene	500	449		89.8	45 - 120
3-Nitroaniline	1500	1120		74.8	22 - 120
2,4-Dinitrophenol	2750	2310		84.0	10 - 120
Dibenzofuran	500	411		82.2	43 - 120
4-Nitrophenol	1500	1290		86.2	15 - 138
2,4-Dinitrotoluene	1500	1440		95.9	35 - 127
Fluorene	500	456		91.2	45 - 120
4-Chlorophenylphenyl ether	500	443		88.6	32 - 120
Diethyl phthalate	500	474		94.9	50 - 120
4-Nitroaniline	1500	2400	*, Q	160 *	24 - 125
4,6-Dinitro-2-methylphenol	2750	2650		96.3	24 - 120
N-Nitrosodiphenylamine	500	458		91.7	36 - 120
4-Bromophenyl phenyl ether	500	448		89.5	39 - 120
Hexachlorobenzene	500	435		86.9	33 - 120
Pentachlorophenol	1500	973	Q	64.8	16 - 120
Phenanthrene	500	466		93.2	49 - 120
Anthracene	500	445		89.1	45 - 120
Carbazole	500	506		101	43 - 135
Di-n-Butylphthalate	500	471		94.2	48 - 126
Fluoranthene	500	513		103	53 - 120
Pyrene	500	493		98.6	48 - 121
Butylbenzylphthalate	500	499		99.9	45 - 132
Benzo(a)anthracene	500	485		97.0	49 - 120
3,3'-Dichlorobenzidine	1500	1130		75.7	10 - 120
Chrysene	500	491		98.2	47 - 120
bis(2-Ethylhexyl)phthalate	500	496		99.3	34 - 130
Di-n-Octylphthalate	500	469		93.7	28 - 124
Benzofluoranthenes, Total	1000	1030		103	30 - 160
Benzo(a)pyrene	500	484		96.7	42 - 120
Indeno(1,2,3-cd)pyrene	500	499		99.8	42 - 123
Dibenzo(a,h)anthracene	500	483		96.6	30 - 133
Benzo(g,h,i)perylene	500	490		98.0	38 - 126
1-Methylnaphthalene	500	346		69.3	42 - 120

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LCS / LCS DUPLICATE RECOVERY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	06/03/19 13:52
Batch:	BHE0712	Laboratory ID:	BHE0712-BS1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	LCS
Initial/Final:	10 g / 1 mL		

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019051701.D	Injection Date:	05/17/19
Instrument ID:	NT10	Injection Time:	15:35
Sequence:	SHE0305	Lab Sample ID:	SHE0305-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	41.3	PASS
68	Less than 2% of 69	0.48	PASS
69	Less than 100% of 198	57.8	PASS
70	Less than 2% of 69	0.158	PASS
127	10 - 80% of 198	53.5	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.99	PASS
275	10 - 60% of 198	27.7	PASS
365	1 - 100% of 198	4.25	PASS
441	0.1 - 24% of 442	21.1	PASS
442	50 - 200% of 198	80.8	PASS
443	15 - 24% of 442	19	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019051701.D	Injection Date:	05/17/19
Instrument ID:	NT10	Injection Time:	15:35
Sequence:	SHE0305	Lab Sample ID:	SHE0305-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	41.3	PASS
68	Less than 2% of 69	0.48	PASS
69	Less than 100% of 198	57.8	PASS
70	Less than 2% of 69	0.158	PASS
127	10 - 80% of 198	53.5	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.99	PASS
275	10 - 60% of 198	27.7	PASS
365	1 - 100% of 198	4.25	PASS
441	0.1 - 24% of 442	21.1	PASS
442	50 - 200% of 198	80.8	PASS
443	15 - 24% of 442	19	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Client Sample ID	Lab Sample ID	Lab File ID	Date Analyzed	Time Analyzed
MS Tune	SHE0305-TUN1	NT1019051701.D	05/17/2019	15:35
Cal Standard	SHE0305-CAL5	NT1019051702.D	05/17/2019	15:50
Cal Standard	SHE0305-CAL7	NT1019051703.D	05/17/2019	16:28
Cal Standard	SHE0305-CAL1	NT1019051704.D	05/17/2019	17:05
Cal Standard	SHE0305-CAL3	NT1019051705.D	05/17/2019	17:42
Cal Standard	SHE0305-CAL6	NT1019051706.D	05/17/2019	18:19
Cal Standard	SHE0305-CAL4	NT1019051708.D	05/17/2019	19:33
Cal Standard	SHE0305-CAL2	NT1019051710.D	05/17/2019	20:46
Secondary Cal Check	SHE0305-SCV1	NT1019051711.D	05/17/2019	21:23
MS Tune	SHE0305-TUN2	NT1019051712.D	05/17/2019	21:55
Initial Cal Check	SHE0305-ICV1	NT1019051713.D	05/17/2019	22:11
Blank	BHE0211-BLK1	NT1019051715.D	05/17/2019	23:25
LCS	BHE0211-BS1	NT1019051716.D	05/18/2019	0:01
ZZZZZ	19E0075-01	NT1019051717.D	05/18/2019	0:38
ZZZZZ	19E0075-02	NT1019051720.D	05/18/2019	2:28
ZZZZZ	19E0075-03	NT1019051721.D	05/18/2019	3:05
ZZZZZ	19E0075-04	NT1019051722.D	05/18/2019	3:41
Blank	BHE0374-BLK1	NT1019051723.D	05/18/2019	4:19
LCS	BHE0374-BS1	NT1019051724.D	05/18/2019	4:56
ZZZZZ	19D0426-03	NT1019051725.D	05/18/2019	5:33
ZZZZZ	19D0426-04	NT1019051726.D	05/18/2019	6:09
ZZZZZ	19D0426-05	NT1019051727.D	05/18/2019	6:46

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019051701.D	Injection Date:	05/17/19
Instrument ID:	NT10	Injection Time:	15:35
Sequence:	SHE0305	Lab Sample ID:	SHE0305-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	41.3	PASS
68	Less than 2% of 69	0.48	PASS
69	Less than 100% of 198	57.8	PASS
70	Less than 2% of 69	0.158	PASS
127	10 - 80% of 198	53.5	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.99	PASS
275	10 - 60% of 198	27.7	PASS
365	1 - 100% of 198	4.25	PASS
441	0.1 - 24% of 442	21.1	PASS
442	50 - 200% of 198	80.8	PASS
443	15 - 24% of 442	19	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Calibration Check	SHE0305-CCV1	NT1019051728.D	05/18/2019	7:23

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019051712.D	Injection Date:	05/17/19
Instrument ID:	NT10	Injection Time:	21:55
Sequence:	SHE0305	Lab Sample ID:	SHE0305-TUN2

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	44.7	PASS
68	Less than 2% of 69	0	PASS
69	Less than 100% of 198	59.6	PASS
70	Less than 2% of 69	0.533	PASS
127	10 - 80% of 198	53	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.74	PASS
275	10 - 60% of 198	28.3	PASS
365	1 - 100% of 198	4.11	PASS
441	0.1 - 24% of 442	21	PASS
442	50 - 200% of 198	79	PASS
443	15 - 24% of 442	19.6	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Client Sample ID	Lab Sample ID	Lab File ID	Date Analyzed	Time Analyzed
MS Tune	SHE0305-TUN1	NT1019051701.D	05/17/2019	15:35
Cal Standard	SHE0305-CAL5	NT1019051702.D	05/17/2019	15:50
Cal Standard	SHE0305-CAL7	NT1019051703.D	05/17/2019	16:28
Cal Standard	SHE0305-CAL1	NT1019051704.D	05/17/2019	17:05
Cal Standard	SHE0305-CAL3	NT1019051705.D	05/17/2019	17:42
Cal Standard	SHE0305-CAL6	NT1019051706.D	05/17/2019	18:19
Cal Standard	SHE0305-CAL4	NT1019051708.D	05/17/2019	19:33
Cal Standard	SHE0305-CAL2	NT1019051710.D	05/17/2019	20:46
Secondary Cal Check	SHE0305-SCV1	NT1019051711.D	05/17/2019	21:23
MS Tune	SHE0305-TUN2	NT1019051712.D	05/17/2019	21:55
Initial Cal Check	SHE0305-ICV1	NT1019051713.D	05/17/2019	22:11
Blank	BHE0211-BLK1	NT1019051715.D	05/17/2019	23:25
LCS	BHE0211-BS1	NT1019051716.D	05/18/2019	0:01
ZZZZZ	19E0075-01	NT1019051717.D	05/18/2019	0:38
ZZZZZ	19E0075-02	NT1019051720.D	05/18/2019	2:28
ZZZZZ	19E0075-03	NT1019051721.D	05/18/2019	3:05
ZZZZZ	19E0075-04	NT1019051722.D	05/18/2019	3:41
Blank	BHE0374-BLK1	NT1019051723.D	05/18/2019	4:19
LCS	BHE0374-BS1	NT1019051724.D	05/18/2019	4:56
ZZZZZ	19D0426-03	NT1019051725.D	05/18/2019	5:33
ZZZZZ	19D0426-04	NT1019051726.D	05/18/2019	6:09
ZZZZZ	19D0426-05	NT1019051727.D	05/18/2019	6:46

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019051712.D	Injection Date:	05/17/19
Instrument ID:	NT10	Injection Time:	21:55
Sequence:	SHE0305	Lab Sample ID:	SHE0305-TUN2

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	44.7	PASS
68	Less than 2% of 69	0	PASS
69	Less than 100% of 198	59.6	PASS
70	Less than 2% of 69	0.533	PASS
127	10 - 80% of 198	53	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.74	PASS
275	10 - 60% of 198	28.3	PASS
365	1 - 100% of 198	4.11	PASS
441	0.1 - 24% of 442	21	PASS
442	50 - 200% of 198	79	PASS
443	15 - 24% of 442	19.6	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Calibration Check	SHE0305-CCV1	NT1019051728.D	05/18/2019	7:23

Analytical Resources, Incorporated
Analytical Chemists and Consultants

MASS SPECTROMETER
INSTRUMENT PERFORMANCE CHECK
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Lab File ID:	NT1019060301.D	Injection Date:	06/03/19
Instrument ID:	NT10	Injection Time:	11:46
Sequence:	SHF0027	Lab Sample ID:	SHF0027-TUN1

m/z	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE	
51	10 - 80% of 198	46.1	PASS
68	Less than 2% of 69	1.19	PASS
69	Less than 100% of 198	59.9	PASS
70	Less than 2% of 69	0.613	PASS
127	10 - 80% of 198	55	PASS
197	Less than 2% of 198	0	PASS
198	Base peak, 100% relative abundance	100	PASS
199	5 - 9% of 198	6.83	PASS
275	10 - 60% of 198	26.8	PASS
365	1 - 100% of 198	4.23	PASS
441	0.1 - 24% of 442	21	PASS
442	50 - 200% of 198	73	PASS
443	15 - 24% of 442	18.6	PASS
4,4'-DDD	Less than 20% of 4,4'-DDT		
4,4'-DDE	Less than 20% of		
4,4'-DDT	Less than 200% of		

Client Sample ID	Lab Sample ID	Lab File ID	Date Analyzed	Time Analyzed
MS Tune	SHF0027-TUN1	NT1019060301.D	06/03/2019	11:46
Initial Cal Check	SHF0027-ICV1	NT1019060302.D	06/03/2019	12:01
Low Cal Check	SHF0027-LCV1	NT1019060303.D	06/03/2019	12:38
Blank	BHE0712-BLK1	NT1019060304.D	06/03/2019	13:15
LCS	BHE0712-BS1	NT1019060305.D	06/03/2019	13:52
ST10-050819	19E0222-01	NT1019060306.D	06/03/2019	14:29
Blank	BHE0753-BLK1	NT1019060307.D	06/03/2019	15:07
LCS	BHE0753-BS1	NT1019060308.D	06/03/2019	15:44
ZZZZZ	19E0334-01	NT1019060309.D	06/03/2019	16:21
ZZZZZ	19E0334-02	NT1019060310.D	06/03/2019	16:59
Calibration Check	SHF0027-CCV1	NT1019060311.D	06/03/2019	17:36

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
Phenol	0.2	1.631588	0.5	1.487296	1	1.578552	2.5	1.438129	5	1.572352	10	1.440627
bis(2-chloroethyl) ether	0.2	1.388155	0.5	1.179822	1	1.227896	2.5	1.216066	5	1.233479	10	1.126452
2-Chlorophenol	0.2	1.452766	0.5	1.323274	1	1.32913	2.5	1.238074	5	1.308479	10	1.24081
1,3-Dichlorobenzene	0.2	1.614619	0.5	1.425043	1	1.343181	2.5	1.367318	5	1.388557	10	1.306441
1,4-Dichlorobenzene	0.2	1.554577	0.5	1.405285	1	1.350626	2.5	1.294856	5	1.303426	10	1.231529
1,2-Dichlorobenzene	0.2	1.599608	0.5	1.352776	1	1.298388	2.5	1.234553	5	1.22466	10	1.175207
Benzyl Alcohol	0.2	0.9071627	0.5	0.8823629	1	0.8861269	2.5	0.832077	5	0.9078717	10	0.8315146
2,2'-Oxybis(1-chloropropane)	0.2	0.5097079	0.5	0.4425348	1	0.4524903	2.5	0.4338927	5	0.4403061	10	0.4194206
2-Methylphenol	0.2	1.232175	0.5	1.039077	1	1.051367	2.5	1.014856	5	1.041254	10	0.9610603
Hexachloroethane	0.2	0.6709088	0.5	0.5440336	1	0.5845867	2.5	0.5341953	5	0.5648445	10	0.5312474
N-Nitroso-di-n-Propylamine	0.2	0.8980258	0.5	0.7738268	1	0.7362575	2.5	0.7060248	5	0.7392857	10	0.671087
4-Methylphenol	0.2	1.296133	0.5	1.160334	1	1.062896	2.5	1.029876	5	1.104446	10	1.015131
Nitrobenzene	0.2	0.402062	0.5	0.3368237	1	0.3218836	2.5	0.3110338	5	0.3420167	10	0.3181409
Isophorone	0.2	0.6449889	0.5	0.5310441	1	0.5807107	2.5	0.5684327	5	0.6369012	10	0.5949511
2-Nitrophenol			0.5	0.1590799	1	0.1745026	2.5	0.1788036	5	0.1953674	10	0.1855573
2,4-Dimethylphenol	0.4	0.3884416	1	0.3513319	2	0.3561597	5	0.3332505	10	0.3506549	20	0.3160077
Bis(2-Chloroethoxy)methane	0.2	0.4051654	0.5	0.3743701	1	0.3712815	2.5	0.3266245	5	0.3465917	10	0.3244166
2,4-Dichlorophenol	0.4	0.2861158	1	0.2518158	2	0.2504695	5	0.2435583	10	0.2555908	20	0.2453689
1,2,4-Trichlorobenzene	0.2	0.3427527	0.5	0.2909661	1	0.2783392	2.5	0.2774528	5	0.2772896	10	0.2617266
Naphthalene	0.2	0.9929139	0.5	0.8944054	1	0.8448712	2.5	0.8258927	5	0.8452615	10	0.8205257
Benzoic acid			2	0.1539036	4	0.2024618	10	0.2164046	20	0.2372266	40	0.2403496
4-Chloroaniline			1	0.3580392	2	0.3686637	5	0.3588682	10	0.3769592	20	0.3747675
Hexachlorobutadiene	0.2	0.1687902	0.5	0.149748	1	0.1580475	2.5	0.1475152	5	0.1515224	10	0.1498693
4-Chloro-3-Methylphenol			1	0.2653762	2	0.2955911	5	0.2825274	10	0.3020723	20	0.3026719
2-Methylnaphthalene	0.2	0.7146429	0.5	0.6664297	1	0.6796693	2.5	0.6685646	5	0.6871715	10	0.6975837
Hexachlorocyclopentadiene			1	0.3007861	2	0.323659	5	0.3259976	10	0.340962	20	0.3429917
2,4,6-Trichlorophenol	0.4	0.3664386	1	0.3376842	2	0.3598715	5	0.3551475	10	0.3735869	20	0.3601727
2,4,5-Trichlorophenol	0.4	0.3840728	1	0.3322316	2	0.3674254	5	0.367932	10	0.3881621	20	0.385761

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
2-Chloronaphthalene	0.2	1.277421	0.5	1.157732	1	1.166683	2.5	1.089655	5	1.146818	10	1.13227
2-Nitroaniline	0.4	0.3616774	1	0.2847273	2	0.320114	5	0.3107446	10	0.3428637	20	0.3199753
Acenaphthylene	0.2	2.032517	0.5	1.756466	1	1.834079	2.5	1.729095	5	1.714786	10	1.613959
Dimethylphthalate	0.2	1.409325	0.5	1.300245	1	1.27754	2.5	1.249073	5	1.273554	10	1.211873
2,6-Dinitrotoluene			1	0.2735234	2	0.2940066	5	0.2842765	10	0.2937488	20	0.2776883
Acenaphthene	0.2	1.088383	0.5	1.091853	1	1.09121	2.5	1.055188	5	1.053392	10	1.05352
3-Nitroaniline			1	0.3130357	2	0.3283636	5	0.3190034	10	0.3256761	20	0.3301209
2,4-Dinitrophenol			2	7.125651E-02	4	0.1093993	10	0.150519	20	0.1791998	40	0.1960319
Dibenzofuran	0.2	1.858644	0.5	1.70209	1	1.656098	2.5	1.672166	5	1.704244	10	1.627947
4-Nitrophenol			1	0.1626053	2	0.1842759	5	0.1903507	10	0.2050536	20	0.2012
2,4-Dinitrotoluene			1	0.3601666	2	0.3709042	5	0.3814327	10	0.3911167	20	0.3819742
Fluorene	0.2	1.459759	0.5	1.238698	1	1.230295	2.5	1.166515	5	1.194828	10	1.133183
4-Chlorophenylphenyl ether	0.2	0.6062637	0.5	0.6332418	1	0.6100123	2.5	0.5810785	5	0.572205	10	0.5606475
Diethyl phthalate	0.2	1.392396	0.5	1.181334	1	1.285492	2.5	1.533746	5	1.243877	10	1.209062
4-Nitroaniline			1	0.3812298	2	0.3205447	5	0.2812594	10	0.2492531	20	0.2162726
4,6-Dinitro-2-methylphenol			2	0.1306368	4	0.1570657	10	0.1678247	20	0.1780607	40	0.1784498
N-Nitrosodiphenylamine	0.2	0.6678546	0.5	0.6469032	1	0.6538694	2.5	0.6186188	5	0.5894455	10	0.556141
4-Bromophenyl phenyl ether	0.2	0.3065594	0.5	0.2726554	1	0.2788534	2.5	0.2812685	5	0.2787352	10	0.2750938
Hexachlorobenzene	0.2	0.3325491	0.5	0.3332736	1	0.3451232	2.5	0.3157183	5	0.3158281	10	0.3011152
Pentachlorophenol			1	8.418257E-02	2	0.1146259	5	0.1243543	10	0.1387187	20	0.1367308
Phenanthrene	0.2	0.9887871	0.5	0.8689732	1	0.8573313	2.5	0.8727398	5	0.8594996	10	0.8342649
Anthracene	0.2	0.9775643	0.5	0.8532074	1	0.889935	2.5	0.902224	5	0.8910201	10	0.8808642
Carbazole	0.2	0.9657508	0.5	0.8853292	1	0.8375859	2.5	0.7414182	5	0.6951077	10	0.7619073
Di-n-Butylphthalate	0.2	1.250849	0.5	1.057151	1	1.173001	2.5	1.227977	5	1.285374	10	1.289766
Fluoranthene	0.2	1.104611	0.5	0.9661757	1	0.9662308	2.5	0.9795078	5	0.9930473	10	1.011335
Pyrene	0.2	1.142694	0.5	1.030599	1	1.022588	2.5	1.044595	5	1.050956	10	1.05256
Butylbenzylphthalate	0.2	0.5902907	0.5	0.4851951	1	0.5049335	2.5	0.5246473	5	0.5374469	10	0.5205123
Benzo(a)anthracene	0.2	1.169392	0.5	0.9898291	1	0.9999728	2.5	0.9734625	5	0.990089	10	0.9563472

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
3,3'-Dichlorobenzidine			1.5	0.3883167	3	0.3597815	7.5	0.289821	15	0.2743602	30	0.3103445
Chrysene	0.2	0.957971	0.5	0.9059671	1	0.8719998	2.5	0.8752426	5	0.8762085	10	0.8793843
bis(2-Ethylhexyl)phthalate	0.2	0.3706173	0.5	0.2692054	1	0.3058495	2.5	0.3080997	5	0.3090749	10	0.3027931
Di-n-Octylphthalate	0.2	0.7890503	0.5	0.6774283	1	0.6612107	2.5	0.647915	5	0.6419136	10	0.6219474
Benzofluoranthenes, Total	0.4	1.055417	1	0.9332896	2	0.9387111	5	0.9217643	10	1.007355	20	0.9416213
Benzo(a)pyrene	0.2	0.9459567	0.5	0.8544641	1	0.8922294	2.5	0.8712364	5	0.9232553	10	0.8987469
Indeno(1,2,3-cd)pyrene	0.2	1.13934	0.5	1.041516	1	1.104455	2.5	1.098365	5	1.16258	10	1.073483
Dibenzo(a,h)anthracene	0.2	0.9933337	0.5	0.9122617	1	0.9230026	2.5	0.8932817	5	0.941568	10	0.8622316
Benzo(g,h,i)perylene	0.2	0.9831186	0.5	0.9226792	1	0.9355887	2.5	0.9382534	5	0.97942	10	0.931173
1-Methylnaphthalene	0.2	0.7811934	0.5	0.696321	1	0.685783	2.5	0.6678003	5	0.710175	10	0.7046497
2-Fluorophenol	0.3	1.380976	0.75	1.146711	1.5	1.254196	3.75	1.170399	7.5	1.317865	15	1.220053
Phenol-d5			0.75	1.418998	1.5	1.504698	3.75	1.41458	7.5	1.560479	15	1.49032
2-Chlorophenol-d4	0.3	1.347909	0.75	1.247217	1.5	1.281175	3.75	1.218964	7.5	1.274976	15	1.2138
1,2-Dichlorobenzene-d4	0.2	1.0155	0.5	0.9213384	1	0.8897295	2.5	0.7997249	5	0.8041302	10	0.7832654
Nitrobenzene-d5	0.2	0.3772349	0.5	0.326544	1	0.342111	2.5	0.3292077	5	0.3560262	10	0.3321235
2-Fluorobiphenyl	0.2	1.526416	0.5	1.426325	1	1.362158	2.5	1.328706	5	1.345897	10	1.322577
2,4,6-Tribromophenol			0.75	0.2464848	1.5	0.2400027	3.75	0.280335	7.5	0.2869514	15	0.2833891
p-Terphenyl-d14	0.2	0.8319428	0.5	0.7682615	1	0.7534861	2.5	0.7636533	5	0.7807925	10	0.7532423

Analytical Resources, Incorporated
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INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
Phenol	20	1.444397										
bis(2-chloroethyl) ether	20	1.110919										
2-Chlorophenol	20	1.264329										
1,3-Dichlorobenzene	20	1.274731										
1,4-Dichlorobenzene	20	1.210158										
1,2-Dichlorobenzene	20	1.162233										
Benzyl Alcohol	20	0.8346863										
2,2'-Oxybis(1-chloropropane)	20	0.416138										
2-Methylphenol	20	0.9667109										
Hexachloroethane	20	0.5464371										
N-Nitroso-di-n-Propylamine	20	0.6889619										
4-Methylphenol	20	1.033031										
Nitrobenzene	20	0.3243974										
Isophorone	20	0.6266514										
2-Nitrophenol	20	0.1947693										
2,4-Dimethylphenol	40	0.3059182										
Bis(2-Chloroethoxy)methane	20	0.3295614										
2,4-Dichlorophenol	40	0.2390055										
1,2,4-Trichlorobenzene	20	0.2572845										
Naphthalene	20	0.8288806										
Benzoic acid	80	0.2368187										
4-Chloroaniline	40	0.3844775										
Hexachlorobutadiene	20	0.1808924										
4-Chloro-3-Methylphenol	40	0.311741										
2-Methylnaphthalene	20	0.7292067										
Hexachlorocyclopentadiene	40	0.3487451										
2,4,6-Trichlorophenol	40	0.3705059										
2,4,5-Trichlorophenol	40	0.386388										

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INITIAL CALIBRATION DATA
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Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
2-Chloronaphthalene	20	1.148896										
2-Nitroaniline	40	0.3290735										
Acenaphthylene	20	1.567764										
Dimethylphthalate	20	1.153518										
2,6-Dinitrotoluene	40	0.2753621										
Acenaphthene	20	1.057898										
3-Nitroaniline	40	0.3319294										
2,4-Dinitrophenol	80	0.2079659										
Dibenzofuran	20	1.664977										
4-Nitrophenol	40	0.2067022										
2,4-Dinitrotoluene	40	0.3900994										
Fluorene	20	1.11874										
4-Chlorophenylphenyl ether	20	0.55623										
Diethyl phthalate	20	1.327263										
4-Nitroaniline	40	0.2732233										
4,6-Dinitro-2-methylphenol	80	0.1754194										
N-Nitrosodiphenylamine	20	0.5147565										
4-Bromophenyl phenyl ether	20	0.2809366										
Hexachlorobenzene	20	0.2805781										
Pentachlorophenol	40	0.1371595										
Phenanthrene	20	0.8336927										
Anthracene	20	0.882748										
Carbazole	20	0.8187734										
Di-n-Butylphthalate	20	1.31076										
Fluoranthene	20	1.055712										
Pyrene	20	1.112053										
Butylbenzylphthalate	20	0.5109656										
Benzo(a)anthracene	20	0.9513237										

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INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
3,3'-Dichlorobenzidine	60	0.3653445										
Chrysene	20	0.8531833										
bis(2-Ethylhexyl)phthalate	20	0.2950641										
Di-n-Octylphthalate	20	0.6106655										
Benzofluoranthenes, Total	40	0.9401962										
Benzo(a)pyrene	20	0.9059963										
Indeno(1,2,3-cd)pyrene	20	1.056088										
Dibenzo(a,h)anthracene	20	0.820359										
Benzo(g,h,i)perylene	20	0.9220571										
1-Methylnaphthalene	20	0.7378986										
2-Fluorophenol	30	1.219524										
Phenol-d5	30	1.556942										
2-Chlorophenol-d4	30	1.215803										
1,2-Dichlorobenzene-d4	20	0.7755903										
Nitrobenzene-d5	20	0.3351278										
2-Fluorobiphenyl	20	1.324718										
2,4,6-Tribromophenol	30	0.2987315										
p-Terphenyl-d14	20	0.8788854										

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INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
Phenol	1.513277	5.3			RSD (15)	
bis(2-chloroethyl) ether	1.211827	7.6			RSD (15)	
2-Chlorophenol	1.308123	5.7			RSD (15)	
1,3-Dichlorobenzene	1.388556	8.0			RSD (15)	
1,4-Dichlorobenzene	1.33578	8.8			RSD (15)	
1,2-Dichlorobenzene	1.292489	11.7			RSD (15)	
Benzyl Alcohol	0.8688289	4.0			RSD (15)	
2,2'-Oxybis(1-chloropropane)	0.4449272	7.0			RSD (15)	
2-Methylphenol	1.043786	8.7			RSD (15)	
Hexachloroethane	0.5680362	8.6			RSD (15)	
N-Nitroso-di-n-Propylamine	0.7447814	10.2			RSD (15)	
4-Methylphenol	1.100264	9.1			RSD (15)	
Nitrobenzene	0.3366226	9.1			RSD (15)	
Isophorone	0.5976686	6.9			RSD (15)	
2-Nitrophenol	0.1813467	7.6			RSD (15)	
2,4-Dimethylphenol	0.3431092	8.0			RSD (15)	
Bis(2-Chloroethoxy)methane	0.3540016	8.6			RSD (15)	
2,4-Dichlorophenol	0.2531321	6.2			RSD (15)	
1,2,4-Trichlorobenzene	0.2836874	10.0			RSD (15)	
Naphthalene	0.8646787	7.1			RSD (15)	
Benzoic acid	0.2145275	15.5		0.9996	QCOD (0.99)	
4-Chloroaniline	0.3702959	2.8			RSD (15)	
Hexachlorobutadiene	0.158055	7.9			RSD (15)	
4-Chloro-3-Methylphenol	0.29333	5.7			RSD (15)	
2-Methylnaphthalene	0.6918955	3.4			RSD (15)	
Hexachlorocyclopentadiene	0.3305236	5.3			RSD (15)	
2,4,6-Trichlorophenol	0.3604868	3.3			RSD (15)	
2,4,5-Trichlorophenol	0.373139	5.4			RSD (15)	
2-Chloronaphthalene	1.159925	5.0			RSD (15)	
2-Nitroaniline	0.324168	7.5			RSD (15)	
Acenaphthylene	1.749809	8.7			RSD (15)	

Analytical Resources, Incorporated
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INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
Dimethylphthalate	1.267875	6.3			RSD (15)	
2,6-Dinitrotoluene	0.2831009	3.2			RSD (15)	
Acenaphthene	1.070206	1.8			RSD (15)	
3-Nitroaniline	0.3246882	2.2			RSD (15)	
2,4-Dinitrophenol	0.1523954	34.9		0.9982	QCOD (0.99)	
Dibenzofuran	1.698024	4.5			RSD (15)	
4-Nitrophenol	0.1916979	8.7			RSD (15)	
2,4-Dinitrotoluene	0.3792823	3.1			RSD (15)	
Fluorene	1.220288	9.4			RSD (15)	
4-Chlorophenylphenyl ether	0.5885255	4.9			RSD (15)	
Diethyl phthalate	1.310453	9.3			RSD (15)	
4-Nitroaniline	0.2869638	20.1		0.9939	QCOD (0.99)	
4,6-Dinitro-2-methylphenol	0.1645762	11.2			RSD (15)	
N-Nitrosodiphenylamine	0.6067984	9.3			RSD (15)	
4-Bromophenyl phenyl ether	0.2820146	4.0			RSD (15)	
Hexachlorobenzene	0.3177408	6.9			RSD (15)	
Pentachlorophenol	0.1226286	17.2		0.9996	QCOD (0.99)	
Phenanthrene	0.8736127	6.1			RSD (15)	
Anthracene	0.8967947	4.3			RSD (15)	
Carbazole	0.8151246	11.3			RSD (15)	
Di-n-Butylphthalate	1.22784	7.2			RSD (15)	
Fluoranthene	1.010946	5.1			RSD (15)	
Pyrene	1.065149	4.2			RSD (15)	
Butylbenzylphthalate	0.5248559	6.3			RSD (15)	
Benzo(a)anthracene	1.004345	7.5			RSD (15)	
3,3'-Dichlorobenzidine	0.3313281	13.9			RSD (15)	
Chrysene	0.8885652	3.9			RSD (15)	
bis(2-Ethylhexyl)phthalate	0.308672	9.9			RSD (15)	
Di-n-Octylphthalate	0.6643044	8.9			RSD (15)	
Benzofluoranthenes, Total	0.9626221	5.1			RSD (15)	
Benzo(a)pyrene	0.8988407	3.4			RSD (15)	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00049	Instrument:	NT10
Calibration Date:	05/20/2019 14:03	Column (1):	ZB-5MSi

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
Indeno(1,2,3-cd)pyrene	1.096547	4.0			RSD (15)	
Dibenzo(a,h)anthracene	0.9065769	6.1			RSD (15)	
Benzo(g,h,i)perylene	0.9446129	2.7			RSD (15)	
1-Methylnaphthalene	0.7119744	5.3			RSD (15)	
2-Fluorophenol	1.244246	6.6			RSD (15)	
Phenol-d5	1.491003	4.3			RSD (15)	
2-Chlorophenol-d4	1.257121	3.9			RSD (15)	
1,2-Dichlorobenzene-d4	0.8556112	10.5			RSD (15)	
Nitrobenzene-d5	0.342625	5.3			RSD (15)	
2-Fluorobiphenyl	1.376685	5.5			RSD (15)	
2,4,6-Tribromophenol	0.2726491	8.7			RSD (15)	
p-Terphenyl-d14	0.7900377	6.0			RSD (15)	

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8270D

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00049
Laboratory ID: SHE0305-SCV1
Sequence: SHE0305
Sequence Name: SCV 5.0
Standard ID: G004584

ANALYTE	EXPECTED (ug/mL)	FOUND (ug/mL)	% DRIFT	QC LIMIT
Phenol	5.0000	4.9	-2.3	20.00
bis(2-chloroethyl) ether	5.0000	5.0	-0.4	20.00
2-Chlorophenol	5.0000	4.9	-1.6	20.00
1,3-Dichlorobenzene	5.0000	5.0	0.1	20.00
1,4-Dichlorobenzene	5.0000	5.0	-0.4	20.00
1,2-Dichlorobenzene	5.0000	4.8	-3.1	20.00
Benzyl Alcohol	5.0000	4.4	-12.5	20.00
2,2'-Oxybis(1-chloropropane)	5.0000	4.6	-7.8	20.00
2-Methylphenol	5.0000	4.9	-1.8	20.00
Hexachloroethane	5.0000	4.9	-2.2	20.00
N-Nitroso-di-n-Propylamine	5.0000	4.8	-4.0	20.00
4-Methylphenol	5.0000	4.9	-2.1	20.00
Nitrobenzene	5.0000	4.5	-10.1	20.00
Isophorone	5.0000	4.6	-7.8	20.00
2-Nitrophenol	5.0000	5.0	0.3	20.00
2,4-Dimethylphenol	5.0000	4.1	-18.2	20.00
Bis(2-Chloroethoxy)methane	5.0000	4.8	-4.1	20.00
2,4-Dichlorophenol	5.0000	5.0	-1.0	20.00
1,2,4-Trichlorobenzene	5.0000	4.8	-4.6	20.00
Naphthalene	5.0000	5.0	-0.5	20.00
Benzoic acid	10.000	8.8	-11.6	20.00
4-Chloroaniline	5.0000	4.4	-11.9	20.00
Hexachlorobutadiene	5.0000	4.7	-5.4	20.00
4-Chloro-3-Methylphenol	5.0000	4.8	-4.8	20.00
2-Methylnaphthalene	5.0000	4.2	-16.2	20.00
Hexachlorocyclopentadiene	5.0000	5.5	9.2	20.00
2,4,6-Trichlorophenol	5.0000	5.1	1.7	20.00
2,4,5-Trichlorophenol	5.0000	5.0	-0.2	20.00
2-Chloronaphthalene	5.0000	5.0	-0.2	20.00
2-Nitroaniline	5.0000	4.6	-8.5	20.00
Acenaphthylene	5.0000	5.1	2.6	20.00
Dimethylphthalate	5.0000	4.9	-1.8	20.00
2,6-Dinitrotoluene	5.0000	5.2	3.8	20.00
Acenaphthene	5.0000	5.3	6.4	20.00
3-Nitroaniline	5.0000	5.0	-0.06	20.00

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8270D

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00049
Laboratory ID: SHE0305-SCV1
Sequence: SHE0305
Sequence Name: SCV 5.0
Standard ID: G004584

2,4-Dinitrophenol	5.0000	3.7	-25.6 *	20.00
Dibenzofuran	5.0000	4.5	-10.8	20.00
4-Nitrophenol	5.0000	4.9	-1.4	20.00
2,4-Dinitrotoluene	5.0000	5.0	1.0	20.00
Fluorene	5.0000	5.0	0.1	20.00
4-Chlorophenylphenyl ether	5.0000	4.8	-4.0	20.00
Diethyl phthalate	5.0000	4.7	-5.4	20.00
4-Nitroaniline	5.0000	5.8	15.9	20.00
4,6-Dinitro-2-methylphenol	5.0000	5.1	1.8	20.00
N-Nitrosodiphenylamine	5.0000	5.5	9.4	20.00
4-Bromophenyl phenyl ether	5.0000	4.7	-5.4	20.00
Hexachlorobenzene	5.0000	4.9	-2.0	20.00
Pentachlorophenol	5.0000	4.9	-2.1	20.00
Phenanthrene	5.0000	5.3	6.5	20.00
Anthracene	5.0000	4.9	-1.4	20.00
Carbazole	5.0000	4.5	-10.3	20.00
Di-n-Butylphthalate	5.0000	4.9	-1.3	20.00
Fluoranthene	5.0000	5.2	4.7	20.00
Pyrene	5.0000	5.1	2.9	20.00
Butylbenzylphthalate	5.0000	5.0	0.7	20.00
Benzo(a)anthracene	5.0000	5.2	4.5	20.00
3,3'-Dichlorobenzidine	10.000	11.6	15.5	20.00
Chrysene	5.0000	5.3	6.4	20.00
bis(2-Ethylhexyl)phthalate	5.0000	5.1	1.5	20.00
Di-n-Octylphthalate	5.0000	4.8	-3.7	20.00
Benzofluoranthenes, Total	10.000	10.3	3.1	20.00
Benzo(a)pyrene	5.0000	5.2	4.9	20.00
Indeno(1,2,3-cd)pyrene	5.0000	5.3	6.5	20.00
Dibenzo(a,h)anthracene	5.0000	5.2	3.2	20.00
Benzo(g,h,i)perylene	5.0000	5.2	5.0	20.00
1-Methylnaphthalene	5.0000	4.0	-19.7	20.00

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 8270D

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00049
Laboratory ID: SHF0027-LCV1
Sequence: SHF0027
Standard ID: H004928

ANALYTE	EXPECTED (ug/mL)	FOUND (ug/mL)	% DRIFT	QC LIMIT
Phenol	0.50000	0.5	-9.2	50.00
bis(2-chloroethyl) ether	0.50000	0.5	-3.6	50.00
2-Chlorophenol	0.50000	0.5	2.9	50.00
1,3-Dichlorobenzene	0.50000	0.6	12.3	50.00
1,4-Dichlorobenzene	0.50000	0.5	4.1	50.00
1,2-Dichlorobenzene	0.50000	0.5	4.5	50.00
Benzyl Alcohol	0.50000	0.3	-41.6	50.00
2,2'-Oxybis(1-chloropropane)	0.50000	0.5	2.5	50.00
2-Methylphenol	0.50000	0.5	-9.1	50.00
Hexachloroethane	0.50000	0.5	-2.1	50.00
N-Nitroso-di-n-Propylamine	0.50000	0.4	-11.4	50.00
4-Methylphenol	0.50000	0.4	-10.8	50.00
Nitrobenzene	0.50000	0.5	-4.7	50.00
Isophorone	0.50000	0.4	-15.6	50.00
2-Nitrophenol	0.50000	0.5	-8.8	50.00
2,4-Dimethylphenol	1.0000	1.0	0.08	50.00
Bis(2-Chloroethoxy)methane	0.50000	0.5	-6.6	50.00
2,4-Dichlorophenol	1.0000	1.0	3.6	50.00
1,2,4-Trichlorobenzene	0.50000	0.5	3.8	50.00
Naphthalene	0.50000	0.5	0.8	50.00
Benzoic acid	2.0000	0.9	-55.4 *	50.00
4-Chloroaniline	1.0000	1.0	-2.3	50.00
Hexachlorobutadiene	0.50000	0.5	5.8	50.00
4-Chloro-3-Methylphenol	1.0000	0.9	-11.3	50.00
2-Methylnaphthalene	0.50000	0.5	-2.5	50.00
Hexachlorocyclopentadiene	1.0000	0.9	-5.2	50.00
2,4,6-Trichlorophenol	1.0000	0.9	-7.8	50.00
2,4,5-Trichlorophenol	1.0000	0.9	-14.2	50.00
2-Chloronaphthalene	0.50000	0.5	-2.5	50.00

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 8270D

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00049
Laboratory ID: SHF0027-LCV1
Sequence: SHF0027
Standard ID: H004928

2-Nitroaniline	1.0000	0.8	-18.5	50.00
Acenaphthylene	0.50000	0.5	1.0	50.00
Dimethylphthalate	0.50000	0.5	6.8	50.00
2,6-Dinitrotoluene	1.0000	1.0	3.2	50.00
Acenaphthene	0.50000	0.5	1.0	50.00
3-Nitroaniline	1.0000	1.1	6.1	50.00
2,4-Dinitrophenol	2.0000	0.9	-54.2 *	50.00
Dibenzofuran	0.50000	0.5	3.2	50.00
4-Nitrophenol	1.0000	0.7	-29.4	50.00
2,4-Dinitrotoluene	1.0000	1.0	-0.09	50.00
Fluorene	0.50000	0.5	6.4	50.00
4-Chlorophenylphenyl ether	0.50000	0.5	7.8	50.00
Diethyl phthalate	0.50000	0.5	-5.2	50.00
4-Nitroaniline	1.0000	2.3	132 *	50.00
4,6-Dinitro-2-methylphenol	2.0000	1.7	-15.9	50.00
N-Nitrosodiphenylamine	0.50000	0.5	7.8	50.00
4-Bromophenyl phenyl ether	0.50000	0.5	-6.8	50.00
Hexachlorobenzene	0.50000	0.5	-5.3	50.00
Pentachlorophenol	1.0000	0.3	-69.5 *	50.00
Phenanthrene	0.50000	0.5	-0.9	50.00
Anthracene	0.50000	0.5	-4.8	50.00
Carbazole	0.50000	0.5	0.2	50.00
Di-n-Butylphthalate	0.50000	0.4	-10.5	50.00
Fluoranthene	0.50000	0.5	-0.9	50.00
Pyrene	0.50000	0.5	5.0	50.00
Butylbenzylphthalate	0.50000	0.5	-0.05	50.00
Benzo(a)anthracene	0.50000	0.5	2.5	50.00
3,3'-Dichlorobenzidine	1.5000	1.8	20.4	50.00
Chrysene	0.50000	0.5	-2.1	50.00
bis(2-Ethylhexyl)phthalate	0.50000	0.5	-4.8	50.00
Di-n-Octylphthalate	0.50000	0.5	-1.2	50.00

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LOW-CONCENTRATION CALIBRATION VERIFICATION

EPA 8270D

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00049
Laboratory ID: SHF0027-LCV1
Sequence: SHF0027
Standard ID: H004928

Benzofluoranthenes, Total	1.0000	1.1	5.2	50.00
Benzo(a)pyrene	0.50000	0.5	-0.3	50.00
Indeno(1,2,3-cd)pyrene	0.50000	0.5	0.07	50.00
Dibenzo(a,h)anthracene	0.50000	0.5	-0.5	50.00
Benzo(g,h,i)perylene	0.50000	0.5	-4.8	50.00
1-Methylnaphthalene	0.50000	0.5	2.0	50.00
2-Fluorophenol	0.75000	0.673	-10.3	50.00
Phenol-d5	0.75000	0.680	-9.3	50.00
2-Chlorophenol-d4	0.75000	0.791	5.4	50.00
1,2-Dichlorobenzene-d4	0.50000	0.524	4.7	50.00
Nitrobenzene-d5	0.50000	0.487	-2.7	50.00
2-Fluorobiphenyl	0.50000	0.513	2.5	50.00
2,4,6-Tribromophenol	0.75000	0.538	-28.3	50.00
p-Terphenyl-d14	0.50000	0.485	-3.0	50.00

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019051713.D	Calibration Date:	05/20/19 14:03
Sequence:	SHE0305	Injection Date:	05/17/19
Lab Sample ID:	SHE0305-ICV1	Injection Time:	22:11
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Phenol	A	5.0000	4.8	1.5132770	1.4648420		-3.2	20
bis(2-chloroethyl) ether	A	5.0000	4.8	1.2118270	1.1546240		-4.7	20
2-Chlorophenol	A	5.0000	5.0	1.3081230	1.2953890		-1.0	20
1,3-Dichlorobenzene	A	5.0000	4.9	1.3885560	1.3655320		-1.7	20
1,4-Dichlorobenzene	A	5.0000	4.9	1.3357800	1.3144450		-1.6	20
1,2-Dichlorobenzene	A	5.0000	4.7	1.2924890	1.2109600		-6.3	20
Benzyl Alcohol	A	5.0000	4.8	0.8688289	0.8255582		-5.0	20
2,2'-Oxybis(1-chloropropane)	A	5.0000	4.7	0.4449272	0.4211594		-5.3	20
2-Methylphenol	A	5.0000	4.7	1.0437860	0.9890177		-5.2	20
Hexachloroethane	A	5.0000	4.9	0.5680362	0.5578975		-1.8	20
N-Nitroso-di-n-Propylamine	A	5.0000	4.6	0.7447814	0.6888500		-7.5	20
4-Methylphenol	A	5.0000	4.8	1.1002640	1.0564180		-4.0	20
Nitrobenzene	A	5.0000	4.8	0.3366226	0.3217261		-4.4	20
Isophorone	A	5.0000	4.9	0.5976686	0.5821643		-2.6	20
2-Nitrophenol	A	5.0000	5.2	0.1813467	0.1872626		3.3	20
2,4-Dimethylphenol	A	10.000	9.6	0.3431092	0.3309355		-3.6	20
Bis(2-Chloroethoxy)methane	A	5.0000	4.6	0.3540016	0.3272493		-7.6	20
2,4-Dichlorophenol	A	10.000	10.2	0.2531321	0.2573684		1.7	20
1,2,4-Trichlorobenzene	A	5.0000	4.8	0.2836874	0.2717344		-4.2	20
Naphthalene	A	5.0000	4.9	0.8646787	0.8449850		-2.3	20
Benzoic acid	A	20.000	19.8	0.2145275	0.2354632		-0.8	20
4-Chloroaniline	A	10.000	10.1	0.3702959	0.3736921		0.9	20
Hexachlorobutadiene	A	5.0000	5.0	0.1580550	0.1583056		0.2	20
4-Chloro-3-Methylphenol	A	10.000	9.9	0.2933300	0.2917527		-0.5	20
2-Methylnaphthalene	A	5.0000	4.9	0.6918955	0.6838387		-1.2	20
Hexachlorocyclopentadiene	A	10.000	10.5	0.3305236	0.3475669		5.2	20
2,4,6-Trichlorophenol	A	10.000	10.0	0.3604868	0.3591487		-0.4	20
2,4,5-Trichlorophenol	A	10.000	10.4	0.3731390	0.3891128		4.3	20
2-Chloronaphthalene	A	5.0000	4.9	1.1599250	1.1364540		-2.0	20
2-Nitroaniline	A	10.000	9.5	0.3241680	0.3072326		-5.2	20
Acenaphthylene	A	5.0000	4.9	1.7498090	1.7216490		-1.6	20

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019051713.D	Calibration Date:	05/20/19 14:03
Sequence:	SHE0305	Injection Date:	05/17/19
Lab Sample ID:	SHE0305-ICV1	Injection Time:	22:11
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Dimethylphthalate	A	5.0000	5.1	1.2678750	1.2984530		2.4	20
2,6-Dinitrotoluene	A	10.000	10.3	0.2831009	0.2917336		3.0	20
Acenaphthene	A	5.0000	5.0	1.0702060	1.0806450		1.0	20
3-Nitroaniline	A	10.000	10.4	0.3246882	0.3372128		3.9	20
2,4-Dinitrophenol	A	20.000	20.2	0.1523954	0.1859347		1.2	20
Dibenzofuran	A	5.0000	5.0	1.6980240	1.6897630		-0.5	20
4-Nitrophenol	A	10.000	10.8	0.1916979	0.2068005		7.9	20
2,4-Dinitrotoluene	A	10.000	10.1	0.3792823	0.3844768		1.4	20
Fluorene	A	5.0000	4.9	1.2202880	1.1963490		-2.0	20
4-Chlorophenylphenyl ether	A	5.0000	4.9	0.5885255	0.5819812		-1.1	20
Diethyl phthalate	A	5.0000	4.9	1.3104530	1.2923310		-1.4	20
4-Nitroaniline	A	10.000	11.3	0.2869638	0.2564956		12.7	20
4,6-Dinitro-2-methylphenol	A	20.000	21.5	0.1645762	0.1771892		7.7	20
N-Nitrosodiphenylamine	A	5.0000	4.9	0.6067984	0.5972767		-1.6	20
4-Bromophenyl phenyl ether	A	5.0000	4.9	0.2820146	0.2772482		-1.7	20
Hexachlorobenzene	A	5.0000	4.9	0.3177408	0.3141499		-1.1	20
Pentachlorophenol	A	10.000	9.9	0.1226286	0.1348386		-0.7	20
Phenanthrene	A	5.0000	4.9	0.8736127	0.8529254		-2.4	20
Anthracene	A	5.0000	5.0	0.8967947	0.9047196		0.9	20
Carbazole	A	5.0000	4.5	0.8151246	0.7335805		-10.0	20
Di-n-Butylphthalate	A	5.0000	5.2	1.2278400	1.2690520		3.4	20
Fluoranthene	A	5.0000	4.9	1.0109460	0.9908099		-2.0	20
Pyrene	A	5.0000	5.1	1.0651490	1.0862540		2.0	20
Butylbenzylphthalate	A	5.0000	5.1	0.5248559	0.5384007		2.6	20
Benzo(a)anthracene	A	5.0000	4.9	1.0043450	0.9923795		-1.2	20
3,3'-Dichlorobenzidine	A	15.000	13.4	0.3313281	0.2966862		-10.5	20
Chrysene	A	5.0000	5.0	0.8885652	0.8834593		-0.6	20
bis(2-Ethylhexyl)phthalate	A	5.0000	5.0	0.3086720	0.3100894		0.5	20
Di-n-Octylphthalate	A	5.0000	4.8	0.6643044	0.6324679		-4.8	20
Benzofluoranthenes, Total	A	10.000	10.0	0.9626221	0.9647395		0.2	20
Benzo(a)pyrene	A	5.0000	5.1	0.8988407	0.9101608		1.3	20

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019051713.D	Calibration Date:	05/20/19 14:03
Sequence:	SHE0305	Injection Date:	05/17/19
Lab Sample ID:	SHE0305-ICV1	Injection Time:	22:11
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Indeno(1,2,3-cd)pyrene	A	5.0000	5.2	1.0965470	1.1351110		3.5	20
Dibenzo(a,h)anthracene	A	5.0000	5.1	0.9065769	0.9191918		1.4	20
Benzo(g,h,i)perylene	A	5.0000	5.1	0.9446129	0.9652568		2.2	20
1-Methylnaphthalene	A	5.0000	4.9	0.7119744	0.7021326		-1.4	20
2-Fluorophenol	A	7.5000	7.55	1.2442460	1.2520060		0.6	20
Phenol-d5	A	7.5000	7.38	1.4910030	1.4679440		-1.5	20
2-Chlorophenol-d4	A	7.5000	7.60	1.2571210	1.2742340		1.4	20
1,2-Dichlorobenzene-d4	A	5.0000	4.77	0.8556112	0.8157465		-4.7	20
Nitrobenzene-d5	A	5.0000	4.82	0.3426250	0.3302566		-3.6	20
2-Fluorobiphenyl	A	5.0000	4.83	1.3766850	1.3302910		-3.4	20
2,4,6-Tribromophenol	A	7.5000	7.61	0.2726491	0.2765847		1.4	20
p-Terphenyl-d14	A	5.0000	4.88	0.7900377	0.7709575		-2.4	20

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019060302.D	Calibration Date:	05/20/19 14:03
Sequence:	SHF0027	Injection Date:	06/03/19
Lab Sample ID:	SHF0027-ICV1	Injection Time:	12:01
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Phenol	A	5.0000	4.5	1.5132770	1.3654250		-9.8	20
bis(2-chloroethyl) ether	A	5.0000	4.5	1.2118270	1.0811280		-10.8	20
2-Chlorophenol	A	5.0000	5.0	1.3081230	1.3140010		0.4	20
1,3-Dichlorobenzene	A	5.0000	5.0	1.3885560	1.3763170		-0.9	20
1,4-Dichlorobenzene	A	5.0000	5.0	1.3357800	1.3301560		-0.4	20
1,2-Dichlorobenzene	A	5.0000	4.8	1.2924890	1.2347970		-4.5	20
Benzyl Alcohol	A	5.0000	4.2	0.8688289	0.7345421		-15.5	20
2,2'-Oxybis(1-chloropropane)	A	5.0000	4.7	0.4449272	0.4163907		-6.4	20
2-Methylphenol	A	5.0000	4.5	1.0437860	0.9438502		-9.6	20
Hexachloroethane	A	5.0000	5.0	0.5680362	0.5692479		0.2	20
N-Nitroso-di-n-Propylamine	A	5.0000	4.1	0.7447814	0.6155921		-17.3	20
4-Methylphenol	A	5.0000	4.6	1.1002640	1.0196770		-7.3	20
Nitrobenzene	A	5.0000	4.5	0.3366226	0.3027671		-10.1	20
Isophorone	A	5.0000	4.6	0.5976686	0.5484439		-8.2	20
2-Nitrophenol	A	5.0000	5.4	0.1813467	0.1952547		7.7	20
2,4-Dimethylphenol	A	10.000	9.1	0.3431092	0.3112243		-9.3	20
Bis(2-Chloroethoxy)methane	A	5.0000	4.5	0.3540016	0.3168041		-10.5	20
2,4-Dichlorophenol	A	10.000	10.3	0.2531321	0.2617734		3.4	20
1,2,4-Trichlorobenzene	A	5.0000	4.9	0.2836874	0.2786295		-1.8	20
Naphthalene	A	5.0000	4.8	0.8646787	0.8312145		-3.9	20
Benzoic acid	A	20.000	16.2	0.2145275	0.1926309		-18.9	20
4-Chloroaniline	A	10.000	10.4	0.3702959	0.3850209		4.0	20
Hexachlorobutadiene	A	5.0000	5.2	0.1580550	0.1650042		4.4	20
4-Chloro-3-Methylphenol	A	10.000	9.9	0.2933300	0.2899351		-1.2	20
2-Methylnaphthalene	A	5.0000	5.1	0.6918955	0.7047864		1.9	20
Hexachlorocyclopentadiene	A	10.000	11.2	0.3305236	0.3693063		11.7	20
2,4,6-Trichlorophenol	A	10.000	10.0	0.3604868	0.3606840		0.1	20
2,4,5-Trichlorophenol	A	10.000	10.6	0.3731390	0.3939244		5.6	20
2-Chloronaphthalene	A	5.0000	5.1	1.1599250	1.1777390		1.5	20
2-Nitroaniline	A	10.000	9.5	0.3241680	0.3082768		-4.9	20
Acenaphthylene	A	5.0000	4.9	1.7498090	1.7203470		-1.7	20

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019060302.D	Calibration Date:	05/20/19 14:03
Sequence:	SHF0027	Injection Date:	06/03/19
Lab Sample ID:	SHF0027-ICV1	Injection Time:	12:01
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF		
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT	
Dimethylphthalate	A	5.0000	5.1	1.2678750	1.3033620		2.8	20	
2,6-Dinitrotoluene	A	10.000	10.7	0.2831009	0.3032886		7.1	20	
Acenaphthene	A	5.0000	5.1	1.0702060	1.0955290		2.4	20	
3-Nitroaniline	A	10.000	10.8	0.3246882	0.3502587		7.9	20	
2,4-Dinitrophenol	A	20.000	21.4	0.1523954	0.1970709		7.1	20	
Dibenzofuran	A	5.0000	5.0	1.6980240	1.7091080		0.7	20	
4-Nitrophenol	A	10.000	10.5	0.1916979	0.2007823		4.7	20	
2,4-Dinitrotoluene	A	10.000	10.6	0.3792823	0.4018030		5.9	20	
Fluorene	A	5.0000	5.1	1.2202880	1.2343980		1.2	20	
4-Chlorophenylphenyl ether	A	5.0000	5.1	0.5885255	0.6029010		2.4	20	
Diethyl phthalate	A	5.0000	4.9	1.3104530	1.2954490		-1.1	20	
4-Nitroaniline	A	10.000	20.7	0.2869638	0.4951258		107	20	*
4,6-Dinitro-2-methylphenol	A	20.000	23.3	0.1645762	0.1917381		16.5	20	
N-Nitrosodiphenylamine	A	5.0000	5.0	0.6067984	0.6077028		0.1	20	
4-Bromophenyl phenyl ether	A	5.0000	5.1	0.2820146	0.2857218		1.3	20	
Hexachlorobenzene	A	5.0000	4.9	0.3177408	0.3140118		-1.2	20	
Pentachlorophenol	A	10.000	7.4	0.1226286	0.1009324		-25.6	20	*
Phenanthrene	A	5.0000	5.0	0.8736127	0.8697045		-0.4	20	
Anthracene	A	5.0000	5.0	0.8967947	0.8974092		0.06	20	
Carbazole	A	5.0000	4.9	0.8151246	0.7974111		-2.2	20	
Di-n-Butylphthalate	A	5.0000	5.1	1.2278400	1.2516500		1.9	20	
Fluoranthene	A	5.0000	5.2	1.0109460	1.0497040		3.8	20	
Pyrene	A	5.0000	5.3	1.0651490	1.1353890		6.6	20	
Butylbenzylphthalate	A	5.0000	5.2	0.5248559	0.5408461		3.0	20	
Benzo(a)anthracene	A	5.0000	5.0	1.0043450	1.0002770		-0.4	20	
3,3'-Dichlorobenzidine	A	15.000	14.6	0.3313281	0.3229440		-2.5	20	
Chrysene	A	5.0000	4.9	0.8885652	0.8689575		-2.2	20	
bis(2-Ethylhexyl)phthalate	A	5.0000	5.3	0.3086720	0.3259779		5.6	20	
Di-n-Octylphthalate	A	5.0000	4.8	0.6643044	0.6429940		-3.2	20	
Benzofluoranthenes, Total	A	10.000	10.4	0.9626221	0.9988501		3.8	20	
Benzo(a)pyrene	A	5.0000	5.2	0.8988407	0.9324162		3.7	20	

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION CHECK

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	NT10	Calibration:	CE00049
Lab File ID:	NT1019060302.D	Calibration Date:	05/20/19 14:03
Sequence:	SHF0027	Injection Date:	06/03/19
Lab Sample ID:	SHF0027-ICV1	Injection Time:	12:01
Sequence Name:	Initial Cal Check		

		CONC. (ug/mL)		RESPONSE FACTOR			% DRIFT/DIFF	
COMPOUND	TYPE	STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Indeno(1,2,3-cd)pyrene	A	5.0000	5.1	1.0965470	1.1116900		1.4	20
Dibenzo(a,h)anthracene	A	5.0000	4.8	0.9065769	0.8787216		-3.1	20
Benzo(g,h,i)perylene	A	5.0000	4.9	0.9446129	0.9274483		-1.8	20
1-Methylnaphthalene	A	5.0000	5.0	0.7119744	0.7096358		-0.3	20
2-Fluorophenol	A	7.5000	7.27	1.2442460	1.2067290		-3.0	20
Phenol-d5	A	7.5000	7.25	1.4910030	1.4406490		-3.4	20
2-Chlorophenol-d4	A	7.5000	7.56	1.2571210	1.2664090		0.7	20
1,2-Dichlorobenzene-d4	A	5.0000	4.79	0.8556112	0.8198468		-4.2	20
Nitrobenzene-d5	A	5.0000	4.87	0.3426250	0.3334484		-2.7	20
2-Fluorobiphenyl	A	5.0000	4.95	1.3766850	1.3628970		-1.0	20
2,4,6-Tribromophenol	A	7.5000	7.37	0.2726491	0.2678874		-1.7	20
p-Terphenyl-d14	A	5.0000	5.03	0.7900377	0.7940059		0.5	20

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0305	Instrument:	NT10
		Calibration:	CE00049

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
MS Tune	SHE0305-TUN1	NT1019051701.D	NA	05/17/19 15:35
ABN 5.0	SHE0305-CAL5	NT1019051702.D	NA	05/17/19 15:50
ABN 20	SHE0305-CAL7	NT1019051703.D	NA	05/17/19 16:28
ABN 0.2	SHE0305-CAL1	NT1019051704.D	NA	05/17/19 17:05
ABN 1.0	SHE0305-CAL3	NT1019051705.D	NA	05/17/19 17:42
ABN 10	SHE0305-CAL6	NT1019051706.D	NA	05/17/19 18:19
ABN 2.5	SHE0305-CAL4	NT1019051708.D	NA	05/17/19 19:33
ABN 0.5	SHE0305-CAL2	NT1019051710.D	NA	05/17/19 20:46
SCV 5.0	SHE0305-SCV1	NT1019051711.D	NA	05/17/19 21:23
MS Tune	SHE0305-TUN2	NT1019051712.D	NA	05/17/19 21:55
Initial Cal Check	SHE0305-ICV1	NT1019051713.D	NA	05/17/19 22:11
ZZZZZ	BHE0211-BLK1	NT1019051715.D	Solid	05/17/19 23:25
ZZZZZ	BHE0211-BS1	NT1019051716.D	Solid	05/18/19 00:01
ZZZZZ	19E0075-01	NT1019051717.D	Solid	05/18/19 00:38
ZZZZZ	19E0075-02	NT1019051720.D	Solid	05/18/19 02:28
ZZZZZ	19E0075-03	NT1019051721.D	Solid	05/18/19 03:05
ZZZZZ	19E0075-04	NT1019051722.D	Solid	05/18/19 03:41
ZZZZZ	BHE0374-BLK1	NT1019051723.D	Solid	05/18/19 04:19
ZZZZZ	BHE0374-BS1	NT1019051724.D	Solid	05/18/19 04:56
ZZZZZ	19D0426-03	NT1019051725.D	Solid	05/18/19 05:33
ZZZZZ	19D0426-04	NT1019051726.D	Solid	05/18/19 06:09
ZZZZZ	19D0426-05	NT1019051727.D	Solid	05/18/19 06:46
ABN 5	SHE0305-CCV1	NT1019051728.D	NA	05/18/19 07:23

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHF0027	Instrument:	NT10
		Calibration:	CE00049

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
MS Tune	SHF0027-TUN1	NT1019060301.D	NA	06/03/19 11:46
Initial Cal Check	SHF0027-ICV1	NT1019060302.D	NA	06/03/19 12:01
ABN 0.5	SHF0027-LCV1	NT1019060303.D	NA	06/03/19 12:38
Blank	BHE0712-BLK1	NT1019060304.D	Solid	06/03/19 13:15
LCS	BHE0712-BS1	NT1019060305.D	Solid	06/03/19 13:52
ST10-050819	19E0222-01	NT1019060306.D	Solid	06/03/19 14:29
ZZZZZ	BHE0753-BLK1	NT1019060307.D	Solid	06/03/19 15:07
ZZZZZ	BHE0753-BS1	NT1019060308.D	Solid	06/03/19 15:44
ZZZZZ	19E0334-01	NT1019060309.D	Solid	06/03/19 16:21
ZZZZZ	19E0334-02	NT1019060310.D	Solid	06/03/19 16:59
ABN 5	SHF0027-CCV1	NT1019060311.D	NA	06/03/19 17:36

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
8270D SV (20-200 ppb) or (0.2-2 ppb Low LVL SepF)	**Solid**	**EPA 8270D**

Checklist for SEQUENCE SHF0027 — Checklist: Analyst Checklist-SVOA(rev3)

#	Checklist Item	Response		Analyst Initials	Date
1	DFTPP abundance and time criteria met	YES		YZ	06/04/2019
2	DDT Breakdown <20% and Peak Tailing <=2	YES		YZ	06/04/2019
3	Narrate all Internal Standard areas not within 50-200% for all affected Workorders	NA		YZ	06/04/2019
4	Retention times within windows and Coelution summary checked for all Workorders	YES		YZ	06/04/2019
5	Manual Integrations were applied as per SOP 1021s.	YES		YZ	06/04/2019
6	Narrate any Workorders where the Project specific requirements have not been met	NA		YZ	06/04/2019
7	Narrate samples per Workorder that will require more than one analysis to be reported due to dilutions or re-analysis	YES		YZ	06/04/2019
8	Verify that all samples requiring a dilution or re-analysis have been added to another batch or sequence	YES		YZ	06/04/2019
9	Extraction basis, cleanups, and total solids are correctly entered	YES		YZ	06/04/2019
10	An extract dilution bench sheet is attached to the sequence for all dilutions performed	NA		YZ	06/04/2019
11	AUTOCHECK: Blank checked for exceedence of criteria	YES	*	YZ	06/04/2019
12	AUTOCHECK: Check blank spike recovery	NO	*	YZ	06/04/2019

Comments:

LCS Recovery for 4-Nitroaniline (160%) was outside acceptance limits (24-125) in BHE0712-BS1 for 8270D SV (20-200 ppb) or (0.2-2 ppb Low LVL SepF)
- Flagged value is not within established control limits.
- Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)

LCS Recovery for 4-Nitroaniline (130%) was outside acceptance limits (24-125) in BHE0753-BS1 for 8270D SV (20-200 ppb) or (0.2-2 ppb Low LVL SepF)
- Flagged value is not within established control limits.
- Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)

13	AUTOCHECK: Check blank spike/blank spike duplicate RPD. If exceeded include outliers in exception report.	NA	*	YZ	06/04/2019
14	AUTOCHECK: Compounds in method designated as blank spike compounds are present	YES	*	YZ	06/04/2019
15	AUTOCHECK: Check %RPD between sample and sample duplicate	NA	*	YZ	06/04/2019
16	AUTOCHECK: Matrix spike recoveries within limits	NA	*	YZ	06/04/2019
17	AUTOCHECK: Matrix spike/matrix spike duplicate RPD within limits	NA	*	YZ	06/04/2019
18	AUTOCHECK: List of compounds listed as spiked are present	NA	*	YZ	06/04/2019
19	AUTOCHECK: Check SRM limits for exceedance	NA	*	YZ	06/04/2019
20	AUTOCHECK: Check Surrogate recoveries	YES	*	YZ	06/04/2019
21	AUTOCHECK: Checks Surrogate spike list against Analysis	YES	*	YZ	06/04/2019

* = Indicates Automated Response from Element DataSyst

Printed: 6/5/2019

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
8270D SV (20-200 ppb) or (0.2-2 ppb Low LVL SepF)	**Solid**	**EPA 8270D**

Checklist for SEQUENCE SHF0027 — Checklist: Analyst Checklist-SVOA(rev3)

#	Checklist Item	Response	Analyst Initials	Date
22	Data locked, checklist completed and status is analyzed (REVIEWER)	YES	BB	06/04/2019
23	Color warnings have been addressed, narrated and (or) qualified (REVIEWER)	YES	BB	06/04/2019
24	rev_DilutionCheck.rpt and rev_DilutionCheck.exe was run to verify multiple sample results are consistent (REVIEWER)	NA	BB	06/04/2019
25	List of samples or QC in this sequence that will require additional runs-verify reshot created (ANALYST) Comments: *Samples 19E0334-01,02 will be re-run at dilution.*	YES	YZ	06/04/2019
26	List of samples or QC in this sequence that are re-analysis or dilutions of samples (ANALYST)	NA	YZ	06/04/2019
27	Additional Notes (ANALYST and REVIEWER) Comments: *4-nitroaniline high in all QC. NO HITS in samples*	YES	BB	06/04/2019

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0305	Instrument:	NT10
Calibration:	CE00049	Calibration Date:	05/17/2019

Surrogate Compound	Spike Level ug/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
SHE0305-ICV1 (Solid)			Lab File ID: NT1019051713.D				Analyzed: 05/17/19 22:11	
2-Fluorophenol	7.5000	101	80 - 120	6.882	6.886571	-0.0046	N/A	
Phenol-d5	7.5000	98.5	80 - 120	8.466	8.468833	-0.0028	N/A	
2-Chlorophenol-d4	7.5000	101	80 - 120	8.752	8.751857	0.0001	N/A	
1,2-Dichlorobenzene-d4	5.0000	95.3	80 - 120	9.473	9.477285	-0.0043	N/A	
Nitrobenzene-d5	5.0000	96.4	80 - 120	10.21	10.21214	-0.0021	N/A	
2-Fluorobiphenyl	5.0000	96.6	80 - 120	13.807	13.80571	0.0013	N/A	
2,4,6-Tribromophenol	7.5000	101	80 - 120	16.838	16.8365	0.0015	N/A	
p-Terphenyl-d14	5.0000	97.6	80 - 120	21.362	21.36029	0.0017	N/A	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHF0027	Instrument:	NT10
Calibration:	CE00049	Calibration Date:	05/17/2019

Surrogate Compound	Spike Level ug/mL	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
SHF0027-ICV1 (Solid)			Lab File ID: NT1019060302.D				Analyzed: 06/03/19 12:01	
2-Fluorophenol	7.5000	97.0	80 - 120	6.504	6.886571	-0.3826	N/A	
Phenol-d5	7.5000	96.6	80 - 120	8.073	8.468833	-0.3958	N/A	
2-Chlorophenol-d4	7.5000	101	80 - 120	8.328	8.751857	-0.4239	N/A	
1,2-Dichlorobenzene-d4	5.0000	95.8	80 - 120	9.033	9.477285	-0.4443	N/A	
Nitrobenzene-d5	5.0000	97.3	80 - 120	9.762	10.21214	-0.4501	N/A	
2-Fluorobiphenyl	5.0000	99.0	80 - 120	13.305	13.80571	-0.5007	N/A	
2,4,6-Tribromophenol	7.5000	98.3	80 - 120	16.29	16.8365	-0.5465	N/A	
p-Terphenyl-d14	5.0000	101	80 - 120	20.806	21.36029	-0.5543	N/A	
SHF0027-LCV1 (Solid)			Lab File ID: NT1019060303.D				Analyzed: 06/03/19 12:38	
2-Fluorophenol	0.75000	89.7	50 - 150	6.504	6.886571	-0.3826	N/A	
Phenol-d5	0.75000	90.7	50 - 150	8.065	8.468833	-0.4038	N/A	
2-Chlorophenol-d4	0.75000	105	50 - 150	8.32	8.751857	-0.4319	N/A	
1,2-Dichlorobenzene-d4	0.50000	105	50 - 150	9.033	9.477285	-0.4443	N/A	
Nitrobenzene-d5	0.50000	97.3	50 - 150	9.755	10.21214	-0.4571	N/A	
2-Fluorobiphenyl	0.50000	103	50 - 150	13.305	13.80571	-0.5007	N/A	
2,4,6-Tribromophenol	0.75000	71.7	50 - 150	16.282	16.8365	-0.5545	N/A	
p-Terphenyl-d14	0.50000	97.0	50 - 150	20.806	21.36029	-0.5543	N/A	
BHE0712-BLK1 (Solid)			Lab File ID: NT1019060304.D				Analyzed: 06/03/19 13:15	
2-Fluorophenol	750.00	57.1	27 - 120	6.52	6.886571	-0.3666	N/A	
Phenol-d5	750.00	57.8	29 - 120	8.065	8.468833	-0.4038	N/A	
2-Chlorophenol-d4	750.00	66.5	31 - 120	8.328	8.751857	-0.4239	N/A	
1,2-Dichlorobenzene-d4	500.00	63.5	32 - 120	9.033	9.477285	-0.4443	N/A	
Nitrobenzene-d5	500.00	58.2	30 - 120	9.755	10.21214	-0.4571	N/A	
2-Fluorobiphenyl	500.00	67.6	35 - 120	13.298	13.80571	-0.5077	N/A	
2,4,6-Tribromophenol	750.00	64.2	24 - 134	16.282	16.8365	-0.5545	N/A	
p-Terphenyl-d14	500.00	87.0	37 - 120	20.807	21.36029	-0.5533	N/A	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHF0027	Instrument:	NT10
Calibration:	CE00049	Calibration Date:	05/17/2019

Surrogate Compound	Spike Level ug/kg wet	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
BHE0712-BS1 (Solid)			Lab File ID: NT1019060305.D				Analyzed: 06/03/19 13:52	
2-Fluorophenol	750.00	74.0	27 - 120	6.512	6.886571	-0.3746	N/A	
Phenol-d5	750.00	74.5	29 - 120	8.065	8.468833	-0.4038	N/A	
2-Chlorophenol-d4	750.00	82.5	31 - 120	8.328	8.751857	-0.4239	N/A	
1,2-Dichlorobenzene-d4	500.00	76.9	32 - 120	9.033	9.477285	-0.4443	N/A	
Nitrobenzene-d5	500.00	70.0	30 - 120	9.755	10.21214	-0.4571	N/A	
2-Fluorobiphenyl	500.00	81.6	35 - 120	13.305	13.80571	-0.5007	N/A	
2,4,6-Tribromophenol	750.00	82.1	24 - 134	16.282	16.8365	-0.5545	N/A	
p-Terphenyl-d14	500.00	97.9	37 - 120	20.806	21.36029	-0.5543	N/A	
19E0222-01 (Solid)			Lab File ID: NT1019060306.D				Analyzed: 06/03/19 14:29	
2-Fluorophenol	1307.5	54.7	27 - 120	6.519	6.886571	-0.3676	N/A	
Phenol-d5	1307.5	57.1	29 - 120	8.073	8.468833	-0.3958	N/A	
2-Chlorophenol-d4	1307.5	63.8	31 - 120	8.328	8.751857	-0.4239	N/A	
1,2-Dichlorobenzene-d4	871.69	64.3	32 - 120	9.033	9.477285	-0.4443	N/A	
Nitrobenzene-d5	871.69	62.6	30 - 120	9.762	10.21214	-0.4501	N/A	
2-Fluorobiphenyl	871.69	68.5	35 - 120	13.305	13.80571	-0.5007	N/A	
2,4,6-Tribromophenol	1307.5	67.4	24 - 134	16.297	16.8365	-0.5395	N/A	
p-Terphenyl-d14	871.69	83.1	37 - 120	20.829	21.36029	-0.5313	N/A	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0305	Instrument:	NT10
		Calibration:	CE00049

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Secondary Cal Check (SHE0305-SCV1)		(Solid)		Lab File ID: NT1019051711.D				Analyzed: 05/17/19 21:23	
1,4-Dichlorobenzene-d4	24944	9.116	32928	9.147	76	50 - 200	0.0310	+/-0.50	
Naphthalene-d8	93845	11.595	118034	11.633	80	50 - 200	0.0380	+/-0.50	
Acenaphthene-d10	46643	15.2	60788	15.254	77	50 - 200	0.0540	+/-0.50	
Phenanthrene-d10	84916	18.229	109110	18.283	78	50 - 200	0.0540	+/-0.50	
Chrysene-d12	86451	23.259	111956	23.321	77	50 - 200	0.0620	+/-0.50	
Di-n-Octylphthalate-d4	197761	24.289	272079	24.351	73	50 - 200	0.0620	+/-0.50	
Perylene-d12	98803	25.869	119349	25.954	83	50 - 200	0.0850	+/-0.50	
Initial Cal Check (SHE0305-ICV1)		(Solid)		Lab File ID: NT1019051713.D				Analyzed: 05/17/19 22:11	
1,4-Dichlorobenzene-d4	26825	9.116	32928	9.116	81	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	96032	11.594	118034	11.594	81	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	49526	15.2	60788	15.2	81	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	89817	18.229	109110	18.229	82	50 - 200	0.0000	+/-0.50	
Chrysene-d12	92251	23.259	111956	23.259	82	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	215930	24.289	272079	24.289	79	50 - 200	0.0000	+/-0.50	
Perylene-d12	102846	25.868	119349	25.868	86	50 - 200	0.0000	+/-0.50	
Calibration Check (SHE0305-CCV1)		(Solid)		Lab File ID: NT1019051728.D				Analyzed: 05/18/19 07:23	
1,4-Dichlorobenzene-d4	27567	9.155	32928	9.155	84	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	98158	11.641	118034	11.641	83	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	51757	15.254	60788	15.254	85	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	98905	18.291	109110	18.291	91	50 - 200	0.0000	+/-0.50	
Chrysene-d12	72314	23.329	111956	23.329	65	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	172554	24.367	272079	24.367	63	50 - 200	0.0000	+/-0.50	
Perylene-d12	65194	25.977	119349	25.977	55	50 - 200	0.0000	+/-0.50	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHF0027	Instrument:	NT10
		Calibration:	CE00049

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Initial Cal Check (SHF0027-ICV1)		(Solid)		Lab File ID: NT1019060302.D				Analyzed: 06/03/19 12:01	
1,4-Dichlorobenzene-d4	30554	8.684	32928	8.684	93	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	109539	11.123	118034	11.123	93	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	57015	14.667	60788	14.667	94	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	106610	17.657	109110	17.657	98	50 - 200	0.0000	+/-0.50	
Chrysene-d12	109041	22.688	111956	22.688	97	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	252184	23.733	272079	23.733	93	50 - 200	0.0000	+/-0.50	
Perylene-d12	115140	25.08	119349	25.08	96	50 - 200	0.0000	+/-0.50	
Low Cal Check (SHF0027-LCV1)		(Solid)		Lab File ID: NT1019060303.D				Analyzed: 06/03/19 12:38	
1,4-Dichlorobenzene-d4	31098	8.676	32928	8.684	94	50 - 200	0.0080	+/-0.50	
Naphthalene-d8	114824	11.116	118034	11.123	97	50 - 200	0.0070	+/-0.50	
Acenaphthene-d10	57867	14.667	60788	14.667	95	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	109656	17.657	109110	17.657	101	50 - 200	0.0000	+/-0.50	
Chrysene-d12	109132	22.688	111956	22.688	97	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	233615	23.733	272079	23.733	86	50 - 200	0.0000	+/-0.50	
Perylene-d12	109310	25.08	119349	25.08	92	50 - 200	0.0000	+/-0.50	
Blank (BHE0712-BLK1)		(Solid)		Lab File ID: NT1019060304.D				Analyzed: 06/03/19 13:15	
1,4-Dichlorobenzene-d4	31123	8.684	32928	8.684	95	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	117800	11.116	118034	11.123	100	50 - 200	0.0070	+/-0.50	
Acenaphthene-d10	57274	14.667	60788	14.667	94	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	112392	17.65	109110	17.657	103	50 - 200	0.0070	+/-0.50	
Chrysene-d12	103273	22.68	111956	22.688	92	50 - 200	0.0080	+/-0.50	
Di-n-Octylphthalate-d4	228003	23.733	272079	23.733	84	50 - 200	0.0000	+/-0.50	
Perylene-d12	107759	25.08	119349	25.08	90	50 - 200	0.0000	+/-0.50	
LCS (BHE0712-BS1)		(Solid)		Lab File ID: NT1019060305.D				Analyzed: 06/03/19 13:52	
1,4-Dichlorobenzene-d4	25765	8.684	32928	8.684	78	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	96943	11.123	118034	11.123	82	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	47174	14.667	60788	14.667	78	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	90328	17.657	109110	17.657	83	50 - 200	0.0000	+/-0.50	
Chrysene-d12	89535	22.688	111956	22.688	80	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	207417	23.733	272079	23.733	76	50 - 200	0.0000	+/-0.50	
Perylene-d12	93082	25.08	119349	25.08	78	50 - 200	0.0000	+/-0.50	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8270D

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHF0027	Instrument:	NT10
		Calibration:	CE00049

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
ST10-050819 (19E0222-01)		(Solid)		Lab File ID: NT1019060306.D				Analyzed: 06/03/19 14:29	
1,4-Dichlorobenzene-d4	29884	8.684	32928	8.684	91	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	118199	11.123	118034	11.123	100	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	57987	14.675	60788	14.667	95	50 - 200	-0.0080	+/-0.50	
Phenanthrene-d10	113157	17.665	109110	17.657	104	50 - 200	-0.0080	+/-0.50	
Chrysene-d12	79108	22.711	111956	22.688	71	50 - 200	-0.0230	+/-0.50	
Di-n-Octylphthalate-d4	177530	23.764	272079	23.733	65	50 - 200	-0.0310	+/-0.50	
Perylene-d12	72759	25.134	119349	25.08	61	50 - 200	-0.0540	+/-0.50	
Calibration Check (SHF0027-CCV1)		(Solid)		Lab File ID: NT1019060311.D				Analyzed: 06/03/19 17:36	
1,4-Dichlorobenzene-d4	33796	8.684	32928	8.684	103	50 - 200	0.0000	+/-0.50	
Naphthalene-d8	116617	11.123	118034	11.123	99	50 - 200	0.0000	+/-0.50	
Acenaphthene-d10	61588	14.675	60788	14.675	101	50 - 200	0.0000	+/-0.50	
Phenanthrene-d10	121151	17.657	109110	17.657	111	50 - 200	0.0000	+/-0.50	
Chrysene-d12	92164	22.696	111956	22.696	82	50 - 200	0.0000	+/-0.50	
Di-n-Octylphthalate-d4	215673	23.741	272079	23.741	79	50 - 200	0.0000	+/-0.50	
Perylene-d12	83298	25.096	119349	25.096	70	50 - 200	0.0000	+/-0.50	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HOLDING TIME SUMMARY

Analysis: EPA 8270D

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
ST10-050819 19E0222-01	05/08/19 10:40	05/16/19 13:05	05/29/19 14:00	21	14	06/03/19 14:29	5	40	*

* Indicates hold time exceedance.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 8270D

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Matrix: Solid Instrument: NT10

Analyte	MDL	RL	Units
Phenol	8.2	20.0	ug/kg
bis(2-chloroethyl) ether	6.8	20.0	ug/kg
2-Chlorophenol	6.5	20.0	ug/kg
1,3-Dichlorobenzene	5.1	20.0	ug/kg
1,4-Dichlorobenzene	4.4	20.0	ug/kg
1,2-Dichlorobenzene	4.7	20.0	ug/kg
Benzyl Alcohol	14.9	20.0	ug/kg
2,2'-Oxybis(1-chloropropane)	5.7	20.0	ug/kg
2-Methylphenol	7.8	20.0	ug/kg
Hexachloroethane	5.7	20.0	ug/kg
N-Nitroso-di-n-Propylamine	10.8	20.0	ug/kg
4-Methylphenol	14.7	20.0	ug/kg
Nitrobenzene	8.0	20.0	ug/kg
Isophorone	7.8	20.0	ug/kg
2-Nitrophenol	6.9	20.0	ug/kg
2,4-Dimethylphenol	26.8	100	ug/kg
Bis(2-Chloroethoxy)methane	6.3	20.0	ug/kg
2,4-Dichlorophenol	32.0	100	ug/kg
1,2,4-Trichlorobenzene	6.0	20.0	ug/kg
Naphthalene	5.3	20.0	ug/kg
Benzoic acid	59.1	200	ug/kg
4-Chloroaniline	33.7	100	ug/kg
Hexachlorobutadiene	5.0	20.0	ug/kg
4-Chloro-3-Methylphenol	28.9	100	ug/kg
2-Methylnaphthalene	5.7	20.0	ug/kg
Hexachlorocyclopentadiene	41.3	100	ug/kg
2,4,6-Trichlorophenol	25.4	100	ug/kg
2,4,5-Trichlorophenol	26.9	100	ug/kg
2-Chloronaphthalene	4.4	20.0	ug/kg
2-Nitroaniline	30.2	100	ug/kg
Acenaphthylene	4.8	20.0	ug/kg
Dimethylphthalate	6.4	20.0	ug/kg
2,6-Dinitrotoluene	26.7	100	ug/kg
Acenaphthene	5.1	20.0	ug/kg
3-Nitroaniline	37.7	100	ug/kg
2,4-Dinitrophenol	41.3	200	ug/kg

Analytical Resources, Incorporated
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 8270D

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Matrix: Solid Instrument: NT10

Analyte	MDL	RL	Units
Dibenzofuran	4.6	20.0	ug/kg
4-Nitrophenol	44.4	100	ug/kg
2,4-Dinitrotoluene	22.9	100	ug/kg
Fluorene	5.0	20.0	ug/kg
4-Chlorophenylphenyl ether	7.0	20.0	ug/kg
Diethyl phthalate	17.7	20.0	ug/kg
4-Nitroaniline	34.9	100	ug/kg
4,6-Dinitro-2-methylphenol	50.5	200	ug/kg
N-Nitrosodiphenylamine	9.6	20.0	ug/kg
4-Bromophenyl phenyl ether	6.1	20.0	ug/kg
Hexachlorobenzene	4.7	20.0	ug/kg
Pentachlorophenol	31.3	100	ug/kg
Phenanthrene	4.7	20.0	ug/kg
Anthracene	5.9	20.0	ug/kg
Carbazole	7.4	20.0	ug/kg
Di-n-Butylphthalate	5.3	20.0	ug/kg
Fluoranthene	4.5	20.0	ug/kg
Pyrene	5.6	20.0	ug/kg
Butylbenzylphthalate	8.1	20.0	ug/kg
Benzo(a)anthracene	5.2	20.0	ug/kg
3,3'-Dichlorobenzidine	31.2	100	ug/kg
Chrysene	5.2	20.0	ug/kg
bis(2-Ethylhexyl)phthalate	28.8	50.0	ug/kg
Di-n-Octylphthalate	8.7	20.0	ug/kg
Benzofluoranthenes, Total	10.2	40.0	ug/kg
Benzo(a)pyrene	6.5	20.0	ug/kg
Indeno(1,2,3-cd)pyrene	6.0	20.0	ug/kg
Dibenzo(a,h)anthracene	6.2	20.0	ug/kg
Benzo(g,h,i)perylene	5.8	20.0	ug/kg
1-Methylnaphthalene	6.0	20.0	ug/kg

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST10-050819

Dual Column

ORGANIC ANALYSIS DATA SHEET
EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Solid	Laboratory ID:	19E0222-01 A	File ID:	19052206ECD5.D
Sampled:	05/08/19 10:40	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 09:41
% Solids:	35.69	Preparation:	EPA 3546 (Microwave)	Initial/Final:	14.01 g Wet / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column 1:	ZB5	Column 2:	ZB35

CAS NO.	COMPOUND	Col #	DILUTION	CONC. (ug/kg dry)	MDL	RL	Q
12674-11-2	Aroclor 1016	1	1	20.0	8.0	20.0	U
11104-28-2	Aroclor 1221	1	1	20.0	8.0	20.0	U
11141-16-5	Aroclor 1232	1	1	20.0	8.0	20.0	U
53469-21-9	Aroclor 1242	1	1	20.0	8.0	20.0	U
12672-29-6	Aroclor 1248	1	1	72.5	8.0	20.0	
11097-69-1	Aroclor 1254	1	1	49.7	8.0	20.0	
11096-82-5	Aroclor 1260	2	1	143	9.3	20.0	

SURROGATES	Col #	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
Decachlorobiphenyl	*1*	*39.995*			*40 - 133*	*NRS*
Tetrachlorometaxylene	*1*	*39.995*	*25.2*	*62.9*	*53 - 120*	
Decachlorobiphenyl	*2*	*39.995*	*29.9*	*74.7*	*40 - 133*	
Tetrachlorometaxylene	*2*	*39.995*	*18.6*	*46.4*	*53 - 120*	*

INTERNAL STANDARDS	Col #	Cal Ref Response	Response	% REC	QC LIMITS	Q
1-Bromo-2-Nitrobenzene	*1*	*13740310*	*10096110*	*73.5*	*50 - 200*	
Hexabromobiphenyl	*1*	*7186114*	*2562752*	*35.7*	*50 - 200*	*
1-Bromo-2-Nitrobenzene	*2*	*32377010*	*23678860*	*73.1*	*50 - 200*	
Hexabromobiphenyl	*2*	*10251100*	*5802500*	*56.6*	*50 - 200*	

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052206ECD5.D
Data file 2: /20190522.b/20190522.b/19052206ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: 19E0222-01
Client ID:
Injection Date: 22-MAY-2019 09:41
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 1.000

ZB5 Col RT	ZB5 Col Shift	ZB5 Col Response	ZB35 Col RT	ZB35 Col Shift	ZB35 Col Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.387	0.002	3246428	4.139	0.001	6483293	25.2	18.6	30.1	Tetrachloro-m-xylene
12.703	-0.001	1223455	12.787	0.000	3436732	34.8	29.9	15.2	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	62.9	46.4
Decachlorobiphenyl	~~87.0~~ nrs	74.7

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	10096113	-26.5
Hexabromobiphenyl	7186114	2562752	-64.3 <-

fails low due to oily matrix

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	23678855	-26.9
Hexabromobiphenyl	10251097	5802500	-43.4

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

	ZB5 Col					ZB35 Col				
Aroclor	Peak#	RT	Shift	Area	Amount	Peak#	RT	Shift	Area	Amount
Aroclor-1016	1	6.009	0.001	321742	101.1	1	6.491	0.000	1964538	70.4
Aroclor-1016	2	6.412	0.005	857428	82.4	2	6.696	-0.001	607017	52.3
Aroclor-1016	3	6.668	0.002	291905	95.1	3	6.869	0.000	422068	58.8
Aroclor-1016	4	7.377	0.001	330673	89.5	4	7.381	-0.001	724896	97.6
Total Col1Ave (4 peaks):				92.1		Total Col2Ave (4 peaks):			69.8	RPD = 28
Corrected Ave (3 peaks):				89.0		Corrected Ave (3 peaks):			60.5	RPD = 38
Aroclor-1221	1	3.372	-0.002	19966	29.4	1	3.447	-0.015	2272000	1200.0
Aroclor-1221	2	4.723	-0.007	269348	161.3	2	4.784	-0.011	307782	68.3
Aroclor-1221	3	5.016	0.003	58121	19.8	3	5.171	0.012	1916533	264.4
Aroclor-1221	NS	---			----	4	6.491	-0.019	1964538	766.5
Total Col1Ave (3 peaks):				70.2		Total Col2Ave (4 peaks):			574.8	RPD = 156*
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):			366.4	
Aroclor-1232	1	3.372	-0.002	19966	47.3	1	3.447	-0.015	2272000	1778.0
Aroclor-1232	2	6.009	0.002	321742	239.2	2	5.851	-0.021	884854	141.4
Aroclor-1232	3	6.412	0.006	857428	195.8	3	6.491	-0.019	1964538	159.2
Aroclor-1232	4	7.377	0.002	330673	166.0	4	7.381	-0.022	724896	193.2
Total Col1Ave (4 peaks):				162.1		Total Col2Ave (4 peaks):			567.9	RPD = 111*
Corrected Ave (3 peaks):				136.4		Corrected Ave (3 peaks):			164.6	RPD = 19
Aroclor-1242	1	6.009	0.002	321742	117.8	1	5.851	-0.008	884854	81.7
Aroclor-1242	2	6.412	0.005	857428	96.1	2	6.491	-0.005	1964538	85.6
Aroclor-1242	3	6.668	0.002	291905	111.1	3	7.909	-0.008	684930	107.4
Aroclor-1242	4	8.029	-0.003	442433	135.3	4	8.247	-0.009	1146161	148.5
Total Col1Ave (4 peaks):				115.1		Total Col2Ave (4 peaks):			105.8	RPD = 8
Corrected Ave (3 peaks):				108.3		Corrected Ave (3 peaks):			91.6	RPD = 17
Aroclor-1248	1	7.014	0.043	21259081	6837.8	1	6.978	-0.001	517943	52.1
Aroclor-1248	2	7.377	0.001	330673	56.9	2	7.381	-0.002	724896	74.4
Aroclor-1248	3	7.798	-0.001	560016	73.6	3	7.835	-0.003	669124	58.6
Aroclor-1248	4	8.029	-0.004	442433	87.0	4	8.247	-0.003	1146161	91.8
Total Col1Ave (4 peaks):				1763.8		Total Col2Ave (4 peaks):			69.2	RPD = 185*
Corrected Ave (3 peaks):				72.5		Corrected Ave (3 peaks):			61.7	RPD = 16
Aroclor-1254	1	8.114	-0.001	323820	42.0	1	8.152	0.003	703719	60.1
Aroclor-1254	2	8.230	0.040	222120	87.7	2	8.247	0.007	1146161	193.4
Aroclor-1254	3	8.495	0.010	296208	67.9	3	8.653	-0.005	383691	43.9
Aroclor-1254	4	8.619	0.001	469620	48.0	4	8.802	-0.003	767848	52.6
Aroclor-1254	5	9.320	-0.000	234749	41.0	5	9.571	-0.005	523769	55.3
Total Col1Ave (5 peaks):				57.3		Total Col2Ave (5 peaks):			81.1	RPD = 34
Corrected Ave (4 peaks):				49.7		Corrected Ave (4 peaks):			53.0	RPD = 6
Aroclor-1260	1	9.870	-0.001	349034	121.2	1	10.334	-0.003	816889	100.6
Aroclor-1260	2	10.589	0.037	1208411	201.7	2	10.609	-0.002	1314730	85.5
Aroclor-1260	3	10.950	0.000	167759	64.2	3	11.117	-0.003	1088472	237.5
Aroclor-1260	4	11.063	-0.002	481964	375.5	4	11.180	0.005	1461768	149.1
Aroclor-1260	5	11.793	-0.006	436668	361.0	NS	---			----
Total Col1Ave (5 peaks):				224.7		Total Col2Ave (4 peaks):			143.2	RPD = 44*
Corrected Ave (4 peaks):				187.0		Corrected Ave (3 peaks):			111.7	RPD = 50*
Aroclor-1262	1	10.185	-0.001	204332	66.3	1	9.899	-0.021	757351	75.0
Aroclor-1262	2	10.589	0.036	1208411	180.4	2	10.334	-0.024	816889	89.0
Aroclor-1262	3	10.950	-0.001	167759	87.1	3	10.609	-0.022	1314730	80.5
Aroclor-1262	4	11.063	-0.003	481964	195.0	4	11.180	-0.021	1461768	133.3
Aroclor-1262	5	11.793	-0.007	436668	251.8	5	11.906	-0.023	800372	143.9
Total Col1Ave (5 peaks):				156.1		Total Col2Ave (5 peaks):			104.3	RPD = 40
Corrected Ave (4 peaks):				132.2		Corrected Ave (4 peaks):			94.4	RPD = 33
Aroclor-1268	1	11.063	-0.004	481964	68.6	1	11.117	-0.026	1088472	64.0
Aroclor-1268	2	11.136	-0.000	448667	67.1	2	11.180	-0.028	1461768	84.6
Aroclor-1268	3	11.522	0.001	233666	43.9	3	11.572	-0.025	393267	28.3

```
Aroclor-1268 4  12.297  -0.004    472431    33.8      4   12.382  -0.025  1339266    34.4
      Total Col1Ave (4 peaks):    53.4       Total Col2Ave (4 peaks):    52.8   RPD = 1
      Corrected Ave (3 peaks):    48.3       Corrected Ave (3 peaks):    42.2   RPD = 13
```

Total PCB Area Col1 (4.485 - 12.604) = 44524559 Col1 Total PCB = 0.41 ppm*

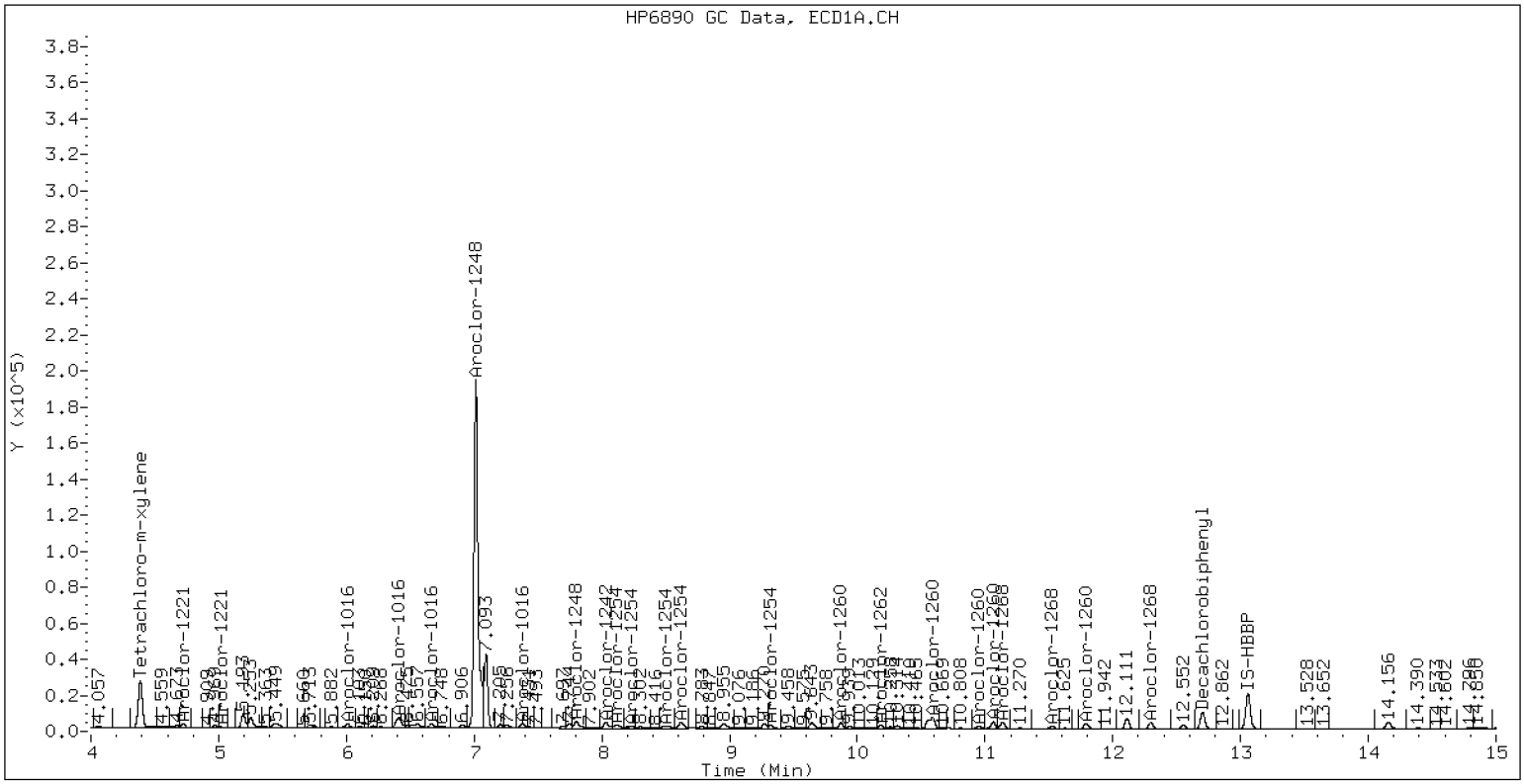
Total PCB Area Col2 (4.485 - 12.604) = 98306310 Col2 Total PCB = 0.47 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

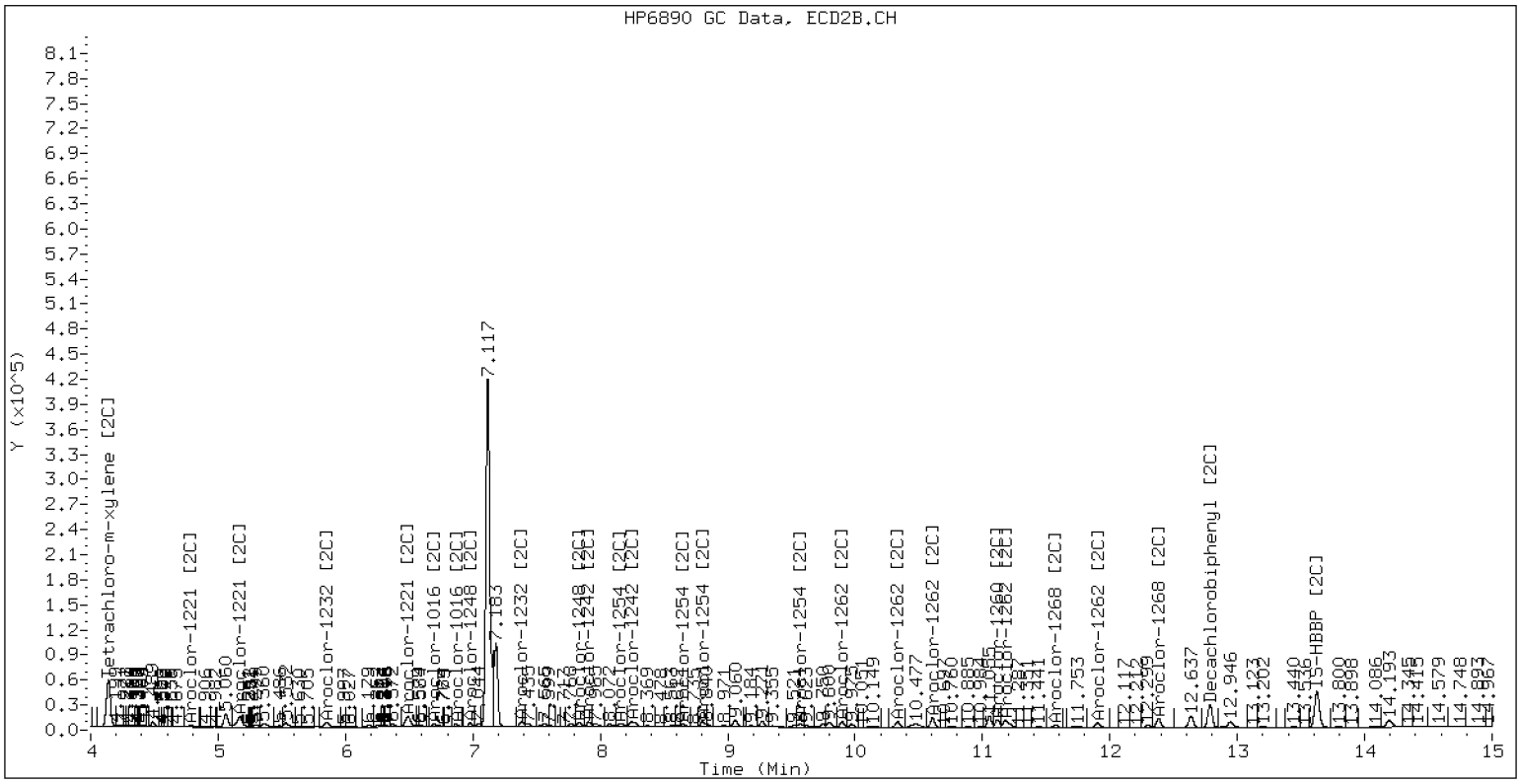
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052206ECD5.D 19E0222-01 22-MAY-2019 09:41 2ul JGR



ZB-5 Manual Integration: YES

ECD5-ZB35 /20190522.b/20190522.b/19052206ECD5.D 19E0222-01

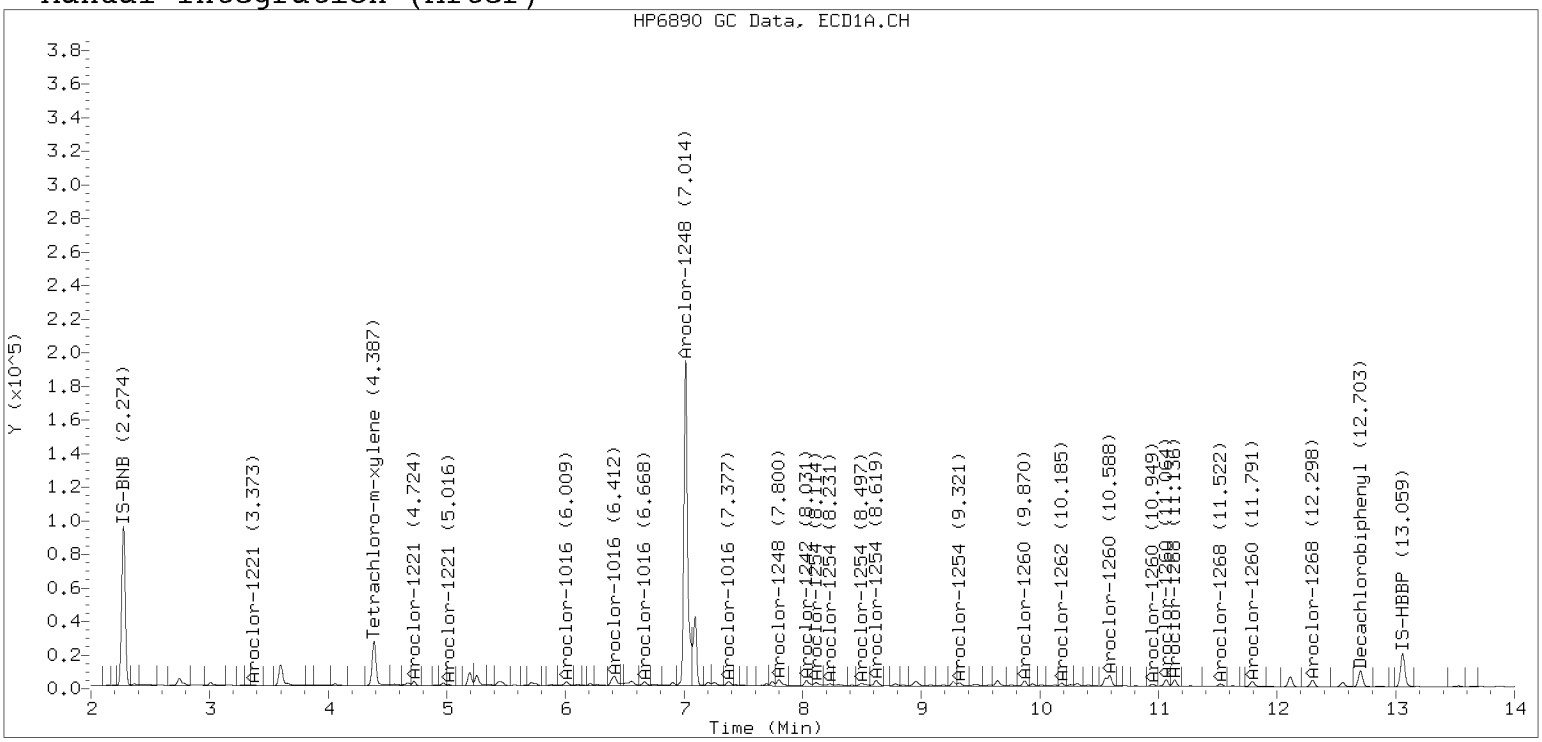


ZB-35 Manual Integration: YES

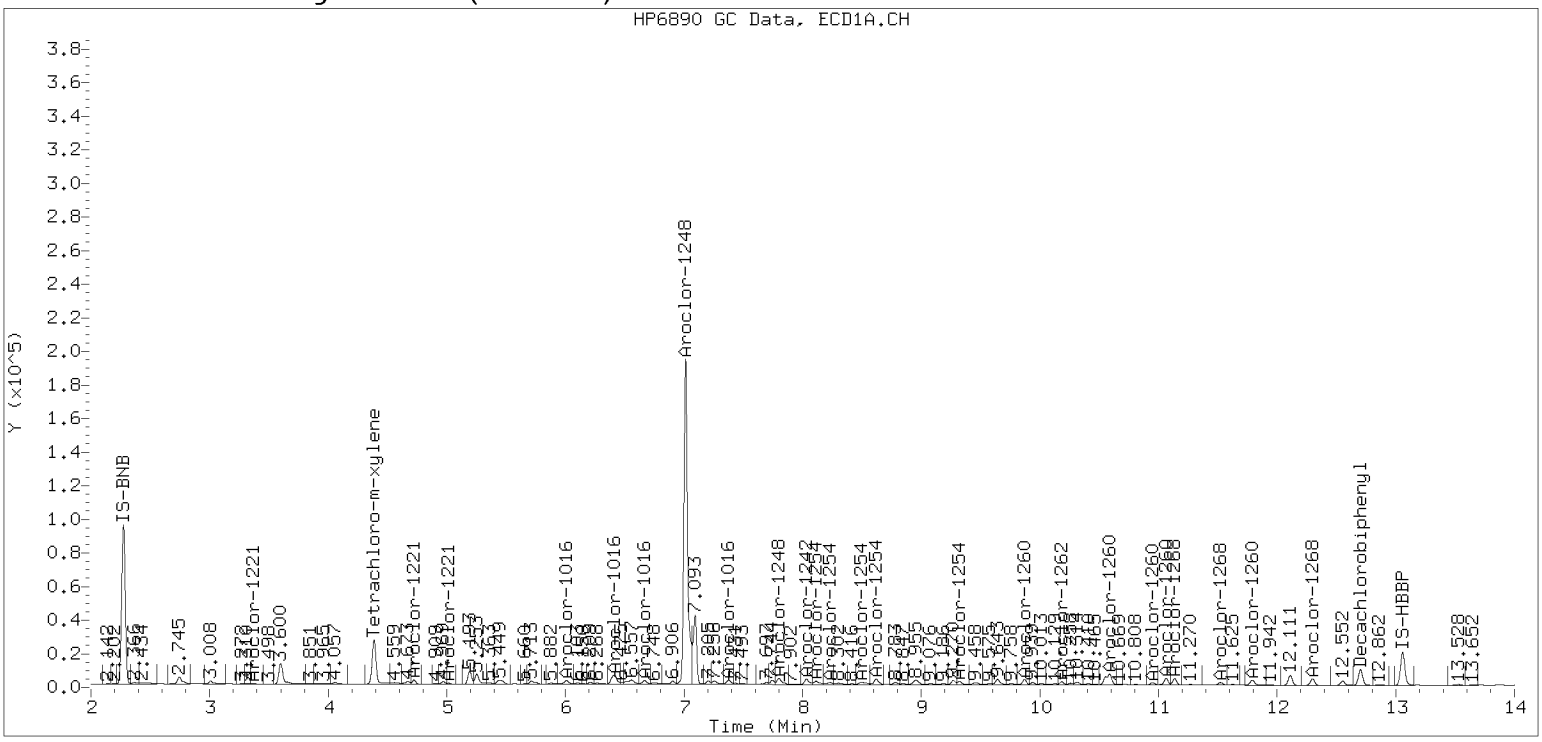
Manual Peak Adjustment, ZB-5

Datafile: ecd5.i/20190522.b/19052206ECD5.D Injection Date: 22-MAY-2019 09:4

Manual Integration (After)



Processed Integration (Before)



Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST09-050819

Dual Column

ORGANIC ANALYSIS DATA SHEET
EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Solid	Laboratory ID:	19E0222-03 A	File ID:	19052207ECD5.D
Sampled:	05/08/19 11:00	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 10:02
% Solids:	23.58	Preparation:	EPA 3546 (Microwave)	Initial/Final:	14.12 g Wet / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column 1:	ZB5	Column 2:	ZB35

CAS NO.	COMPOUND	Col #	DILUTION	CONC. (ug/kg dry)	MDL	RL	Q
12674-11-2	Aroclor 1016	1	1	30.0	12.0	30.0	U
11104-28-2	Aroclor 1221	1	1	30.0	12.0	30.0	U
11141-16-5	Aroclor 1232	1	1	30.0	12.0	30.0	U
53469-21-9	Aroclor 1242	1	1	30.0	12.0	30.0	U
12672-29-6	Aroclor 1248	1	1	110	12.0	30.0	
11097-69-1	Aroclor 1254	1	1	105	12.0	30.0	
11096-82-5	Aroclor 1260	1	1	68.6	13.9	30.0	

SURROGATES	Col #	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
Decachlorobiphenyl	*1*	*60.074*			*40 - 133*	*NRS*
Tetrachlorometaxylene	*1*	*60.074*	*35.0*	*58.2*	*53 - 120*	

INTERNAL STANDARDS	Col #	Cal Ref Response	Response	% REC	QC LIMITS	Q
1-Bromo-2-Nitrobenzene	*1*	*13740310*	*10247320*	*74.6*	*50 - 200*	
Hexabromobiphenyl	*1*	*7186114*	*2085170*	*29.*	*50 - 200*	*

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052207ECD5.D
Data file 2: /20190522.b/20190522.b/19052207ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: 19E0222-03
Client ID:
Injection Date: 22-MAY-2019 10:02
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 1.000

ZB5 Col RT	Shift	Response	ZB35 Col RT	Shift	Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.386	0.001	3048759	4.139	0.000	6539172	23.3	20.2	14.2	Tetrachloro-m-xylene
12.704	0.001	1117420	12.786	-0.000	2885032	39.1	31.8	20.6	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	58.2	50.5
Decachlorobiphenyl	97.7 nrs	79.4 nrs

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	10247322	-25.4
Hexabromobiphenyl	7186114	2085170	-71.0 <- fails low due to oily matrix

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	21959798	-32.2
Hexabromobiphenyl	10251097	4580891	-55.3 <- fails low due to oily matrix

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

Aroclor	ZB5 Col Peak#	RT	Shift	Area	Amount	ZB35 Col Peak#	RT	Shift	Area	Amount
Aroclor-1016	1	6.009	0.001	235788	73.0	1	6.491	0.001	1536403	59.4
Aroclor-1016	2	6.414	0.006	704026	66.7	2	6.696	-0.000	397008	36.9
Aroclor-1016	3	6.668	0.001	198606	63.8	3	6.867	-0.002	309586	46.5
Aroclor-1016	4	7.377	0.000	277125	73.9	4	7.383	0.001	761912	110.7
Total Col1Ave (4 peaks):				69.4		Total Col2Ave (4 peaks):			63.4	RPD = 9
Corrected Ave (3 peaks):				67.8		Corrected Ave (3 peaks):			47.6	RPD = 35
Aroclor-1221	1	3.279	-0.095	53815	78.1	1	3.445	-0.017	858009	488.7
Aroclor-1221	2	4.724	-0.006	256004	151.1	2	4.795	0.000	110761	26.5
Aroclor-1221	3	5.018	0.004	31573	10.6	3	5.162	0.003	57036	8.5
Aroclor-1221	NS	---			----	4	6.491	-0.019	1536403	646.4
Total Col1Ave (3 peaks):				79.9		Total Col2Ave (4 peaks):			292.5	RPD = 114*
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):			174.6	
Aroclor-1232	1	3.279	-0.095	53815	125.5	1	3.445	-0.016	858009	724.0
Aroclor-1232	2	6.009	0.002	235788	172.7	2	5.850	-0.022	430043	74.1
Aroclor-1232	3	6.414	0.008	704026	158.4	3	6.491	-0.019	1536403	134.2
Aroclor-1232	4	7.377	0.001	277125	137.0	4	7.383	-0.020	761912	219.0
Total Col1Ave (4 peaks):				149.4		Total Col2Ave (4 peaks):			297.9	RPD = 64*
Corrected Ave (3 peaks):				140.3		Corrected Ave (3 peaks):			142.4	RPD = 1
Aroclor-1242	1	6.009	0.001	235788	85.0	1	5.850	-0.009	430043	42.8
Aroclor-1242	2	6.414	0.006	704026	77.7	2	6.491	-0.005	1536403	72.2
Aroclor-1242	3	6.668	0.001	198606	74.4	3	7.910	-0.006	641724	108.5
Aroclor-1242	4	8.031	-0.002	451843	136.2	4	8.246	-0.011	1419929	198.3
Total Col1Ave (4 peaks):				93.3		Total Col2Ave (4 peaks):			105.5	RPD = 12
Corrected Ave (3 peaks):				79.1		Corrected Ave (3 peaks):			74.5	RPD = 6
Aroclor-1248	1	7.013	0.041	4193300	1328.8	1	6.979	0.000	677304	73.4
Aroclor-1248	2	7.377	0.000	277125	47.0	2	7.383	-0.000	761912	84.4
Aroclor-1248	3	7.802	0.003	657587	85.2	3	7.836	-0.002	725352	68.5
Aroclor-1248	4	8.031	-0.002	451843	87.6	4	8.246	-0.004	1419929	122.6
Total Col1Ave (4 peaks):				387.1		Total Col2Ave (4 peaks):			87.2	RPD = 126*
Corrected Ave (3 peaks):				73.2		Corrected Ave (3 peaks):			75.4	RPD = 3
Aroclor-1254	1	8.114	-0.001	410674	52.4	1	8.164	0.015	601574	55.4
Aroclor-1254	2	8.231	0.041	285711	111.2	2	8.246	0.005	1419929	250.4
Aroclor-1254	3	8.499	0.014	402014	90.7	3	8.651	-0.007	500215	61.7
Aroclor-1254	4	8.619	0.002	523020	52.7	4	8.802	-0.002	1155812	85.4
Aroclor-1254	5	9.322	0.001	253272	43.6	5	9.569	-0.006	599094	68.2
Total Col1Ave (5 peaks):				70.1		Total Col2Ave (5 peaks):			105.8	RPD = 41*
Corrected Ave (4 peaks):				59.9		Corrected Ave (4 peaks):			67.7	RPD = 12
Aroclor-1260	1	9.874	0.003	75674	32.3	1	10.318	-0.018	652323	101.7
Aroclor-1260	2	10.589	0.037	1583975	324.9	2	10.609	-0.001	368357	30.4
Aroclor-1260	3	10.950	0.000	87873	41.3	3	11.114	-0.005	159874	44.2
Aroclor-1260	4	11.066	0.002	66313	63.5	4	11.175	0.000	326182	42.2
Aroclor-1260	5	11.782	-0.016	316105	321.2	NS	---			----
Total Col1Ave (5 peaks):				156.6		Total Col2Ave (4 peaks):			54.6	RPD = 97*
Corrected Ave (4 peaks):				114.6		Corrected Ave (3 peaks):			38.9	RPD = 99*
				45.7						
Aroclor-1262	1	10.186	0.000	63827	25.4	1	9.897	-0.023	199515	25.0
Aroclor-1262	2	10.589	0.036	1583975	290.7	2	10.318	-0.040	652323	90.0
Aroclor-1262	3	10.950	-0.001	87873	56.1	3	10.609	-0.022	368357	28.6
Aroclor-1262	4	11.066	0.001	66313	33.0	4	11.175	-0.026	326182	37.7
Aroclor-1262	5	11.782	-0.017	316105	224.1	5	11.904	-0.025	172553	39.3
Total Col1Ave (5 peaks):				125.8		Total Col2Ave (5 peaks):			44.1	RPD = 96*
Corrected Ave (4 peaks):				84.6		Corrected Ave (4 peaks):			32.6	RPD = 89*
Aroclor-1268	1	11.066	-0.000	66313	11.6	1	11.114	-0.028	159874	11.9
Aroclor-1268	2	11.136	-0.001	60928	11.2	2	11.175	-0.033	326182	23.9
Aroclor-1268	3	11.525	0.004	23312	5.4	3	11.574	-0.023	50031	4.6

```
Aroclor-1268 4  12.304   0.003    191918    16.9      4   12.382  -0.025   153464     5.0
      Total Col1Ave (4 peaks):    11.3       Total Col2Ave (4 peaks):    11.3   RPD = 1
      Corrected Ave (3 peaks):     9.4       Corrected Ave (3 peaks):     7.2   RPD = 27
```

Total PCB Area Col1 (4.485 - 12.604) = 21269490 Col1 Total PCB = 0.20 ppm*

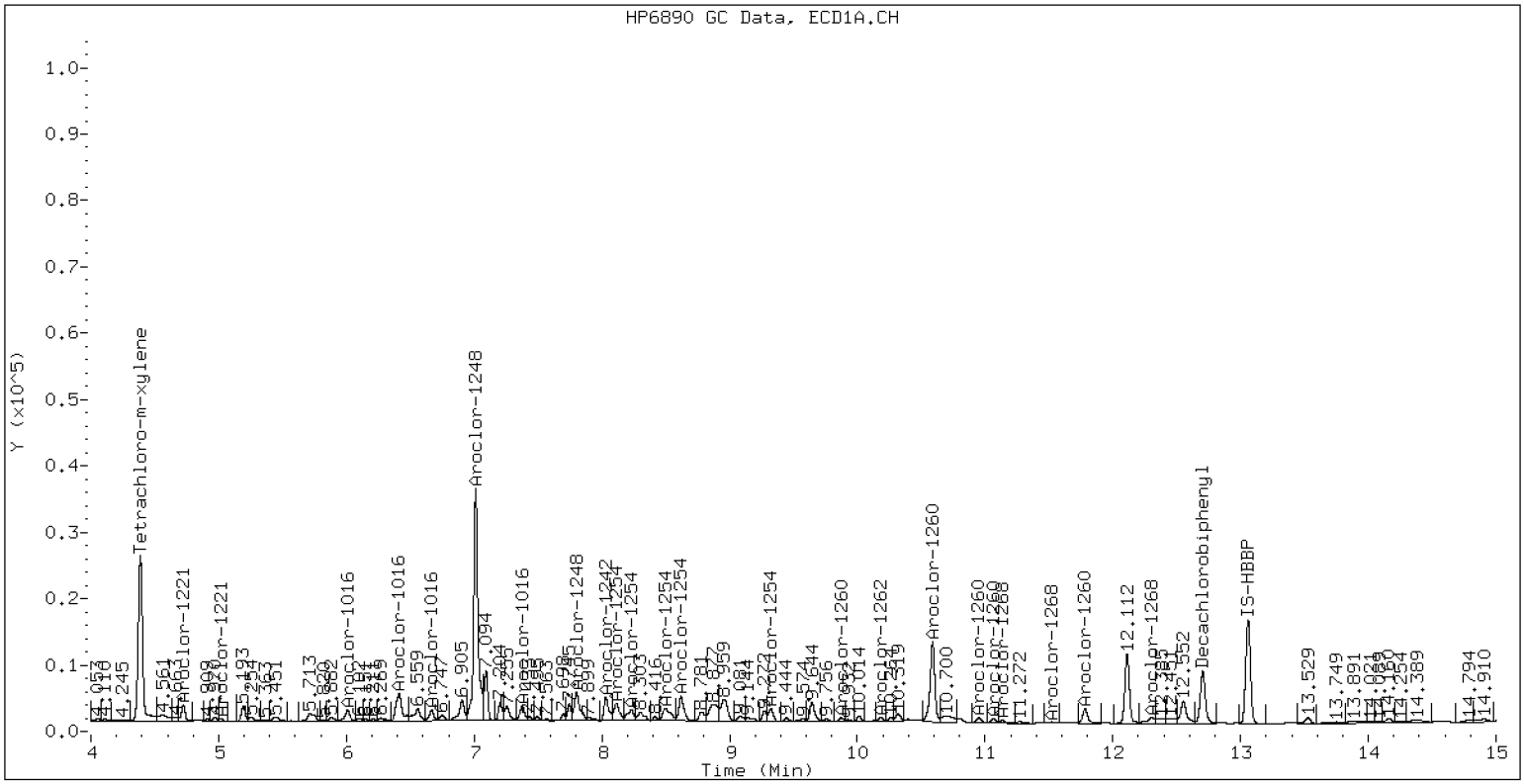
Total PCB Area Col2 (4.485 - 12.604) = 43120907 Col2 Total PCB = 0.21 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

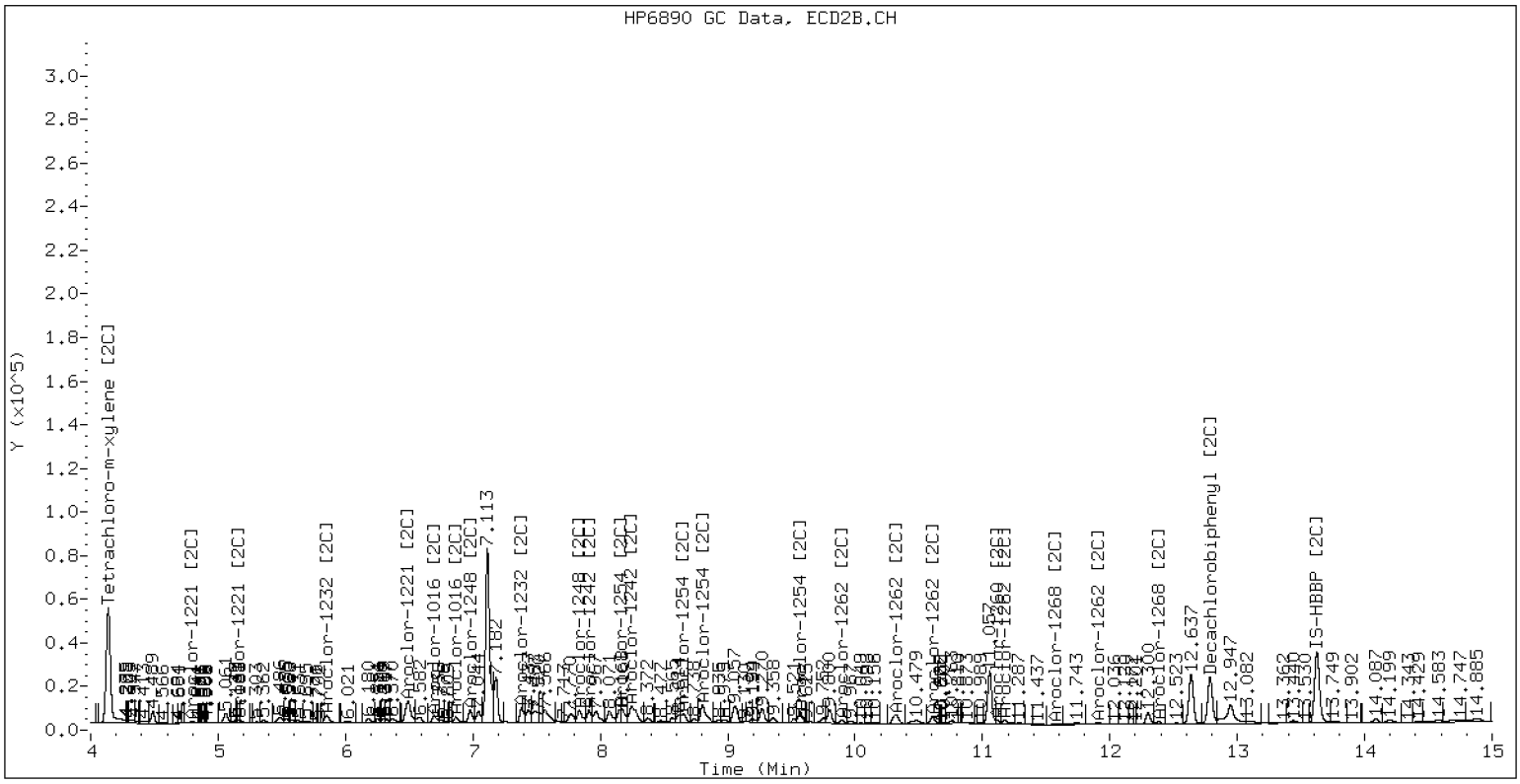
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052207ECD5.D 19E0222-03 22-MAY-2019 10:02 2ul JGR



ZB-5 Manual Integration: YES

ECD5-ZB35 /20190522.b/20190522.b/19052207ECD5.D 19E0222-03

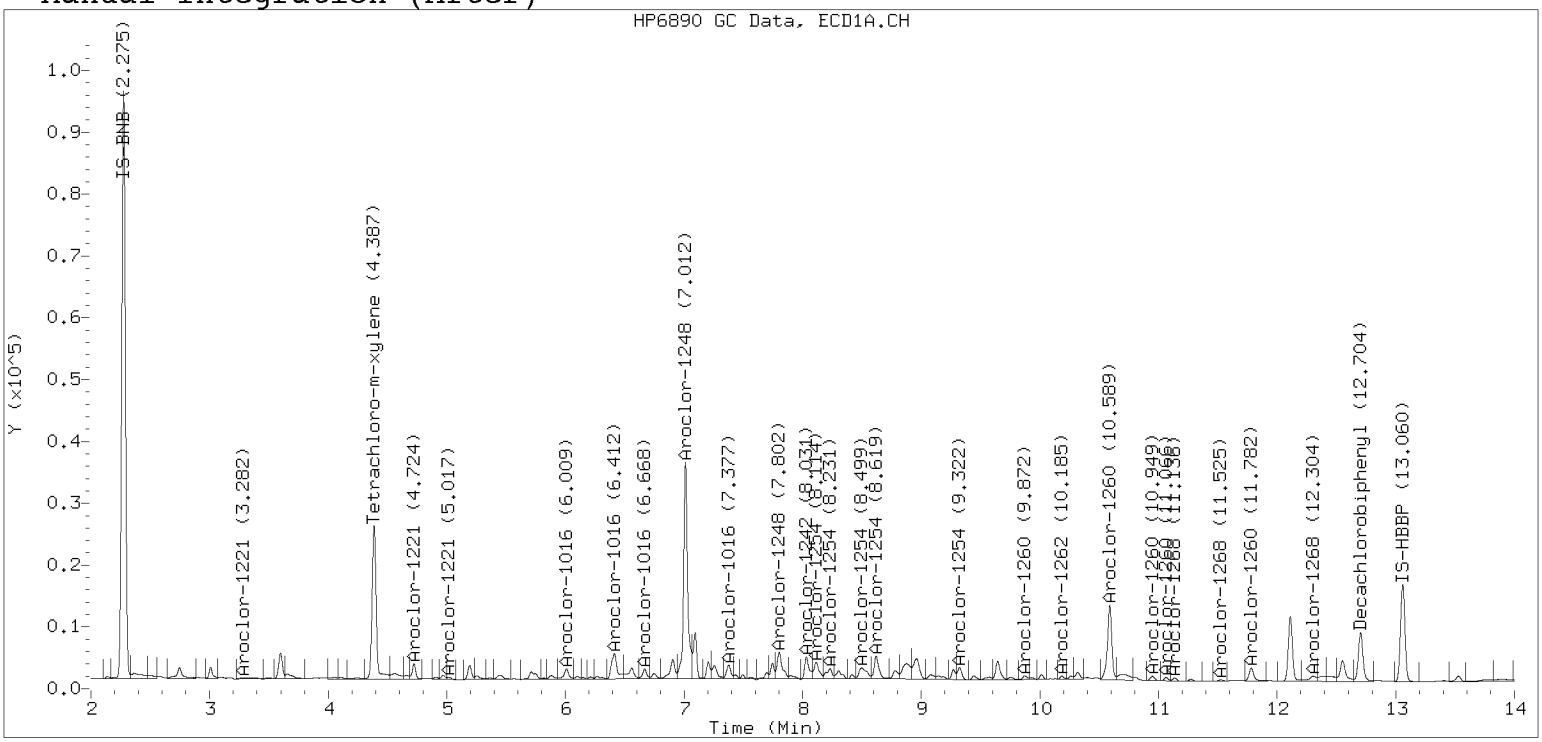


ZB-35 Manual Integration: NO

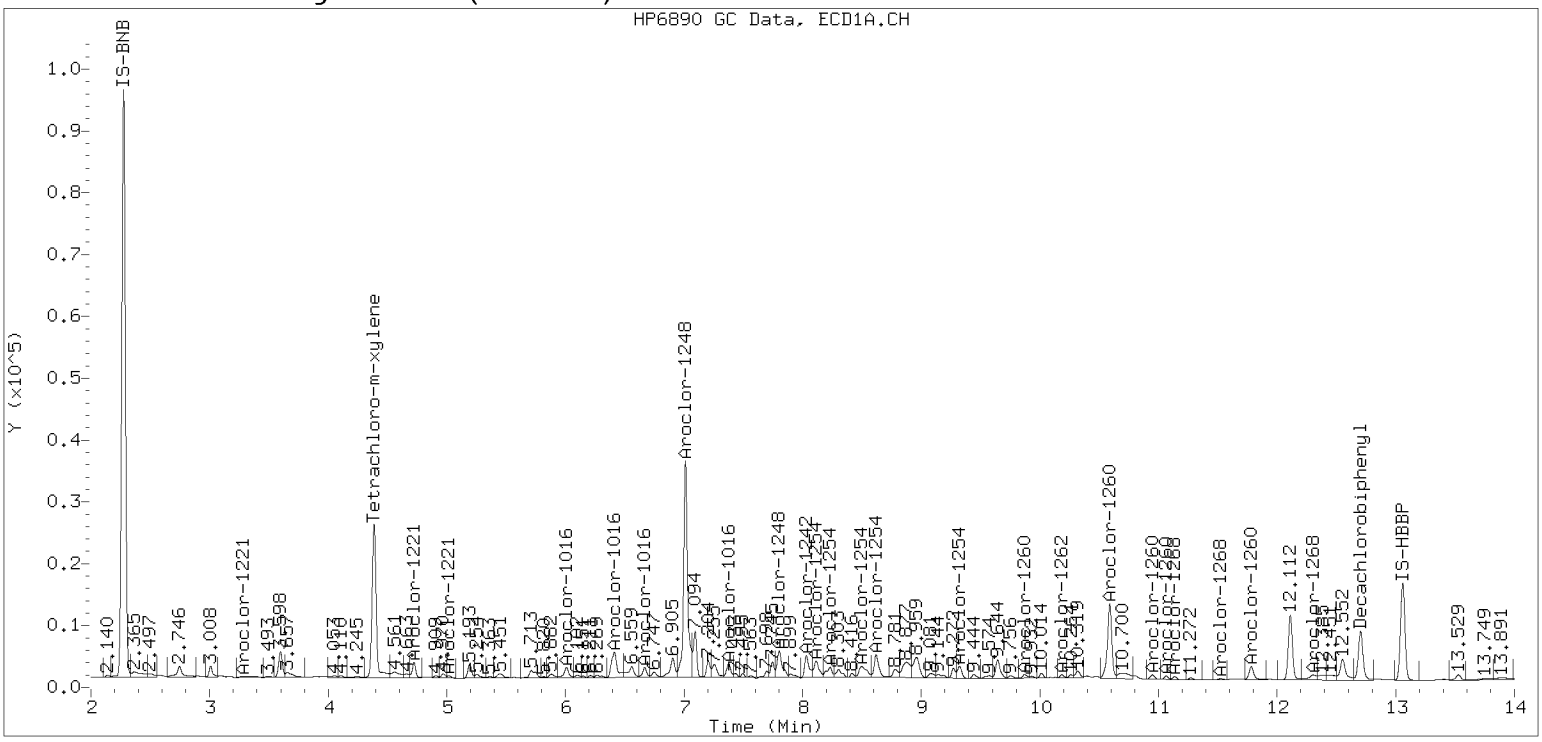
Manual Peak Adjustment, ZB-5

Datafile: ecd5.i/20190522.b/19052207ECD5.D Injection Date: 22-MAY-2019 10:0

Manual Integration (After)



Processed Integration (Before)



Analytical Resources, Incorporated
Analytical Chemists and Consultants

ST09-050819

Dual Column

ORGANIC ANALYSIS DATA SHEET
EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Solid	Laboratory ID:	19E0222-03RE1 A	File ID:	19052213ECD5.D
Sampled:	05/08/19 11:00	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 12:10
% Solids:	23.58	Preparation:	EPA 3546 (Microwave)	Initial/Final:	14.12 g Wet / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column 1:	ZB5	Column 2:	ZB35

CAS NO.	COMPOUND	Col #	DILUTION	CONC. (ug/kg dry)	MDL	RL	Q
12674-11-2	Aroclor 1016	1	5	150	60.1	150	U
11104-28-2	Aroclor 1221	1	5	150	60.1	150	U
11141-16-5	Aroclor 1232	1	5	150	60.1	150	U
53469-21-9	Aroclor 1242	1	5	150	60.1	150	U
12672-29-6	Aroclor 1248	1	5	161	60.1	150	D
11097-69-1	Aroclor 1254	1	5	158	60.1	150	D
11096-82-5	Aroclor 1260	1	5	150	69.7	150	U

SURROGATES	Col #	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
Decachlorobiphenyl	*1*	*60.074*	*58.2*	*96.9*	*40 - 133*	
Tetrachlorometaxylene	*1*	*60.074*	*37.4*	*62.3*	*53 - 120*	

INTERNAL STANDARDS	Col #	Cal Ref Response	Response	% REC	QC LIMITS	Q
1-Bromo-2-Nitrobenzene	*1*	*13740310*	*12433570*	*90.5*	*50 - 200*	
Hexabromobiphenyl	*1*	*7186114*	*3697817*	*51.5*	*50 - 200*	

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052213ECD5.D
Data file 2: /20190522.b/20190522.b/19052213ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: 19E0222-03RE1
Client ID:
Injection Date: 22-MAY-2019 12:10
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 5.000

ZB5 Col RT	Shift	Response	ZB35 Col RT	Shift	Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.386	0.000	792207	4.137	-0.001	2046044	5.0	4.8	4.2	Tetrachloro-m-xylene
12.704	0.000	393397	12.784	-0.002	907873	7.8	5.7	30.7	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	62.3	59.8
Decachlorobiphenyl	96.9	71.1

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	12433569	-9.5
Hexabromobiphenyl	7186114	3697817	-48.5

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	29012295	-10.4
Hexabromobiphenyl	10251097	8047673	-21.5

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

	ZB5 Col					ZB35 Col				
Aroclor	Peak#	RT	Shift	Area	Amount	Peak#	RT	Shift	Area	Amount
Aroclor-1016	1	6.008	0.000	75829	19.4	1	6.493	0.002	555473	16.2
Aroclor-1016	2	6.411	0.004	236583	18.5	2	6.696	-0.001	165759	11.7
Aroclor-1016	3	6.668	0.001	69004	18.3	3	6.868	-0.001	109181	12.4
Aroclor-1016	4	7.376	-0.001	115358	25.4	4	7.381	-0.001	300803	33.1
Total Col1Ave (4 peaks):					20.4	Total Col2Ave (4 peaks):				18.3 RPD = 10
Corrected Ave (3 peaks):					18.7	Corrected Ave (3 peaks):				13.4 RPD = 33
Aroclor-1221	1	---			0.0	1	3.443	-0.019	284285	122.6
Aroclor-1221	2	---			0.0	2	4.801	0.006	43749	7.9
Aroclor-1221	3	---			0.0	3	5.164	0.005	108379	12.2
Aroclor-1221	NS	---			----	4	6.493	-0.017	555473	176.9
Col1Ave: <3 Quant Peaks						Col2Ave: 79.9				
Aroclor-1232	1	---			0.0	1	3.443	-0.018	284285	181.6
Aroclor-1232	2	6.008	0.001	75829	45.8	2	5.851	-0.021	232024	30.3
Aroclor-1232	3	6.411	0.005	236583	43.9	3	6.493	-0.017	555473	36.7
Aroclor-1232	4	7.376	-0.000	115358	47.0	4	7.381	-0.021	300803	65.4
Total Col1Ave (3 peaks):					45.6	Total Col2Ave (4 peaks):				78.5 RPD = 53*
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):				44.1
Aroclor-1242	1	6.008	0.001	75829	22.5	1	5.851	-0.008	232024	17.5
Aroclor-1242	2	6.411	0.004	236583	21.5	2	6.493	-0.003	555473	19.8
Aroclor-1242	3	6.668	0.001	69004	21.3	3	7.910	-0.006	205831	26.4
Aroclor-1242	4	8.031	-0.001	150610	37.4	4	8.243	-0.014	529375	56.0
Total Col1Ave (4 peaks):					25.7	Total Col2Ave (4 peaks):				29.9 RPD = 15
Corrected Ave (3 peaks):					21.8	Corrected Ave (3 peaks):				21.2 RPD = 3
Aroclor-1248	1	7.011	0.039	1160382	303.1	1	6.979	-0.000	279664	22.9
Aroclor-1248	2	7.376	-0.001	115358	16.1	2	7.381	-0.002	300803	25.2
Aroclor-1248	3	7.802	0.003	223678	23.9	3	7.837	-0.001	260028	18.6
Aroclor-1248	4	8.031	-0.002	150610	24.1	4	8.243	-0.007	529375	34.6
Total Col1Ave (4 peaks):					91.8	Total Col2Ave (4 peaks):				25.3 RPD = 113*
Corrected Ave (3 peaks):					21.4	Corrected Ave (3 peaks):				22.2 RPD = 4
Aroclor-1254	1	8.113	-0.002	152230	16.0	1	8.156	0.007	414987	28.9
Aroclor-1254	2	8.231	0.041	107323	34.4	2	8.243	0.002	529375	72.9
Aroclor-1254	3	8.496	0.011	141374	26.3	3	8.647	-0.010	184451	17.2
Aroclor-1254	4	8.619	0.001	191299	15.9	4	8.801	-0.004	442731	24.8
Aroclor-1254	5	9.321	0.001	89906	12.8	5	9.570	-0.006	299184	25.8
Total Col1Ave (5 peaks):					21.1	Total Col2Ave (5 peaks):				33.9 RPD = 47*
Corrected Ave (4 peaks):					17.7	Corrected Ave (4 peaks):				24.2 RPD = 31
Aroclor-1260	1	9.871	-0.000	30302	7.3	1	10.321	-0.016	235858	20.9
Aroclor-1260	2	10.588	0.036	504681	58.4	2	10.608	-0.002	151344	7.1
Aroclor-1260	3	10.948	-0.002	30149	8.0	3	11.173	0.054	142804	22.5
Aroclor-1260	4	11.064	-0.000	18018	9.7	4	---			0.0
Aroclor-1260	5	11.780	-0.018	118554	67.9	NS	---			----
Total Col1Ave (5 peaks):					30.3	Total Col2Ave (3 peaks):				16.8 RPD = 57*
Corrected Ave (4 peaks):					20.8	Corrected Ave: < 3 Peaks				
Aroclor-1262	1	10.184	-0.002	19951	4.5	1	9.898	-0.022	87480	6.2
Aroclor-1262	2	10.588	0.035	504681	52.2	2	10.321	-0.037	235858	18.5
Aroclor-1262	3	10.948	-0.003	30149	10.8	3	10.608	-0.023	151344	6.7
Aroclor-1262	4	11.064	-0.001	18018	5.1	4	11.173	-0.028	142804	9.4
Aroclor-1262	5	11.780	-0.019	118554	47.4	5	11.911	-0.018	157708	20.4
Total Col1Ave (5 peaks):					24.0	Total Col2Ave (5 peaks):				12.3 RPD = 65*
Corrected Ave (4 peaks):					16.9	Corrected Ave (4 peaks):				10.2 RPD = 50*
Aroclor-1268	1	11.064	-0.002	18018	1.8	1	11.173	0.031	142804	6.1
Aroclor-1268	2	---			0.0	2	---			0.0
Aroclor-1268	3	---			0.0	3	11.578	-0.019	39848	2.1
Aroclor-1268	4	12.299	0.002	22603	1.1	4	12.379	0.028	81297	1.5

Col1Ave: <3 Quant Peaks Col2Ave: 3.2

Total PCB Area Col1 (4.485 - 12.604) = 6267506 Col1 Total PCB = 0.06 ppm*

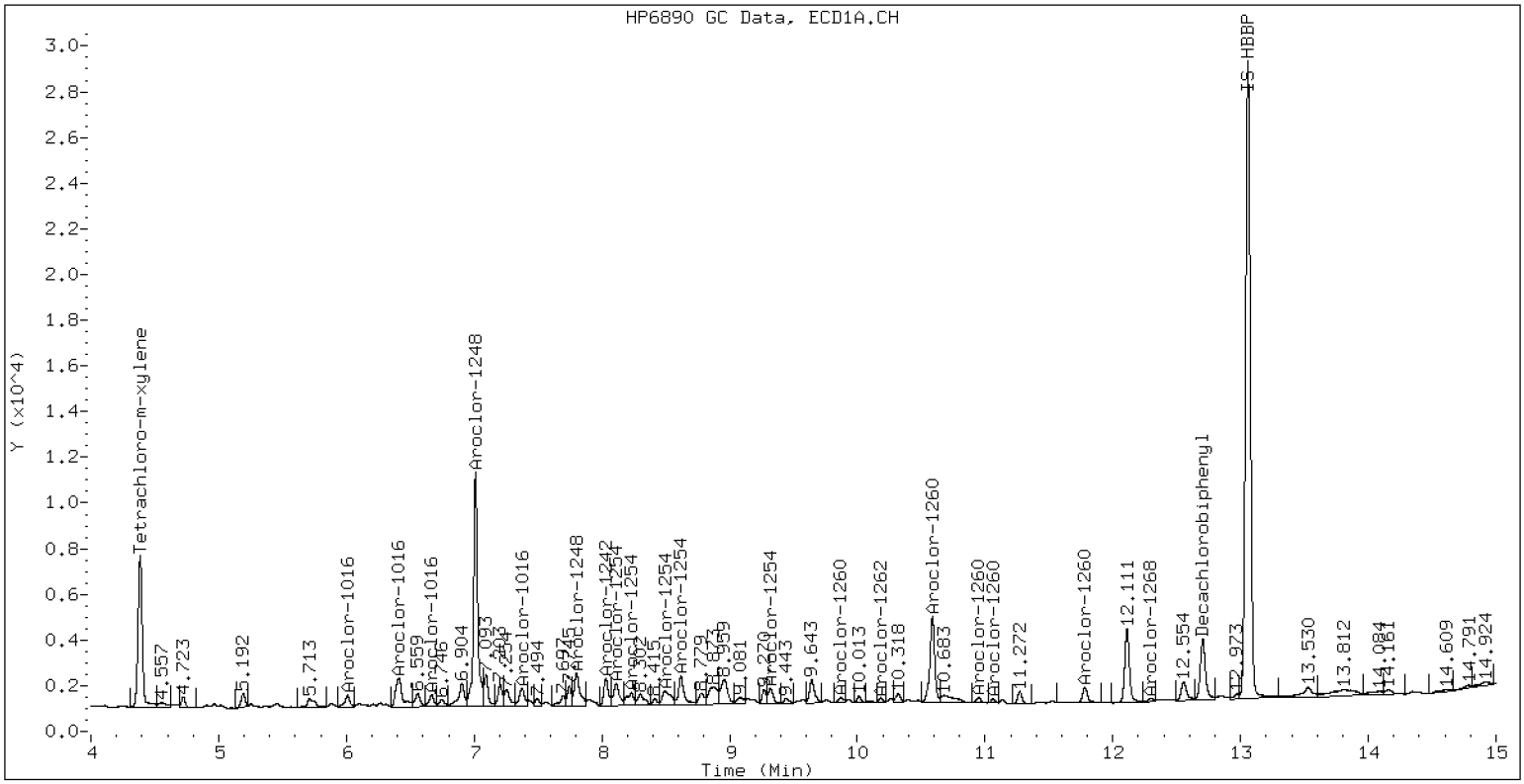
Total PCB Area Col2 (4.485 - 12.604) = 16200532 Col2 Total PCB = 0.08 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

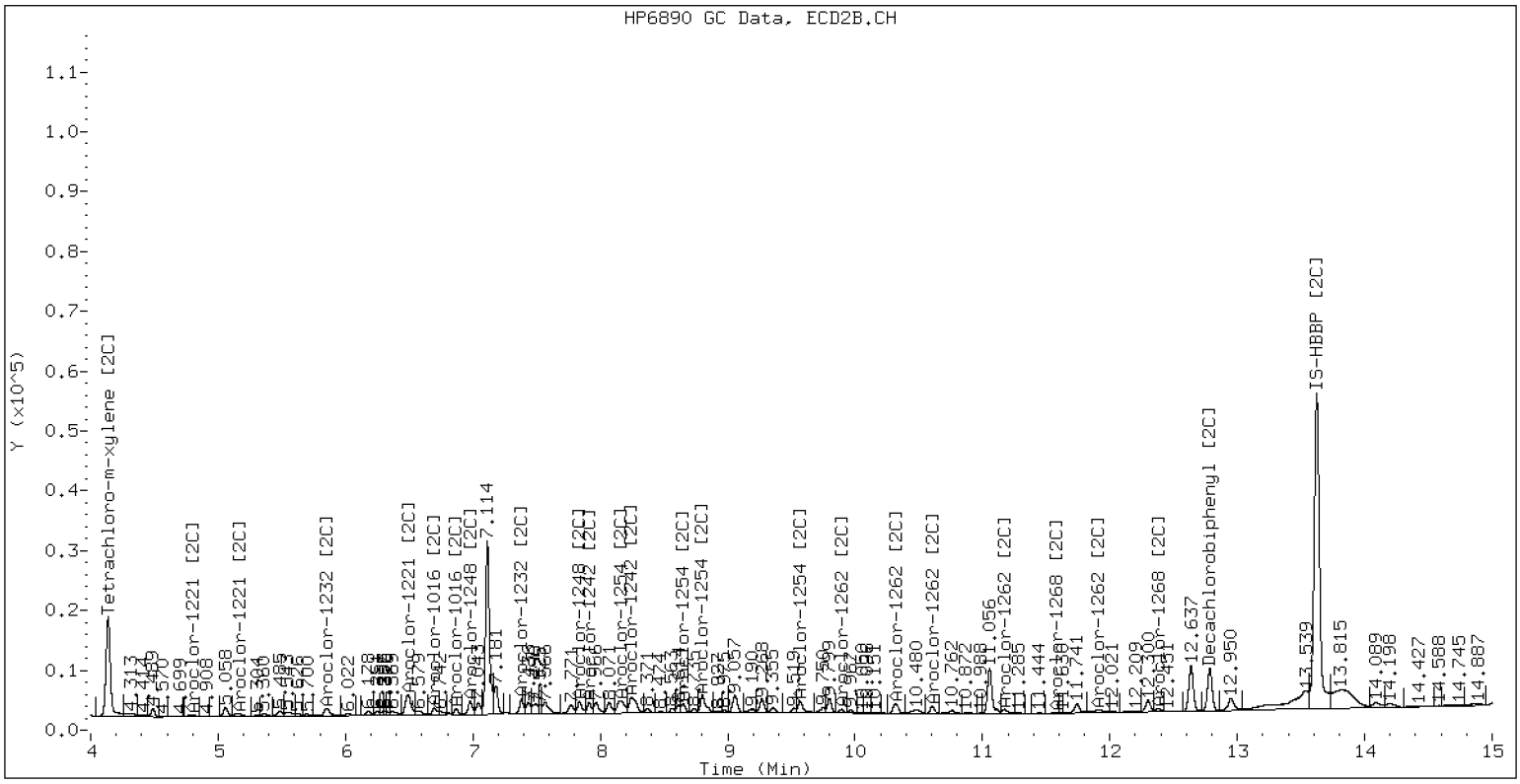
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052213ECD5.D 19E0222-03RE1 22-MAY-2019 12:10 2ul JGR



ZB-5 Manual Integration: NO

ECD5-ZB35 /20190522.b/20190522.b/19052213ECD5.D 19E0222-03RE1

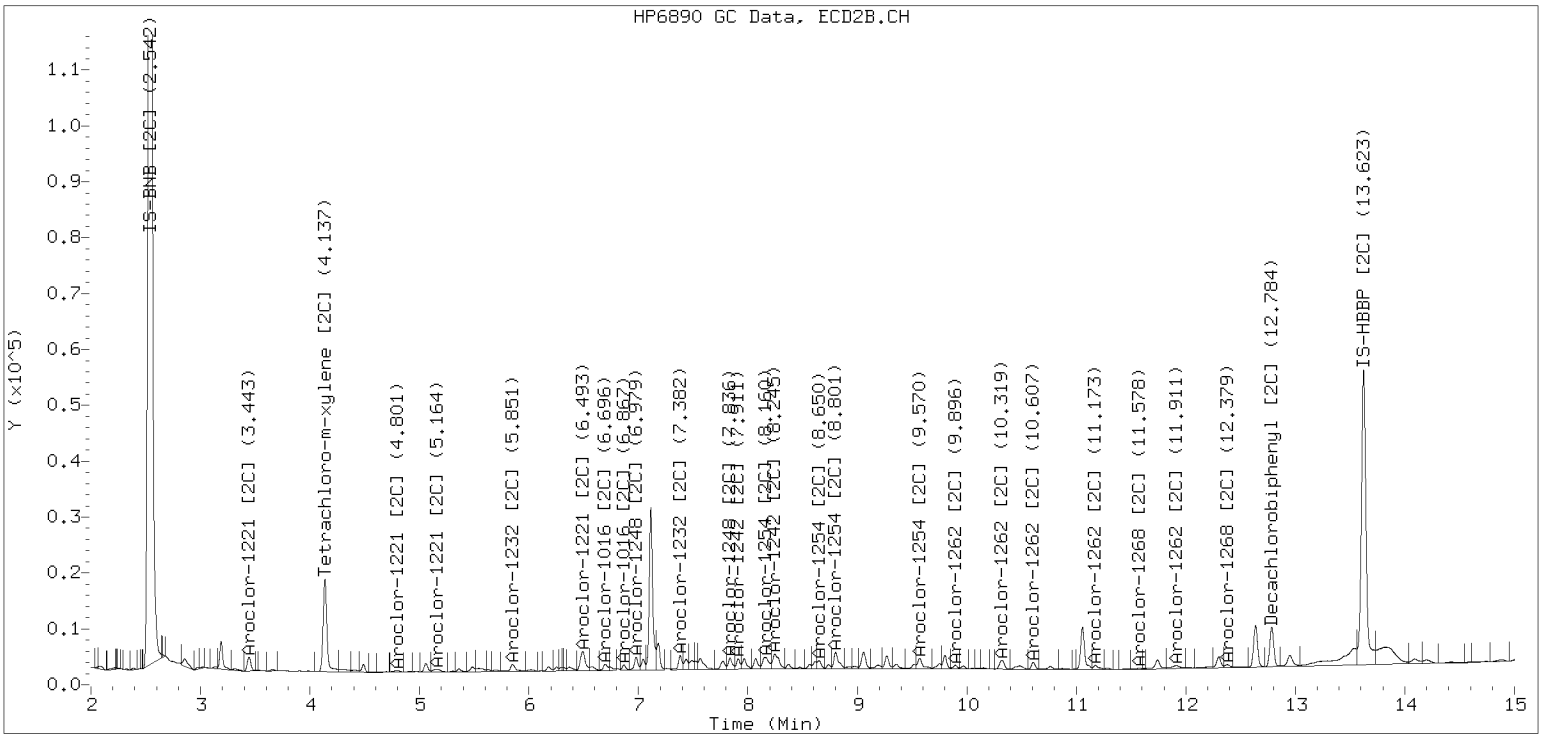


ZB-35 Manual Integration: YES

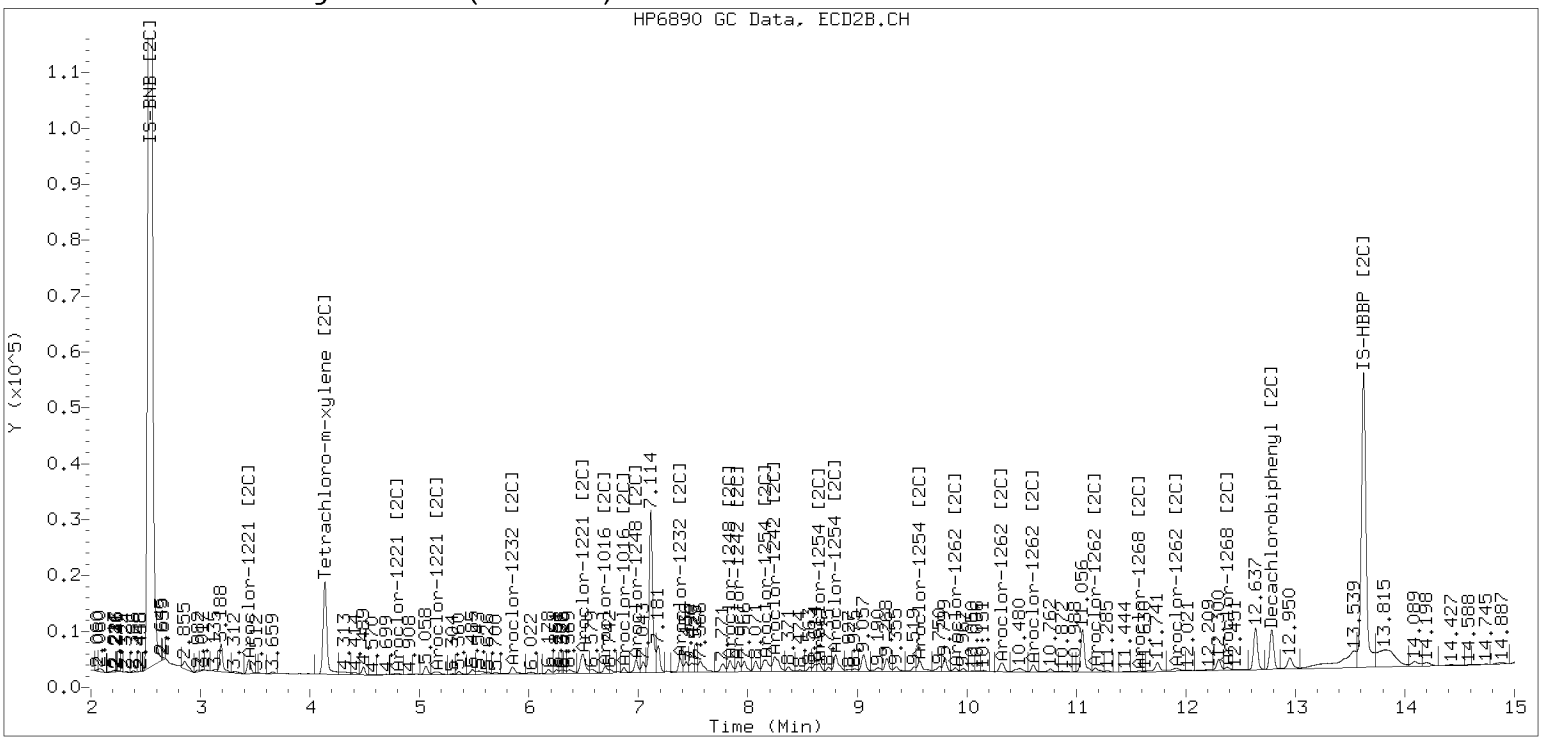
Manual Peak Adjustment, ZB-35

Datafile: ecd5.i/20190522.b/20190522.b/19052213ECD5.D Injection Date: 22-MAY-2

Manual Integration (After)



Processed Integration (Before)



Analytical Resources, Incorporated
Analytical Chemists and Consultants

17th-ST1-050819

Dual Column

ORGANIC ANALYSIS DATA SHEET
EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Solid	Laboratory ID:	19E0222-05 A	File ID:	19052208ECD5.D
Sampled:	05/08/19 11:35	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 10:24
% Solids:	18.08	Preparation:	EPA 3546 (Microwave)	Initial/Final:	10.36 g Wet / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column 1:	ZB5	Column 2:	ZB35

CAS NO.	COMPOUND	Col #	DILUTION	CONC. (ug/kg dry)	MDL	RL	Q
12674-11-2	Aroclor 1016	1	1	53.4	21.4	53.4	U
11104-28-2	Aroclor 1221	1	1	53.4	21.4	53.4	U
11141-16-5	Aroclor 1232	1	1	53.4	21.4	53.4	U
53469-21-9	Aroclor 1242	1	1	53.4	21.4	53.4	U
12672-29-6	Aroclor 1248	1	1	53.4	21.4	53.4	U
11097-69-1	Aroclor 1254	1	1	112	21.4	53.4	
11096-82-5	Aroclor 1260	1	1	573	24.8	53.4	

SURROGATES	Col #	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
Decachlorobiphenyl	*1*	*106.78*			*40 - 133*	*NRS*
Tetrachlorometaxylene	*1*	*106.78*	*95.5*	*89.5*	*53 - 120*	

INTERNAL STANDARDS	Col #	Cal Ref Response	Response	% REC	QC LIMITS	Q
1-Bromo-2-Nitrobenzene	*1*	*13740310*	*11509430*	*83.8*	*50 - 200*	
Hexabromobiphenyl	*1*	*7186114*	*2225447*	*31.*	*50 - 200*	*

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052208ECD5.D
Data file 2: /20190522.b/20190522.b/19052208ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: 19E0222-05
Client ID:
Injection Date: 22-MAY-2019 10:24
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 1.000

ZB5 Col RT	Shift	Response	ZB35 Col RT	Shift	Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.387	0.002	5264829	4.138	0.000	11253978	35.8	24.8	36.3	Tetrachloro-m-xylene
12.702	-0.001	1303456	12.785	-0.001	3406205	42.7	36.9	14.7	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	89.5	62.0
Decachlorobiphenyl	106.7 nrs	92.2 nrs

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	11509426	-16.2
Hexabromobiphenyl	7186114	2225447	-69.0 <- fails low due to oily matrix

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	30786064	-4.9
Hexabromobiphenyl	10251097	4661926	-54.5 <- fails low due to oily matrix

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

	ZB5 Col					ZB35 Col				
Aroclor	Peak#	RT	Shift	Area	Amount	Peak#	RT	Shift	Area	Amount
Aroclor-1016	1	6.008	0.001	28750	7.9	1	6.499	0.009	338854	9.3
Aroclor-1016	2	6.408	0.000	47641	4.0	2	6.712	0.015	130545	8.7
Aroclor-1016	3	---			0.0	3	6.794	-0.074	105073	11.3
Aroclor-1016	4	7.375	-0.002	39454	9.4	4	7.383	0.002	112182	11.6
Total Col1Ave (3 peaks):				7.1		Total Col2Ave (4 peaks):			10.2	RPD = 36
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):			9.8	
Aroclor-1221	1	3.387	0.013	212448	274.6	1	3.452	-0.009	549931	223.4
Aroclor-1221	2	4.723	-0.007	416541	218.9	2	4.785	-0.009	1098326	187.5
Aroclor-1221	3	4.962	-0.052	65022	19.4	3	5.172	0.013	5452945	578.6
Aroclor-1221	NS	---			----	4	6.499	-0.011	338854	101.7
Total Col1Ave (3 peaks):				171.8		Total Col2Ave (4 peaks):			272.8	RPD = 46*
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):			170.9	
Aroclor-1232	1	3.387	0.013	212448	441.3	1	3.452	-0.009	549931	331.0
Aroclor-1232	2	6.008	0.002	28750	18.7	2	5.849	-0.023	94160	11.6
Aroclor-1232	3	6.408	0.002	47641	9.5	3	6.499	-0.011	338854	21.1
Aroclor-1232	4	7.375	-0.001	39454	17.4	4	7.383	-0.019	112182	23.0
Total Col1Ave (4 peaks):				121.7		Total Col2Ave (4 peaks):			96.7	RPD = 23
Corrected Ave (3 peaks):				15.2		Corrected Ave (3 peaks):			18.6	RPD = 20
Aroclor-1242	1	6.008	0.001	28750	9.2	1	5.849	-0.010	94160	6.7
Aroclor-1242	2	6.408	0.000	47641	4.7	2	6.499	0.003	338854	11.4
Aroclor-1242	3	---			0.0	3	7.914	-0.002	56328	6.8
Aroclor-1242	4	8.031	-0.001	130688	35.1	4	8.237	-0.020	164424	16.4
Total Col1Ave (3 peaks):				16.3		Total Col2Ave (4 peaks):			10.3	RPD = 45*
Corrected Ave: < 3 Peaks						Corrected Ave (3 peaks):			8.3	
Aroclor-1248	1	7.012	0.040	1232399	347.7	1	6.979	-0.000	133304	10.3
Aroclor-1248	2	7.375	-0.002	39454	6.0	2	7.383	0.000	112182	8.9
Aroclor-1248	3	7.808	0.009	191827	22.1	3	7.839	0.001	132241	8.9
Aroclor-1248	4	8.031	-0.002	130688	22.6	4	8.237	-0.013	164424	10.1
Total Col1Ave (4 peaks):				99.6		Total Col2Ave (4 peaks):			9.5	RPD = 165*
Corrected Ave (3 peaks):				16.9		Corrected Ave (3 peaks):			9.3	RPD = 58*
Aroclor-1254	1	8.115	0.001	290696	33.0	1	8.148	-0.001	734708	48.3
Aroclor-1254	2	8.232	0.042	152382	52.8	2	8.237	-0.004	164424	21.3
Aroclor-1254	3	8.497	0.012	225295	45.3	3	8.637	-0.021	1058959	93.2
Aroclor-1254	4	8.618	0.001	414128	37.2	4	8.803	-0.001	609193	32.1
Aroclor-1254	5	9.271	-0.049	965538	148.0	5	9.576	0.000	764802	62.1
Total Col1Ave (5 peaks):				63.3		Total Col2Ave (5 peaks):			51.4	RPD = 21
Corrected Ave (4 peaks):				42.1		Corrected Ave (4 peaks):			41.0	RPD = 3
Aroclor-1260	1	9.871	0.001	408892	163.5	1	10.334	-0.002	1190399	182.4
Aroclor-1260	2	10.554	0.001	1286266	247.2	2	10.609	-0.001	2348654	190.2
Aroclor-1260	3	10.949	-0.001	478687	210.9	3	11.117	-0.002	651735	177.0
Aroclor-1260	4	11.064	0.000	198740	178.3	4	11.172	-0.003	1455759	184.8
Aroclor-1260	5	11.795	-0.004	287141	273.4	NS	---			----
Total Col1Ave (5 peaks):				214.7		Total Col2Ave (4 peaks):			183.6	RPD = 16
Corrected Ave (4 peaks):				200.0		Corrected Ave (3 peaks):			181.4	RPD = 10
Aroclor-1262	1	10.185	-0.001	387288	144.7	1	9.899	-0.021	1002068	123.4
Aroclor-1262	2	10.554	0.000	1286266	221.1	2	10.334	-0.023	1190399	161.5
Aroclor-1262	3	10.949	-0.002	478687	286.1	3	10.609	-0.021	2348654	179.0
Aroclor-1262	4	11.064	-0.001	198740	92.6	4	11.172	-0.029	1455759	165.2
Aroclor-1262	5	11.795	-0.005	287141	190.7	5	11.905	-0.024	604831	135.4
Total Col1Ave (5 peaks):				187.0		Total Col2Ave (5 peaks):			152.9	RPD = 20
Corrected Ave (4 peaks):				162.3		Corrected Ave (4 peaks):			146.4	RPD = 10
Aroclor-1268	1	11.064	-0.002	198740	32.6	1	11.117	-0.025	651735	47.7
Aroclor-1268	2	11.137	0.000	214528	37.0	2	11.172	-0.036	1455759	104.8
Aroclor-1268	3	11.524	0.014	82449	20.0	3	11.578	0.019	42637	3.9

```
Aroclor-1268 4  12.301   0.000    147949    12.2      4   12.380  -0.026   136450     4.4
      Total Col1Ave (4 peaks):    25.4       Total Col2Ave (4 peaks):    40.2   RPD = 45*
      Corrected Ave (3 peaks):    21.6       Corrected Ave (3 peaks):    18.7   RPD = 15
```

Total PCB Area Col1 (4.485 - 12.604) = 17456388 Col1 Total PCB = 0.16 ppm*

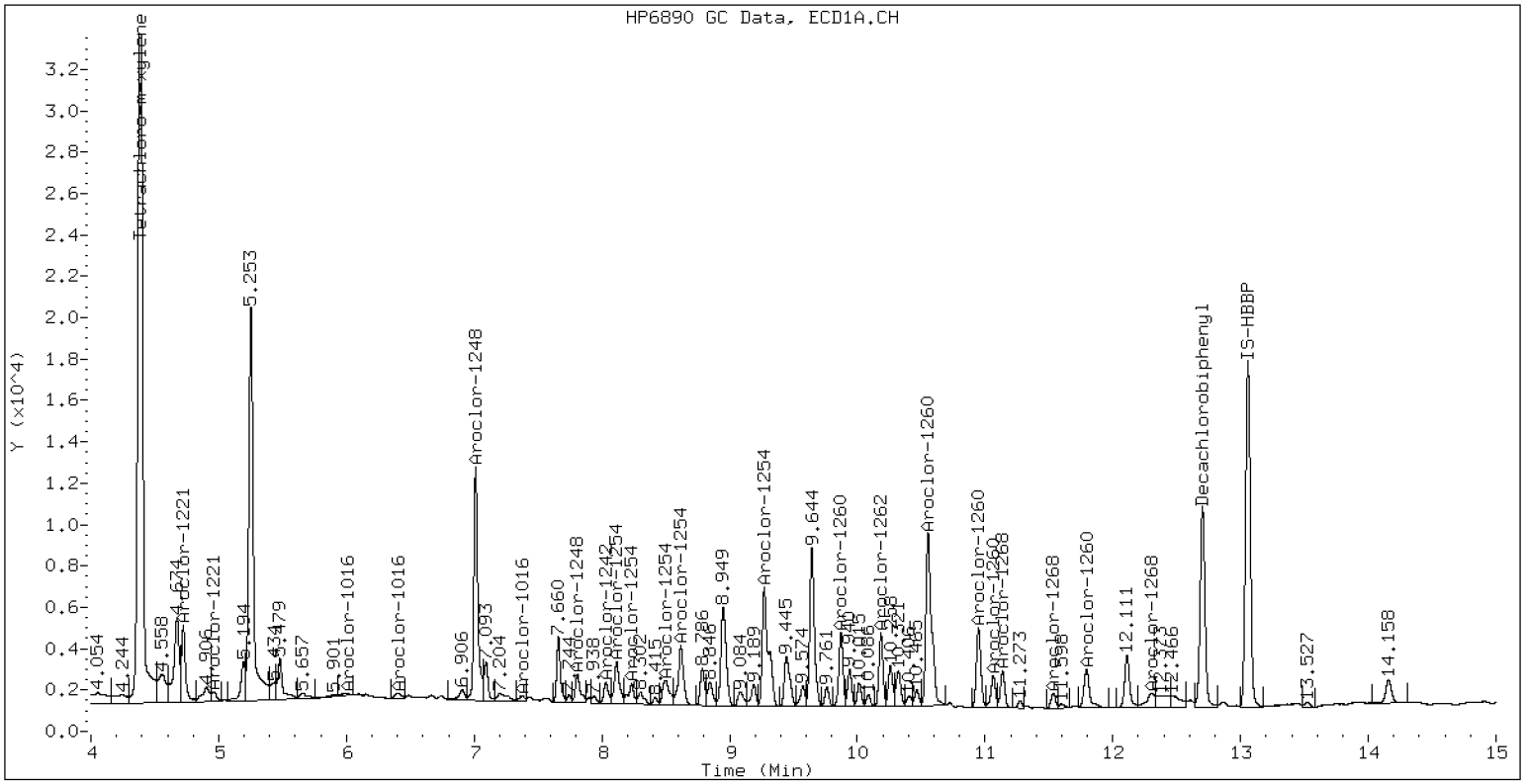
Total PCB Area Col2 (4.485 - 12.604) = 39907754 Col2 Total PCB = 0.19 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

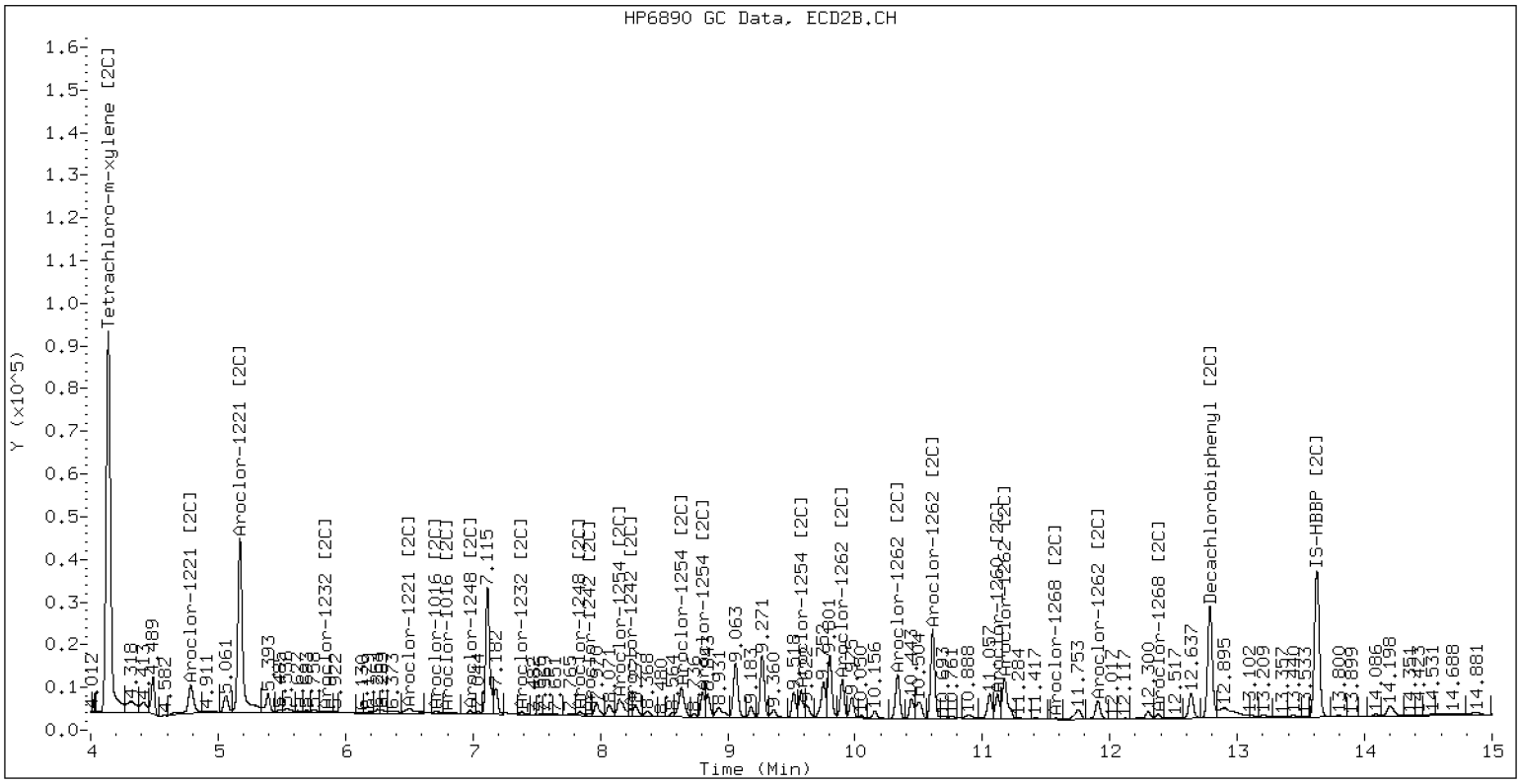
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052208ECD5.D 19E0222-05 22-MAY-2019 10:24 2ul JGR



ZB-5 Manual Integration: NO

ECD5-ZB35 /20190522.b/20190522.b/19052208ECD5.D 19E0222-05



ZB-35 Manual Integration: YES

Analytical Resources, Incorporated
Analytical Chemists and Consultants

17th-ST1-050819

Dual Column

ORGANIC ANALYSIS DATA SHEET
EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Solid	Laboratory ID:	19E0222-05RE1 A	File ID:	19052214ECD5.D
Sampled:	05/08/19 11:35	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 12:32
% Solids:	18.08	Preparation:	EPA 3546 (Microwave)	Initial/Final:	10.36 g Wet / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column 1:	ZB5	Column 2:	ZB35

CAS NO.	COMPOUND	Col #	DILUTION	CONC. (ug/kg dry)	MDL	RL	Q
12674-11-2	Aroclor 1016	1	5	267	107	267	U
11104-28-2	Aroclor 1221	1	5	267	107	267	U
11141-16-5	Aroclor 1232	1	5	267	107	267	U
53469-21-9	Aroclor 1242	1	5	267	107	267	U
12672-29-6	Aroclor 1248	1	5	267	107	267	U
11097-69-1	Aroclor 1254	1	5	267	107	267	U
11096-82-5	Aroclor 1260	2	5	574	124	267	D

SURROGATES	Col #	ADDED (ug/kg dry)	CONC (ug/kg dry)	% REC	QC LIMITS	Q
Decachlorobiphenyl	*1*	*106.78*			*40 - 133*	*NRS*
Tetrachlorometaxylene	*1*	*106.78*	*90.0*	*84.3*	*53 - 120*	
Decachlorobiphenyl	*2*	*106.78*	*124*	*116*	*40 - 133*	
Tetrachlorometaxylene	*2*	*106.78*	*80.2*	*75.1*	*53 - 120*	

INTERNAL STANDARDS	Col #	Cal Ref Response	Response	% REC	QC LIMITS	Q
1-Bromo-2-Nitrobenzene	*1*	*13740310*	*13027010*	*94.8*	*50 - 200*	
Hexabromobiphenyl	*1*	*7186114*	*3157216*	*43.9*	*50 - 200*	*
1-Bromo-2-Nitrobenzene	*2*	*32377010*	*38144270*	*117.8*	*50 - 200*	
Hexabromobiphenyl	*2*	*10251100*	*6077615*	*59.3*	*50 - 200*	

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052214ECD5.D
Data file 2: /20190522.b/20190522.b/19052214ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: 19E0222-05RE1
Client ID:
Injection Date: 22-MAY-2019 12:32
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 5.000

ZB5 Col RT	Shift	Response	ZB35 Col RT	Shift	Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.384	-0.001	1123129	4.137	-0.001	3378229	6.7	6.0	11.6	Tetrachloro-m-xylene
12.703	-0.001	344211	12.785	-0.001	1116506	7.9	9.3	15.4	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	84.3	75.1
Decachlorobiphenyl	~~99.~~3 nrs	115.9

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	13027008	-5.2
Hexabromobiphenyl	7186114	3157216	-56.1 <-

fails low due to oily matrix

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	38144269	17.8
Hexabromobiphenyl	10251097	6077615	-40.7

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

Aroclor	Peak#	ZB5 Col RT	Shift	Area	Amount	Peak#	ZB35 Col RT	Shift	Area	Amount
Aroclor-1016	1	---			0.0	1	6.500	0.009	44475	1.0
Aroclor-1016	2	---			0.0	2	6.705	0.008	12925	0.7
Aroclor-1016	3	---			0.0	3	---			0.0
Aroclor-1016	4	---			0.0	4	7.381	-0.001	57605	4.8
		Col1Ave: <3 Quant Peaks					Col2Ave:		2.2	
Aroclor-1221	1	3.389	0.015	91952	105.0	1	3.447	-0.015	266961	87.5
Aroclor-1221	2	4.722	-0.008	81372	37.8	2	4.783	-0.011	397636	54.8
Aroclor-1221	3	---			0.0	3	5.170	0.011	1639431	140.4
Aroclor-1221	NS	---			----	4	6.500	-0.010	44475	10.8
		Col1Ave: <3 Quant Peaks					Col2Ave:		73.4	
Aroclor-1232	1	---			0.0	1	3.447	-0.015	266961	129.7
Aroclor-1232	2	---			0.0	2	5.867	-0.005	13497	1.3
Aroclor-1232	3	---			0.0	3	6.500	-0.010	44475	2.2
Aroclor-1232	4	---			0.0	4	7.381	-0.021	57605	9.5
		Col1Ave: <3 Quant Peaks					Col2Ave:		35.7	
Aroclor-1242	1	---			0.0	1	5.867	0.008	13497	0.8
Aroclor-1242	2	---			0.0	2	6.500	0.004	44475	1.2
Aroclor-1242	3	---			0.0	3	7.916	-0.000	21903	2.1
Aroclor-1242	4	---			0.0	4	8.239	-0.018	59660	4.8
		Col1Ave: <3 Quant Peaks					Col2Ave:		2.2	
Aroclor-1248	1	7.010	0.039	292213	72.8	1	6.977	-0.002	31232	1.9
Aroclor-1248	2	---			0.0	2	7.381	-0.002	57605	3.7
Aroclor-1248	3	7.807	0.008	67630	6.9	3	7.841	0.003	63204	3.4
Aroclor-1248	4	8.031	-0.002	45194	6.9	4	8.239	-0.011	59660	3.0
		Total Col1Ave (3 peaks):			28.9		Total Col2Ave (4 peaks):			3.0 RPD = 162*
		Corrected Ave: < 3 Peaks					Corrected Ave (3 peaks):			2.8
Aroclor-1254	1	8.115	0.000	90594	9.1	1	8.148	-0.001	252772	13.4
Aroclor-1254	2	8.232	0.042	51975	15.9	2	8.239	-0.002	59660	6.3
Aroclor-1254	3	8.498	0.013	59594	10.6	3	8.636	-0.022	286941	20.4
Aroclor-1254	4	8.618	0.001	125007	9.9	4	8.803	-0.002	188094	8.0
Aroclor-1254	5	9.270	-0.050	275015	37.2	5	9.574	-0.002	245891	16.1
		Total Col1Ave (5 peaks):			16.5		Total Col2Ave (5 peaks):			12.8 RPD = 25
		Corrected Ave (4 peaks):			11.4		Corrected Ave (4 peaks):			10.9 RPD = 4
Aroclor-1260	1	9.870	-0.001	124273	35.0	1	10.334	-0.002	375883	44.2
Aroclor-1260	2	10.552	-0.000	380005	51.5	2	10.608	-0.002	726742	45.1
Aroclor-1260	3	10.948	-0.002	135090	42.0	3	11.117	-0.002	202379	42.2
Aroclor-1260	4	11.064	0.000	55496	35.1	4	11.172	-0.003	417084	40.6
Aroclor-1260	5	11.795	-0.004	78544	52.7	NS	---			----
		Total Col1Ave (5 peaks):			45.3		Total Col2Ave (4 peaks):			43.0 RPD = 1
		Corrected Ave (4 peaks):			40.9		Corrected Ave (3 peaks):			42.3 RPD = 3
Aroclor-1262	1	10.184	-0.002	119826	31.5	1	9.898	-0.023	332609	31.4
Aroclor-1262	2	10.552	-0.001	380005	46.1	2	10.334	-0.024	375883	39.1
Aroclor-1262	3	10.948	-0.003	135090	56.9	3	10.608	-0.023	726742	42.5
Aroclor-1262	4	11.064	-0.001	55496	18.2	4	11.172	-0.029	417084	36.3
Aroclor-1262	5	11.795	-0.005	78544	36.8	5	11.906	-0.023	217715	37.4
		Total Col1Ave (5 peaks):			37.9		Total Col2Ave (5 peaks):			37.3 RPD = 1
		Corrected Ave (4 peaks):			33.1		Corrected Ave (4 peaks):			36.1 RPD = 8
Aroclor-1268	1	11.064	-0.002	55496	6.4	1	11.117	-0.025	202379	11.4
Aroclor-1268	2	11.136	-0.001	60556	7.4	2	11.172	-0.036	417084	23.0
Aroclor-1268	3	11.534	0.013	20550	3.1	3	11.576	-0.020	8852	0.6
Aroclor-1268	4	12.304	0.003	59593	3.5	4	12.380	-0.027	91926	2.3
		Total Col1Ave (4 peaks):			5.1		Total Col2Ave (4 peaks):			9.3 RPD = 59*
		Corrected Ave (3 peaks):			4.3		Corrected Ave (3 peaks):			4.7 RPD = 9

Total PCB Area Col1 (4.485 - 12.604) = 4526957 Col1 Total PCB = 0.04 ppm*

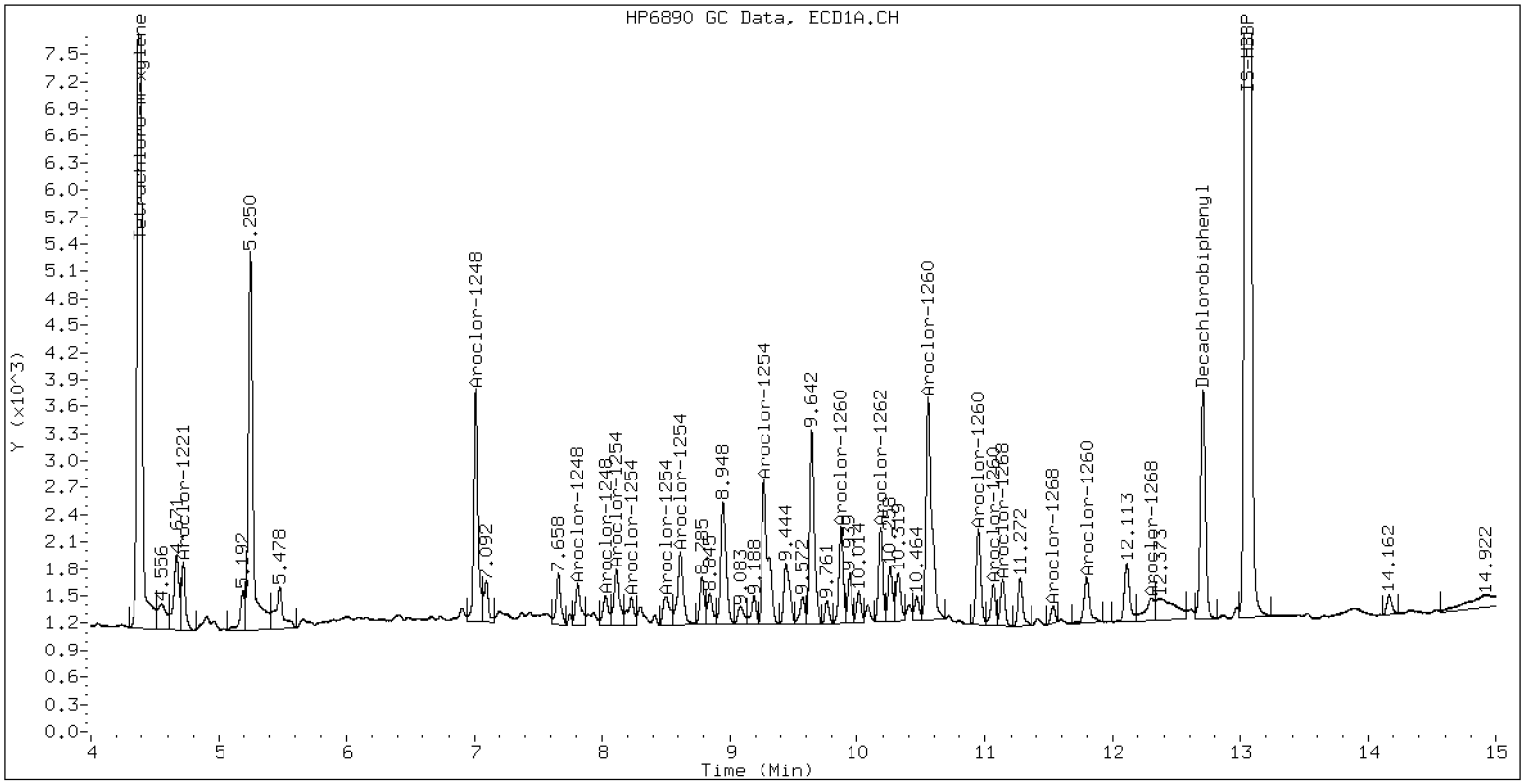
Total PCB Area Col2 (4.485 - 12.604) = 12835920 Col2 Total PCB = 0.06 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

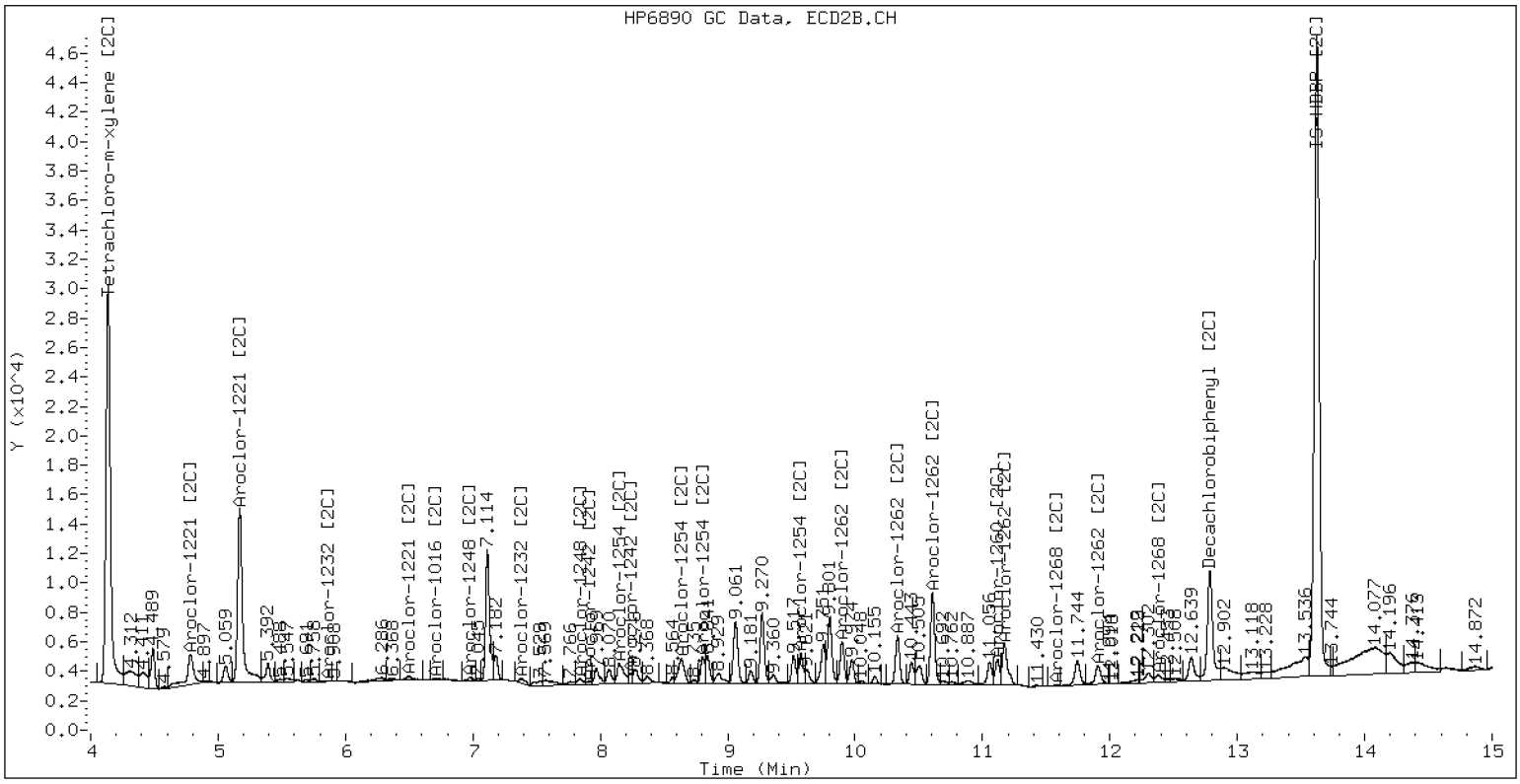
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052214ECD5.D 19E0222-05RE1 22-MAY-2019 12:32 2ul JGR



ZB-5 Manual Integration: NO

ECD5-ZB35 /20190522.b/20190522.b/19052214ECD5.D 19E0222-05RE1



ZB-35 Manual Integration: NO

Analytical Resources, Incorporated
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Batch:	BHE0486	Batch Matrix:	Solid	Preparation:	EPA 3546 (Microwave)

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	19052206ECD5.D	05/20/19 11:00	
ST09-050819	19E0222-03	19052207ECD5.D	05/20/19 11:00	
ST09-050819	19E0222-03RE1	19052213ECD5.D	05/20/19 11:00	Added 5/23/2019 by JGR
17th-ST1-050819	19E0222-05	19052208ECD5.D	05/20/19 11:00	
17th-ST1-050819	19E0222-05RE1	19052214ECD5.D	05/20/19 11:00	Added 5/23/2019 by JGR
Blank	BHE0486-BLK1	19052204ECD5.D	05/20/19 11:00	
LCS	BHE0486-BS1	19052205ECD5.D	05/20/19 11:00	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Cleanup Batch:	CHE0190	Cleanup Type:	Sulfuric Acid
Cleanup Method:	EPA 3665A Sulfuric Acid Cleanup	Analysis:	EPA 8082A

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	19052206ECD5.D	05/21/2019	
17th-ST1-050819	19E0222-05	19052208ECD5.D	05/21/2019	
Blank	BHE0486-BLK1	19052204ECD5.D	05/21/2019	
LCS	BHE0486-BS1	19052205ECD5.D	05/21/2019	
ST09-050819	19E0222-03	19052207ECD5.D	05/21/2019	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Cleanup Batch:	CHE0191	Cleanup Type:	Sulfur
Cleanup Method:	EPA 3660B Sulfur Cleanup	Analysis:	EPA 8082A

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
Blank	BHE0486-BLK1	19052204ECD5.D	05/21/2019	
LCS	BHE0486-BS1	19052205ECD5.D	05/21/2019	
ST10-050819	19E0222-01	19052206ECD5.D	05/21/2019	
17th-ST1-050819	19E0222-05	19052208ECD5.D	05/21/2019	
ST09-050819	19E0222-03	19052207ECD5.D	05/21/2019	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

CLEANUP BATCH SUMMARY

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Cleanup Batch:	CHE0192	Cleanup Type:	Silica Gel
Cleanup Method:	EPA 3630C Silica Gel Cleanup	Analysis:	EPA 8082A

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	19052206ECD5.D	05/21/2019	
Blank	BHE0486-BLK1	19052204ECD5.D	05/21/2019	
LCS	BHE0486-BS1	19052205ECD5.D	05/21/2019	
ST09-050819	19E0222-03	19052207ECD5.D	05/21/2019	
17th-ST1-050819	19E0222-05	19052208ECD5.D	05/21/2019	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
METHOD BLANK DATA SHEET
EPA 8082A

Blank

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Solid	Laboratory ID:	BHE0486-BLK1	File ID:	19052204ECD5.D
Sampled:	N/A	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 08:59
Solids:		Preparation:	EPA 3546 (Microwave)	Initial/Final:	5 g / 5 mL
Batch:	BHE0486	Sequence:	SHE0332	Calibration:	CE00008
Instrument:	ECD5	Column:	ZB5	Cleanups:	Silica Gel, Sulfur, Sulfuric Acid

CAS NO.	COMPOUND	DILUTION	CONC. (ug/kg wet)	Q	DL	RL
12674-11-2	Aroclor 1016	1	20.0	U	8.0	20.0
11104-28-2	Aroclor 1221	1	20.0	U	8.0	20.0
11141-16-5	Aroclor 1232	1	20.0	U	8.0	20.0
53469-21-9	Aroclor 1242	1	20.0	U	8.0	20.0
12672-29-6	Aroclor 1248	1	20.0	U	8.0	20.0
11097-69-1	Aroclor 1254	1	20.0	U	8.0	20.0
11096-82-5	Aroclor 1260	1	20.0	U	9.3	20.0

SURROGATES	ADDED (ug/kg wet)	CONC (ug/kg wet)	% REC	QC LIMITS	Q
Decachlorobiphenyl	40.000	38.9	97.2	40 - 133	
Tetrachlorometaxylene	40.000	35.9	89.7	53 - 120	
Decachlorobiphenyl [2C]	40.000	38.9	97.3	40 - 133	
Tetrachlorometaxylene [2C]	40.000	24.9	62.2	53 - 120	

INTERNAL STANDARDS	AREA	RT	REF AREA	REF RT	Q
1-Bromo-2-Nitrobenzene	11737030	2.272	14827220	2.272	
Hexabromobiphenyl	6159531	13.059	7443589	13.059	

Analytical Resources Inc.
Dual Column 608/8082 PCB

Data file 1: /20190522.b/19052204ECD5.D
Data file 2: /20190522.b/20190522.b/19052204ECD5.D
Method: ecd5.i\20190522.b\PCB.m
Instrument, Inj.Vol, Analyst: ecd5.i, 2ul, JGR
Compound Sublist: PCB.sub
Quant Method: Internal Std

ARI ID: BHE0486-BLK1
Client ID:
Injection Date: 22-MAY-2019 08:59
Matrix: NONE
Ical Date: 02-MAY-2019
Dilution Factor: 1.000

ZB5 Col RT	ZB5 Col Shift	ZB5 Col Response	ZB35 Col RT	ZB35 Col Shift	ZB35 Col Response	ZB5 on col	ZB35 on col	RPD	Compound/Flag
4.383	-0.002	5382992	4.138	0.000	12065631	35.9	24.9	36.2	Tetrachloro-m-xylene
12.703	-0.000	3286317	12.789	0.002	6047589	38.9	38.9	0.1	Decachlorobiphenyl

* Indicates RPD > 40%
M Indicates Column 1 peak was manually integrated
N Indicates Column 2 peak was manually integrated

SURROGATE PERCENT RECOVERY

SURROGATE	Col1	Col2
Tetrachloro-m-xylene	89.7	62.2
Decachlorobiphenyl	97.2	97.3

INTERNAL STANDARD SUMMARY

Column 1

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	13740310	11737031	-14.6
Hexabromobiphenyl	7186114	6159531	-14.3

Column 2

Standard Cpnd	Standard Area*	Sample Area	%D
Bromo-Nitrobenzene	32377014	32893421	1.6
Hexabromobiphenyl	10251097	7840027	-23.5

* Standard Areas taken from Initial Cal Level 3
Initial Calibration Date: 02-MAY-2019
<- Indicates standard response outside Limits (-50 to +100%)

	ZB5 Col					ZB35 Col				
Aroclor	Peak#	RT	Shift	Area	Amount	Peak#	RT	Shift	Area	Amount
Aroclor-1016	1	---			0.0	1	6.484	-0.007	56961	1.5
Aroclor-1016	2	---			0.0	2	6.618	-0.079	6311	0.4
Aroclor-1016	3	---			0.0	3	---			0.0
Aroclor-1016	4	---			0.0	4	7.335	-0.047	128237	12.4
	Col1Ave: <3 Quant Peaks					Col2Ave: 4.8				
Aroclor-1221	1	3.332	-0.042	130433	165.3	1	---			0.0
Aroclor-1221	2	4.720	-0.010	246440	127.0	2	4.807	0.012	149034	23.8
Aroclor-1221	3	---			0.0	3	5.153	-0.006	81107	8.1
Aroclor-1221	NS	---			----	4	6.484	-0.026	56961	16.0
	Col1Ave: <3 Quant Peaks					Col2Ave: 16.0				
Aroclor-1232	1	3.332	-0.042	130433	265.7	1	---			0.0
Aroclor-1232	2	5.926	-0.081	35276	22.6	2	5.907	0.035	70310	8.1
Aroclor-1232	3	---			0.0	3	6.484	-0.027	56961	3.3
Aroclor-1232	4	---			0.0	4	7.335	-0.068	128237	24.6
	Col1Ave: <3 Quant Peaks					Col2Ave: 12.0				
Aroclor-1242	1	---			0.0	1	5.907	0.048	70310	4.7
Aroclor-1242	2	---			0.0	2	6.484	-0.012	56961	1.8
Aroclor-1242	3	---			0.0	3	7.844	-0.072	101460	11.5
Aroclor-1242	4	---			0.0	4	8.244	-0.013	43925	4.1
	Col1Ave: <3 Quant Peaks					Col2Ave: 5.5				
Aroclor-1248	1	---			0.0	1	---			0.0
Aroclor-1248	2	---			0.0	2	7.335	-0.048	128237	9.5
Aroclor-1248	3	---			0.0	3	7.844	0.007	101460	6.4
Aroclor-1248	4	---			0.0	4	8.244	-0.006	43925	2.5
	Col1Ave: <3 Quant Peaks					Col2Ave: 6.1				
Aroclor-1254	1	---			0.0	1	8.244	0.095	43925	2.7
Aroclor-1254	2	---			0.0	2	---			0.0
Aroclor-1254	3	---			0.0	3	8.635	-0.023	102607	8.4
Aroclor-1254	4	---			0.0	4	---			0.0
Aroclor-1254	5	---			0.0	5	9.549	-0.027	19095	1.5
	Col1Ave: <3 Quant Peaks					Col2Ave: 4.2				
Aroclor-1260	1	---			0.0	1	---			0.0
Aroclor-1260	2	---			0.0	2	---			0.0
Aroclor-1260	3	---			0.0	3	---			0.0
Aroclor-1260	4	---			0.0	4	---			0.0
Aroclor-1260	5	---			0.0	NS	---			----
	Col1Ave: <3 Quant Peaks					Col2Ave: <3 Quant Peaks				
Aroclor-1262	1	---			0.0	1	---			0.0
Aroclor-1262	2	---			0.0	2	---			0.0
Aroclor-1262	3	---			0.0	3	---			0.0
Aroclor-1262	4	---			0.0	4	---			0.0
Aroclor-1262	5	---			0.0	5	---			0.0
	Col1Ave: <3 Quant Peaks					Col2Ave: <3 Quant Peaks				
Aroclor-1268	1	---			0.0	1	11.073	-0.070	11040	0.5
Aroclor-1268	2	---			0.0	2	---			0.0
Aroclor-1268	3	---			0.0	3	---			0.0
Aroclor-1268	4	---			0.0	4	12.382	-0.025	10136	0.2
	Col1Ave: <3 Quant Peaks					Col2Ave: <3 Quant Peaks				

Total PCB Area Col1 (4.485 - 12.604) = 1015115 Col1 Total PCB = 0.01 ppm*

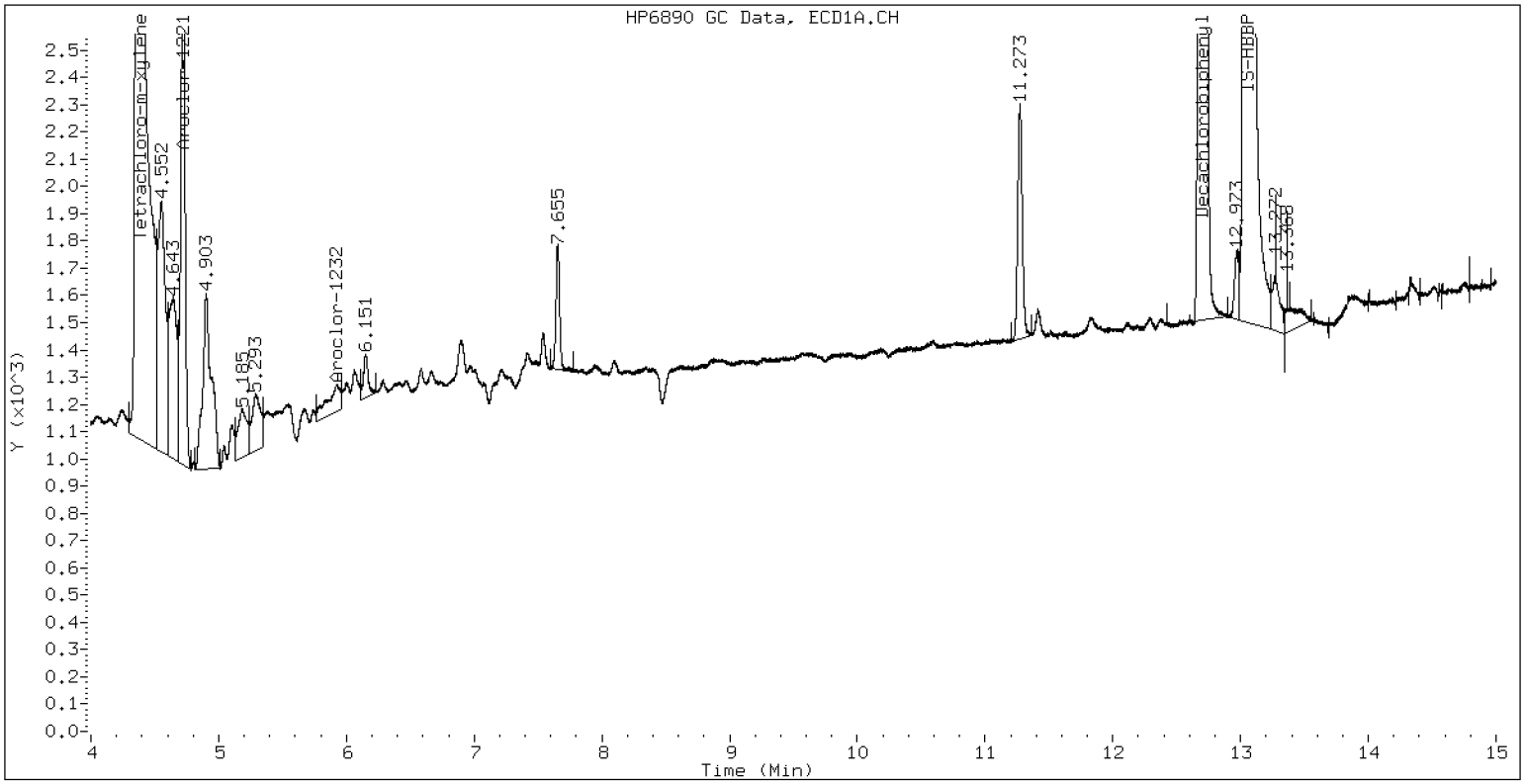
Total PCB Area Col2 (4.485 - 12.604) = 3004478 Col2 Total PCB = 0.01 ppm*

* Quantitated against AR1660 0.25ppm in Ical

PCB-Form 10 Mod.

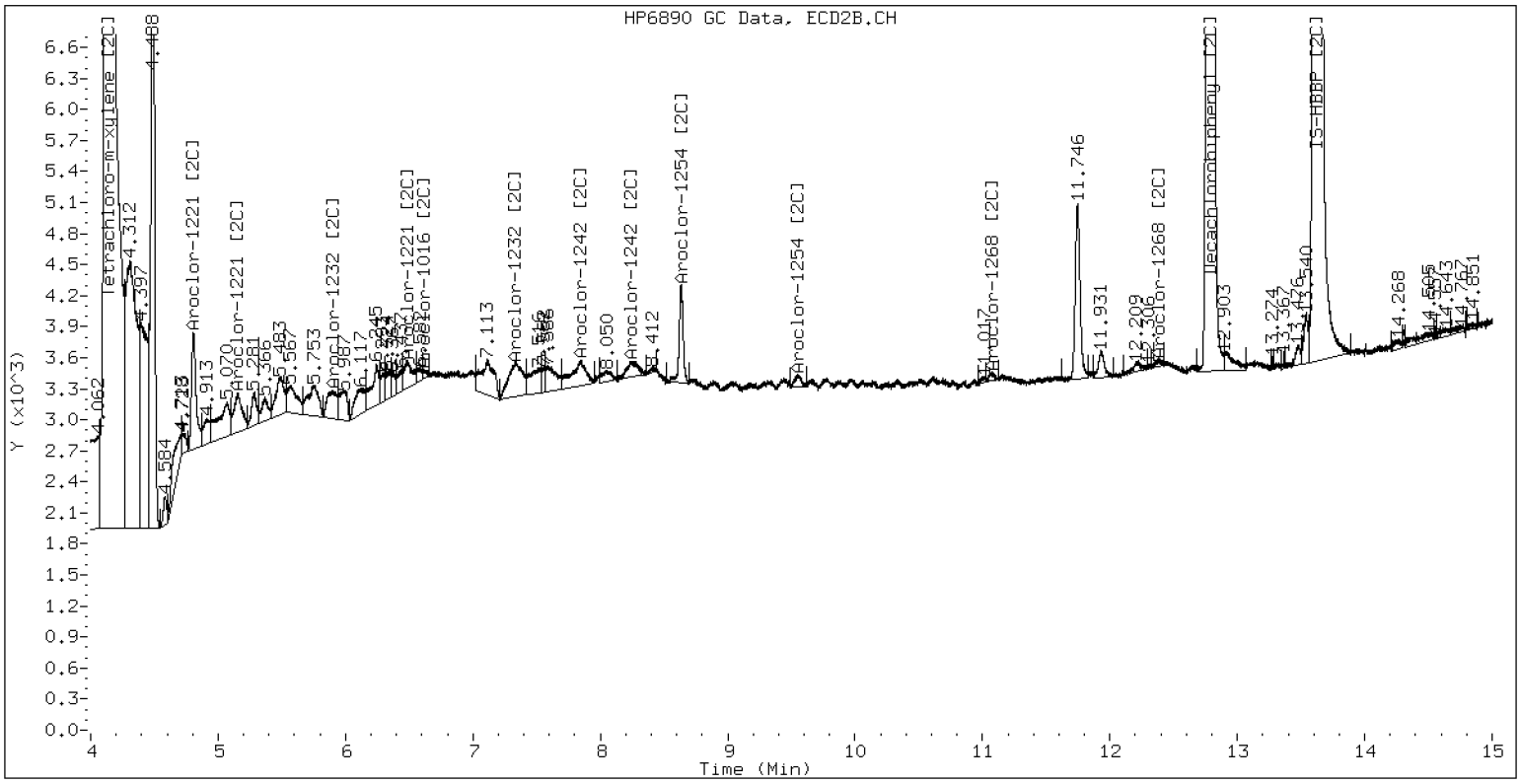
PCB Dual Column Chromatograms

ECD5-ZB5 /20190522.b/19052204ECD5.D BHE0486-BLK1 22-MAY-2019 08:59 2ul JGR



ZB-5 Manual Integration: NO

ECD5-ZB35 /20190522.b/20190522.b/19052204ECD5.D BHE0486-BLK1

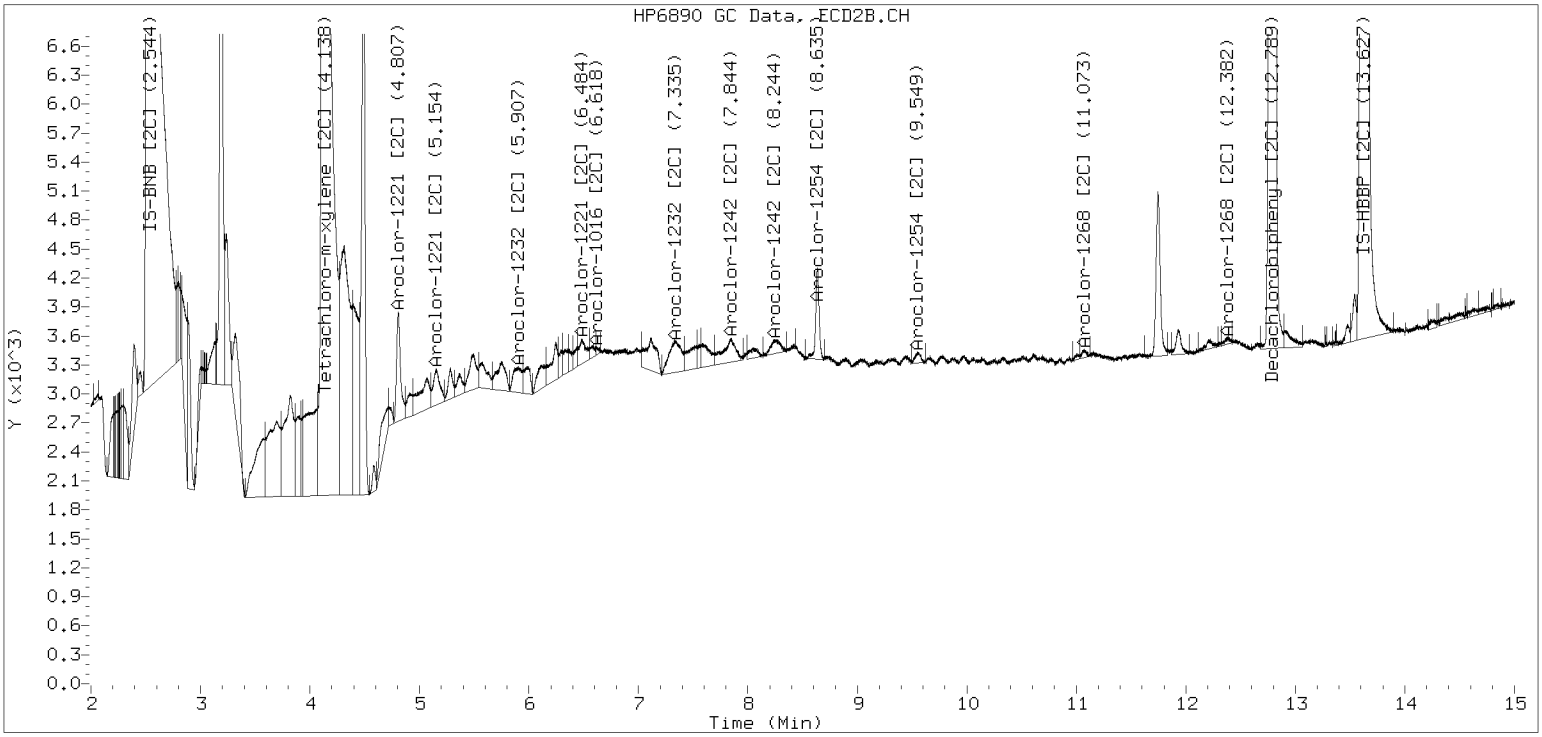


ZB-35 Manual Integration: YES

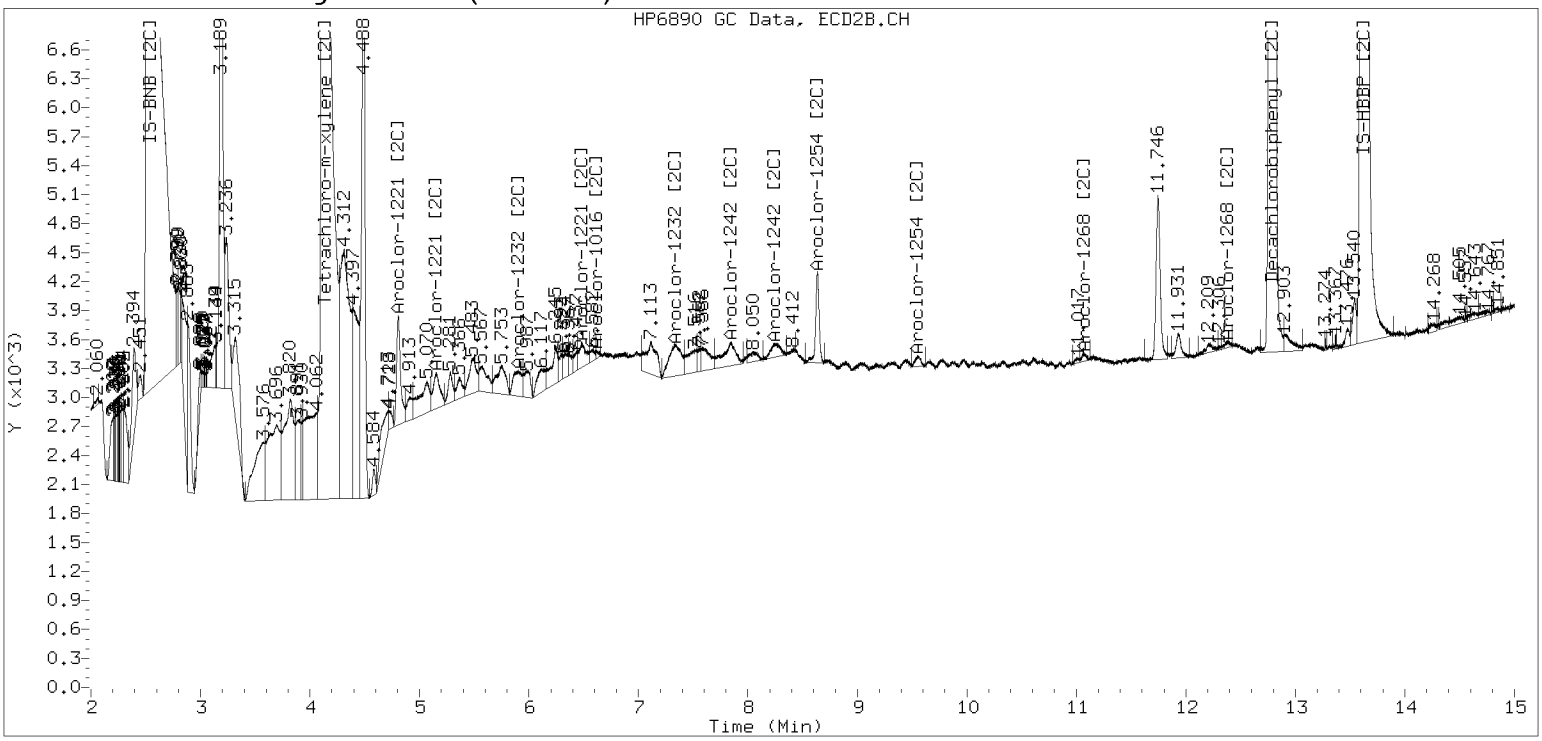
Manual Peak Adjustment, ZB-35

Datafile: ecd5.i/20190522.b/20190522.b/19052204ECD5.D Injection Date: 22-MAY-2

Manual Integration (After)



Processed Integration (Before)



Analytical Resources, Incorporated
Analytical Chemists and Consultants

LCS / LCS DUPLICATE RECOVERY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	05/22/19 09:20
Batch:	BHE0486	Laboratory ID:	BHE0486-BS1
Preparation:	EPA 3546 (Microwave)	Sequence Name:	LCS
Initial/Final:	5 g / 5 mL		

COMPOUND	SPIKE ADDED (ug/kg wet)	LCS CONCENTRATION (ug/kg wet)	Q	LCS % REC. #	QC LIMITS REC.
Aroclor 1016	500	457		91.4	52 - 120
Aroclor 1260 [2C]	500	401		80.3	57 - 120

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (1):	ZB5

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
Aroclor 1016	250	4.444832E-02	20	3.841759E-02	50	3.795474E-02	1000	3.703254E-02	100	4.268972E-02	500	4.127154E-02
Aroclor 1260	250	8.761422E-02	20	9.854602E-02	50	8.175295E-02	1000	8.485714E-02	100	8.748948E-02	500	8.334489E-02
Decachlorobiphenyl	40	1.151331	3.2	1.074519	8	1.006655	160	1.080331	16	1.156122	80	1.116435
Tetrachlorometaxylene	40	1.116161	3.2	0.9714149	8	0.9888867	160	0.9098073	16	1.137245	80	1.012059

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (1):	ZB5

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
Aroclor 1232									250	1.612173E-02		
Aroclor 1242	250	3.477581E-02										
Aroclor 1248			250	4.281088E-02								
Aroclor 1254					250	0.0477245						

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INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (1):	ZB5

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
Aroclor 1016	4.030241E-02	7.3			RSD (20)	
Aroclor 1232		0.0			RSD (20)	
Aroclor 1242		0.0			RSD (20)	
Aroclor 1248		0.0			RSD (20)	
Aroclor 1254		0.0			RSD (20)	
Aroclor 1260	8.726745E-02	6.9			RSD (20)	
Decachlorobiphenyl	1.097565	5.1			RSD (20)	
Tetrachlorometaxylene	1.022596	8.6			RSD (20)	

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INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (2):	ZB35

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
Aroclor 1016 [2C]	250	4.605422E-02	20	0.0542009	50	4.700244E-02	1000	3.508827E-02	100	4.995564E-02	500	4.192798E-02
Aroclor 1260 [2C]	250	0.1244326	20	0.1493977	50	0.1350711	1000	0.1139656	100	0.142852	500	0.1176089
Decachlorobiphenyl [2C]	40	1.549978	3.2	1.759333	8	1.602749	160	1.366297	16	1.777107	80	1.458407
Tetrachlorometaxylene [2C]	40	1.187907	3.2	1.356485	8	1.222418	160	0.934375	16	1.311023	80	1.066778

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INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (2):	ZB35

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
Aroclor 1232 [2C]									250	0.0199578		
Aroclor 1242 [2C]	250	4.042401E-02										
Aroclor 1248 [2C]			250	3.682197E-02								
Aroclor 1254 [2C]					250	3.408291E-02						

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INITIAL CALIBRATION DATA
EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00008	Instrument:	ECD5
Calibration Date:	05/02/2019 0:00	Column (2):	ZB35

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	Limit Type & Limit	Q
Aroclor 1016 [2C]	4.570491E-02	14.5			RSD (20)	
Aroclor 1232 [2C]		0.0			RSD (20)	
Aroclor 1242 [2C]		0.0			RSD (20)	
Aroclor 1248 [2C]		0.0			RSD (20)	
Aroclor 1254 [2C]		0.0			RSD (20)	
Aroclor 1260 [2C]	0.1305546	10.9			RSD (20)	
Decachlorobiphenyl [2C]	1.585645	10.3			RSD (20)	
Tetrachlorometaxylene [2C]	1.179831	13.3			RSD (20)	

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
Client: Seattle Public Utilities
Calibration: CE00008
Sequence: SHE0019

SDG: 19E0222
Project: Lower Duwamish Waterway
Laboratory ID: SHE0019-SCV1
Sequence Name: AR1660SCV1
Standard ID: H004289

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1016	250.00	267	6.8	20.00
Aroclor 1016 [2C]	250.00	252	1.0	20.00
Aroclor 1260	250.00	243	-2.8	20.00
Aroclor 1260 [2C]	250.00	244	-2.5	20.00
Decachlorobiphenyl	40.000	37.1	-7.3	20.00
Tetrachlorometaxylene	40.000	41.3	3.2	20.00
Decachlorobiphenyl [2C]	40.000	35.8	-10.6	20.00
Tetrachlorometaxylene [2C]	40.000	38.9	-2.6	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
Client: Seattle Public Utilities
Calibration: CE00008
Sequence: SHE0019

SDG: 19E0222
Project: Lower Duwamish Waterway
Laboratory ID: SHE0019-SCV2
Sequence Name: AR1242SCV2
Standard ID: H004290

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1242	250.00	231	-7.6	20.00
Aroclor 1242 [2C]	250.00	235	-6.1	20.00
Decachlorobiphenyl	40.000	36.6	-8.5	20.00
Tetrachlorometaxylene	40.000	40.7	1.7	20.00
Decachlorobiphenyl [2C]	40.000	35.4	-11.5	20.00
Tetrachlorometaxylene [2C]	40.000	37.6	-5.9	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00008
Laboratory ID: SHE0019-SCV3
Sequence: SHE0019
Sequence Name: AR1248SCV3
Standard ID: H004291

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1248	250.00	250	-0.1	20.00
Aroclor 1248 [2C]	250.00	254	1.5	20.00
Decachlorobiphenyl	40.000	36.9	-7.8	20.00
Tetrachlorometaxylene	40.000	41.1	2.7	20.00
Decachlorobiphenyl [2C]	40.000	35.8	-10.6	20.00
Tetrachlorometaxylene [2C]	40.000	38.3	-4.2	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
Client: Seattle Public Utilities
Calibration: CE00008
Sequence: SHE0019

SDG: 19E0222
Project: Lower Duwamish Waterway
Laboratory ID: SHE0019-SCV4
Sequence Name: AR1254SCV4
Standard ID: H004292

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1254	250.00	275	10.0	20.00
Aroclor 1254 [2C]	250.00	280	11.9	20.00
Decachlorobiphenyl	40.000	38.8	-3.1	20.00
Tetrachlorometaxylene	40.000	40.5	1.3	20.00
Decachlorobiphenyl [2C]	40.000	37.9	-5.3	20.00
Tetrachlorometaxylene [2C]	40.000	39.8	-0.4	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Calibration: CE00008
Laboratory ID: SHE0019-SCV5
Sequence: SHE0019
Sequence Name: AR2162SCV5
Standard ID: H004293

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1221	250.00	267	6.8	20.00
Aroclor 1221 [2C]	250.00	261	4.3	20.00
Decachlorobiphenyl	40.000	36.3	-9.3	20.00
Tetrachlorometaxylene	40.000	40.8	1.9	20.00
Decachlorobiphenyl [2C]	40.000	35.1	-12.2	20.00
Tetrachlorometaxylene [2C]	40.000	39.8	-0.4	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

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SECOND-SOURCE CALIBRATION VERIFICATION

EPA 8082A

Laboratory: Analytical Resources, Inc.
Client: Seattle Public Utilities
Calibration: CE00008
Sequence: SHE0019

SDG: 19E0222
Project: Lower Duwamish Waterway
Laboratory ID: SHE0019-SCV6
Sequence Name: AR3268SCV6
Standard ID: H004294

ANALYTE	EXPECTED (ug/L)	FOUND (ug/L)	% DRIFT	QC LIMIT
Aroclor 1232	250.00	262	4.9	20.00
Aroclor 1232 [2C]	250.00	265	6.2	20.00
Decachlorobiphenyl	40.000	50.5	26.2	20.00
Tetrachlorometaxylene	40.000	40.6	1.6	20.00
Decachlorobiphenyl [2C]	40.000	47.3	18.3	20.00
Tetrachlorometaxylene [2C]	40.000	37.2	-7.1	20.00

* Indicates values outside of QC limits
[2C] indicates second-column analyte.

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INITIAL CALIBRATION CHECK

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	ECD5	Calibration:	CE00008
Lab File ID:	19052202ECD5.D	Calibration Date:	05/02/19 00:00
Sequence:	SHE0332	Injection Date:	05/22/19
Lab Sample ID:	SHE0332-ICV1	Injection Time:	08:18
Sequence Name:	AR1254ICV1		

COMPOUND	TYPE	CONC. (ug/L)		RESPONSE FACTOR			% DRIFT/DIFF		
		STD	ICV	ICAL	ICV	MIN	ICV	LIMIT	
Aroclor 1254	A	250.00	213	0.0477245	0.0405276		-14.6	20	
Aroclor 1254 [2C]	A	250.00	186	0.0340829	0.0255925		-25.4	20	*
Decachlorobiphenyl	A	40.000	41.0	1.0975650	1.1241930		2.5	20	
Tetrachlorometaxylene	A	40.000	42.9	1.0225960	1.0975430		7.3	20	
Decachlorobiphenyl [2C]	A	40.000	37.8	1.5856450	1.4994910		-5.5	20	
Tetrachlorometaxylene [2C]	A	40.000	36.4	1.1798310	1.0743940		-9.0	20	

* Values outside of QC limits

* Values outside of QC limits

Analytical Resources, Incorporated
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INITIAL CALIBRATION CHECK

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument ID:	ECD5	Calibration:	CE00008
Lab File ID:	19052203ECD5.D	Calibration Date:	05/02/19 00:00
Sequence:	SHE0332	Injection Date:	05/22/19
Lab Sample ID:	SHE0332-ICV2	Injection Time:	08:38
Sequence Name:	AR1660ICV2		

COMPOUND	TYPE	CONC. (ug/L)		RESPONSE FACTOR			% DRIFT/DIFF	
		STD	ICV	ICAL	ICV	MIN	ICV	LIMIT
Aroclor 1016	A	250.00	246	0.0403024	0.0395266		-1.8	20
Aroclor 1016 [2C]	A	250.00	209	0.0457049	0.0386527		-16.3	20
Aroclor 1260	A	250.00	228	0.0872675	0.0783623		-8.6	20
Aroclor 1260 [2C]	A	250.00	219	0.1305546	0.1154052		-12.3	20
Decachlorobiphenyl	A	40.000	44.2	1.0975650	1.2141110		10.5	20
Tetrachlorometaxylene	A	40.000	42.1	1.0225960	1.0771780		5.3	20
Decachlorobiphenyl [2C]	A	40.000	40.9	1.5856450	1.6222550		2.3	20
Tetrachlorometaxylene [2C]	A	40.000	38.5	1.1798310	1.1354520		-3.8	20

* Values outside of QC limits

Analytical Resources, Incorporated
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Dual Column

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0019	Instrument:	ECD5
		Calibration:	CE00008

Sample Name	Lab Sample ID	Column 1 File ID	Column 2 File ID	Matrix	Analysis Date/Time
Cal Standard	SHE0019-CAL1	19050208ECD5.D	19050208ECD5.D	NA	05/02/19 15:48
Cal Standard	SHE0019-CAL2	19050209ECD5.D	19050209ECD5.D	NA	05/02/19 16:09
Cal Standard	SHE0019-CAL3	19050210ECD5.D	19050210ECD5.D	NA	05/02/19 16:29
Cal Standard	SHE0019-CAL4	19050211ECD5.D	19050211ECD5.D	NA	05/02/19 16:50
Cal Standard	SHE0019-CAL5	19050212ECD5.D	19050212ECD5.D	NA	05/02/19 17:10
Cal Standard	SHE0019-CAL6	19050213ECD5.D	19050213ECD5.D	NA	05/02/19 17:31
Cal Standard	SHE0019-CAL7	19050214ECD5.D	19050214ECD5.D	NA	05/02/19 17:51
Cal Standard	SHE0019-CAL8	19050215ECD5.D	19050215ECD5.D	NA	05/02/19 18:11
Cal Standard	SHE0019-CAL9	19050216ECD5.D	19050216ECD5.D	NA	05/02/19 18:31
Cal Standard	SHE0019-CALB	19050218ECD5.D	19050218ECD5.D	NA	05/02/19 19:12
Secondary Cal Check	SHE0019-SCV1	19050219ECD5.D	19050219ECD5.D	NA	05/02/19 19:32
Secondary Cal Check	SHE0019-SCV2	19050220ECD5.D	19050220ECD5.D	NA	05/02/19 19:52
Secondary Cal Check	SHE0019-SCV3	19050221ECD5.D	19050221ECD5.D	NA	05/02/19 20:13
Secondary Cal Check	SHE0019-SCV4	19050222ECD5.D	19050222ECD5.D	NA	05/02/19 20:33
Secondary Cal Check	SHE0019-SCV5	19050223ECD5.D	19050223ECD5.D	NA	05/02/19 20:53
Secondary Cal Check	SHE0019-SCV6	19050224ECD5.D	19050224ECD5.D	NA	05/02/19 21:13

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Dual Column

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0332	Instrument:	ECD5
		Calibration:	CE00008

Sample Name	Lab Sample ID	Column 1 File ID	Column 2 File ID	Matrix	Analysis Date/Time
Initial Cal Check	SHE0332-ICV1	19052202ECD5.D	19052202ECD5.D	NA	05/22/19 08:18
Initial Cal Check	SHE0332-ICV2	19052203ECD5.D	19052203ECD5.D	NA	05/22/19 08:38
Blank	BHE0486-BLK1	19052204ECD5.D	19052204ECD5.D	Solid	05/22/19 08:59
LCS	BHE0486-BS1	19052205ECD5.D	19052205ECD5.D	Solid	05/22/19 09:20
ST10-050819	19E0222-01	19052206ECD5.D	19052206ECD5.D	Solid	05/22/19 09:41
ST09-050819	19E0222-03	19052207ECD5.D	19052207ECD5.D	Solid	05/22/19 10:02
17th-ST1-050819	19E0222-05	19052208ECD5.D	19052208ECD5.D	Solid	05/22/19 10:24
ST09-050819	19E0222-03RE1	19052213ECD5.D	19052213ECD5.D	Solid	05/22/19 12:10
17th-ST1-050819	19E0222-05RE1	19052214ECD5.D	19052214ECD5.D	Solid	05/22/19 12:32
Calibration Check	SHE0332-CCV1	19052215ECD5.D	19052215ECD5.D	NA	05/22/19 12:53
Calibration Check	SHE0332-CCV2	19052216ECD5.D	19052216ECD5.D	NA	05/22/19 13:14
Calibration Check	SHE0332-CCV3	19052218ECD5.D	19052218ECD5.D	NA	05/22/19 18:39
Calibration Check	SHE0332-CCV4	19052219ECD5.D	19052219ECD5.D	NA	05/22/19 18:59
Calibration Check	SHE0332-CCV5	19052233ECD5.D	19052233ECD5.D	NA	05/22/19 23:45
Calibration Check	SHE0332-CCV6	19052234ECD5.D	19052234ECD5.D	NA	05/23/19 00:06

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
8082A PCB (20 ug/kg) or (MTCA 0.1 ug/L)	**Solid**	**EPA 8082A**

Checklist for SEQUENCE SHE0332 — Checklist: Analyst Checklist(rev3)-ECD

#	Checklist Item	Response	Analyst Initials	Date
1	Endrin and DDT breakdown <=15% (8081B only) for all affected Workorders	NA	JGR	05/23/2019
2	Detail all ICV/CCV failures for all affected Workorders	YES	JGR	05/23/2019
	Comments: *ar1254icv1 fails low on zb-35, passes on zb-5. reporting from passing column* *ar1248ccv1 fails low on zb-35, passes on zb-5. reporting from passing column* *for 19e0308 closing ar1254 fails low on both columns, can drop low peaks to bring within qc. sample is a non-detect for ar1254 ok to report as per P.M.*			
3	Narrate any Retention times not within windows for all affected Workorders	NA	JGR	05/23/2019
4	Narrate all Internal Standard areas not within 50-200% for all affected Workorders	YES	JGR	05/23/2019
	Comments: *19e0222-01,190296-06,19e0275-01,19e0222-05re hbbp fails low on zb-5, passes on zb-35. reporting affected from passing column* *19e0222-03,-05 1x runs hbbp fails low on both columns, ran 5x to reduce oily matrix affects. reporting both runs to attain rl and passing qc* *ar1660ccv4 hbbp fails low on zb-5, passes on zb-35.*			
5	Manual Integrations were applied as per SOP 1021s	YES	JGR	05/23/2019
6	Narrate any workorders where the project specific requirements have not been met	NA	JGR	05/23/2019
7	Narrate samples per Workorder that will require more than one analysis to be reported due to dilutions or re-analysis	NA	JGR	05/23/2019
8	Verify that all samples requiring dilution or re-analysis have been added to another batch or sequence	NA	JGR	05/23/2019
9	Extraction basis, cleanups, and total solids are correctly entered	YES	JGR	05/23/2019
10	An extract dilution bench sheet is attached to the sequence for all dilutions performed	YES	JGR	05/23/2019
11	AUTOCHECK: Blank checked for exceedence of criteria	YES *	JGR	05/23/2019
12	AUTOCHECK: Check blank spike recovery	YES *	JGR	05/23/2019
13	AUTOCHECK: Check blank spike/blank spike duplicate RPD. If exceeded include outliers in exception report.	NA *	JGR	05/23/2019
14	AUTOCHECK: Compounds in method designated as blank spike compounds are present	YES *	JGR	05/23/2019
15	AUTOCHECK: Check %RPD between sample and sample duplicate	NA *	JGR	05/23/2019
16	AUTOCHECK: Matrix spike recoveries within limits	NA *	JGR	05/23/2019
17	AUTOCHECK: Matrix spike/matrix spike duplicate RPD within limits	NA *	JGR	05/23/2019
18	AUTOCHECK: List of compounds listed as spiked are present	NA *	JGR	05/23/2019
19	AUTOCHECK: Check SRM limits for exceedance	NA *	JGR	05/23/2019

* = Indicates Automated Response from Element DataSyst

Printed: 6/5/2019

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
8082A PCB (20 ug/kg) or (MTCA 0.1 ug/L)	**Solid**	**EPA 8082A**

Checklist for SEQUENCE SHE0332 — Checklist: Analyst Checklist(rev3)-ECD

#	Checklist Item	Response	Analyst Initials	Date
20	AUTOCHECK: Check Surrogate recoveries	NO *	JGR	05/23/2019

Comments:
surr's pass on other column

Surrogate Recovery for Tetrachlorometaxylene [2C] (46.4%) was outside acceptance limits (53-120) in 19E0222-01 for 8082A PCB (20 ug/kg) or (MTCA 0.1 ug/L)
- Flagged value is not within established control limits.

Surrogate Recovery for Tetrachlorometaxylene [2C] (50.5%) was outside acceptance limits (53-120) in 19E0222-03 for 8082A PCB (20 ug/kg) or (MTCA 0.1 ug/L)
- Flagged value is not within established control limits.

Surrogate Recovery for Tetrachlorometaxylene [2C] (45.2%) was outside acceptance limits (53-120) in 19E0229-06 for 8082A PCB (20 ug/kg) or (MTCA 0.1 ug/L)
- Flagged value is not within established control limits.

21	AUTOCHECK: Checks Surrogate spike list against Analysis	YES *	JGR	05/23/2019
22	Data locked, checklist completed and status is analyzed (REVIEWER)	YES	MW	05/23/2019
23	Color warnings have been addressed, narrated and (or) qualified (REVIEWER)	YES	MW	05/23/2019
24	rev_DilutionCheck.rpt and rev_DilutionCheck.exe was run to verify multiple sample results are consistent (REVIEWER)	NA	BB	05/23/2019
25	List of samples or QC in this sequence that will require additional runs-verify reshot created (ANALYST)	NA	JGR	05/23/2019
26	List of samples or QC in this sequence that are reanalysis or dilutions of samples (ANALYST)	YES	JGR	05/23/2019

Comments:
diluted 19e0222-03, -05 to reduce oily matrix affects

27	Additional Notes (ANALYST and REVIEWER)	YES	JGR	05/23/2019

Comments:
went with best fit, misc peaks throughout samples, adjusted oily baseline rise

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0019	Instrument:	ECD5
Calibration:	CE00008	Calibration Date:	05/02/2019

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
SHE0019-SCV1 (Solid)			Lab File ID: 19050219ECD5.D				Analyzed: 05/02/19 19:32	
Decachlorobiphenyl	40.000	92.7	80 - 120	12.706	12.70683	-0.0008	N/A	
Tetrachlorometaxylene	40.000	103	80 - 120	4.382	4.382167	-0.0002	N/A	
Decachlorobiphenyl [2C]	40.000	89.4	80 - 120	12.811	12.8115	-0.0005	N/A	
Tetrachlorometaxylene [2C]	40.000	97.4	80 - 120	4.155	4.154833	0.0002	N/A	
SHE0019-SCV2 (Solid)			Lab File ID: 19050220ECD5.D				Analyzed: 05/02/19 19:52	
Decachlorobiphenyl	40.000	91.5	80 - 120	12.706	12.70683	-0.0008	N/A	
Tetrachlorometaxylene	40.000	102	80 - 120	4.382	4.382167	-0.0002	N/A	
Decachlorobiphenyl [2C]	40.000	88.5	80 - 120	12.811	12.8115	-0.0005	N/A	
Tetrachlorometaxylene [2C]	40.000	94.1	80 - 120	4.154	4.154833	-0.0008	N/A	
SHE0019-SCV3 (Solid)			Lab File ID: 19050221ECD5.D				Analyzed: 05/02/19 20:13	
Decachlorobiphenyl	40.000	92.2	80 - 120	12.705	12.70683	-0.0018	N/A	
Tetrachlorometaxylene	40.000	103	80 - 120	4.381	4.382167	-0.0012	N/A	
Decachlorobiphenyl [2C]	40.000	89.4	80 - 120	12.811	12.8115	-0.0005	N/A	
Tetrachlorometaxylene [2C]	40.000	95.8	80 - 120	4.154	4.154833	-0.0008	N/A	
SHE0019-SCV4 (Solid)			Lab File ID: 19050222ECD5.D				Analyzed: 05/02/19 20:33	
Decachlorobiphenyl	40.000	96.9	80 - 120	12.706	12.70683	-0.0008	N/A	
Tetrachlorometaxylene	40.000	101	80 - 120	4.381	4.382167	-0.0012	N/A	
Decachlorobiphenyl [2C]	40.000	94.7	80 - 120	12.811	12.8115	-0.0005	N/A	
Tetrachlorometaxylene [2C]	40.000	99.6	80 - 120	4.154	4.154833	-0.0008	N/A	
SHE0019-SCV5 (Solid)			Lab File ID: 19050223ECD5.D				Analyzed: 05/02/19 20:53	
Decachlorobiphenyl	40.000	90.7	80 - 120	12.705	12.70683	-0.0018	N/A	
Tetrachlorometaxylene	40.000	102	80 - 120	4.381	4.382167	-0.0012	N/A	
Decachlorobiphenyl [2C]	40.000	87.8	80 - 120	12.81	12.8115	-0.0015	N/A	
Tetrachlorometaxylene [2C]	40.000	99.6	80 - 120	4.155	4.154833	0.0002	N/A	
SHE0019-SCV6 (Solid)			Lab File ID: 19050224ECD5.D				Analyzed: 05/02/19 21:13	
Decachlorobiphenyl	40.000	126	80 - 200	12.706	12.70683	-0.0008	N/A	
Tetrachlorometaxylene	40.000	102	80 - 120	4.382	4.382167	-0.0002	N/A	
Decachlorobiphenyl [2C]	40.000	118	80 - 120	12.811	12.8115	-0.0005	N/A	
Tetrachlorometaxylene [2C]	40.000	92.9	80 - 120	4.155	4.154833	0.0002	N/A	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0332	Instrument:	ECD5
Calibration:	CE00008	Calibration Date:	05/02/2019

Surrogate Compound	Spike Level ug/L	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
SHE0332-ICV1 (Solid)			Lab File ID: 19052202ECD5.D				Analyzed: 05/22/19 08:18	
Decachlorobiphenyl	40.000	103	80 - 120	12.703	12.70683	-0.0038	N/A	
Tetrachlorometaxylene	40.000	107	80 - 120	4.384	4.382167	0.0018	N/A	
Decachlorobiphenyl [2C]	40.000	94.5	80 - 120	12.789	12.8115	-0.0225	N/A	
Tetrachlorometaxylene [2C]	40.000	91.0	80 - 120	4.14	4.154833	-0.0148	N/A	
SHE0332-ICV2 (Solid)			Lab File ID: 19052203ECD5.D				Analyzed: 05/22/19 08:38	
Decachlorobiphenyl	40.000	111	80 - 120	12.703	12.70683	-0.0038	N/A	
Tetrachlorometaxylene	40.000	105	80 - 120	4.383	4.382167	0.0008	N/A	
Decachlorobiphenyl [2C]	40.000	102	80 - 120	12.788	12.8115	-0.0235	N/A	
Tetrachlorometaxylene [2C]	40.000	96.3	80 - 120	4.139	4.154833	-0.0158	N/A	
BHE0486-BLK1 (Solid)			Lab File ID: 19052204ECD5.D				Analyzed: 05/22/19 08:59	
Decachlorobiphenyl	40.000	97.2	40 - 133	12.703	12.70683	-0.0038	N/A	
Tetrachlorometaxylene	40.000	89.7	53 - 120	4.383	4.382167	0.0008	N/A	
Decachlorobiphenyl [2C]	40.000	97.3	40 - 133	12.788	12.8115	-0.0235	N/A	
Tetrachlorometaxylene [2C]	40.000	62.2	53 - 120	4.138	4.154833	-0.0168	N/A	
BHE0486-BS1 (Solid)			Lab File ID: 19052205ECD5.D				Analyzed: 05/22/19 09:20	
Decachlorobiphenyl	40.000	101	40 - 133	12.703	12.70683	-0.0038	N/A	
Tetrachlorometaxylene	40.000	91.5	53 - 120	4.385	4.382167	0.0028	N/A	
Decachlorobiphenyl [2C]	40.000	101	40 - 133	12.788	12.8115	-0.0235	N/A	
Tetrachlorometaxylene [2C]	40.000	61.2	53 - 120	4.136	4.154833	-0.0188	N/A	
19E0222-01 (Solid)			Lab File ID: 19052206ECD5.D				Analyzed: 05/22/19 09:41	
Decachlorobiphenyl	39.995		40 - 133	12.702	12.70683	-0.0048	N/A	NRS
Tetrachlorometaxylene	39.995	62.9	53 - 120	4.387	4.382167	0.0048	N/A	
Decachlorobiphenyl [2C]	39.995	74.7	40 - 133	12.786	12.8115	-0.0255	N/A	
Tetrachlorometaxylene [2C]	39.995	46.4	53 - 120	4.139	4.154833	-0.0158	N/A	*
19E0222-03 (Solid)			Lab File ID: 19052207ECD5.D				Analyzed: 05/22/19 10:02	
Decachlorobiphenyl	60.074		40 - 133	12.704	12.70683	-0.0028	N/A	NRS
Tetrachlorometaxylene	60.074	58.2	53 - 120	4.386	4.382167	0.0038	N/A	
Decachlorobiphenyl [2C]	60.074		40 - 133	12.786	12.8115	-0.0255	N/A	NRS
Tetrachlorometaxylene [2C]	60.074	50.5	53 - 120	4.138	4.154833	-0.0168	N/A	*

Analytical Resources, Incorporated
Analytical Chemists and Consultants

SURROGATE RECOVERY AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG/WO:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0332	Instrument:	ECD5
Calibration:	CE00008	Calibration Date:	05/02/2019

Surrogate Compound	Spike Level ug/kg dry	% Recovery	Recovery Limits	RT	Calibration Mean RT	RT Diff	RT Diff Limit	Q
19E0222-05 (Solid)			Lab File ID: 19052208ECD5.D				Analyzed: 05/22/19 10:24	
Decachlorobiphenyl	106.78		40 - 133	12.702	12.70683	-0.0048	N/A	NRS
Tetrachlorometaxylene	106.78	89.5	53 - 120	4.386	4.382167	0.0038	N/A	
Decachlorobiphenyl [2C]	106.78		40 - 133	12.785	12.8115	-0.0265	N/A	NRS
Tetrachlorometaxylene [2C]	106.78	62.0	53 - 120	4.138	4.154833	-0.0168	N/A	
19E0222-03RE1 (Solid)			Lab File ID: 19052213ECD5.D				Analyzed: 05/22/19 12:10	
Decachlorobiphenyl	60.074	96.9	40 - 133	12.703	12.70683	-0.0038	N/A	
Tetrachlorometaxylene	60.074	62.3	53 - 120	4.385	4.382167	0.0028	N/A	
Decachlorobiphenyl [2C]	60.074	71.1	40 - 133	12.784	12.8115	-0.0275	N/A	
Tetrachlorometaxylene [2C]	60.074	59.8	53 - 120	4.137	4.154833	-0.0178	N/A	
19E0222-05RE1 (Solid)			Lab File ID: 19052214ECD5.D				Analyzed: 05/22/19 12:32	
Decachlorobiphenyl	106.78		40 - 133	12.702	12.70683	-0.0048	N/A	NRS
Tetrachlorometaxylene	106.78	84.3	53 - 120	4.384	4.382167	0.0018	N/A	
Decachlorobiphenyl [2C]	106.78	116	40 - 133	12.785	12.8115	-0.0265	N/A	
Tetrachlorometaxylene [2C]	106.78	75.1	53 - 120	4.137	4.154833	-0.0178	N/A	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0019	Instrument:	ECD5
		Calibration:	CE00008

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Secondary Cal Check (SHE0019-SCV1)		(Solid)		Lab File ID: 19050219ECD5.D				Analyzed: 05/02/19 19:32	
1-Bromo-2-Nitrobenzene	14083450	2.272	13740310	2.272	102.5	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl	7795287	13.062	7186114	13.062	108.5	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	34097080	2.556	32377010	2.556	105.3	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	11069650	13.654	10251100	13.654	108.	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (SHE0019-SCV2)		(Solid)		Lab File ID: 19050220ECD5.D				Analyzed: 05/02/19 19:52	
1-Bromo-2-Nitrobenzene	14427760	2.271	13740310	2.272	105.	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl	8205257	13.062	7186114	13.062	114.2	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	35365590	2.555	32377010	2.556	109.2	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl [2C]	11643740	13.654	10251100	13.654	113.6	50 - 200	0.0000	+/-0.50	
Secondary Cal Check (SHE0019-SCV3)		(Solid)		Lab File ID: 19050221ECD5.D				Analyzed: 05/02/19 20:13	
1-Bromo-2-Nitrobenzene	14036920	2.27	13740310	2.272	102.2	50 - 200	0.0020	+/-0.50	
Hexabromobiphenyl	7823967	13.061	7186114	13.062	108.9	50 - 200	0.0010	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	34497890	2.554	32377010	2.556	106.6	50 - 200	0.0020	+/-0.50	
Hexabromobiphenyl [2C]	11138600	13.653	10251100	13.654	108.7	50 - 200	0.0010	+/-0.50	
Secondary Cal Check (SHE0019-SCV4)		(Solid)		Lab File ID: 19050222ECD5.D				Analyzed: 05/02/19 20:33	
1-Bromo-2-Nitrobenzene	14051090	2.271	13740310	2.272	102.3	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl	6657935	13.061	7186114	13.062	92.7	50 - 200	0.0010	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	33797900	2.556	32377010	2.556	104.4	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	9492106	13.653	10251100	13.654	92.6	50 - 200	0.0010	+/-0.50	
Secondary Cal Check (SHE0019-SCV5)		(Solid)		Lab File ID: 19050223ECD5.D				Analyzed: 05/02/19 20:53	
1-Bromo-2-Nitrobenzene	14267270	2.271	13740310	2.272	103.8	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl	7980331	13.061	7186114	13.062	111.1	50 - 200	0.0010	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	32552440	2.555	32377010	2.556	100.5	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl [2C]	11339360	13.653	10251100	13.654	110.6	50 - 200	0.0010	+/-0.50	
Secondary Cal Check (SHE0019-SCV6)		(Solid)		Lab File ID: 19050224ECD5.D				Analyzed: 05/02/19 21:13	
1-Bromo-2-Nitrobenzene	14338660	2.271	13740310	2.272	104.4	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl	8017274	13.062	7186114	13.062	111.6	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	34092020	2.556	32377010	2.556	105.3	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	11419900	13.653	10251100	13.654	111.4	50 - 200	0.0010	+/-0.50	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0332	Instrument:	ECD5
		Calibration:	CE00008

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
Initial Cal Check (SHE0332-ICV1)		(Solid)		Lab File ID: 19052202ECD5.D				Analyzed: 05/22/19 08:18	
1-Bromo-2-Nitrobenzene	17691400	2.275	13740310	2.275	128.8	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl	9588660	13.059	7186114	13.059	133.4	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	48339080	2.544	32377010	2.544	149.3	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	11537370	13.629	10251100	13.629	112.5	50 - 200	0.0000	+/-0.50	
Initial Cal Check (SHE0332-ICV2)		(Solid)		Lab File ID: 19052203ECD5.D				Analyzed: 05/22/19 08:38	
1-Bromo-2-Nitrobenzene	14827220	2.272	13740310	2.272	107.9	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl	7443589	13.059	7186114	13.059	103.6	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	37020700	2.544	32377010	2.544	114.3	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	9175979	13.628	10251100	13.628	89.5	50 - 200	0.0000	+/-0.50	
Blank (BHE0486-BLK1)		(Solid)		Lab File ID: 19052204ECD5.D				Analyzed: 05/22/19 08:59	
1-Bromo-2-Nitrobenzene	11737030	2.272	13740310	2.272	85.4	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl	6159531	13.059	7186114	13.059	85.7	50 - 200	0.0000	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	32893420	2.543	32377010	2.544	101.6	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl [2C]	7840027	13.627	10251100	13.628	76.5	50 - 200	0.0010	+/-0.50	
LCS (BHE0486-BS1)		(Solid)		Lab File ID: 19052205ECD5.D				Analyzed: 05/22/19 09:20	
1-Bromo-2-Nitrobenzene	11825240	2.272	13740310	2.272	86.1	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl	6482704	13.06	7186114	13.059	90.2	50 - 200	-0.0010	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	33918210	2.542	32377010	2.544	104.8	50 - 200	0.0020	+/-0.50	
Hexabromobiphenyl [2C]	8323751	13.628	10251100	13.628	81.2	50 - 200	0.0000	+/-0.50	
ST10-050819 (19E0222-01)		(Solid)		Lab File ID: 19052206ECD5.D				Analyzed: 05/22/19 09:41	
1-Bromo-2-Nitrobenzene	10096110	2.275	13740310	2.272	73.5	50 - 200	-0.0030	+/-0.50	
Hexabromobiphenyl	2562752	13.058	7186114	13.059	35.7	50 - 200	0.0010	+/-0.50	*
1-Bromo-2-Nitrobenzene [2C]	23678860	2.542	32377010	2.544	73.1	50 - 200	0.0020	+/-0.50	
Hexabromobiphenyl [2C]	5802500	13.625	10251100	13.628	56.6	50 - 200	0.0030	+/-0.50	
ST09-050819 (19E0222-03)		(Solid)		Lab File ID: 19052207ECD5.D				Analyzed: 05/22/19 10:02	
1-Bromo-2-Nitrobenzene	10247320	2.275	13740310	2.272	74.6	50 - 200	-0.0030	+/-0.50	
Hexabromobiphenyl	2085170	13.059	7186114	13.059	29.	50 - 200	0.0000	+/-0.50	*
1-Bromo-2-Nitrobenzene [2C]	21959800	2.543	32377010	2.544	67.8	50 - 200	0.0010	+/-0.50	
Hexabromobiphenyl [2C]	4580891	13.624	10251100	13.628	44.7	50 - 200	0.0040	+/-0.50	*

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTERNAL STANDARD AREA AND RT SUMMARY

EPA 8082A

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0332	Instrument:	ECD5
		Calibration:	CE00008

Internal Standard	Response	RT	Reference Response	Reference RT	Area %	Area % Limits	RT Diff	RT Diff Limit	Q
17th-ST1-050819 (19E0222-05)		(Solid)		Lab File ID: 19052208ECD5.D				Analyzed: 05/22/19 10:24	
1-Bromo-2-Nitrobenzene	11509430	2.275	13740310	2.272	83.8	50 - 200	-0.0030	+/-0.50	
Hexabromobiphenyl	2225447	13.058	7186114	13.059	31.	50 - 200	0.0010	+/-0.50	*
1-Bromo-2-Nitrobenzene [2C]	30786060	2.544	32377010	2.544	95.1	50 - 200	0.0000	+/-0.50	
Hexabromobiphenyl [2C]	4661926	13.624	10251100	13.628	45.5	50 - 200	0.0040	+/-0.50	*
ST09-050819 (19E0222-03RE1)		(Solid)		Lab File ID: 19052213ECD5.D				Analyzed: 05/22/19 12:10	
1-Bromo-2-Nitrobenzene	12433570	2.273	13740310	2.272	90.5	50 - 200	-0.0010	+/-0.50	
Hexabromobiphenyl	3697817	13.058	7186114	13.059	51.5	50 - 200	0.0010	+/-0.50	
1-Bromo-2-Nitrobenzene [2C]	29012300	2.541	32377010	2.544	89.6	50 - 200	0.0030	+/-0.50	
Hexabromobiphenyl [2C]	8047673	13.623	10251100	13.628	78.5	50 - 200	0.0050	+/-0.50	
17th-ST1-050819 (19E0222-05RE1)		(Solid)		Lab File ID: 19052214ECD5.D				Analyzed: 05/22/19 12:32	
1-Bromo-2-Nitrobenzene	13027010	2.273	13740310	2.272	94.8	50 - 200	-0.0010	+/-0.50	
Hexabromobiphenyl	3157216	13.057	7186114	13.059	43.9	50 - 200	0.0020	+/-0.50	*
1-Bromo-2-Nitrobenzene [2C]	38144270	2.542	32377010	2.544	117.8	50 - 200	0.0020	+/-0.50	
Hexabromobiphenyl [2C]	6077615	13.624	10251100	13.628	59.3	50 - 200	0.0040	+/-0.50	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DUAL COLUMN CONFIRMATION SUMMARY

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Sediment	Laboratory ID:	19E0222-01	File ID:	19052206ECD5.D
Sampled:	05/08/19 10:40	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 09:41
Solids:	35.69	Preparation:	EPA 3546 (Microwave)	Instrument:	ECD5
Batch:	BHE0486	Sequence:	SHE0332		
GC Column(1):	ZB5			GC Column(2):	ZB35

COMPOUND	COL	RT	EXP RT	RT DIFF	AREA	CONC	%D
Aroclor 1248	* 1	8.029	8.031	0.002	5648051	72.5	4.7
Aroclor 1248	2	8.247	8.267	0.02	764531	69.2	
Aroclor 1254	* 1	9.319	9.321	0.002	309303.4	49.7	6.4
Aroclor 1254	2	9.57	9.593	0.023	705037.6	53.0	
Aroclor 1260	1	11.792	11.8005	0.0085	528767.2	143	.
Aroclor 1260	* 2	11.18	11.198	0.018	1170465	143	

* Column used for quantitation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DUAL COLUMN CONFIRMATION SUMMARY

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Sediment	Laboratory ID:	19E0222-03	File ID:	19052207ECD5.D
Sampled:	05/08/19 11:00	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 10:02
Solids:	23.58	Preparation:	EPA 3546 (Microwave)	Instrument:	ECD5
Batch:	BHE0486	Sequence:	SHE0332		
GC Column(1):	ZB5			GC Column(2):	ZB35

COMPOUND	COL	RT	EXP RT	RT DIFF	AREA	CONC	%D
Aroclor 1248	* 1	8.03	8.031	0.001	1394964	110	17.4
Aroclor 1248	2	8.245	8.267	0.022	896124.3	131	
Aroclor 1254	* 1	9.321	9.321	0	374938.2	105	2.9
Aroclor 1254	2	9.569	9.593	0.024	855324.8	102	
Aroclor 1260	* 1	11.782	11.8005	0.0185	425988	68.6	16.1
Aroclor 1260	2	11.175	11.198	0.023	376684	58.4	

* Column used for quantitation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DUAL COLUMN CONFIRMATION SUMMARY

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Sediment	Laboratory ID:	19E0222-03RE1	File ID:	19052213ECD5.D
Sampled:	05/08/19 11:00	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 12:10
Solids:	23.58	Preparation:	EPA 3546 (Microwave)	Instrument:	ECD5
Batch:	BHE0486	Sequence:	SHE0332		
GC Column(1):	ZB5			GC Column(2):	ZB35

COMPOUND	COL	RT	EXP RT	RT DIFF	AREA	CONC	%D
Aroclor 1248	* 1	8.031	8.031	0	412507	161	16.5
Aroclor 1248	2	8.242	8.267	0.025	342467.5	190	
Aroclor 1254	* 1	9.321	9.321	0	136426.4	158	14.1
Aroclor 1254	2	9.569	9.593	0.024	374145.6	182	

* Column used for quantitation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DUAL COLUMN CONFIRMATION SUMMARY

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Sediment	Laboratory ID:	19E0222-05	File ID:	19052208ECD5.D
Sampled:	05/08/19 11:35	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 10:24
Solids:	18.08	Preparation:	EPA 3546 (Microwave)	Instrument:	ECD5
Batch:	BHE0486	Sequence:	SHE0332		
GC Column(1):	ZB5			GC Column(2):	ZB35

COMPOUND	COL	RT	EXP RT	RT DIFF	AREA	CONC	%D
Aroclor 1254	* 1	9.271	9.321	0.05	409607.8	112	20.1
Aroclor 1254	2	9.575	9.593	0.018	666417.2	137	
Aroclor 1260	* 1	11.794	11.8005	0.0065	531945.2	573	15.6
Aroclor 1260	2	11.172	11.198	0.026	1411637	490	

* Column used for quantitation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DUAL COLUMN CONFIRMATION SUMMARY

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Matrix:	Sediment	Laboratory ID:	19E0222-05RE1	File ID:	19052214ECD5.D
Sampled:	05/08/19 11:35	Prepared:	05/20/19 11:00	Analyzed:	05/22/19 12:32
Solids:	18.08	Preparation:	EPA 3546 (Microwave)	Instrument:	ECD5
Batch:	BHE0486	Sequence:	SHE0332		
GC Column(1):	ZB5			GC Column(2):	ZB35

COMPOUND	COL	RT	EXP RT	RT DIFF	AREA	CONC	%D
Aroclor 1260	1	11.794	11.8005	0.0065	154681.6	574	.
Aroclor 1260	* 2	11.171	11.198	0.027	430522	574	

* Column used for quantitation

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HOLDING TIME SUMMARY

Analysis: EPA 8082A

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
ST10-050819 19E0222-01	05/08/19 10:40	05/16/19 13:05	05/20/19 11:00	12	14	05/22/19 09:41	2	40	
ST09-050819 19E0222-03	05/08/19 11:00	05/16/19 13:05	05/20/19 11:00	12	14	05/22/19 10:02	2	40	
ST09-050819 19E0222-03RE1	05/08/19 11:00	05/16/19 13:05	05/20/19 11:00	12	14	05/22/19 12:10	2	40	
17th-ST1-050819 19E0222-05	05/08/19 11:35	05/16/19 13:05	05/20/19 11:00	11	14	05/22/19 10:24	2	40	
17th-ST1-050819 19E0222-05RE1	05/08/19 11:35	05/16/19 13:05	05/20/19 11:00	11	14	05/22/19 12:32	2	40	

* Indicates hold time exceedance.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 8082A

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Matrix: Solid
Instrument: ECD5

Analyte	MDL	RL	Units
Aroclor 1016	8.0	20.0	ug/kg
Aroclor 1016 [2C]	8.0	20.0	ug/kg
Aroclor 1221	8.0	20.0	ug/kg
Aroclor 1221 [2C]	8.0	20.0	ug/kg
Aroclor 1232	8.0	20.0	ug/kg
Aroclor 1232 [2C]	8.0	20.0	ug/kg
Aroclor 1242	8.0	20.0	ug/kg
Aroclor 1242 [2C]	8.0	20.0	ug/kg
Aroclor 1248	8.0	20.0	ug/kg
Aroclor 1248 [2C]	8.0	20.0	ug/kg
Aroclor 1254	8.0	20.0	ug/kg
Aroclor 1254 [2C]	8.0	20.0	ug/kg
Aroclor 1260	9.3	20.0	ug/kg
Aroclor 1260 [2C]	9.3	20.0	ug/kg

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 7471B

Total Metals

ST10-050819

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/28/19 09:37	File ID:	SMM 05-29-19-019
% Solids:	35.69	Preparation:	SMM EPA 7471B	Analyzed:	05/29/19 17:48
Batch:	BHE0633	Sequence:	SHE0458	Initial/Final:	0.214 g Wet / 50 mL
Instrument:	CVAA			Calibration:	CE00077

CAS NO.	Analyte	Concentration (mg/kg dry)	Dilution Factor	MDL	MRL	Q
7439-97-6	Mercury	0.114	1	0.0137	0.0655	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 7471B

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Batch:	BHE0633	Batch Matrix:	Solid	Preparation:	SMM EPA 7471B

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	SMM 05-29-19-019	05/28/19 09:37	
Blank	BHE0633-BLK1	SMM 05-29-19-013	05/28/19 09:37	
LCS	BHE0633-BS1	SMM 05-29-19-015	05/28/19 09:37	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I

METHOD BLANK DATA SHEET

EPA 7471B

Total Metals

Blank

Batch: BHE0633 Laboratory ID: BHE0633-BLK1 Prepared: 05/28/19 09:37

Matrix: Solid Preparation: SMM EPA 7471B Analyzed: 05/29/19 17:32

Sequence: SHE0458 Calibration: CE00077 Instrument: CVAA

CAS NO.	Analyte	Concentration (mg/kg wet)	Dilution Factor	MDL	MRL	Q
7439-97-6	Mercury	0.0123	1	0.00525	0.0250	J

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INSTRUMENT BLANKS
EPA 7471B

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: CVAA
Calibration: CE00077
Sequence: SHE0458
Date Analyzed: 05/29/19 17:22

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SHE0458-ICB1	Mercury	-0.000063	0.000021	0.000100	mg/L	
SHE0458-CCB1	Mercury	-0.000061	0.000021	0.000100	mg/L	
SHE0458-CCB2	Mercury	-0.000058	0.000021	0.000100	mg/L	
SHE0458-CCB3	Mercury	-0.000056	0.000021	0.000100	mg/L	
SHE0458-CCB4	Mercury	-0.000061	0.000021	0.000100	mg/L	
SHE0458-CCB5	Mercury	-0.000054	0.000021	0.000100	mg/L	

Analytical Resources, Incorporated
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LCS / LCS DUPLICATE RECOVERY

EPA 7471B

Total Metals

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	05/29/19 17:39
Batch:	BHE0633	Laboratory ID:	BHE0633-BS1
Preparation:	SMM EPA 7471B	Sequence Name:	LCS
Initial/Final:	0.2 g / 50 mL		

COMPOUND	SPIKE ADDED (mg/kg wet)	LCS CONCENTRATION (mg/kg wet)	Q	LCS % REC. #	QC LIMITS REC.
Mercury	0.500	0.598		120	80 - 120

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 7471B

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00077	Instrument:	CVAA
Calibration Date:	05/30/2019 12:18		

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
Mercury	0	0	0.0001	1.015E+07	0.0005	6936000	0.001	7299000	0.002	7161000	0.005	7031000

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 7471B

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00077	Instrument:	CVAA
Calibration Date:	05/30/2019 12:18		

Compound	Level 07		Level 08		Level 09		Level 10		Level 11		Level 12	
		RF		RF		RF		RF		RF		RF
Mercury	0.01	6904700										

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 7471B

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CE00077	Instrument:	CVAA
Calibration Date:	05/30/2019 12:18		

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	COD Limit	Q
Mercury	6497386	47.6	0.9999		0.99	

Analytical Resources, Incorporated
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ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 7471B

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0458	Instrument:	CVAA
		Calibration:	CE00077

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Cal Standard	SHE0458-CAL1	SMM 05-29-19-001	NA	05/29/19 17:03
Cal Standard	SHE0458-CAL2	SMM 05-29-19-002	NA	05/29/19 17:05
Cal Standard	SHE0458-CAL3	SMM 05-29-19-003	NA	05/29/19 17:07
Cal Standard	SHE0458-CAL4	SMM 05-29-19-004	NA	05/29/19 17:10
Cal Standard	SHE0458-CAL5	SMM 05-29-19-005	NA	05/29/19 17:12
Cal Standard	SHE0458-CAL6	SMM 05-29-19-006	NA	05/29/19 17:14
Cal Standard	SHE0458-CAL7	SMM 05-29-19-007	NA	05/29/19 17:17
Initial Cal Check	SHE0458-ICV1	SMM 05-29-19-008	NA	05/29/19 17:20
Initial Cal Blank	SHE0458-ICB1	SMM 05-29-19-009	NA	05/29/19 17:22
Instrument RL Check	SHE0458-CRL1	SMM 05-29-19-010	NA	05/29/19 17:25
Calibration Check	SHE0458-CCV1	SMM 05-29-19-011	NA	05/29/19 17:28
Calibration Blank	SHE0458-CCB1	SMM 05-29-19-012	NA	05/29/19 17:30
Blank	BHE0633-BLK1	SMM 05-29-19-013	Solid	05/29/19 17:32
LCS	BHE0633-BS1	SMM 05-29-19-015	Solid	05/29/19 17:39
ST10-050819	19E0222-01	SMM 05-29-19-019	Solid	05/29/19 17:48
Calibration Check	SHE0458-CCV2	SMM 05-29-19-023	NA	05/29/19 17:57
Calibration Blank	SHE0458-CCB2	SMM 05-29-19-024	NA	05/29/19 18:00
Calibration Check	SHE0458-CCV3	SMM 05-29-19-034	NA	05/29/19 18:25
Calibration Blank	SHE0458-CCB3	SMM 05-29-19-035	NA	05/29/19 18:27
Calibration Check	SHE0458-CCV4	SMM 05-29-19-038	NA	05/29/19 18:35
Calibration Blank	SHE0458-CCB4	SMM 05-29-19-039	NA	05/29/19 18:37
Calibration Check	SHE0458-CCV5	SMM 05-29-19-042	NA	05/29/19 18:46
Calibration Blank	SHE0458-CCB5	SMM 05-29-19-043	NA	05/29/19 18:48

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
Met 7471B Hg	**Solid**	**EPA 7471B**

Checklist for SEQUENCE SHE0458 — Checklist: Analyst Checklist - Metals

#	Checklist Item	Response	Analyst Initials	Date
1	Dilution factors recorded correctly	YES	SKM	05/30/2019
2	Crossouts/Corrections/Deletions - what does this mean now	YES	SKM	05/30/2019
3	Blank and Standard intensities are within limits	YES	SKM	05/30/2019
4	Standard deviations within method requirements	YES	SKM	05/30/2019
5	Curve fit within method requirements	YES	SKM	05/30/2019
6	ICV/CCV are in control	YES	SKM	05/30/2019
7	ICB/CCB are in control	YES	SKM	05/30/2019
8	RSDs & SDs of replicate readings within control	YES	SKM	05/30/2019
9	Internal standards within method limits	YES	SKM	05/30/2019
10	Carry-over noted and checked	NA	SKM	05/30/2019
11	CRI/CRA are in control	YES	SKM	05/30/2019
12	ICSA/ICSAB are in control	NA	SKM	05/30/2019
13	AUTOCHECK: Post spikes within method requirements	YES *	SKM	05/30/2019
14	Serial dilutions performed if needed	NA	SKM	05/30/2019
15	AUTOCHECK: Standard reference material spike recovery within limits	NA *	SKM	05/30/2019
16	AUTOCHECK: LCS spike recovery within limits	YES *	SKM	05/30/2019
17	AUTOCHECK: LCS run at required frequency	YES *	SKM	05/30/2019
18	AUTOCHECK: All target compounds designated as spikes are present in the LCS	YES *	SKM	05/30/2019
19	AUTOCHECK: Matrix Spike recoveries are within limits	NO *	SKM	05/30/2019
	Comments: *EXCEPTION REPORT REQUIRED* *BHE0633-MS1, BHE0711-MS1, BHE0711-MSD1 % RECOVERY > 125%*			
20	AUTOCHECK: All target compounds designated as spikes are present in the matrix spike	YES *	SKM	05/30/2019
21	AUTOCHECK: MS run at required frequency	YES *	SKM	05/30/2019
22	AUTOCHECK: Duplicate RPD within limits	NO *	SKM	05/30/2019
	Comments: *EXCEPTION REPORT REQUIRED* *BHE0711-DUP1 RPD > 20*			
23	AUTOCHECK: Duplicate run at frequency required by the method	YES *	SKM	05/30/2019
24	AUTOCHECK: Check method blank for exceedences and list in exception report	NA *	SKM	05/30/2019
25	AUTOCHECK: Check blank frequency specified	YES *	SKM	05/30/2019
26	Raw data matches distributed data	YES	SKM	05/30/2019
27	Analyst Comments	NO	SKM	05/30/2019
	Comments: *EXCEPTION REPORT REQUIRED*			

* = Indicates Automated Response from Element DataSyst

Printed: 6/5/2019

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
Met 7471B Hg	**Solid**	**EPA 7471B**

Checklist for SEQUENCE SHE0458

Checklist: Analyst Checklist - Metals

#	Checklist Item	Response	Analyst Initials	Date
	BHE0633-MS1, BHE0711-MS1, BHE0711-MSD1 % RECOVERY > 125% *BHE0711-DUP1 RPD > 20*			

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
Met 7471B Hg	**Solid**	**EPA 7471B**

Checklist for SEQUENCE SHE0458

Checklist: Reviewer Checklist-Metals

#	Checklist Item	Response	Analyst Initials	Date
1	Analyst and Peer review checklist completed	YES	EL	05/30/2019
2	Data is locked and Status is Peer Reviewed	YES	EL	05/30/2019
3	Qualifers have been correctly added	YES	EL	05/30/2019
4	Color warnings have been addressed, narrated and (or) qualified	YES	EL	05/30/2019

Analytical Resources, Incorporated
Analytical Chemists and Consultants

DETECTION LEVEL STANDARD
EPA 7471B

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: CVAA
Calibration: CE00077
Sequence: SHE0458
Lab Sample ID: SHE0458-CRL1

Analyte	True	Found	%R	Units	QC Limts
Mercury	0.000100	0.000093	92.9	mg/L	70 - 130

* Values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

HOLDING TIME SUMMARY

Analysis: EPA 7471B

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
ST10-050819 19E0222-01	05/08/19 10:40	05/16/19 13:05	05/28/19 09:37	19	28	05/29/19 17:48	21	28	

* Indicates hold time exceedance.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

METHOD DETECTION AND REPORTING LIMITS

EPA 7471B

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Matrix: Solid
Instrument: CVAA

Analyte	MDL	RL	Units
Mercury	0.00525	0.0250	mg/kg

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
EPA 6010C
Total Metals

ST10-050819

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/28/19 10:04	File ID:	I2190531PRE-024
% Solids:	35.69	Preparation:	SWC EPA 3050B	Analyzed:	05/31/19 08:47
Batch:	BHE0637	Sequence:	SHE0478	Initial/Final:	1.04 g Wet / 50 mL
Instrument:	ICP2			Calibration:	CF00001

CAS NO.	Analyte	Concentration (mg/kg dry)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic	14.7	2	0.755	13.5	
7440-50-8	Copper	211	2	0.0664	0.539	
7439-92-1	Lead	118	2	0.351	5.39	
7440-66-6	Zinc	1260	2	0.430	2.69	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

PREPARATION BATCH SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.			SDG:	19E0222
Client:	Seattle Public Utilities			Project:	Lower Duwamish Waterway
Batch:	BHE0637	Batch Matrix:	Solid	Preparation:	SWC EPA 3050B

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01	I2190531PRE-024	05/28/19 10:04	
Blank	BHE0637-BLK1	I2190531-019	05/28/19 10:04	
LCS	BHE0637-BS1	I2190531-028	05/28/19 10:04	

Analytical Resources, Incorporated
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Form I

METHOD BLANK DATA SHEET

EPA 6010C

Total Metals

Blank

Batch: BHE0637 Laboratory ID: BHE0637-BLK1 Prepared: 05/28/19 10:04

Matrix: Solid Preparation: SWC EPA 3050B Analyzed: 05/31/19 08:25

Sequence: SHE0478 Calibration: CF00001 Instrument: ICP2

CAS NO.	Analyte	Concentration (mg/kg wet)	Dilution Factor	MDL	MRL	Q
7440-38-2	Arsenic	ND	2	0.470	5.00	U
7440-50-8	Copper	ND	2	0.0660	0.200	U
7439-92-1	Lead	ND	2	0.190	2.00	U
7440-66-6	Zinc	ND	2	0.210	1.00	U

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INSTRUMENT BLANKS
EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: ICP2
Calibration: CF00001
Sequence: SHE0478
Date Analyzed: 05/31/19 07:57

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SHE0478-ICB1	Arsenic	-0.0004	0.0047	0.0500	mg/L	
SHE0478-ICB1	Copper	0.0002	0.0007	0.0020	mg/L	
SHE0478-ICB1	Lead	0.0009	0.0019	0.0200	mg/L	
SHE0478-ICB1	Zinc	0.0005	0.0021	0.0100	mg/L	
SHE0478-CCB1	Arsenic	-0.0002	0.0047	0.0500	mg/L	
SHE0478-CCB1	Copper	0.0003	0.0007	0.0020	mg/L	
SHE0478-CCB1	Lead	0.0011	0.0019	0.0200	mg/L	
SHE0478-CCB1	Zinc	0.0002	0.0021	0.0100	mg/L	
SHE0478-CCB2	Arsenic	0.0003	0.0047	0.0500	mg/L	
SHE0478-CCB2	Copper	0.0004	0.0007	0.0020	mg/L	
SHE0478-CCB2	Lead	0.0004	0.0019	0.0200	mg/L	
SHE0478-CCB2	Zinc	0.0007	0.0021	0.0100	mg/L	
SHE0478-CCB3	Arsenic	-0.0016	0.0047	0.0500	mg/L	
SHE0478-CCB3	Copper	0.0002	0.0007	0.0020	mg/L	
SHE0478-CCB3	Lead	0.0009	0.0019	0.0200	mg/L	
SHE0478-CCB3	Zinc	0.0001	0.0021	0.0100	mg/L	
SHE0478-CCB4	Arsenic	-0.0011	0.0047	0.0500	mg/L	
SHE0478-CCB4	Copper	0.0005	0.0007	0.0020	mg/L	
SHE0478-CCB4	Lead	0.0002	0.0019	0.0200	mg/L	
SHE0478-CCB4	Zinc	0.0005	0.0021	0.0100	mg/L	
SHE0478-CCB5	Arsenic	-0.0008	0.0047	0.0500	mg/L	
SHE0478-CCB5	Copper	0.0003	0.0007	0.0020	mg/L	
SHE0478-CCB5	Lead	-0.00004	0.0019	0.0200	mg/L	
SHE0478-CCB5	Zinc	-0.0001	0.0021	0.0100	mg/L	
SHE0478-CCB6	Arsenic	-0.0011	0.0047	0.0500	mg/L	
SHE0478-CCB6	Copper	0.0003	0.0007	0.0020	mg/L	
SHE0478-CCB6	Lead	0.0007	0.0019	0.0200	mg/L	
SHE0478-CCB6	Zinc	0.000007	0.0021	0.0100	mg/L	
SHE0478-CCB7	Arsenic	0.0003	0.0047	0.0500	mg/L	
SHE0478-CCB7	Copper	0.0004	0.0007	0.0020	mg/L	
SHE0478-CCB7	Lead	0.0007	0.0019	0.0200	mg/L	
SHE0478-CCB7	Zinc	0.0004	0.0021	0.0100	mg/L	
SHE0478-CCB8	Arsenic	0.0002	0.0047	0.0500	mg/L	
SHE0478-CCB8	Copper	0.0004	0.0007	0.0020	mg/L	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INSTRUMENT BLANKS
EPA 6010C

Laboratory: Analytical Resources, Inc.
Client: Seattle Public Utilities
Instrument ID: ICP2
Sequence: SHE0478

SDG: 19E0222
Project: Lower Duwamish Waterway
Calibration: CF00001
Date Analyzed: 05/31/19 14:05

Lab Sample ID	Analyte	Found	MDL	MRL	Units	C
SHE0478-CCB8	Lead	0.0013	0.0019	0.0200	mg/L	
SHE0478-CCB8	Zinc	0.0004	0.0021	0.0100	mg/L	
SHE0478-CCB9	Arsenic	-0.0015	0.0047	0.0500	mg/L	
SHE0478-CCB9	Copper	0.0003	0.0007	0.0020	mg/L	
SHE0478-CCB9	Lead	0.0012	0.0019	0.0200	mg/L	
SHE0478-CCB9	Zinc	0.0006	0.0021	0.0100	mg/L	
SHE0478-CCBA	Arsenic	-0.0008	0.0047	0.0500	mg/L	
SHE0478-CCBA	Copper	0.0002	0.0007	0.0020	mg/L	
SHE0478-CCBA	Lead	0.0017	0.0019	0.0200	mg/L	
SHE0478-CCBA	Zinc	0.0004	0.0021	0.0100	mg/L	
SHE0478-CCBB	Arsenic	0.0011	0.0047	0.0500	mg/L	
SHE0478-CCBB	Copper	0.00001	0.0007	0.0020	mg/L	
SHE0478-CCBB	Lead	0.0004	0.0019	0.0200	mg/L	
SHE0478-CCBB	Zinc	-0.0004	0.0021	0.0100	mg/L	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

LCS / LCS DUPLICATE RECOVERY

EPA 6010C

Total Metals

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Matrix:	Solid	Analyzed:	05/31/19 09:07
Batch:	BHE0637	Laboratory ID:	BHE0637-BS1
Preparation:	SWC EPA 3050B	Sequence Name:	LCS
Initial/Final:	1 g / 50 mL		

COMPOUND	SPIKE ADDED (mg/kg wet)	LCS CONCENTRATION (mg/kg wet)	Q	LCS % REC. #	QC LIMITS REC.
Arsenic	200	196		97.9	80 - 120
Copper	50.0	47.8		95.5	80 - 120
Lead	200	192		96.2	80 - 120
Zinc	50.0	48.0		96.0	80 - 120

* Indicates values outside of QC limits

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CF00001	Instrument:	ICP2
Calibration Date:	05/31/2019 7:41		

Compound	Level 01		Level 02		Level 03		Level 04		Level 05		Level 06	
		RF		RF		RF		RF		RF		RF
Arsenic	0	0	0		10	2358.441	0		0			
Copper	0	0	10	233046.4	0		0		0			
Lead	0	0	0		10	11892.35	0		0			
Zinc	0	0	0		10	5646.216	0		0			

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INITIAL CALIBRATION DATA

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Calibration:	CF00001	Instrument:	ICP2
Calibration Date:	05/31/2019 7:41		

COMPOUND	Mean RF	RF RSD	Linear COD	Quad COD	COD Limit	Q
Arsenic	1179.221	141.4	1.0000			
Copper	116523.2	141.4	1.0000			
Lead	5946.175	141.4	1.0000			
Zinc	2823.108	141.4	1.0000			

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0478	Instrument:	ICP2
		Calibration:	CF00001

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
CAL 0	SHE0478-CAL1	I2190531-006	NA	05/31/19 07:41
CAL 1 - LOW CHECK	SHE0478-CAL2	I2190531-007	NA	05/31/19 07:45
CAL 2	SHE0478-CAL3	I2190531-008	NA	05/31/19 07:47
CAL 3	SHE0478-CAL4	I2190531-009	NA	05/31/19 07:49
CAL 4	SHE0478-CAL5	I2190531-010	NA	05/31/19 07:51
Initial Cal Check	SHE0478-ICV1	I2190531-011	NA	05/31/19 07:54
Initial Cal Blank	SHE0478-ICB1	I2190531-012	NA	05/31/19 07:57
Instrument RL Check	SHE0478-CRL1	I2190531-013	NA	05/31/19 08:01
Interference Check A	SHE0478-IFA1	I2190531-014	NA	05/31/19 08:05
Interference Check B	SHE0478-IFB1	I2190531-015	NA	05/31/19 08:09
Calibration Check	SHE0478-CCV1	I2190531-017	NA	05/31/19 08:17
Calibration Blank	SHE0478-CCB1	I2190531-018	NA	05/31/19 08:21
Blank	BHE0637-BLK1	I2190531-019	Solid	05/31/19 08:25
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ZZZZZ	19E0382-01	I2190531PRE-022	Solid	05/31/19 08:38
ST10-050819	19E0222-01	I2190531PRE-024	Solid	05/31/19 08:47
ST10-050819	19E0222-01	I2190531PRE-024	Solid	05/31/19 08:47
ST10-050819	19E0222-01	I2190531PRE-024	Solid	05/31/19 08:47
ST10-050819	19E0222-01	I2190531PRE-024	Solid	05/31/19 08:47
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0478	Instrument:	ICP2
		Calibration:	CF00001

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0345-01	I2190531PRE-026	Solid	05/31/19 08:59
ZZZZZ	19E0388-01	I2190531-027	Solid	05/31/19 09:03
ZZZZZ	19E0388-01	I2190531-027	Solid	05/31/19 09:03
LCS	BHE0637-BS1	I2190531-028	Solid	05/31/19 09:07
Calibration Check	SHE0478-CCV2	I2190531-029	NA	05/31/19 09:11
Calibration Blank	SHE0478-CCB2	I2190531-030	NA	05/31/19 09:15
ZZZZZ	19E0378-01	I2190531-032	Solid	05/31/19 09:24
ZZZZZ	19E0378-01	I2190531-032	Solid	05/31/19 09:24
ZZZZZ	19E0378-01	I2190531-032	Solid	05/31/19 09:24
ZZZZZ	19E0401-01	I2190531-033	Solid	05/31/19 09:28
ZZZZZ	19E0401-01	I2190531-033	Solid	05/31/19 09:28
ZZZZZ	19E0401-01	I2190531-033	Solid	05/31/19 09:28
ZZZZZ	19E0401-01	I2190531-033	Solid	05/31/19 09:28
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0327-01	I2190531-035	Solid	05/31/19 09:36
ZZZZZ	19E0345-01	I2190531-037	Solid	05/31/19 09:45
ZZZZZ	19E0345-01	I2190531-037	Solid	05/31/19 09:45
ZZZZZ	19E0345-01	I2190531-037	Solid	05/31/19 09:45
ZZZZZ	19E0345-01	I2190531-037	Solid	05/31/19 09:45
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52

Analytical Resources, Incorporated
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ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0478	Instrument:	ICP2
		Calibration:	CF00001

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
ZZZZZ	19E0334-01	I2190531-039	Solid	05/31/19 09:52
Calibration Check	SHE0478-CCV3	I2190531-041	NA	05/31/19 09:59
Calibration Blank	SHE0478-CCB3	I2190531-042	NA	05/31/19 10:03
Calibration Check	SHE0478-CCV4	I2190531-053	NA	05/31/19 10:52
Calibration Blank	SHE0478-CCB4	I2190531-054	NA	05/31/19 10:56
Calibration Check	SHE0478-CCV5	I2190531-065	NA	05/31/19 11:40
Calibration Blank	SHE0478-CCB5	I2190531-066	NA	05/31/19 11:44
ZZZZZ	BHE0743-BLK1	I2190531-067	Solid	05/31/19 11:48
ZZZZZ	BHE0743-BS1	I2190531-070	Solid	05/31/19 12:00
Calibration Check	SHE0478-CCV6	I2190531-077	NA	05/31/19 12:28
Calibration Blank	SHE0478-CCB6	I2190531-078	NA	05/31/19 12:32
Calibration Check	SHE0478-CCV7	I2190531-089	NA	05/31/19 13:14

Analytical Resources, Incorporated
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ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0478	Instrument:	ICP2
		Calibration:	CF00001

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
Calibration Blank	SHE0478-CCB7	I2190531-090	NA	05/31/19 13:18
ZZZZZ	19E0402-01	I2190531-091	Solid	05/31/19 13:22
Calibration Check	SHE0478-CCV8	I2190531-101	NA	05/31/19 14:01
Calibration Blank	SHE0478-CCB8	I2190531-102	NA	05/31/19 14:05
Calibration Check	SHE0478-CCV9	I2190531-109	NA	05/31/19 14:32
Calibration Blank	SHE0478-CCB9	I2190531-110	NA	05/31/19 14:36
Calibration Check	SHE0478-CCVA	I2190531-111	NA	05/31/19 16:02
Calibration Blank	SHE0478-CCBA	I2190531-112	NA	05/31/19 16:07
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	19E0307-01	I2190531-117	Water	05/31/19 16:31
ZZZZZ	BHE0764-BS1	I2190531-119	Water	05/31/19 16:40
ZZZZZ	BHE0764-BLK1	I2190531-120	Water	05/31/19 16:43
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48

Analytical Resources, Incorporated
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ANALYSIS BATCH (SEQUENCE) SUMMARY

EPA 6010C

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Sequence:	SHE0478	Instrument:	ICP2
		Calibration:	CF00001

Sample Name	Lab Sample ID	Lab File ID	Matrix	Analysis Date/Time
ZZZZZ	19E0347-04	I2190531-121	Water	05/31/19 16:48
ZZZZZ	19E0352-01	I2190531-122	Water	05/31/19 16:53
ZZZZZ	19E0352-01	I2190531-122	Water	05/31/19 16:53
ZZZZZ	19E0352-01	I2190531-122	Water	05/31/19 16:53
Calibration Check	SHE0478-CCVB	I2190531-123	NA	05/31/19 16:58
Calibration Blank	SHE0478-CCBB	I2190531-124	NA	05/31/19 17:02

Work Order(s):	19E0222	
Analysis	**Matrix**	**Method**
Met 6010C - As	Solid	EPA 6010C
Met 6010C - Cu	Solid	EPA 6010C
Met 6010C - Pb	Solid	EPA 6010C
Met 6010C - Zn	Solid	EPA 6010C
Met 6010C - As	Water	EPA 6010C
Met 6010C - Cu	Water	EPA 6010C
Met 6010C - Pb	Water	EPA 6010C
Met 6010C - Zn	Water	EPA 6010C

Checklist for SEQUENCE SHE0478 — Checklist: Analyst Checklist - Metals

#	Checklist Item	Response	Analyst Initials	Date
1	Dilution factors recorded correctly	YES	TCH	06/03/2019
2	Crossouts/Corrections/Deletions - what does this mean now Comments: *see log*	YES	TCH	06/03/2019
3	Blank and Standard intensities are within limits	YES	TCH	06/03/2019
4	Standard deviations within method requirements	YES	TCH	06/03/2019
5	Curve fit within method requirements	YES	TCH	06/03/2019
6	ICV/CCV are in control	YES	TCH	06/03/2019
7	ICB/CCB are in control	YES	TCH	06/03/2019
8	RSDs & SDs of replicate readings within control	YES	TCH	06/03/2019
9	Internal standards within method limits	YES	TCH	06/03/2019
10	Carry-over noted and checked	YES	TCH	06/03/2019
11	CRI/CRA are in control	YES	TCH	06/03/2019
12	ICSA/ICSAB are in control	YES	TCH	06/03/2019
13	AUTOCHECK: Post spikes within method requirements	NA *	TCH	06/03/2019
14	Serial dilutions performed if needed	NA	TCH	06/03/2019
15	AUTOCHECK: Standard reference material spike recovery within limits	NA *	TCH	06/03/2019
16	AUTOCHECK: LCS spike recovery within limits	YES *	TCH	06/03/2019
17	AUTOCHECK: LCS run at required frequency	YES *	TCH	06/03/2019
18	AUTOCHECK: All target compounds designated as spikes are present in the LCS	YES *	TCH	06/03/2019
19	AUTOCHECK: Matrix Spike recoveries are within limits Comments: *EXCEPTION REPORT REQUIRED* *BHE0637-MS1: Sb %R < 75. LOW. Al, Ca, Fe, Mg, Mn, Zn SPIKED TOO LOW*	NO *	TCH	06/03/2019
20	AUTOCHECK: All target compounds designated as spikes are present in the matrix spike	YES *	TCH	06/03/2019
21	AUTOCHECK: MS run at required frequency	YES *	TCH	06/03/2019
22	AUTOCHECK: Duplicate RPD within limits Comments: *EXCEPTION REPORT REQUIRED*	NO *	TCH	06/03/2019

* = Indicates Automated Response from Element DataSyst

Printed: 6/5/2019

Work Order(s):	19E0222

Analysis	Matrix	Method
Met 6010C - As	Solid	EPA 6010C
Met 6010C - Cu	Solid	EPA 6010C
Met 6010C - Pb	Solid	EPA 6010C
Met 6010C - Zn	Solid	EPA 6010C
Met 6010C - As	Water	EPA 6010C
Met 6010C - Cu	Water	EPA 6010C
Met 6010C - Pb	Water	EPA 6010C
Met 6010C - Zn	Water	EPA 6010C

Checklist for SEQUENCE SHE0478 — Checklist: Analyst Checklist - Metals

#	Checklist Item	Response	Analyst Initials	Date
	BHE0745-DUP1: Zn DIFFERENCE > 1RL. HIGH			
23	AUTOCHECK: Duplicate run at frequency required by the method	YES *	TCH	06/03/2019
24	AUTOCHECK: Check method blank for exceedences and list in exception report	YES *	TCH	06/03/2019
	Comments: *BHE0745-BLK1: Ba CONTAMINATION FROM TCLP FILTER (0.02399 mg/L)*			
25	AUTOCHECK: Check blank frequency specified	YES *	TCH	06/03/2019
26	Raw data matches distributed data	YES	TCH	06/03/2019
27	Analyst Comments	YES	TCH	06/03/2019

Comments:
BHE0745-BLK1: Ba CONTAMINATION FROM TCLP FILTER (0.02399 mg/L)
BHE0745-DUP1: Zn DIFFERENCE > 1RL. HIGH
BHE0637-MS1: Sb %R < 75. LOW.

Work Order(s):	19E0222

Analysis	Matrix	Method
Met 6010C - As	Solid	EPA 6010C
Met 6010C - Cu	Solid	EPA 6010C
Met 6010C - Pb	Solid	EPA 6010C
Met 6010C - Zn	Solid	EPA 6010C
Met 6010C - As	Water	EPA 6010C
Met 6010C - Cu	Water	EPA 6010C
Met 6010C - Pb	Water	EPA 6010C
Met 6010C - Zn	Water	EPA 6010C

Checklist for SEQUENCE SHE0478

Checklist: Reviewer Checklist-Metals

#	Checklist Item	Response	Analyst Initials	Date
1	Analyst and Peer review checklist completed	YES	EL	06/03/2019
2	Data is locked and Status is Peer Reviewed	YES	EL	06/03/2019
3	Qualifers have been correctly added	YES	EL	06/03/2019
4	Color warnings have been addressed, narrated and (or) qualified	YES	EL	06/03/2019

Analytical Resources, Incorporated
Analytical Chemists and Consultants

ICP INTERFERENCE CHECK SAMPLE

EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: ICP2
Calibration: CF00001
Sequence: SHE0478
Standard ID: H004206

Lab Sample ID	Analyte	True	Found	%R	Units
SHE0478-IFA1	Arsenic	0	0.0119		mg/L
	Copper	0	0.0005		mg/L
	Lead	0	0.0067		mg/L
	Zinc	0	0.0024		mg/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, Incorporated
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ICP INTERFERENCE CHECK SAMPLE

EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: ICP2
Calibration: CF00001
Sequence: SHE0478
Standard ID: H004206

Lab Sample ID	Analyte	True	Found	%R	Units
SHE0478-IFB1	Arsenic	1.0000	1.0265	103	mg/L
	Copper	1.0000	0.9806	98.1	mg/L
	Lead	1.0000	0.9864	98.6	mg/L
	Zinc	1.0000	0.9681	96.8	mg/L

* Indicates %R outside of QC limits

NOTE: True value and %R are populated only for analytes found in the interference check standards, and will be seen only if those analytes were requested.

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTER-ELEMENT CORRECTION FACTORS

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument:	ICP2	IEC Date:	04/26/2019

Analyte	Wave-length (nm)	Interelement Correction Factors for:				
		Al	Ca	Fe	Mg	Sb
Aluminum	308.22					
Antimony	206.84	0.11113				
Arsenic	188.98		0.032374			
Barium	233.53			0.060018		
Beryllium	313.04					
Cadmium	228.8					
Chromium	267.72			-0.046264	0.065811	
Cobalt	228.62					
Copper	324.75			-0.04141	0.008071	
Iron	273.96					
Lead	220.35	-0.215392		0.056765		
Magnesium	279.08			0.732007		
Manganese	257.61	0.006929				
Nickel	231.6					-0.665647
Selenium	196.03		0.108354	-0.135881	0.117255	
Silver	328.07					
Sodium	330.24		7.292129			
Thallium	190.8		0.109844	-0.112443		
Vanadium	292.4			0.043044		
Zinc	206.2					0.372282

Analytical Resources, Incorporated
Analytical Chemists and Consultants

INTER-ELEMENT CORRECTION FACTORS

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument:	ICP2	IEC Date:	04/26/2019

Analyte	Wave-length (nm)	Interelement Correction Factors for: As	Ba	Cd	Cr	Co
Aluminum	308.22					
Antimony	206.84				16.92517	
Arsenic	188.98				1.867997	-1.045097
Barium	233.53					-0.193624
Beryllium	313.04					
Cadmium	228.8	6.78389				0.141972
Chromium	267.72					
Cobalt	228.62		0.086497			
Copper	324.75				-0.02196	-0.150139
Iron	273.96				-1.111711	
Lead	220.35				-2.835826	0
Magnesium	279.08				-0.985888	-1.311775
Manganese	257.61					0
Nickel	231.6					
Selenium	196.03					0
Silver	328.07					
Sodium	330.24					
Thallium	190.8				0.419431	6.097803
Vanadium	292.4				-4.227219	
Zinc	206.2			0	-0.445119	

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INTER-ELEMENT CORRECTION FACTORS

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument:	ICP2	IEC Date:	04/26/2019

Analyte	Wave-length (nm)	Interelement Correction Factors for:				
		Cu	Pb	Mn	Mo	Ni
Aluminum	308.22				15.81688	
Antimony	206.84					
Arsenic	188.98				4.047051	
Barium	233.53					0.12491
Beryllium	313.04					
Cadmium	228.8					-0.844665
Chromium	267.72		0	0.124714		
Cobalt	228.62				-0.34424	0.136384
Copper	324.75				0.360089	
Iron	273.96	0				
Lead	220.35	1.572459				0
Magnesium	279.08			0	-2.740694	
Manganese	257.61	0	-0.257807			
Nickel	231.6					
Selenium	196.03					
Silver	328.07	0.086706				
Sodium	330.24					
Thallium	190.8			0	0.838699	
Vanadium	292.4			-0.118367	-0.407752	
Zinc	206.2		-0.115122		0.328676	0.174959

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INTER-ELEMENT CORRECTION FACTORS

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument:	ICP2	IEC Date:	04/26/2019

Analyte	Wave-length (nm)	Interelement Correction Factors for:				
		K	Si	Ag	Tl	Sn
Aluminum	308.22					
Antimony	206.84					-10.08495
Arsenic	188.98					
Barium	233.53					
Beryllium	313.04					
Cadmium	228.8					
Chromium	267.72					
Cobalt	228.62					
Copper	324.75					
Iron	273.96					
Lead	220.35			0		
Magnesium	279.08					
Manganese	257.61					
Nickel	231.6				0.374587	
Selenium	196.03					
Silver	328.07					
Sodium	330.24					
Thallium	190.8					
Vanadium	292.4					
Zinc	206.2		-0.117183			2.176557

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INTER-ELEMENT CORRECTION FACTORS

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Instrument:	ICP2	IEC Date:	04/26/2019

Analyte	Wave-length (nm)	Interelement Correction Factors for: Ti	V	Zn		
Aluminum	308.22	1.789848	15.57622			
Antimony	206.84	0	-4.265888			
Arsenic	188.98	-9.166767	0.198781			
Barium	233.53		0.600361			
Beryllium	313.04	0	4.676363			
Cadmium	228.8		0.079966			
Chromium	267.72		0.16953			
Cobalt	228.62	1.879473				
Copper	324.75	0.182233				
Iron	273.96		11.17715			
Lead	220.35					
Magnesium	279.08					
Manganese	257.61					
Nickel	231.6					
Selenium	196.03		0			
Silver	328.07		-0.267651			
Sodium	330.24	-181.9295		392.7569		
Thallium	190.8		3.727268			
Vanadium	292.4	0.537028				
Zinc	206.2		0			

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DETECTION LEVEL STANDARD
EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Instrument ID: ICP2
Calibration: CF00001
Sequence: SHE0478
Lab Sample ID: SHE0478-CRL1

Analyte	True	Found	%R	Units	QC Limts
Arsenic	0.0500	0.0471	94.2	mg/L	50 - 150
Copper	0.0020	0.0021	106	mg/L	50 - 150
Lead	0.0200	0.0214	107	mg/L	50 - 150
Zinc	0.0100	0.0103	103	mg/L	50 - 150

* Values outside of QC limits

Analytical Resources, Incorporated
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HOLDING TIME SUMMARY

Analysis: EPA 6010C

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
ST10-050819 19E0222-01	05/08/19 10:40	05/16/19 13:05	05/28/19 10:04	19	180	05/31/19 08:47	23	180	

* Indicates hold time exceedance.

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METHOD DETECTION AND REPORTING LIMITS

EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Matrix: Solid
Instrument: ICP2

Analyte	MDL	RL	Units
Arsenic	0.470	5.00	mg/kg
Copper	0.0660	0.200	mg/kg
Lead	0.190	2.00	mg/kg
Zinc	0.210	1.00	mg/kg

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METHOD DETECTION AND REPORTING LIMITS

EPA 6010C

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Matrix: Water
Instrument: ICP2

Analyte	MDL	RL	Units
Arsenic	0.0047	0.0500	mg/L
Copper	0.0007	0.0020	mg/L
Lead	0.0019	0.0200	mg/L
Zinc	0.0021	0.0100	mg/L

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Form I
INORGANIC ANALYSIS DATA SHEET
SM 2540 G-97

ST10-050819

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-01 A	SDG:	19E0222
Sampled:	05/08/19 10:40	Prepared:	05/17/19 04:27	File ID:	
% Solids:	35.69	Preparation:	No Prep Wet Chem	Analyzed:	05/17/19 04:48
Batch:	BHE0453	Sequence:		Initial/Final:	10 g Wet / 10 g
Instrument:	BAL2			Calibration:	

CAS NO.	Analyte	Concentration (%)	Dilution Factor	MDL	MRL	Q
	Total Solids	35.69	1	0.04	0.04	

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Form I
INORGANIC ANALYSIS DATA SHEET
SM 2540 G-97

ST09-050819

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-03 A	SDG:	19E0222
Sampled:	05/08/19 11:00	Prepared:	05/17/19 04:27	File ID:	
% Solids:	23.58	Preparation:	No Prep Wet Chem	Analyzed:	05/17/19 04:48
Batch:	BHE0453	Sequence:		Initial/Final:	10 g Wet / 10 g
Instrument:	BAL2			Calibration:	

CAS NO.	Analyte	Concentration (%)	Dilution Factor	MDL	MRL	Q
	Total Solids	23.58	1	0.04	0.04	

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Form I
INORGANIC ANALYSIS DATA SHEET
SM 2540 G-97

17th-ST1-050819

Laboratory:	Analytical Resources, Inc.				
Client:	Seattle Public Utilities				
Project:	Lower Duwamish Waterway				
Matrix:	Sediment	Laboratory ID:	19E0222-05 A	SDG:	19E0222
Sampled:	05/08/19 11:35	Prepared:	05/17/19 04:27	File ID:	
% Solids:	18.08	Preparation:	No Prep Wet Chem	Analyzed:	05/17/19 04:48
Batch:	BHE0453	Sequence:		Initial/Final:	10 g Wet / 10 g
Instrument:	BAL2			Calibration:	

CAS NO.	Analyte	Concentration (%)	Dilution Factor	MDL	MRL	Q
	Total Solids	18.08	1	0.04	0.04	

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PREPARATION BATCH SUMMARY

SM 2540 G-97

Laboratory:	Analytical Resources, Inc.	SDG:	19E0222
Client:	Seattle Public Utilities	Project:	Lower Duwamish Waterway
Batch:	BHE0453 Batch Matrix: Solid	Preparation:	No Prep Wet Chem

SAMPLE NAME	LAB SAMPLE ID	LAB FILE ID	DATE PREPARED	OBSERVATIONS
ST10-050819	19E0222-01		05/17/19 04:27	
ST09-050819	19E0222-03		05/17/19 04:27	
17th-ST1-050819	19E0222-05		05/17/19 04:27	
Blank	BHE0453-BLK1		05/17/19 04:27	

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Form I

METHOD BLANK DATA SHEET

SM 2540 G-97

TotalAnalytes

Blank

Batch: BHE0453 Laboratory ID: BHE0453-BLK1 Prepared: 05/17/19 04:27

Matrix: Solid Preparation: No Prep Wet Chem Analyzed: 05/17/19 04:48

Sequence: Calibration: Instrument: BAL2

CAS NO.	Analyte	Concentration (%)	Dilution Factor	MDL	MRL	Q
	Total Solids	ND	1	0.04	0.04	U

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HOLDING TIME SUMMARY

Analysis: SM 2540 G-97

Laboratory: Analytical Resources, Inc. SDG: 19E0222

Client: Seattle Public Utilities Project: Lower Duwamish Waterway

Sample Name	Date Collected	Date Received	Date Prepared	Days to Prep	Max Days to Prep	Date Analyzed	Days to Analysis	Max Days to Analysis	Q
ST10-050819 19E0222-01	05/08/19 10:40	05/16/19 13:05	05/17/19 04:27	8	28	05/17/19 04:48	9	28	
ST09-050819 19E0222-03	05/08/19 11:00	05/16/19 13:05	05/17/19 04:27	8	28	05/17/19 04:48	9	28	
17th-ST1-050819 19E0222-05	05/08/19 11:35	05/16/19 13:05	05/17/19 04:27	8	28	05/17/19 04:48	9	28	

* Indicates hold time exceedance.

Analytical Resources, Incorporated
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METHOD DETECTION AND REPORTING LIMITS

SM 2540 G-97

Laboratory: Analytical Resources, Inc.
SDG: 19E0222
Client: Seattle Public Utilities
Project: Lower Duwamish Waterway
Matrix: Solid
Instrument:

Analyte	MDL	RL	Units
Total Solids	0.04	0.04	%

APPENDIX B

VISUAL INSPECTION LOG

Table 2-1. Evaluation Criteria for Visual Inspections

Area	Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Follow-up Proposed Actions
Upland Area (including stormwater controls)	Trash and Debris	Conduct visual inspection to identify trash and debris.	Trash and debris is accumulating at the site (including swale and outlet pipe).	Remove trash and debris from upland area, including swale and outlet pipe, and dispose of the at an appropriate off-site facility.
	Contaminants and Pollution	Conduct inspection to identify evidence of contaminants (e.g., discoloration, staining, oil sheen, odor).	Visual evidence of contaminants or pollution (e.g., oil, gasoline, concrete slurries or paint) are apparent.	Remove and dispose of any materials that appears to be the source of the contamination and dispose of it according to applicable regulations.
	Sediment Accumulation	Check the swale and the outlet pipe for sediment accumulation.	Sediment depth exceeds 2-inches in 10% or more of the swale or sediment inhibits grass growth in > 10% of swale. Sediment is noted filling > 20% of the outlet pipe.	Remove and control sediment to allow for proper function of swale and outlet pipe.
	Erosion/Scouring	Visually inspect the hillside, swale and outfall areas for erosion (e.g., rivulets).	Signs of erosion are noted on the hillside or erosion/scour is evident in the bottom of the swale.	Identify the cause of erosion and determine the required follow-up action with EPA and Ecology.
	Vegetation Coverage	Conduct visual inspection of grass in swale.	Grass in swale is sparse or bare or eroded in patches in > 10% of the swale bottom.	Develop and implement plan to revegetate bare spots and mitigate the cause, if apparent.
	Grass height and invasive plants	Check the height of the grass in the swale and conduct visual inspection of the entire site for invasive plants.	Grass > 10 inches in height or nuisance weeds and other vegetation have taken over the swale or other portions of the site.	Cut grass in swale to between 3 to 4-inches in height and remove invasive plants/nuisance weeds.
	Constant Baseflow	Check the base of the swale for continuous flow or muddy channel.	Continuous flow in swale is evident even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.	Modify stormwater controls to eliminate baseflow (e.g., install drain or bypass flow around swale).
	Standing Water	Check the swale for the presence of standing water.	Water pooling in the swale between storms or swale does not drain freely.	Modify swale so that it drains freely and no standing water is present in swale between storms.
	Channelization	Check swale for development of channels.	An eroded channel through the swale is evident.	Modify swale to eliminate flow channels.
	Fence	Conduct visual inspection to assess condition of the fence, including the access gate, surrounding the site.	Breaches in upland perimeter fencing is evident.	Repair fence and complete other actions as needed to re-establish site security.
	Trespassing	Conduct visual inspection for evidence of trespassing.	Evidence of vandalism or trespassing is noted.	Conduct repairs or maintenance to address vandalism and/or identify measures to minimize trespassing. Contact the authorities if active trespassing is noted.
	T-117 Signage	Following completion of the habitat restoration project, confirm that the signs required by the environmental covenant have been installed.	Signs notifying the public of the presence of PCBs beneath the DU1 cap are missing.	Re-install signs required by the environmental covenant.
	Invasive Plants	Assess vegetation throughout the upland area for the presence of invasive plants (e.g., Himalayan Blackberry, Japanese knotweed and Scotch Broom).	Invasive plants are present at the site.	Identify and implement measures to control invasive plants.

Table 2-1. Evaluation Criteria for Visual Inspections

Area	Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Follow-up Proposed Actions
Shoreline Bank	Erosion	Conduct visual inspection of the Shoreline Bank to identify any apparent changes resulting from erosion (e.g., rivulets).	Signs of erosion are evident in the area.	Determine the required follow-up action with EPA and Ecology.
	Presence of the armor stone	Inspect shore armor and document with photographs. Identify areas where the sediment density characteristics appear to be anomalous compared to final as-built survey.	Armor material is missing, displaced, or has moved at the shoreline. Anomalies are > 10 ft by 10 ft in size and the area appears to be lower in elevation than the post-construction elevation.	Determine if the armor stone is missing or if excessive sediment accumulation has occurred. Engineer to review this information and make additional recommendations for maintenance, or design modifications if necessary.
	Seeps	Conduct visual inspection to determine if seeps are present.	Sheen present on seep(s).	Determine if sheen is naturally occurring or oil-based (See field test described below in Note 2). Perform follow-up inspection to confirm conditions. Determine the required follow-up action with EPA and Ecology.
	Slope Stability	Conduct visual inspection to identify evidence of slope instability.	Slumps, cracks or other evidence of bank instability are apparent.	Determine the required follow-up action with EPA and Ecology.
DU1 Cap	Erosion	Conduct visual inspection of cap to identify any apparent changes resulting from erosion (e.g., loss of cap material, slumps, rivulets).	Evidence of erosion features noted in the area.	Engineer will review to determine if a follow-up survey is needed to further characterize the erosion. Additional maintenance recommendations may be required based on the engineer's review. Determine the required follow-up action with EPA and Ecology.
	Surficial debris/large obstructions	Identify the approximate length, width, and type of any surficial objects/large obstructions.	Surficial debris/objects are present and appear to be > 10 ft by 10 ft in area and/or is the object adversely impacting the cap.	Engineer will review to determine if a follow-up survey is needed to further characterize the object(s). Additional maintenance recommendations may be required, including surficial object/debris removal, based on the engineer's review.
	Presence of the armor layer	Inspect shore armor and document with photographs. Identify areas where cap characteristics appear to be anomalous compared to final as-built survey.	Armor material missing, displaced, or moving at the shoreline. There are anomalies > 10 ft by 10 ft in area and material appears to be lower in elevation than the post-construction elevation.	Determine if the armor stone is missing and sand layer is exposed or if excessive sediment has been deposited. Engineer will review this information and additional maintenance recommendations may be required, including replacement of armor stone. The nature of the disturbance to the cap identified during the inspection monitoring event will be the basis for any design modifications. If the armor layer is disturbed by a high flow event, then larger diameter stone may be placed along the slope to maintain cap stability.
	Slope Stability	Measure the slope across the extent of the cap (top surface).	The grade across the cap has increased to > 3H:1V or changed substantially (> 50%) over an area > 20 ft by 20 ft. There is evidence of slope failure, such as stone accumulation at the base of slopes.	Conduct a follow-up visual or bathymetry survey to provide visual evidence of the change. Engineer will review results of the follow up survey and additional maintenance recommendations may be required, including a geotechnical reevaluation and placement of buttress armor along the slope.
	Cap Thickness	Evaluate deposition and scour processes.	Not applicable; assume minimum cap thickness is maintained if armor stone is present.	No additional action is necessary.

Notes:
H = horizontal
n/a = not applicable
V = vertical
Ft = feet
> = greater
% = percent

1) Monitoring parameters for upland stormwater include relevant maintenance components included in King County Surface Water Design Manual (King County 2016)
2) To assess the nature of the sheen (i.e., natural vs. petroleum), conduct a field test as follows: break the apparent sheen surface of the water with a stick or a stone, if the sheen breaks up into platelets, it's probably natural. If the material tries to reform and moves back together it's likely petroleum. Also check for odor.

AECOM

Visual Inspection Log
Terminal 117 Joint Long-Term Monitoring and Maintenance Plan
Quality Assurance Project Plan (QAPP)
Upland and Sediment Areas Long-Term Monitoring

INSPECTOR: Eric Olson INSPECTION DATE/TIME: 6/18/19
COMPANY: AECOM WEATHER: Overcast, 50s

SECTION 1: T-117 Upland Area (including stormwater controls)

Description: Perform a visual inspection of the entire upland area as shown on Figure 5 of the QAPP (attached). Evaluate parameters as outlined below and identify whether conditions described in decision criteria are evident. Provide additional details in notes section below for any decision criteria that were observed (e.g., extent of erosion in swale or quantity of trash and debris) and document observations with photographs. For a YES provide a follow-up note at the end of the table.

Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Condition Observed	
Construction Stormwater BMPs	Inspect construction stormwater general permit BMPs until coverage of vegetation in swale reaches approximately 75%.	Changes in swale, slope, berms or outfall areas are evident due to erosion or other conditions. BMPs (e.g., straw wattles and erosion control matting) appear to not be functioning properly.	Yes	No
Trash and Debris	Conduct visual inspection to identify trash and debris.	Trash and debris is accumulating at the site (including swale and outlet pipe). tiny bit	Yes	No
Contaminants and Pollution	Conduct inspection to identify evidence of contaminants (e.g., discoloration, staining, oil sheen, odor).	Visual evidence of contaminants or pollution (e.g., oil, gasoline, concrete slurries or paint) are apparent.	Yes	No
Sediment Accumulation	Check the swale and the outlet pipe for sediment accumulation.	Sediment depth exceeds 2-inches in 10% or more of the swale or sediment inhibits grass growth in > 10% of swale. Sediment is noted filling > 20% of the outlet pipe.	Yes	No
Erosion/Scouring	Visually inspect the hillside, swale and outfall areas for erosion (e.g. rivulets).	Signs of erosion are noted on the hillside or erosion/scour is evident in the bottom of the swale. v. slight rivulets in W. hillside.	Yes	No
Vegetation Coverage	Conduct visual inspection of grass in swale.	Grass in swale is sparse or bare or eroded in patches in > 10% of the swale bottom.	Yes	No
Grass height and invasive plants	Check the height of the grass in the swale and conduct visual inspection of the entire site for invasive plants.	Grass > 10 inches in height or nuisance weeds and other vegetation have taken over the swale or other portions of the site.	Yes	No

Notes:

- get rid of large pipe during year
- clear blackberry bush in SW corner & along W fence line
- replace original deteriorated signage on perimeter fence.

Attach additional notes to Inspection Log as necessary.

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SECTION 1: Upland Area (Continued)

Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Condition Observed	
Constant Baseflow	Check the base of the swale for continuous flow or muddy channel.	Continuous flow in swale is evident even when it has been dry for weeks or an eroded, muddy channel has formed in the swale bottom.	Yes	No
Standing Water	Check the swale for the presence of standing water.	Water pooling in the swale between storms or swale does not drain freely.	Yes	No
Channelization	Check swale for development of channels.	An eroded channel through the swale is evident.	Yes	No
Fence	Conduct visual inspection to assess condition of the fence, including the access gate, surrounding the site.	Breaches in upland perimeter fencing is evident.	Yes	No
Trespassing	Conduct visual inspection for evidence of trespassing.	Evidence of vandalism or trespassing is noted. one beer bottle	Yes	No
T-117 Signage	Following completion of the habitat restoration project, confirm that the signs required by the environmental covenant have been installed.	Signs notifying the public of the presence of PCBs beneath the DU1 cap are missing.	Yes	No
Invasive Plants	Assess vegetation throughout the upland area for the presence of invasive plants (e.g., Himalayan Blackberry, Japanese knotweed and Scotch Broom).	Invasive plants are present at the site. butterfly bushes	Yes	No

Notes:

Attach additional notes to Inspection Log as necessary.

AECOM

SECTION 2: Shoreline Bank

Perform a visual inspection of the shoreline bank area (North Bank, Mid Bank and South Bank) as shown on Figure 5 of the QAPP. Evaluate parameters as outlined below and identify whether conditions described in decision criteria are evident. Provide additional details in notes section below for any decision criteria that were observed (e.g., extent of erosion, missing armor material, or seeps) and document observations with photographs. Perform shoreline/bank inspection during tide of +2 feet (ft) above mean lower low water (MLLW) or lower. For a YES provide a follow-up note at the end of the table.

Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Condition Observed	
Erosion	Conduct visual inspection of the Shoreline Bank to identify any apparent changes resulting from erosion (e.g., rivulets).	Signs of erosion are evident noted in the area.	Yes	No
Presence of the armor stone	Inspect shore armor and document with photographs. Identify areas where the sediment density characteristics appear to be anomalous compared to final as-built survey.	Armor material is missing, displaced, or has moved at the shoreline. Anomalies are > 10 ft by 10 ft in size and the area appears to be lower in elevation than the post-construction elevation.	Yes	No
Seeps	Conduct visual inspection to determine if seeps are present.	Sheen present on seep(s).	Yes	No
Slope Stability	Conduct visual inspection to evidence slope instability.	Slumps, cracks or other evidence of bank instability are apparent.	Yes	No

If a sheen is present at seep, assess the nature of the sheen (i.e., natural vs. petroleum), by conducting a field test as follows: break the apparent sheen surface of the water with a stick or a stone, if the sheen breaks up into platelets, it's probably natural.

Notes:

Attach additional notes to Inspection Log as necessary.

AECOM

SECTION 3:DU1 Cap

Perform a visual inspection of the DU1 Cap as shown on Figure 5 of the QAPP. Evaluate parameters as outlined below and identify whether conditions described in decision criteria are evident. Provide additional details in notes section below for any decision criteria that were observed (e.g., extent of erosion or loss of armor stone) and document observations with photographs. Perform DU1 Cap inspection during tide of +2 ft MLLW or lower. For a YES provide a follow-up note at the end of the table.

Monitoring Parameter	Data Evaluation of the Parameter	Decision Criteria	Condition Observed	
Erosion	Conduct visual inspection of cap to identify any apparent changes resulting from erosion(e.g., loss of cap material, slumps, rivulets).	Evidence of erosion features noted in the area.	Yes	No
Surficial debris/large obstructions	Identify the approximate length, width, and type of any surficial objects/large obstructions.	Surficial debris/objects are present and appear to be > 10 ft by 10 ft area and/or is the object adversely impacting the cap.	Yes	No
Presence of the armor layer	Inspect shore armor and document with photographs. Identify areas where cap characteristics appear to be anomalous compared to final as-built survey.	Armor material missing, displaced, or moving at the shoreline. There are anomalies > 10 ft by 10 ft in area and appears to be lower in elevation than the post-construction elevation.	Yes	No
Slope Stability	Measure the slope across the extent of the cap (top surface).	The grade across the cap has increased to > 3H:1V or changed substantially (> 50%) over an area > 20 ft by 20 ft. There is evidence of slope failure, such as stone accumulation at the base of slopes.	Yes	No
Cap Thickness	Evaluate deposition and scour processes.	Not applicable; assume minimum cap thickness is maintained if armor stone is present.	Yes	No

No evidence of slope change

Notes:

Attach additional notes to Inspection Log as necessary.

APPENDIX C

VISUAL INSPECTION PHOTOGRAPHS

Terminal 117 Visual Inspection Photolog

Photo 1 – North end of shoreline bank at Marina Corner

Photo 2 – Blackberries near Marina Corner

Terminal 117 Visual Inspection Photolog

Photo 3 – New sign near Marina Corner

Terminal 117 Visual Inspection Photolog

Photo 4 – Looking south from north end of shoreline bank near Marina Corner

Photo 5 – Swale looking south

Terminal 117 Visual Inspection Photolog

Photo 6 – North end of swale

Terminal 117 Visual Inspection Photolog

Photo 7 – Near top of shoreline bank looking south

Photo 8 – Top of shoreline bank near Sheet Pile wall looking north

Photo 9 – Straw waddle near sheet pile wall

Terminal 117 Visual Inspection Photolog

Photo 10 – Outlet pipe discharge from swale

Photo 11 – Outlet pipe inlet in swale

Terminal 117 Visual Inspection Photolog

Photo 12 – Swale looking north

Photo 13 – Swale Looking south

Terminal 117 Visual Inspection Photolog

Photo 14 – HDPE pipe near sheet pile wall

Photo 15 – Tidal seep near south end of site

Terminal 117 Visual Inspection Photolog

Photo 16 – DU1 Cap and tidal seep south of sheet pile wall

Photo 17 – Shoreline bank on south side of site

Terminal 117 Visual Inspection Photolog

Photo 18 – Blackberries on shoreline bank near south end of site

Photo 19 – Southern fence line

Photo 20 – Looking north onto Site

Photo 21 – Blackberries along Dallas Avenue fence (1)

Photo 22 – Blackberries along Dallas Avenue fence (2)

Photo 23 – Blackberries along Dallas Avenue fence (3)

Terminal 117 Visual Inspection Photolog

Photo 24 – Damaged sign on Dallas Avenue fence

Photo 25 – Replaced signage along Dallas Avenue (October 2019)

Terminal 117 Visual Inspection Photolog

Photo 26 – Replaced signage along Dallas Avenue (2) (October 2019)

Photo 27 – Vegetation cleared along Dallas Avenue (1) (October 2019)

Photo 28 – Vegetation cleared along Dallas Avenue (2) (October 2019)

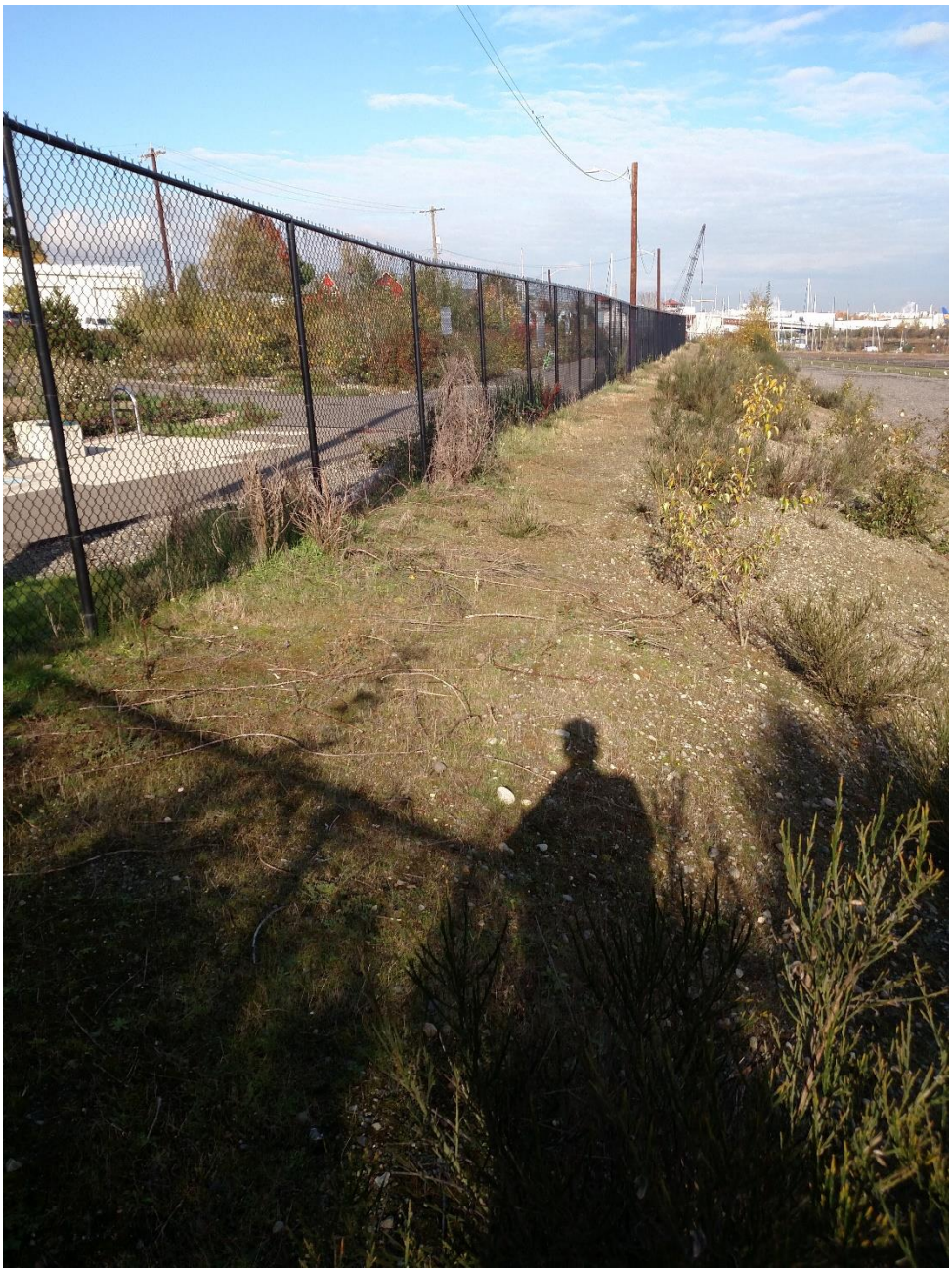


Photo 29 – Vegetation cleared along south side of site (October 2019)

Photo 30 – Replaced signage looking south on Dallas Avenue (October 2019)

APPENDIX D

SEDIMENT SAMPLING DOCUMENTATION AND ANALYTICAL RESULTS

Field Forms

T-117 EARLY ACTION AREA SURFACE SEDIMENT COLLECTION FORM

Project Name: T-117 Sediment Sampling **Project No.:** 60599719 pg ___ of ___
Date: 3-28-19 **Crew:** Eric Parker, Andrew Muth
Weather: Cloudy 50s Anders Utter, Demetrio Cabanillas
Sampling Method: Power Grab

Time: 820 **Station:** LTM 1 **Replicate:** yes **Acceptable Grab:** (Yes) No
Target Coordinates: -122.309832 47.525673
Actual "On Bottom" Coordinates: -122.309830 47.525673
Distance from Target Station: 1.4 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 8.2 / 7.6 ft **Penetration Depth:** 16 (cm) **Photo ID:**
Fines Overlying Cap Material: (Yes) No **Fines Thickness:** 1 (cm)
Sample ID: T117-LTM 1-20190328
Type: cobble gravel (sand) [coarse / (medium) / fine] silt clay organic matter (wood/shell fragments)
Color: drab olive gray black brown (brown surface) **Redox Discontinuity Depth:** NA (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

Comments/Description:

0-1 cm Olive Brown SILT with orange streaks
1-16 cm Black SAND with silt no odor
no sheen, trace woody debris (backfill)

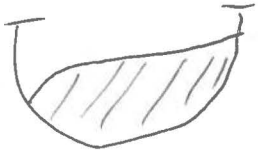
Sample collected 835 from 0-10 cm
Dup 1 collected

Cap = backfill at time of construction

Time: 848 **Station:** LTM 2 **Replicate:** no **Acceptable Grab:** (Yes) No
Target Coordinates: -122.310120 47.526106
Actual "On Bottom" Coordinates: -122.310121 47.526103
Distance from Target Station: 1.3 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 6.5 ft **Penetration Depth:** 21.5 (cm) **Photo ID:**
Fines Overlying Cap Material: (Yes) No **Fines Thickness:** 0.1 (cm)
Sample ID: T117-LTM 2-20190328
Type: cobble gravel (sand) [coarse / (medium) / fine] silt clay organic matter wood/shell fragments
Color: drab olive gray black (brown) (brown surface) **Redox Discontinuity Depth:** NA (cm)
Odor: none slight moderate strong sulfidic petroleum other

Comments/Description:

0.1-21.5cm Olive brown SAND with silt, no odor
no sheen, trace wood (backfill)



Sample collected 905 from 0-10 cm

Cap = backfill at time of construction

T-117 EARLY ACTION AREA SURFACE SEDIMENT COLLECTION FORM

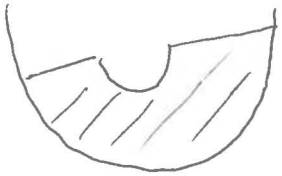
Project Name: T 117 Sediment Sampling **Project No.:** 60519719 pg ___ of ___
Date: 3-28-19 **Crew:** Eric Parker, Andrew Muth
Weather: Cloudy 50s Anders Utter, Demetrio Cabanillas
Sampling Method: Power Grab

Time: 914 **Station:** LTM 3 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.310361 47.526539
Actual "On Bottom" Coordinates: -122.310362 47.526534
Distance from Target Station: 1.3 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 8.9 ft **Penetration Depth:** 21.5 (cm) **Photo ID:**
Fines Overlying Cap Material: (Yes) No **Fines Thickness:** 0.2 (cm)
Sample ID: T117-LTM3-20190328
Type: cobble gravel (sand) [coarse / (medium) / fine] silt clay organic matter wood/shell fragments
Color: drab olive gray black brown brown surface **Redox Discontinuity Depth:** NA (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

Comments/Description:

0.2 - 21.5 cm Olive brown SAND trace silt, no odor
no sheen, trace wood (backfill)

sample collected 930 from 0-10 cm



Cap = backfill at time of construction
Yes

(brown)

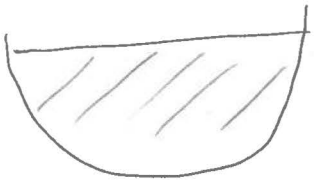
Time: 937 **Station:** LTM4 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.310882 47.526932
Actual "On Bottom" Coordinates: -122.310879 47.526933
Distance from Target Station: 1.3 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 14.8 ft **Penetration Depth:** 28 (cm) **Photo ID:**
Fines Overlying Cap Material: (Yes) (No) **Fines Thickness:** 0.4 (cm)
Sample ID: T117-LTM4-20190328
Type: cobble gravel sand [coarse / medium / fine] silt clay ☒ organic matter / ☒ wood/shell fragments
Color: drab olive (gray) black brown (brown surface) **Redox Discontinuity Depth:** 0.4 (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

(brown surface)

Comments/Description:

0-0.4 cm Olive brown SILT

0.4 - 28 cm Gray SILT trace fine sand
trace organic matter with wood debris
no odor, no sheen
wire at bottom of power grab trap



sample collected 950 from 0-10 cm
MS/MSD collected

T-117 EARLY ACTION AREA SURFACE SEDIMENT COLLECTION FORM

Project Name: T-117 Sediment Sampling **Project No.:** 60599719 pg ___ of ___
Date: 3-28-19 **Crew:** Eric Parker, Andrew Mutt
Weather: cloudy 50s Anders Utter, Demetrio Cabanillas
Sampling Method: Power Grab

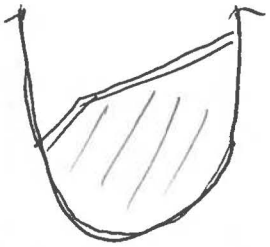
Time: 958 **Station:** Perim 1 **Replicate:** no **Acceptable Grab:** (Yes) No
Target Coordinates: -122.309664 47.525341
Actual "On Bottom" Coordinates: -122.309648 47.525347
Distance from Target Station: 5.85 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 7.1 ft **Penetration Depth:** 19 (cm) **Photo ID:** ___
Fines Overlying Cap Material: (Yes) No **Fines Thickness:** 0.5 (cm)
Sample ID: T117-P1-20190328
Type: cobble (gravel) (sand) [(coarse) / medium / fine] silt clay organic matter wood/shell fragments
Color: drab olive gray black brown (brown surface) **Redox Discontinuity Depth:** 5.8 (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

Comments/Description:

1st grab sample rejected not enough material

~~0.5~~ .5-8cm olive brown SAND with Gravel, trace silt & cobbles, no sheen, no odor

(2-inch)
5.8cm - 19cm Gray SAND with gravel with (backfill) orange streaks



sample collected 1015 from 0-10 cm

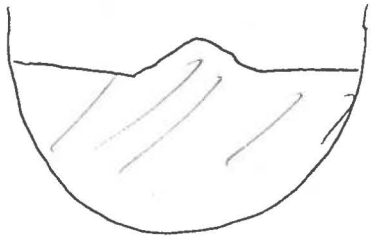
Cap = backfill at time of construction. Yes

Time: 1028 **Station:** P2 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.309519 47.525844
Actual "On Bottom" Coordinates: -122.309514 47.525848
Distance from Target Station: 1.5 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 20.4 ft **Penetration Depth:** 25 (cm) **Photo ID:** ___
Fines Overlying Cap Material: (Yes) (No) **Fines Thickness:** 1 (cm)
Sample ID: T117-P2-20190328
Type: cobble gravel sand [coarse / medium / fine] (silt clay) organic matter wood/shell fragments
Color: drab olive (gray) black brown (brown surface) **Redox Discontinuity Depth:** 1 (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

Comments/Description:

0-1cm olive Brow SILT surface

1-25cm Gray SILT trace sand organic layers, trace wood no odor, no sheen



sample collected 1045 from 0-10 cm

T-117 EARLY ACTION AREA SURFACE SEDIMENT COLLECTION FORM

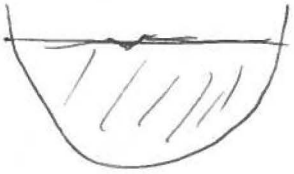
Project Name: T-117 Sediment Sampling **Project No.:** 60599719 pg ___ of ___
Date: 3-28-19 **Crew:** Eric Porter, Andrew Moth
Weather: Cloudy 50 Anders Utter, Demetrio Cabanillas
Sampling Method: Power Grab

Time: 1052 **Station:** P3 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.309974 47.526515
Actual "On Bottom" Coordinates: -122.309964 47.526518
Distance from Target Station: 1.4 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 20.3 ft **Penetration Depth:** 25 (cm) **Photo ID:** ___
Fines Overlying Cap Material: Yes (No) **Fines Thickness:** 0.5 (cm)
Sample ID: T117-P3-20190328
Type: cobble gravel (sand) [coarse / medium / (fine)] (silt/clay) organic matter (wood/shell fragments)
Color: drab olive (gray) black brown (brown surface) **Redox Discontinuity Depth:** 0.5 (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

Comments/Description:

0-0.5 cm olive brown surface layer SILT

0.5-25cm Gray SILT trace sand, trace orange streaks, wood debris no odor, no sheen



Sample collected 1105 from 0-10cm

Yes

Yes

Time: 1117 **Station:** P4 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.311062 47.527178
Actual "On Bottom" Coordinates: -122.311061 47.527178
Distance from Target Station: 1.4 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 16.2 ft **Penetration Depth:** 25 (cm) **Photo ID:** ___
Fines Overlying Cap Material: Yes (No) **Fines Thickness:** 0.5 (cm)
Sample ID: T117-P4-20190328
Type: cobble gravel (sand) [coarse / medium / (fine)] (silt/clay) organic matter wood/shell fragments
Color: drab olive (gray) black brown (brown surface) **Redox Discontinuity Depth:** ___ (cm)
Odor: none slight moderate strong sulfidic petroleum (other)

Comments/Description:

0-0.5cm olive brown surface SILT

0.5-25cm Gray black SILT, trace sand trace wood debris, slight organic odor no sheen

sample collected 1130 from 0-10cm

T-117 EARLY ACTION AREA SURFACE SEDIMENT COLLECTION FORM

Project Name: T-117 Sediment Sampling **Project No.:** 60599719 pg ___ of ___
Date: 3-28-19 **Crew:** Eric Parker, Andrew Muth
Weather: Cloudy 50 Anders Utter, Demetrio Cabanillas
Sampling Method: Power Grab

Time: 1150 **Station:** P5 **Replicate:** No **Acceptable Grab:** (Yes) No
Target Coordinates: -122.311865 47.527373
Actual "On Bottom" Coordinates: -122.311889 47.527372
Distance from Target Station: 4.5 ft **(Tolerance is +/- 3 meters)**
Bottom Depth: 10.5 ft **Penetration Depth:** 27.5 (cm) **Photo ID:** ___
Fines Overlying Cap Material: (Yes) (No) **Fines Thickness:** 2 (cm)
Sample ID: T117-P5-20190328
Type: cobble gravel (sand) [coarse / medium / (fine)] (silt clay) organic matter wood/shell fragments
Color: drab olive (gray) black brown (brown surface) **Redox Discontinuity Depth:** 2 (cm)
Odor: (none) slight moderate strong sulfidic petroleum other

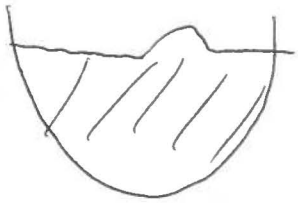
Comments/Description:

1st grab rejected, over penetration

0-2 cm olive brown surface SILT

2-27.5 cm Gray SILT with orange streaks
trace fine sand, trace debris
no odor, no sheen

Sample collected 1220 from 0-10 cm



Time: ___ **Station:** ___ **Replicate:** ___ **Acceptable Grab:** Yes No
Target Coordinates: ___
Actual "On Bottom" Coordinates: ___
Distance from Target Station: ___ **(Tolerance is +/- 3 meters)**
Bottom Depth: ___ **Penetration Depth:** ___ (cm) **Photo ID:** ___
Fines Overlying Cap Material: Yes No **Fines Thickness:** ___ (cm)
Sample ID: ___
Type: cobble gravel sand [coarse / medium / fine] silt clay organic matter wood/shell fragments
Color: drab olive gray black brown brown surface **Redox Discontinuity Depth:** ___ (cm)
Odor: none slight moderate strong sulfidic petroleum other

Comments/Description:

Yes

Photo Log

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. T117-LTM1	**Date:** 3-28-19	
Description: Olive brown with orange streaks and black sand. Sandy silt with no odor, no sheen, and trace amounts of woody debris.		
Location Id. T117-LTM1	**Date:** 3-28-19	
Target Coordinates: 47.525673 -122.309832 **Actual "On Bottom" Coordinates:** 47.525668 -122.309830		

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. T117-LTM2	**Date:** 3-28-19	
Description: Olive brown sandy silt. No odor, no sheen, and trace amount of woody debris.		
Location Id. T117-LTM2	**Date:** 3-28-19	
Target Coordinates: 47.526106 -122.310120 **Actual "On Bottom" Coordinates:** 47.526103 -122.310121		

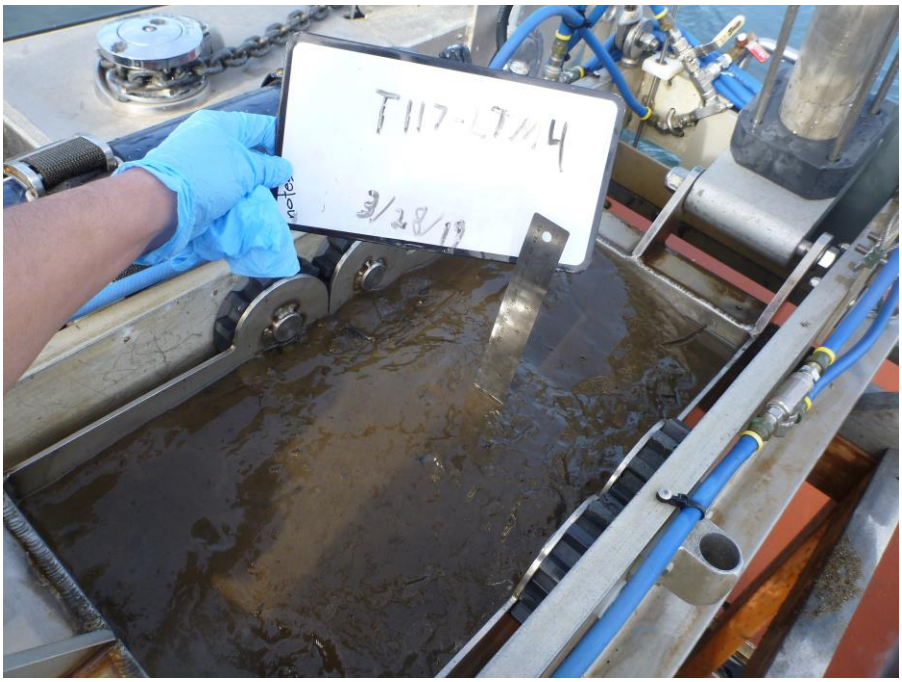
AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. T117-LTM3	**Date:** 3-28-19	
Description: Olive brown color, sandy with trace amounts of silt. No odor, no sheen, trace amounts of woody debris.		
Location Id. T117-LTM3	**Date:** 3-28-19	
Target Coordinates: 47.526539 -122.310361 **Actual "On Bottom" Coordinates:** 47.526534 -122.310362		

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. T117-LTM4	**Date:** 3-28-19	
Description: Olive brown surface, grey silty layer below, trace amounts of fine sand. Organic woody debris with no odor, no sheen. Observed a wire hooked on bottom of power grab sampler.		
Location Id. T117-LTM4	**Date:** 3-28-19	
Target Coordinates: 47.526932 -122.310882 **Actual "On Bottom" Coordinates:** 47.526933 -122.310879		

AECOM

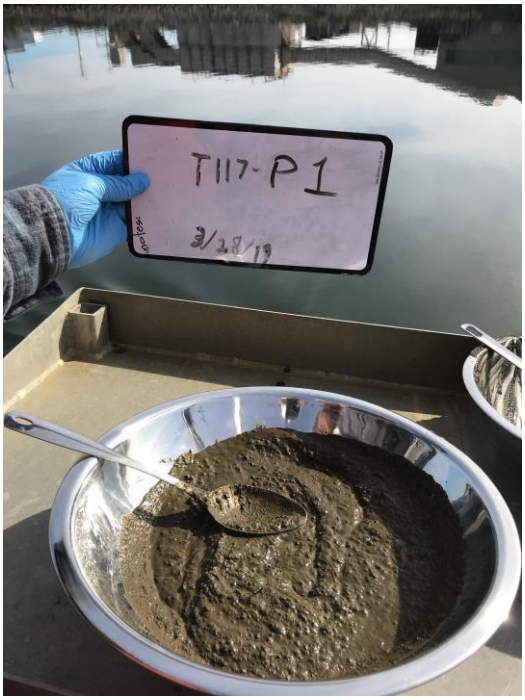
PHOTOGRAPHIC LOG

Port of Seattle	T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway

Location Id.	Date:
PERIM-1-LTM	3-28-19

Description: 1st grab insufficient material. 2nd grab successful.

Olive brown sandy/gravel material. Trace amounts of silt and cobbles. No sheen, no odor present. Grey sandy layer 2 inches beneath the surface with orange streaks.



Location Id.	Date:
PERIM-1-LTM	3-28-19

Target Coordinates:
47.525341
-122.309664

Actual "On Bottom" Coordinates:
47.525347
-122.309648

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. PERIM-2-LTM	**Date:** 3-28-19	
Description: Olive brown surface with a grey, silty organic layer beneath. Trace amounts of sand and woody debris present. No odor or sheen present.		
Location Id. PERIM-2-LTM	**Date:** 3-28-19	
Target Coordinates: 47.525844 -122.309519 **Actual "On Bottom" Coordinates:** 47.525848 -122.309514		

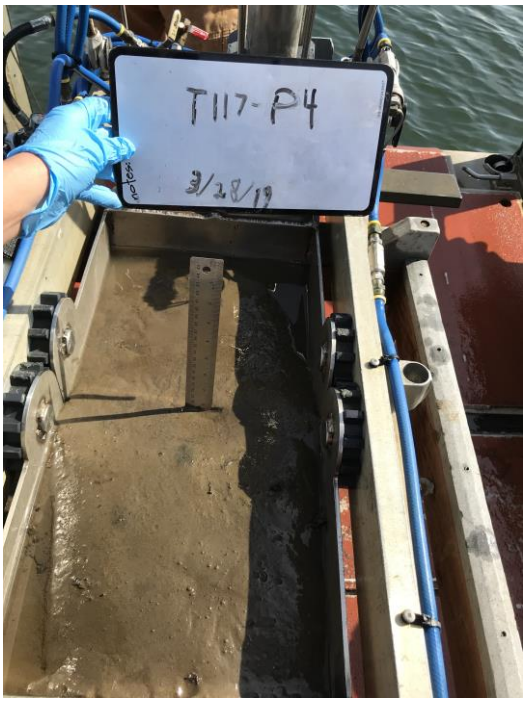
AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. PERIM-3-LTM	**Date:** 3-28-19	
Description: Olive brown surface, grey silty layer, traces of sand and woody debris. No odor and no sheen observed.		
Location Id. PERIM-3-LTM	**Date:** 3-28-19	
Target Coordinates: 47.526515 -122.309974 **Actual "On Bottom" Coordinates:** 47.526518 -122.309964		

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. PERIM-4-LTM	**Date:** 3-28-19	
Description: Olive brown surface, gray/black silty layer below. Trace amounts of sand and wood debris observed. Slight organic odor observed. No sheen observed.		
Location Id. PERIM-4-LTM	**Date:** 3-28-19	
Target Coordinates: 47.527178 -122.311062 **Actual "On Bottom" Coordinates:** 47.527178 -122.311061		

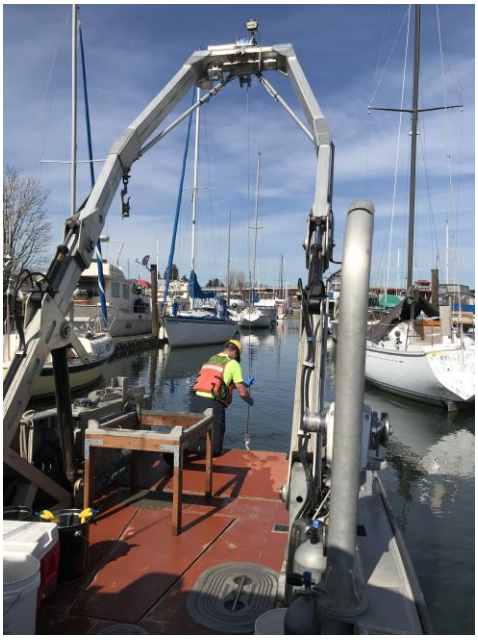
AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. PERIM-5-LTM	**Date:** 3-28-19	
Description: 1st grab over penetration. 2nd grab was successful. Olive brown surface, grey silty layer with orange streaks below olive surface. Trace amounts of fine sand and woody debris observed. No odor and no sheen observed.		
Location Id. PERIM-5-LTM	**Date:** 3-28-19	
Target Coordinates: 47.527373 -122.311889 **Actual "On Bottom" Coordinates:** 47.527372 -122.311889		

AECOM

PHOTOGRAPHIC LOG

Port of Seattle		T-117 Early Action Cleanup Sediment Sampling Observations Lower Duwamish Waterway
Location Id. N/A	**Date:** 3-28-19	
Description: Facing bow of the boat where samples were collected and processed.		
Location Id. N/A	**Date:** 3-28-19	
Description: Facing bow of the boat with power grab sampler being raised from the water.		

Sediment Analytical Results Summary Table and Data Quality Review Memoranda

Laboratory Sediment Sample Results
Terminal T117 Cleanup
Seattle, Washington

Sample ID:	LTM1				LTM2		LTM3		LTM4		P1		P2		P3		P4		P5	
Sample Date:	3/28/19				3/28/19		3/28/19		3/28/19		3/28/19		3/28/19		3/28/19		3/28/19		3/28/19	
Other Sample Information:			(DUP)																	
Fraction:	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC	Total	OC
Polycyclic Aromatic Hydrocarbons (ug/kg dry)																				
2-Methylnaphthalene	5.52	836	4.85 U	614 U	4.78 U	NA	4.81 U	NA	17.5	634	4.86 U	748 U	15.2	626	12.0	69	10.7	527	9.47	282
Acenaphthene	4.97 U	753 U	4.85 U	614 U	4.78 U	NA	4.81 U	NA	9.20	333	4.86 U	748 U	10.4	428	5.95	34	5.85	288	7.79	232
Dibenzofuran	2.57 J	389 J	2.08 J	263 J	4.78 U	NA	4.81 U	NA	12.2	442	1.77 J	272 J	11.8	486	7.54	43	7.40	365	8.33	248
Fluorene	4.97 U	753 U	4.85 U	614 U	4.78 U	NA	4.81 U	NA	11.8	428	4.86 U	748 U	13.5	556	5.27	30	6.51	321	6.88	205
Phenanthrene	15.7	2,379	14.9	1,886	4.78 U	NA	4.81 U	NA	77.5	2,808	19.2	2,954	83.5	3,436	36.3	209	42.1	2,074	56.8	1,690
Anthracene	5.15	780	5.90	747	1.06 J	NA	1.50 J	NA	31.1	1,127	4.13 J	635 J	35.5	1,461	15.2	87	11.9	586	15.5	461
Fluoranthene	32.7	4,955	39.6	5,013	7.46	NA	7.26	NA	182	6,594	45.0	6,923	161	6,626	84.3	484	101	4,975	147	4,375
Benzo(a)anthracene [a]	13.6	NA	15.0	NA	3.26 J	NA	3.32 J	NA	78.3	NA	13.9	NA	78.9	NA	30.2	NA	33.9	NA	42.5	NA
Chrysene [a]	27.5	NA	31.7	NA	6.16	NA	6.58	NA	136	NA	28.6	NA	143	NA	49.2	NA	57.4	NA	86.2	NA
Benzo(b)fluoranthene [a]	25.2	NA	28.2	NA	6.69	NA	6.28	NA	130	NA	25.5	NA	111	NA	53.3	NA	47.5	NA	75.1	NA
Benzo(k)fluoranthene [a]	11.8	NA	13.2	NA	3.57 J	NA	3.13 J	NA	63.5	NA	13.0	NA	55.9	NA	24.5	NA	22.1	NA	34.1	NA
Total Benzofluoranthenes	47.4	NA	52.1	NA	14.0	NA	12.8	NA	255	NA	51.8	NA	219	NA	54.1	NA	48.2	NA	76.2	NA
Benzo(a)pyrene [a]	15.3	NA	18.4	NA	4.63 J	NA	4.32 J	NA	92.9	NA	18.0	NA	78.7	NA	35.6	NA	34.4	NA	47.4	NA
Indeno(1,2,3-cd)pyrene [a]	15.2	NA	14.5	NA	3.94 J	NA	3.20 J	NA	64.7	NA	15.4	NA	50.7	NA	26.4	NA	23.3	NA	34.8	NA
Dibenz(a,h)anthracene [a]	5.28	NA	3.64 J	NA	4.78 U	NA	4.81 U	NA	19.5	NA	4.22 J	NA	14.5	NA	6.70	NA	7.37	NA	8.98	NA
Benzo(g,h,i)perylene	17.4	NA	17.2	NA	4.55 J	NA	3.89 J	NA	77.4	NA	19.4	NA	65.5	NA	34.0	NA	29.5	NA	45.2	NA
TTEC	22.7	NA	26.2	NA	6.44	NA	5.98	NA	130	NA	25.5	NA	111	NA	50.2	NA	48.4	NA	67.8	NA
Semivolatile Organic Compound (ug/kg dry)																				
Phenol	17.5 J	NA	12.0 U	NA	17.1 U	NA	20.5 J	NA	179 J	NA	8.8 J	NA	96.5 J	NA	28.1 J	NA	41.0 J	NA	36.0 J	NA
PCBs (ug/kg dry)																				
Aroclor 1016	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Aroclor 1221	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Aroclor 1232	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Aroclor 1242	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Aroclor 1248	7.5	NA	8.0	NA	4.0 U	NA	2.8 J	NA	26.7	NA	7.8	NA	16.8	NA	12.1	NA	13.9	NA	15.3	NA
Aroclor 1254	14.2	NA	14.9	NA	2.8 J	NA	5.5	NA	50.8	NA	15.3	NA	32.0	NA	21.2	NA	21.8 J	NA	24.0	NA
Aroclor 1260	11.8	NA	10.0	NA	2.7 J	NA	3.5 J	NA	36.2	NA	14.6	NA	22.1	NA	14.4	NA	12.0	NA	15.6	NA
Aroclor 1262	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Aroclor 1268	3.9 U	NA	3.8 U	NA	4.0 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA	4.0 U	NA	3.9 U	NA	4.0 U	NA
Total PCBs [b]	33.5	5,075.8	32.9	4,164.6	5.5	NA	11.8	NA	113.7	4,119.6	37.7	5,800.0	70.9	2,917.7	47.7	2,741.4	47.7	2,349.8	54.9	1,633.9
Dioxins/Furans (ng/kg dry)																				
2,3,7,8-TCDF	--	NA	--	NA	0.997 U	NA	--	NA	0.637 J	NA	0.315 J	NA	--	NA	--	NA	--	NA	0.454 J	NA
2,3,7,8-TCDD	--	NA	--	NA	0.997 U	NA	--	NA	0.997 U	NA	0.997 U	NA	--	NA	--	NA	--	NA	0.999 U	NA
1,2,3,7,8-PeCDF	--	NA	--	NA	0.997 U	NA	--	NA	0.399 J	NA	0.197 J	NA	--	NA	--	NA	--	NA	0.394 J	NA
2,3,4,7,8-PeCDF	--	NA	--	NA	0.997 U	NA	--	NA	0.845 J	NA	0.528 JN	NA	--	NA	--	NA	--	NA	0.597 JN	NA
1,2,3,7,8-PeCDD	--	NA	--	NA	0.997 U	NA	--	NA	0.920 JN	NA	0.355 J	NA	--	NA	--	NA	--	NA	0.739 JN	NA
1,2,3,4,7,8-HxCDF	--	NA	--	NA	0.175 J	NA	--	NA	3.33	NA	1.12	NA	--	NA	--	NA	--	NA	1.89	NA
1,2,3,6,7,8-HxCDF	--	NA	--	NA	0.997 U	NA	--	NA	1.02	NA	0.640 J	NA	--	NA	--	NA	--	NA	0.773 J	NA
2,3,4,6,7,8-HxCDF	--	NA	--	NA	0.997 U	NA	--	NA	1.53	NA	0.923 JN	NA	--	NA	--	NA	--	NA	0.438 J	NA
1,2,3,7,8,9-HxCDF	--	NA	--	NA	0.997 U	NA	--	NA	0.997 U	NA	0.997 U	NA	--	NA	--	NA	--	NA	0.999 U	NA
1,2,3,4,7,8-HxCDD	--	NA	--	NA	0.997 U	NA	--	NA	1.08	NA	0.386 J	NA	--	NA	--	NA	--	NA	0.922 J	NA
1,2,3,6,7,8-HxCDD	--	NA	--	NA	0.273 J	NA	--	NA	4.34	NA	1.70	NA	--	NA	--	NA	--	NA	3.46	NA
1,2,3,7,8,9-HxCDD	--	NA	--	NA	0.231 J	NA	--	NA	2.46	NA	0.889 J	NA	--	NA	--	NA	--	NA	2.29	NA
1,2,3,4,6,7,8-HpCDF	--	NA	--	NA	1.80 U	NA	--	NA	25.7	NA	61.1	NA	--	NA	--	NA	--	NA	18.7	NA
1,2,3,4,7,8,9-HpCDF	--	NA	--	NA	0.097 JN	NA	--	NA	2.44	NA	0.926 J	NA	--	NA	--	NA	--	NA	1.43 JN	NA
1,2,3,4,6,7,8-HpCDD	--	NA	--	NA	8.86 U	NA	--	NA	137	NA	33.2	NA	--	NA	--	NA	--	NA	99.9	NA
OCDF	--	NA	--	NA	5.06 U	NA	--	NA	79.3	NA	40.4	NA	--	NA	--	NA	--	NA	72.0	NA
OCDD	--	NA	--	NA	76.4 U	NA	--	NA	1,360	NA	170 U	NA	--	NA	--	NA	--	NA	834	NA
Total TCDF	--	NA	--	NA	0.223	NA	--	NA	16.2	NA	8.38	NA	--	NA	--	NA	--	NA	11.7	NA
Total TCDD	--	NA	--	NA	0.654	NA	--	NA	3.61	NA	1.81	NA	--	NA	--	NA	--	NA	3.2	NA
Total PeCDF	--	NA	--	NA	0.50	NA	--	NA	14.1	NA	7.43	NA	--	NA	--	NA	--	NA	10.6	NA
Total PeCDD	--	NA	--	NA	0.377	NA	--	NA	5.66	NA	2.97	NA	--	NA	--	NA	--	NA	4.19	NA
Total HxCDF	--	NA	--	NA	2.07	NA	--	NA	40.5	NA	34.9	NA	--	NA	--	NA	--	NA	29.1	NA
Total HxCDD	--	NA	--	NA	2.98	NA	--	NA	39.1	NA	20.7	NA	--	NA	--	NA	--	NA	30.1	NA
Total HpCDF	--	NA	--	NA	5.41	NA	--	NA	94.8	NA	128	NA	--	NA	--	NA	--	NA	64.6	NA
Total HpCDD	--	NA	--	NA	19.2	NA	--	NA	320	NA	67.0	NA	--	NA	--	NA	--	NA	221	NA
Metals (mg/kg dry)																				
Arsenic	6.27	NA	7.47	NA	3.39	NA	2.89	NA	14.1	NA	9.21	NA	14.8	NA	7.03	NA	8.13	NA	15.9	NA
General Chemistry																				
Total Organic Carbon (% dry)	0.66	NA	0.79	NA	0.23	NA	0.16	NA	2.76	NA	0.65	NA	2.43	NA	1.74	NA	2.03	NA	3.36	NA
Total Solids (%)	70.84	NA	--	NA	79.64	NA	79.68	NA	42.60	NA	68.58	NA	47.27	NA	58.13	NA	50.95	NA	40.94	NA

Notes:
[a] Carcinogenic Polycyclic Aromatic Hydrocarbon (cPAH)
[b] Sum of detected aroclors
dw - dry weight
% - percent
DUP - field duplicate
HpCDD - heptachlorinated dibenzo-p-dioxins
HpCDF - heptachlorinated dibenzofurans
HxCDD - hexachlorinated dibenzo-p-dioxins
HxCDF - hexachlorinated dibenzofurans
J - estimated value
mg/kg - milligram per kilogram
JN - tentatively identified, value is approximate concentration
ng/kg - nanogram per kilogram
OC - organic carbon normalized
OCDD - octachlorinated dibenzo-p-dioxins
OCDF - octachlorinated dibenzofurans
PeCDD - pentachlorinated dibenzo-p-dioxins
PeCDF - pentachlorinated dibenzofurans
TCDD - tetrachlorinated dibenzo-p-dioxins
TCDF - tetrachlorinated dibenzofurans
U - Compound was analyzed for but not detected above the method detection limit.
ug/kg - microgram per kilogram

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Memorandum

To	Jim Flynn, Project Manager	Info	FINAL
Subject	Summary Data Quality Review T117 Sediment Sampling		
From	Lucy Panteleeff, Chemist Jennifer B. Garner, Chemist		
Date	June 17, 2019		

The summary data quality review of 9 sediment samples, one field duplicate, and 4 wipe samples collected on March 28, 2019, has been completed. Wipe samples were collected after sediment sampling occurred. The samples were analyzed at ARI Laboratories located in Tukwila, Washington for polycyclic aromatic hydrocarbons (PAHs) by EPA Method 8270D modified by selected ion monitoring (SIM); phenol by EPA Method 8270D (sediments) and EPA Method 8270D-SIM (wipe samples); polychlorinated biphenyls (PCBs) by EPA Method 8082A; dioxins and furans by EPA Method 1613B, arsenic by EPA Method 6020A; TOC by Plumb, 1981; total solids (TS) by Standard Methods (SM) 2540 G-97; and/or grain size by Puget Sound Estuary Program (PSEP) methodology. The analyses were performed in general accordance with the methods specified in EPA's *Test Methods for Evaluating Solid Waste (SW-846)*, Standard Methods for the Examination of Water and Wastewater, *Procedures for Handling and Chemical Analysis of Sediment and Water Samples*, USEPA, May, 1981, Russell H. Plumb Jr., and PSEP User's Manual for Pollutant of Concern Matrix. The laboratory provided Level II (summary report) and Level IV (raw data) reports containing sample results and associated quality assurance (QA) and quality control (QC) data, preparation logs, and raw instrument outputs for all samples (where applicable). For this report, the sample identifications (IDs) do not include the sampling date suffix (-20190328) unless required for clarity. The following samples are associated with ARI laboratory group 19D0004:

Sample ID	**Laboratory ID**	**Requested Analyses**
T117-LTM1-20190328	19D0004-01	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-LTM2-20190328	19D0004-02	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic, TOC, TS, Grain Size
T117-LTM3-20190328	19D0004-03	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-LTM4-20190328	19D0004-04	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic, TOC, TS, Grain Size
T117-P1-20190328	19D0004-05	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic, TOC, TS, Grain Size
T117-P2-20190328	19D0004-06	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-P3-20190328	19D0004-07	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-P4-20190328	19D0004-08	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-P5-20190328	19D0004-09	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic, TOC, TS, Grain Size
T117-DUP1-20190328 (Duplicate of T117-LTM1-20190328)	19D0004-10	PAHs, Phenol, PCBs, Arsenic, TOC, TS, Grain Size
T117-FWSP-20190328	19D0004-11	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic
T117-FWB-20190328	19D0004-12	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic
T117-FWR-20190328	19D0004-13	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic
T117-FB-20190328	19D0004-14	PAHs, Phenol, PCBs, Dioxins+Furans, Arsenic

The results for dioxins+furans were validated; however, the findings of the data validation are reported under separate cover. The data discussed herein were evaluated based on validation criteria established in the *National Functional Guidelines for Organic Superfund Methods Data Review*, January 2017, and the *National Functional Guidelines for Inorganic Superfund Methods Data Review*, January 2017, as applied to the reported methodology.

The following data components were reviewed during the limited data validation procedure for compliance with method specific or laboratory control charted criteria where appropriate: chain of custody forms, holding times, instrument performance (tunes), instrument calibrations, method/trip/instrument blanks, surrogate recoveries, internal standard recoveries, matrix spike/matrix spike duplicate recoveries, laboratory and field duplicate results, laboratory control sample/laboratory control sample duplicate recoveries, reporting limits, sample chromatograms, raw data review (including calculation checks), and electronic data deliverables.

A summary of qualifiers that may be assigned to results in these laboratory groups are included in Table 1. Qualifiers that may be assigned to results include:

- U - The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R - The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
- DNR - Do Not Report. Another result is available that is more reliable or appropriate.

Sample Receipt

Upon receipt by the laboratory, the sample jar information was compared to the chain-of-custody (COC) and the cooler temperatures were recorded. No discrepancies related to sample identifications were noted by the laboratory. One cooler was received at a temperature exceeding the EPA-recommended limits of greater than 0°C and less than or equal to 6°C at 11°C. Ice was present in the cooler, and all samples were received within 5 hours of collection; therefore, no data were qualified based on the elevated cooler temperature.

The laboratory noted that the number of sample containers listed on the COC did not match the number of containers received for T117-LTM4 and T117-DUP1. Sufficient volume was present in the containers submitted for these samples allowing the requested analyses to proceed.

Sample T117-FWR was not analyzed per AECOM request.

Organic Analyses

Samples were analyzed for PAHs, phenol, and PCBs by the methods identified in the introduction of this report.

1. Holding Times – Acceptable

2. Instrument Performance (Tunes) – Acceptable where applicable

3. Instrument Calibration – Acceptable except as noted below:

   Phenol by EPA Method 8270D – The laboratory noted that the percent difference (%D) for phenol (27.1%) in the continuing calibration verification (CCV) analyzed on April 20, 2019 exceeded the method limits of ±20%. All results for phenol reported as detected in the sediment samples were qualified as estimated and flagged 'J' based on this CCV result.

   PCBs by EPA Method 8082A – The laboratory noted that the %Ds for the surrogate decachlorobiphenyl and/or Aroclor 1260 on one analytical column were outside the method limits of ±20% in multiple CCVs analyzed on April 17, 2019. All associated results were reported from the alternate column which had passing %Ds; therefore, data were not qualified based on these CCV %D outliers.

4. Blanks – Acceptable except as noted below:

   PAHs by EPA Method 8270-SIM – The following analytes were detected at concentrations between the method detection limits (MDLs) and the reporting limits in the method blank extracted on April 9, 2019:

Analyte	Result (ug/kg)
2-Methylnaphthalene	2.16
Acenaphthene	1.03
Fluorene	0.86
Phenanthrene	1.08
Fluoranthene	0.71

   The results for 2-methylnaphthalene in T117-LTM2, T117-LTM3, T117-P1, and T117-DUP1; acenaphthene and fluorene in T117-LTM1, T117-P1, and T117-DUP1; and phenanthrene in T117-LTM2 and T117-LTM3 were reported at concentrations between the MDLs and the reporting limits, were qualified as not detected, and were flagged 'U' at the reporting limits. PAH results for all other samples associated with this method blank were reported at concentrations significantly higher than the blank concentrations; therefore, no additional data were qualified based on these method blank results.

5. Surrogates – Acceptable except as noted below:

   PCB by EPA Method 8082A – Decachlorobiphenyl was not reported by the laboratory for one analytical column in T117-LTM4 and the MS/MSD performed using T117-LTM4 due to chromatographic interference causing low internal standard recovery as discussed in Section

4. Associated Aroclor results were reported from the alternate analytical column which had acceptable results; therefore, data were not qualified based on this surrogate result.

6. Internal Standards – Acceptable except as noted below:

PAHs and Phenol by EPA Method 8270-SIM – The internal standard area count for perylene-d12 was outside the control limits of 50-200% in the method blank associated with the sediment samples. Data were not qualified based on internal standard area counts in QC samples.

PCBs by EPA Method 8082A - The internal standard area counts for hexabromobiphenyl in T117-LTM4 and the MS/MSD performed using T117-LTM4 were outside the control limits 50-200% (low) on one analytical column due chromatographic interference. Associated Aroclor results were reported from the alternate column which had acceptable internal standard area counts; therefore, data were not qualified based on these internal standard outliers.

7. Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) – Acceptable

8. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – Acceptable except as noted below:

General – MS/MSDs were performed using T117-LTM4 for all organic analyses. Results were acceptable with the following exceptions.

PAHs by EPA Method 8270-SIM – The relative percent difference (RPD) for fluoranthene (35.4%) exceeded the control limits of 30%. The percent recoveries for fluoranthene in the MS and MSD were acceptable; therefore, the result for fluoranthene in T117-LTM4 was not qualified based on this MS/MSD result.

9. Field Duplicate – Acceptable

General – A field duplicate was submitted for T117-LTM1and identified as T117-DUP1. RPDs were calculated and compared to control criteria only when reported concentrations were greater than five times the reporting limits. Results were comparable for all analytes reported at concentration greater than five times the reporting limits.

10. Reporting Limits – Acceptable except as noted below:

One or more analytes were ‘J’ flagged by the laboratory to indicate that the results were reported at concentrations less than the reporting limits but above the MDLs. Laboratory ‘J’-flagged results are considered estimated results. As these results were between the MDLs and the reporting limits, there are greater levels of uncertainty associated with these numerical results.

One or more sediment reporting limits were elevated due to the moisture content of the samples. The elevated reporting limits do not impact the use of the data.

11. Raw Data Review and Calculation Checks:

    General - Chromatograms/spectra were reviewed to confirm target analytes were properly identified. The review confirmed target analytes were properly identified and reported by the laboratory. A calculation check was performed for sample results on one sample per calibration. The review confirmed the final results were correct as reported.

Metals Analysis

Samples were analyzed for arsenic by EPA Method 6020A.

1. Holding Times – Acceptable

2. Instrument Performance – Acceptable

3. Instrument Calibration - Acceptable

4. Blanks – Acceptable except as noted below:

   Arsenic was detected in one or more continuing calibration blanks associated with the samples in this laboratory group at concentrations between the MDLs and the reporting limits. The results for arsenic in T117-FWSP, T117-FWB, and T117-FB were reported at concentrations above the reporting limits, but less than 10 times the associated continuing calibration blank concentrations; therefore, the results for arsenic in T117-FWSP, T117-FWB, and T117-FB were qualified as estimated and flagged 'J' based on these calibration blank results. Arsenic results in all other samples associated with these continuing calibration blanks were greater than 10 times the instrument blank concentrations; therefore, no additional data were qualified based on these continuing calibration blanks.

   T117-FB was collected to identify potential background concentrations present in the wipe samples. Arsenic was detected in T117-FB (0.052 ug/wipe). The results for arsenic in T117-FWSP and T117-FWB were qualified based on instrument blank contamination; therefore, no further qualification was necessary.

   Wipe samples T117-FWSP and T117-FWB were collected to help identify possible contamination from the sampling environment or from the sample handling equipment and are applicable to the sediment samples reported in this laboratory group. Arsenic was detected in T117-FWSP (0.043 ug/wipe) and T117-FWB (0.048 ug/wipe). Arsenic results in all the sediment samples reported in this laboratory group were greater than 10 times the wipe concentrations; therefore, data were not qualified based on these wipe blanks.

5. Laboratory Control Sample (LCS) – Acceptable

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD)

   An MS/MSD was performed using T117-LTM4. Results were acceptable.

7. Laboratory Duplicates

   A laboratory duplicate was performed using T117-LTM4. Results were comparable.

8. Field Duplicate – Acceptable

   A field duplicate was submitted for T117-LTM1 and identified as T117-DUP1. Results were comparable.

9. Reporting Limits – Acceptable

CONVENTIONAL ANALYSES

Sediment samples were analyzed for TOC and total solids by the methods identified in the introduction to this report.

1. Holding Times – Acceptable

2. Instrument Calibration – Acceptable where applicable

3. Blanks – Acceptable

4. Laboratory Control Sample (LCS) – Acceptable where applicable

5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – Acceptable where applicable, except as noted below:

   TOC by Method Plumb 1981 – An MS/MSD was performed using T117-LTM4. The RPD for TOC (29.0%) exceeded the control limits of 20%. The percent recoveries for TOC in the MS and MSD were acceptable; therefore, the result for TOC in T117-LTM4 was not qualified based on the elevated RPD.

6. Field Duplicate – Acceptable where applicable

   TOC by Method Plumb 1981 – A field duplicate was submitted for T117-LTM1 and identified as T117-DUP1. Results were comparable.

7. Laboratory Duplicate – Acceptable

   General – Laboratory duplicates for all TOC and total solids were performed using T117-LTM4. Results were comparable.

8. Reporting Limits – Acceptable

GRAIN SIZE ANALYSIS

Sediment samples were analyzed for grain size by the method identified in the introduction to this report. With the exception of the field duplicate, these results were not reviewed as part of this data validation. A field duplicate was submitted for T117-LTM1 and identified as T117-DUP1. The RPD for Phi Size 7 to 8 was 52%. All other grain size RPDs were less than 50%. No data were qualified based on grain size field duplicate RPDs.

Summary Data Quality Review
T117 Sediment Sampling
Laboratory Group: 19D0004

Overall Assessment of Data

The data reported in these laboratory groups, as qualified, are considered to be usable for meeting project objectives. The completeness for ARI laboratory group 19D0004 is 100%.

QA/QC Data Summary Review
T117 Sediment Sampling
Laboratory Group 19D0004

Table 1 - Summary of Qualified Data

Sample ID	Laboratory ID	Method	Analyte	Laboratory Result	Detection Limit	Reporting Limit	Units	Final Result
T117-LTM1-20190328	19D0004-01	SW8270DSIM	Acenaphthene	1.91 J	0.57	4.97	ug/kg	4.97 U
T117-LTM1-20190328	19D0004-01	SW8270DSIM	Fluorene	2.40 J	0.63	4.97	ug/kg	4.97 U
T117-LTM1-20190328	19D0004-01	SW8270D	Phenol	17.5 J	7.7	18.8	ug/kg	17.5 J
T117-LTM2-20190328	19D0004-02	SW8270DSIM	2-Methylnaphthalene	1.35 J	1.06	4.78	ug/kg	4.78 U
T117-LTM2-20190328	19D0004-02	SW8270DSIM	Phenanthrene	3.08 J	0.69	4.78	ug/kg	4.78 U
T117-LTM3-20190328	19D0004-03	SW8270DSIM	2-Methylnaphthalene	1.55 J	1.06	4.81	ug/kg	4.81 U
T117-LTM3-20190328	19D0004-03	SW8270DSIM	Phenanthrene	3.96 J	0.69	4.81	ug/kg	4.81 U
T117-LTM3-20190328	19D0004-03	SW8270D	Phenol	20.5	8	19.6	ug/kg	20.5 J
T117-LTM4-20190328	19D0004-04	SW8270D	Phenol	179	15.8	38.3	ug/kg	179 J
T117-P1-20190328	19D0004-05	SW8270DSIM	2-Methylnaphthalene	3.16 J	1.07	4.86	ug/kg	4.86 U
T117-P1-20190328	19D0004-05	SW8270DSIM	Acenaphthene	1.45 J	0.55	4.86	ug/kg	4.86 U
T117-P1-20190328	19D0004-05	SW8270DSIM	Fluorene	2.56 J	0.61	4.86	ug/kg	4.86 U
T117-P1-20190328	19D0004-05	SW8270D	Phenol	8.8 J	5	12.1	ug/kg	8.8 J
T117-P2-20190328	19D0004-06	SW8270D	Phenol	96.5	11.5	27.9	ug/kg	96.5 J
T117-P3-20190328	19D0004-07	SW8270D	Phenol	28.1	6.9	16.8	ug/kg	28.1 J
T117-P4-20190328	19D0004-08	SW8270D	Phenol	41	8.7	21.1	ug/kg	41 J
T117-P5-20190328	19D0004-09	SW8270D	Phenol	36	11.1	26.9	ug/kg	36 J
T117-DUP1-20190328	19D0004-10	SW8270DSIM	2-Methylnaphthalene	3.86 J	1.07	4.85	ug/kg	4.85 U
T117-DUP1-20190328	19D0004-10	SW8270DSIM	Acenaphthene	2.07 J	0.55	4.85	ug/kg	4.85 U
T117-DUP1-20190328	19D0004-10	SW8270DSIM	Fluorene	2.43 J	0.61	4.85	ug/kg	4.85 U
T117-FWSP-20190328	19D0004-11	SW6020A	Arsenic	0.043	0.001	0.01	ug/wipe	0.043 J
T117-FWB-20190328	19D0004-12	SW6020A	Arsenic	0.048	0.001	0.01	ug/wipe	0.048 J
T117-FB-20190328	19D0004-14	SW6020A	Arsenic	0.052	0.001	0.01	ug/wipe	0.052 J

Notes:
J - estimated value
U - Compound was analyzed for, but not detected above the value shown.
ug/kg - microgram per kilogram

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Data Validation Report

Project:	Lower Duwamish Waterway Superfund Site, Terminal 117, Upland and Sediment Areas Long-Term Monitoring	
Laboratory:	Analytical Resources, Inc., Tukwila, Washington	
Laboratory Group:	19D0004	
Analyses/Method:	Clean Water Act - Dioxins and Furans / CWA1613B	
Validation Level:	4	
AECOM Project Number:	60597719.3	
Prepared by:	Peter Fairbanks/AECOM	Completed on: 05/28/2019
Reviewed by:	George Kisluk/AECOM	File Name: 19D0004 DVR Level_4_rev1

SUMMARY

The samples listed below were collected by AECOM at Terminal 117 Sediment Area in Seattle, WA on March 28, 2019. According to the chain-of-custody and sampling team, the wipe samples were collected after the sediment sampling was completed.

Sample ID	Matrix/Sample Type
T117-LTM2-20190328	Sediment
T117-LTM4-20190328	Sediment
T117-P1-20190328	Sediment
T117-P5-20190328	Sediment
T117-FWSP-20190328	Equipment Filter Wipe (Spoon)
T117-FWB-20190328	Equipment Filter Wipe (Bowl)
T117-FB-20190328	Filter Blank

Data validation activities were conducted with reference to:

- EPA Method 1613B: *Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS (October 1994),*
- *USEPA Contract Laboratory Program National Functional Guidelines for High Resolution Superfund Methods Data Review (April 2016),*
- *Quality Assurance Project Plan, Upland Sediment Areas Long-Term Monitoring, Lower Duwamish Waterway Superfund Site (September 2018),* and the
- Laboratory Quality Control (QC) limits.

The National Functional Guidelines were modified to accommodate the non-CLP methodologies. In the absence of method-specific information, laboratory QC limits, project-specific requirements and/or AECOM professional judgment were used as appropriate.

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REVIEW ELEMENTS

The data were evaluated based on the following parameters (where applicable to the method):

✓	Data completeness [chain-of-custody (COC)/sample integrity]
✓	Holding times and sample preservation
✓	Mass resolution/ window defining mix (WDM)/isomer specificity check (ISC) results
✓	Initial calibration/continuing calibration verification
✗	Laboratory blanks/equipment filter wipe blanks
NA	Matrix spike (MS) and/or matrix spike duplicate (MSD) results
✓	Ongoing precision and recovery (OPR) results
NA	Field duplicate results
✓	Labeled compound and clean-up standard recoveries
✗	Sample results/reporting issues

The symbol (✓) indicates that no validation qualifiers were applied based on this parameter. An NA indicates that the parameter was not included as part of this data set or was not applicable to this validation and therefore not reviewed. The symbol (✗) indicates that a QC nonconformance resulted in the qualification of data. Any QC nonconformance that resulted in the qualification of data is discussed below. In addition, nonconformances or other issues that were noted during validation, but did not result in qualification of data, may be discussed for informational purposes only.

The data appear valid as qualified and may be used for decision making purposes. Select data points were qualified as estimated due to nonconformances of certain QC criteria (see discussion below). Qualified sample results are presented in Table 1.

RESULTS

Data Completeness (COC)/Sample Integrity

The data package was reviewed and found to meet acceptance criteria for completeness:

- The COCs were reviewed for completeness of information relevant to the samples and requested analyses, and for signatures indicating transfer of sample custody;
- The laboratory sample login sheet(s) were reviewed for issues potentially affecting sample integrity, including the condition of sample containers upon receipt at the laboratory;
- Completeness of analyses was verified by comparing the reported results to the COC requests.

Holding Times and Sample Preservation

Sample preservation and preparation/analysis holding times were reviewed for conformance with method criteria. All method QC acceptance criteria were met.

Mass Resolution/ WDM/ISC Results

The data were reviewed to ensure that:

- the perfluorokerosene (PFK) molecular leak was performed at the correct frequency (at the beginning and end of a 12-hour shift) and the mass resolution was at a resolving power of > 10,000;
- the window defining mix (WDM) containing the first and last eluting isomers in each homologous series was analyzed at the correct frequency;
- the isomer specificity check (ISC) standard criteria were met for the chromatographic resolution of 2,3,7,8-TCDD and of 2,3,7,8-TCDF on the RTX-Dioxin2 column.

All method QC acceptance criteria were met.

Initial Calibration/Continuing Calibration Verification

The data were reviewed to ensure that:

- the absolute and relative retention time, signal/noise (S/N), and ion abundance ratio method acceptance criteria were met (as summarized by the laboratory);
- the initial calibration percent relative standard deviation (%RSD) method acceptance criteria were met for all native and labeled compounds;
- The calibration verification standard (CCV) method acceptance criteria were met.

Section 10.2.4 of Method 1613 states: *"The absolute retention time of $^{13}C_{12}$-1,2,3,4-TCDD shall exceed 25.0 minutes on the DB-5 column, and the retention time of $^{13}C_{12}$-1,2,3,4-TCDD shall exceed 15.0 minutes on the DB-225 column; otherwise the GC temperature program shall be adjusted and this test repeated until the above-stated minimum retention time criteria are met."*

However, Section 1.5 of Method 1613 states: *"The analyst is permitted to modify the method to lower the cost of measurements, provided that all performance criteria in this method are met."*

Since the absolute retention time of $^{13}C_{12}$-1,2,3,4-TCDD in the daily continuing calibrations was only slightly less than 25.0 minutes (i.e., range from 24.95 to 24.99 minutes) and the instrument met all performance criteria, no data validation actions were taken on this basis.

Laboratory Blanks/Equipment Filter Wipe Blanks

Laboratory method blanks and equipment filter wipe blank results are evaluated as to whether there are contaminants detected above the estimated detection limit (EDL).

Target compounds were detected in the method blanks and the equipment filter wipe blanks associated with the samples in this data set. The method and equipment filter wipe blank contamination was used to qualify field samples in the following manner:

- When the blank results were < ½ quantitation limit (QL) (3x QL for OCDD/OCDF) and sample results were < the QL (3x QL for OCDD/OCDF), the sample result was qualified as non-detect (U) at the QL.
- When the blank results were ≥ ½ QL (3x QL for OCDD/OCDF) and sample results were < the QL (3x QL for OCDD/OCDF), the sample result was qualified as non-detect (U) at the QL.
- When the blank results were ≥ ½ QL (3x QL for OCDD/OCDF) and sample results were ≥ the QL and < blank results, the sample result was qualified as non-detect (U) at the blank result.
- When the sample result was ≥ QL (3x QL for OCDD/OCDF) and/or ≥ blank result, the sample result was not qualified. The laboratory qualifier "B" was removed (where applicable).

Qualified sample results are summarized in Table 1.

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MS/MSD Results

MS/MSD analyses were not performed on a sample in this data set. No data validation actions were taken on this basis.

OPR Results

The OPR %Rs and/or RPDs were reviewed for conformance with the method QC acceptance criteria

The laboratory 2nd source standard reference material sample was greater than the QC limit for 2,3,7,8-TCDD. Since the associated samples were either non-detect (or qualified as non-detect during the data validation due to blank contamination), no qualification was added to the sample results.

Field Duplicate Results

A field duplicate was not collected on a sample in this data set.

Labeled Compound and Clean-up Standard Recoveries

The labeled compounds and labeled clean-up standard %Rs met method QC acceptance criteria.

Sample Results/Reporting Issues

All sample results detected at concentrations less than the lowest calibration standard but greater than the EDL are qualified by the laboratory as estimated (J). This “J” qualifier is retained during data validation.

PFK Lock Mass

The laboratory confirmed that a lock mass is monitored for each instrument descriptor.

Compound Identification

The data were reviewed to ensure that:

- the retention time, relative retention time, ion abundance ratios, SIM ion co-maximization, and S/N method acceptance criteria were met for compound identification; and
- the quantitative determination of PCDFs were not affected by the presence of polychlorinated diphenyl ether (PCDPE) interferences detected above the 2.5:1 S/N ratio limit.

All QC acceptance criteria were met with the following exceptions. Sample results which don't meet all of the method stipulated qualitative identification criteria are considered to be Estimated Maximum Possible Concentrations (EMPCs). Details concerning sample results in this data set which did not meet these identification criteria are noted below along with any data qualifications, as applicable.

The laboratory qualified all EMPC sample results with an "EMPC" laboratory qualifier to indicate that the ion ratio criterion was not met. All ion ratios were verified and affected sample results which did not meet the ion ratio criteria were qualified as estimated and tentatively identified (JN). Qualified sample results are shown in Table 1.

Second Column Confirmation (2,3,7,8-TCDF)

The sample data were reviewed to ensure that results for 2,3,7,8-TCDF when analyzed on a DB-5 (or equivalent) column were confirmed on a second column (i.e., DB-225 or equivalent) when isomer specificity is not achieved.

Section 16.5 of Method 1613 states: *"Confirmatory Analysis—Isomer specificity for 2,3,7,8-TCDF cannot be achieved on the DB-5 column. Therefore, any sample in which 2,3,7,8-TCDF is identified by analysis on a DB-5 column must have a confirmatory analysis performed on a DB-225, SP-2330, or equivalent GC column. The operating conditions in Section 10.1.1 may be adjusted to optimize the analysis on the second GC column, but the GC/MS must meet the mass resolution and calibration specifications in Section 10."*

Since the laboratory was able to demonstrate isomer specificity for 2,3,7,8-TCDF on the RTX-Dioxin2 column, no confirmation column analyses were required. Therefore, professional judgement was used to take no actions on this basis. Nevertheless, the detected results for 2,3,7,8-TCDF in the samples were below the QL ("J" values), thus are considered estimated values.

Percent Solids Content

The percent solids data were reviewed since the amount of moisture in a solid sample may have an impact on data representativeness. Due to the extremely low solubility of dioxins and furans in water, these analytes should be contained in the solid phase. Consequently, the NFG guidance does not stipulate a percent solids criterion. If applicable, EPA Regional guidance is used when assessing percent solids content. In the absence of EPA Regional guidance, AECOM uses 30% solids (from the NFG semivolatile guidance) as a benchmark to evaluate the percent solids content and professional judgment is used to determine the necessity to qualify data. Qualification on this basis was not required.

Verification of calculations was performed on a subset of the data as deemed appropriate. No discrepancies were noted.

QUALIFICATION ACTIONS

Sample results qualified as a result of validation actions are summarized in Table 1. All actions are described above.

ATTACHMENTS

Attachment A: Nonconformance Summary Tables

Attachment B: Qualifier Codes and Explanations

Attachment C: Reason Codes and Explanations

Table 1 - Data Validation Summary of Qualified Data

Sample ID	Matrix	Compound	Lab Result	Final Result	QL	EDL	Units	Validation Qualifiers	Validation Reason
T117-LTM2-20190328	SE	1,2,3,7,8,9-HxCDF	0.079 EMPC,J,B	0.997	0.997	0.079	ng/Kg	U	bl
T117-LTM2-20190328	SE	1,2,3,4,6,7,8-HpCDF	1.80	2.52	2.52	1.80	ng/Kg	U	bl
T117-LTM2-20190328	SE	1,2,3,4,7,8,9-HpCDF	0.097 EMPC,J	0.097	0.997		ng/Kg	JN	k
T117-LTM2-20190328	SE	1,2,3,4,6,7,8-HpCDD	8.86	12.6	12.6	8.86	ng/Kg	U	bl
T117-LTM2-20190328	SE	OCDF	5.06	12.3	12.3	5.06	ng/Kg	U	bl
T117-LTM2-20190328	SE	OCDD	76.4	183	183	76.4	ng/Kg	U	bl
T117-LTM4-20190328	SE	2,3,7,8-TCDD	0.349 EMPC,J,B	0.997	0.997	0.349	ng/Kg	U	bl
T117-LTM4-20190328	SE	1,2,3,7,8-PeCDD	0.920 EMPC,J	0.920	0.997		ng/Kg	JN	k
T117-LTM4-20190328	SE	1,2,3,7,8,9-HxCDF	0.688 EMPC,J,B	0.997	0.997	0.688	ng/Kg	U	bl
T117-P1-20190328	SE	2,3,7,8-TCDD	0.211 EMPC,J,B	0.997	0.997	0.211	ng/Kg	U	bl
T117-P1-20190328	SE	2,3,4,7,8-PeCDF	0.528 EMPC,J	0.528	0.997		ng/Kg	JN	k
T117-P1-20190328	SE	2,3,4,6,7,8-HxCDF	0.923 EMPC,J	0.923	0.997		ng/Kg	JN	k
T117-P1-20190328	SE	1,2,3,7,8,9-HxCDF	0.343 J,B	0.997	0.997	0.343	ng/Kg	U	bl
T117-P1-20190328	SE	OCDD	170 B	183	183	170	ng/Kg	U	bl
T117-P5-20190328	SE	2,3,7,8-TCDD	0.338 EMPC,J,B	0.999	0.999	0.338	ng/Kg	U	bl
T117-P5-20190328	SE	2,3,4,7,8-PeCDF	0.597 EMPC,J	0.597	0.999		ng/Kg	JN	k
T117-P5-20190328	SE	1,2,3,7,8-PeCDD	0.739 EMPC,J	0.739	0.999		ng/Kg	JN	k
T117-P5-20190328	SE	1,2,3,7,8,9-HxCDF	0.485 J,B	0.999	0.999	0.485	ng/Kg	U	bl
T117-P5-20190328	SE	1,2,3,4,7,8,9-HpCDF	1.43 EMPC	1.43	0.999		ng/Kg	JN	k
T117-FWSP-20190328	WP	OCDD	7.01 EMPC,B	7.01	1.06		ng/Kg	JN	k
T117-FWB-20190328	SE	1,2,3,4,6,7,8-HpCDD	12.6 EMPC,B	12.6	0.530		ng/Kg	JN	k

Attachment A

Qualifier Codes and Explanations

Qualifier	Explanation
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J-	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential low bias.
J+	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample with a potential high bias.
JN	The analyte was tentatively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

Attachment B

Reason Codes and Explanations

Reason Code	Explanation
be	Equipment blank contamination
bf	Field blank contamination
bl	Laboratory blank contamination
c	Calibration issue
cl	Clean-up standard recovery
d	Reporting limit raised due to chromatographic interference
fd	Field duplicate RPDs
h	Holding times
i	Internal standard areas
k	Estimated Maximum Possible Concentration (EMPC)
l	LCS or OPR recoveries
lc	Labeled compound recovery
ld	Laboratory duplicate RPDs
lp	Laboratory control sample/laboratory control sample duplicate RPDs
m	Matrix spike recovery
md	Matrix spike/matrix spike duplicate RPDs
ma	Multiple analyses, sample analyzed more than once, a value from another analysis should be used
nb	Negative laboratory blank contamination
p	Chemical preservation issue
r	Dual column RPD
q	Quantitation issue
s	Surrogate recovery
su	Ion suppression
t	Temperature preservation issue
x	Percent solids
y	Serial dilution results
z	ICS results

CD with Analytical Laboratory Report

APPENDIX E

SPU ADJACENT STREETS AND STORMWATER INSPECTION CHECKLISTS

INSPECTION CHECKLIST FOR GSI IN THE ROW

Project Name:	T-117 Adjacent Streets	Purpose of Inspection	NPDES-Qtrly		Plan Number:777-822
Mature/Established?	Establishment (1-3)	Weather	Clear		
Project Street		Precipitation (inches) in last 72 hrs:			
Inspection Date	Aug 1 2019	Site Issue Log Updated?	Yes		
Name of Inspector	Jolk/Honeycutt	Service Request Issued?	No		
Comments:					

GSI Facility Component	Observation (walk facility-look for conditions that may trigger maintenance)	Acceptable (Targeted Standard)	Yes?	Unacceptable Maintenance Trigger-Corrections/Improvements Required) - **Not applicable for Establishment GSI**	Yes?	Comments Special Issues
Vegetation						
General: Facility bottom; slope and top vegetation and mulch	Swale bottom	Emergents, vegetation and mulch cover at least 70%. Mulch at least 2" deep	x	Emergents, vegetation and mulch covers less than 70% and mulch is less than 2" deep		
	Trash, debris and pet waste	Minor	x	Heavy.		
	Plant blockage	Minor blockage at curb cuts, weirs and CB grates	x	Plant growth preventing flow; plant growth over curbs or across pavement by 6+/- inches; Heavy blockate at curb cuts, weirs and CB grates.		
	Overhanging shrubs, ground covers, grasses	Plants growing <6" over adjacent paved or grassed areas	x	Plants growing >6" over adjacent paved or grassed areas		
Plant Health	Unhealthy plants	Over 70% of planted vegetation is healthy and has a generally good appearance; may be signs of minor stress, wilting, spotting or holes in leaves	x	Less than 70% of planted vegetation is healthy; plants show signs of significant stress, wilting, spotting or holes in leaves, broken leaders or branches, leaning trees		
Trees and shrubs	Pruning	Branches meet 8' clearance over sidewalk; 14' over road. Trees do not interfere with powerlines. Shrubs are pruned up.	x	Branches do not meet acceptable clearances; branches interfere with powerlines; shrubs need pruning		
Weeds	Weeds	Less than 20% of vegetation is weeds	x	More than 20% of vegetation is weeds		
Safety						
Fire Hydrant	Visibility	Clearly visible and accessible	x	Blocked by vegetation overgrowth		
Vegetation	Line-of-sight	Vegetation not obstructing traffic or street lights or signs. Visibility through planter is good.	x	Vegetation blocks visibility of traffic or street lights or signs. Visibility through planter is poor.		
Major Storm Events (more than 1" rain 24 hours or wind above 20 mph)						
Drain Curb Cuts, Catch Basins (CB), Trench Drains and Weirs	Blockage	Facility is ready for a storm event: minor blockage from debris, sediment or vegetation, minor ponding	x	Facility is NOT ready for a storm event: Moderate to heave blockage from debris, sediment or vegetation, damaged structures, and/or visible ponding		
Facility Footprint						
Soil	Erosion and washouts	Moderate erosion, channelization or scouring with < 40% bare spots	x	Heavy erosion, channelization or scouring with > 40% bare spots		
	Settlement	Adjacent to pavement, MH, and crossings: 2" or less	x	2" or greater		
	Settlement	Adjacent to pipe outfalls and overflow structures: 4" or less	x	4" or greater		
	Settlement	Lower slopes and bottom areas: 6" or less	x			
	Excessive exposed soils	Bottom zone plant coverage approximately 70%	x	Bottom zone plant coverage less than 70%		
	Sediment accumulation	Moderate and water is draining	x	Heavy and water is not draining		

INSPECTION CHECKLIST FOR GSI IN THE ROW

Project Name:	T-117 Adjacent Streets	Purpose of Inspection	NPDES-Qtrly		Plan Number:777-822
Mature/Established?	Establishment (1-3)	Weather	Clear		
Project Street		Precipitation (inches) in last 72 hrs:			
Inspection Date	Aug 1 2019	Site Issue Log Updated?	Yes		
Name of Inspector	Jolk/Honeycutt	Service Request Issued?	No		
Comments:					

GSI Facility Component	Observation (walk facility-look for conditions that may trigger maintenance)	Acceptable (Targeted Standard)	Yes?	Unacceptable Maintenance Trigger-Corrections/Improvements Required) - **Not applicable for Establishment GSI**	Yes?	Comments Special Issues
	Water is not draining	Soils free draining with no standing water 24 hours aftger storm event	x	Soils appear compressed and ponding 24 hours following storm event		
Check Dams/weirs	Blockage, backed up water; undercutting; damage	Moderate at check dam/weir	x	Heavy at check dam/weir		
Vertical walls: Concrete, Segmental, Rockery	Separation, leaning, cracking.	Minor cracks. Separation of joints in segmental walls of 1/4" three feet apart	x	Displacement of wall at cracks; Separation of joints in segmental walls >1/4" 2 feet apart		
	Rockery Loose, segmental wall top uneven/cap missing	Minor weeds in rockery	x	Top semental wall loose; rockery unstable or missing rocks; rockery imbedded with weeks; weeds coming through segmental joints		
	Moss accumulation	Not a performance issue	x	Heavy accumulation that's moving into vegetation or onto sidewalk		
Boulders, cobbles, etc.	Settling, uindercutting or blocked cobbles at drain curb cuts and grates.	Minor blockage	x	Heavy blockage; settling, undercutting or erosion.		
	Displaced boulders	Pipe outfalls protected	x	Pipe outfalls w/o boulder or other type of armour protection; displaced, random boulders		
Surface-Inlets/Outlets/Pipes/Grates, Etc.						
Drain curb cuts, trench drain grates	Trash, debris, sediment and leaf litter; blockages	Minor	x	Moderate		
Planter wall openings (along sidewalk)	Damage to wall opening; trash debris, sediment and leaf litter blockages	Minor damage to wall opening <5 inches wide	x	Heavy damage to wall opening > 5 inches wide		
Presettling	Trash, debris, sediment and leaf litter	Moderate at entry and pad zone	x	Heavy trash at entry and pad zone		
Grates and trash racks	Trash, debris, sediment and leaf litter	Moderate	x	Heavy		
	Blockages	Moderate blockage at pipe outfalls and grates	x	Heavy blockage at pipe outfalls and grates		
	Damage	See major corrective maintenance table in O&M manual	x	See major corrective maintenance table in O&M manual		
Catch Basins	Debris, sediment, leaf litter; blockages; damaged structures	Minor	x	Heavy		
Surface clean-outs and observation ports	Cover intact; no water observed	Cover present but may have some vegetation growintg on it; clean-out port has no accumulated water or sediment	x	Cover missing; surface cover has become buried under soil; water or debris in clean-out		
Trenchdrains	Blockages; damaged structure	Moderate blockages. See major corrective maintenance table for structural damage	x	Heavy blockage and water does not flow through. See major corrective maintenance table for structural damage		
Geotextile fabric	Exposed fabric	Minor exposure (< 2")	x	Fabric pulled out and unsightly		
Watering						
Watering (hand from nearby source of water truck)	Dought; wilted or stressed plants; areas bare of plants	Plants show a few signs of stress, including pests and disease, or wilting and there are no areas bare of plants due to lack of water	x	Plants are stressed (pests and disease), leaves wilting or visible branch die off		minimal

INSPECTION CHECKLIST FOR GSI IN THE ROW

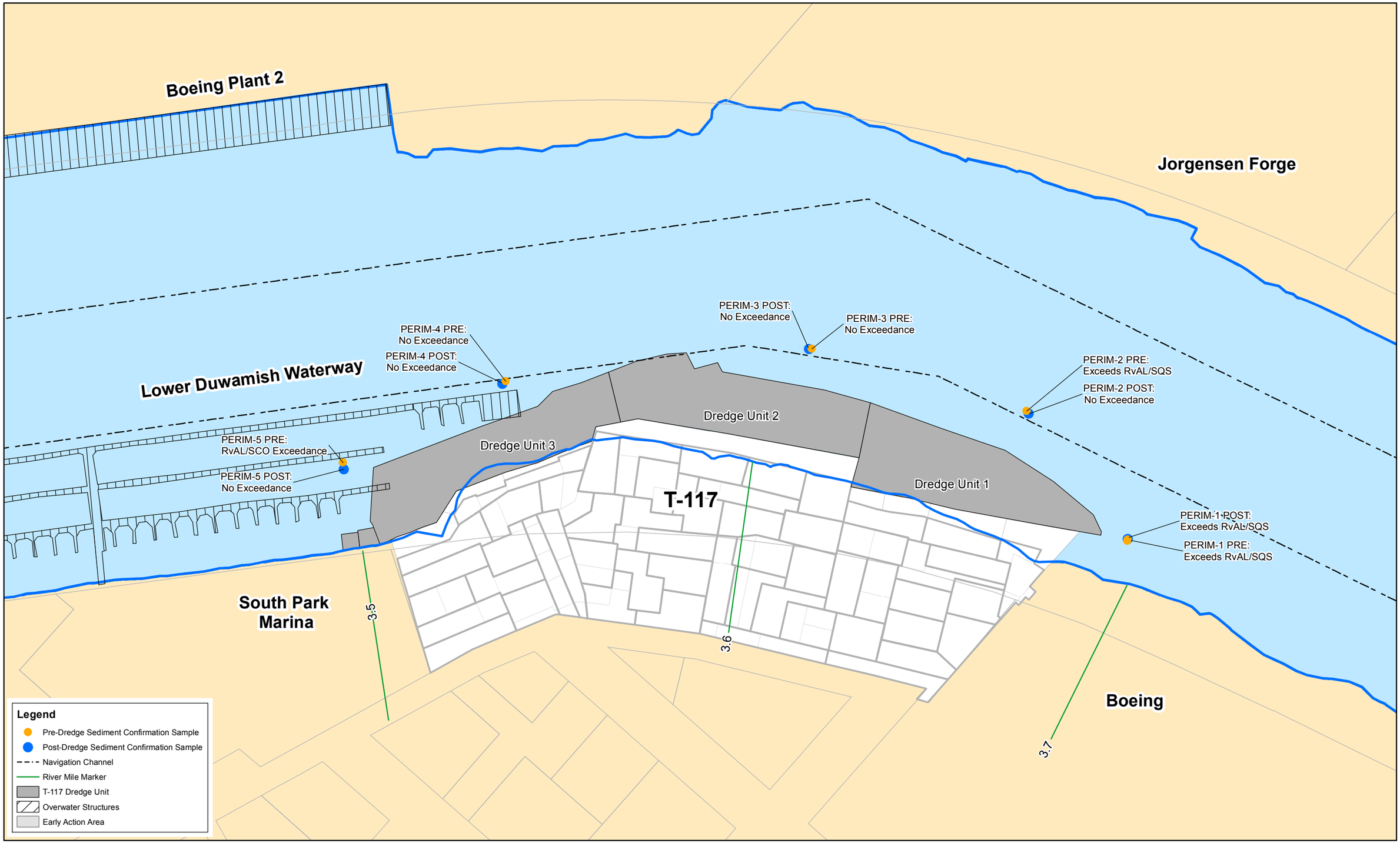
Project Name:	T-117 Adjacent Streets	Purpose of Inspection	NPDES-Qtrly		Plan Number:777-822
Mature/Established?	Establishment (1-3)	Weather	Clear		
Project Street		Precipitation (inches) in last 72 hrs:			
Inspection Date	Aug 1 2019	Site Issue Log Updated?	Yes		
Name of Inspector	Jolk/Honeycutt	Service Request Issued?	No		
Comments:					

GSI Facility Component	Observation (walk facility-look for conditions that may trigger maintenance)	Acceptable (Targeted Standard)	Yes?	Unacceptable Maintenance Trigger-Corrections/Improvements Required) - **Not applicable for Establishment GSI**	Yes?	Comments Special Issues
Irrigation	System	System works (e.g. there are a few broken parts; coverage is slightly uneven; broken equipment or lines to be capped)		System is not working. (e.g. coverage is uneven, areas unusually dry or wet; areas bare of plants due to poor coverage; soils washed out_		
	Winterize system	System has been winterized prior to freezing weather	N/a	System has not been winterized prior to freezing weather		
Comments:	System swales are mulched, weeded and very minimal trash. Surrounding area has lots of weeds and blackberries and they are trimmed back and not invading the facility. That is an on-going concern. Some of the sed pads on 16th have minor sedimentation on them. (PM's are being created for cleaning in September and March) No homeless issues noted at the time of this inspection.					

APPENDIX F

SUPPORTING DOCUMENTATION

Pre/Post Dredge Perimeter
Sediment Samples Locations and Results



Notes:
1. Feasibility Study Sediment Sample Locations shown include samples which were removed during dredging.

AECOM

0 100 200 Feet

T-117 CLEANUP REMOVAL ACTION CONSTRUCTION REPORT			T-117 PRE/POST DREDGE PERIMETER SEDIMENT SAMPLE LOCATIONS	
Date: 3/25/2016	DRWN:lmh/sea	Revision: 0	Project No: 60288925	Figure 7

Path: P:\ENV\PROJECTS\W\Port of Seattle\T-117 Cleanup Oversight\900-CAD-GIS\AECOM\MXD\RACR\Figure 7 Pre_Post Confirmation Sampling.mxd

Table 5-5 Sediment Perimeter Sampling Results

	Criteria					Location:	PERIM-1		PERIM-2		PERIM-3		PERIM-4		PERIM-5			
						Sample ID:	SG-PERIM-1-PRE	SG-PERIM-1-POST	SG-PERIM-2-PRE	SG-PERIM-2-POST	SG-PERIM-3-PRE	SG-PERIM-3-POST	SG-PERIM-4-PRE	SG-PERIM-4-POST	SG-PERIM-5-PRE	SG-PERIM-6-PRE (field dup)	SG-PERIM-5-POST	SG-PERIM-6-POST (field dup)
						Sample date:	11/22/2013	5/12/2014	11/22/2013	5/12/2014	11/22/2013	5/12/2014	11/22/2013	5/12/2014	11/22/2013	5/12/2014	11/22/2013	5/12/2014
Chemical	RvAL	SCO	Units	LAET	Units	ΓOC (%):	0.566	1.05	1.17	4.31	1.28	0.871	1.33	1.22	2.30	2.24	1.38	1.21
Metals																		
Arsenic	12	57	mg/kg dw				9.24	8.02	9.54	9.97	8.21	2.92	8.59	3.49	15.8	15.0	4.26	4.40
Cadmium		5.1	mg/kg dw				1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chromium		260	mg/kg dw				10 U	7.39 J	15.5	16.9 J	13.4	10.5 J	14.3	9.94 J	16.6	16.1	12.7 J	12.5 J
Copper		390	mg/kg dw				16.2	17.6	35.4	35.7	27.8	17.4	31.5	16.8	41.2	49.8	21.8	21.2
Lead		450	mg/kg dw				11.2	16.6	13.9	16.8	11.4	5.11	11.5	6.44	17.0	16.6	7.02	6.94
Mercury		0.41	mg/kg dw				0.1 U	0.097	0.24 J	0.19	0.11 J	0.063	0.11 J	0.075	0.15 J	0.15 J	0.071	0.063
Silver		6.1	mg/kg dw				1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Zinc		410	mg/kg dw				45.9 J	72.2	72.6 J	78.4	66.1 J	31.8	63.4 J	36.8	79.4 J	84.3 J	39.7	39.9
PAHs																		
2-Methylnaphthalene	38	38	mg/kg OC	0.67	mg/kg dw		0.18 U	0.48 U	0.28	0.010 U [a]	0.22	0.57 U	0.27	0.41 U	0.18 J	0.58 J	0.40	0.60
Acenaphthene	16	16	mg/kg OC	0.5	mg/kg dw		0.42	0.48 U	0.25	0.010 U [a]	0.19	0.57 U	0.30	0.41 U	1.7 U	1.8 U	0.36 U	0.99
Acenaphthylene		66	mg/kg OC	1.3	mg/kg dw		0.35 U	0.48 U	0.21	0.010 U [a]	0.16 U	0.57 U	0.19	0.41 U	1.7 U	1.8 U	0.36 U	0.41 U
Anthracene	220	220	mg/kg OC	0.96	mg/kg dw		0.95	0.48 U	1.7	0.016 [a]	0.55	0.57 U	0.69	0.64	4.2 J	2.5 J	0.80	1.8
Benzo(a)anthracene		110	mg/kg OC	1.3	mg/kg dw		4.1	2.9	2.9	0.057 [a]	2.6	1.3	3.4	3.0	19	16	1.2	4.5
Benzo(a)pyrene		99	mg/kg OC	1.6	mg/kg dw		5.8	3.0	3.5	0.055 [a]	3.0	1.4	3.5	2.6	14	13	1.2	4.9
Benzo(g,h,i)perylene		31	mg/kg OC	0.67	mg/kg dw		4.9	2.5	2.9	0.053 [a]	2.4	1.3	2.4	1.6	7.4	7.1	1.1	3.7
Total benzofluoranthenes		230	mg/kg OC	3.2	mg/kg dw		13	6.7	9.32	0.14 [a]	7.4	3.3	4.1	5.9	35	33	2.6	8.35
Chrysene		110	mg/kg OC	1.4	mg/kg dw		6.9	4.2	5.0	0.093 [a]	3.7	1.8	4.2	3.5	17	17	1.9	5.9
Dibenzo(a,h)anthracene		12	mg/kg OC	0.23	mg/kg dw		1.0	0.54	0.62	0.010 U [a]	0.55	0.57 U	0.53	0.41 U	1.9	1.8 U	0.36 U	0.62
Dibenzofuran	15	15	mg/kg OC	0.54	mg/kg dw		0.23	0.26	0.26	0.0074 [a]	0.21	0.23 U	0.32	0.28	0.39 J	1.5 J	0.37	0.61
Fluoranthene	160	160	mg/kg OC	1.7	mg/kg dw		13	8.4	8.5	0.15 [a]	5.5	3.4	9.0	8.2	57	45	3.3	9.1
Fluorene	23	23	mg/kg OC	0.54	mg/kg dw		0.49	0.48 U	0.68	0.010 U [a]	0.24	0.57 U	0.38	0.41 U	2.2	1.8 U	0.39	1.1
Indeno(1,2,3-cd)pyrene		34	mg/kg OC	0.6	mg/kg dw		5.3	2.7	3.2	0.050 [a]	2.7	1.3	2.6	1.8	8.3	8.0	1.0	3.6
Naphthalene		99	mg/kg OC	2.1	mg/kg dw		0.35 U	0.48 U	0.21	0.010 U [a]	0.16	0.57 U	0.17	0.41 U	1.7 U	1.8 U	0.36 U	0.55
Phenanthrene	100	100	mg/kg OC	1.5	mg/kg dw		7.4	4.2	4.1	0.064 [a]	2.2	1.5	3.4	3.9	27 J	8.5 J	2.0	8.3
Pyrene		1000	mg/kg OC	2.6	mg/kg dw		13	7.4	7.9	0.13 [a]	5.7	2.9	8.3	7.9	41	33	3.1	12
Total HPAHs		960	mg/kg OC	12	mg/kg dw		66.4	38.3	44	0.73 [a]	33.5	16.6	38	34	200	170	15.3	52
Total LPAHs		370	mg/kg OC	5.2	mg/kg dw		9.4	4.2	7.2	0.080 [a]	3.4	1.5	5.1	4.6	33 J	11 J	3.2	12
cPAHs	0.09		mg/kg dw				0.046	0.046	0.060	0.081	0.056	0.017	0.061	0.046	0.48	0.43	0.023	0.080
Phthalates																		
Bis(2-ethylhexyl)phthalate		47	mg/kg OC	1.3	mg/kg dw		12	12 J	10 J	0.44 J [a]	7.8 J	9.1 J	7.5	6.3 J	4.8	6.7	8.7 J	11 J
Butyl benzyl phthalate		4.9	mg/kg OC	0.063	mg/kg dw		1.0 U	0.95 U	1.5 J	0.029 [a]	0.64 J	1.1 U	0.75	0.82 U	0.65 J	1.5 J	0.72 UJ	0.83 U
Diethyl phthalate		61	mg/kg OC	0.2	mg/kg dw		0.71 U	0.95 U	0.35	0.020 U [a]	0.31 U	1.1 U	0.30 U	0.82 U	0.17 U	0.20	0.72 U	0.83 U
Dimethyl phthalate		53	mg/kg OC	0.071	mg/kg dw		0.48	0.95 U	0.54	0.020 U [a]	0.43	1.1 U	0.41	0.82 U	0.57	0.58	0.72 U	0.83 U
Di-n-butyl phthalate		220	mg/kg OC	1.4	mg/kg dw		3.5 U	0.95 U	1.7 U	0.040 [a]	1.6 U	1.1 U	1.5 U	0.82 U	0.87 U	0.89 U	0.72 U	0.83 U
Di-n-octyl phthalate		58	mg/kg OC	6.2	mg/kg dw		0.57 U	1.2	0.27 U	0.020 U [a]	0.31	1.1 U	0.24 U	0.82 U	0.24 J	0.42 J	0.72 U	0.83 U
Other SVOCs																		
1,2,4-Trichlorobenzene		0.81	mg/kg OC	0.031	mg/kg dw		0.99	0.19 U	0.66	0.0040 U [a]	0.31	0.23 U	0.45	0.16 U	0.39	0.26	0.14 U	0.17 U
1,2-Dichlorobenzene		2.3	mg/kg OC	0.035	mg/kg dw		0.71 U	0.19 U	0.35	0.0040 U [a]	0.31 U	0.23 U	0.30 U	0.16 U	0.22	0.18 U	0.14 U	0.17 U
1,4-Dichlorobenzene		3.1	mg/kg OC	0.11	mg/kg dw		0.42 U	0.19 U	0.30	0.0040 U [a]	0.19 U	0.23 U	0.18 U	0.16 U	0.13	0.17	0.14 U	0.17 U
2,4-Dimethylphenol		0.03	mg/kg dw				0.019 U	0.010 U	0.019 U	0.020 U	0.019 U	0.010 U	0.019 U	0.010 U	0.019 U	0.019 U	0.010 U	0.010 U
2-Methylphenol		0.06	mg/kg dw				0.0064 U	0.0020 U	0.0064 U	0.0040 U	0.0064 U	0.0020 U	0.0064 U	0.0020 U	0.0064 U	0.0064 U	0.0020 U	0.0020 U
3/4-Methylphenol		0.67	mg/kg dw				0.059	0.0040 U	0.014 U	0.018	0.014 U	0.0040 U	0.014 U	0.0040	0.014 U	0.014 U	0.0040 U	0.0040 U
Benzoic acid		0.65	mg/kg dw				0.054 U	0.10 U	0.054 U	0.20 U	0.054 U	0.10 U	0.054 U	0.10 U	0.054 U	0.059 J	0.10 U	0.10 U
Benzyl alcohol		0.06	mg/kg dw				0.020	0.020 U	0.052	0.040 U	0.034	0.020 U	0.018	0.020 U	0.035 J	0.067 J	0.020 U	0.020 U
Hexachlorobenzene		0.38	mg/kg OC	0.022	mg/kg dw		0.18 UJ	0.19 U	0.085 UJ	0.0040 U [a]	0.078 UJ	0.23 U	0.075 U	0.16 U	0.043 UJ	0.045 UJ	0.14 U	0.17 U
Hexachlorobutadiene		3.9	mg/kg OC	0.011	mg/kg dw		0.35 U	0.19 U	0.17 U	0.0040 U [a]	0.16 U	0.23 U	0.15 U	0.16 U	0.087 U	0.089 U	0.14 U	0.17 U
n-Nitrosodiphenylamine		11	mg/kg OC	0.028	mg/kg dw		0.18 UJ	0.19 U	0.11 J	0.0040 U [a]	0.078 UJ	0.23 U	0.075 UJ	0.16 U	0.043 UJ	0.045 UJ	0.14 U	0.17 U
Pentachlorophenol		0.36	mg/kg dw				0.0062 UJ	0.010 U	0.0097 J	0.020 U	0.0062 UJ	0.010 U	0.0062 UJ	0.010 U	0.0062 UJ	0.0062 UJ	0.010 U	0.010 U
Phenol	0.42	0.42	mg/kg dw				0.020	0.0020 U	0.0057	0.0040 U	0.0054 U	0.0020 U	0.0054 U	0.0020 U	0.0070	0.0063	0.0020 U	0.0020 U
PCBs																		
Total PCBs	12	12	mg/kg OC	0.13	mg/kg dw		10	14.9	4.3	0.074 [a]	2.3	1.50	4.1	3.8	7.0	8.5	2.6	3.6 J
Dioxin/furan																		
Dioxin/furan TEQ	13		ng/kg dw				1.41 J	1.88 J	54.8 J	4.12 J	2.40 J	1.20 J	2.35 J	1.62 J	6.55 J	8.43 J	1.30 J	1.84 J

Notes:
All values are reported in RvAL/SCO units, except where noted (see footnote 'a')
Orange-highlighted values exceed the RvAL or SCO (note: arsenic is the only chemical with an RvAL different from the SCO)
There were no exceedances of CSL or 2LAET criteria
[a] TOC exceeded 4% for this sample; dry-weight result was compared to LAET/2LAET criteria.
dw - dry-weight
OC - organic carbon-normalized

Potential Scour Areas and Estimated Net Sedimentation Rates from LDW ROD

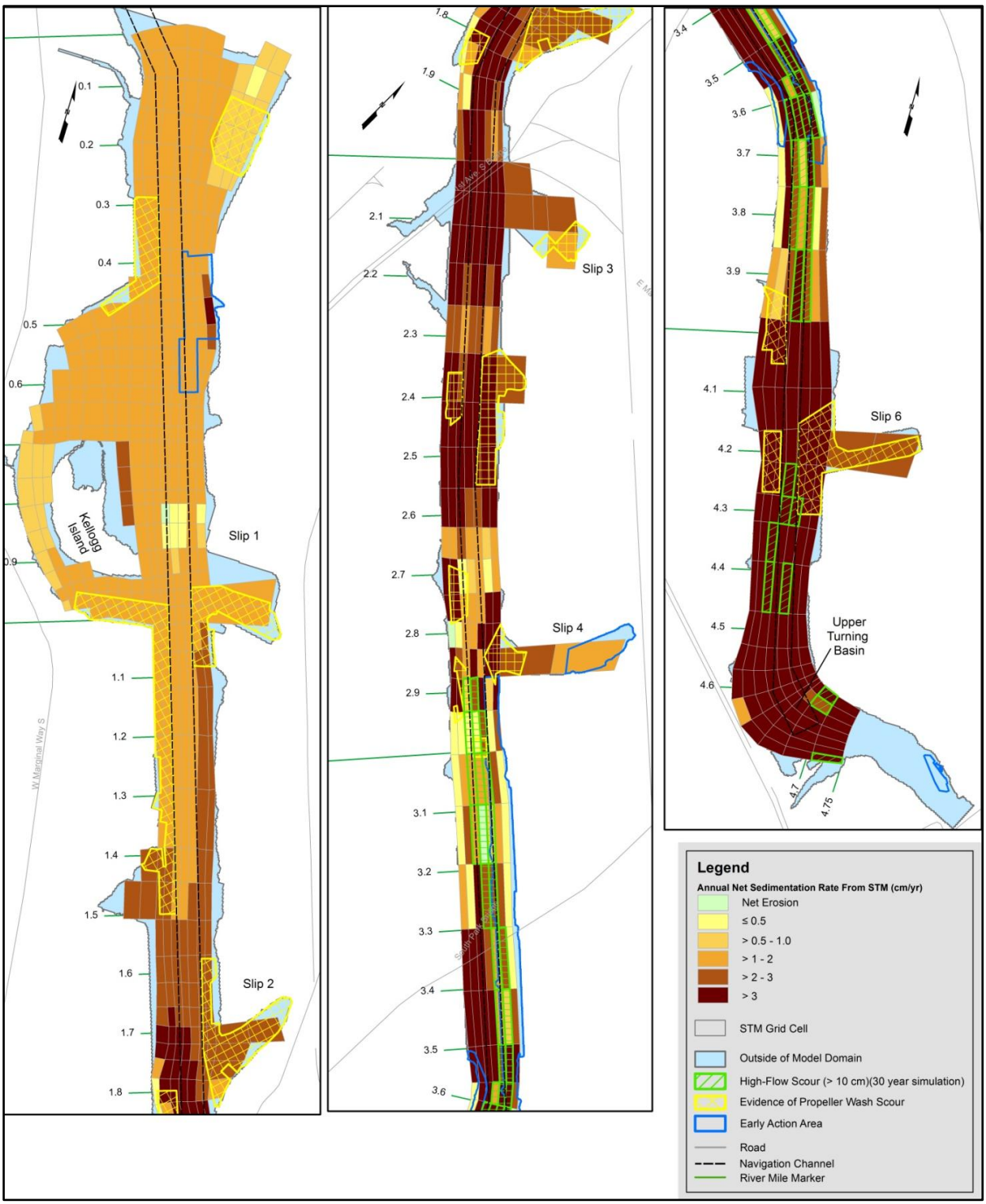


Figure 2. Potential Scour Areas and Estimated Net Sedimentation Rates

Remedial Action Levels from LDW ROD

Table 27. Selected Remedy RAO 3 RALs

SMS Contaminant of Concern for RAO 3	RAL for Recovery Category 1 Areas[a] (Benthic SCO)	RAL for Recovery Category 2 & 3 Areas (2 x Benthic SCO)[b]
Metals (mg/kg dw)		
Arsenic	57	n/a
Cadmium	5.1	10.2
Chromium	260	520
Copper	390	780
Lead	450	900
Mercury	0.41	0.82
Silver	6.1	12.2
Zinc	410	820
PAHs (mg/kg OC)		
2-Methylnaphthalene	38	76
Acenaphthene	16	32
Anthracene	220	440
Benzo(a)anthracene	110	220
Benzo(a)pyrene	99	198
Benzo(g,h,i)perylene	31	62
Total benzofluoranthenes	230	4650
Chrysene	110	220
Dibenzo(a,h)anthracene	12	24
Dibenzofuran	15	30
Fluoranthene	160	320
Fluorene	23	46
Indeno(1,2,3-cd)pyrene	34	68
Naphthalene	99	198
Phenanthrene	100	200
Pyrene	1,000	2,000
Total HPAHs	960	1,920
Total LPAHs	370	740

SMS Contaminant of Concern for RAO 3	RAL for Recovery Category 1 Areas[a] (Benthic SCO)	RAL for Recovery Category 2 & 3 Areas (2 x Benthic SCO)[b]
Phthalates (mg/kg OC)		
Bis(2-ethylhexyl)phthalate	47	94
Butyl benzyl phthalate	4.9	9.8
Dimethyl phthalate	53	106
Chlorobenzenes (mg/kg OC)		
1,2,4-Trichlorobenzene	0.81	1.62
1,2-Dichlorobenzene	2.3	4.6
1,4-Dichlorobenzene	3.1	6.2
Hexachlorobenzene	0.38	0.76
Other SVOCs and COCs, (µg/kg dw except as shown)		
2,4-Dimethylphenol	29	58
4-Methylphenol	670	1,340
Benzoic acid	650	1,300
Benzyl alcohol	57	114
n-Nitrosodiphenylamine, mg/kg OC	11	22
Pentachlorophenol	360	720
Phenol	420	840
PCBs (mg/kg OC)		
Total PCBs	12	n/a

Notes:
General:

- PCBs and arsenic are also human health COCs (see Table 28 for RALs for human health COCs), and RALs for the the human health category take precedence over RAO 3 RALs. The surface sediment (10 cm) Recovery Category 1 RALs for PCBs and arsenic are the same for human health and benthic invertebrates, but the 2 X SCO Recovery Category 2 and 3 criteria are not applicable to PCBs and arsenic. Figure 22 and Figure 23 list all RALs for human health COCs.
- Table 23 describes Recovery Categories and Figure 12 shows Recovery Category areas.

a. The RAL applies to the 10 cm and 45 cm depth intervals for intertidal areas and to the 10 cm and 60 cm depth intervals for subtidal areas. See Figure 22 and Figure 23 .
b. For Recovery Category 2 and 3 areas, the RAL applies to the 10 cm depth interval. See Figure 22 and Figure 23.

Table 28. Remedial Action Levels, ENR Upper Limits, and Areas and Depths of Application

			Intertidal Sediments (+11.3 ft MLLW to -4 ft MLLW)				Subtidal Sediments (-4 ft MLLW and Deeper)				
			Recovery Category 1 RALs, ENR ULs, and Application Depths		Recovery Category 2 and 3 RALs, ENR ULs, and Application Depths		Recovery Category 1 RALs, ENR ULs, and Application Depths		Recovery Category 2 and 3 RALs, ENR ULs, and Application Depths		Shoaled Areas[b] in Federal Navigation Channel
Risk Driver COC	**Units**	**Action Levels**	Top 10 cm (4 in)	Top 45 cm (1.5 ft)	Top 10 cm (4 in)	Top 45 cm (1.5 ft)	Top 10 cm (4 in)	Top 60 cm (2 ft)	Top 10 cm (4 in)	Top 60 cm (2 ft)[c]	Top to Authorized Navigation Depth Plus 2 ft
Human Health Based RALs											
PCBs (Total)	mg/kg OC	RAL	12	12	12	65	12	12	12	195	12
		UL[a] for ENR	--	--	36	97	--	--	36	195	--
Arsenic (Total)	mg/kg dw	RAL	57	28	57	28	57	57	57	--	57
		UL[a] for ENR	--	--	171	42	--	--	171	--	--
cPAH	µg TEQ/kg dw	RAL	1000	900	1000	900	1000	1000	1000	--	1000
		UL[a] for ENR	--	--	3000	1350	--	--	3000	--	--
Dioxins/Furans	ng TEQ/kg dw	RAL	25	28	25	28	25	25	25	--	25
		UL[a] for ENR	--	--	75	42	--	--	75	--	--
Benthic Protection RALs											
39 SMS COCs [d]	Contaminant-specific	RAL	Benthic SCO	Benthic SCO	2x Benthic SCO	--	Benthic SCO	Benthic SCO	2x Benthic SCO	--	Benthic SCO
		UL[a] for ENR	--	--	3x RAL	--	--	--	3x RAL	--	--

a. The ENR Upper Limit (UL) is the highest concentration that would allow for application of ENR in the areas described. For areas with no ENR limit listed, ENR is not a currently designated technology (see Section 13.2.1.2 for further discussion).

b. Shoaled areas are those areas in federal navigation channel with sediment accumulation above the authorized depth including a 2 ft over-dredge depth that USACE uses to maintain the channel for navigation purposes. The authorized channel depths are (1) from RM 0 to 2 (from Harbor Island to the First Avenue South Bridge), 30 ft below MLLW; (2) from RM 2 to RM 2.8 (from the First Avenue South Bridge to Slip 4), 20 ft below MLLW; and (3) from RM 2.8 to 4.7 (Slip 4 to the Upper Turning Basin), 15 ft below MLLW. For shoaled areas, the compliance intervals will be determined during Remedial Design; these are typically 2-4 ft core intervals. For areas in the channel that are not shoaled, Recovery Categories 1 or 2 & 3 RALs apply as indicated in the other subtidal columns.

c. Applied only in potential vessel scour areas. These are defined as subtidal areas (i.e., below -4 ft MLLW) that are above -24 ft MLLW north of the 1st Ave South Bridge, and above -18 ft MLLW south of the 1st Ave South Bridge (see Figure 17).

d. There are 41 SMS COCs, but total PCBs and arsenic ENR ULs are based upon human health based RALs only (see Table 20).