Accelerated Source Tracing Study
Lower Duwamish Waterway

Data Report

Prepared for

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List of Acronyms

µg	microgram
µS	microsiemen
2LAET	second lowest apparent effects threshold
ARI	Analytical Resources, Inc.
AST	accelerated source tracing
Axys	Axys Analytical Services, Ltd
cm	centimeter
COPC	contaminant of potential concern
CSL	Cleanup Screening Level
CSO	combined sewer overflow
DC	direct current
DOC	dissolved organic carbon
DW	dry weight
Ecology	Washington State Department of Ecology
EPA	Environmental Protection Agency
g	gram
GIS	Geographic Information System
gpm	gallons per minute
HPAH	high molecular weight polycyclic aromatic hydrocarbon
I-5	Interstate-5
kg	kilogram
L	liter
LAET	lowest apparent effects threshold
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
LDW	Lower Duwamish Waterway
LDWG	Lower Duwamish Waterway Group
LPAH	low molecular weight polycyclic aromatic hydrocarbon
mg	milligram
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NCDC	National Climatic Data Center
OCDD	octachlorodibenzo-p-dioxin
PAH	polycyclic aromatic hydrocarbon
PBDE	polybrominated diphenylether
PCB	polychlorinated biphenyl
pg	pictogram
PSEP	Puget Sound Estuary Program
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation/Feasibility Study
RL	reporting limit
RPD	relative percent difference
SAIC	Science Applications International Corporation

SAP	Sampling and Analysis Plan
SD	storm drain
SMS	Sediment Management Standards
SPU	Seattle Public Utilities
SQS	Sediment Quality Standard
SVOC	semi-volatile organic compound
TEF	toxic equivalency factor
TEQ	toxic equivalent quotient
TOC	total organic carbon
TSS	total suspended solids
VOC	volatile organic compound
WHO	World Health Organization
WQC	Water Quality Criteria

Executive Summary

Introduction

The Washington State Department of Ecology (Ecology) supports the Environmental Protection Agency (EPA) efforts on the Lower Duwamish Waterway (LDW) Remedial Investigation/ Feasibility Study (RI/FS) and is leading source control efforts in coordination with local governments. A wide range of contaminants are present in a 5.5-mile reach of the LDW, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals. High concentrations of these contaminants have made this portion of the LDW a Federal Superfund and state Model Toxics Control Act (MTCA) site.

The Accelerated Source Tracing Study was conducted to measure contaminant concentrations in stormwater at multiple locations in two LDW sub-basins to assess the practicality and effectiveness of an “up-the-pipe” source tracing approach. This report includes the chemical analysis results for whole water, filtered solids, sediment trap solids, and bedload sediment trap solids collected between January and June 2011. These results were used to trace potential sources of various contaminants of potential concern (COPCs) in the selected sub-basins, and to compare different sampling methods to assess which are most useful for purposes of source tracing.

The specific objectives of the Accelerated Source Tracing Study were as follows:

- Collect data necessary to trace and identify potential sources of LDW sediment contamination from two tidally influenced storm drain sub-basins of the LDW drainage basin.
- Correlate in-line sediment trap, filtered solids, and catch basin solids data with stormwater data, to the extent possible.
- Compare different sampling methods to determine the relative utility and cost effectiveness of the various techniques.

Sample Collection

Eight sampling locations monitored during this study were located in the S Snoqualmie Street and S Dakota Street drainage sub-basins of the City of Seattle’s Diagonal Avenue S Combined Sewer Overflow/Storm Drain (CSO/SD) system. Whole water and filtered solids samples were collected from the locations during three different types of stormwater flow conditions between January and May 2011:

- Storm Events — A total of eight storm events were sampled for whole water and filtered solids. These samples are representative of varying precipitation amounts and conditions over the sampling period.
- Base flow — Whole water and filtered solids samples were collected during base flow conditions to be representative of water and solids that enter the storm drain system via groundwater infiltration or as a result of unidentified connections to the system.

- Tidal Inundation — Whole water and filtered solids samples were collected during a period of tidal inundation (a high tide period where LDW river water runs up the storm drain system). These samples were collected to be representative of LDW river water that may transport contaminants both up-line and down-line and influence solids deposited in sediment traps. One Snoqualmie and two Dakota Street locations were not influenced by tides.

Storm event sampling occurred at all locations. Base flow and tidal inundation sampling activities were conducted at locations where one or both flow conditions were present. All of the whole water and filtered solids samples consisted of one composite sample per individual sampling event.

Sediment trap and bedload sediment trap samples were composited over a period of several weeks or months to provide enough material for chemical analysis. The collection of inline grab samples was part of the original sampling approach. However, Seattle Public Utilities (SPU) has been collecting inline and catch basin grab samples in the LDW Diagonal Avenue S CSO/SD drainage basin for several years. The SPU database of grab and sediment trap samples was used to supplement samples collected as part of this study (SPU 2010).

In addition to the samples collected for chemical and physical analysis, the whole water sampling equipment logged water level, conductivity, and velocity data during sample collection and for select periods over the course of the wet season. These data were used to assess the tidal and base flow conditions observed at each of the sampling locations.

COPC Results

COPC results for whole water, filtered solids, sediment traps, and bedload sediment trap samples were compared to applicable numeric criteria. Whole water results were compared to surface water Water Quality Criteria (WQC) for Washington State, and the solids results were compared the dry weight Sediment Management Standards (SMS) sediment criteria and the Lowest Apparent Effects Thresholds (LAET/2LAET). A wide variety of detected contaminants exceeded these criteria. Copper frequently exceeded the criteria in whole water, while total PCBs, mercury, zinc, high molecular weight PAHs (HPAHs), and phthalates frequently exceeded the sediment standards. Additional COPCs such as polybrominated diphenylethers (PBDEs) and dioxin/furan congeners were also analyzed. These contaminants do not have numeric criteria, but concentrations were elevated relative to what is typically seen in Washington State sediments, particularly for PBDEs.

Comparison of Sample Types

Comparison of COPC results between sample types was limited given the relatively small number of samples, the different distribution of total suspended solids (TSS) and bedload solids sampled by each sampling method, and differences in matrices. Although statistically significant comparisons could not be made due to the small number of samples, qualitative comparisons of the sample types led to the following observations:

- Although data were limited for grain size comparisons, each of the different sampling equipment types targets different grain size distributions, which may impact contaminant concentrations found with each sample type. Whole water samples were believed to mainly contain TSS. Filtered solids samplers primarily sampled TSS, but also collected some bedload material. Sediment trap samplers collected more bedload material than filtered solids. Bedload sediment traps had the least amount of fines, and therefore collected the greatest amount of bedload sediments.

- Comparisons of COPC concentrations between sample types indicated that there was fair agreement between the results of filtered solids and sediment traps and between filtered solids and whole water normalized to mass concentrations. There was poor agreement between the results of the bedload samplers and other sample types.
- Total PCB concentrations are not well correlated between any of the sample types, while total HPAH concentrations were fairly consistent across sample types. One hypothesis for this discrepancy may be that PCBs were bound to a particular particle size that no two sample types collected equally, while HPAHs were present in all particle sizes and were therefore measured in approximately equal concentrations regardless of sample type.

Source Tracing

One of the early objectives of this study was to perform “up-the-pipe” source tracing. This entailed sampling outfalls as they enter the river and then moving upstream, or up the pipe, tracking any elevated concentrations of COPCs. Due to logistical constraints, this type of source tracing could not be conducted. Rather, multiple locations were selected for in-depth sampling in two sub-basins.

- Mercury and total PCBs had concentration peaks at two S Snoqualmie Street locations (SQ2 and SQ3). Nearby samples collected by the SPU also had the high concentrations of these chemicals, but did not provide additional information to locate any potential sources. Concentrations of both of these COPCs were particularly high at SQ3. SQ3 samples were collected from a sump and it is unknown how the sediments accumulated in the basin impacted sampling for filtered solids and whole water. The accumulated sediment may have been responsible for the elevated concentrations seen in base flow at this location.
- Zinc and total HPAHs were detected at elevated concentrations, but the addition of the SPU data to the data evaluation did not facilitate the identification of hotspots or sources for these COPCs.
- Bis(2-ethylhexyl)phthalate concentrations were elevated in all samples collected from the Snoqualmie and Dakota lines and in nearly all samples collected by SPU. All but three samples had detected concentrations above the 2LAET. The ubiquitous nature of this COPC makes source tracing difficult.

Sample Type Recommendations

- Based on the results of this study, several recommendations are made regarding the appropriate sampler type for source tracing. Each of the sample types can be used for source tracing, but some offer more advantages than others. Whole water samplers can effectively measure conditions during individual storms. They are capable of collecting separate samples for storm flow and base flow. Sample collection is rapid, so several locations can be sampled in a short amount of time with an unlimited target analyte list. Results are in mass per volume units, making comparisons to existing data difficult.

- Filtered solids samplers can also measure conditions during individual storms. Sample collection is also rapid, so several locations can be sampled in a short amount of time. The unit is custom made, relatively expensive, requires higher maintenance, and programming is less standard. The target analyte list for filtered solids is more limited. For example: TOC cannot be measured because of interferences from the filter bag; analysis of phthalates is possible, but this would require the analysis of additional filter blanks to determine the potential for phthalate contamination from the sampling equipment. Results for many of the COPCs, including PCBs, PAHs, and dioxin/furan congeners, are reported by the laboratories in mass per filter bag. Converting concentrations to mass per mass units can be complicated.

- Sediment traps collect composite samples representing conditions during both base flow and storm flow. Collection of each sample can take months, with no guarantee of success. However, the equipment is relatively inexpensive and sampling requires minimal labor. Results are reported in mass-based units. The target analyte list is only limited to the amount of solids collected.

- Bedload samplers collect composite samples representing conditions during both base flow and storm flow. Sample collection can take weeks. With their current design, the samplers did not consistently collect solids during each deployment. Collecting samples with a bedload sampler requires a custom-made stainless steel unit, which is a significant upfront investment. Results are reported in mass-based units. The target analyte list is only limited to the amount of solids collected. However, in comparisons with other sample types, bedload samplers produced results with consistently lower concentrations of various COPCs.

- Overall, sediment traps are the least expensive sampler, easiest to deploy and retrieve, and easiest to analyze. They work well for source tracing that does not require discrete samples and where sufficient time is available for sample collection. If discrete samples are needed for base flow or individual storm events and the timeline is short, filtered solids or whole water samplers should be considered.
- The target COPCs may also influence the preferred sampling method, particularly for HPAH and total PCBs. For each sampling method, measured HPAH concentrations were within a factor of two. Total PCB concentrations were not directly comparable for any of the sampling methods. Additional study is needed to determine which sample type is most representative of PCB concentrations.

1.0 Introduction

The Washington State Department of Ecology (Ecology) supports the Environmental Protection Agency (EPA) efforts on the Lower Duwamish Waterway (LDW) Remedial Investigation/ Feasibility Study (RI/FS) and is leading source control efforts in coordination with local governments. Ecology and EPA are currently implementing a two-phase RI/FS with a workgroup of potentially responsible parties, collectively known as the Lower Duwamish Waterway Group (LDWG). The LDWG members include the City of Seattle, The Boeing Company, the Port of Seattle, and King County. A wide range of contaminants are present in a 5.5-mile reach of the LDW, including polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and metals. High concentrations of these contaminants have made this portion of the LDW a Federal Superfund and state Model Toxics Control Act (MTCA) site.

Ecology tasked Science Applications International Corporation (SAIC) with collecting samples and measuring contaminant concentrations in stormwater at multiple locations in two LDW sub-basins to assess the practicality and effectiveness of an "up-the-pipe" source tracing approach. This approach involves collection of sampling data throughout a drainage sub-basin to prioritize further investigations of potential contaminant sources. SAIC has contracted with NewFields to assist in this effort.

This report includes the chemical analysis results for whole water, filtered solids, sediment trap solids, and bedload sediment trap solids collected between January and June 2011. These results will be used to trace potential sources of various contaminants of potential concern (COPCs) in the selected sub-basins, and to compare different sampling methods to assess which are most useful for purposes of source tracing.

Sampling was conducted following the study design and methods described in the *Accelerated Source Tracing Study Combined Sampling and Analysis and Quality Assurance Project Plan* (SAP/QAPP) (SAIC 2010a). This study was performed in conjunction with the LDW *Stormwater Lateral Loading Study* (SAIC and NewFields 2011a) and shares many of the same sampling methods. Appendix C describes the logistical challenges encountered in both of these studies associated with sampling of tidally influenced storm drains (SD) that discharge to the LDW.

1.1 Project Scope and Objectives

The purpose of this sampling and analysis effort was to collect whole water and filtered solids samples from up to five individual storm events and to collect sediment trap and bedload sediment trap composite samples over the course of the wet season. Eight sampling locations were identified in two lateral storm drains that discharge to the LDW through the Diagonal Avenue S combined sewer overflow/storm drain (CSO/SD). The specific objectives of the Accelerated Source Tracing Study were as follows:

- Collect data necessary to trace and identify potential sources of LDW sediment contamination from two tidally influenced storm drain sub-basins of the LDW drainage basin.

- Correlate in-line sediment trap, filtered solids, and catch basin solids data with stormwater data, to the extent possible.
- Compare different sampling methods to determine the relative utility and cost effectiveness of the various techniques.

1.2 Document Organization

This Data Report summarizes and evaluates the results of the Accelerated Source Tracing Study within the context of the project scope and study objectives outlined in Section 1.1 of this document. Section 2.0 provides descriptions of each of the sampling locations. Section 3.0 describes how the samples were collected as well as any deviations from the SAP/QAPP (SAIC 2010a). Section 4.0 lists the analytical laboratories and analytical methods used, and the procedure for calculating the mass of solids on the filter bags. The chemical data results for whole water, filtered solids, sediment trap solids, and bedload sediment trap solids are presented in Section 5.0. A summary of the data validation reports for the chemical analyses is provided in Section 6.0. Section 7.0 presents a discussion of the sample results in relation to the project objectives. Conclusions and recommendations drawn from the study are presented in Section 8.0. References are provided in Section 9.0. The following appendices are included as part of this report:

- Appendix A. Outfall and Storm Drain Access Locations
- Appendix B. Synopsis of a Storm Sampling Event
- Appendix C. Challenges of Stormwater Sampling
- Appendix D. Field Logs
- Appendix E. Chemistry Results Summary Tables
- Appendix F. Analytical Laboratory Reports and Chain-of-Custody Forms
- Appendix G. Data Validation Report

2.0 Sampling Locations

The eight sampling locations monitored during this study are located in the S Snoqualmie Street and S Dakota Street drainage sub-basins of the City of Seattle's Diagonal Avenue S CSO/SD system. The Diagonal Avenue S drainage basin encompasses approximately 2,600 acres, including the primarily industrial areas west of I-5 and residential neighborhoods east of I-5 (e.g., Beacon Hill, Rainier Valley, and Central District).

Field reconnaissance conducted during September and October 2010 identified access locations appropriate for sampling. Four locations each were sampled in the S Snoqualmie Street and S Dakota Street sub-basins (Figure 1). Sampling within a sub-basin generally took place at access locations staggered along the main storm drain. In both sub-basins, the sampling locations were numbered sequentially from upstream to downstream. Locations in the S Snoqualmie Street (Snoqualmie) line were designated SQ, and S Dakota Street (Dakota) line locations were designated DK.

The surface area of the Dakota and Snoqualmie sub-basins was calculated using Geographic Information System (GIS) software following Thiessen polygon analysis of storm drain structure shapefiles to determine probable drainage boundaries. The area of impervious surface and land cover classifications for each sub-basin was determined using the National Land Cover 2006 Percent Developed Imperviousness dataset, available at: http://www.mrlc.gov/nlcd_2006.php. The same calculations were made for the four individual drainage areas in each sub-basin.

Table 1 lists the total area, total impervious area, and land cover classifications for the Snoqualmie and Dakota sub-basins. All areas should be considered estimates. The upper portion of the Dakota line is more residential and less developed than other portions of the two lines. For this reason, the upper Dakota drainage is listed separately on tables and figures. Table 2 lists the total area, impervious area, the runoff coefficient, and the approximate total stormwater runoff volume for the sub-basins represented by each sampling location in the Snoqualmie and Dakota lines. The runoff coefficient multiplied by the total area and the precipitation amount is an approximation of total runoff. The 2010–2011 wet season precipitation total of 37.53 inches was used to calculate total stormwater volumes (Section 5.1.2). The calculated runoff is discussed further in Section 7.0 as a means of evaluating relative contaminant inputs from each of the sub-basin.

Figures 2 and 3 show the sub-basins and individual sub-basin areas, storm drains, and sampling access locations for the Snoqualmie and Dakota lines, respectively. Table A–1 of Appendix A presents specific information about the locations and dimensions of the sampled access locations, including SPU structure number, coordinates, storm drain diameters, and elevations.

2.1 S Snoqualmie Street Drainage

The Snoqualmie sub-basin is highly developed (Table 1). The total drainage area is 83 acres, comprising 3 percent of the total Diagonal Avenue S drainage basin. Stormwater leaving the Snoqualmie line enters the Diagonal Avenue S storm drain 2,900 feet upgradient of the outfall. The Snoqualmie line is located downstream of a combined sewer overflow structure, which can impact storm drain flows during periods of excessive precipitation.

The following sections describe each of the access locations in the Snoqualmie sub-basin and some of the characteristics unique to each location. Table 2 presents the drainage area and impervious surface draining to each of the locations.

SQ1: Sampling location SQ1 is on S Snoqualmie Street and Airport Way S, and drains a total of 29.3 acres (Table 2). It is the farthest upstream location sampled on the Snoqualmie line. The storm drain at SQ1 sits at an elevation of +11.3 feet above mean lower low water (MLLW). Although infrequent, tides higher than this elevation do inundate the SQ1 location with river water. Three storm drains converge at SQ1: one line from the south and one line from the north along Airport Way S, and a third line entering from the east after draining a small vegetated area under Interstate-5 (I-5) (Figure 2). With the exception of this vegetated area, the majority of the SQ1 sub-basin is industrial or roadway, draining much of Airport Way S.

SQ2: The SQ2 sampling location is at S Snoqualmie Street and 7th Avenue S (Figure 2). The storm drain at this location is at an elevation of +9.7 feet MLLW and is frequently inundated by river water. An 18-inch storm drain enters the maintenance hole from the north at 7th Avenue S. Significant flow was observed coming from this line and likely contributed a large portion of the total flow observed at SQ2. An additional line enters from the south but drains a smaller area (Figure 2). The total area for SQ2 is 14.6 acres, with a cumulative drainage area of 43.9 acres (Table 2).

SQ3: Sampling location SQ3 is located at S Snoqualmie Street and 6th Avenue S. It encompasses 29.0 acres and drains a total of 72.9 acres of the Snoqualmie line (Table 2). The sub-basin is entirely industrial and incorporates much of 6th Avenue S plus a nearly 600-foot length of S Snoqualmie Street (Figure 2) downstream of SQ2. The storm drain at SQ3 is at an elevation of +8.8 feet MLLW and is subject to tidal inundation. Unlike the other sampled locations on the Snoqualmie line, this location has a large maintenance hole with a 3-foot sump. The sump was effective at capturing solids and contained several inches of sediment.

SQ4: The SQ4 sampling location is located a few feet north of S Snoqualmie Street on 4th Avenue S (Figure 2). As such, SQ4 does not receive the cumulative stormwater runoff from SQ1, SQ2, and SQ3. The SQ4 drainage basin does include stormwater flow from several industrial buildings and parking lots along 4th Avenue S, and may include additional inputs from the 4th Avenue Bridge. The elevation of SQ4 is +8.7 feet MLLW. Observed flow at SQ4 was less than the other locations due to its smaller size (9.8 acres; Table 2) and lack of cumulative input from the Snoqualmie line.

2.2 S Dakota Street Drainage

The Dakota sub-basin is located north and adjacent to the Snoqualmie sub-basin (Figure 1). The Dakota sub-basin drains 260 acres, or 10 percent of the total Diagonal Avenue S drainage basin. Stormwater from the Dakota sub-basin joins the Diagonal Avenue S mainline at Diagonal Avenue S, just west of 4th Avenue S. It contains a mix of residential, roadway, and industrial stormwater flow. For clarity, the sub-basin is divided into the mainly residential upper Dakota drainage and the more industrial lower portion of the drainage (Figure 3). The following sections describe each of the sampling locations on the Dakota line and some of the drainage characteristics unique to each location's drainage area. Table 2 presents the drainage area and impervious surface for each of the locations.

DK1: The access location for DK1 is located at the terminus of 10th Avenue S on Beacon Hill. The location is at +128 feet MLLW. This sub-basin incorporates stormwater from a section of the Beacon Hill neighborhood, including the Veterans Administration (VA) Medical Center (Figure 3), for a total of 144.9 acres. The slope of the storm drain is steep (~20 percent) relative to the other sampling locations, resulting in higher velocity of flow during storm events as well as base flow conditions.

DK2: The DK2 access location is at the intersection of S Dakota Street and 9th Avenue S, immediately downstream of an I-5 storm drain connection, which is responsible for a significant portion of total stormwater flow at DK2 (Figure 3). The drainage area for DK2 also contains a portion of Beacon Hill downstream of DK1. The total area of DK2 is 62.7 acres, with a cumulative drainage area of 207.6 acres. Less than half of the total area is impervious (Table 2). The DK2 drain is located at an elevation of +10.2 feet MLLW and is subject to tidal inundation above this level on occasion.

Between DK1 and DK3, stormwater descends nearly 125 feet in elevation from Beacon Hill. The result is fast moving stormwater and base flow at DK2. The sampling difficulties caused by this flow are discussed in Section 3.1.4.

DK3: The DK3 access location is at S Dakota Street and 7th Avenue S. The area encompasses 18.5 acres and drains a total of 226.1 acres. The DK3 area includes industrial runoff from streets and parking lots as well as several industrial building rainwater diversion systems (Figure 3). The DK3 site is at an elevation of +3.2 feet MLLW and is frequently inundated with river water due to tidal influence.

DK4: DK4 is located at the intersection of 6th Avenue S and S Industrial Way. The drainage area incorporates runoff from both of these streets and adjacent properties. The DK4 sampling location lies on a lateral line running perpendicular to the Dakota storm drain and is elevated slightly above the primary line running the length of S Dakota Street. DK4 drains an industrial area of 24.3 acres, separate from the residential runoff of the other Dakota line locations. At an elevation of +4.8 feet MLLW, DK4 is often inundated with river water due to tidal influence.

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3.0 Data Collection

This section describes the collection of whole water, filtered solids, sediment trap, and bedload sediment trap solids from the storm drains, as well as water flow and conductivity data. A synopsis of a typical stormwater sampling event is outlined in Appendix B, which summarizes the logistics involved with this sampling effort. Appendix B also includes information regarding the prediction of potential sampling events, mobilization of field equipment, and deployment and recovery of sampling gear. All sample collection activities followed the SAP/QAPP (SAIC 2010a), with the exceptions noted in Section 3.2. Specific challenges associated with this data collection effort are detailed in Appendix C.

3.1 Sample Collection

Whole water and filtered solids samples were collected from the Dakota and Snoqualmie sub-basin locations during three different types of stormwater flow conditions between January and May 2011:

- Storm events — Eight storm events were sampled for whole water and filtered solids. These samples are representative of varying precipitation amounts and conditions over the sampling period. Although a total of eight storm events were sampled, actual sample counts vary by location and analyte due to sampling difficulties and limited sample volumes for analysis.
- Base flow — Samples collected during base flow conditions were intended to be representative of water and solids that enter the storm drain system via groundwater infiltration or as a result of unidentified connections to the system. One or two base flow samples were collected at each locations with the exception of DK4, which had no base flow.
- Tidal inundation — At each location, one sample was collected during a period of tidal inundation. These samples were intended to be representative of LDW river water that may transport contaminants both up-line and down-line and influence solids deposited in sediment traps. One tidal sample was targeted at each location except SQ1, DK2, and DK1, which had minimal or nonexistent tidal inundation.

Storm event sampling occurred at all locations. Base flow and tidal inundation sampling activities were conducted at locations where one or both flow conditions were present. All of the whole water and filtered solids samples consisted of one composite sample per individual sampling event.

Sediment trap and bedload sediment trap samples were composited over a period of several weeks or months to provide enough material for chemical analysis. The collection of inline grab samples was included in the original sampling plan; however, Seattle Public Utilities (SPU) has been collecting inline and catch basin grab samples in the LDW Diagonal Avenue S CSO/SD drainage basin for years. Consequently, the SPU database of grab and sediment trap sample results was used to supplement the data collected as part of this study (SPU 2010).

In addition to the samples collected for chemical and physical analysis, the whole water sampling equipment logged water level, conductivity, and velocity data during sample collection and for select periods over the course of the wet season. These data were used to assess the tidal and base flow conditions observed at each of the sampling locations.

The following sections provide specific details on the collection of each of the sample types. A timeline of all sampling activities relative to daily precipitation is presented in Figure 4. The timeline extends through June. The designated wet season for Western Washington is generally October through April (Ecology 2007).

In December 2010, SPU hired a contractor to jet wash and clean portions of the Diagonal Avenue S storm drain line including the Snoqualmie storm drain line (SPU 2010). During cleaning, all solids in the storm drain pipes are vacuumed out of the drain and removed from the site for disposal. This jet cleaning occurred before most of the sampling (Figure 4), although the exact dates of the jet cleaning could not be verified at the time this report was published.

3.1.1 Equipment Installation

Certain components of the sampling systems remained installed at each sampling location for the duration of the sampling season, while other components were deployed only for an individual sampling event. All equipment, with the exception of batteries, was dedicated to a specific sampling location in order to minimize the possibility of cross contamination between sites.

At the beginning of the sampling season, a confined-space entry team from Clearcreek Contractors, Everett, WA, installed the sediment traps, flow sensors, and whole water suction lines within the storm drains. Field notes associated with equipment installation and sampling are presented in Appendix D. The exact configuration of equipment varied among locations due to site-specific characteristics such as pipe shape, diameter, and maintenance hole depth. The stormwater suction line and flow sensor were mounted adjacent to each other on a stainless steel scissor bracket installed in the storm drain just upstream of the maintenance hole (Figure 5). Sediment traps were installed just downstream of the maintenance holes, leaving the area directly underneath the maintenance hole clear for the intermittent deployment of whole water samplers and stormwater filtration systems (Figure 5). Two bedload sediment traps were deployed throughout the sampling period. The bedload samplers were fastened behind the sediment traps and rested on the bottom of the storm drain.

A whole water sampler and stormwater filtration system were installed at each sampling location during sampling events only, and they were removed between sampling events. Temporary installation of this equipment also included the deployment of two 12-volt marine batteries to power the collection systems and sensors. This equipment was not left in the maintenance holes for more than a few days, because the water levels in the holes during high tidal stages had the potential to damage the electronic components of the systems. A tripod and winch were used to lower the whole water sampler and stormwater filtration system in tandem into the maintenance hole (Figure 5). The entire sampling unit remained suspended from a harness designed to fit securely below the maintenance hole cover during sampling. The sampling unit was removed upon sampling completion so that whole water and filtered solids samples could be retrieved, data could be downloaded, and batteries could be recharged.

3.1.2 Flow Modules and Conductivity Measurements

Water level, velocity, and conductivity of water in the storm drains were measured using Isco equipment leased from Teledyne Isco, Lincoln, NE. Water level and velocity measurements were made at all locations. Conductivity was measured only at SQ1, SQ3, SQ4, and DK4 to provide conductivity data in both sub-basins where tidal inundation was expected. An Isco 6712c automated whole water sampler was used to power, control, and record data received from a Model 750 area velocity flow module and a YSI 600 (Yellow Springs Instruments; Yellow Springs, OH) conductivity sonde.

Flow sensors were attached to the scissor brackets installed in the storm drains and were present for the duration of the sampling season. The conductivity sensors were attached directly to the stormwater filtration pumps and were deployed only during sampling events (Figure 6). Because both sensors were controlled by the Isco sampler, flow and conductivity data were only collected during sampling events and other select intervals, rather than continuously over the entire sampling season.

3.1.3 Whole Water Samples

Whole water samples were collected using the Isco 6712c units. For the storm events and base flow sampling, the timers on the Isco computers were programmed to collect aliquots only during low tidal windows when LDW river water was not present in the storm drains. For the tidal water collection event, the Isco timers were set to collect aliquots during high tidal stages during periods of no precipitation when LDW tidal water was known to be present in the storm drains.

The Isco samplers were programmed with sampling interval start/stop times based upon the storm drain elevations, predicted daily tidal levels in the LDW, and the timing of predicted storm activity. Although effort was made to sample as much of the storm hydrograph as possible, rising tidal levels generally restricted sampling to a maximum of 6 hours at tidally influenced locations. Time-weighted whole water samples were collected by the Isco samplers over the programmed sampling interval, generally collecting a 1-liter aliquot every 15 minutes, without overfilling the carboy. The programs included rinsing and purging of the suction line before the collection of each aliquot. The composite sample was collected within a decontaminated 2.5-gallon carboy installed in the sampler base.

Some whole water samples were collected in a single grab rather than as time-weighted composites. Tidal windows were short at DK4 due to the low height of the maintenance hole (Table A–1). Consequently, discrete grab samples were collected at this location during two storm events. Base flow samples were also collected as discrete grab samples at all four Snoqualmie line locations on February 2, 2011, and from locations DK1 and DK3 on January 26, 2011.

Immediately before sampler deployment, the Isco suction line and flow sensor cord were retrieved from the maintenance hole, where they were installed for the duration of the sampling season, and connected to the Isco sampler. The conductivity sensor, also connected to the Isco sampler, was lowered to the bottom of the storm drain along with the stormwater filtration pump.

At several locations, sand bags were placed in the pipe to back up base flow or stormwater to a sufficient depth for sampling. Sandbags were used at DK1, DK3, SQ2, and SQ4 throughout sampling, and for one attempted event at DK2 and SQ1.

After the completion of sampling, the Isco sampler was removed from the maintenance hole and the carboy was delivered to Analytical Resources, Inc. (ARI), of Tukwila, WA. The laboratory was responsible for decontamination of the carboy as specified in the SAP/QAPP (SAIC 2010a). Isco samplers were taken to the NewFields office in Edmonds, WA, where their exteriors were rinsed and stored between sampling events. Flow and conductivity data were downloaded from the Isco units after each sampling event.

3.1.4 Filtered Solids Samples

The stormwater filtration system used to collect suspended solids samples was described in the SAP/QAPP (SAIC 2010a). These filtration units were specifically designed to fit within a variety of maintenance hole sizes and configurations without the need for an external power source. The stormwater filtration systems were deployed in conjunction with the Isco whole water samplers for storm, base flow, and tidal water sampling events.

Each filtered solids sampling unit consisted of the following:

- Polyvinyl chloride (PVC) frame,
- Two 12-volt deep cycle marine batteries,
- Two filter housings,
- Two in-line flow totalizers,
- Water-resistant control box containing a digital timer,
- Pump cage,
- Bilge pump,
- Float switch, and
- Conductivity sensor (at SQ 1, SQ3, SQ4, and DK4; for connection to the Isco sampler).

Depending upon the sampling location, as much as 8 feet of tidal water could be present within the maintenance hole at high tide. While the filtered solids sampling equipment was designed to be water-resistant, the digital timer, totalizers, and batteries could not be submerged. Therefore, the long-term deployment of the sampling equipment would have resulted in severe damage. This restriction required deployment, sampling, and recovery of sampling equipment during a low-tide period, generally limiting sampling intervals to 6 hours.

Tidal water samples were collected on a rising tide. Sampling equipment was pulled from the maintenance hole once sufficient water and solids were collected but before the tide was high enough to damage equipment.

The submerged portion of the filtration system consisted of a direct current (DC) powered, 2,000-gallons-per-hour submersible bilge pump and float switch connected to the pump cage. One-inch diameter tubing connected the pump to the two parallel filtration housings mounted on the PVC frame (Figure 6). When deployed, the weighted pump cage sat upright on the bottom of the maintenance hole while the filtration apparatus hung below the maintenance hole cover (Figure 5). The PVC frame also supported the two 12-volt marine batteries required to power the bilge pump, pump timer, Isco sampler, and sensors.

Immediately before sampler deployment, the DC timer on the filtration system was set with the same start/stop times as the Isco sampler (Section 3.1.3). During the first storm event, the float switch located on the pump cage was set just above the base flow water level. It was assumed that, when the timer reached its start time and there was a sufficient depth of stormwater, the pump would activate. In reality, the float switches at many locations were pinned down by the turbulent storm flow, which failed to start the pump. For all subsequent events, the float switches were not wired into the control system and the pump was activated strictly by the timer.

Setup at DK2 deviated from this standard plan due to high flow velocities during both storm and base flow events. A small stilling well was fabricated in order to capture whole water as well as suspended solids. Three large holes were drilled near the bottom of a 5-gallon bucket. The pump was fastened to the inside bottom of the bucket. A permanently secured eyebolt in the center of the storm drain offered an anchoring point to secure the stilling well directly in the turbulent flow, allowing enough water to collect during sampling events to keep the pump engaged.

Once the pump was activated, stormwater was pushed through the pump hose where the flow was split and forced through separate, pre-weighed, 5-micron polypropylene filter bags. Flow totalizers connected to the outflow side of each filter housing measured the volume of water passing through each filter. As with the whole water samples, filtered solids samples were time-weighted rather than flow-weighted. Low-tide windows were targeted for storm events and base flow, while a precipitation-free, rising tide period was sampled for tidal water.

This parallel filtration system allowed for the concurrent collection of two discrete solids samples at each location. The two filters were labeled A and B for identification purposes. Each filter was assumed to be equally representative of the sampling event. Analytical options for the filter bags were limited because a whole bag extraction was necessary for analysis of either PCB Aroclors, PAHs, or dioxin/furan congeners. Therefore, analysis of these contaminants was rotated between sampling events.

At the completion of a sampling event, the filtration systems and the Isco samplers were retrieved. The totalizer volume for each filter was recorded in the field logbook. Filter bags were removed from the filter housings, squeezed of their excess water, and placed into labeled plastic ziplocked bags. Collected filters were stored on ice and delivered to the analytical laboratory with the whole water samples. Between sampling events, the filtration systems were stored in the NewFields warehouse with other field equipment.

3.1.5 Sediment Trap Solids Samples

Sediment traps consist of a stainless steel bracket, which holds a 1-liter Teflon sample bottle. The traps were mounted to the wall of the storm drain downstream of all sensors and sampling gear. At most locations, the top of the sediment trap bottles were below the height of tidal influence. Therefore, the sediment traps had the ability to capture particles suspended in tidal water when the traps were submerged at high tidal stages.

Two sediment traps were installed at each location by a confined space entry crew throughout the first week of November 2010. Teflon®-lined caps were placed on the traps in the Snoqualmie line for the duration of the jet cleaning. Sediment trap samples were collected on January 19, 2011, and a second set of fresh traps was installed at each location. The sediment traps collected on January 19, 2011, were capped with Teflon®-lined caps and stored by

NewFields at approximately 4°C until delivery to ARI on April 1, 2011. The second set of sediment traps was retrieved on May 5, 2011, and immediately delivered to ARI for analysis. The solid material retrieved from each of the two sediment trap bottles from the same location and sampling event were combined by ARI prior to analysis.

Upon the completion of sampling, a confined space entry crew removed the bottles and brackets from the storm drains.

3.1.6 Bedload Sediment Trap Samples

Two bedload sediment traps were available for sampling over the course of the study. The samplers resemble a stainless steel box. A ramp allows sediment moving along the bottom of the drain to move over the top of the box, where it is deposited through a series of slits. Once inside the trap, a series of baffles keep the sediment from washing out. The trap has a low profile and is weighted at the bottom to help it stay place.

The samplers were deployed at DK3 and SQ3 from November 4, 2010, through April 7, 2011. During this time period, the traps were held in place using a harness that attached to the top four corners of the trap. Upon retrieval, the trap at DK3 was filled with solids. The trap at SQ3 had rotated on its harness and did not retain any solids.

The traps were decontaminated and redeployed at DK1 and SQ1 on April 7, 2011. At these locations the harness was fastened to the front of the trap, minimizing the opportunity for movement. The traps were retrieved on May 5, 2011, samples were collected, and the traps were replaced at the same location. The traps were retrieved again on June 15, 2011. For this third deployment, the trap at SQ1 had captured solids, but at DK1 a piece of the frame had broken free and the trap did not retain any solids.

3.2 Deviations from the Sampling Plan

As anticipated during the planning stages of this study, several deviations from the approved SAP/QAPP (SAIC 2010a) were required during the sampling effort to collect representative samples of sufficient volume for chemical analysis. Deviations are summarized below.

3.2.1 Targeted Storm Events

The storm events targeted for sampling did not always meet the criteria outlined in the SAP/QAPP. At the beginning of the sampling season, storm events targeted for sampling were evaluated relative to the following criteria (Ecology 2007):

- Wet Season: October 1, 2010, through April 30, 2011
- Rainfall volume: 0.20 inch minimum, no fixed maximum
- Rainfall duration: No fixed minimum or maximum
- Antecedent dry period: Less than or equal to 0.02 inch of rain in the previous 24 hours
- Inter-event dry period: 6 hours

It was expected that these criteria would need to be modified in order to sample a sufficient number of storm events. The SAP/QAPP also stated that an effort would be made to sample at least 75 percent of the storm hydrograph or at least 75 percent of the first 24 hours if the storm event lasted longer than 24 hours. Early in the sampling season it was apparent that tidal inundation would restrict the number of possible sampling events and the duration of sample collection.

Table 3 presents a summary of the sampled storm events. All eight storm events consisted of an uninterrupted sampling interval of 5 hours or more with total precipitation greater than 0.2 inch, with the exception of storm event 3, which had 0.133 inch of precipitation. The antecedent dry period criterion was dismissed. Only four of the eight storm sampling events captured 75 percent or more of the storm hydrograph, because high tides required either late initiation or early termination of a given sampling event. Samples that targeted storm events and missed due to late precipitation were reclassified as base flow. Samples DK1-030111-W, DK2-030111-W, and DK-030111-S were collected and analyzed and later deemed unrepresentative of storm flow or base flow. These results are not included in this report but are presented in Appendix E, Tables E–5 and E–6.

Five of the eight storm events samples occurred over the falling limb of the hydrograph. Only one storm captured the entire hydrograph (February 2, 2011). Although these storms may not be fully representative of runoff conditions in these two sub-basins, they were the best available events due to the difficulties of sampling within tidal windows.

3.2.2 Time-Weighted Whole Water Samples

Throughout the sampling season, time-weighted rather than flow-weighted whole water samples were collected at all of the sampling locations. As presented in the SAP, whole water samples were to be collected as flow-weighted composites, consisting of equal volume aliquots sampled at predetermined runoff volume intervals. Such a sampling scheme would collect aliquots more frequently at higher flow rates and less frequently at lower flow rates. Flow-weighted samples are preferred over time-weighted samples, as they better reflect the typical storm hydrograph.

In order to program the Isco units to collect flow-weighted whole water samples, the relationship between precipitation amount and stormwater runoff is required for each location. The Isco samplers were deployed with the flow meters prior to stormwater sampling in hopes of obtaining this relationship. However, high tides obscured most of the precipitation events, causing problems with the flow sensor's ability to accurately measure stormwater velocity and depth (Section 5.1.1). As sampling progressed, it was realized that the tidally restricted sampling windows prevented the collection of a flow-weighted sample over the entire storm hydrograph. As a result, time-weighted whole water samples, rather than flow-weighted samples, were collected over the same sampling interval as the filtered solids samples.

3.2.3 Tidal Water Sampling

Sampling of tidal water in the storm drains was not included in the SAP/QAPP. It became apparent through numerous field observations that the sediment trap bottles at many locations became inundated during high tides. This is demonstrated in Figure 7, which shows the schematic of a tidally influenced outfall and storm drain. Dashed lines representing the MLLW and MHHW levels show the extent of the tidal influence near the sampling gear.

It was also observed that storm flow in the storm drains did not always cover the mouths of the sediment trap bottles. In order to account for particles that may be deposited in the sediment traps during high tides, whole water and filtered solids were collected at each tidally influenced sampling location when river water was observed in the storm drain. These tidal samples were collected during a time of no precipitation so that tidal water was not being influenced by stormwater.

3.2.4 Inline Solids Sampling

The SAP/QAPP stated that inline solids grab samples would be collected at each of the sampling locations. If inline solids were not present at the location, an attempt would be made to collect the sample from an alternate access location along the same storm drain line. As discussed in Section 3.1, SPU also collects sediment trap, inline, and catch basin grab samples from the Diagonal Avenue S CSO/SD basin. To avoid duplicating efforts, grab sample results from SPU's December 2010 Source Control Progress Report (SPU 2010) were incorporated into the results of this study.

4.0 Analytical Methods

All analytical procedures for chemical and physical parameters were performed by subcontracted laboratories in accordance with Ecology guidelines as outlined in the SAP/QAPP (SAIC 2010a). This section summarizes the analytical methods for each sample type. Specific methods used for analysis of each of the contaminants are presented in the data summary tables (Appendix E, Tables E–1 through E–7). The number of whole water and filtered solids samples analyzed for storm events, base flow, and tidal water is displayed in Table 4.

4.1 Whole Water Samples

After sampling, the 2.5-gallon carboys containing the whole water samples were delivered to ARI for sub-sampling and analysis. Twelve different conventional parameters were measured including: pH, total alkalinity, alkalinity as carbonate, alkalinity as bicarbonate, alkalinity as hydroxide, total suspended solids (TSS), chloride, nitrate, sulfate, total organic carbon (TOC), dissolved organic carbon (DOC), and hardness as calcium carbonate. The methods for each of these parameters are presented with the data tables in Appendix E.

Whole water samples were also analyzed for low level PCB Aroclors (EPA 8082), semi-volatile organic compounds (SVOC) (EPA 8270D and EPA 8270DSIM), pesticides (EPA 8081B), volatile organic compounds (VOC) (EPA 8260C), and total and dissolved metals (EPA 200.8, EPA 6010B, and EPA 7470A). Dissolved metals were analyzed after an aliquot of unpreserved sample was passed through a 0.45-micron filter.

For select samples, ARI also sub-sampled an aliquot, which was sent to Axys Analytical Services, Ltd (Axys) of Sidney, BC, for polybrominated diphenylether (PBDE) analysis (EPA 1614).

4.2 Filtered Solids Samples

After sample collection, the filters were delivered to ARI for processing and analysis. Filtered solids from the A filter of the parallel filtration system were first scraped to obtain material for analysis of metals and grain size. Approximately 10 grams (g) of material were needed for metals analysis, and approximately 20 grams for grain size. If insufficient sample material was obtained to analyze for all parameters, mercury was analyzed first, then other metals, then grain size. The remainder of the filter bag was extracted in its entirety and analyzed for either PCB Aroclors or PAHs. Metals were reported as milligrams per kilogram (mg/kg) dry weight (DW), organics (PCB Aroclors and PAHs) were reported in units of micrograms (µg) per filter bag, and grain size was reported in percent size fraction.

For PCB Aroclor analysis, the filter bags were dried following metals and grain size subsampling to determine the dry weight of material captured during filtration. The dry filter bags were then extracted whole and analyzed for PCB Aroclors. For PAH analysis, the filter bags were not dried due to the volatility of some of the individual PAH compounds. Rather, the wet filter bags were extracted whole and analyzed for PAHs.

PCB Aroclors were analyzed by EPA 8082, PAHs were analyzed by EPA 8270D, and metals were analyzed by EPA 6010B and EPA 7471A for mercury. Grain size analyses were initially performed on the Sedigraph unit. Due to instrument breakdown in early April, subsequent grain size analyses were instead performed by a laser diffraction unit. Both instruments used Puget Sound Estuary Program (PSEP) methods and produce comparable data of acceptable quality.

Select B filters were sent to Axys for analysis of dioxin/furan congeners. The first batch of filters sent to Axys was sent wet weight (i.e., not dried) on the assumption that sufficient solids could be scraped from the filter for analysis. Subsequent batches of filters were dried and weighed by ARI before shipment to Axys for dry weight, whole-bag extraction. Dioxin/furan congeners were analyzed using EPA 1613.

All filters were labeled and weighed by ARI prior to sampling. The difference between the dry weight of a filter after sampling and the dry weight of the filter before sampling represents the total mass of solids captured on the filter during sampling. Correction factors were used to account for the removal of metals and grain size splits. This captured mass of solids was used to convert the laboratory reported units of µg per filter bag to mg/kg DW for PCBs and PAHs, or to convert the laboratory reported units of picograms (pg) per filter bag to pictograms per gram (pg/g) DW for dioxins/furans. Calculating this mass for both filters per location per event was dependent on one of three analytical scenarios:

- In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters were equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals splits accounted for 5 percent of the wet weight of filter bag A, then the dried mass of solids captured for filter B was equal to the mass of solids captured on bag A multiplied by 1.05.
- In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters were equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys[1] and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals splits accounted for 5 percent of the wet weight of filter bag A, then the dried mass of solids captured for filter A was equal to the mass of solids on filter B multiplied by 0.95.
- In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

There were five cases where the calculated mass of solids captured in the filter was slightly negative. Consequently the results for PCBs, PAHs, and dioxins/furans for these samples were

[1] Early in the project, Axys removed splits from some of the filters for analysis of dioxin/furan congeners. Removing the splits was meant to expedite analysis, but it complicated the calculation for mass of solids captured. If a split was removed by Axys, total solids was also measured. Total solids multiplied by the wet weight of the split equals the dry weight of the split. This split dry weight was added to the difference between the dry weight after sampling and the dry weight before sampling to obtain a total mass.

not converted from laboratory reported units (µg/filter or pg/filter) to final reported dry weight concentrations (mg/kg DW or pg/g DW). All five of these samples were collected as base flow samples or as stormwater samples at locations with known stormwater volume issues. It is believed that little or no solids were collected in the filters during sampling and that the negative calculated mass is likely a result of analytical variability. There were an additional three cases where the mass of solids captured was less than 1 gram. The results for these samples were also not converted from laboratory reported units to dry weight concentrations because they would be highly uncertain due to the small sample mass. The results for these eight samples are not included in the data interpretation discussions in this report but are presented in Appendix E, Table E–7 for reference purposes.

The mass of solids captured on each filter is listed in the data summary tables for filtered solids (Appendix E). Given the complexity of the calculation for determining the mass of solids and the relatively small volume of solids recovered from the filters, all filtered solids results should be treated as estimates.

4.3 Sediment Trap and Bedload Sediment Trap Samples

Two sediment traps were deployed on November 4, 2010, at each of the four locations. Sediment samples from the traps were collected on January 19, 2011, and May 5, 2011. The sediment retrieved from each of the two bottles from the same location and sampling event was combined by ARI prior to analysis.

Two bedload sediment traps were deployed, one in each sub-basin. Two samples were collected from SQ1 in the Snoqualmie line. One sample was collected from DK3 and another from DK1 in the Dakota line.

There was no consistent analyte list for the sediment trap and bedload sediment traps. Analyses were selected based on the results of, or data gaps present in, the filtered solids data. Limited volume of solids in the sediment traps also dictated the number of analyses that could be performed from each sample.

PBDE analysis was not performed on filtered solids samples, so efforts were made to analyze PBDEs in at least one of the sediment trap samples from each location. PBDEs were analyzed by EPA Method 1614.

Phthalates were analyzed in the sediment trap samples because they could not be analyzed in the filtered solids samples because of matrix interferences. Elevated PCB concentrations were present in the Snoqualmie line filtered solids and whole water samples, so sediment traps from those locations were analyzed for PCBs.

Phthalates and other SVOCs were analyzed by EPA Method 8270D. All other analytical methods for the sediment trap and bedload sediment trap samples matched that of filtered solids samples presented in Section 4.2.

4.4 Analytical Deviations

The initial plan for the analysis of PBDEs was to remove or scrape solids from the filter bags and extract the solids subsample for PBDEs. It was not possible to obtain a sufficient amount of solids from the filters in this manner, and the entire filter bag could not be extracted due to the potential for interferences introduced from the dissolution of the filter bag during extraction and/or contamination during air drying at ARI. As a result, PBDEs were analyzed in whole water samples, sediment trap, and bedload samples rather than filtered solids samples for select base flow and storm events.

Dioxin/furan concentrations were analyzed from solids scraped from the filter bag as well as extraction of the entire filter. This led to an additional step in calculating the mass of solids from the filter bag as described in Section 4.2.

Sediment trap samples were collected on January 19, 2011, and stored by NewFields at approximately 4°C until delivery to ARI on April 1, 2011, and Axys on May 24, 2011; consequently, several analyses took place beyond standard analytical holding times.

5.0 Summary of Results

This section summarizes the physical and chemical measurements made as part of the Accelerated Source Tracing Study. Samples from thirteen events including storm events, base flow, and tidal sampling are presented in Appendix E. Complete analytical results are presented in Appendix F. Analytical data validation results are summarized in Section 6.0 and presented in Appendix G.

In this section, whole water chemical concentrations are compared to the acute and chronic Washington State Marine Water Quality Criteria (WQC). There are no regulatory standards for filtered solids, sediment trap solids, or inline solids samples. Results for these sample types are compared to the state sediment management standards (SMS) and the Washington State Model Toxics Control Act (MTCA) Method A cleanup standards. Although these standards do not apply to storm drain solids, they are used as benchmarks in this report to provide a rough indication of storm drain sediment quality. The SMS establish two levels:

- Sediment quality standards (SQS): Concentrations below the SQS are expected to have no adverse effects on biological resources and no significant human health risk.
- Cleanup screening level (CSL): Minor effects level used to identify areas of potential concern.

Storm drain solids chemical concentrations are compared to SMS criteria for chemicals that have dry weight SMS criteria. For chemicals that have TOC-normalized SMS criteria, chemical concentrations are compared to the lowest apparent effects threshold (LAET), which is functionally equivalent to the SQS, or the second lowest apparent effects threshold (2LAET), which is functionally equivalent to CSL.

Comparison of storm drain solids collected from filtered solids and sediment traps to SMS is considered conservative. If source sediment samples are below the SMS, there is little chance of sediment offshore of the outfalls becoming contaminated to these levels. However, a concentration above the SMS does not necessarily indicate that the sediment offshore of the outfall will exceed standards, because sediment discharged from a storm drain disperses in the receiving environment and mixes with sediment from other sources before depositing.

5.1 Flow Measurements and Precipitation

Conductivity probes and flow modules were deployed for each sampling event and for select monitoring periods. Although there was difficulty in determining stormwater and base flow volumes due to problems with the velocity data (see Section 5.1.1), the level and conductivity measurements indicate the tidal conditions present at the sampling locations.

5.1.1 Flow Measurements

Level and velocity flow meters were deployed at all eight locations. Conductivity probes were deployed at SQ1, SQ3, SQ4, and DK4. Where present, the level and conductivity measurements matched the tidal level recorded at Elliott Bay tide station 9447130 (http://co-ops.nos.noaa.gov/geo.shtml?location=9447130). During the sampling season, tidal heights varied between -2 and +13 feet MLLW; however, daily ranges were typically between 0 and +11 feet MLLW.

Figure 8 presents measurements from a two-day dry period in early March for SQ4. Tidal levels (red) correlate to flow meter levels (blue) for all tides greater than +9.4 feet MLLW, a depth that corresponds to the bottom drain elevation. At tidal levels less than +9.4 feet MLLW, water levels in the storm drain are representative of base flow conditions. Conductivity measurements track the tides in the storm drain. At a high tide, conductivity readings varied between 8,000 and 10,000 microsiemens per centimeter (µS/cm). Tidal patterns were similar at SQ3 and SQ1, though less pronounced due to greater elevation. SQ1 was at the outer edge of tidal inundation. Conductivity readings of around 300 µS/cm were recorded during a +12.2-foot MLLW tide.

As long as precipitation fell during a low tide window, the flow meters installed in the Snoqualmie line were also capable of measuring water level due to stormwater runoff. However, stormwater levels were much lower than those associated with tidal inundation. The increase in water level in the lines from stormwater runoff for even the largest storms was smaller than water levels due to the tide. This difference often made it difficult to discern water level increases due to stormwater flow from those caused by tidal inundation.

The flow meters in the Dakota line and the conductivity probe at DK4 were not able to obtain accurate readings for the following reasons. High velocity flows were present at DK1 and DK2 due to the slope of the storm drain. Obstructions in the drain, including the scissors bracket, caused water to spray rather than flow over the sensor at these two locations. Level and velocity could not be recorded under these conditions. Tidal inundation at DK3 and DK4 prevented overnight installation of equipment. At a high tide, river water came within a few inches of the maintenance hole cover. Isco data at these two locations is only available for the short windows when samples were collected.

At all tidally influenced locations, tidal flow interfered with the ability of the flow meter to measure velocity. As a result, most of the velocity measurements are not reliable. A typical velocity profile for a tidal cycle consisted of rapid fluctuations in velocity from positive to negative, with no correlation to the direction of tidal flow. This same interference carried over into most low tidal windows, making it difficult to measure the velocity of base flow or storm flow.

Because of the problems associated with the collection of water level and velocity at each location, the stormwater runoff estimates presented in Table 2 are based solely on total and impervious surface area.

Additional flow and water level data were collected to obtain estimates for base flow volumes. On June 9 and 10, 2011, field measurements of water level and velocity were made using a Global Water Flow Probe, manufactured by Global Water Instrumentation, Inc. in Gold River, California. The probe consisted of a 15-foot handle with a propeller end for measuring velocity. The probe was not suitable for measuring velocity when water depths were less than 2 inches. In some cases of low water depth, velocities were visually estimated by timing the movement of debris carried by the flow.

Level and velocity were used in conjunction with the storm drain diameter to calculate flow. All calculated base flow values should be regarded as approximations. Base flow was consistent from SQ1 through SQ3, ranging from 0.2 to 0.5 gallons-per-minute (gpm). Though water was present at SQ4 during low tidal windows, velocity could not be measured. DK1 and DK2 had consistent base flow during all dry periods, but the combination of shallow depth and rapid velocity made measurements difficult. Estimated base flow at DK3 was 0.5 gpm. It can be assumed DK1 and DK2 had similar flows. No base flow was present at DK4.

5.1.2 Precipitation Data

The Boeing Field–King County International Airport rain gauge (identified as "KBFI") was chosen to be representative of precipitation for this study. The KBFI rain gauge is located 6.1 meters (20 feet) above sea level at 7602 Perimeter Road, on the King County International Airport property (Figure 1). KBFI is part of a network of meteorological stations maintained by the National Climatic Data Center (NCDC). Precipitation data are logged hourly and are available for download via subscription at (http://www.ncdc.noaa.gov/oa/climate/stationlocator.html). Trace amounts of precipitation are reported as "T" by NCDC. These values were replaced with 0.001 inch for data processing purposes.

Precipitation data from KBFI and tidal height from the Elliott Bay tide station were used in conjunction with the sampler time intervals to show a profile of each stormwater, base flow, and tidal sampling event. Figure 9 presents the eight stormwater sampling events and Figure 10 presents the four base flow events and tidal sampling event. In all figures, dark blue represents the tidal level and the rose colored bars represent the hourly precipitation totals. Green shading indicates the sampling window for stormwater events, yellow shading represents base flow sampling periods, and red shading represents the tidal water sampling period.

5.2 Whole Water

Whole water samples collected during storm events, base flow, and high tidal stages were analyzed for the conventional and chemical parameters listed in Table 4. Results of whole water analysis are presented in Appendix E, Table E–1 and are summarized below. Two additional samples were collected and analyzed, but it was later determined that the associated sample collection time period did not meet the project criteria for storm or base flow. Results from these two samples are presented in Appendix E, Table E–5 but are not summarized in this report.

Whole water chemical concentrations are compared to the acute and chronic WQC for PCBs, metals, and pesticides. The WQC do not exist for the other chemicals analyzed during this study.

Table 5 summarizes the frequency of detection of chemicals in whole water storm event samples. Chemicals that are not listed were infrequently or not detected in any whole water samples (Table E-8, Appendix E). Cells highlighted yellow indicate locations where stormwater whole water samples exceeded the chronic WQC in one or more sample, while cells highlighted blue indicate locations where stormwater samples exceeded acute WQC in one or more sample. PCBs, metals, and PAHs are the most frequently detected chemicals. Pesticides were not detected, while VOCs were rarely detected. Bis(2-ethylhexyl)phthalate was the only phthalate detected in whole water. Tables 6a, 6b, and 6c list the maximum concentrations of the individual chemicals that exceeded WQC in base flow, whole water, and tide samples, respectively.

5.2.1 Conventionals

The difference in composition of base flow, stormwater, and tidal water in the sub-basins is reflected in the distribution of whole water conventional parameters. The highest TSS concentrations were measured at two Snoqualmie Street locations during a base flow event. TSS concentrations at SQ1 and SQ2 were 474 mg/L and 2,640 mg/L, respectively, during base flow event BF2. As noted in Section 3.1.3, these samples were collected as discrete aliquots rather than time-weighted composites. These high TSS concentrations also corresponded to an elevation of some chemicals described below, specifically PCB Aroclors and mercury. The conditions observed during this base flow are likely due to an unusual discharge, as similar conditions were not observed during a second base flow monitoring event (BF3) or during monitoring in the Dakota sub-basin. No further source tracing was done to determine the origins of the high TSS at these locations.

Across all sub-basins, TSS concentrations were highest in stormwater with an average of 48 mg/L. Of the individual sub-basins, the highest TSS concentrations were measured at SQ4. Excluding the anomalous concentrations discussed above, the average TSS concentration for base flow was 12 mg/L. TSS concentrations for the tidal inflow event averaged 20 mg/L.

Whole water chloride concentrations indicate the extent of tidal influence on a particular sample. All locations were tidally influenced with the exception of DK1, though tidal inundation at SQ1 is rare. Chloride concentrations were greatest in tidal samples (average of 1,117 mg/L) with the exception of SQ4. Due to logistical constraints, the tidal sample at SQ4 was collected on a separate day and may have been collected during a part of the tidal cycle prior to significant intrusion of the salt wedge. Chloride concentrations averaged 19.3 mg/L during storm events and averaged 83.8 mg/L during base flow. Elevated levels of chloride are not uncommon in base flow samples due to groundwater infiltration.

Alkalinity of base flow water samples was higher than stormwater and tidal water samples, which is consistent with the presence of higher carbonate content in groundwater sources.

5.2.2 PCBs

Figures 11a and 11b present the average total PCB concentrations between the base flow, stormwater, and tidal water samples in the Snoqualmie and Dakota sub-basins, respectively. The bars represent the minimum and maximum concentrations when more than one sample for a given type was analyzed. Total PCB results in Figure 11a are presented on a logarithmic scale due to elevated concentrations in the Snoqualmie line.

PCBs were detected in base flow at SQ1, SQ2, and SQ3 in the Snoqualmie line locations but were not detected in the Dakota line (Appendix E, Table E–1). The highest total PCBs (9.1 µg/L) were measured at SQ2 during base flow event BF2. This measurement corresponded to the highest TSS measurement as described above. However, additional base flow monitoring at SQ2 (event BF3) resulted in a total PCB concentration of 0.043 µg/L.

With the exception of DK4, total PCBs were detected in whole water samples at all Snoqualmie and Dakota line locations for multiple storm events (Figures 11a and 11b). PCBs were not detected at DK4, although only one stormwater event was sampled at this location due to constraints with the sampling tidal window (Appendix C). Detected total PCB concentrations averaged 0.028 µg/L for the Dakota line stormwater samples, ranging from 0.011 to 0.032 µg/L. Detected total PCB concentrations averaged 0.11 µg/L for the Snoqualmie line stormwater samples, ranging from 0.011 to 0.34 µg/L.

The highest total PCB concentration was measured at SQ3, with an average of 0.22 µg/L over four storm events. A higher number of PCB Aroclors was also detected in the Snoqualmie sub-basin (Aroclors 1242, 1248, 1254, and 1260) in comparison to the Dakota sub-basin (Aroclors 1248 and 1254).

Similar to base flow, PCBs were detected in tidal water samples at three of the Snoqualmie line locations but not detected at the Dakota line locations. Concentrations ranged from 0.014 to 0.025 µg/L.

5.2.3 Total Metals

Commonly detected metals in stormwater, base flow, and tidal whole water samples include arsenic, calcium, chromium, copper, lead, magnesium, nickel, and zinc. Low levels of cadmium were detected in some samples for stormwater, base flow, and tidal water for both the Dakota and Snoqualmie sub-basins. Mercury was not detected in whole water samples with the exception of SQ1 and SQ2 during base flow event BF2. Selenium was detected in a few stormwater, base flow, and tidal water samples in the Snoqualmie sub-basin but not in the Dakota sub-basin.

Lead (214 µg/L), nickel (39.3 µg/L), mercury (2.2 µg/L), and zinc (310 µg/L) were detected at elevated concentrations at SQ2 during base flow event BF2. These results corresponded to the highest TSS and PCB concentrations as described above. Similarly, elevated metals concentrations were not observed during a third base flow monitoring event in the Snoqualmie line (BF3).

5.2.4 Dissolved Metals

Dissolved arsenic (0.4 to 2.3 µg/L), copper (1.2 to 16.7 µg/L), nickel (1.1 to 16.9 µg/L), and zinc (5 to 72 µg/L) were detected in most samples. Copper exceeded the WQC in 24 out of 41 samples. Nineteen of these exceedances were from the stormwater samples. Nickel exceeded the WQC in two samples. Cadmium and lead were frequently detected as total metals, but detected in less than a third of samples in the dissolved fraction. Dissolved chromium was detected in 58 percent of samples where total chromium was found.

Detected concentrations of dissolved metals were less than the associated concentrations of total metals. Cadmium was not detected in the dissolved phase. Dissolved chromium concentrations averaged approximately 18 percent of total chromium concentrations across all samples. Dissolved copper and zinc concentrations averaged approximately 40 percent of associated total concentrations, while dissolved nickel and arsenic concentrations averaged approximately 60 percent of associated total concentrations across all samples.

5.2.5 Pesticides

Pesticides were not detected in any of the whole water samples.

5.2.6 Phenols

Phenolic compounds were not detected in base flow, stormwater, or tidal water samples, with the exception of phenol. Phenol was occasionally detected at low levels in base flow (1.2 to 2.2 µg/L) and storm event (0.8 to 1.4 µ/L) samples from locations DK1, DK2, DK3, SQ3, and SQ4. Phenol was not detected in the tidal water samples.

5.2.7 Phthalates

Bis(2-ethylhexyl)phthalate and butyl benzyl phthalate were the only phthalates detected in whole water samples. Bis(2-ethylhexyl)phthalate was detected in base flow (2.2 to 57 µg/L), stormwater (1.1 to 8.2 µg/L), and a tidal water sample (1.3 µg/L). The highest concentration of bis(2-ethylhexyl)phthalate was detected in the first base flow sample collected at DK1 (57 µg/L); but it was not detected in the second base flow sample collected at this location. Butyl benzyl phthalate was detected in one stormwater sample at SQ4 (0.7 µg/L).

5.2.8 PAHs

PAHs were detected in all base flow, storm event, and tidal water samples. PAH compounds were most frequently detected during stormwater sampling events. Highest concentrations of total high molecular weight polycyclic aromatic hydrocarbons (HPAHs) and total low molecular weight polycyclic aromatic hydrocarbons (LPAHs) were measured during base flow event BF2 at SQ1 (HPAH = 6.8 µg/L, LPAH = 1.4 µg/L) and SQ2 (HPAH = 40 µg/L, LPAH = 7.2 µg/L). These measurements correspond with the highest TSS, PCBs, and metals concentrations measured at the same locations during the same base flow event. There are no WQC for PAH compounds.

5.2.9 Other SVOCs

Other SVOCs (not discussed previously) were not detected in any of the base flow, storm event or tidal whole water samples.

5.2.10 VOCs

VOCs in whole water samples were generally either not detected or present at low concentrations; 1,1-dichloroethane (0.2 µg/L), 1,2-dichloroethane (0.2 µg/L), chloroform (0.3 to 0.4 µg/L), cis-1,2-dichloroethene (0.3 to 0.4 µg/L), methyl ethyl ketone (5.1 to 7.6 µg/L), tetrachloroethene (0.3 to 0.4 µg/L), and trichloroethene (0.3 to 0.4 µg/L) were occasionally detected.

5.2.11 PBDE Congeners

PBDEs were detected in all base flow and storm event samples analyzed, although only a subset of the whole water samples were analyzed for PBDEs. Tidal samples were not analyzed for PBDEs. Total PBDEs[2] ranged from 271 to 24,300 pg/L for base flow samples, and ranged from

[2] Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these “Total PBDE” values may not be directly comparable to other datasets.

13,100 to 28,000 pg/L for storm event samples. Unlike many of the contaminants, PBDE concentrations were comparable between the Snoqualmie and Dakota sub-basins (Figures 12a and 12b).

The WQC do not exist for PBDEs, and these compounds have rarely been analyzed for in Washington State stormwater samples. In one study, stormwater collected from commercial/industrial sub-basins of the Snohomish River and Puyallup River watersheds had a median total PBDE concentration of 3,300 pg/L (Herrera 2011). With the exception of one base flow sample, all results from this study exceeded that median concentration by at least a factor of four.

5.3 Filtered Solids

Filtered solids samples collected during storm events, base flow, and high tidal stages were analyzed for the conventional and chemical parameters listed in Table 4. Results of filtered solids analysis are presented in Appendix E, Table E–2. An additional sample was collected and analyzed but it was later determined that the associated sampling event did not meet the project criteria for storm or base flow. Results from this sample are presented in Appendix E, Table E–6 but are not discussed in this report.

Table 7 lists the most frequently detected chemicals. Most chemicals that were targeted for analysis in the filtered solids were detected in at least some of the stormwater samples. In most cases, there were more detected chemicals in the Snoqualmie line than in the Dakota line.

Filtered solids chemical concentrations were not converted to organic carbon normalized concentrations because TOC cannot be measured in the filtered solids samples due to interferences from the polypropylene filter bag. Therefore, filtered solids chemical concentrations were compared to SQS and CSL (Chapter 173-204 WAC) for chemicals that have dry weight SMS criteria. For chemicals that have organic carbon normalized SMS criteria, sample concentrations were compared to the lowest apparent effects threshold (LAET) and the second lowest apparent effects threshold (2LAET), which are functionally equivalent to SQS and CSL, respectively (PTI 1988). Filtered solids samples with chemicals that exceed SMS/LAET criteria are presented in Table 8.

As discussed in Appendix C, the amount of solids collected by the filtered solids samplers was limited. Therefore, the chemicals selected for analysis for each event alternated between sampling events and were later prioritized based on detected chemicals.

5.3.1 Grain Size

Filtered solids grain size was the only sediment conventional parameter analyzed. Because of the limited amount of solids collected on filters and the priority of chemical analysis, grain size was only determined for five filtered solids samples. The two samples collected in the Snoqualmie sub-basin ranged from 23 percent fines (silt + clay) at SQ3 to 91.2 percent fines at SQ4. In the Dakota sub-basin, percent fines ranged from 38 percent at DK2 to 72 percent fines at DK4.

The low percent fines at SQ3 was due to the pump cage placement in the storm drain. The pump cage rested on top of accumulated storm drain solids in the sump. A piece of plywood was attached to the bottom of the pump cage to prevent the pump from directly sampling the solids.

However, storm flow conditions would have likely resuspended a portion of the solids in the sump.

5.3.2 Dioxin/Furan Congeners

Only dioxin/furan congener results from samples collected in the Snoqualmie sub-basin are presented in this report. Samples from the Dakota sub-basin captured insufficient solids and could not be normalized to pg/g DW as discussed in Section 4.2. Dioxin/furan congeners were detected in all base flow and storm event filtered solids samples analyzed. Base flow concentrations were approximately half of stormwater concentrations (Figure 13a). Tidal filtered solids samples were not analyzed for dioxin/furan congeners (Table 4).

Octachlorodibenzo-p-dioxin (OCDD) was the congener detected at the highest concentration in all samples. For each sample, a toxic equivalent quotient (TEQ) was calculated using the most recent mammalian toxic equivalency factor (TEF) values from the World Health Organization (WHO) (Van den Berg et al. 2006). In the Snoqualmie sub-basin, the maximum TEQ value of 170 pg/g was detected in a stormwater sample from SQ4, while the lowest TEQ value of 19.8 pg/g was detected in a stormwater sample from SQ1. In the Dakota sub-basin, the maximum TEQ value of 183 pg/g occurred in a base flow sample from DK3.

5.3.3 PCBs

PCBs were detected in all storm event, base flow, and tidal filtered solids samples, except one storm event sample collected at DK1 (Table 7). All detected total PCB concentrations exceeded the LAET of 0.13 mg/kg (Table 8). PCB Aroclors 1248, 1254, and 1260 were the only Aroclors detected in these samples.

The highest total PCB concentrations were consistently detected in samples collected from the Snoqualmie sub-basin, particularly at location SQ3. The maximum total PCB concentrations for base flow, stormwater, and tidal water samples were measured at SQ3 (13 mg/kg, 15 mg/kg, and 1.1 mg/kg, respectively).

Total PCB concentrations in the Dakota sub-basin ranged from a maximum of 1.5 mg/kg in a stormwater sample at DK1 to a minimum of 0.15 mg/kg from a stormwater sample at DK3. Total PCB concentrations exceeded the 2LAET of 1.0 mg/kg for multiple storm event samples from both the Snoqualmie and Dakota sub-basins. Base flow concentrations were a significant percentage of stormwater concentrations, even exceeding stormwater concentrations at SQ2 and SQ3 (Figures 13b and 13c). At SQ3, it is possible that solids from the sump were collected during the base flow event, accounting for much of the high concentrations measured.

5.3.4 Metals

All metals were detected in base flow and storm event filtered solids samples, with the exception of arsenic and silver (Table 7). Arsenic was undetected or detected at low levels (15 to 20 mg/kg) in filtered solids samples, and silver was undetected in all samples with the exception of one base flow sample (1.3 mg/kg) and storm event sample (1.0 mg/kg) at SQ3.

The only metals found in concentrations exceeding SMS criteria were mercury and zinc (Table 8). Mercury was detected in all filtered solids samples (0.10 to 2.67 mg/kg) and exceeded SMS criteria in multiple storm event samples from SQ1, SQ2, and SQ3, and the base flow sample from SQ3. Only one base flow sample was analyzed for metals due to the limited amount of solids collected and the priority of chemical analysis. Mercury did not exceed SMS criteria from samples in the Dakota sub-basin. Zinc exceeded SMS criteria in all storm event samples from all locations (590 to 2,430 mg/kg) but did not exceed SMS criteria in the base flow sample from SQ3. The maximum zinc concentration (2,430 mg/kg) was measured in a storm event sample at SQ4.

5.3.5 PAHs

Most LPAHs and HPAHs were detected in filtered solids samples from locations in both the Dakota and Snoqualmie sub-basins. The LAETs were exceeded for multiple PAH compounds in base flow and storm event filtered solids samples (Table 8). Storm event samples from DK2, DK4, and SQ4 exceeded the LAET for total HPAHs. No tidal filtered solids PAH concentrations exceeded LAETs. The maximum concentrations of total HPAHs (48 mg/kg) and total LPAHs (15 mg/kg) occurred in storm event samples in SQ2 and DK1, respectively. Average HPAH and LPAH concentrations for base flow and storm event filtered solids samples were greater than those in the tidal samples.

5.4 Sediment Trap Solids

A sediment trap is capable of collecting solids whenever the bottle's mouth is submerged. When only stormwater is present in the storm drain, submergence of the trap requires approximately 0.02 inch of precipitation per hour. Less intense storm events are incapable of producing enough runoff to raise stormwater levels in storm drains above trap mouths. For all locations sampled, the trap is too tall to be submerged exclusively by base flow. When tidal water is present in the storm drain above the trap mouth, sediment traps have the ability to capture particles suspended in stormwater, base flow or the tidal water itself. Traps at lower elevation experience more frequent and longer duration tidal influence, allowing tidal water to more frequently submerge the traps than stormwater. Traps placed at elevations above +13 feet MLLW are above the level of tidal influence and therefore should only be submerged during storm flow conditions.

Chemicals detected in the sediment trap samples are presented in Table 9. Results of sediment trap solids analysis are summarized in Appendix E, Table E–3. Although TOC was measured in sediment trap solids, concentrations are compared to LAET/2LAET criteria for organic chemicals. Sediment trap solids samples with COPCs that exceed these criteria are presented in Table 10.

5.4.1 TOC

The organic carbon content of sediment trap solids ranged from 6.32 to 15.9 percent in the Dakota sub-basin and from 10.4 to 14.7 percent in the Snoqualmie sub-basin. In each sub-basin, the highest TOC was measured at the location farthest away from the outfall (DK1 and SQ1), and generally decreased moving downstream.

5.4.2 Dioxin/Furan Congeners

Dioxin/furan congeners were analyzed in sediment trap solids samples at all locations in the Dakota and Snoqualmie sub-basins. All congeners were detected in all samples analyzed, with the exception of 1,2,3,7,8,9-HxCDF, which was undetected during the first round of analyses for DK2. OCDD was the congener with the highest concentration in all samples. TEQ values ranged from 20.6 to 92.7 pg/g in the Dakota sub-basin with the highest TEQ occurring at DK1 (Figures 13c and 13d). In the Snoqualmie sub-basin, TEQ values ranged from 40.8 to 89.8 pg/g, with the highest TEQ measured at SQ4.

5.4.3 PCB Aroclors

PCB Aroclors were analyzed in the first round of sediment trap solids samples at all locations in the Dakota and Snoqualmie sub-basins. Only Aroclors 1248, 1254, and 1260 were detected, similar to the filtered solids samples. Total PCB Aroclor concentrations ranged from 0.08 to 3.1 mg/kg. Total PCB Aroclor concentrations exceeded the LAET at all locations with the exception of DK2. The 2LAET for total PCB Aroclors was exceeded at SQ2 and SQ3, with the highest concentration (3.1 mg/kg) measured at SQ3.

5.4.4 Metals

Metals were analyzed in the first round of sediment trap solids samples at two locations in the Dakota sub-basin (DK2 and DK3) and two locations in the Snoqualmie sub-basin (SQ2 and SQ3). All metals were detected with the exception of silver, which was undetected at DK3 and SQ3 (Table 9). Zinc exceeded the SQS for all samples, and cadmium exceeded the SQS at SQ2. The CSLs were exceeded for mercury at SQ2 and SQ3 (1.05 and 1.01 mg/kg, respectively), and for copper at SQ2 (1,640 mg/kg).

5.4.5 Phenols

Phenolic compounds were analyzed in the second round of sediment trap solids samples at all locations. Phenol (0.38 to 2.5 mg/kg) and 4-methylphenol (0.24 to 39 mg/kg) were detected at all locations; pentachlorophenol was also detected at SQ4 (0.24 mg/kg). Concentrations of phenol exceeded CSL at SQ1; phenol also exceeded the SQS at all locations with the exception of SQ3. Concentrations of 4-methylphenol exceeded the CSL at DK1, DK2, DK3, SQ1, and SQ2; the highest concentration (39 mg/kg) was detected at SQ1 (Table 10).

5.4.6 Phthalates

Phthalates were analyzed in the second round of sediment trap solids samples. Bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and di-n-octyl phthalate were detected at all locations in the Dakota and Snoqualmie sub-basins (Table 9). Bis(2-ethylhexyl)phthalate exceeded the 2LAET at all locations(9.0 to 22 mg/kg); and butyl benzyl phthalate exceeded the LAET at all locations (0.36 to 0.90 mg/kg, Table 10). Diethyl phthalate exceeded the LAET at DK3 (0.38 mg/kg). Dimethyl phthalate exceeded the 2LAET at DK4 (0.19 mg/kg); this chemical also exceeded the LAET at DK3 (0.076 mg/kg) and SQ4 (0.15 mg/kg).

The highest concentrations of bis(2-ethylhexyl) phthalate and butyl benzyl phthalate were measured at SQ4. The highest concentrations of diethyl phthalate and dimethyl phthalate were measured at DK3 and DK4, respectively.

5.4.7 PAHs

PAHs were analyzed in the second round of sediment trap solids samples. Most LPAHs and HPAHs were detected in sediment trap solids samples from all locations (Table 9). Higher concentrations of LPAHs and HPAHs were measured in the Snoqualmie sub-basin than in the Dakota sub-basin. For the Snoqualmie sub-basin, total LPAH and total HPAH concentrations ranged from 1.9 to 8.0 mg/kg and 12 to 59 mg/kg, respectively. For the Dakota sub-basin, total LPAH and total HPAH concentrations ranged from 0.83 to 2.6 mg/kg and 6.0 to 12 mg/kg, respectively.

In the Dakota sub-basin, only a few PAH compounds (chrysene, fluoranthene, and indeno(1,2,3-cd)pyrene) exceeded LAETs at DK2 and DK4. Benzo(g,h,i)perylene exceeded the 2 LAET at DK4. In the Snoqualmie sub-basin, multiple PAH compounds including total HPAH exceeded 2LAET criteria at SQ2 and SQ4 (Table 10). The highest total HPAH and total LPAH concentrations were measured at SQ4.

5.4.8 Other SVOCs

Benzoic acid (0.34 to 1.6 mg/kg) and benzyl alcohol (0.19 to 0.48 mg/kg) were the only other SVOCs (not discussed previously) detected in sediment trap solids samples. These compounds were detected at all locations with the exception of DK1, where benzyl alcohol was not detected. All detected concentrations exceeded CSL with the exception of benzoic acid concentrations measured at DK3 and SQ1 (Table 10).

5.4.9 PBDE Congeners

PBDE congeners were analyzed in sediment trap solids samples at all locations in the Dakota and Snoqualmie sub-basins. The majority of PBDE congeners were detected in all samples. BDE-209 was the congener of highest concentration in all samples. In each sub-basin, total PBDE concentrations increase down gradient with the highest concentrations of total PBDEs measured at DK4 (1,910,000 pg/g) and SQ4 (1,410,000 pg/g).

SMS/LAET sediment criteria do not exist for PBDEs, and these compounds have rarely been analyzed for in LDW sediment or stormwater samples. Three sediment composite samples collected in the vicinity of the LDW Turning Basin had total PBDE congener concentrations with a range of 570 to 11,000 pg/g (SAIC and NewFields 2011b). In contrast, stormwater sediment trap solids concentrations ranged from 266,000 pg/g to 1,910,000 pg/g. Concentrations were consistent across all locations except SQ4 and DK4, which had the highest concentrations (Figures 12c and 12d).

5.5 Bedload Trap Solids

Two bedload sediment trap samplers were deployed in the Dakota and Snoqualmie sub-basins and the solids analysis results are summarized in Appendix E, Table E–4. Bedload sediment trap solids were collected at DK1, DK3, and SQ1 (two samples at SQ1 collected over two deployment periods). Although TOC was measured in bedload sediment trap solids, concentrations are compared to the LAET/2LAET criteria for organic chemicals. Bedload sediment trap solids samples with COPCs that exceed these criteria are presented in Table 11.

5.5.1 Conventional Parameters

The bedload sediment trap solids were analyzed for grain size and TOC. Percent fines varied between locations, ranging from a low of 5.8 percent fines at DK3 to a high of 61.1 percent fines at SQ1. The organic carbon content of bedload sediment trap solids ranged from 6.79 percent at DK3 to 11.4 percent at SQ1.

5.5.2 Dioxin/Furan Congeners

Dioxin/furan congeners were analyzed in two bedload sediment trap solids samples collected at DK1 and SQ1. All congeners were detected in all samples analyzed and OCDD was the congener with the highest concentration in both samples. The measured TEQ values were 167 pg/g at DK1 and 29.2 pg/g at SQ1 (Figures 13c and 13d).

5.5.3 PCB Aroclors

PCB Aroclors were analyzed in the bedload sediment trap solids samples collected at DK1, DK3, and SQ1. Only Aroclors 1248, 1254, and 1260 were detected, similar to the sediment trap solids samples. However, detected concentrations of total PCBs were much lower in the bedload sediment trap solids (0.10 to 0.31 mg/kg). PCB Aroclors were not detected at DK1. Total PCB Aroclor concentrations exceeded the LAET at SQ1 only (Table 11).

5.5.4 Metals

Metals were detected in the bedload sediment trap solids samples collected at DK1, DK3, and SQ1. Silver was undetected with the exception of one of the bedload sediment solids collected at SQ1 (0.8 mg/kg). Zinc exceeded the SQS for the bedload sediment trap solids samples collected at DK1 (539 mg/kg) and SQ1 (623 to 630 mg/kg).

5.5.5 Pesticides

One bedload sediment trap solids sample collected at DK3 was analyzed for pesticides. All pesticide compounds were undetected.

5.5.6 Phenols

The bedload sediment trap solids samples were analyzed for phenolic compounds. Similar to the sediment trap solids samples, 4-methylphenol (2.2 to 14 mg/kg) and phenol (0.35 to 1.4 mg/kg), which were detected at all locations. Concentrations of 4-methylphenol exceeded the CSL at all locations and the highest concentration (14 mg/kg) was detected at SQ1. Detected concentrations of phenol exceeded the CSL at DK1 and exceeded the SQS at SQ1 and (Table 11).

5.5.7 Phthalates

The bedload sediment trap solids samples were analyzed for phthalates, and the detected compounds included bis(2-ethylhexyl)phthalate (5.2 to 10 mg/kg), butyl benzyl phthalate (0.38 to 1.1 mg/kg), dibutyl phthalate (0.089 to 0.70 mg/kg), and dimethyl phthalate (0.16 mg/kg). Bis(2-ethylhexyl)phthalate exceeded the 2LAET in all samples, similar to the suspended sediment trap samples. Butyl benzyl phthalate exceeded the 2LAET at DK1 and DK3, and exceeded the LAET at SQ1. One detected concentration of dimethyl phthalate exceeded the LAET at SQ1.

5.5.8 PAHs

Most LPAHs and HPAHs were detected in bedload sediment trap solids samples collected at DK1, DK3, and SQ1. Higher concentrations of LPAHs and HPAHs were measured at SQ1, which is similar to the distribution of concentrations measured in the suspended sediment trap solids samples. Benzo(g,h,i)perylene exceeded the 2LAET at SQ1; chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, and phenanthrene exceeded the LAET at this location. All concentrations of LPAH and HPAH compounds in the S Dakota Street locations were below LAET criteria.

5.5.9 Other SVOCs

Benzoic acid (0.45 to 2.6 mg/kg) and benzyl alcohol (0.21 mg/kg) were the only other SVOCs (not discussed previously) detected in the bedload sediment trap solids samples. Benzoic acid was detected in all samples and exceeded the CSL at DK1 and SQ1. Benzyl alcohol was detected at DK3 at a concentration of 0.21 mg/kg, which exceeded the CSL.

5.5.10 PBDE Congeners

The bedload sediment trap solids samples collected at DK1 and SQ1 were analyzed for PBDE congeners. The number of PBDE congeners detected in the bedload sediment trap solids samples was less than those detected in the suspended sediment trap solids samples at the same locations. Total concentrations were still elevated at 170,000 pg/g for DK1 and 337,000 pg/g for SQ1, respectively (Figures 12c and 12d).

5.6 Inline Solids

Inline solids samples were not collected as part of this study. SPU has monitored inline and catch basin solids chemistry in the Dakota and Snoqualmie sub-basins. Their data results are discussed in Section 7.0.

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6.0 Quality Assurance/Quality Control

Analyses were conducted following the quality assurance/quality control (QA/QC) requirements specified in the project SAP/QAPP (SAIC 2010a) and the referenced test methods. The QA/QC procedures ensure that the results of the investigation are defensible and usable for their intended purpose.

6.1 Equipment Rinse Blanks

Two equipment rinse blank samples were collected to determine whether target chemicals would contaminate the samples during sampling. The rinse blank samples consist of reagent grade water provided by ARI rinsed across and/or through the sample collection and processing equipment. Rinse blank samples from the Isco equipment were analyzed for VOCs, SVOCs, PAHs by selected ion monitoring, PCBs, pesticides, and metals. Rinse blank samples for the filtered solids equipment were analyzed for metals, PAHs, and PCBs. If chemicals were detected in the rinse blank samples, the detected concentrations were compared to the associated sample results to evaluate the potential for contamination. Detected sample concentrations within the action limit set by the associated rinse blank concentrations were requalified as nondetect (U) by EcoChem during data validation. Qualified results are discussed in the data validation report in Appendix G.

6.2 Data Validation

All chemical results gathered during this investigation were independently validated by EcoChem, Inc. of Seattle, WA. A full-level, EPA Stage 3 or 4 data validation was performed on approximately 10 percent of the results; a summary-level, EPA Stage 2B data validation was performed on the remainder of results. A compliance-level screening, EPA Stage 2A data validation including a comparison of detected results to sample concentrations was performed on the rinse blank samples. All PBDE and dioxin/furan results underwent full-level data validation. Data validation was performed following EPA guidance (EPA 1994, 2004, 2005, 2008, 2009).

For VOC analysis, only vials preserved with hydrochloric acid to a pH<2 were collected. Due to the highly reactive nature of 2-chloroethyl vinyl ether in acid preserved samples, all results for this chemical were rejected by EcoChem. Two results for benzyl alcohol were rejected during data validation because of extremely low laboratory control sample/laboratory control sample duplicate (LCS/LCSD) percent recoveries (i.e., less than 10 percent). Rejected results should not be used for any purpose. All other results were considered acceptable, as qualified. Issues resulting in data qualification are summarized below. A full list of qualified results including the reason for data qualification is presented in the data validation report in Appendix G.

Results for various chemicals were J- or UJ-qualified as estimated because calibration verification, matrix spike/matrix spike duplicate, LCS/LCSD, standard reference material, internal standard, surrogate, reporting limit verification, and/or inductively coupled plasma check standard recoveries; or duplicate sample and/or second column confirmation results' relative percent difference (RPD) were outside of control limits. One result each for dibenzo(a,h)anthracene and Aroclor 1260 were JN-qualified as estimated with tentative identification because of low spectral match or because the dual column RPD exceeded 60 percent, respectively. Four mercury results were J-qualified as estimated because samples were analyzed beyond standard holding times.

Twenty-four results for six chemicals were re-qualified as nondetect at elevated reporting limits (RLs) because of method blank contamination, including the following results: nine results for naphthalene ranging from 0.014 to 0.0037 µg/L, seven results for bis(2-ethylhexyl)phthalate ranging from 1.2 to 5.0 µg/L, five results for nitrate ranging from 0.2 to 0.5 mg/L, and one result each for 2-methylnaphthalene, BDE-049, and BDE-209 at 0.01 µg/L, 3.23 pg/L, and 322 pg/L, respectively. Thirty-three results for methylene chloride ranging from 1.0 to 7.5 µg/L, 16 results for acetone ranging from 5.0 to 26 µg/L, and 8 results for toluene ranging from 0.2 to 0.7 µg/L were re-qualified as nondetect because of equipment rinse blank contamination.

Sixteen results (i.e., nine filtered solids results, five whole water, and two bedload sediment results) for four individual PCB Aroclors, one result for aldrin in a water sample, and one result for heptachlor in a water sample were Y-qualified by ARI as nondetect at elevated RLs because chromatographic interferences prevented adequate resolution of the compound at the standard RL. Nine results (eight filtered solids results and one sediment trap result) for five dioxin/furan congeners and 157 results for 31 specific PBDE congeners were K-qualified by Axys as being estimated maximum possible concentrations because not all method-required compound identification parameters were met. These results were requalified as nondetect (U-qualified) by EcoChem at the reported concentrations.

Some planned analyses (e.g., metals and/or grain size on some specific samples) could not be performed because of insufficient sample volume. Additionally, project-specific laboratory QA/QC samples could not be analyzed at required frequencies because of insufficient sample volume.

7.0 Discussion

This section presents a comparison of physical and chemistry results from the various sampling methods, including filtered solids, whole water, sediment traps, and bedload sediment traps. Physical results were compared for grain size distribution, and chemical results are compared for five COPCs: total PCBs, mercury, total HPAH, zinc, and bis(2-ethylhexyl) phthalate. Each COPC was selected based on both the frequency of detection and the frequency of WQC or SMS/LAET criteria exceedances as summarized in Section 5.0. PBDEs and dioxin/furan congeners were also considered COPCs but were not analyzed in enough sample types to allow for comparison.

Elevated concentrations of these COPCs detected in any of the Snoqualmie or Dakota sub-basins may be indicative of a nearby source. Because source tracing is limited with only four sampling locations per sub-basin for this investigation, sediment trap and catch basin solids samples collected by the City of Seattle were used in conjunction with data from this study to better establish potential sources.

7.1 Comparison of Sampling Methods

Comparison of the physical and chemistry results for whole water, filtered solids, and sediment trap solids samples can be useful for determining which sample collection methods to use for future storm drain source tracing studies. This section summarizes the physical and chemical results of these different sample types to determine if the COPC concentrations are comparable. Figures 14 and 15 display the concentrations for each sample type, location, and COPC.

The methods associated with each of these sample types present different sampling biases and logistical challenges. This section also provides a summary of these challenges and provides recommendations on when a given sampling method may be appropriate. Most of the observations made in this section are based on an extremely small sample size and should not be applied to other studies or locations without additional data.

7.1.1 TSS and Grain Size

Grain size distributions may vary between sample types, as each sample type was collected over a different time period and contains a variable percentage of suspended versus bedload solids. Suspended solids are fine-grained particles present in the water column and bedload solids are heavier materials moving along the base of the storm drain. Quantitative descriptions of the differences in grain size distribution between each sample type could not be fully determined due to limited sample sizes. The following descriptions of grain size by sample type include a mix of quantitative results and qualitative results from sample collection.

- Whole water samples represent conditions during a single storm event. Although the suction hose was positioned along the bottom of the storm drain, the pump does not preferentially sample bedload solids. Rather, the whole water sample was mainly TSS with a mix of some bedload solids. Many of the samples collected remained cloudy hours after the completion of the sampling event, indicating the presence of TSS. Small amounts of silt and sand were observed at the base of the carboy.

- Filtered solids samples also represent conditions during a single storm event. The filtration pumps were also positioned along the bottom of the storm drain. These pumps likely sampled both bedload solids and TSS, although collection of bedload solids may have been limited because 1) the pump intake was not always in contact with the bottom of the storm drain and 2) the loss of hydrostatic head over the course of sampling would have limited collection of larger particles.
- Sediment traps collected material over a period of several months. These samplers were designed to collect TSS. The height of the trap prevents collection of base flow solids when tidal water was not present in the storm drain. The traps intermittently become inundated with tidal water when deployed at low elevations, allowing the traps to collect any suspended solids present in the tidal water.
- Bedload sediment traps were positioned along the bottom of the storm drain for a period of several weeks to months. The time required to fill the trap was not assessed, as the traps had to be positioned in the storm drain lines and were not visible without doing a confined-space entry into the maintenance hole. The traps were designed to continuously capture solids carried as bedload, which may contain solids from both storm flow and base flow. It was also possible that the traps were intermittently flushed of captured solids during high flows associated with large storm events.

Grain size distribution as measured by percent fines (the sum of silt and clay fractions) for the different sample types was compared to assess the range of solids collected by each sampling method. Sufficient solids were not collected for grain size analysis of whole water samples. However, because filtered solids and whole water samples were collected during the same storm events and the inlets for their pumps were positioned relatively close to each other along the storm drain bottom, it is likely that these sample types contain a similar range of grain sizes.

DK3 was the only location where filtered solids, suspended sediment trap solids, and bedload sediment trap solids were all collected (Figure 15a). The bedload sediment trap at DK3 captured relatively coarse solids (5.8 percent fines) compared to filtered solids (55.8 percent fines) and suspended sediment trap solids (26.0 percent fines).

The bedload sediment traps at SQ1 and DK1 collected a higher percentage of fines, approximately 50 percent (Figures 14a and 15a). Grain size distributions from filtered solids or sediment traps were not available at these two locations.

At all locations except SQ3 (Figure 14a) filtered solids samples were finer than suspended sediment trap solids. These results suggest that filtered solids samplers preferentially sample finer grained solids. SQ3 was an exception to this trend because the pump rested in a sump where it may have sucked up previously deposited solids during the initial pump activation (Section 5.3).

7.1.2 Chemistry

Comparing COPC results between sample types was difficult, considering each method preferentially samples a different distribution of TSS and bedload solids, or even a different matrix. Given the small number of samples collected at each location, it was not possible to make statistically significant comparisons. Instead, this section presents a qualitative comparison of sample types, followed by a quantitative comparison using RPD.

Another complicating factor was that chemical concentration data for solids and whole water samples are not directly comparable, as they were reported in mass-normalized (mg/kg) and volume-normalized (µg/L) units, respectively. Therefore, agreement between water and solids was qualitatively assessed by comparing the relative magnitudes of solids and whole water concentration data (Figures 14 and 15). Attempts to better correlate filtered solids and whole water concentrations are presented in Section 7.1.3.

Qualitative Comparison

Filtered solids and suspended sediment trap solids data were similar for mercury and zinc concentrations, though filtered solids concentrations were consistently higher (Figures 14b,c and 15b,c). However, mercury and zinc exceeded the LAET in both sample types. Mercury was not detected in storm event whole water samples. Bedload samples were collocated with other sample types at both SQ1 and DK3. In both instances, concentrations of mercury and zinc were lower in the bedload samplers than filtered solids or sediment traps.

All sample types for total PCBs show similar patterns for Snoqualmie sub-basin samples. PCB concentrations were highest at SQ3, followed by SQ2 (Figure 14d). There was less agreement in the Dakota sub-basin (Figure 15d). Whole water PCB concentrations were highest at DK1, although a steep slope at this location made solids sampling difficult. PCB concentrations in filtered solids were highest at DK3, and sediment trap PCB concentrations were highest at DK4. In most cases, total PCB concentrations in filtered solids were higher than those in the sediment traps. Bedload total PCBs were measured at SQ1, DK1, and DK3. All three bedload samples had the lowest PCB concentrations measured at their respective locations. This trend may be attributed to the higher percentage of coarse material in the bedload samplers.

Total HPAH concentrations were relatively similar between sample types with the exception of SQ4. At most locations, sediment trap concentrations were higher than filtered solids. This is especially true at SQ4, where sediment trap concentrations were over five times higher than filtered solids (Figures 14e and 15e). Unlike the other COPCs, concentrations of HPAH in bedload samples had similar concentrations to the other sample types.

Bis(2-ethylhexyl) phthalate was not analyzed in the filtered solids, so less data were available for comparison. High and low concentrations in the whole water and sediment trap solids correlate with each other (Figures 14f and 15f). Where present, results for bedload samples are lower than those from sediment traps.

Zinc, mercury, and total PCB concentrations were detected at higher concentrations in filtered solids samples than sediment traps samples. The differences in chemical concentrations could be due to differences in grain size composition between sample types (i.e., filtered solids samplers capture more fines and hence higher concentrations), or due to deposition and dilution of TSS from tidal water. COPC concentrations were lowest in the tidal water sample collected for filtered solids. Some of the TSS from tidal water may have entered the sediment traps.

Quantitative Comparison Using RPD

Because all solids sample types were reported in mass-normalized units, the COPC concentrations were compared using the RPD. The RPD is the difference between two concentrations divided by the average of the two concentrations. Lower RPD values indicate that concentrations between sample types were more similar. As an example, RPD values are used by analytical laboratories to evaluate the difference between duplicate samples. ARI uses default RPD values of 30 percent for organics and 25 percent for inorganics when evaluating sample duplicate pairs (i.e., matrix spike/matrix spike duplicate samples for organics and sample/laboratory duplicate sample for inorganics). If the RPD is below this threshold, the results are considered to be in compliance with the data quality objectives.

RPD values less than 30 percent were considered an excellent match between results. An RPD value of 66 percent means one result in the comparison was twice the concentration as the other. An RPD value of 100 percent means one result in the comparison was three times the concentration as the other, and RPD value of 163 percent represents an order of magnitude difference between compared values.

Table 12 lists the RPDs for the selected COPCs. RPDs were determined for the different sample type pairs: averaged results from filtered solids were compared to those from associated sediment traps, results from filtered solids were compared to those from associated bedload sediment traps, and results from sediment traps were compared to those from associated bedload sediment traps. RPDs were calculated for each individual sample pairing across all eight locations. Both the average and range of RPDs are presented. In Table 12, average RPDs less than 30 percent are highlighted pink and less than 66 percent are highlighted yellow, to provide a rough indication of comparability in COPC concentrations measured between sample types.

As noted in the previous section, percent fines were variable between the sample types. There were reasonably similar concentrations measured between filtered solids and sediment traps (RPD 58 percent), but more significant differences in percent fines concentrations were calculated when comparing results to the bedload sediment traps (Table 12). Few samples were evaluated in this comparison, as all three sample types were only present at DK3. Additional grain size distribution data would be needed for a more comprehensive analysis. However, it is likely that the differences in variability that were observed for chemical concentrations were due in part to the differences in captured percent fines.

The similarity between filtered solids and sediment traps was evident in the other COPCs for these two sample types. With the exception of total PCBs, all average RPD values were below 66 percent (Table 12). The RPD for PCBs was 97 percent, indicating that on average, filtered solid concentrations were approximately three times higher than sediment traps.

There was less similarity between concentrations in filtered solids and bedload sediment traps. Only PAH concentrations were comparable for these two methods. Sediment traps and bedload sediment traps obtained similar results. Bis(2-ethylhexyl)phthalate, zinc, and total HPAH concentrations were comparable between these two methods, though HPAH concentrations seem to be consistent regardless of sample type.

Average RPD values for total HPAH were low for all sample type comparisons (Table 12). HPAH were the only COPC (Figures 14e and 15e) for which sediment traps had higher average concentrations. This suggests that HPAH concentrations in storm drains were more consistent across all particle size distributions and may even be concentrated in the coarser materials. Conversely, bis(2-ethylhexyl)phthalate, mercury, and zinc concentrations were higher in the fine-grained solids. RPDs for PCBs were high for all sample type comparisons, suggesting no consistent partitioning to grain size. Similar partitioning was observed for these COPCs when analyzed in size-fractionated stormwater solids for the King County Airport SD#3/PS44 EOF sub-basin (SAIC 2010b, 2011). Additional data from these storm drains analyzed by size fraction would help to verify this apparent pattern.

7.1.3 Whole Water and Filtered Solids

As mentioned above, it was possible to make qualitative comparisons between filtered solids and whole water samples, but it was not possible to make direct comparisons due to the differences in units. In an effort to increase comparability, whole water results from the stormwater samples were converted from µg/L to mg/kg using the whole water TSS measurements. This conversion was carried out for total PCBs, zinc, and total HPAH. Mercury was undetected in most whole water samples, and bis(2-ethylhexyl)phthalate was not analyzed in the filtered solids samples.

In making this conversion, it was assumed that nearly all contaminants in a whole water sample area associated with the solids fraction, rather than the dissolved fraction. This assumption was reasonable for the many of the organic parameters, but was less valid for metals. For zinc, nearly 40 percent of the total was present in the dissolved fraction (Section 5.2.4).

The RPD values between the average converted whole water and filtered solids results are presented in Table 12. Total PCBs were higher in the filtered solids samples, with an average RPD of 65 percent. Converted whole water values were higher for zinc and HPAH. The RPD for HPAH was the lowest at 62 percent.

7.2 Source Tracing

One of the early objectives of this study was to perform “up the pipe” source tracing. This entailed sampling outfalls as they enter the river and then moving upstream, or up the pipe, tracking any elevated concentrations of COPCs. Due to logistical constraints, this type of source tracing could not be conducted. Rather, multiple locations were selected for in-depth sampling in two sub-basins.

While elevated concentrations of various COPCs were detected at the sampling locations within the Snoqualmie and Dakota sub-basins, no efforts were made to collect additional samples from the lateral lines draining into the accelerated source tracing (AST) sampling locations. This section summarizes Snoqualmie and Dakota sampling locations with the highest concentrations and uses the results of sampling conducted by SPU to both confirm the results of this study and to expand the scope of source tracing.

The SPU database included samples collected and analyzed as of October 10, 2010. A total of 25 locations were present in the Snoqualmie and Dakota sub-basins. Each of these locations is presented in Figure 16 and marked according to their respective sample type. Sample types collected by SPU include in-line sediment traps, catch basin grabs, right-of-way catch basin grabs, and opportunistic surface dirt samples. Catch basin samples are those collected from individual sites of interest, typically off the main line. Right-of-way catch basin samples are collected from public rights-of-way, such as roads, and represent stormwater flow from larger areas.

Figures 17 through 21 show the results of the sediment traps from this study alongside data from SPU. AST results are presented as triangles, while SPU results are presented as circles. All results per figure are color coded by the same concentration gradient. Location RCB21 in the southeast corner of the upper Dakota sub-basin (Figure 16) was excluded from these figures in an effort to maximize the spatial extent. Mercury and total PCBs at RCB21 were undetected. Concentrations of zinc, total HPAH, and bis(2-ethylhexyl)phthalate at RCB21 were all towards the low end of the range.

Table 13 lists the dates and availability of SPU data at each location for five COPCs (mercury, zinc, bis(2-ethylhexyl)phthalate, total PCBs, and total HPAHs). If a location was sampled multiple times, only the most recent results were used. Most non-detect results from the SPU database are presented in the summary figures and represent the low end of measured concentrations. Non-detect results were excluded if detection limits were raised due to analytical issues.

The following sections describe all of the data available for each of the COPCs. Dioxin/furan congeners and total PBDEs are also considered COPCs, but result for these contaminants were not available in the SPU data set.

7.2.1 Mercury

Within this study, the highest mercury concentrations were measured at SQ2 and SQ3, both with concentrations above 1 mg/kg in filtered solids and sediment trap samples. Two SPU samples, MH208 and RCB217 were collected in the vicinity of SQ2 (Figure 17). Concentrations at these two locations were 0.76 mg/kg and 2.20 mg/kg, respectively. Mercury concentrations north of RCB217 on 7th Avenue and south of Snoqualmie on 7th Avenue were lower, in the range of 0.02 to 0.20 mg/kg. Lower concentrations were detected at SQ1 (Figure 14); therefore, the high mercury concentrations found at SQ2 appear to be fairly localized.

SPU reported high concentrations of mercury at RCB36 in 2004. Subsequent source tracing efforts determined that a barrel cleaning facility on Airport Way S may be a potential contaminating source (SPU 2010). The Snoqualmie line was jet-cleaned in December 2010 in an effort to remove the existing volume of mercury contaminated sediment. Elevated concentrations detected after the jet-cleaning suggest a continuing contamination source may be present.

Although elevated levels of mercury were found in a sump at the Seattle Barrel site on Airport Way S, SPU has been unable to confirm that this material reached the city-owned storm drain system. SPU attempted to resample this area in 2011, but there was insufficient material in the lines and CBs to sample. Additional investigations are planned by SPU.

Concentrations at SQ3 were also elevated, but there is less evidence in the SPU data for a nearby source. One sample was taken at the same location as SQ3 (MH18) and had a concentration of 0.48 mg/kg. Other locations sampled along 6th Avenue did not exceed 0.41 mg/kg.

It is not clear whether the sump at SQ3 captures and/or concentrates stormwater and base flow contaminant loads from upstream. After the jet-cleaning in December 2010, storm drain sediment had accumulated to a depth of several inches by the completion of wet-season sampling. It is possible that the high concentrations for many COPCs that were found at SQ3 were due to sampling these accumulated solids in the sump rather than event-specific suspended solids. This may account for the high mercury concentration measured in the base flow sample at SQ3. Overall, it is not known how efficient sumps are at retaining solids.

Mercury concentrations measured in filtered solids at SQ4 were comparable with those measured at RCB35 (Figure 17). Since SQ4 was not located directly on the Snoqualmie storm drain, it is not possible to determine if the same elevated concentrations seen at SQ2 and SQ3 extend to downstream locations.

Fewer SPU samples were collected in the Dakota line. One SPU sample was collected at the same location as DK3 (MH12), and all sample concentrations were less than 0.20 mg/kg. Another SPU sample was collected at the DK4 location (MH233) with a reported concentration of 1.34 mg/kg, compared to the filtered solids sample collected at this location which had a concentration of 0.24 mg/kg.

7.2.2 Zinc

The distribution of zinc concentrations within the AST dataset did not show a trend or a hotspot of zinc contamination. No trend or hotspot was found with the incorporation of the City of Seattle data (Figure 18). Filtered solids and sediment trap zinc concentrations at SQ2 were 1,625 mg/kg and 624 mg/kg, respectively. SPU sample concentrations along 7th Avenue ranged from 196 mg/kg to 1,550 mg/kg zinc. The range of zinc concentrations between sample types combined with the spatial distribution did not suggest a particular contamination source.

There was insufficient data for zinc in the Dakota sub-basin to make any conclusions regarding sources.

7.2.3 Total PCBs

Location SQ3 had the highest total PCB concentrations, followed by SQ2. Samples collected upstream at SQ2, including RCB218, and the locations north of Snoqualmie Street on 7th Avenue all had concentrations greater than 0.3 mg/kg total PCBs (Figure 19). These locations are likely sources to SQ2 and SQ3. There were no samples collected north of SQ3 on 6th Avenue, so this area cannot be excluded as a potential source.

Base flow concentrations of PCBs were greater than PCB concentrations measured in stormwater at both SQ2 and SQ3 for the filtered solids data. In terms of source tracing, it was more difficult to identify the origins of contaminants in base flow because many of the sampling methods employed by SPU capture coarser material from storm flow, rather than finer suspended material from base flow. Using the base flow estimates from Section 5.1.1, annual base flow in the Snoqualmie sub-basin would total nearly 260,000 gallons, or approximately 20 percent of total stormwater flow in the sub-basin (Table 2).

As described above in the discussion for mercury, it was unknown what role that the sump at SQ3 played in the accumulation of PCB contaminated solids and whether resuspension during base flow sampling may have biased base flow concentrations at this location. Given the high concentrations measured during base flow sampling at SQ3 and SQ2 and the large total volume of base flow, additional base flow sampling at other access locations would be beneficial.

7.2.4 Total HPAH

Good correlation was observed for elevated HPAH concentrations between the AST and SPU datasets for location SQ2. The sediment trap HPAH concentration at SQ2 was 26 mg/kg, and nearby location RCB1 had an HPAH concentration of 27.9 mg/kg (Figure 20). Total HPAH concentrations at other locations were less correlated. It is difficult to identify specific sources of HPAH in an industrial area, since they are a byproduct of combustion and other industrial processes.

7.2.5 Bis(2-ethylhexyl)phthalate

Phthalates are used as plasticizers in many products and are ubiquitous in the environment. The results for bis(2-ethylhexyl)phthalate are presented in Figure 21. Red triangles and circles represent concentrations that exceed1.9 mg/kg, equivalent to the 2LAET. All locations in the Snoqualmie sub-basin and all but three locations in the Dakota sub-basin exceeded this criterion. Two locations (SQ4 and CB81) had concentrations exceeding 20 mg/kg.

8.0 Conclusions and Recommendations

Four locations were sampled in each of two sub-basins to the Diagonal Avenue S drainage basin. The two selected sub-basins ran along S Snoqualmie Street and S Dakota Street. Multiple sample types were collected at each of the locations from November 2010 through June 2011. Sample types included whole water, filtered solids, sediment traps, and bedload sediment traps. For the whole water and filtered solids, samples were collected during periods of stormwater flow, base flow, and high tide in efforts to gain a better understanding of contaminant concentrations that may exist during different flow conditions in the storm drains.

All results were compared to applicable numeric criteria. Whole water results were compared to surface water WQC and the solids results were compared the dry weight SMS sediment criteria and the LAET/2LAET thresholds. A wide variety of detected contaminants exceeded these criteria. Copper frequently exceeded the criteria in whole water, while total PCBs, mercury, zinc, HPAH, and phthalates frequently exceeded the sediment standards. Additional COPCs such as PBDE and dioxin/furan congeners were also analyzed. These contaminants do not have numeric criteria, but concentrations were elevated relative to what is typically seen in Washington State sediments, particularly for PBDEs.

The objectives of this study were to compare sampling types for relative effectiveness of collecting and measuring contaminants, and to identify spatial patterns in COPC concentrations for source tracing. These two objectives were often at odds. A larger sample size was needed for a given parameter to compare sample types, but a wider range of contaminants was needed for source tracing. This study attempted was made to balance the two objectives.

The following sections summarize the results of this study including sample type comparison, source tracing results, and additional findings made during the study.

8.1 Sample Type Comparison

- Although data was limited for grain size comparisons, each of the different sampling equipment types targets different grain size distributions, which may impact contaminant concentrations found with each sample type. Whole water samples were believed to mainly contain TSS. Filtered solids samplers mostly sampled TSS, but also collected some bedload material. Sediment trap samplers collected more bedload material than filtered solids. Bedload sediment traps had the least fines, and therefore collected the greatest amount of bedload sediments.

- Comparisons of COPC concentrations between sample types determined that there was fair agreement between the results of filtered solids and sediment traps and between filtered solids and whole water normalized to mass concentrations. There was poor agreement between the results of the bedload samplers and other sample types.

- Total PCB concentrations are not well correlated between any of the sample types, while total HPAH concentrations were fairly consistent across sample types. One hypothesis for this discrepancy may be that PCBs were bound to a particular particle size that no two sample types collected equally, while HPAHs were present in all particle sizes and were therefore measured in approximately equal concentrations regardless of sample type.

8.2 Source Tracing

- Mercury and total PCBs had concentration peaks at locations SQ2 and SQ3. Nearby samples collected by the City of Seattle also had the high concentrations of these chemical, but did not provide additional information to locate any potential sources. Concentrations of both of these COPCs were particularly high at SQ3. SQ3 samples were collected from a sump and it is unknown how the sediments accumulated in the basin impacted sampling for filtered solids and whole water. The accumulated sediment may have been responsible for the elevated concentrations seen in base flow at this location.
- Zinc and HPAHs were detected at elevated concentrations, but the addition of the SPU data to the data evaluation did not facilitate the identification of hotspots or sources for these COPCs.
- Bis(2-ethylhexyl)phthalate concentrations were elevated in all samples collected from the Snoqualmie and Dakota lines and in nearly all samples collected by SPU. All but three samples had detected concentrations above the 2LAET. The ubiquitous nature of this COPC makes source tracing difficult.

8.3 Additional Findings

- Filtered solids and whole water samples collected during different flow conditions yielded different results. Concentrations in stormwater were generally higher for most of chemicals, but there were cases where base flow concentrations were also elevated (e.g., mercury and total PCBs at SQ2 and SQ3).
- Differences between stormwater and tidal water were evident based on the relative measurements for chloride and TSS. Differences were also observed for tidal water chemical concentrations which were consistently lower than stormwater. The frequent inundation of the sediment traps by tidal water may have caused dilution of chemical concentration in the traps due to TSS deposition.

8.4 Sample Type Recommendations

Based on the results of this study, several recommendations are made regarding the appropriate sampler type for source tracing. Each of the sample types can be used for source tracing, but some offer more advantages than others. Recommendations for additional sampling and analysis are also provided that could help support some of the conclusions drawn from this study.

- Whole water samplers can effectively measure conditions during individual storms, which mean they are capable of collecting separate samples for storm flow and base flow. Sample collection is rapid, so several locations can be sampled in a short amount of time. The Isco unit is relatively expensive but easy to program and maintain. Whole water samples also have an unlimited target analyte list. A downside to whole water samplers is that the results are in mass per volume units, making comparisons to existing data difficult.

- Filtered solids samplers can also measure conditions during individual storms, meaning they are capable of collecting separate samples for storm flow and base flow. Sample collection is also rapid, so several locations can be sampled in a short amount of time. The unit is custom made, relatively expensive, requires higher maintenance, and programming is less standard. The target analyte list for filtered solids is more limited, for example: TOC cannot be measured because of interferences from the filter bag; analysis of phthalates is possible, but this would require the analysis of additional filter blanks to determine the potential for phthalate contamination from the sampling equipment; analysis of PBDEs is possible, if sufficient sample volume is collected. In addition, results for many of the COPCs, including PCBs, PAHs, and dioxin/furan congeners, are reported in mass per filter bag. Converting concentrations to mass per mass units can be complicated.

- Sediment traps collect composite samples representing conditions during both base flow and storm flow. Collection of each sample can take months, with no guarantee of success. However, the equipment is relatively inexpensive and sampling requires minimal labor. Results are reported in mass-based units. The target analyte list is only limited to the amount of solids collected. At locations where sediment trap deployment is not feasible (e.g., small diameter pipe locations), inline grabs can be considered for collection.

- Bedload samplers collect composite samples representing conditions during both base flow and storm flow. Sample collection can take weeks. With their current design, the samplers did not consistently collect solids during each deployment. Collecting samples with a bedload sampler requires a custom-made stainless steel unit, which is a significant upfront investment. Results are reported in mass based units. The target analyte list is only limited to the amount of solids collected. However, in comparisons with other sample types, bedload samplers reported consistently lower concentrations of various COPCs.

Overall, sediment traps are the least expensive sampler, easiest to deploy and retrieve, and easiest to analyze. They work well for source tracing that does not require discrete samples and where sufficient time is available for collection. If discrete samples are needed for base flow or individual storm events and the timeline is short, filtered solids or whole water samplers are better options.

The target COPC may also influence the sampling method, particularly for HPAH and total PCBs. HPAH concentrations were within a factor of two of each other regardless of the sampling method. Total PCB concentrations were not directly comparable for any of the sampling methods. Additional study is needed to determine which sample type is most representative of PCB concentrations. Collection of field duplicates may also assist with evaluating the variability of PCB concentrations.

8.5 Additional Sampling and Analysis

All of the conclusions and recommendations made from this study were based on a relatively small number of samples. The collection of more samples of each type from a single location is recommended, so that statistical analysis can be better conducted on the results. Additional recommendations for future work include the following:

- Additional grain size distribution analysis is recommended to help clarify the differences in grain size distributions of material collected by the different samplers.
- It was not clear what impact the large sump at SQ3 had on chemical concentrations in the whole system. Both total PCBs and mercury were high at SQ2 and SQ3, but no measurements were made downstream of SQ3. Sediments rapidly accumulate in the sump, but it is not known how well they are retained and whether the sump can act as a sink for some contaminants in the Snoqualmie line. Collecting additional samples downstream of SQ3 could help determine what role sumps have in source control.
- Base flow concentrations were high for several chemicals at SQ2 and SQ3. Some of the base flow samples were collected as discrete samples, and some at SQ3 may have been influenced by the solids accumulated in the sump. Additional base flow sampling would help to determine if base flow is a source of various COPCs and a potential source control problem.
- Total PCB concentrations were inconsistent between sample types, while HPAH concentrations were in better agreement. This is likely due to the presence of these contaminants on different particle size fractions. Grab samples collected from SQ3 and analyzed for various COPCs in different particle size fractions would help to verify this assumption and may help to determine why chemical concentrations differ between the sample types.
- Additional bedload sediment trap sampling is recommended. The conclusions in this study were made based on the results of four bedload sediment trap samples. Prior to additional sampling, engineering changes need to be made to prevent the samplers from rotating in the storm drain and to keep all the pieces together in the event of excess flow.
- Given the high concentrations of PBDEs measured relative to sediments in the Duwamish River, additional storm drain sampling for PBDEs is recommended.

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Figures

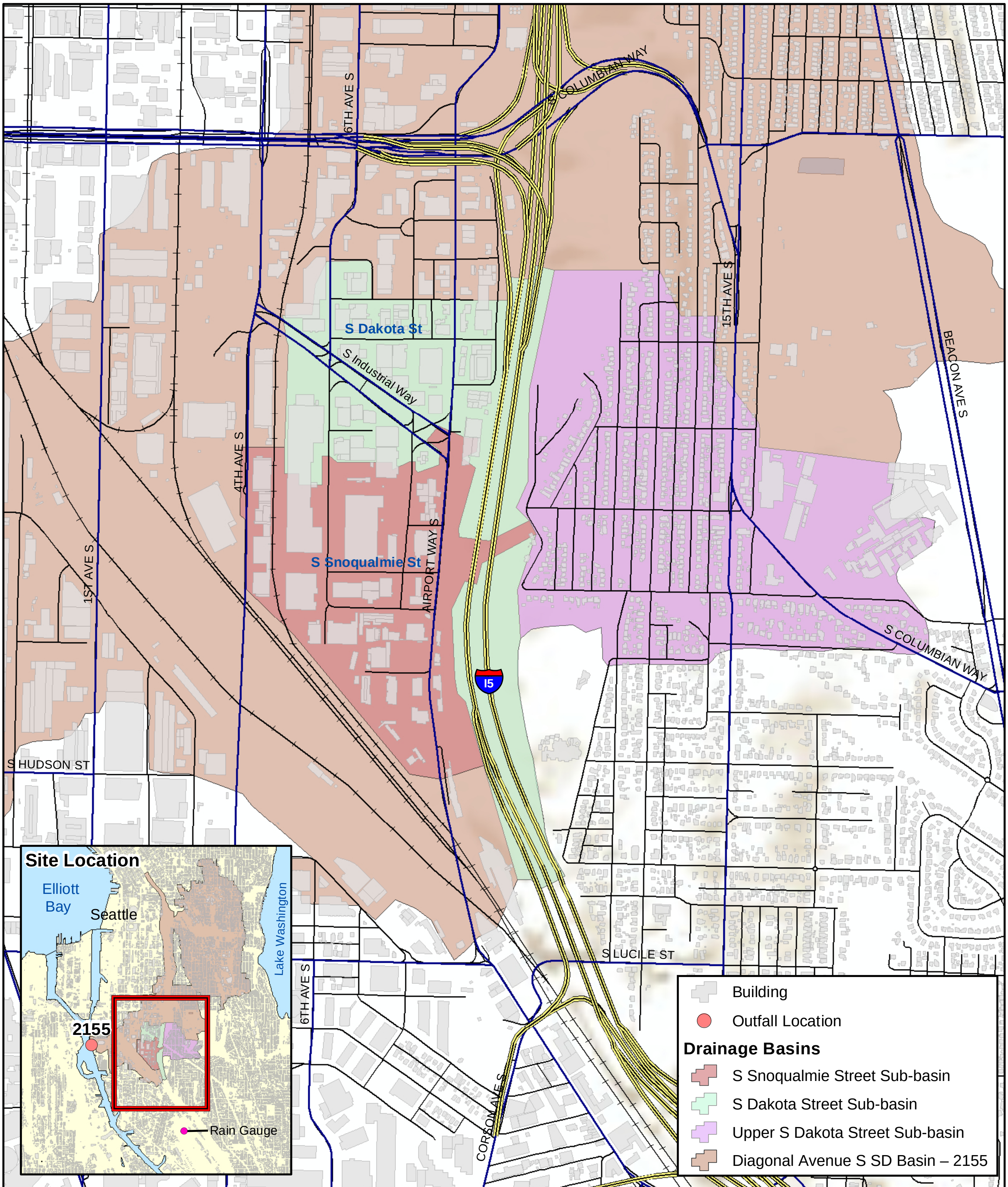


Figure 1. Stormwater Sub-basins Selected for Sampling in the Diagonal Avenue S Storm Drain Basin

N

0 500 1,000 2,000 Feet

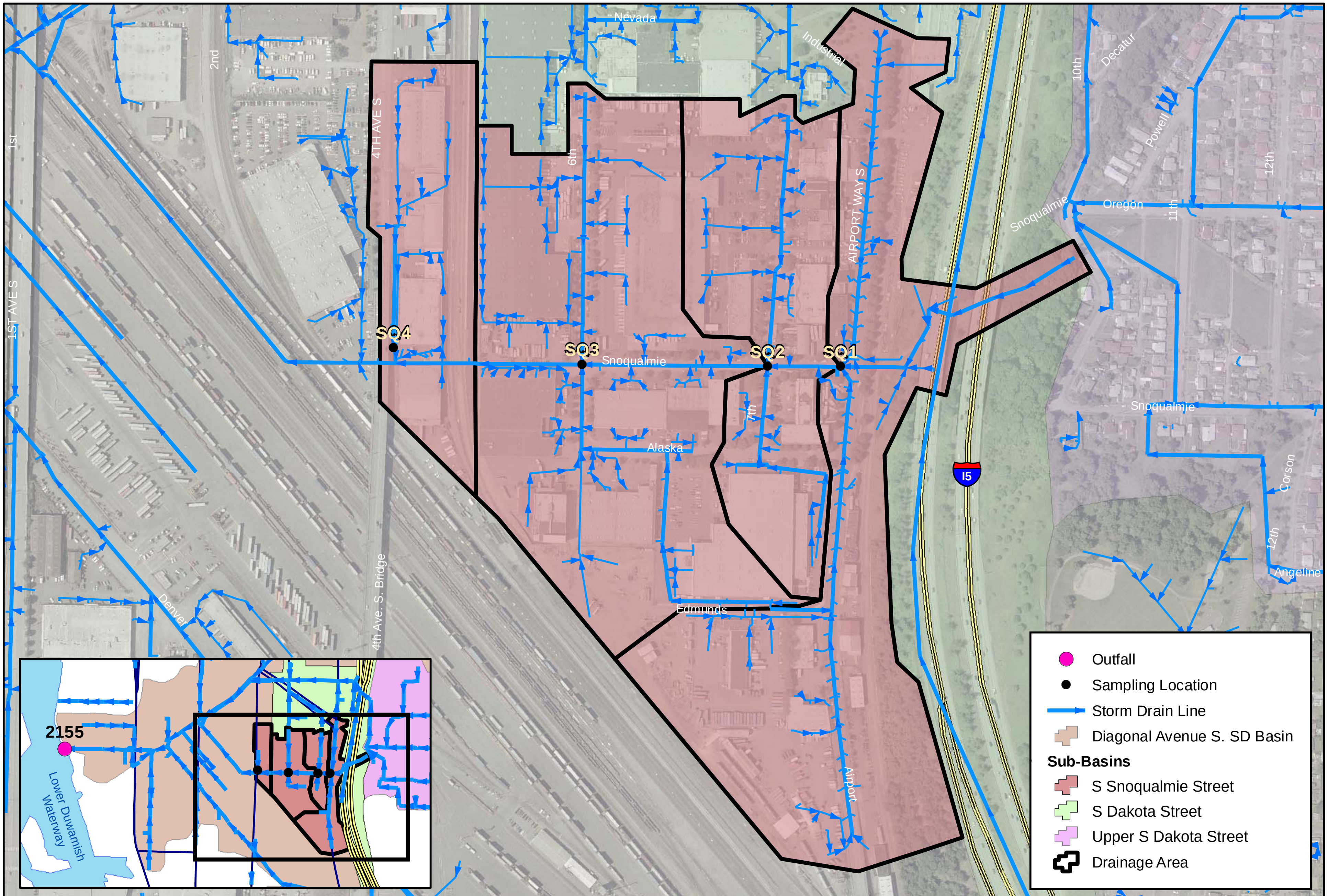


Figure 2. S Snoqualmie Street Drainage Sub-basin and Sampling Locations

N

0 250 500 1,000 Feet

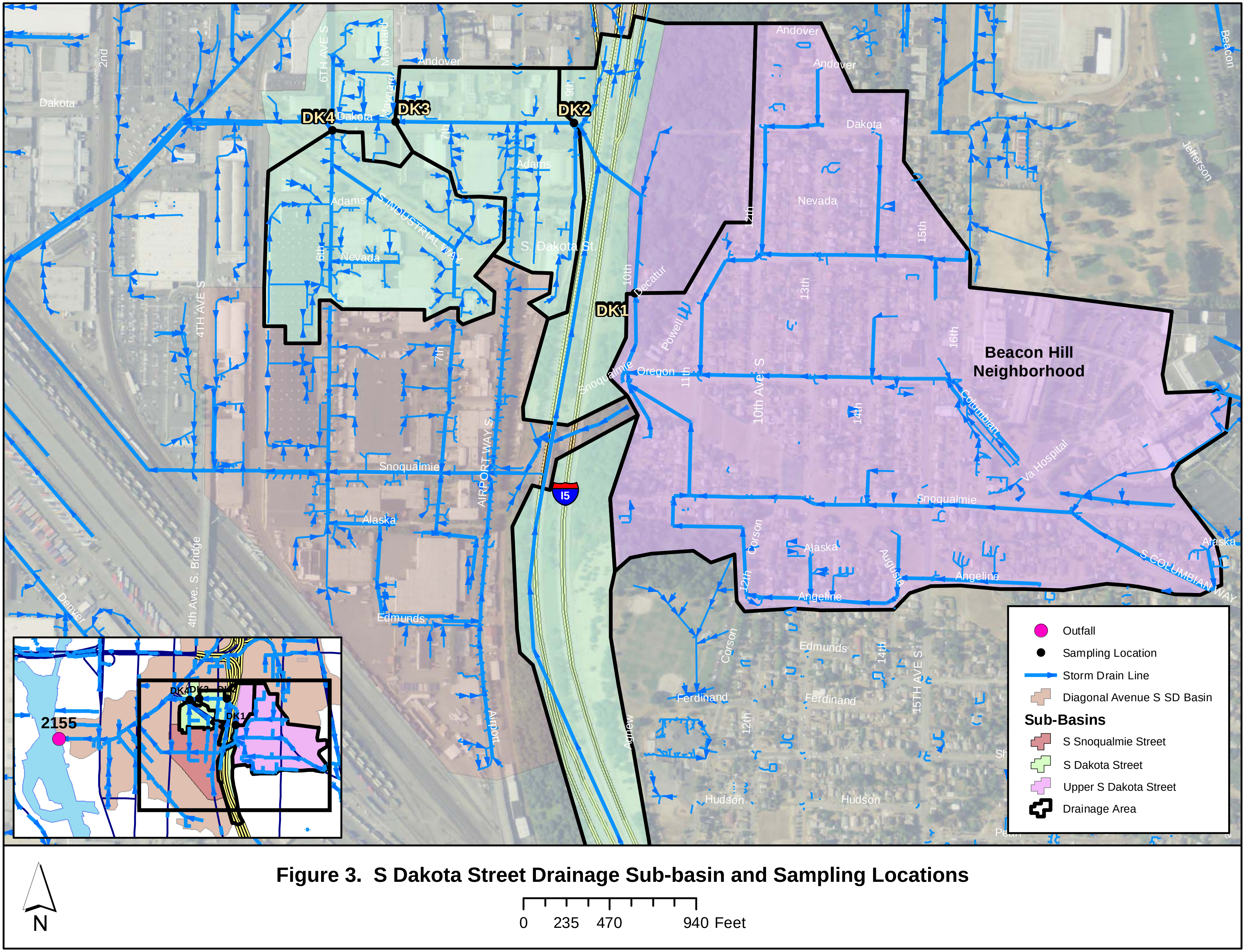


Figure 3. S Dakota Street Drainage Sub-basin and Sampling Locations

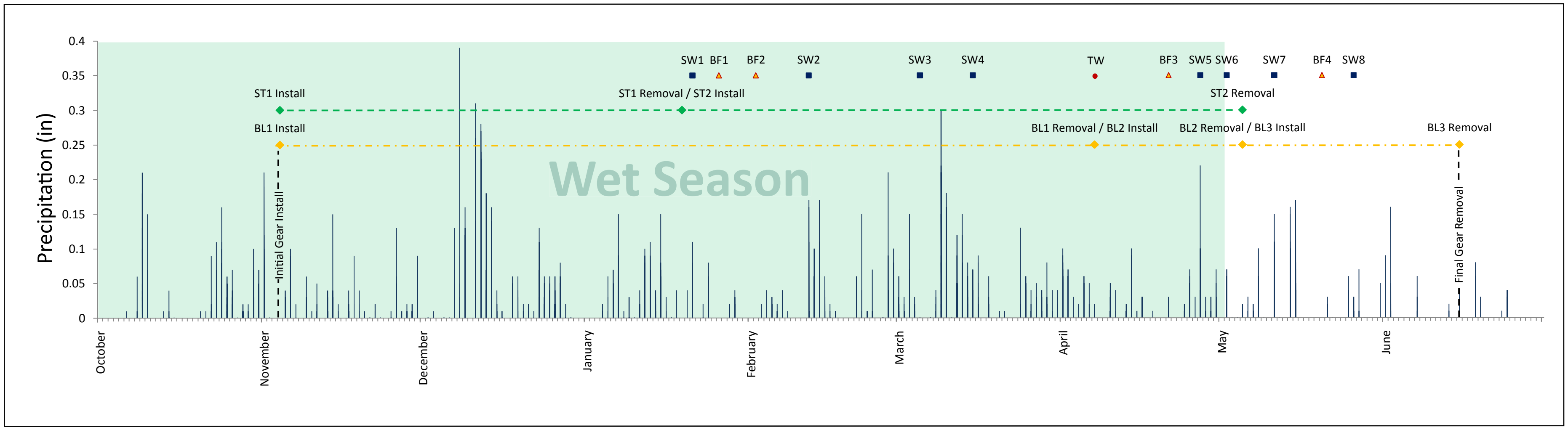


Figure 4. Timeline of Sampling Events During the 2010–2011 Wet Season

SW Storm Water Event
BF Base Flow
ST Sediment Trap
BL Bedload Sampler
TW Tide Water

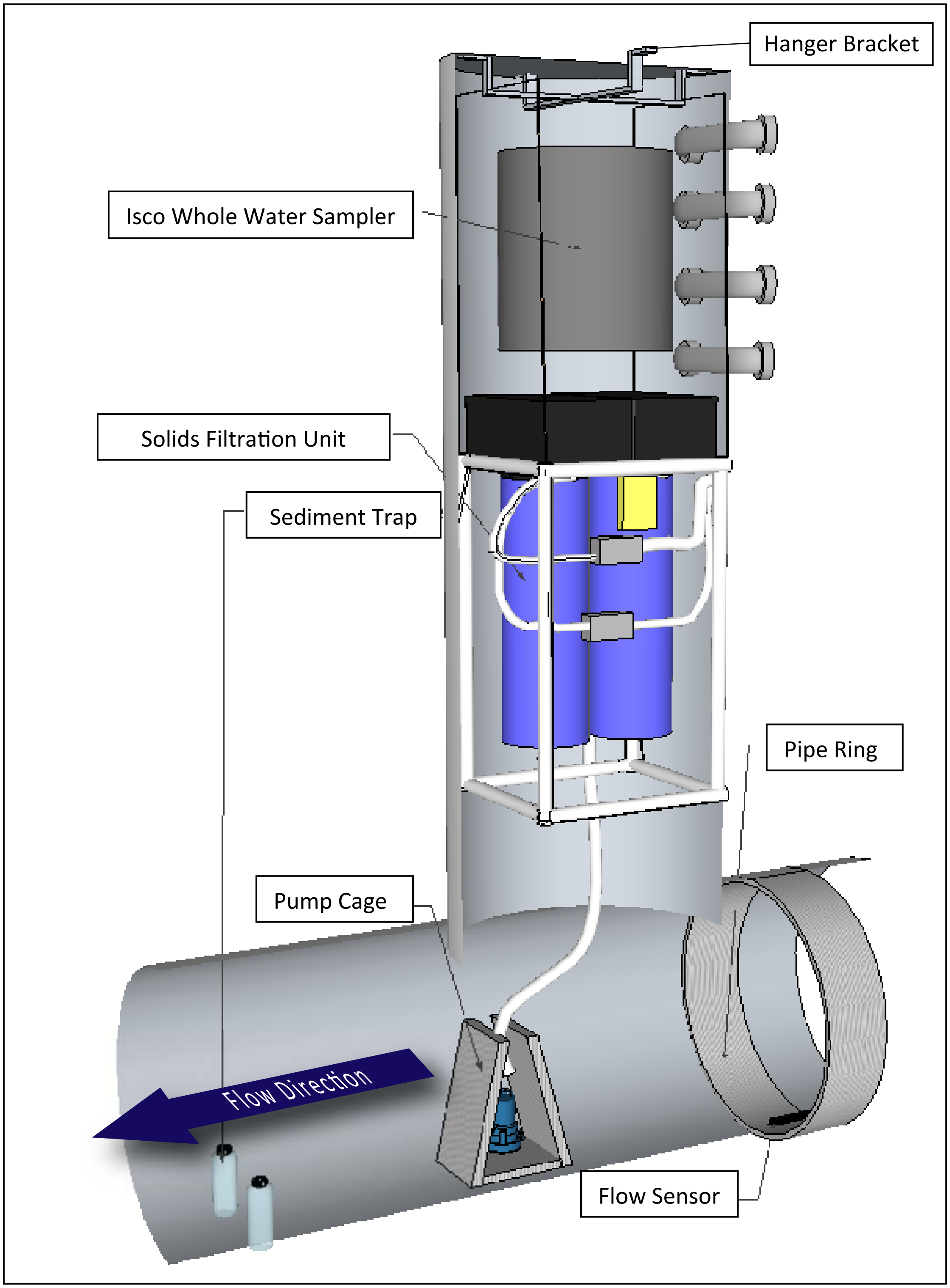


Figure 5. Schematic of Equipment Installed in a Storm Drain Maintenance Hole

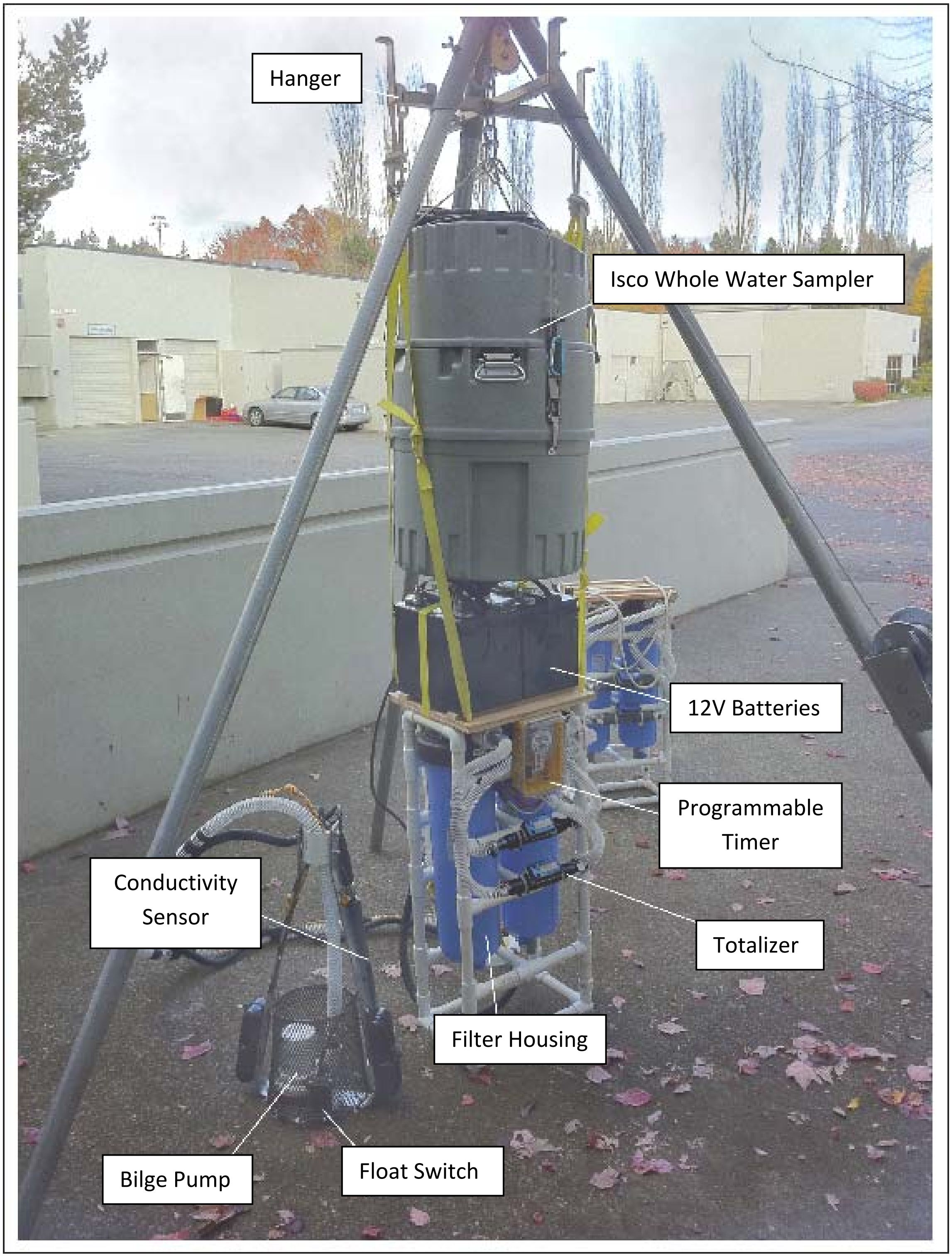


Figure 6. Stormwater Sampling Components

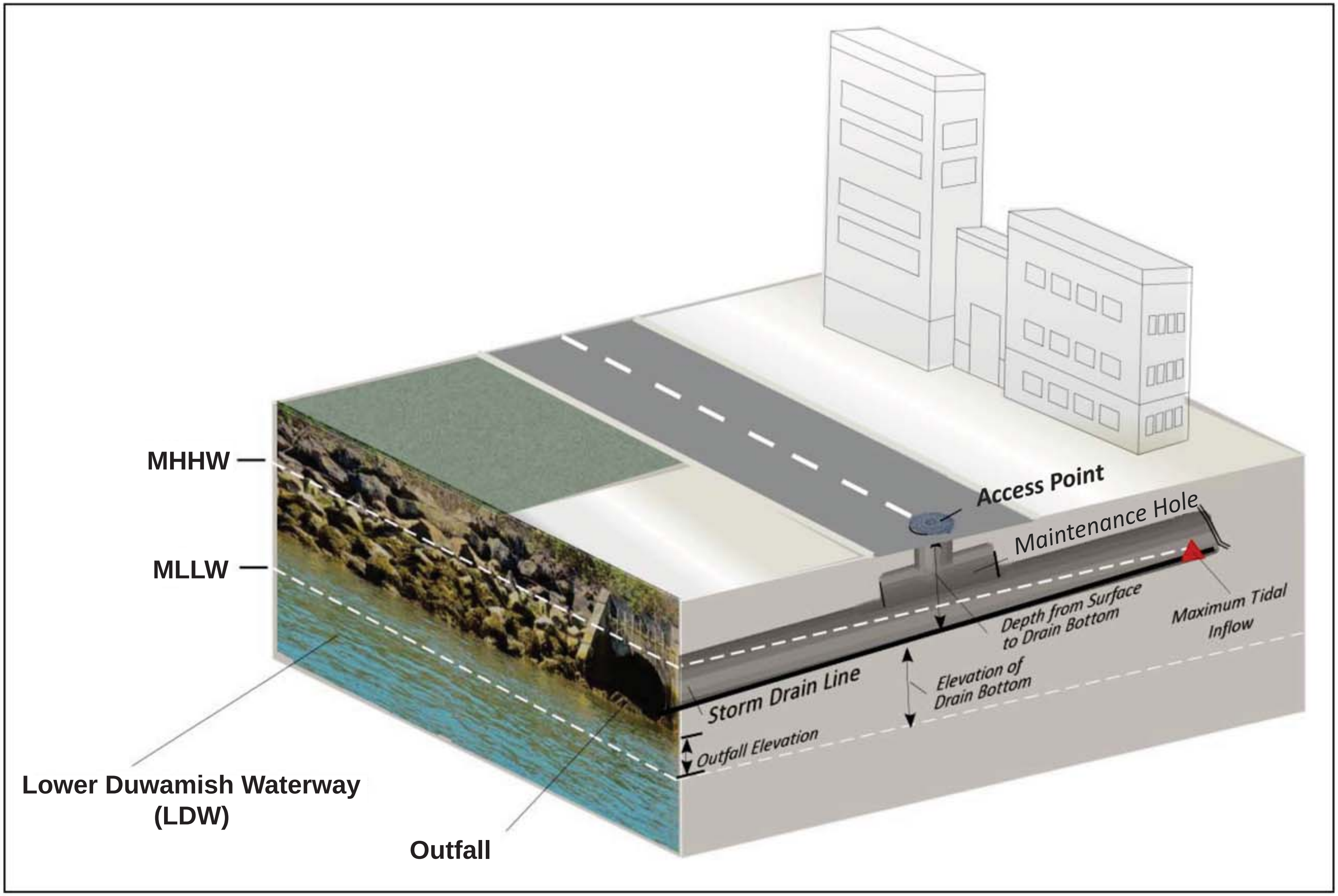


Figure 7. Schematic of a Typical LDW Storm Drain Line and Outfall

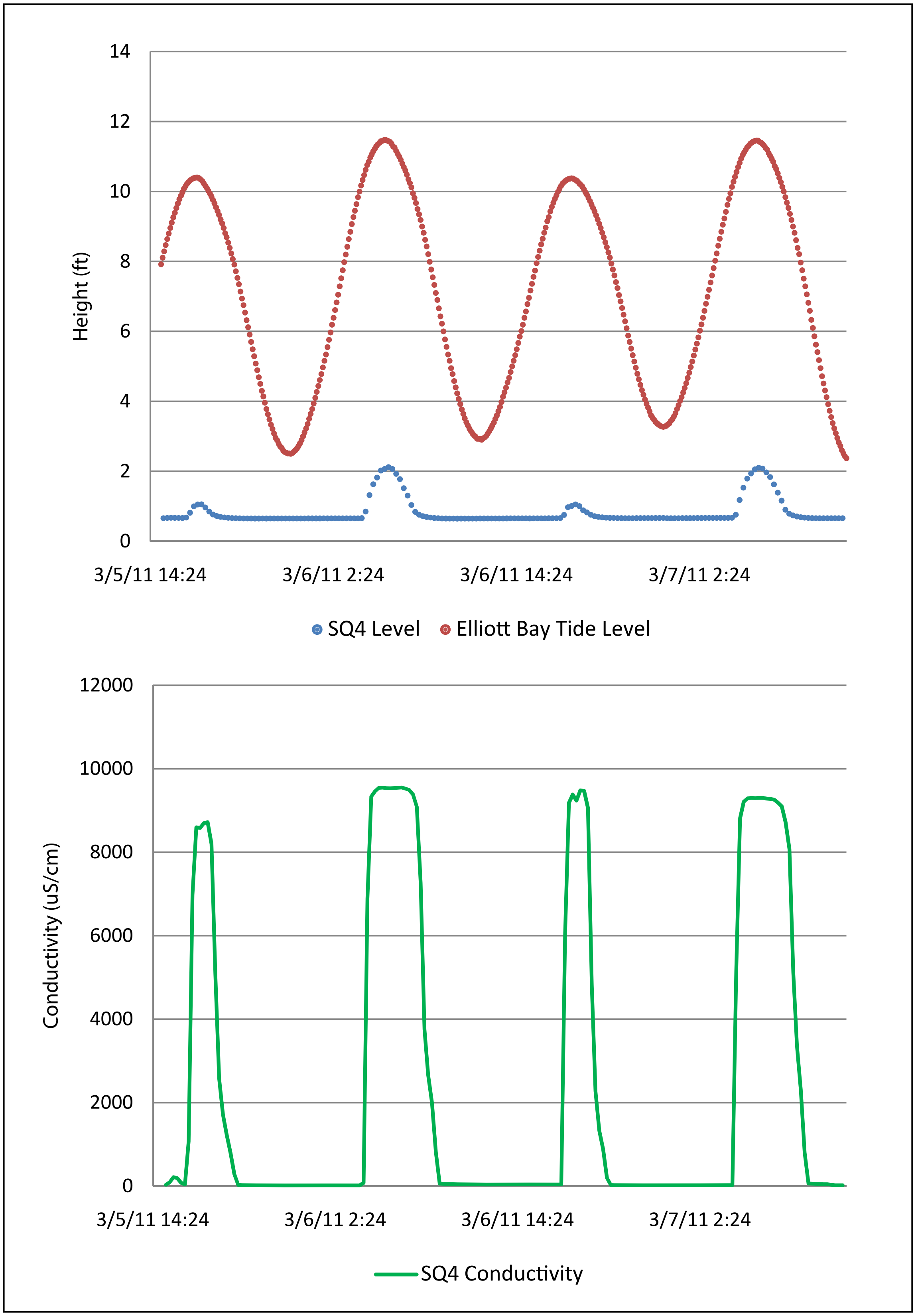


Figure 8. Water Level and Conductivity at Sampling Location SQ4

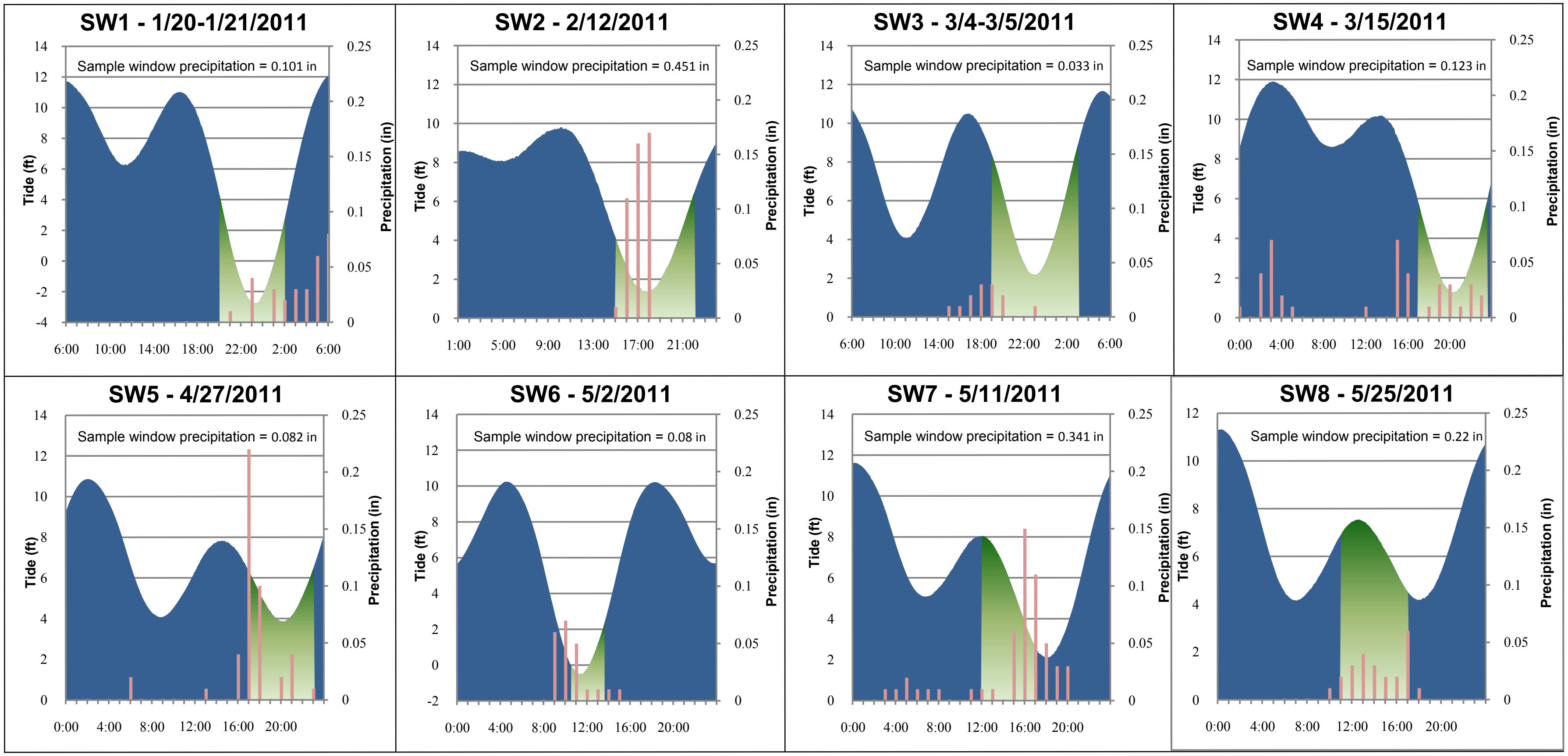
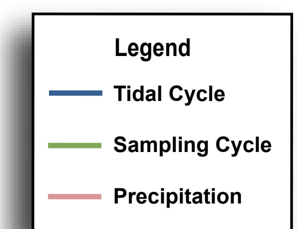


Figure 9. Tidal Heights and Hourly Precipitation for Captured Accelerated Source Tracing Storm Events

The window of the tidal cycle sampled for storm water is given in green. The total precipitation for each sampling window is provided.



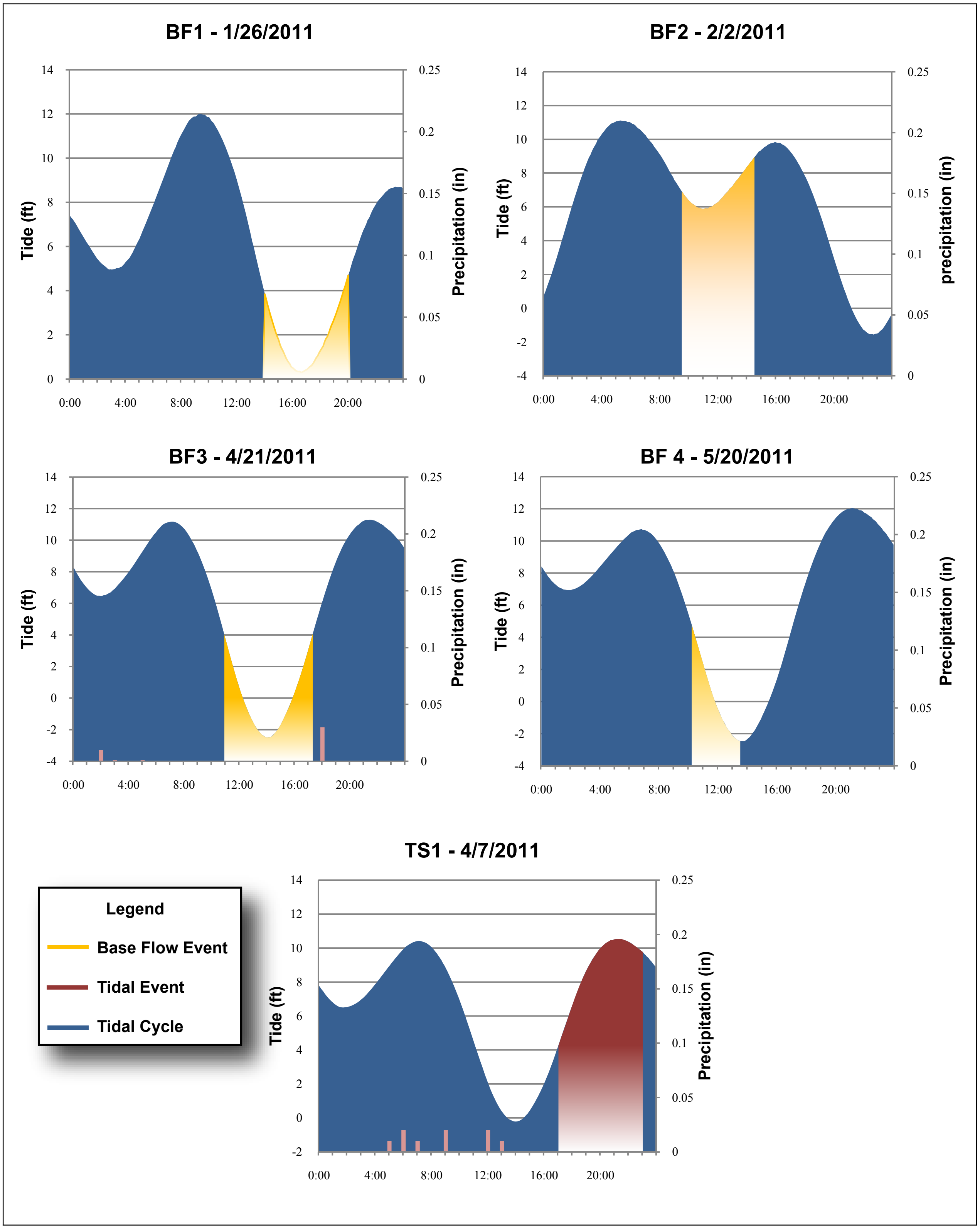


Figure 10. Tidal Heights (Blue) and Hourly Precipitation (Rose-colored Bars) for Captured Accelerated Source Tracing Base Flow and Tidal Water Sampling Events

The Window of the tidal cycle sampled is given in yellow (base flow) or red (tidal sampling).

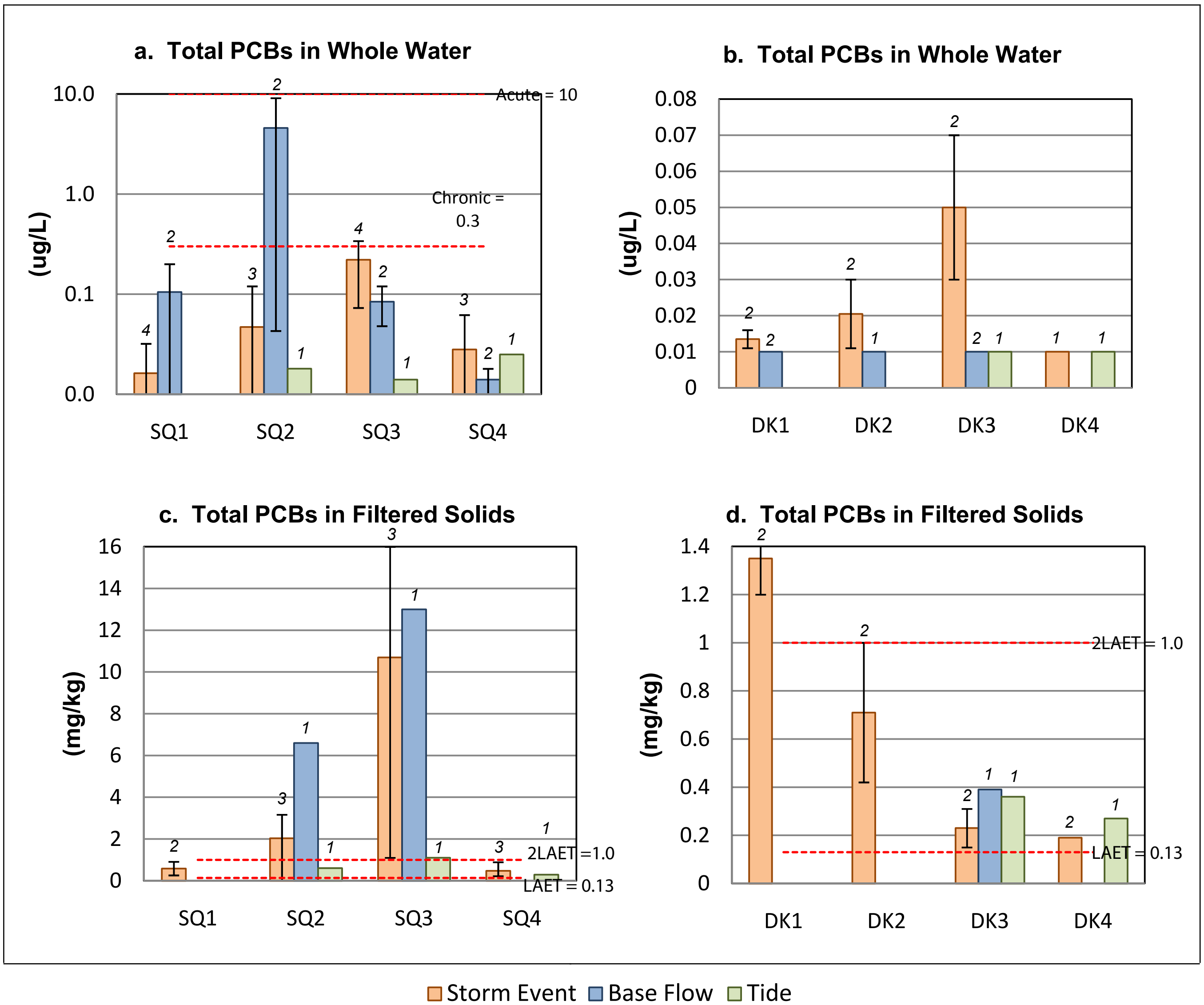


Figure 11. Total PCBs in Whole Water, Total PCBs in Filtered Solids

Whole water results in Figure 11a are presented on a logarithmic scale.

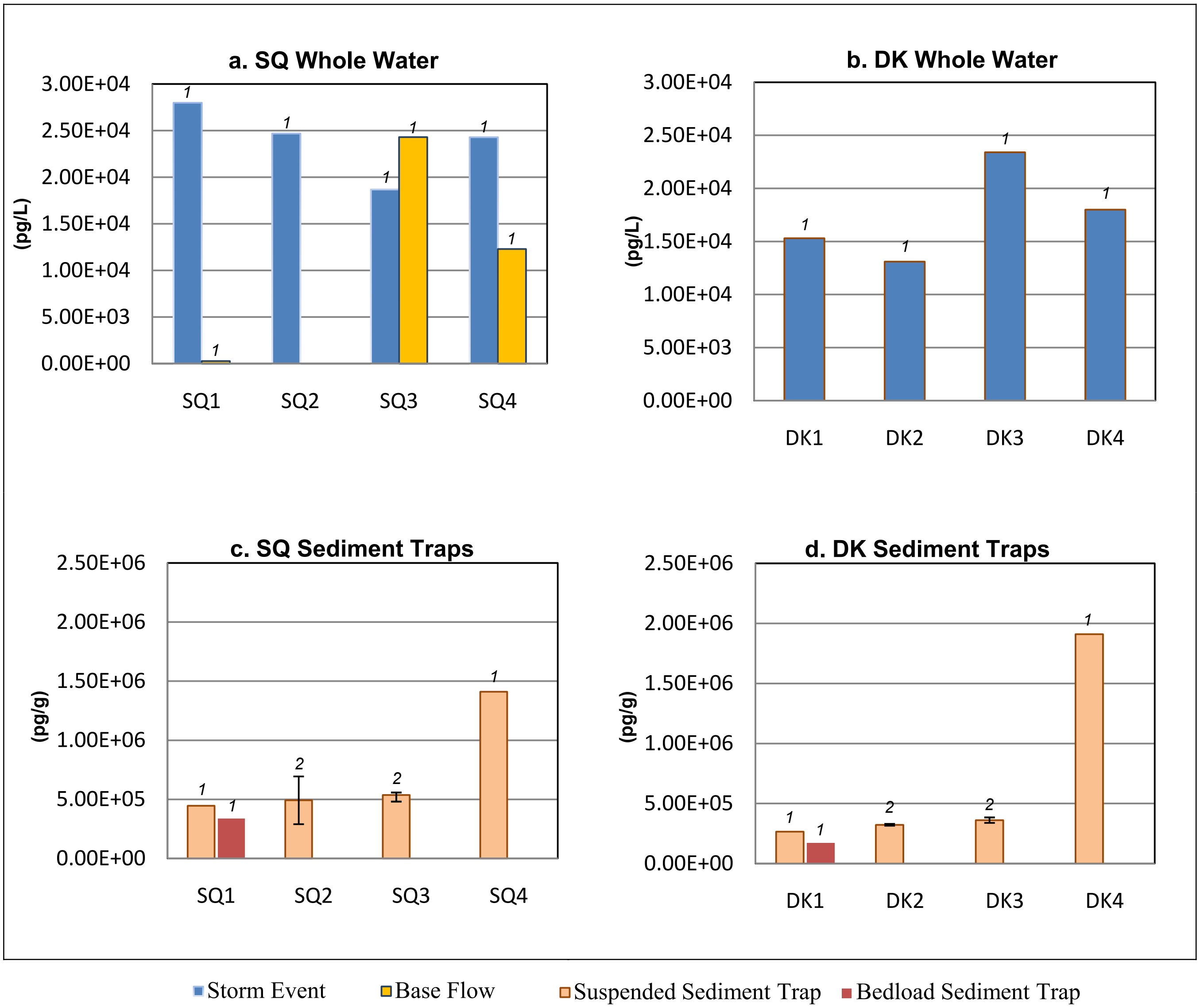


Figure 12. PBDE Concentrations in Whole Water, Sediment Traps, and Bedload Sediment Trap Samples

Error bars represent minimum and maximum concentrations.

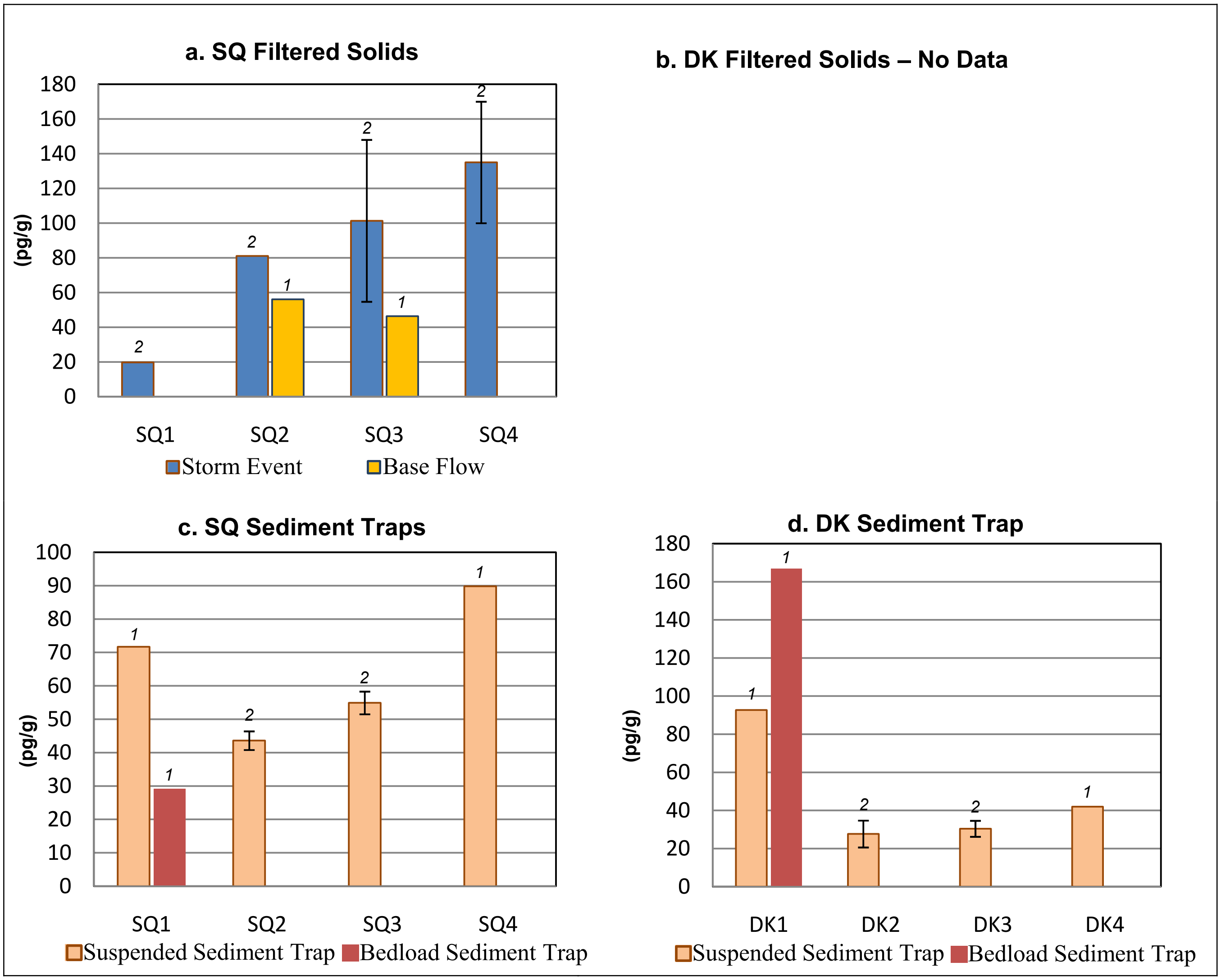


Figure 13. Dioxin/Furan Concentrations in Filtered Solids, Sediment Traps, and Bedload Sediment Trap Samples

Error bars represent minimum and maximum concentrations.

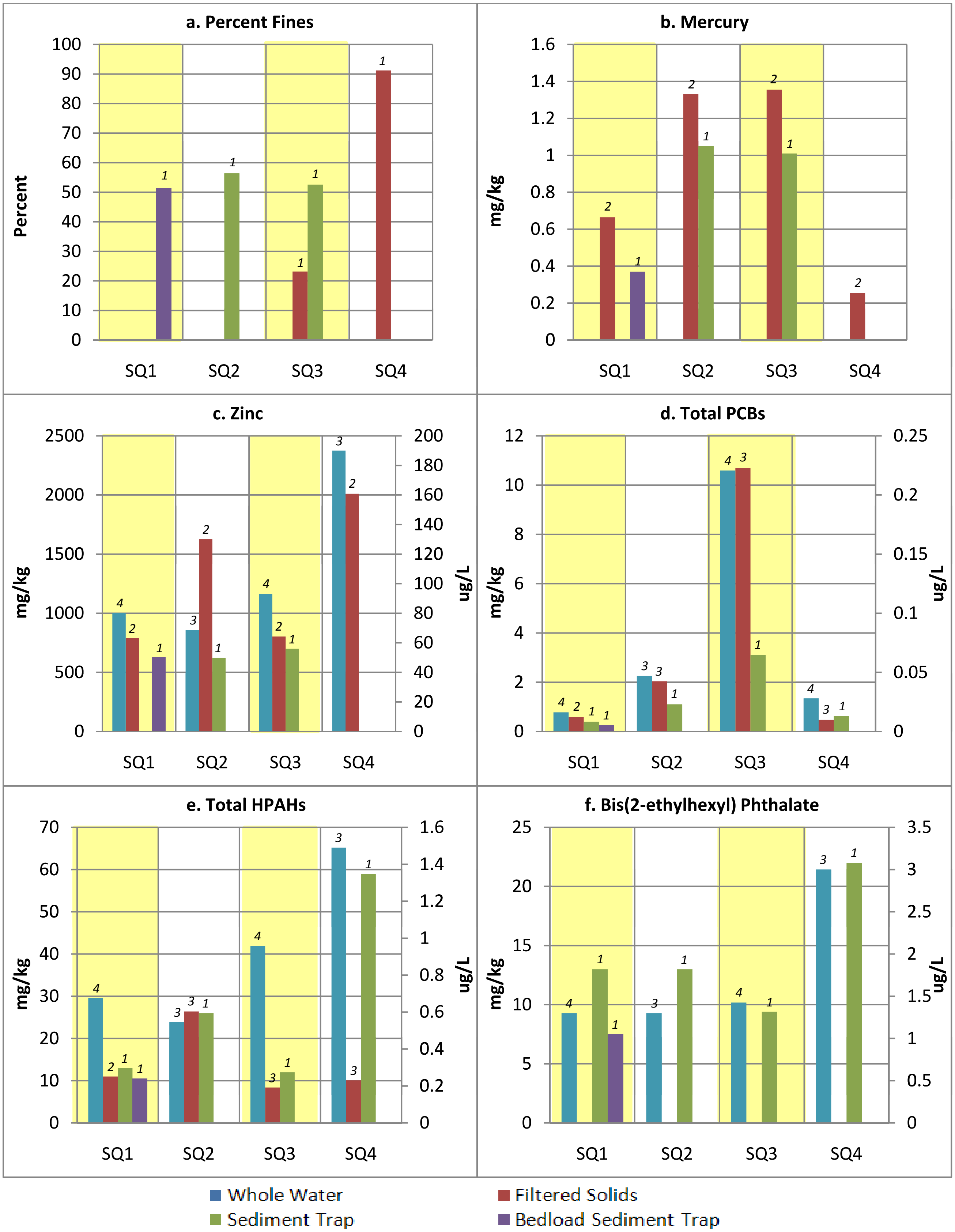


Figure 14. Comparison of Sample Results in the S Snoqualmie Street Sub-basin

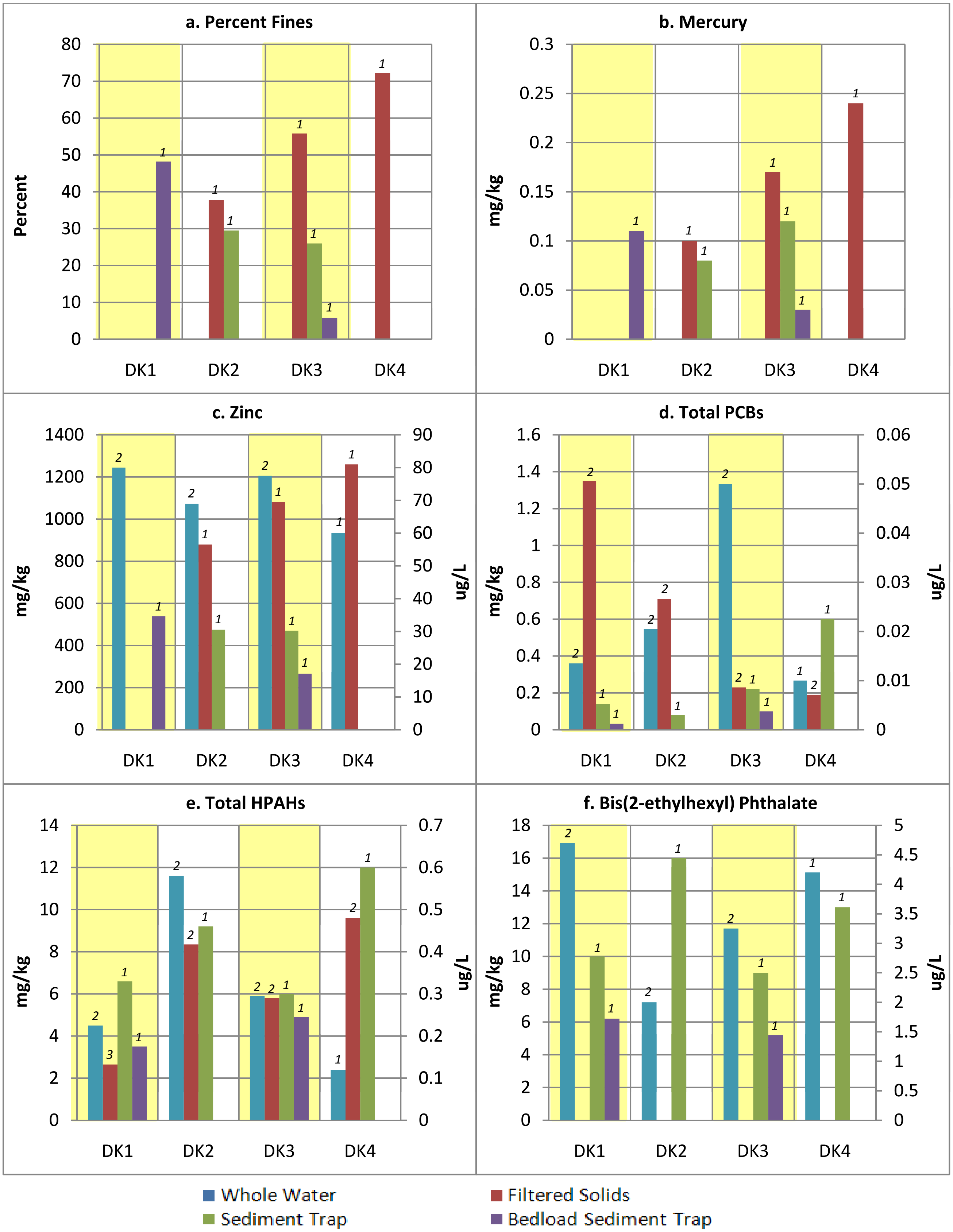
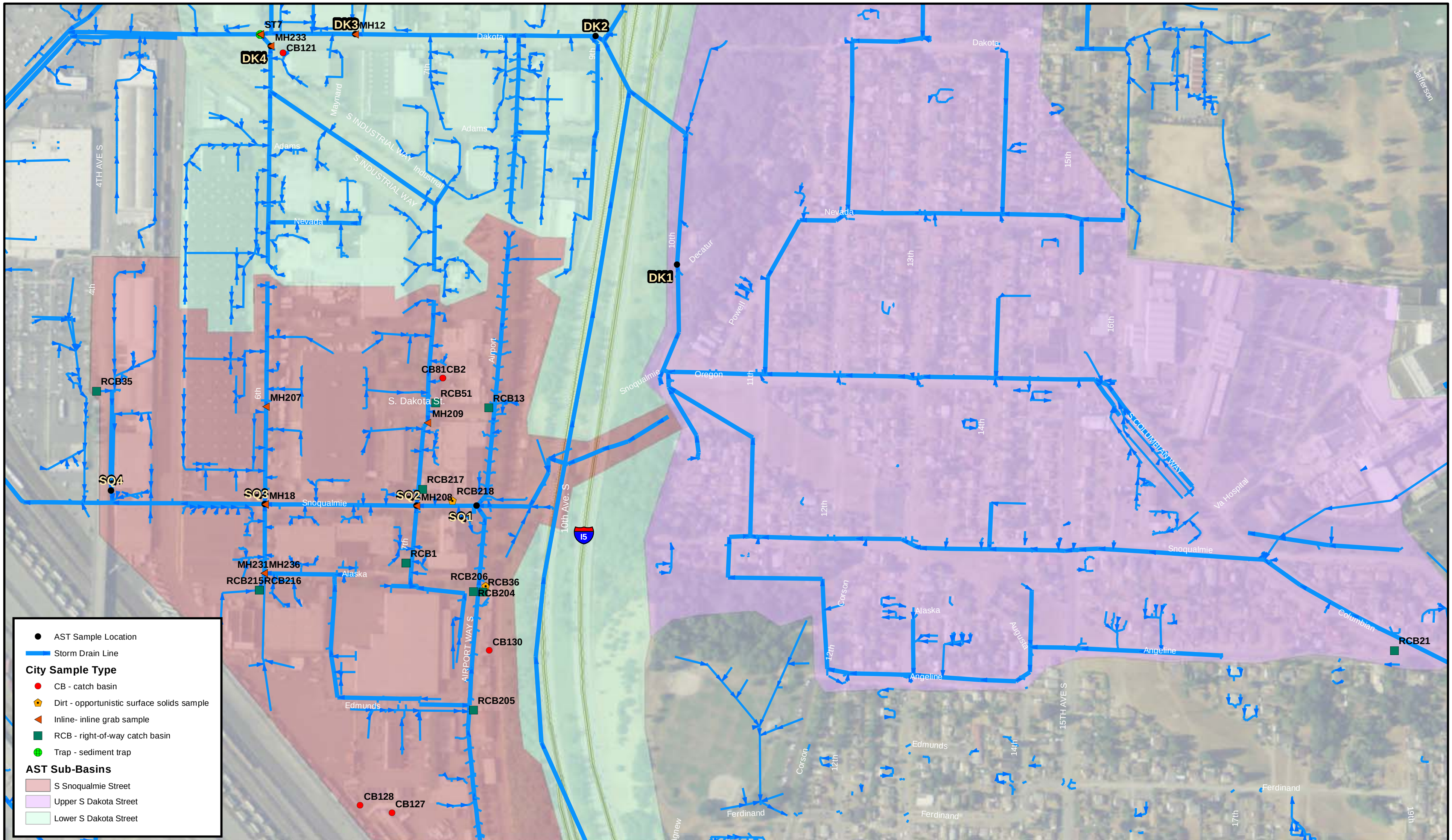


Figure 15. Comparison of Sample Results in the S Dakota Street Sub-basin



N

0 250 500 1,000 Feet

Figure 16. Samples Collected by Seattle Public Utilities within the S Snoqualmie Street and S Dakota Street Sub-basins

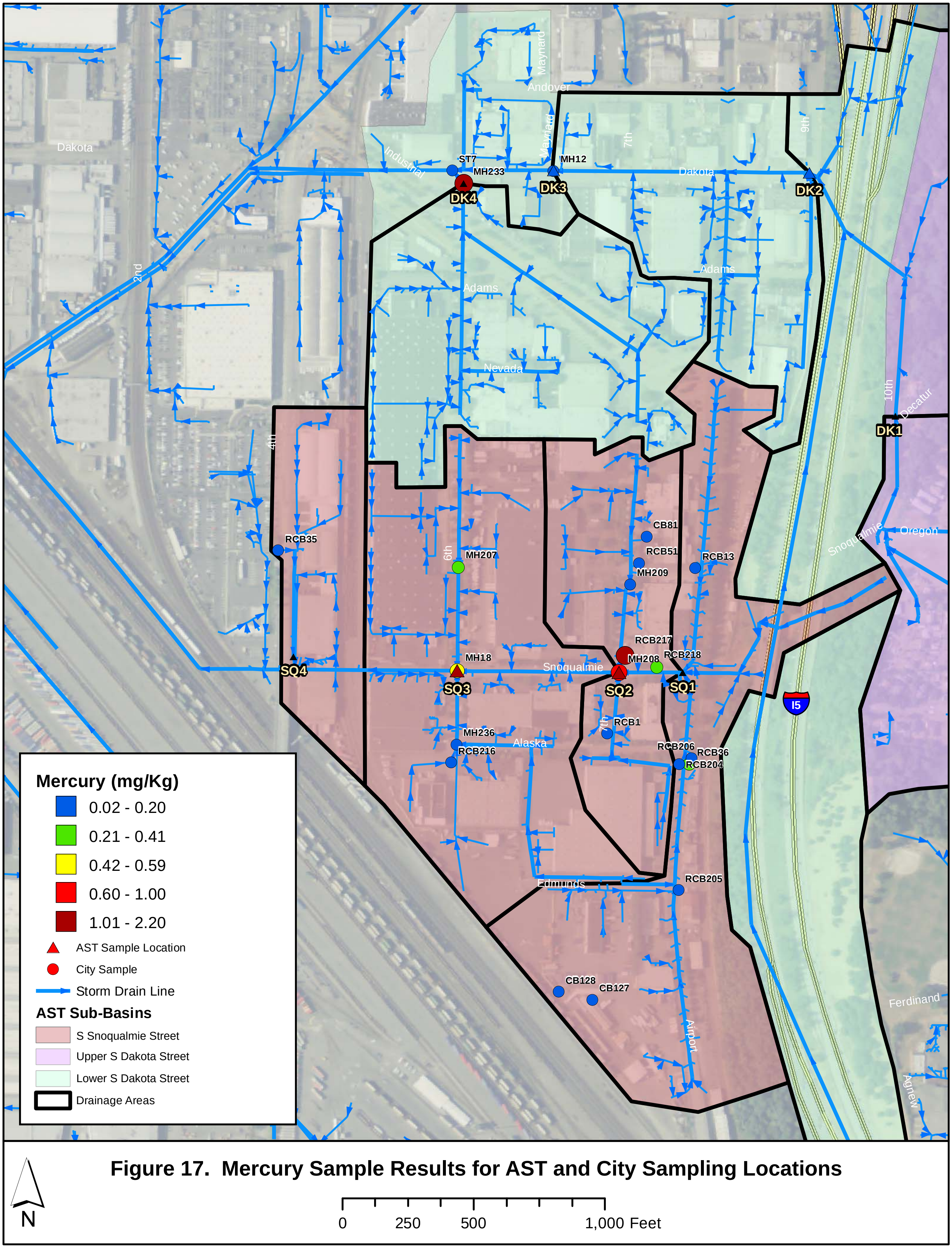


Figure 17. Mercury Sample Results for AST and City Sampling Locations

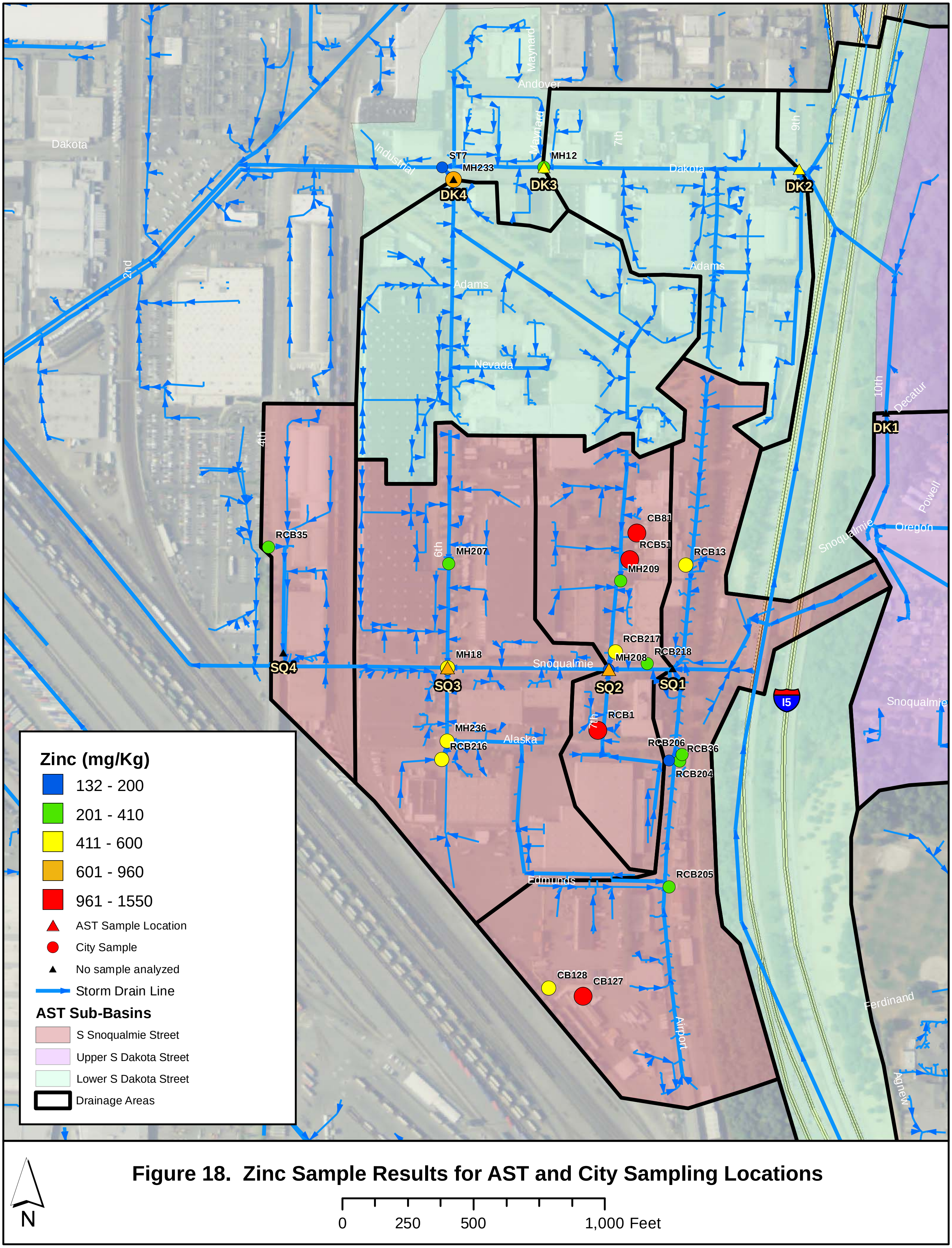


Figure 18. Zinc Sample Results for AST and City Sampling Locations

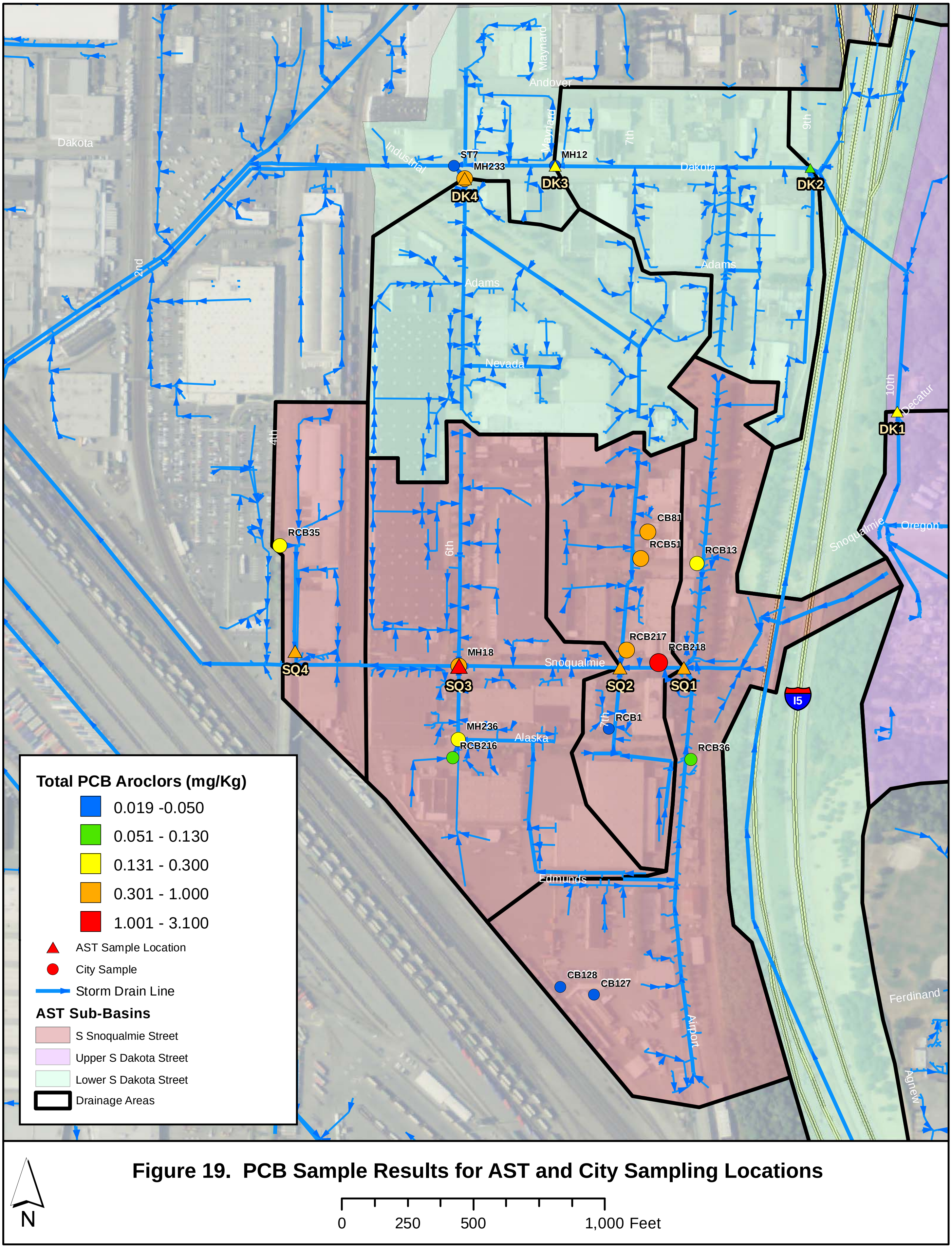


Figure 19. PCB Sample Results for AST and City Sampling Locations

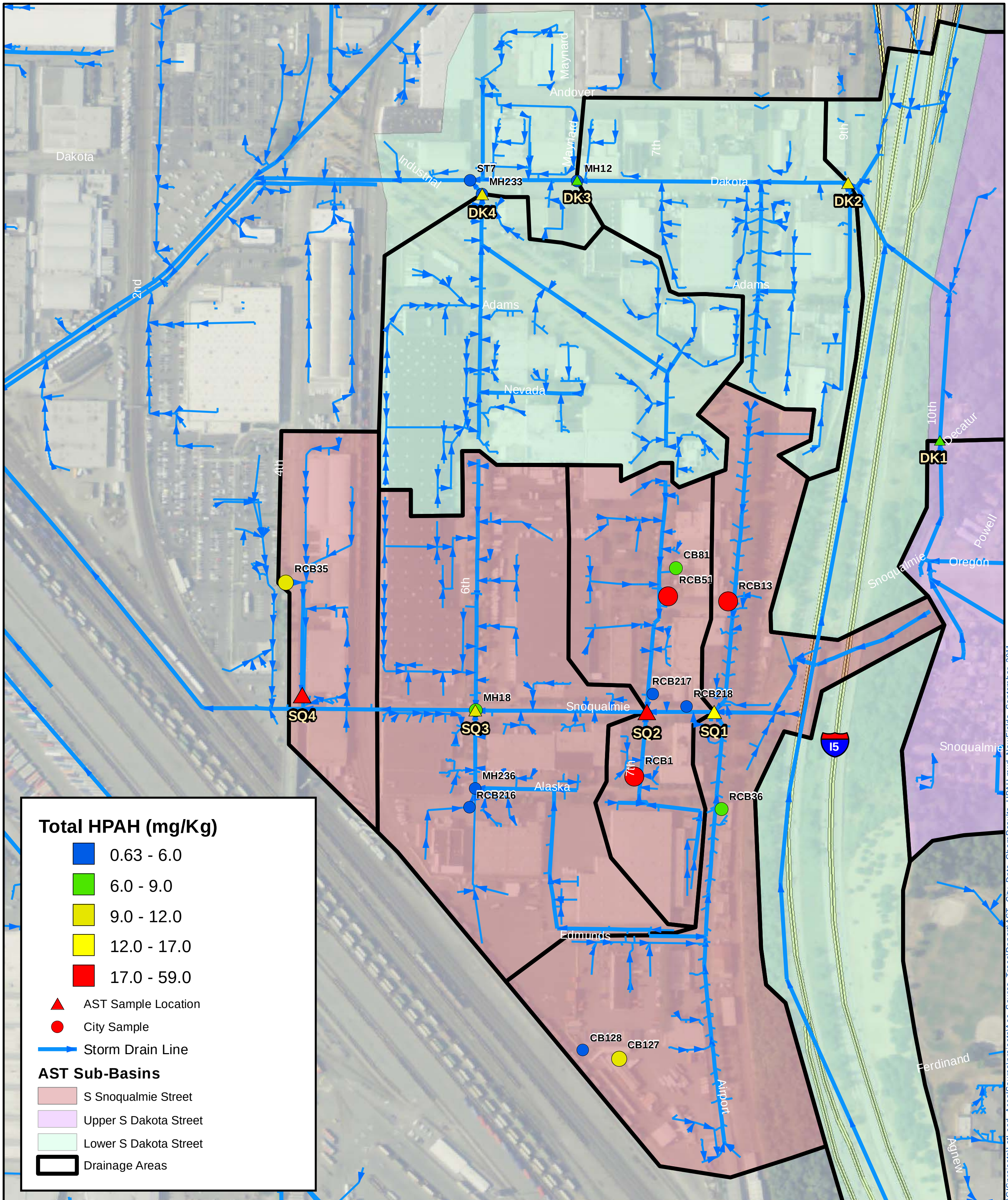


Figure 20. Total HPAH Sample Results for AST and City Sampling Locations

N

0 250 500 1,000 Feet

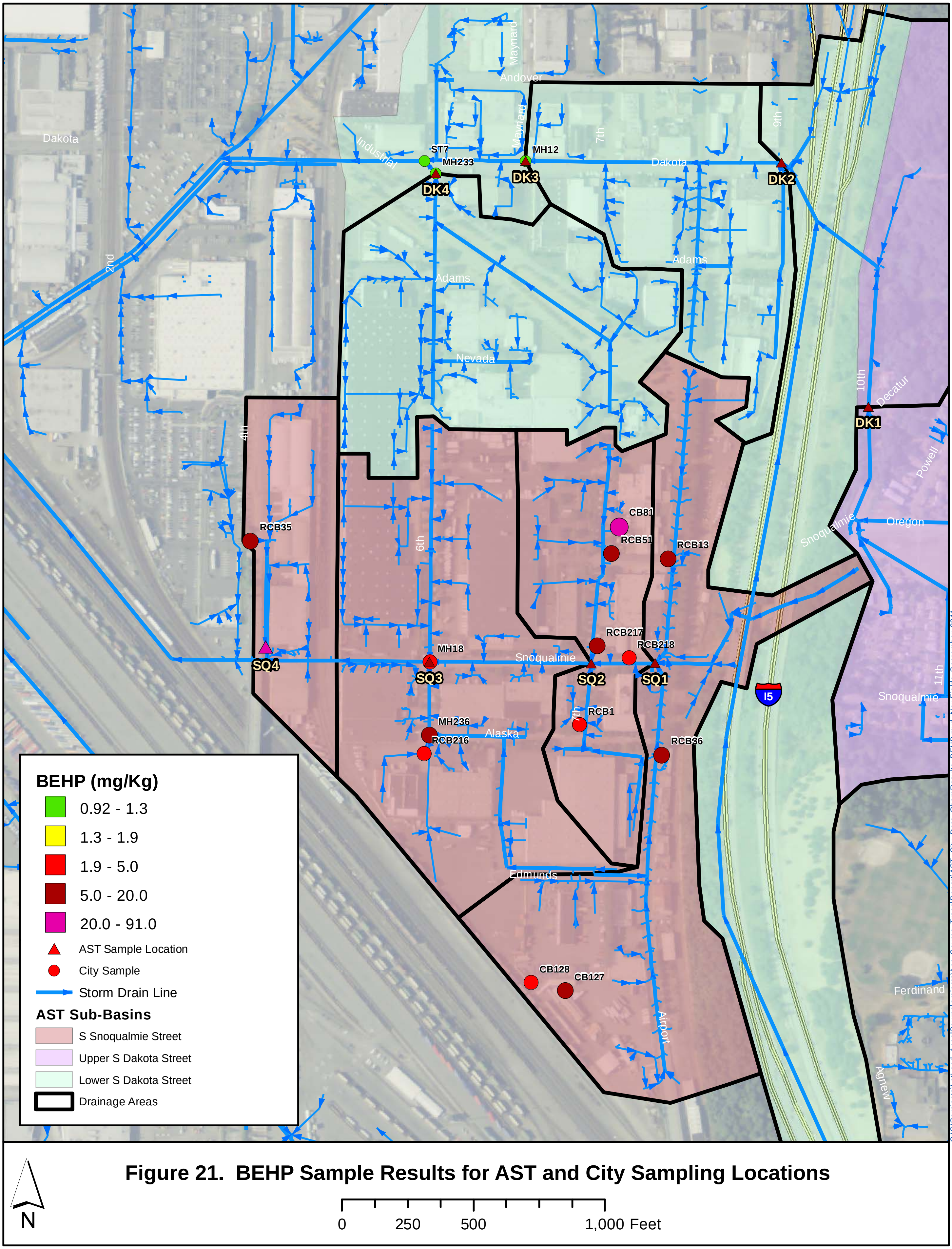


Figure 21. BEHP Sample Results for AST and City Sampling Locations

Tables

Table 1. Characteristics of Accelerated Source Tracing Basins Sampled

LDW Sub-basin	Sampling Locations Abbreviation	Sub-basin Surface Area (acre)		Landcover Classification (%)			
		Total	Impervious	Developed, High Intensity	Developed, Medium Intensity	Developed, Low Intensity	Vegetation/ Open Space
South Snoqualmie Drainage Area	SQ1, SQ2, SQ3, SQ4	83	71	86	9.5	2.5	2
South Dakota Drainage Area	DK2[1], DK3, DK4	97	71	53	32.3	10.5	4.2
Upper Dakota Drainage Area	DK2[1], DK1	163	87	8.6	61.8	17	12.6

1. The DK2 sub-basin includes a portion of the upper Dakota drainage area.

Table 2. Sub-basin Surface Area, Impervious Area, and Predicted Stormwater Runoff

Sub-basin Surface Area (acre)	Total	Impervious	Runoff Coefficient[1]	Stormwater Runoff2 (gal)
Snoqualmie Sub-basins				
SQ1	29.3	22.3	0.74	393,000
SQ2	14.6	13.5	0.88	234,000
SQ3	29.0	25.9	0.85	451,000
SQ4	9.8	8.9	0.86	155,000
Dakota Sub-basins				
DK1	144.9	85.1	0.58	1,530,000
DK2	62.7	27.7	0.45	511,000
DK3	18.5	17.1	0.88	297,000
DK4	24.3	19.4	0.77	339,000

1. Runoff Coefficient equal to 0.009 * (%Impervious Surface)+0.05.

2. Stormwater Runoff equal to total precipitation for the 2010-2011 wet season (37.53 inches) multiplied by Total area by Runoff Coefficient and converted to gallons.

Table 3. Summary of Sampled Storm Events

Storm Event Date	Event	Total Event Precipitation (inches)	Total Event Duration (hours)	Fraction of Event Precipitation Sampled (%)	Fraction of Event Duration Sampled (%)	Section of Event Hydrograph Sampled
1/21/2011	SW1	0.301	10	34	80	increasing
2/12/2011	SW2	0.451	5	100	100	entire
3/5/2011	SW3	0.133	10	47	60	decreasing
3/15/2011	SW4	0.242	10	54	70	decreasing
4/27/2011	SW5	0.433	9	91	78	decreasing
5/2/2011	SW6	0.221	8	37	38	decreasing
5/11/2011	SW7	0.461	10	74	60	increasing
5/25/2011	SW8	0.240	9	92	78	decreasing

Table 4. Number of Storm Events, Base Flow, and Tidal Event Water Samples Analyzed

Location	Whole Water									Filtered Solids				
	TSS	pH, Alkalinity, Hardness, TSS, Anions, TOC, DOC	Total and Dissolved Metals (EPA 200.8/7470)	SVOCs (EPA 8270D)	SIM SVOC (8270C)	PCB Aroclors (EPA 8082)	Pesticides (EPA 8081B)	VOCs (EPA 8260C)	PBDEs Congeners (EPA 1614)	Grain Size (PSEP)	Total Metals (EPA 200.8/7471)	PAHs (EPA 8270D)	PCB Aroclors (EPA 8082)	Dioxin/Furan Congeners (EPA 1614)
Base Flow														
DK1	-	2	2	2	2	2	2	2	-	-	-	1	-	1
DK2	-	1	1	1	1	1	1	1	-	-	-	-	-	-
DK3	-	2	2	2	2	2	2	2	-	-	-	2	1	1
DK4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SQ1	-	2	2	2	2	2	2	1	1	-	-	1	-	-
SQ2	-	2	2	1	1	2	1	1		-	-	2	1	1
SQ3	-	2	2	2	2	2	2	2	1	-	1	2	1	1
SQ4	-	2	2	2	2	2	2	2	1	-	-	-	-	-
Storm Event														
DK1	-	2	2	2	2	2	2	2	1	-	-	3	2	-
DK2	-	2	2	2	2	2	1	2	1	1	1	2	2	-
DK3	-	2	2	2	2	2	2	2	1	1	1	2	2	-
DK4	-	1	1	1	1	1	1	1	1	1	1	2	2	-
SQ1	-	4	4	4	4	4	4	4	1	-	2	2	2	2
SQ2	-	3	3	3	3	3	3	3	1	-	2	3	3	2
SQ3	-	4	4	4	4	4	4	4	1	1	2	3	3	2
SQ4	1	3	3	3	3	4	3	3	1	1	2	3	3	2
Tidal Water														
DK1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DK2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DK3	-	1	1	1	1	1	1	1	-	-	-	1	1	-
DK4	-	1	1	1	1	1	1	1	-	-	-	1	1	-
SQ1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SQ2	-	1	1	1	1	1	1	1	-	-	-	1	1	-
SQ3	-	1	1	1	1	1	1	1	-	-	-	1	1	-
SQ4	-	1	1	1	1	1	1	1	-	-	-	1	1	-

Notes:

- no sample collected

Storm events — These samples are representative of a range of precipitation amounts and storm conditions.

Base flow — These samples are representative of water and solids that enter the storm drain system via groundwater infiltration or as a result of unidentified connections to the system.

Tidal water — One sample was collected at each location during a period of both high tide and no precipitation. These samples were intended to represent LDW river water that may transport contaminants both up-line and down-line and influence solids deposited in sediment traps.

Table 5. Frequency of Detected Chemical Parameters in Storm Event Whole Water Samples

Analyte	SQ1	SQ2	SQ3	SQ4	DK1	DK2	DK3	DK4
PCBs								
Total PCBs	2/4	2/3	4/4	3/4	2/2	2/2	2/2	0/1
Metals – Total								
Arsenic	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Cadmium	3/4	2/3	4/4	2/3	2/2	1/2	2/2	1/1
Chromium	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Copper	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Lead	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Mercury	0/4	0/3	1/4	0/3	0/2	0/2	0/2	0/1
Nickel	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Selenium	0/4	1/3	0/4	0/3	0/2	0/2	0/2	0/1
Zinc	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Metals – Dissolved								
Arsenic	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Cadmium	0/4	0/3	1/4	0/3	0/2	0/2	0/2	0/1
Chromium	0/4	1/3	3/4	0/3	2/2	1/2	2/2	1/1
Copper	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Lead	0/4	2/3	1/4	0/3	2/2	1/2	2/2	1/1
Nickel	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Zinc	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Phthalates								
Bis(2-Ethylhexyl) Phthalate	1/4	0/3	3/4	2/3	1/2	1/2	2/2	1/1
PAHs								
1-Methylnaphthalene	1/4	0/3	3/4	2/3	0/2	1/2	0/2	0/1
2-Methylnaphthalene	3/4	1/3	3/4	2/3	0/2	1/2	1/2	1/1
Acenaphthene	2/4	2/3	3/4	1/3	0/2	0/2	0/2	0/1
Acenaphthylene	0/4	0/3	0/4	0/3	0/2	0/2	0/2	0/1
Anthracene	2/4	1/3	1/4	1/3	0/2	0/2	0/2	0/1
Benzo(a)anthracene	3/4	2/3	4/4	3/3	1/2	2/2	2/2	0/1
Benzo(a)pyrene	3/4	2/3	4/4	3/3	1/2	2/2	2/2	0/1
Benzo(ghi)perylene	3/4	2/3	4/4	3/3	2/2	2/2	2/2	1/1
Benzofluoranthene	4/4	2/3	4/4	3/3	2/2	2/2	2/2	1/1
Chrysene	4/4	2/3	4/4	3/3	2/2	2/2	2/2	1/1
Dibenzo(a,h)anthracene	3/4	1/3	3/4	3/3	0/2	2/2	0/2	0/1
Dibenzofuran	1/4	1/3	1/4	2/3	0/2	0/2	0/2	0/1
Fluoranthene	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Fluorene	2/4	1/3	3/4	3/3	0/2	0/2	0/2	0/1
Indeno(1,2,3-cd)pyrene	3/4	2/3	4/4	3/3	1/2	2/2	2/2	0/1
Naphthalene	4/4	3/3	3/4	2/3	1/2	1/2	2/2	1/1
Phenanthrene	3/4	2/3	4/4	3/3	2/2	2/2	2/2	1/1
Pyrene	4/4	2/3	4/4	3/3	2/2	2/2	2/2	1/1
Total HPAHs	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
Total LPAHs	4/4	3/3	4/4	3/3	2/2	2/2	2/2	1/1
PBDEs								
Total BDEs	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Light yellow highlighted cells - One or more samples exceed Washington State Marine Water Quality Chronic criteria

Light blue highlighted cells - One or more samples exceed Washington State Marine Water Quality Acute criteria

Table 6a. Maximum Concentration of Whole Water Base Flow Samples with WQC Surface Water Exceedances

Event Type	WQC	WQC	Base Flow					
Location ID	Chronic	Acute	SQ1	n[1]	SQ2	n[1]	SQ3	n[1]
PCBs (µg/L)								
Total PCBs	0.03	10	0.2	1/2	9.1	2/2	0.12	2/2
Metals – Dissolved (µg/L)								
Copper	3.1	4.8	10.1	1/2	4.8	1/2	4.5	2/2
Nickel	8.2	74			8.8	1/2		

WQC = Washington State Marine Water Quality Criteria

1. (number of samples exceeding criteria)/(total sample number)

Light yellow highlighted cells - Chronic criteria exceedance

Light blue highlighted cells - Acute criteria exceedance

Table 6b. Maximum Concentration of Whole Water Storm Event Samples with WQC Surface Water Exceedances

Event Type	WQC Chronic	WQC Acute	Storm Event															
Location ID			SQ1	n[1]	SQ2	n[1]	SQ3	n[1]	SQ4	n[1]	DK1	n[1]	DK2	n[1]	DK3	n[1]	DK4	n[1]
PCBs (µg/L)																		
Total PCBs	0.03	10	0.032	1/4	0.12	1/3	0.34	4/4	2	1/4					0.07	1/2		
Metals – Dissolved (µg/L)																		
Copper	3.1	4.8	7.9	4/4	6.2	3/3	12.3	3/4	6.3	2/3	16.7	2/2	7.5	2/2	8.2	2/2	6.6	1/1
Nickel	8.2	74													16.9	1/2		

WQC = Washington State Marine Water Quality Criteria

1. (number of samples exceeding criteria)/(total sample number)

Light yellow highlighted cells - Chronic criteria exceedance

Light blue highlighted cells - Acute criteria exceedance

Table 6c. Maximum Concentration of Whole Water Tide Samples with WQC Surface Water Exceedances

Event Type	WQC	WQC	Tide Sample	
Location ID	Chronic	Acute	SQ4	n[1]
Metals – Dissolved (µg/L)				
Copper	3.1	4.8	4.6	1/1

WQC = Washington State Marine Water Quality Criteria

1. (number of samples exceeding criteria)/(total sample number)

Light yellow highlighted cells - Chronic criteria exceedance

Light blue highlighted cells - Acute criteria exceedance

Table 7. Frequency of Detected Chemical Parameters in Storm Event Filtered Solids Samples

Chemical	SQ1	SQ2	SQ3	SQ4	DK1	DK2	DK3	DK4
Dioxins and Furans								
Dioxin/Furan Congeners	2/2	2/2	2/2	2/2	--	--	--	--
PCBs								
Total PCBs	2/2	3/3	3/3	3/3	1/2	2/2	2/2	2/2
Metals								
Arsenic	0/2	0/2	1/2	1/2	--	1/1	1/1	1/1
Cadmium	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
Chromium	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
Copper	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
Lead	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
Mercury	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
Silver	0/2	0/2	1/2	0/2	--	0/1	0/1	0/1
Zinc	2/2	2/2	2/2	2/2	--	1/1	1/1	1/1
PAHs								
1-Methylnaphthalene	2/2	3/3	2/3	1/3	2/3	1/2	1/2	1/2
2-Methylnaphthalene	2/2	3/3	3/3	2/3	2/3	1/2	1/2	1/2
Acenaphthene	1/2	2/3	1/3	1/3	2/3	0/2	0/2	0/2
Acenaphthylene	1/2	1/3	0/3	0/3	1/3	0/2	0/2	0/2
Anthracene	2/2	1/3	1/3	1/3	2/3	0/2	0/2	0/2
Benzo(a)anthracene	2/2	3/3	3/3	3/3	1/3	2/2	2/2	2/2
Benzo(a)pyrene	2/2	3/3	3/3	3/3	1/3	2/2	2/2	2/2
Benzo(ghi)perylene	2/2	3/3	3/3	3/3	2/3	2/2	2/2	2/2
Benzofluoranthene	2/2	3/3	3/3	3/3	1/3	2/2	2/2	2/2
Chrysene	2/2	3/3	3/3	3/3	2/3	2/2	2/2	2/2
Dibenzo(a,h)anthracene	2/2	1/3	0/3	0/3	1/3	0/2	0/2	1/2
Dibenzofuran	2/2	3/3	1/3	2/3	2/3	0/2	0/2	1/2
Fluoranthene	2/2	3/3	3/3	3/3	2/3	2/2	2/2	2/2
Fluorene	2/2	3/3	1/3	2/3	2/3	0/2	0/2	0/2
Indeno(1,2,3-cd)pyrene	2/2	3/3	3/3	3/3	1/3	2/2	2/2	2/2
Naphthalene	2/2	3/3	2/3	2/3	2/3	1/2	2/2	2/2
Phenanthrene	2/2	3/3	3/3	3/3	3/3	2/2	2/2	2/2
Pyrene	2/2	3/3	3/3	3/3	1/3	2/2	2/2	2/2
Total HPAHs	2/2	3/3	3/3	3/3	2/3	2/2	2/2	2/2
Total LPAHs	2/2	3/3	3/3	3/3	3/3	2/2	2/2	2/2

- not analyzed

Light yellow highlighted cells - One or more samples exceed SQS/LAET

Light blue highlighted cells - One or more samples exceed CSL/2LAET

Table 8a. Maximum Concentration of Filtered Solids Base Flow Samples with SQS/LAET and CSL/2LAET Exceedances

Event Type	SQS/ LAET	CSL/ 2LAET	Base Flow					
Location ID			SQ2	n[1]	SQ3	n[1]	DK3	n[1]
PCBs (mg/kg)								
Total PCBs	0.13	1	6.6	1/1	13	1/1	0.39	1/1
Metals – Total (mg/kg)								
Mercury	0.41	0.59			2.67	1/1		
PAHs (mg/kg)								
Benzo(g,h,i)perylene	0.67	0.72	1.4	2/2				
Chrysene	1.4	2.8	1.6	1/1				
Fluoranthene	1.7	2.5	2.0	1/1				
Indeno(1,2,3-cd)pyrene	0.6	0.69	0.66	1/1				

SQS = Washington State Sediment Quality Standard

LAET = Lowest Apparent Effects Threshold

CSL = Washington State Cleanup Screening Level

2LAET = Second Lowest Apparent Effects Threshold

1. (Number of samples exceeding criteria)/(Total Sample number)

Light yellow highlighted cells - SQS/LAET exceedance

Light blue highlighted cells - CSL/2LAET exceedance

Table 8b. Maximum Concentration of Filtered Solids Storm Event Samples with SQS/LAET and CSL/2LAET Exceedances

Event Type	SQS/ LAET	CSL/ 2LAET	Storm Event															
Location ID			**SQ1**	**n[1]**	**SQ2**	**n[1]**	**SQ3**	**n[1]**	**SQ4**	**n[1]**	**DK1**	**n[1]**	**DK2**	**n[1]**	**DK3**	**n[1]**	**DK4**	**n[1]**
PCBs (mg/kg)																		
Total PCBs	0.13	1	0.91	2/2	3.1	2/2	16	3/3	0.89	3/3	1.5	1/1	1.0	2/2	0.31	2/2	0.19	2/2
Metals – Total (mg/kg)																		
Mercury	0.41	0.59	0.92	1/2	2.06	2/2	2.17	2/2										
Zinc	410	960	902	2/2	1830	2/2	1020	2/2	2430	2/2			879	1/1	1080	1/1	1260	1/1
PAHs (mg/kg)																		
Anthracene	0.96	4.4									1.3	1/1						
Benzo(g,h,i)perylene	0.67	0.72	1.0	1/1			1.1	2/2	1.2	2/3	1.4	1/1	1.5	1/2	0.81	2/2	1.8	1/2
Chrysene	1.4	2.8	1.9	1/1			1.7	1/2	2.0	2/3			1.8	1/2			2.1	1/2
Dibenzo(a,h)anthracene	0.23	0.54	0.28	1/1													0.43	1/2
Fluoranthene	1.7	2.5					3.0	2/2	3.1	2/3			3.1	1/2			3.5	1/2
Indeno(1,2,3-cd)pyrene	0.6	0.69															0.97	1/2
Phenanthrene	1.5	5.4							2.0	1/3			1.6	1/2			1.7	1/2
Pyrene	2.6	3.3							3.6	2/3								
Total HPAHs	12	17							14	1/3			13	1/2			16	1/2

SQS = Washington State Sediment Quality Standard

LAET = Lowest Apparent Effects Threshold

CSL = Washington State Cleanup Screening Level

2LAET = Second Lowest Apparent Effects Threshold

1. (Number of samples exceeding criteria)/(Total Sample number)

Light yellow highlighted cells - SQS/LAET exceedance

Light blue highlighted cells - CSL/2LAET exceedance

Table 8c. Maximum Concentration of Filtered Solids Tide Samples with SQS/LAET and CSL/2LAET Exceedances

Event Type	LAET	2LAET	Tide Sample									
Location ID			SQ2	n[1]	SQ3	n[1]	SQ4	n[1]	DK3	n[1]	DK4	n[1]
PCBs (mg/kg)												
Total PCBs	0.13	1	**0.60**	1/1	**1.1**	1/1	**0.29**	1/1	**0.36**	1/1	**0.27**	1/1

SQS = Washington State Sediment Quality Standard

LAET = Lowest Apparent Effects Threshold

CSL = Washington State Cleanup Screening Level

2LAET = Second Lowest Apparent Effects Threshold

1. (Number of samples exceeding criteria)/(Total Sample number)

Light yellow highlighted cells - SQS/LAET exceedance

Light blue highlighted cells - CSL/2LAET exceedance

Table 9. Frequency of Detected Chemical Parameters in Sediment Trap Samples

Analyte	SQ1	SQ2	SQ3	SQ4	DK1	DK2	DK3	DK4
Dioxins and Furans								
Dioxin/Furan Congeners	1/1	2/2	2/2	1/1	1/1	2/2	2/2	1/1
PCBs								
Total PCBs	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Metals – Total								
Arsenic	--	1/1	1/1	--	--	1/1	1/1	--
Cadmium	--	1/1	1/1	--	--	1/1	1/1	--
Chromium	--	1/1	1/1	--	--	1/1	1/1	--
Copper	--	1/1	1/1	--	--	1/1	1/1	--
Lead	--	1/1	1/1	--	--	1/1	1/1	--
Mercury	--	1/1	1/1	--	--	1/1	1/1	--
Silver	--	1/1	0/1	--	--	1/1	0/1	--
Zinc	--	1/1	1/1	--	--	1/1	1/1	--
Phenols								
p-Cresol	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Pentachlorophenol	0/1	0/1	0/1	1/1	0/1	0/1	0/1	0/1
Phenol	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Phthalates								
Bis(2-Ethylhexyl) Phthalate	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Butyl benzyl phthalate	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Dibutyl phthalate	1/1	1/1	1/1	0/1	0/1	1/1	1/1	1/1
Diethyl phthalate	0/1	0/1	0/1	0/1	0/1	0/1	1/1	0/1
Dimethyl phthalate	0/1	0/1	0/1	1/1	0/1	0/1	1/1	1/1
Di-n-Octyl phthalate	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
PAHs								
1-Methylnaphthalene	0/1	1/1	0/1	0/1	0/1	1/1	1/1	0/1
2-Methylnaphthalene	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
Acenaphthene	0/1	1/1	0/1	1/1	0/1	1/1	1/1	0/1
Acenaphthylene	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Anthracene	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
Benzo(a)anthracene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Benzo(a)pyrene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Benzo(ghi)perylene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Benzofluoranthene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Chrysene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Dibenzo(a,h)anthracene	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
Dibenzofuran	1/1	1/1	1/1	1/1	0/1	1/1	1/1	0/1
Fluoranthene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Table 9. Frequency of Detected Chemical Parameters in Sediment Trap Samples

Analyte	SQ1	SQ2	SQ3	SQ4	DK1	DK2	DK3	DK4
Fluorene	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
Indeno(1,2,3-cd)pyrene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Naphthalene	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
Phenanthrene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Pyrene	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Total HPAHs	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Total LPAHs	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
SVOCs								
1,4-Dichlorobenzene	0/1	0/1	1/1	0/1	0/1	0/1	0/1	0/1
Benzoic Acid	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
Benzyl Alcohol	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
PBDEs								
Total BDEs	1/1	2/2	2/2	1/1	1/1	2/2	2/2	1/1

- not analyzed

Light yellow highlighted cells - One or more samples exceed SQS/LAET

Light blue highlighted cells -One or more samples exceed CSL/2LAET

Table 10. Maximum Concentration of Sediment Trap Samples with SQS/LAET and CSL/2LAET Exceedances

Event ID	SQS/	CSL/	Sediment Traps							
Location ID	**LAET**	**2LAET**	**SQ1**	**SQ2**	**SQ3**	**SQ4**	**DK1**	**DK2**	**DK3**	**DK4**
PCBs (mg/kg)[1]										
Total PCBs	0.13	1	**0.4**	**1.1**	**3.1**	**0.63**	**0.14**		**0.22**	**0.6**
Metals – Total (mg/kg)[1]										
Cadmium	5.1	6.7		**5.8**						
Copper	390	390		**1640**						
Mercury	0.41	0.59		**1.05**	**1.01**					
Zinc	410	960		**624**	**699**			**475**	**470**	
Phenols (mg/kg)[2]										
p-Cresol	0.67	0.67	**39**	**14**			**5.4**	**5.2**	**1.4**	
Phenol	0.42	1.2	**2.5**	**0.78**		**0.49**	**0.55**	**0.53**	**0.43**	**0.49**
Phthalates (mg/kg)[2]										
Bis(2-Ethylhexyl) Phthalate	1.3	1.9	**13**	**13**	**9.4**	**22**	**10**	**16**	**9.0**	**13**
Butyl benzyl phthalate	0.063	0.9	**0.40**	**0.76**	**0.39**	**0.90**	**0.77**	**0.64**	**0.36**	**0.58**
Diethyl phthalate	0.2	1.2							**0.38**	
Dimethyl phthalate	0.071	0.16				**0.15**			**0.076**	**0.19**
PAHs (mg/kg)[2]										
Benzo(a)anthracene	1.3	1.6		**1.9**		**3.9**				
Benzo(a)pyrene	1.6	3		**2**		**4.5**				
Benzo(g,h,i)perylene	0.67	0.72	**1.1**	**1.9**	**0.91**	**3.9**				**0.94**
Benzofluoranthene	3.2	3.6		**4.3**		**9.8**				
Chrysene	1.4	2.8	**1.9**	**3.2**	**1.6**	**6.8**				**1.5**
Dibenzo(a,h)anthracene	0.23	0.54	**0.28**	**0.5**	**0.24**	**1.3**				
Fluoranthene	1.7	2.5	**3**	**6.1**	**2.7**	**16**		**2.3**		**2.5**
Indeno(1,2,3-cd)pyrene	0.6	0.69	**0.61**	**1.4**	**0.62**	**3.6**				**0.61**
Phenanthrene	1.5	5.4	**1.7**	**2.9**		**6.3**				
Pyrene	2.6	3.3		**4.2**		**9.4**				
Total HPAHs	12	17	**13**	**26**		**59**				
Total LPAHs	5.2	13				**8**				
SVOCs (mg/kg)[2]										
Benzoic Acid	0.65	0.65		**1.4**	**1.2**	**1.4**	**1.4**	**0.66**		**1.6**
Benzyl Alcohol	0.057	0.073	**0.28**	**0.32**	**0.19**	**0.48**	**0.24**	**0.28**	**0.29**	**0.33**

SQS = Washington State Sediment Quality Standard

LAET = Lowest Apparent Effects Threshold

CSL = Washington State Cleanup Screening Level

2LAET = Second Lowest Apparent Effects Threshold

1. Results from January 19, 2011 sediment traps.
2. Results from May 5, 2011 sediment traps.

Light yellow highlighted cells - SQS/LAET exceedance

Light blue highlighted cells - CSL/2LAET exceedance

Table 11. Bedload Sediment Trap Samples with SQS/LAET and CSL/2LAET Exceedances

Event ID	SQS/ LAET	CSL/ 2LAET	Bed Load			
Location ID			**DK1**	**DK3**	**SQ1**	**SQ1**
Collection Date			**5/5/2011**	**4/7/2011**	**5/5/2011**	**6/15/2011**
PCBs (mg/kg)						
Total PCBs	0.13	1			**0.31**	**0.17**
Metals – Total (mg/kg)						
Zinc	410	960	**539**		**623**	**630**
Phenols (mg/kg)						
p-Cresol	0.67	0.67	**4.8**	**2.2**	**14**	**9.5**
Phenol	0.42	1.2	**1.4**		**1.0**	**0.57**
Phthalates (mg/kg)						
Bis(2-Ethylhexyl) Phthalate	1.3	1.9	**6.2**	**5.2**	**10**	**4.9**
Butyl benzyl phthalate	0.063	0.9	**0.96**	**1.1**	**0.48**	**0.38**
Dimethyl phthalate	0.071	0.16			**0.16**	
PAHs (mg/kg)						
Benzo(g,h,i)perylene	0.67	0.72			**0.9**	
Chrysene	1.4	2.8			**1.5**	
Dibenzo(a,h)anthracene	0.23	0.54			**0.25**	
Fluoranthene	1.7	2.5			**2.4**	**2**
Indeno(1,2,3-cd)pyrene	0.6	0.69			**0.64**	
Phenanthrene	1.5	5.4				**1.6**
SVOCs (mg/kg)						
Benzoic Acid	0.65	0.65	**2.6**		**0.66**	**0.82**
Benzyl Alcohol	0.057	0.073		**0.21**		

SQS = Washington State Sediment Quality Standard

LAET = Lowest Apparent Effects Threshold

CSL = Washington State Cleanup Screening Level

2LAET = Second Lowest Apparent Effects Threshold

Light yellow highlighted cells - SQS/LAET exceedance

Light blue highlighted cells - CSL/2LAET exceedance

Table 12. Relative Percent Differences of Results between Various Sample Types

	Relative Percent Difference (%)			
Results from:	**Filtered Solids**	**Filtered Solids**	**Sediment Trap**	**Filtered Solids**
Compared to:	**Sediment Trap**	**Bedload Sediment Trap**	**Bedload Sediment Trap**	**Converted Whole Water[1]**
Percent Fines				
Average	58	162	127	--
Range	25 - 78	162	127	--
Total PCBs				
Average	83	118	84	65
Range	4 - 162	84 - 191	50 - 126	2 -113
Bis(2-ethylhexyl) phthalate				
Average	--	--	51	--
Range	--	--	47 -54	--
Mercury				
Average	27	99	140	--
Range	22 - 34	58 - 140	140	--
Zinc				
Average	60	72	55	74
Range	14 - 89	23 - 121	55	15 - 105
Total HPAHs				
Average	50	22	34	62
Range	2 - 142	17 - 28	20 - 61	18 - 100

--results are not available for comparison

RPD less than 30 percent

RPD less than 66 percent

Table 13. Summary of City of Seattle Locations and Available Data for Five COPCs

Location	Sample Type	Mercury and Zinc	BEHP, PCBs, and HPAH
CB121	Catch Basin	5/23/2008	5/23/2008
		8/12/2010	8/12/2010
CB127	Catch Basin	10/10/2008	10/10/2008
CB128	Catch Basin	10/10/2008	10/10/2008
CB130	Catch Basin	10/23/2008	10/23/2008
CB81	Catch Basin	8/21/2003	8/21/2003
		11/22/2005	**11/22/2005**
MH12	Inline Trap	10/27/2003	10/27/2003
MH18	Inline Trap	2/20/2004	2/20/2004
	Inline Trap	**11/25/2008**	**11/25/2008**
MH207	Inline Trap	2/4/2009	--
MH208	Inline Trap	2/4/2009	--
MH209	Inline Trap	2/4/2009	--
MH236	Inline Trap	5/28/2009	5/28/2009
MH233	Inline Trap	5/27/2009	5/27/2009
RCB1	RCB	2/2/2004	2/2/2004
		11/25/2008	**11/25/2008**
RCB13	RCB	4/7/2004	4/7/2004
RCB204	RCB	3/26/2009	--
RCB205	RCB	3/26/2009	--
RCB206	Dirt	4/15/2009	--
RCB21	RCB	4/16/2004	4/16/2004
RCB216	RCB	5/28/2009	5/28/2009
RCB217	RCB	6/2/2009	6/2/2009
RCB218	Dirt	6/2/2009	6/2/2009
RCB35	RCB	6/30/2004	6/30/2004
RCB36	RCB	6/30/2004	6/30/2004
		11/25/2008	**11/25/2008**
RCB51	RCB	3/2/2006	3/2/2006
ST7	Inline Trap	2/18/2004	2/18/2004
		11/7/2005	11/7/2005
		3/31/2006	3/31/2006
		9/5/2006	9/5/2006
		9/5/2006	9/5/2006
		3/22/2007	3/22/2007
		8/13/2007	8/13/2007
		8/13/2007	8/13/2007
		4/9/2008	4/9/2008
		9/23/2008	9/23/2008
		9/23/2008	9/23/2008
		3/31/2009	3/31/2009
		3/31/2009	3/31/2009
		4/30/2010	**4/30/2010**

If multiple dates were sampled at one location, **boldface** dates were used.

BEHP - bis(2-ethylhexyl)phthalate

COPC - contaminant of potential concern

PCBs - polychlorinated biphenyls

HPAH - high molecular weight polycyclic aromatic hydrocarbons

RCB - Right of way catch basin

Dirt samples are opportunistic accumulations collected from the street.

Appendix A
Outfall and Storm Drain Access Locations

Table A-1. Storm Drain Access Location Information

Access Location Name	SPU Structure Number	Easting[1]	Northing[1]	Drain Diameter (in)	Approximate Elevation of Drain Bottom (feet above MLLW)[2]	Depth from surface to Drain Bottom (feet)
SQ1	D057-204	1272599.108	208570.076	24	11.3	11.1
SQ2	D057-197	1272356.607	208570.076	48	9.7	9.6
SQ3	D057-190	1271741.789	208576.1758	60	8.8	9.5
SQ4[a]	D057-185/D057186	1271118.199	208632.1407	24	8.7	6.5
DK1	D057-128	1273410.599	209545.8828	30	128.0	8.3
DK2	D057-118	1273080.508	210472.7861	42	10.2	13.3
DK3	D057-105	1272108.083	210480.4832	60	3.2	8.6
DK4	D057-091	1271764.926	210432.5503	42	4.8	10.8

a = SPU structure number could not be determined due to close proximity

1. Washington State Plane North, NAD 83, feet

2. The elevation for NF2095 is approximate

MLLW = mean lower low water

Appendix B
Synopsis of a Storm Sampling Event

Appendix B
Synopsis of a Storm Sampling Event

The purpose of this appendix is to document the sequence of events involved in targeting, mobilizing equipment for, and sampling storm events for both the LDW *Stormwater Lateral Loading Study* and *Accelerated Source Tracing Study*.

Identification of Potential Sampling Events

A forecasted storm event was selected for sampling if it met the following two criteria:

- An uninterrupted 0.2 inch of precipitation was predicted in the 24-hour forecast, and
- The event was predicted to span a minimum of 6 hours during a period when the LDW tidal elevation was less than +5 feet MLLW.

Throughout the sampling season, NewFields staff regularly tracked the short- and long-range precipitation forecast using the National Oceanic and Atmospheric Administration (NOAA) Quantitative Precipitation Forecast website: http://www.wrh.noaa.gov/forecast/wxtables/index.php?lat=47.5405059&lon=-122.3045438&table=custom&duration=7&interval=6.

The website was used to monitor predicted precipitation in 6-hour increments for the south Seattle area. This online resource is ideal for continual weather tracking, as the percent chance of precipitation, precipitation quantity estimates, and the timing of predicted rainfall are updated many times daily. These forecasts were used to identify "potential stormwater sampling events" when an uninterrupted interval of precipitation totaling greater than 0.2 inch was predicted.

After a potential stormwater sampling event had been identified, tidal elevations at the Lower Duwamish Waterway 8th Avenue S tide station were determined for the same time period using the website: http://www.protides.com/washington/776/. Simultaneous stormwater sampling at multiple locations required a tidal elevation below approximately +5 feet MLLW (for Lateral Loading Study locations) for the duration of the sampling event to prevent the sampling of tidal water within the storm drain lines. Sampling intervals greater than 4 hours in length were generally required to collect sufficient filtered solids to warrant analysis. As a result of the tidal elevation and sampling duration requirements, numerous potential storm events were not selected for sampling.

Mobilization

Once a potential storm event that met tidal elevation and sampling duration requirements was identified, a decision was made whether or not to sample the event. While attempts were made to sample most of these events, occasionally events were passed over due to either late changes in the amount or timing of predicted rainfall, or the unavailability of staff. The decision to sample an event was generally made the day before the predicted event due to the time required to mobilize and deploy sampling equipment. On the day prior to the sampling event, a 14-foot box truck was rented and loaded at the NewFields office with Isco units, batteries, pre-weighed filter bags, and tools required for sampling equipment deployment.

On the day of a sampling event, generally 8 to 10 hours before the initiation of sampling, the box truck was loaded with sampling equipment at the NewFields warehouse by the three or four field personnel who would be responsible for sampler deployment. Equipment stored at the warehouse included stormwater filtration units and pumps, harnesses for suspending equipment in the maintenance holes, the tripod and winch required to deploy gear, and safety equipment Typically, decontaminated carboys were picked up from ARI on the day of the sampling event. Filtration units were loaded with filter bags and Iscos were loaded with carboys at the warehouse to minimize the onsite preparation time of the samplers.

Deployment and Sampling

Upon arrival at a sampling location, the area in the vicinity of the maintenance hole was secured and blocked off from traffic using orange safety cones and signage in accordance with Street Use Permits obtained from the City of Seattle Department of Transportation. After removal of the maintenance hole cover, the stormwater suction line and flow sensor cord were retrieved from the vault and attached to the Isco. Two fully charged 12-volt batteries were secured to the top of the filtration frame and were connected to independent control boxes for the Isco and filtration unit. The Isco pump was tested to ensure the suction line was not clogged. Immediately before the deployment of the sampling gear, time programs were set for both the Isco whole water sampler and stormwater filtration units to run during the predetermined sampling event time interval. While in the field, the most current Doppler radar images were monitored to assess the trajectory and likely arrival time of the storm using the NOAA website: http://radar.weather.gov/radar.php?rid=atx&product=N0R&overlay=11101111&loop=no.

The tripod was set up over the open maintenance hole, and the Isco, filtration unit, and pump housing were suspended in tandem from the tripod winch line. As this equipment package was lowered into the maintenance hole, field personnel took care to ensure that electrical and suction lines did not become stressed or kinked. Once the package was hanging within the maintenance hole, a tag line was used to position and secure the pump housing in the center of the storm drain channel. At this point the weight of the equipment was transferred to the hanger bracket positioned across the maintenance hole opening. The final step in deployment was the replacement of the maintenance hole cover. Deployment of equipment generally took an hour per location.

Sample Recovery and Demobilization

Generally, the sampling interval ended within 12 hours. The sampling locations were revisited to retrieve equipment and collect the samples. The tripod and winch were utilized to remove the equipment package from the maintenance hole. Once the equipment was at the surface, the Isco sampler was opened and the carboy containing stormwater was capped and transferred to an ice-filled cooler. Filter housing stopcocks were opened to allow the retained stormwater to drain back into the maintenance hole. Filter bags were squeezed of excess water, placed in plastic bags, and stored on ice. Totalizer volumes were recorded in the field logbook. The suction line was disconnected from the Isco, capped, and secured in the maintenance hole along with the flow sensor cord.

After the sampling equipment had been recovered from all sampling locations, sample carboys and filters were immediately delivered to ARI on ice. Filtration units and deployment gear were returned to the NewFields warehouse. Isco samplers and batteries were returned to the NewFields office. Batteries were charged in preparation for the next sampling event, and both flow and conductivity data were downloaded from the Isco units. The precipitation record for the sampling event was obtained using the Seattle Boeing Field (KBFI) rain gauge data available at: http://www.wrh.noaa.gov/mesowest/getobext.php?wfo=sew&sid=KBFI&num=48&raw=0&dbn=m.

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Appendix C
Challenges of Stormwater Sampling

Appendix C
Challenges of Stormwater Sampling

The purpose of this appendix is to document many of the challenges incurred during the execution of the LDW Stormwater Lateral Loading Study and Accelerated Source Tracing Study. Specifics regarding the difficulties associated with weather predictions, site conditions, and sampling equipment are included in this discussion. Because the same challenges will likely be confronted during future LDW stormwater sampling efforts, the lessons learned from this study can be used to help increase the efficiency and sampling efficacy of future stormwater sampling projects.

Rainfall Prediction

The decision to initiate storm event sampling was based largely on quantitative precipitation forecasts for the south Seattle region available from NOAA. These forecasts are frequently updated with the percent chance of precipitation, precipitation quantity estimates, and the timing of predicted rainfall. A storm event was generally selected for sampling when an uninterrupted interval of precipitation totaling greater than 0.2 inch was predicted in the 24-hour forecast. The storm event also had to meet tidal requirements (see Section 2.0).

Unfortunately, predicted storm events often did not materialize as they were forecasted. Storm activity often shifted several hours, generally occurring later than was predicted in the previous 24 hours. On numerous occasions, sampling equipment was installed and programmed to sample during the tidal window, but the late onset of precipitation caused the collected samples to consist mainly of base flow. Instances also occurred when storm activity shifted so far beyond the tidal window that sampling was cancelled mid-way through the equipment installation process. To minimize such occurrences, adjustments of sample start/stop times were made in the field to account for the current, rather than predicted, weather conditions. This was accomplished in the field by using cell phones to view real-time Doppler radar images in order to track the movement of specific storm pulses.

Tidal Constraints

Stormwater outfalls that empty into the LDW are often submerged at high tide, allowing river water to flow up into the storm drain lines. Figure C-1 identifies the extent of tidal intrusion into stormwater lines in the LDW basin at mean higher high water (MHHW). MHHW for the LDW is +11 feet MLLW. Lateral lines and private storm drain lines are not included on this figure. Large areas where no structures are displayed in Figure C-1 generally indicate regions drained by private storm drain lines, regions that drain to combined sewers, or areas where public storm drain lines have no available elevation data associated with them.

Figure C-1, in conjunction with observations made during field reconnaissance, suggests the following:

- Public storm drain lines west of the LDW experience tidal intrusion to the base of the Highland Park hill.

- Most private and public storm drain lines east of the LDW experience some tidal intrusion.
- Certain storm drain lines east of the LDW, such as the Duwamish/Diagonal CSO/SD and the I-5 storm drain to Slip 4, experience tidal intrusion all the way to I-5.

Stormwater sampling of a tidally influenced storm drain greatly constrains the storm event sampling window to prevent stormwater contamination by tidal water. The elevations of sampling locations for the *Stormwater Lateral Loading Study* ranged from +5.4 to +9.1 feet MLLW (Table A-2). Tides played a substantial role in determining whether a predicted storm event was selected for sampling since simultaneous sampling of all locations could only occur below a tidal elevation of +5.4 feet MLLW. This requirement generally restricted sampling to a 6- to 10-hour low-tide window. Such restriction of the sampling window prevented sampling over the entire duration of the storm hydrograph. Figure C-2 displays the tide and precipitation records for a two-week period over the wet season. During this time interval there were periods when tides were too high to allow sampling, acceptable tides without precipitation, and both successful and unsuccessful storm sampling events.

Not only did tides constrain the window over which samples could be collected, but they also constrained the window within which subsurface sampling equipment could be installed. Depending upon the sampling location, as much as 6 feet of tidal water could be present within the maintenance hole at high tide. While the sampling equipment was designed to be water-resistant, the digital timer, totalizers, batteries, and Isco units could not be submerged. Therefore, the long-term deployment of the sampling equipment would have resulted in severe damage. This restriction required the recovery of sampling equipment before the onset of the highest tides.

Calculation of lateral loading requires an estimate of stormwater volume. This volume can be derived through measured flows, modeling, or a combination of the two. In the case of estimating loading from an intertidal outfall, tidal exchanges influence both water velocity and depth measured by in-line flow sensors. Unfortunately, the resulting flow data cannot easily be corrected for tidal influence. Tidal water in the storm drain lines regularly increased water depth in the maintenance hole by many feet and slowed drain line velocity to near zero. Also, the Isco unit required to record these data could not remain deployed long-term at the sampling location without risking damage to the unit at high tides. Therefore, contaminant mass loading calculations for intertidal outfalls must rely heavily on predicted stormwater flows derived through watershed modeling.

Mobilization Time

Simultaneous storm event sampling at multiple locations required significant time immediately prior to the storm to prepare and install stormwater sampling equipment. After a predicted storm event that meets precipitation and tidal requirements was identified, the following mobilization tasks had to be completed before the onset of the storm:

- Rent box truck,
- Acquire decontaminated carboys and weighed filter bags from ARI,

- Install carboys in Isco units and filter bags in filtration units,
- Program Isco and filtration unit timers based on precipitation prediction and tidal elevation,
- Transport Isco units, batteries, filtration units, stormwater pumps, deployment tools, and safety equipment to sampling locations, and
- Deploy subsurface sampling equipment at sampling locations.

These tasks generally required a minimum of 8 hours to complete prior to sampling. Because of this extensive preparation time, mobilization activities usually were begun the day before a sampling event. On occasion, this investment of time and effort was lost when mobilization activities were begun the day before an event, and then sampling was cancelled the next day due to a change in the precipitation prediction.

Site Access

One of the criteria used to choose specific storm drain access locations for sampling was their ease of access. Despite this, activities by other parties involved in storm drain maintenance, subsurface utility work, and surface asphalt repairs occasionally restricted the ability to sample a particular location. In one instance (1/4/2011) a sampling event was cancelled because Seattle Public Utilities was in the process of jet cleaning the Snoqualmie storm drain line when the field crew arrived on site. It is likely that this jet cleaning disrupted the bedload sediment trap deployed at location SQ3. On another date, sampling equipment could not be deployed at a sampling location (DK1) because Seattle Public Utilities was performing a video survey of the drain line. During the entire month of April, access to locations DK3 and DK4 was impeded during daylight hours due to sewer work and road repair along S Dakota Street.

Subsurface Sampler Placement

All sampling equipment for this study was deployed subsurface within storm drain maintenance holes in order to provide security for the equipment and prevent obstructions in roadways. Although all sampling location maintenance holes had diameters of 24 inches, subsurface ladders and ledges restricted the maximum horizontal dimension of sampling equipment to 17 inches. This dimension limited the volume of whole water and filtered solids that could be collected by restricting the size of the samplers that could be deployed. The Isco 6712c, with a maximum carboy size of 2.5 gallons, was the largest whole water sampler that would fit in all locations. The solids filtration units were designed with a maximum horizontal dimension of 16 inches, the minimum dimension required to fit two parallel filter housings.

Once sampling equipment was fully deployed within the maintenance hole, it remained in place until after the conclusion of a sampling event. The equipment took up so much space within the maintenance hole that it was difficult to do any troubleshooting after deployment. Occasionally a critical error would occur during sampler deployment (e.g., suction hose dislodging) that would not be recognized until sampler recovery. Also, modifying the sampling time program (adjust Isco and filtration unit timers) to account for changing weather predictions could not easily be done without complete removal of the sampling equipment from the maintenance hole.

DC Power

Two 12-volt DC batteries were required to power the Isco sampler, flow sensor, conductivity sensor, filtration unit timer, and bilge pump. This was sufficient power to run all components concurrently for a minimum of 12 hours. Back-to-back sampling of two storm events within a day of each other was not possible because the batteries required a full day to recharge after an event.

The use of DC power limited the design and capacity of the stormwater pumps that could be used for the filtration unit. The pumps used had a maximum capacity of 2,000 gallons per hour when operating with no resistance. However, back-pressure created by the filter bags and hydraulic head caused by the position of the pump below the filtration housings dramatically reduced the pump capacity. In order to minimize resistance, filtration housings were lowered as close to the bottom of the maintenance hole as possible to minimize the amount of hydraulic head that the filtration pumps would have to overcome.

Deterioration of Subsurface Equipment

Harsh conditions within the maintenance holes deteriorated much of the sampling equipment over the course of the sampling season. The flow sensors and suction lines were the only equipment that remained installed in the maintenance holes throughout the duration of the sampling season. Suction line inlets, located along the bottom of the storm drain lines, at locations KC2062 and PS2220 intermittently became clogged with solids. An air compressor was used to clear the line at KC2062, but solids from the PS2220 line could not be dislodged. The suction line installed at PS2220 was abandoned, and instead a new suction line was deployed attached to the filtration unit pump during every sampled event.

Although the sampling equipment was only deployed within the maintenance holes during sampling events, this was sufficient exposure to damage some of their components. While hanging in the maintenance holes, the sampling units were subjected to surface runoff pouring into the holes through the access hole and partial submergence by tidal water. These wet, dirty conditions caused a deterioration of numerous electrical fittings and fuses. All electrical connections needed to be tested prior to deployment to ensure they were working properly. In one instance, filtered solids samples were not collected during sampler deployment due to a blown fuse.

Transport, deployment, and recovery of sampling equipment also contributed to sampler wear. The tight fit of the filtration units within the maintenance holes occasionally caused sampler hoses to snag on ladders within the holes, causing loosened connections or cracks in the hose. The glass carboys contained within the Isco samplers were subjected to substantial jostling during deployment and recovery. Three carboys broke subsequent to sample collection over the course of the sampling season, likely due in part to hairline fractures created in the glass after repeated use.

High Velocity Locations

Over the course of the sampling season it became evident that water velocity and depth could not be accurately measured at locations DK1 and DK2 using the Isco flow sensor. Stormwater velocity at these two locations was greater than at other sampled locations due to the steep gradient of the drain lines. Stormwater velocity and depth data were not obtained from either location because of sensor malfunctions that may have been caused by the turbulence of the stormwater flow. In the case of location DK1, the velocity during heavy rain events was intense enough to shear the bolts securing the flow sensor to the mounting ring, causing significant damage to the sensor. At location DK2, the high velocity and steep gradient caused flowing water to spray throughout the maintenance hole as it passed over the flow sensor, preventing the sensor from collecting accurate measurements.

The high velocity flow at DK2 prevented the collection of filtered solids using the same filtration unit design deployed at other locations. Even with 20 pounds of weight secured to the pump cage, the storm flow at DK2 caused the pump to hydroplane. The pump design was reconfigured for this location to create a stilling well, increasing the water depth and decreasing turbulence. The pump was fastened inside of a 5-gallon bucket that had holes drilled through its lower half. A confined space entry crew was utilized to install an anchoring point (eye bolt) to the center of the storm drain pipe directly below the maintenance hole. During pump deployment for a sampling event, the base of the stilling well was secured to the anchor using a rope. This anchored stilling well allowed a sufficient amount of water to continually collect to keep the pump operating.

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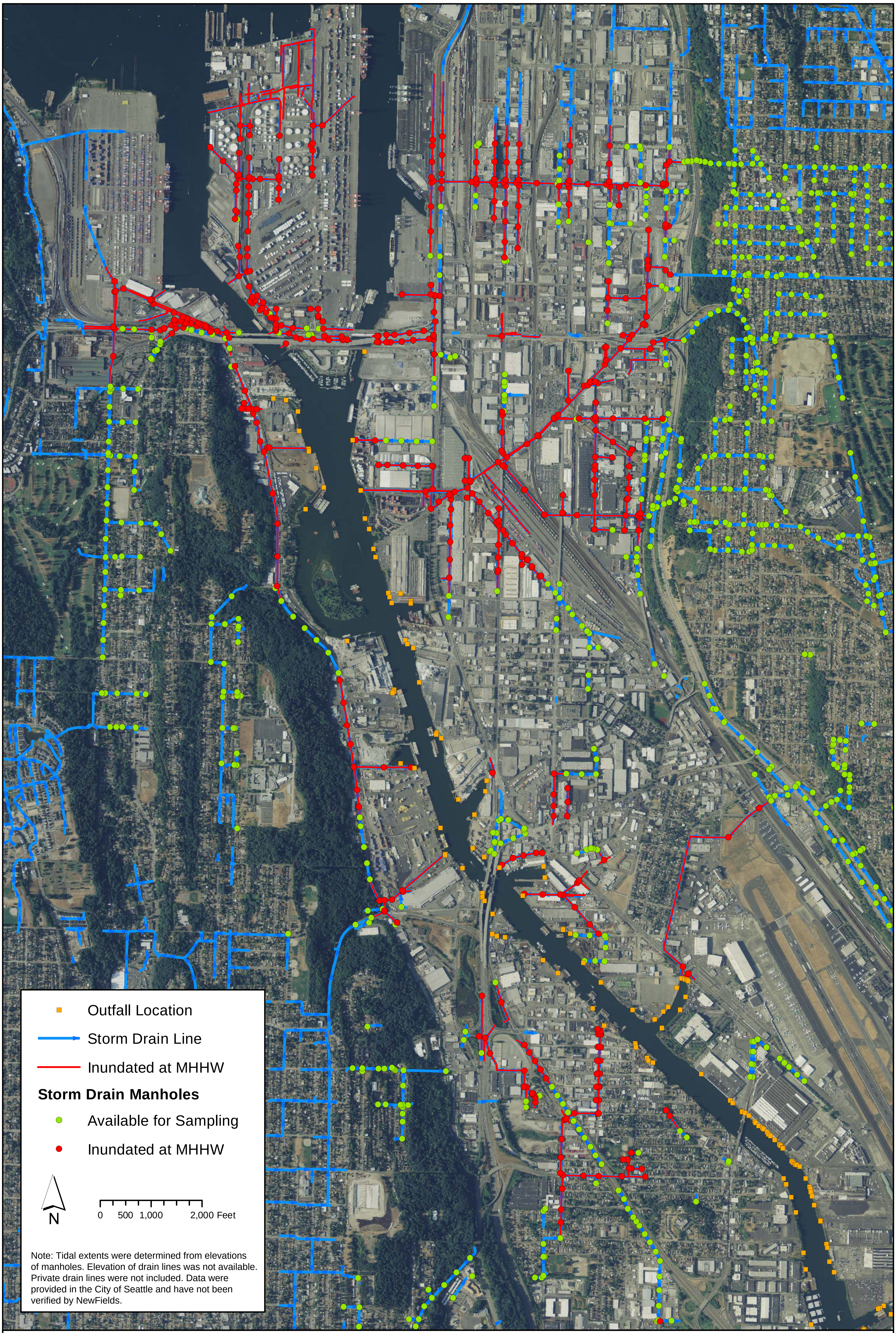

Figure C–1. Extent of Storm Drain Tidal Water Inundation

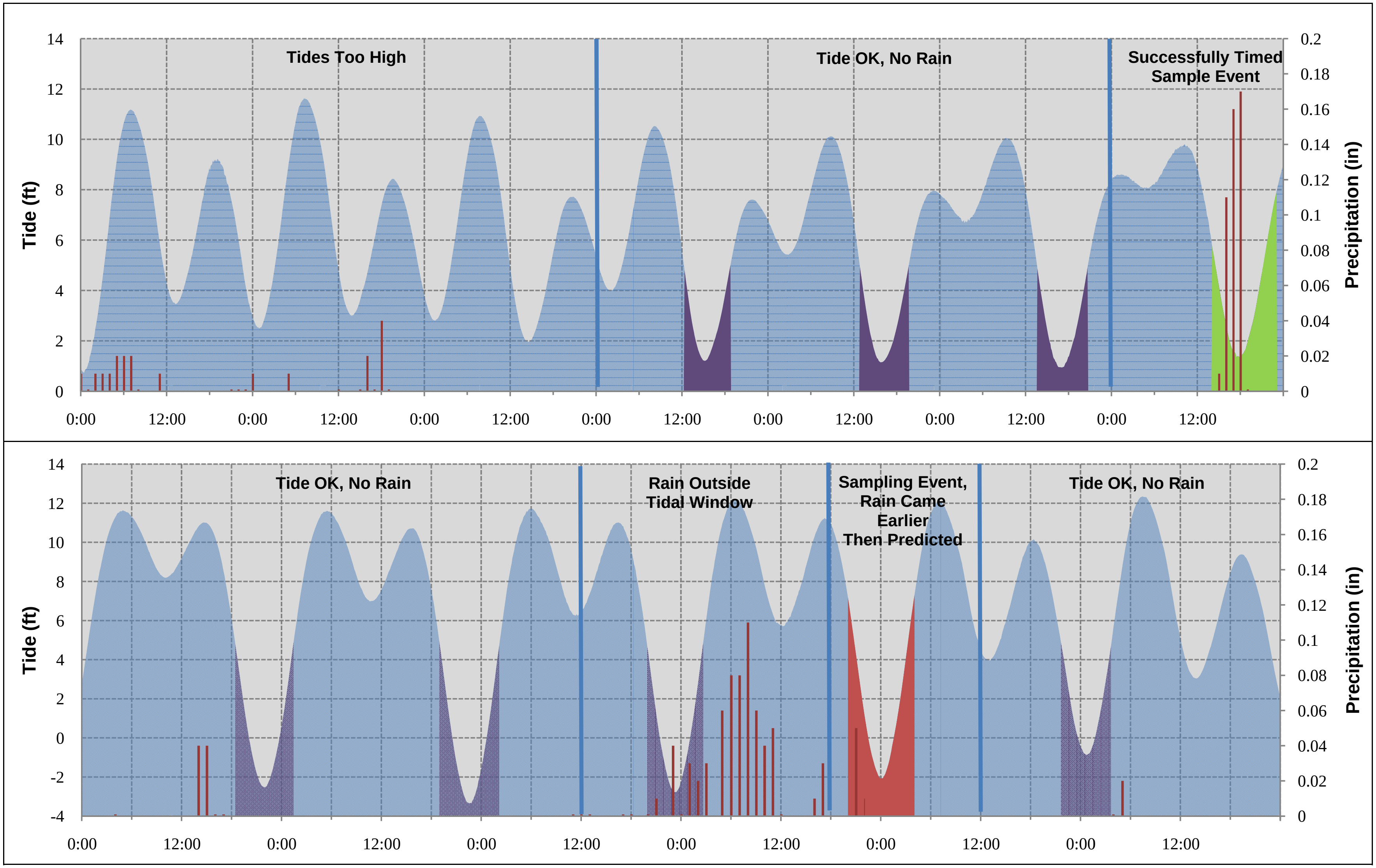

Figure C–2. Sampling Restriction Caused by Tides and Precipitation

Appendix D
Field Logs

11/4/10 low tide 4'3" @ 9:54
8th St. Station

ClearCreek installations

Dakota Street (660 S. Dakota St)

☆ 9am tidal influence abates
~10 am tidal influence

- 2 nalgene sed traps
- 1 sed trap box
- Flow sensor and intake line

- 2 eye bolts (pump cage + filter frame)

1

Rite in the Rain

11/4/2010 10:15am

3925 9th ave S (End of Dakota)

Photo on iPhone of parking/cones
- Flashing truck lights: 4 4.5' Narrow Cones

- 2 sed traps + bottles in

- Flow sensor + inlet tubing + tie strap

- eye bolt for pump.

large drop before vault, room
for vertical harness,

2

Rite in the Rain

12:30 4601 6th ave S.

* photo of traffic diversion setup

- Flow sensor and intake hose + Steel strap
(2×#4; 2×#2; 1×#1 60")

- 2 sediment traps

- 1 ecology sed trap

- no eyebolts installed, tie from rung
* Caps removed from sed traps

finished @ 13:45

We'll have to suspend pump about
1.5 feet above vault floor. Pumpstand? 3

"Rite in the Rain"

13:55 Snoqualmie + airport way

- no tidal influence yet

- 2 sed traps
- Flow Sensor and intake
(2×#1) 24"
- no eyebolts

* Caps removed from sed traps
leave @ 14:55

4

"Rite in the Rain"

15:05 4535 10th ave S 98144
(Decatur + 10th)

- Residential neighborhood, no traffic

- 2 sed traps installed
- Flow sensor + intake
↳ (2×#2 · 30")

- 1 eyebolt installed near inflow side

5

Rite in the Rain.

Field notes Nov 12 2010

Bad sensor readings

- End of Dakota
- Snoqualmie and 6th

☆ Site name for Snoq + Airport must be programmed on the ISCO

6

Rite in the Rain.

1/11/11

ISCO Programming Parameters

Site	Pipe (inches)	Time
NF2095	36"	5pm - 10pm
KC 2062	48"	5pm - 10pm
PS 2220	30"	3pm - 8pm
BDC 2088	(?) 24"	6pm - 10pm

- 1L every hour
- Set minimum level as low as possible

7

Rite in the Rain

1/12/201 Lateral Loading

Deployment of gear for sampling

9:30 Arrive @ storage unit to prep gear

10:45 Install gear @ Port

2:00 meet up with Clearcreek to ~~fst~~ install flow sensor at BDC 2088. 36" diameter

4:00 Sampler installed at BDC

4:15 Install gear at KC 2062
ISCO left outside of manhole
Large amount of baseflow

5:30 Install gear @ NF2095

8:00 Rain starts in Seattle

8

Rite in the Rain

1/13/01 Lateral Load Recovery

7:30 Check inventory
Go to storage to get
Ziplocks and carboy lids.

8:30 Arrive @ BDC 2088
Carboy is half full, program
ended before filling due to
delayed rain.
No Solids filtration due to
late rain.

Line is underwater @ ~8 ft.

9:30 Done @ BDC 2088
Water Sample was the only collected

9:35 Arrive @ NF 2095

9

Rite in the Rain

10:00 NF 2095 No water
Issue with time program
Totalizers: 740
773
Filter bags have some sediment
but not much
LDW/LL-NF2095A-011211-S
LDW/LL-NF2095B-011211-S

10:33 Done at KC2062
Water and Sediment collected
Carboy overfilled, but water
sample was fine.
ISCO Purge program will need
to be adjusted.
This line is inundated with
tidal water at ~8 ft.
Totalizers A=375 B=346
11:30 Done @ PS 2220
Water sample collected

10

Rite in the Rain

1/13/11

PS2220 No sediment sample collected. There is a ledge underneath the ladder. The filter housing needs to be slid into place with the tether line. The pump will only sit along the bottom if this tether is used to move it into place.

11:45 On way to warehouse to offload gear. Samples will be delivered to lab. Batteries and tools will be returned to Edmonds office.

[signature] 11

Rite in the Rain

- Dakota + 9th modification 1-19-2011
- Replace AST Sed traps

1600: Arrive @ Dakota & 9th
low enough flow to install eyebolt in center of vault. Intake line reinforced w/ hose clamps and wire. Presence of steel ring and sensor causes flow to kick up significantly. Collected sed trap bottles w/ good amt. of sediment. labeled DK2 temporarily

o 1800 Arrive @ Snoqualmie Airport to replace sed traps. Labeled SQ1. Gear is in good shape.

12

Rite in the Rain

o 1835: Arrive @ Snoqualmie + 7th
No issue w/ ~~standing~~ water.
Pulled old sed traps, installed
new ones. Labeled bottles SQ2
Gear looks good.

o 1855: Arrive @ Snoqualmie + 6th
Some standing water in vault to
level of pipe, Possibly more
sediment in vault compared to recon.
Replace bottles, labeled old ones
SQ3. Gear looks good. Sed trap OK.

o 1910 Arrive @ Dakota + 7th, no tidal
effects. Replacing bottles w/new
ones. Samples labeled DK3
Steel sed trap was turned 180°;
Clearcreek faced it correctly.

13

Rite in the Rain.

o 1925 Arrive @ Dakota + 6th
Replace Bottles w/ new ones. Samples
labeled DK4. Gear looks good
No tidal effects

o 1940 Arrive @ Snoqualmie + 4th
Replace Bottles w/ new ones
Samples labeled SQ4.
No tidal effects

o 2000: Arrive @ Dakota + 10th
Replace bottles w/ new ones
Samples labeled DK1. One
sed trap came loose, bottle missing
(Just the hinge-bolt came loose),
ONLY one Sample for DK1.

14

Rite in the Rain.

o 2210: Arrived @ Norfolk to put ISCO in storm drain w/ SAlinity Sensor. ~~BBC~~ ISCO is being used to test flow meter/level sensor. ISCO Renamed to NF2095 and installed w/ a top hanging Battery, w/ pump cage hanging from steel ring.

15

Rite in the Rain

1/20/11

Sampling Event #2
Lateral Loading
AST ~~Ab~~ Dakota Line

Filtered Solids Samples

Bag #	Sample Name	Weight
17	LDW/LL PS2220A-012011	62.26
18	PS2220B	64.33
19	BDC2088A	62.05
20	BDC2088B	63.63
21	NF2095A	67.77
22	NF2095B	62.73
23	KC2062A	61.88
24	KC2062B	69.86
25	DK1A	63.23
26	DK1B	61.73
27	DK2A	60.93
28	DK2B	60.63

16

Rite in the Rain

#29	DK3A	65.48
30	DK3B	67.31
31	DK4A	62.33
32	DK4B	63.05

12:54 At warehouse preping gear
No rain yet

Preston
Jon
Will

1309 On way to Install @ Port
Left AST gear in warehouse

1320 Check in w/ Al Zurawski @
Northland Services

1400 Done installing PS2220
Time program:
8PM - 2AM

17

Rite in the Rain.

15:22 Done at Norfolk
NF2095
Time Program: 8PM - 2AM

15:35 Done at BDC
BDC2088
Time Program: 8PM - 2AM

16:15 Done with install @ KC
KC2062
Water in pipe @ 16:00
tide or puddle?
Time Program: 8PM - 2AM

1620 On way to warehouse to
get AST gear

18:00 Done with install @ DK2
Time Program 8PM - 4AM

18

Rite in the Rain.

1900 Done with install @ DK1
Pump filtration housing and ISCO
are hung independently

1915 Reprogram ISCO @ DK2
1930 Dinner break

2030 Set up gear @ DK3
All gear is on surface
We can see this site from DK4
No program set, will trigger
manually

2200 Setup gear @ DK4
ISCO on surface, Filtration
suspended from hanger

2300 Still waiting for rain

2330 Abort! No rain. Tide is rising
Samples collected to this point is baseflow

"Rite in the Rain" 19

1/21/11 Sampler Recovery

830 Preston, Jasper, Jon meet
at warehouse

930 Gear removed from PS2220
Water sample collected
No solids ~~et~~ collected, flow was
probably too low to trigger float

LDW/LL-PS2220-012011-W

1010 Gear removed from BDC 2088
No water or sediment samples
Water was probably to low to
trigger pump
Suction hose came lose, so
no water was collected

"Rite in the Rain" 20

~~10/~~
1/21/11

10:20 NF2095
Water ~~sam~~ and Sediment
Samples collected.
Filter Solids Totalizers
A = 958 g
B = 860 g

1055 Removed gear from KC2062
Sediment Sample Collected
No Water Collected
Not enough rain to be
above baseflow trigger

Lateral Load Summary

PS2220	X	Water
BDC 2088	X	X
NF2095	Sed	Water
KC2062	Sed	X

21

"Rite in the Rain"

1/21/11

11:30 Removed gear from DK2
Half a water sample
No sediment - this setup
will not work. One of
the totalizers registerd 8000g
to other Zero. Must have
something to due with air
pressure.

12:45 Gear removed from DK1
Sediment Sampled, but no water
May be due to program or
baseflow setting or Air
in Line
Totalizer Readings
A = 186
B = 27
Not much water filtered

22

"Rite in the Rain"

1/21/11

1250 Heading to warehouse to drop off gear

AST Summary

DK1	Sed	X
DK2	X	Water
DK3	X	X
DK4	X	X

23

"Rite in the Rain"

1/26/11 Baseflow Sampling

Filter Bags

Lab #	ID	Weight (g)
33	LDW/LL-NF2095A-012611-S	59.15
34	NF2095B	64.79
35	KC2062A	63.75
36	KC2062B	63.31
37	PS2220A	61.18
38	PS2220B	60.79
39	LDW/AST-DK1A-012611	62.38
40	DK1B	67.27
41	DK2A	61.45
42	DK2B	63.27
43	DK3A	70.54
44	DK3B	63.92
45	DK4A	62.30
46	DK4B	67.71

24

"Rite in the Rain"

7:00 Jon picks up deconned carboys from ARI

8:00 Jon, Preston and Jasper meet at warehouse to load gear

10:00 Done @ NF2095
Water sample collected immediately
Solids sampler left in manhole
Time Program 10 AM - 5 PM

10:33 Done with install @ KC2062
Water and solids samplers set for low tide window
Time Program 2 PM - 8 PM

11:24 Done with install @ DK1
Water sample collected immediately
Solids sampler left in manhole
Time Program 11:20 AM - 11 PM

25

"Rite in the Rain"

1310 Done with install @ DK2
Water sample collected immediately
Sandbag set at downstream end of vault. Pump set in puddle upstream of sandbag
Time Program 1:00 PM - 12 PM

1410 Back at warehouse to load gear for DK3 and DK4

1450 Arrive @ DK4 and attempt water sample
No Baseflow

1530 Begin Sampling at DK3
Water collected immediately

1736 Stop filtration units at DK3

[signature]

26

"Rite in the Rain"

1/27/11 Baseflow Sample Pick-up

10:00 Meet at warehouse
Leon
Alisa - SAIC
Preston
Jon

1050 Done at NF2095
Solids samples collected

1106 No water collected at KC2062
~~probably the rain~~
The program was set for a 1 foot trigger. We will come back later in the day to collect water.

1151 No solids collected at DK2
Water not deep enough.
Won't ever be able to set solids here

"Rite in the Rain"

27

1218 Solids collected at DK1
Sandbag worked well

1320 Water sample collected at KC2062
Filtration setup removed

1451 Offload gear at warehouse
remove all samples from ISCOs and filter housings

1500 Take samples to lab

Totalizer Log

DK1	A = 2516	B = 2837
DK3	A = 429	B = 293
NF2095	A = 1850	B = 1485
KC2062	A = 107	B = 102

"Rite in the Rain"

28

2/2/11 Base flow Sampling
Snoqualmie line

Filter Bags

#	Sample	Weight (g)
SNY ~~47~~ 47	SQ1A-020211	62.81
48	SQ1B-020211	66.19
49	SQ 2A-020211	66.91
50	SQ 2B-020211	69.60
51	SQ 3A-020211	61.74
52	SQ 3B-020211	61.60
53	SQ 4A-020211	65.83
54	SQ 4B-020211	59.43

8:00 Jon, Jasper, and Preston meet at warehouse to load gear

9:24 Water sample collected at SQ3 Filtration Unit left pumping

29

"Rite in the Rain."

10:00 Water sample collected at SQ2 Filter unit left pumping. 1 sand bag

10:05 Dead battery in truck! Jumped using our battery and cables

10:50 Water sample collected at SQ1 Filter unit left pumping 2 sandbags placed

11:20 Water sample collected at SQ4 Very little baseflow, too little for filtered solids sampling.

1355 Collect Filtered solids @ SQ3
Platizers A = 1242 g
B = 1430 g

30

"Rite in the Rain."

14:05 Pull filtered solids at SQ2
Totalizers:
A = 1389 g
B = 1315 g

14:20 Pull filtered solids at SQ1
Totalizers:
A: 1193 g
B = 920 g

1425 Heading to warehouse to offload gear.

1505 Done offloading. Deliver samples to ARI.

31

"Rite in the Rain"

2/4/11 Lateral Loading Sampling

Filter Bags

#	Location	Weight (g)
53	NF2095A	65.83
54	NF2095B	59.43
55	KC2062A	67.18
56	KC2062B	64.21
57	BDC2088A	61.80
58	BDC2088B	66.05
59	PS2220A	63.39
60	PS2220B	61.45

7:30 Meet at warehouse to load gear for LL locations
Jasper, Jon, Jason Little
Samplers set from Sat. 9PM - 3AM
This is the tidal window for all locations.

32

"Rite in the Rain"

9:00 Gear installed at NF2095
Lots of baseflow.
Time program set Sat 9PM-3AM

9:34 Gear installed at KC2062
Lots of baseflow
Time program set Sat 9PM-3AM

10:17 Gear installed at BDC2088
No flow. Tide out.
Time program set Sat 9PM-3AM

11:00 Gear installed at PS2220
Low flow; pretty clean compared to previous visits. Catch basin sediment sock at bottom of vault. Excavation taking place all around manhole. Tide out.
Time Program set 9PM-3AM

33

"Rite in the Rain"

2/7/11 LL Sample Recovery

920 Meet at warehouse to load gear.
Crew: Jasper, Jon, Jason Little

There was far less rain than initial predicted during the 9PM to 3AM window.

Today is dry and overcast. Rain was predicted for today too.

940 Talked with Al Zurawski at Port. He said that the area around PS2220 is having an overflow tank installed underground. The area should be repaved by the end of the month.

34

"Rite in the Rain"

10:08 Done removing gear at PS2220
Both water and solids collected.
Water level in the carboy is
low, indicating water level in
the drain line was low for
most of the sampling interval.

10:32 Done removing gear at KC2062
Water and solids collected.
Totalizers registered low volumes.
Either the filters clogged
quickly or there is an issue
with the pump.

10:55 Done removing gear at BDC2088
Only water collected. No solids
filtered, probably due to low
water level.

35

"Rite in the Rain"

1110 Done removing gear from NF2095
Water and solids collected
Vault smells like poo.
Heading back to warehouse
to offload gear and process
samples.

11:56 Totalizer Volumes

PS2220 A	919 gallons
PS2220 B	1162
NF2095 A	1288
NF2095 B	1449
KC2062A	77.4
KC2062B	68.9
BDC 2088 A	0
BDC 2088 B	0

12:00 Take samples to ARI

36

"Rite in the Rain"

2/11/11 LL/AST Sampling Deployment

7:00 Meet at warehouse to load gear. Preston went to lab to get carboys.

Jon, Jasper, Preston, Jason Little

9:15 10ft tide * Bridged float switch installed the Port ISCO & solids units, set timers to sample Sat (12th) 1500 - 22:00

9:10 installed @ Norfolk set timers to sample 14:00 - 23:00 Sat (12th)

9:35 Installed @ BDL Bridged float switch 14:00 - 23:00 Sat (12th)

37

Rite in the Rain

10:00 Install @ KC Bridged float switch 14:00 - 23:00 Sat 12th

11:20 Install @ SQ3 set timers for 14 - 23:00 Sat 12th

12:15 Install SQ1 set timers 14:00 - 23:00 Sat 12th

2/14/11

Crew: Jasper B. Preston M. Jon N.

10:03 recovered @ the Port - ISCO only sampled ~1 Liter of water

* ISCO line appears to be clogged → trouble pumping water both forward & back

38

10:30 Recover @ Norfolk
- Full recovery on ISCO
- minimal volume on filtered solids unit
- pump tested out fine so likely clogged filter bags

10:50 Recovered @ BDC
- Full ISCO

11:10 - Recovered @ King County Airport
- Full ISCO

11:45 - Recovered @ SQ1
- Full ISCO
- Filtered Solids collected

12:00 Recovered @ SQ2
NO ISCO *kinked hose
Filter Solids collected

39

Rite in the Rain

12:17 Recovered @ SQ3
- Full ISCO
- Filter Solids collected

12:40 Recovered @ SQ4
- Full ISCO
- Filtered Solids Collected

1326 Totalizer Log

Location	Volume (g)
PS2220A	103
PS2220B	140
NF2095A	26
NF2095B	63
BDC2088A	80
BDC2088B	72
KC2062A	89
KC2062B	63

40

Totalizer Log Cont.

Location	Volume (g)
SQ1A	557
SQ1B	454
SQ2A	83
SQ2B	93
SQ3A	522
SQ3B	464
SQ4A	223
SQ4B	289

1345: Deliver Samples to Lab

Rite in the Rain

41

3/1/11 Sampler Deployment

11:30 Leave Edmonds for warehouse

Jon, Preston, Jasper

12:00 Prep gear at warehouse
Install all filter bags and carboys

13:15 Check in with Al at Port

14:00 Tried to clear line at Port using air compressor, but this didn't work too well.
Set 7PM - 12

1440 Gear installed at NF2095
Set 7PM - 12

1525 Gear installed at BDC2088
Set 7PM - 12

42

3/1/11

★ NF2095 and KC2062 filter bags have been swithed

Bag	Sample	Weight (g)
★ 77	KC2062A	59.71
78	KC2062B	66.06
79	NF2095A	64.50
80	NF2095B	64.08

1615 Gear installed at KC2062
Suction line was plugged.
Used air compressor to clear line. Error message on Isco suggests changing pump line tubing.
Set 7PM - 12

1630 Load DK gear at warehouse

Rite in the Rain

43

3/1/11

1755 Gear installed at DK2
Water sample collected immediately. New filtration unit seems to be working
Set 6PM - 12

1900 Gear deployed at DK1
Set 7pm - 12

Waiting for it to rain before sampling at ~~DK2~~ DK3 and DK4

2130 No rain yet. Radar shows no incoming rain.

Sampling abandoned for the evening

44

3/2/11 Sample Recovery

900 Meet at warehouse to unload gear from last night.

945 Gear removed from PS2220 Filtered solids collected, but no water. The suction line is still clogged. For the next event a new, weighted suction line should be ~~brou~~ brought out and deployed from surface.

1015 Gear removed from NF2015 Both filtered solids and water collected.

1030 Gear removed from BDC2088 Both solids and water collected

Rite in the Rain

45

3/2/11

1045 Gear removed from KC2062 Solids and water collected

1115 Gear removed from DK2 Solids collected. Water collected yesterday

1140 Gear removed from DK1 Water collected ~~by~~ but no solids. Fuse on filter unit blew.

1150 Unload gear at warehouse Prep samples for lab

46

3/2/11

Totalize Volumes

NF2095A	1435
NF2095B	1011
KC2062A	248
KC2062B	255
PS2220A	1697
PS2220B	1677
BDC2088A	121
BDC2088B	115
DC2 A	883
DC2 B	4205

"Rite in the Rain"

47

3/4/11 Sampling LL and
SQ lines - Will, Preston, Jasper

8:00 met at storage facility
9:45 installed samplers at
Port. set timers for
7PM FRI to 3AM SAT
installed new ISCO suction line
~15ft

10:00 Installed Norfolk
7PM FRI - 3A SAT

10:40 Installed BDC
7PM Fri - 3A SAT

1105 Installed KC
7PM Fri - 3A SAT

48

1320 installed SQ4
Timers set 7P Fri – 3A Sat

1345
~~1400~~ installed SQ3
Timers set 7P Fri – 3A Sat

1415 installed SQ2
Timers set 7P Fri – 3A Sat

- drains at both SQ3 and SQ2 contain a white material, possibly plastic? with coarse particle size

1430 installed SQ1
Timers 7P Fri – 3A sat

Back to warehouse.

Rite in the Rain 49

3/7/11 Will, Jasper, Preston left office

1000 Port
totalizer
A 272
B 257.7
Isco collected sample

1030 Norfolk
A 1555.26
B 1587.0
Isco collected sample

1045 EDC
A 43.1
B 82.2
Isco collected sample

50

1105 KC
Totalizer
A 740.6
B 305
Isco collected sample

1145 SQ4
A 1619.6
B 820.8
Isco collected sample

1240 SQ3
A 1041.1
B 62.1
Isco sample collected

1300 SQ2
A 28.9
B 32.3
Isco sample collected

"Rite in the Rain" 51

1315 SQ1
no filtered solids,
Isco sample collected

1330 To Costco to pick up
sed-trap caps left by Beth

1515 samples to lab

5/10/11 crew: J. Baas, J. Nuwer,
L. Delwiche, R. Martin

8:00 meet @ warehouse load
bags & carboys

9:40 Deploy @ Port
Timers set 12-5pm (10th)

10:15 Deploy @ Norfolk
timers set 12-5pm (10th)

52

10:30 Abort Sampling
Rain isn't developing as predicted
→ pulling all deployed units

10:50 Recovered @ Norfolk
11:20 Recoverd @ Port

"Rite in the Rain"

53

3/15/11 Stormwater Sampling

8:00 Meet at warehouse to load gear and prep units
Jon, Jasper, Preston, Jason Little

9:27 Gear installed at PS2220
Set: 5 PM - 11:30 PM
10:00 Gear installed at NF 2095
Set 5 PM - 11:30 PM

10:25 Gear installed at BDC 2088
Set 5 PM - 11:30 PM

10:50 Gear installed at KC2062
Set 5PM - 11:30 PM

11:00 Return to warehouse to get AST SQ gear.

54

12:15 Gear installed at SQ3
Set 5PM - 11:30 PM

12:35 Gear installed at SQ2
Set. 5PM - 11:30 PM

13:15 Gear installed at SQ1
set 5PM - 11:30 PM

13:45 Gear installed at SQ4
Set 5 PM - 11:30 PM

Heading back to warehouse
to drop off gear

Rite in the Rain. 55

Stormwater Sampling 3/16/11
gear recovery
Preston, Jasper, Leon, Jason (SAIC)

8:00 Meet up at Stormore

8:30 Gear recovery @ Port
good water sample
good filtered solids sample
totalizer A: 657.9
B: 641.6

9:05 Recovery @ Norfolk
~~good water sample~~ broken carboy
good filtered solids sample
Totalizer A: 1708.9
B: 1373.2

9:20 Recovery @ BDC
good water, good solids
Totalizer A: 293.5 B: 201.0

56

3/16/11

9:40 Recovery @ KC
good water sample; good solids
Totalizer A: 211.7 B: 230.5

10:15 Recovery @ SQ3
good water; solids ok (stopcock on B partially open)
Totalizer A: 702.1 B: 112.56

10:30 Recovery @ SQ2
good water, good solids
Totalizer A: 71.9 B: 32.2

10:42 Recovery @ SQ1
good water; solids ok (totalizer B malfunct)
Totalizer A: 497.7 B: 0.64
→ ISCO Hangar dropped down!!

11:05 Recovery @ SQ4
good water; good solids
Totalizer A 2460.0 B: 2.7
→ Pex connector partly submerged!!

57

11:15: Back to the warehouse

Pulling filters and filling out COC's

1:15 Lunch

1:50 Drop off samples @ ARI
A Bags, B bags, water

Notes: check totalizers on
SQ4(B)
SQ1(B)
- Readings were way too low
edit: SQ1(B) sediment bag was also much clearer than SQ1(A)

Dennis P Martin

58

3/23/11 P. Martin, J. Boas
13:20 on site @ Port
14:10 - attempted scraping the storm line → no scrapable material in the line
Tide: Off.
14:24
~~16:24~~ on site @ Norfolk
~~16:35~~ no scrapable material
14:35 @ a negative tide

14:40 on site @ BDC
- no material @ Original sampling site
14:55 - cross the road (east)
- manhole upstream
- really stagnant water might have scrapables
15:00 on site @ KC
- able to scrape 32oz of seds

"Rite in the Rain"

59

1/4/11 AST Sampling Event
Snoqualmie Line

7:10 Arrive @ storage unit to prep samplers

Filter Bags Samples

SQ1	NBF/AST - SQ1A - 010411 - S
	- SQ1B -
SQ2	- SQ2A -
	- SQ2B -
SQ3	- SQ3A -
	- SQ3B
SQ4	- SQ4A -
	- SQ4B -

Whole Water Samples

SQ1	NBF/AST - SQ1 - 010411 - W
SQ2	- SQ2 -
SQ3	- SQ3 -
SQ4	- SQ4 -

60

Scale: 1 square = ______

10:40am Crew: J. Baus, L. Delwiche
SAIC) Michael, Jason

11:25 Deployed @ ~~S~~ SQ3
Timers set for
1800 → 23:59

11:45 Deployed @ SQ2
Timers set for
1800 → 23:59

12:13 Deployed @ SQ1
Timers set for
18:00 → 23:59

12:45 Deployed @ SQ4
Timers set for
1800 → 23:59

~~1~~ 16:15 Deployed @ DK1
Sand bag diffuser below
sed. traps - reset sand bag
flow sensor detached from
pipe ring
timer set 18:00 - 23:59

Scale: 1 square = ______ 61

17:15 Deployed @ DK2
Timers set for
1800 → 23:59

09:50 Recover DK1
no water in filter solids
some in canvy - suction
hose kinked flow sensor detached
from pipe ring

10:45 Recover @ DK2

- Total A = 128.27
- Total B = 9127.21
- Nothing in ISCO

10:30 Recover @ ~~S~~ SQ3
- Total A: 1432
- Total B: 1331
- ISCO 4/5 Full → returned to manhole

10:45 Recover @ SQ2
Total A: 145
Total B: 163
ISCO = Returned to manhole

Scale: 1 square = ______

62

11:00 Recover @ SQ1
- Totalizers @ zero no water pumped
- ISCO was Full but returned to the man hole
Not enough Rain

11:20 Recover @ ~~SQ~~ SQ4
ISCO empty
→ ISCO Line is Kinked
need to fix or replace
Total A: 616
Total B: 000

63

Scale: 1 square = ______

4/7/11 8:00 AM @ Warehouse
Crew: J. Boas ; P. Martin ; W. Hafner
Jason , Mike (SAIC)

9:00 on site @ SQ3 waiting for Clearcreek

10:45 - The Bedload sampler @ SQ3 was turned around backwards
- no sediment collected in the trap consequently
- Also the catch basin has been dredged of all material previously present

11:00 ~~###~~ ~~###~~
Sampler & ISCO deployed
Timers set for:
1930 → 2300

11:05 on site @ SQ1

11:15 Bedload Sampler de-coned and reinstalled @ SQ1

64

Scale: 1 square = ______

11:15 on site @ DK3
11:35 Recovered Bedload Sampler
@ DK3
- recovered quite a bit
of material from trap
→ Installed solids sampler
set Timers for:
17:00 start

12:20 on site @ DK1
for Bedload Sampler
install

13:30 • reinstalled Bedload Sampler
• removed pipe ring & repaired
the suction line
• uninstalled the flow
sensor
• took the sandbag out
• flow sensor mounting screws
sheared off and damaged
plastic sensor housing

65

Scale: 1 square = ______

15:20 on site @ SQ2
15:55 installed @ SQ2
Solids & ISCO
Timers set
20:00 → 22:30

16:00 on site @ SQ4
installed @ SQ4
set timers for
1930 → 2300

17:25 on site @ DK3
There is no tidal water
present, still net outgoing
water flow
Tide = 4.72ft
* Our elevation values for
this location are incorrect!

17:30 pump on! Tide has
arrived
Tide = 4.96ft

66

Scale: 1 square = ______

18:20 Deployed @ DK4
- Solids sampler began pumping during install

20:35 Stopped DK3 pump

Total A 1423.31
Total B 1236.04

- Flow rate not impeded very much.
- Not much TSS in tidal water

20:45 on site @ DK4
pulled ISCO water

21:00 Solids sampler turned off
Total A = 1025
Total B = 926

67

Scale: 1 square =

4/8/11

7:00 At Edmonds loading gear
J. Boas P. Martin

8:32 loaded gear and filter bags @ warehouse

8:45 on site @ Port

9:02 Deployed @ Port
Timers set
Sun (4/10) 13:00 → 20:00

9:15 on site @ Norfolk

9:30 Deployed at Norfolk
Timers set
(4/10) Sun; 13:00 → 20:00

9:35 on site @ BDC
953 deployed @ BDC
Timers set
Sun (4/10) 1300 → 2000

9:55 onsite @ King County Air
Deployed @ KC
1020 Timers set 1300 → 2000 (4/10)

Scale: 1 square =

68

10:25 on site @ BDC
to set solids timers
10:35 solids time set
Sun (4/10) 1300 → 2000

10:47 on site @ SQ3 for
recovery
Total A = 676.00
Total B = 761.98
solids & ISCO collected

11:00 on site @ SQ2 for
recovery
Total A = 628.79
Total B = 601.18

solids & ISCO collected

11:17 on site @ SQ4 for
recovery
Total A = 431.99
* Total B = 0

Solids collected
ISCO hose was kinked.
resetting ISCO to pull tidal 69
water 2230 → 300 Sunday 4/10/11

12:00 installed ISCO @
SQ4
headed for the warehouse

4/11/11 Crew: J Boas, J. Nguyen
P. Martin

10:50 Recovery @ Port

Total A = 94
Total B = 0
No water collected ISCO

11:15 Recovery @ Norfolk

Full ISCO - returned to
site not representative of
a storm event

Total A = 200
Total B = 0
11:30 Recovery @ BDC
Full ISCO returned to site

Total A = 0
Total B = 60.6
70

Scale: 1 square = ______

11:47 Recovery @ KC
- Full ISCO returned to site

Total A =
Total B =

12:15 Recovery @ SQ4
Full ISCO
Tidal H_2O

71

Scale: 1 square = ______

1025 Arrive @ SQ3
Install sampler and ISCO
Timers set 1040 - 1615

1045 Arrive @ SQ2
Install sampler + ISCO
timers set 1100 - 1620
☆ Grabbed sample w/ ISCO @ ~1110
Troubleshooting pump connector on pumpside. Inlet plumbing crack.

1135 Arrive @ SQ1
Install Sampler + ISCO
timer 1145 - 1745

1215 Abort event. Too much rain for baseflow, not enough prediction for storm
Nothing on radar...

1220 Lunch

1330 Retrieve gear from SQ1
dump ISCO from SQ1 + SQ2
~5 gal pumped

DM 72

Scale: 1 square = ______

1345 Retrieve gear @ SQ2
dumped carboy ~500gal
through the filters (each)

1403 Retrieve gear @ SQ3
dumped carboy. 000 on the
totalizers

1425 Retrieve gear @ SQ1
dumped carboy

1500 Retrieve gear @ Port
dumped carboy
Totalizer 1 = 263 gal
Totalizer 2 = 0.0

1530 Dump gear @ Storage
left 5 clean carboys as
well as LL + SQ ISCO's
Jason L. took 5 carboys to
ARI for decon.

73

Scale: 1 square =

800 4/21/11 @ Warehouse loading
gear
Crew: J Boas, L Dewirke, J Little

908 on site @ SQ1
Deployed SQ1
Timers set:
930 → 18:30

929 on site @ SQ2
Deployed SQ2
Timers set for
945 - 1830
*Both ISCO & Solids units
began pumping while on site

950 on site @ SQ3
Deployed @ SQ3
Timers set 1000 → 18:30
* Solids unit began pumping
while on site

10:15 on site @ SQ4
Deployed @ SQ4
Timers set 1030 - 1830
* ISCO began pumping while on
site

Scale: 1 square =

74

* no water in the line so
I dont anticipate getting
any samples

11:00 on site @ Port
11:32 Deployed @ Port
- Installed sand bag
- bridged switch
* ISCO began pumping
while onsite
Timers set: 11:30-1715

11:45 on site @ Norfolk
12:10 Deployed @ Norfolk
- Both isco & pump started
while on site
- set to off @ 18:30

12:15 onsite @ BDC
12:35 install @ BDC
Timers set: 1235 - 1830
- ISCO began as we were onsite
* NO Water in line!

75

Scale: 1 square = ______

1245 on site King County
1305 deployed @ KC
Timers set: 1300 - 1830
- ISCO began while on site

14:55 on site @ SQ1 to recover
15:05 Recoverd SQ1
- Full ISCO
- No filtered Solids
→ Not enough water to
pump solids unit

15:08 on site @ SQ2
→ Filtered solids
Total A = 2871.32
Total B = 1475.18
* ISCO Half full → filled
the rest of way on
site manually
1530 on site SQ3

Total A = 1666.14
Total B = 1483.39
- Full ISCO

76

Scale: 1 square = ______

15:50 on site @ SQ4
1605 Recovered @ SQ4
* Both totalizers read zero!
* Full ISCO recovered

Notes:
- Need to fix 1 pigtail for yellow box
- Fix pump power cord SQ3
- O ring DK3

4/22/11 met @ Subway
800 Crew: J. Beas P. Martin
J. Little (SAIC)
815 Onsite @ Port for recovery
- Total A = 1194.76
- Total B = 1127.24
- Full ISCO

846 on site @ Norfolk
Total A = 1274.46
Total B = 1491.68
Full ISCO
9:05 on site @ BDC

77

Scale: 1 square = ______

BDC continued
915 - NO water pumped in ISCO or filtered solids unit
- Not enough flow in the BDC Line
925 on site @ King County for recovery

9:35 Total A = 0
Total B = 0
* Time for unit was set incorrectly (J.L)

* Full ISCO

78

Scale: 1 square = ______

14:00 on site @ DK2
- Not enough water to sample ISCO
- Filtered solids unit pumping water
1430 - Stopped raining
4/27/2011
8:00 @ Warehouse loading carboys & filter bags

Filter bag Weights:

PSA	#307	61.72g
PSB	#332	62.44g
DK1A	#315	61.52g
DK1B	#336	58.92g
DK2A	#335	63.26g
DK2B	#327	62.63g
KCA	#300	64.40g
KCB	#305	64.24g
NF A	#304	58.60g
NF B	#317	60.05g
BDC A	#319	63.29g
BDC B	#321	61.06g

79

Scale: 1 square = ______

9:25 on site @ Port for install
9:45 deployed @ Port
Timers set 1745 - 2230

10:00 on site @ Norfolk for deploy
10:16 deployed @ NF
Timers set 1700 - 2300
10:26 on site @ BDC for deployment
Timers set 1700-2300

1055 on site @ KC for deploy
11:16 deployed @ KC
Timers set 1700 - 2300

11:34 on site @ DK1
Timers set 1700-2300
Installed New ISCO line attached to pump cage

12:25 on site @ DK2
Timers set 1700 - 2300
Installed new ISCO line to bucket pump

80

Scale: 1 square = ______

4/28/11 Sample Recovery

800 Load gear at warehouse.

840 Pulled gear at PS2220
Water and solids collected.

930 Pulled gear at NF2095
Low totalizer volumes
Water and solids collected

942 Pulled gear at IDC 2088
Low totalizer volumes
Water and solids collected

1000 Pulled gear at KC2062
Only 1 water aliquot collected
before the suction line clogged
We were not able to unclog line
Solids and small volume of
water collected.

1010 Purchase ice.

81

Scale: 1 square = ______

1032 Pulled gear at DK2
Water collected but no solids
Human error timer was not
set correctly

1041 Onsite at DK1
SPU on site doing video survey
at the sampling location.
ISCO has been removed.
SPU unplugged the ISCO from
the battery and replugged after
setting the ISCO on the surface

1110 Pulled gear at DK1
Water collected. Solids maybe.
Totalizer read zero, but the
filter housings were full
of water.

Totalizers	PS2220 A	587 g
	B	1017 g
	NF2095A	40.4 g
	B	48.8

82

Scale: 1 square = ______

BDC 2088A 29.2
B 32.2
KC 2062 A 75.9
71.5
DK1 A 0.9 → Not
B 1.2 Working

1305 At warehouse removing samples from filter housings
1330 Drop off samples at ARI

83

Scale: 1 square = ______

5/2/11 Stormwater Sampling

900 Pick up carboys from ARI

930 Load Dakota gear at warehouse. Gear for DK2, DK3, DK4

10:30 Install gear at DK3
ISCO and Filtration unit left running while we go to DK4

1045 Install gear at DK4
Water collected at 1045
Filtration unit left running in vault.

1130 Finish collecting water sample at DK3. Filtration unit left running.

1315 Remove Filter unit from DK3
Totalizers
DK3A 237 g
DK3B 333 g

84

Scale: 1 square = ______

1335 Gear removed from DK4
Totalizers
DK4A 509 g
DK4B 513

1410 Drop off samples at ARI

1430 Offload gear at warehouse.

1025 @ warehouse
Crew: J Boas, J Little, L Dewidy

11:10 onsite @ Port for install
11:30 deployed @ Port
Timers set: 17:30 - 2200

11:50 on site @ Norfolk
12:15 deployed @ NF
Timers set: 1730 - 2300

12:18 on site @ BDC for deploy
12:40 deployed @ BDC
Timers set: 1730-2500

85

12:45 on site @ King County
1305 deployed @ KC
Timers set 1730-2300

5/5/2011

800 @ Costco Parking Lot

825 @ Beacon Hill to recover sed trap bottles & bedload sampler

* Sed trap bottles recovered → one has a hole in the bottom likely from fast moving debris
* bedload sampler recovered small amount of sed trapped hydro foil bent upwards due to high velocity current
* took pictures of sed recovery in bedload sampler
9:25 Finished @ Beacon Hill

9:35 on site @ SQ1
10:00 Bottles recovered @ SQ1
Bedload Sampler recovered

86

Scale: 1 square = ______

10:45 on site @ Port for
solids/ISCO recovery

Total A = 1706.50
Total B = 1544.05
* Full ISCO sampled

11:20 on site @ Norfolk
for solids/ISCO recovery

Total A = 0
Total B = 12.42
* Both solids cartridges full of
water
* Both totalizers may be
malfunctioning
* Full ISCO sampled

11:45 on site @ BDC
Total A = 124.25
Total B = 1.54
* Full ISCO

12:10 on site @ King County
Total A = 701.70
Total B = 893.21 87

Scale: 1 square = ______

* Full ISCO @ Port

1245 Clear Creek on site
@ KC to recover
Bottles & Traps

13:20 on site @ BDC of
sed trap bottle recovery

68

Scale: 1 square = ______

5/6/11 LL Stormwater Sampling

Filter Bags

	#	Weight (g)
PS2220A	354	61.18
B	344	60.90
NF2095 A	341	64.64
B	346	63.22
KC2062 A	342	60.64
B	347	60.62
BDC 2088 A	340	61.41
B	350	64.51

900 At office load gear for both LL and DK

10:00 At warehouse. Not enough rain to sample DK today. Install gear at LL instead

10:55 on site @ Port for install solids / ISCO units

11:05 gear installed, pump looked good. Timers set for Sat 1100-1700

89

Scale: 1 square = ______

11:40 Gear installed at NF2095

1200 Gear installed at BDC2088

1220 Gear installed at KC2062

1345 At warehouse. Load filterhousing for SQ1

	#	Weight (g)
SQ1A	353	62.45
SQ1B	355	61.65

1415 Filter bags from 1/20/11 delivered to ARI

1515 Gear installed at SQ1
Filtration unit only
Pigtail connector on filter housing needed a pin fixed.
Pump was dead, so we replaced it.

1600 Unload gear at office

90

Scale: 1 square = ______

5/9/11 onsite warehouse to load gear
Crew: J. Boas, L. Delwiche, P. Martin

11:40 onsite @ SQ1 for solids/ ISCO recovery

11:50 re-deployed ISCO to gather flow data

* Both fixes: control Box pig tail & new pump successful

Total A: 1100 gal
Total B: 1200 gal

1200 on site @ SQ2 for ISCO deployment to gather flow data

12:15 installed ISCO removed sand bag to gather accurate flow data

91

Scale: 1 square = ______

12:17 onsite @ SQ3 to deploy an ISCO for flow data

12:30 deployed ISCO @ SQ3

1345 on site @ Norfolk to recover solids/ ISCO units

13:55 re-deployed ISCO to gather Flow data

1400 on site @ BDC for recovery of solids/isco units

14:15 re-deployed ISCO to gather Flow data

14:37 on site @ King County to recover solids / ISCO

14:45 re-deployed ISCO to gather flow data 92

Scale: 1 square = ______

15:05 onsite @ Port for
recovery of Solids/ ISCO

15:15 re-deployed ISCO to
gather flow data

5/11/2011
1000 @ warehouse to load
gear
Crew: J. Boas, L Delwiche
J. Little

10:35 on site @ DK1
for Solids sampler install
Timers set 1200 → 1700

11:12 on site @ DK2 for
solids sampler install
11:40 Timer set 1200 - 1700
11:45 on site @ SQ1 for
solids install
Timers set 1200 - 1700

1205 on site @ SQ2 to
recover ISCO

93

Scale: 1 square = ______

1215 on site @ SQ3
to recover ISCO

1415 on site @ DK3
to install solids unit
& ISCO
+ lightly raining looks
like enough water in the
line to pump

1510 DK 3 & DK4 filtered
solids units installed
* raining pretty good

Timers DK3 1500 - 2030
Timers DK4 1515 - 2030

1620 onsite @ DK3
water flowing / pump pumping

Total A: 43.43 gal
Total B: 38.89 gal
> Totalizer not tallying flow yet water is moving through them

94

Scale: 1 square = ______

16:45 Stopping DK3 → the filtered solids unit has stopped pumping water through
- The bags are likely full

1710 stopped DK4
- filtered solids flow reduced to a trickle
- bags likely full

1800 warehouse to unload gear

5/12/2011 @ warehouse to
930 load gear and personel
Crew: J. Boas, L. Delwiche

Totalizer Readings

DK4 A = 48.38
B = 56.62

DK3 A = 48.45
B = 35.12

95

Scale: 1 square = ______

1050 on site @ Beacon Hill for solids sampler recovery
Total A = 192.30 Total B = 179.97

11:10 on site @ DK2 for solids sampler recovery

* Bags are FULL

- Stop cocks on filter unit were both open
- Jason Little installed bags (Strike 2)

1130 on site @ SQ1 for solids sampler recovery

* Pigtail coming out of the control box shorted out
* need to throw out this pigtail & use a different one

96

Scale: 1 square = ______

5/19/2011 1030 loaded uhaul
truck in Edmonds
· heading to pick up
4 ISCOS @ the LL locations
they've been in the lines
since the 9th of May
· will also attempt to
get scrape/grab samples
from King County &
SQ3

1130 on site @ Port to
recover ISCO & pump cage

1205 on site to recover
ISCO & pump cage
@ Norfolk

12:15 on site @ BDC to
recover ISCO & pump
cage

1230 on site @ KC to recover
ISCO & pump cage

* recovered 16oz jar of grab
sample → on ice Scale: 1 square = 97

12:45 lunch

2:15 @ warehouse offloading
gear

245
* headed to the lab to
pick-up carboys

5/20/2011
830 @ Warehouse loading
gear for baseflow
sampling
· will be setting gear out
@ DK1, DK2, DK3

Filter bags

DK1A:	63.84g	# 351
DK1B	64.50g	# 349
DK3A	60.33g	# 343
DK3B	63.82g	# 352

950 truck loaded
935 on site @ DK1 to
deploy

10:15 filtered solids & ISCO
deployed
Scale: 1 square = 96

* The pump @ DK1 appears
to be burnt out
* very weak sounding
* ISCO able to pump
Timers 1015 → 1250

10:40 installed ISCO @
DK2
Timers 1040 → 1310

10:45 onsite @ DK3 for
solids & ISCO install

Timers 1105 → 13:30

1310 Recovered @ DK4
Full ISCO
No Filtered solids
* pump is dead

1310 Recovered @ DK2

* No ISCO sample
* Not enough flow

99

Scale: 1 square = ______

1332 Recovered @ DK3

- Total A = 718.74
- Total B = 612.78

- Full ISCO

1350 en route to ARI

5/25/11 Crew: J. Baas L. Delwiche
(SAIC) J. Little
900 @ Warehouse to load
filter bags & carboys

10:00 on site @ SQ3
to install filter unit &
ISCO

10:25 Timers set: 1100-1700

10:26 onsite @ SQ2 for
filtered solids & ISCO
installation

100

Scale: 1 square = ______

Timers set: 1100 - 1700

10:45 onsite @ SQ1
for filterd solids & ISCO
install

Timers set: 11:00 - 17.00

11:05 On site @ DK2
for solids unit install

11:55 install complete
→ filtered solids unit
began pumping while onsite

Timer set 11:25 - 17.00

12:00 on site @ DK 1
for ISCO install

1215 Program set 12:10 - 1700

12:30 onsite @ SQ4 for
Filterd solids & ISCO install

Timers set 12:45 - 1700

Scale: 1 square = 101

unit began pumping while
on site

13:03 done headed to
lunch

5/26/11

800 @ warehouse to load
coolers

Crew. J. Boas, J. Little
M. Pagel

8:32 on site @ SQ4
for solids & ISCO
recovery

Total A: 84.92
Total B: 0

* ISCO only 1/8th full
looks like the weight of
the flex hose, once filled
with water, caused the
extra to fall down and
kink the hose @ the first
latter rung.

Scale: 1 square = 102

Totalizer B is non-functional
this is ~~is~~ not the first time
it has registered 0
and a full filter housing
of water came out the
stop cock

845 loaded sampling equip
needed to SQ3

8:50 on site @ SQ3 for
solids & ISCO recovery

Total A: 450.36
Total B: 436.73

* Full ISCO

9:10 onsite @ SQ2
for filtered solids & ISCO
recovery

Total A: 174.60
Total B: 179.72

* Full ISCO

Scale: 1 square = 103

920 on site @ SQ1 for
filtered solids & ISCO recovery

Total A: 807.18
Total B: 0

* Totalizer B is malfunctioning

* Both filter housings full
of water

* Full ISCO

9:35 onsite @ DK2 for
filtered solids unit
recovery

Total A: ~~188.~~ 183.17
Total B: 15904.1

* Total B is likely malfunctioning
* Both filter housings full
of water

104
Scale: 1 square =

9:55 on site @ DK1
for ISCO recovery

Full ISCO

10:30 back @ warehouse to
offload gear and
prepare samples for Lab

6/9/2011 Crew: J Boas, W. Hatner, P. Martin
9 AM load vehical w/ flow
measuring equipment

10:30 on site @ Norfolk to
measure flow

water depth: 3/4"

velocity Avg: N/A

Note: Not enough moving water but water in the
line to spin the blades of
the flow meter.

105

Scale: 1 square = ______

10:45 on site @ BDC to
measure flow

water depth: N/A

Avg velocity: no flow

note: stagnant water less
than 1 inch

10:52 on site @ King County

water depth: 1 3/4"
Avg velocity: 1.2 fps
w/out lift pump on
W/Pump velocity: 4.6 fps
water deph: 8 1/2"

* velocity varies from top
to bottom

12:05 on site @ DK2

water depth: 1 1/4" inch
Avg velocity: 3.5 fps

106

Scale: 1 square = ______

13:30 on site @ Beacon Hill

water depth: 1/4"
Avg velocity: N/A

Note: not enough water to spin blades of flow meter

13:52 on site @ SQ1

~~pool water depth: 3 inches~~
Avg Velocity: 0.6fps

water depth: 1 1/8"

14:10 on site SQ2

water depth: 1/2"

guess velocity: 1fps

14:15 on site @ SQ3
water depth: 1 7/8"
Avg velocity: 0-0.2fps
~~water depth vault~~

Scale: 1 square = 107

6/10/2011 Crew J. Boas P. Martin

~~14:25~~ on site @ DK3
8:10

water depth = 2"
Avg velocity = 0.3

8:15 on site @ DK4

water depth = 1 1/4"
Avg velocity = 0.0

8:25 on site @ SQ4

water depth = 1/8"
Avg velocity = 0.0

8:40 @ Port

water depth = 1/4"
Guess Avg velocity = 0.8

108

Scale: 1 square =

6/15/11
9:10 @ COSTCO to meet Clear Creek

Crew: J. Boas, J. Little
ClearCreek: Rob, Mike

9:25 on site @ Beacon Hill (DK 1)

to recover bedload sampler & pipe ring

10:00 → recovered bedload sampler
- hydrofoil missing
note: - sampler was installed and forward facing velocity must have been great enough to rip it from the sampler
- recoverd 1/2 8oz jar of ss mostly gravel size

→ recovered pipe ring & suction line

109

Scale: 1 square = ______

10:07 @ DK2 for pipe ring recovery

- Recoverd pipe ring and flow sensor

10:25 on site @ DK3 for pipe ring recovery

10.45 recoverd pipe ring & sensor @ DK3

10.50 on site @ DK4 for pipe ring recovery

11:00 recovered pipe ring & sensor @ DK4

11:05 on site @ SQ3
11:15 recovered pipe ring & sensor

11:20 on site @ SQ2
11:30 recovered pipe ring @ SQ2

Scale: 1 square = ______

110

11:32 on site @ SQ1

11:55 recovered bedload
sampler (Full)

recovered pipe ring &
sensor

13:30 Dropped Bedload sample
off @ Lab

~~Site date =~~ BT

III

Scale: 1 square = ______

Appendix E
Chemistry Results Summary Tables

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1		BF4		SW5		SW8		BF1		SW1		SW5		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK3	
Sample ID				DK1-012611-W		DK1-052011-W		DK1-042711-W		DK1-052511-W		DK2-012611-W		DK2-012011-W		DK2-042711-W		DK3-012611-W	
Collection Date				1/27/2011		5/20/2011		4/27/2011		5/26/2011		1/27/2011		1/21/2011		4/27/2011		1/27/2011	
PCBs (µg/L)																			
Aroclor 1016	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Aroclor 1221	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Aroclor 1232	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.012	U	0.010	U
Aroclor 1242	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Aroclor 1248	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.015**		0.010	U	0.010	U
Aroclor 1254	EPA 8082			0.010	U	0.010	U	**0.016**		**0.011**		0.010	U	**0.015**		**0.011**		0.010	U
Aroclor 1260	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Total PCBs	EPA 8082	0.03	10	0.010	U	0.010	U	**0.016**		**0.011**		0.010	U	**0.030**		**0.011**		0.010	U
Metals – Total (µg/L)																			
Arsenic	EPA 200.8			**1.4**		**2.3**		**1.6**		**2.6**		**1.1**		**1.8**		**2.0**		**1.4**	
Cadmium	EPA 200.8			0.2	U	0.1	U	**0.2**		**0.2**		0.2	U	0.2	U	**0.2**		0.2	U
Calcium	EPA 6010B			**33200**		**32000**		**5370**		**11400**		**68800**		**26900**		**24400**		**72500**	
Chromium	EPA 200.8			**0.5**		0.5	U	**4.4**		**2.4**		0.5	U	**3.2**		**5.9**		**64.5**	
Copper	EPA 200.8			**3.3**		**2.4**		**13.5**		**25.0**		**3.8**		**17.3**		**20.2**		**7.5**	
Lead	EPA 200.8			1	U	**0.2**		**7.6**		**4.1**		**1**		**5**		**10.8**		**2**	
Magnesium	EPA 6010B			**14100**		**15400**		**1030**		**1870**		**22200**		**6440**		**7210**		**23300**	
Mercury	EPA 7470A			0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
Nickel	EPA 200.8			**2.8**		**2.2**		**4.1**		**4.2**		**3.0**		**4.4**		**5.4**		**10.2**	
Selenium	EPA 200.8			0.5	U	0.5	UJ	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Silver	EPA 200.8			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Zinc	EPA 200.8			**19**		**22**		**64**		**96**		**23**		**63**		**75**		**29**	
Metals – Dissolved (µg/L)																			
Arsenic	EPA 200.8	36	69	**1.3**		**2.1**		**0.7**		**2.0**		**0.9**		**1.2**		**1.0**		**1.1**	
Cadmium	EPA 200.8	9.3	42	0.2	U	0.1	U	0.1	U	0.1	U	0.2	U	0.2	U	0.1	U	0.2	U
Chromium	EPA 200.8			0.5	U	0.5	U	**1.0**		**0.7**		0.5	U	**1.0**		**1.9**		0.5	U
Copper	EPA 200.8	3.1	4.8	**2.4**		**2.0**		**4.2**		**16.7**		**2.6**		**7.5**		**6.0**		**3.0**	
Lead	EPA 200.8	8.1	210	1	U	0.1	U	**0.1**		**0.5**		1	U	1	U	**0.1**		1	U
Mercury	EPA 7470A	0.025	1.8	0.02	U	0.0200	U	0.02	U	0.0200	U	0.02	U	0.02	U	0.02	U	0.02	U
Nickel	EPA 200.8	8.2	74	**2.3**		**2.0**		**1.1**		**2.6**		**2.4**		**2.2**		**2.0**		**6.9**	
Selenium	EPA 200.8	71	290	0.5	U	0.5	UJ	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Silver	EPA 200.8		1.9	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Zinc	EPA 200.8	81	90	**6**		**15**		**24**		**57**		**6**		**13**		**19**		**10**	
Pesticides (µg/L)																			
Aldrin	EPA 8081B	0.0019	0.71	0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
alpha-BHC	EPA 8081B			0.050	U	0.050	UJ	0.050	UJ	0.050	UJ	0.050	U			0.050	UJ	0.050	U
beta-BHC	EPA 8081B			0.050	U	0.050	U	0.050	UJ	0.050	UJ	0.050	U			0.050	UJ	0.050	U
delta-BHC	EPA 8081B			0.050	UJ	0.050	UJ	0.050	UJ	0.050	UJ	0.050	UJ			0.050	UJ	0.050	UJ
Lindane	EPA 8081B		0.16	0.050	U	0.050	U	0.050	UJ	0.050	UJ	0.050	U			0.050	UJ	0.050	U
cis-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
Chlordane	EPA 8081B			0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Total DDTs	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1		BF4		SW5		SW8		BF1		SW1		SW5		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK3	
Sample ID				DK1-012611-W		DK1-052011-W		DK1-042711-W		DK1-052511-W		DK2-012611-W		DK2-012011-W		DK2-042711-W		DK3-012611-W	
Collection Date				1/27/2011		5/20/2011		4/27/2011		5/26/2011		1/27/2011		1/21/2011		4/27/2011		1/27/2011	
Dieldrin	EPA 8081B	0.0019	0.71	0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	U			0.10	UJ	0.10	U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10	UJ	0.10	U	0.10	U	0.10	U	0.10	UJ			0.10	U	0.10	UJ
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10	U	0.10	U	0.10	UJ	0.10	UJ	0.10	U			0.10	UJ	0.10	U
Endrin	EPA 8081B	0.0023	0.037	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Endrin Aldehyde	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Endrin Ketone	EPA 8081B			0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	U			0.10	UJ	0.10	U
Heptachlor	EPA 8081B	0.0036	0.05	0.050	U	0.050	U	0.050	UJ	0.050	UJ	0.050	U			0.050	UJ	0.050	U
Heptachlor Epoxide	EPA 8081B			0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U			0.050	UJ	0.050	U
Methoxychlor	EPA 8081B			0.50	U	0.50	U	0.50	U	0.50	U	0.50	U			0.50	U	0.50	U
Toxaphene	EPA 8081B	0.0002	0.21	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U	5.0	U
Phenols (µg/L)																			
2,4-Dimethylphenol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
o-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
p-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Pentachlorophenol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Phenol	EPA 8270D			1.0	U	**1.3**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Phthalates (µg/L)																			
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			**57**		1.0	U	1.2	U	**8.2**		1.0	U	**1.3**		2.7	U	1.0	U
Butyl benzyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dibutyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Diethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Dimethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Di-n-Octyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
PAHs (µg/L)																			
1-Methylnaphthalene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.011**		0.010	U	0.010	U
2-Methylnaphthalene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.026**	**J**	0.010	U	0.010	U
Acenaphthene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Acenaphthylene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Anthracene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Benzo(a)anthracene	EPA 8270DSIM			0.010	U	0.010	U	**0.012**		0.010	U	0.010	U	**0.030**	**J**	**0.038**		0.010	U
Benzo(a)pyrene	EPA 8270DSIM			0.010	U	0.010	U	**0.022**		0.010	U	0.010	U	**0.034**		**0.050**		0.010	U
Benzo(g,h,i)perylene	EPA 8270DSIM			0.010	U	0.010	U	**0.044**		**0.024**		0.010	U	**0.064**		**0.066**		0.010	U
Benzofluoranthene	EPA 8270D/8270DSIM			0.010	U	0.010	U	**0.050**		**0.021**		0.010	U	**0.070**		**0.096**		**0.013**	
Chrysene	EPA 8270D/8270DSIM			0.010	U	0.010	U	**0.053**		**0.028**		0.010	U	**0.058**	**J**	**0.082**		0.010	U
Dibenzo(a,h)anthracene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.014**		**0.013**		0.010	U
Dibenzofuran	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Fluoranthene	EPA 8270D/8270DSIM			0.010	U	0.010	U	**0.053**		**0.030**		0.010	U	**0.11**	**J**	**0.13**		**0.013**	
Fluorene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			0.010	U	0.010	U	**0.016**		0.010	U	0.010	U	**0.028**		**0.031**		0.010	U
Naphthalene	EPA 8260C/8270DSIM			0.020	U	0.014	U	0.037	U	**0.024**		0.025	U	**0.045**		0.028	U	0.027	U
Phenanthrene	EPA 8270DSIM			0.010	U	0.010	U	**0.027**		**0.016**		0.010	U	**0.038**	**J**	**0.062**		0.010	U
Pyrene	EPA 8270D/8270DSIM			0.010	U	0.010	U	**0.062**		**0.035**		0.010	U	**0.11**		**0.13**		**0.016**	
Total HPAHs	EPA 8270D/8270DSIM			0.010	U	0.010	U	**0.31**		**0.14**		0.010	U	**0.52**	**J**	**0.64**		**0.042**	
Total LPAHs	EPA 8270D/8270DSIM			0.020	U	0.014	U	**0.027**		**0.040**		0.025	U	**0.083**	**J**	**0.062**		0.027	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1		BF4		SW5		SW8		BF1		SW1		SW5		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK3	
Sample ID				DK1-012611-W		DK1-052011-W		DK1-042711-W		DK1-052511-W		DK2-012611-W		DK2-012011-W		DK2-042711-W		DK3-012611-W	
Collection Date				1/27/2011		5/20/2011		4/27/2011		5/26/2011		1/27/2011		1/21/2011		4/27/2011		1/27/2011	
SVOCs (µg/L)																			
1,2,4-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,4-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Benzoic Acid	EPA 8270D			10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzyl Alcohol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Hexachlorobenzene	EPA 8081B/8270D			0.050	U	0.050	U	0.050	UJ	0.050	U	0.050	U	1.0	U	0.050	UJ	0.050	U
Hexachlorobutadiene	EPA 8081B/8260C			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.5	U	0.050	U	0.050	U
Hexachloroethane	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
N-Nitrosodiphenylamine	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
VOCs (µg/L)																			
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,1-Trichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,2-Trichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2,3-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2,3-Trichloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2,4-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3,5-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2-Hexanone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
4-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Acetone	EPA 8260C			5.0	U	5.0	U	5.7	U	14	U	5.0	U	5.0	U	7.4	U	5.0	U
Acrolein	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U	5.0	U	5.0	U	5.0	U
Acrylonitrile	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromochloromethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromoethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromoform	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromomethane	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Disulfide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Carbon Tetrachloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
CFC-11	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
CFC-113	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chlorodibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1	BF4	SW5	SW8	BF1	SW1	SW5	BF1
Location ID				DK1	DK1	DK1	DK1	DK2	DK2	DK2	DK3
Sample ID				DK1-012611-W	DK1-052011-W	DK1-042711-W	DK1-052511-W	DK2-012611-W	DK2-012011-W	DK2-042711-W	DK3-012611-W
Collection Date				1/27/2011	5/20/2011	4/27/2011	5/26/2011	1/27/2011	1/21/2011	4/27/2011	1/27/2011
Chloroform	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloromethane	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Cumene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Dichlorobromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylene Dibromide	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Methyl ethyl ketone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	**7.6**	5.0 U	5.0 U
Methyl Iodide	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Methyl isobutyl ketone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Methylene Chloride	EPA 8260C			1.0 U	3.7 U	4.9 U	2.4 U	1.2 U	1.2 U	2.3 U	1.1 U
n-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
p-Isopropyltoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
sec-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
tert-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Vinyl Acetate	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
Vinyl Chloride	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
BTEX (µg/L)											
Benzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
m, p-Xylene	EPA 8260C			0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Total Xylenes	EPA 8260C			0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Brominated Diphenylethers (pg/L)											
BDE-007	EPA 1614					1.15 U				0.691 U	
BDE-008	EPA 1614					**1.9 CJ**				1.23 CU	
BDE-010	EPA 1614					0.949 U				0.363 U	
BDE-011	EPA 1614					C8				C8	
BDE-012	EPA 1614					**2.43 CJ**				**1.34 CJ**	
BDE-013	EPA 1614					C12				C12	
BDE-015	EPA 1614					**1.67 J**				1.77 U	
BDE-017	EPA 1614					16.4 CU				**17.8 CJ**	
BDE-025	EPA 1614					C17				C17	
BDE-028	EPA 1614					29.3 CU				**38.1 CJ**	
BDE-030	EPA 1614					0.723 U				1.21 U	
BDE-032	EPA 1614					0.599 U				0.869 U	
BDE-033	EPA 1614					C28				C28	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1		BF4		SW5		SW8		BF1		SW1		SW5		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK3	
Sample ID				DK1-012611-W		DK1-052011-W		DK1-042711-W		DK1-052511-W		DK2-012611-W		DK2-012011-W		DK2-042711-W		DK3-012611-W	
Collection Date				1/27/2011		5/20/2011		4/27/2011		5/26/2011		1/27/2011		1/21/2011		4/27/2011		1/27/2011	
BDE-035	EPA 1614							3.92	U							0.875	U		
BDE-037	EPA 1614							2.66	U							2.35	U		
BDE-047	EPA 1614							**828**								**994**			
BDE-049	EPA 1614							**47.6**	**J**							**59.6**			
BDE-051	EPA 1614							**4.57**	**J**							6.26	U		
BDE-066	EPA 1614							53.8	U							**46.4**	**J**		
BDE-071	EPA 1614							10.7	U							8.12	U		
BDE-075	EPA 1614							2.16	U							4.84	U		
BDE-077	EPA 1614							2.6	U							0.888	U		
BDE-079	EPA 1614							**8.56**	**J**							**4.12**	**J**		
BDE-085	EPA 1614							**47.2**	**J**							**57.2**			
BDE-099	EPA 1614							**1030**								**1200**			
BDE-100	EPA 1614							**233**								**260**			
BDE-105	EPA 1614							3.72	U							5.35	U		
BDE-116	EPA 1614							6	U							12.2	U		
BDE-119	EPA 1614							10	CU							9.44	CU		
BDE-120	EPA 1614							C119								C119			
BDE-126	EPA 1614							2.06	U							2.89	U		
BDE-128	EPA 1614							29.9	U							22.1	U		
BDE-138	EPA 1614							27.7	CU							23.1	CU		
BDE-140	EPA 1614							5.79	U							8.19	U		
BDE-153	EPA 1614							**103**								**137**			
BDE-154	EPA 1614							**89.9**								**105**			
BDE-155	EPA 1614							**4.65**	**J**							8.09	U		
BDE-166	EPA 1614							C138								C138			
BDE-181	EPA 1614							2.05	U							9.4	U		
BDE-183	EPA 1614							**102**								103	U		
BDE-190	EPA 1614							0.825	U							22.9	U		
BDE-203	EPA 1614							232	U							171	U		
BDE-206	EPA 1614							**735**								448	U		
BDE-207	EPA 1614							**1410**								**635**			
BDE-208	EPA 1614							1080	U							**522**			
BDE-209	EPA 1614							**10700**								**9050**			
Total PBDEs	EPA 1614							**15300**	**CJ**							**13100**	**CJ**		
Conventionals																			
Alkalinity as Bicarbonate (mg/L)	SM2320			**102**		**128**		**13.8**		**30.7**		**216**		**79.3**		**79.9**		**224**	
Alkalinity as Carbonate (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Alkalinity, Total (mg/L)	SM2320			**102**		**128**		**13.8**		**30.7**		**216**		**79.3**		**79.9**		**224**	
Chloride (mg/L)	EPA 300.0			**54.4**		**47.8**		**2.0**		**5.8**		**26.4**		**19.6**		**6.5**		**29.1**	
Dissolved Organic Carbon (mg/L)	EPA 415.1			**3.51**		**2.41**		**3.08**		**18.7**		**4.68**		**6.71**		**4.12**		**7.39**	
Hardness as CaCO3 (mg/L)	EPA 6010B			**140**		**140**		**18**		**36**		**260**		**94**		**91**		**280**	
Nitrate (mg/L)	EPA 300.0			**1.3**		**0.9**		0.2	U	**0.6**		**0.6**		**0.5**		0.3	U	**0.5**	
pH (su)	PH			**7.87**		**8.05**		**6.81**		**6.69**		**7.95**		**7.65**		**7.44**		**8.08**	
Sulfate (mg/L)	EPA 300.0			**27.6**		**28.4**		**1.7**		**5.1**		**62.6**		**20.9**		**16.8**		**63.8**	
Total Organic Carbon (mg/L)	EPA 415.1			**3.66**		**2.62**		**5.34**		**23.1**		**4.88**		**9.29**		**5.69**		**8.13**	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF1		BF4		SW5		SW8		BF1		SW1		SW5		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK3	
Sample ID				DK1-012611-W		DK1-052011-W		DK1-042711-W		DK1-052511-W		DK2-012611-W		DK2-012011-W		DK2-042711-W		DK3-012611-W	
Collection Date				1/27/2011		5/20/2011		4/27/2011		5/26/2011		1/27/2011		1/21/2011		4/27/2011		1/27/2011	
Total Solids (percent)	EPA 1614							**0**								**0**			
Total Suspended Solids (mg/L)	EPA 160.2			**2.6**		**2.4**		**46.0**		**24.3**		**4.3**		**26.0**		**37.8**		**12.4**	

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4	SW6	SW7	TS	SW6	TS	BF2	BF3
Location ID				DK3	DK3	DK3	DK3	DK4	DK4	SQ1	SQ1
Sample ID				DK3-052011-W	DK3-050211-W	DK3-051111-W	DK3-040711-W	DK4-050211-W	DK4-040711-W	SQ1-020211-W	SQ1-042111-W
Collection Date				5/20/2011	5/2/2011	5/11/2011	4/7/2011	5/2/2011	4/7/2011	2/2/2011	4/21/2011
PCBs (µg/L)											
Aroclor 1016	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1248	EPA 8082			0.010 U	**0.015**	**0.029**	0.010 U	0.010 U	0.010 U	**0.075**	0.010 U
Aroclor 1254	EPA 8082			0.010 U	**0.015**	**0.041**	0.010 U	0.010 U	0.010 U	**0.10**	0.010 U
Aroclor 1260	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	**0.023**	0.010 U
Total PCBs	EPA 8082	0.03	10	0.010 U	**0.030**	**0.070**	0.010 U	0.010 U	0.010 U	**0.2**	0.010 U
Metals – Total (µg/L)											
Arsenic	EPA 200.8			**1.7**	**2.6**	**2.2**	**1.1**	**0.9**	**1.0**	**1.4**	**0.6**
Cadmium	EPA 200.8			0.1 U	**0.3**	**0.2**	0.1 U	**0.1**	0.1 U	**0.7**	0.1 U
Calcium	EPA 6010B			**72800**	**16200**	**11100**	**37700**	**2990**	**37500**	**76300**	**75500**
Chromium	EPA 200.8			**0.8**	**66.3**	**14.4**	**34.2**	**9.2**	**2.2**	**6.5**	0.5 U
Copper	EPA 200.8			**4.3**	**30.1**	**25.6**	**4.4**	**12.0**	**3.4**	**105**	**4.7**
Lead	EPA 200.8			**1.7**	**13.0**	**12.1**	**1.0**	**5.8**	**0.8**	**31**	**0.8**
Magnesium	EPA 6010B			**25200**	**3460**	**2420**	**96800**	**550**	**98100**	**21200**	**22000**
Mercury	EPA 7470A			0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.2**	0.1 U
Nickel	EPA 200.8			**4.2**	**26.6**	**14.1**	**6.0**	**4.0**	**4.4**	**6.5**	**2.6**
Selenium	EPA 200.8			0.5 UJ	0.5 U	0.5 U	2 U	0.5 U	2 U	0.5 U	**0.5**
Silver	EPA 200.8			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	EPA 200.8			**27**	**87**	**68**	**10**	**60**	**10**	**59** J	**13**
Metals – Dissolved (µg/L)											
Arsenic	EPA 200.8	36	69	**1.4**	**1.1**	**1.1**	**0.6**	**0.6**	**0.7**	**0.5**	**0.5**
Cadmium	EPA 200.8	9.3	42	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.2 U	0.1 U
Chromium	EPA 200.8			0.5 U	**12.0**	**5.8**	**0.7**	**3.3**	**0.6**	0.5 U	0.5 U
Copper	EPA 200.8	3.1	4.8	**2.7**	**8.2**	**6.0**	**1.8**	**6.6**	**1.6**	**10.1**	**2.9**
Lead	EPA 200.8	8.1	210	**0.2**	**0.4**	**0.3**	0.1 U	**0.3**	0.1 U	1 U	0.1 U
Mercury	EPA 7470A	0.025	1.8	0.0200 U	0.02 U	0.0200 U	0.0200 U	0.02 U	0.0200 U	0.02 U	0.02 U
Nickel	EPA 200.8	8.2	74	**3.4**	**16.9**	**7.5**	**5.1**	**3.0**	**2.4**	**2.6**	**2.5**
Selenium	EPA 200.8	71	290	0.5 UJ	0.5 U	0.5 U	2 U	0.5 U	2 U	0.5 U	0.5 U
Silver	EPA 200.8		1.9	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	EPA 200.8	81	90	**18**	**19**	**12**	**6**	**42**	**6**	**9** J	**9**
Pesticides (µg/L)											
Aldrin	EPA 8081B	0.0019	0.71	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
alpha-BHC	EPA 8081B			0.050 UJ	0.050 UJ	0.050 UJ	0.050 U	0.050 UJ	0.050 U	0.050 UJ	0.050 U
beta-BHC	EPA 8081B			0.050 U	0.050 UJ	0.050 U	0.050 U	0.050 UJ	0.050 U	0.050 U	0.050 U
delta-BHC	EPA 8081B			0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ	0.050 U	0.050 UJ
Lindane	EPA 8081B		0.16	0.050 U	0.050 UJ	0.050 U	0.050 U	0.050 UJ	0.050 U	0.050 U	0.050 U
cis-Chlordane	EPA 8081B	0.004	0.09	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Chlordane	EPA 8081B			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Total DDTs	EPA 8081B			0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4		SW6		SW7		TS		SW6		TS		BF2		BF3	
Location ID				DK3		DK3		DK3		DK3		DK4		DK4		SQ1		SQ1	
Sample ID				DK3-052011-W		DK3-050211-W		DK3-051111-W		DK3-040711-W		DK4-050211-W		DK4-040711-W		SQ1-020211-W		SQ1-042111-W	
Collection Date				5/20/2011		5/2/2011		5/11/2011		4/7/2011		5/2/2011		4/7/2011		2/2/2011		4/21/2011	
Dieldrin	EPA 8081B	0.0019	0.71	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10	U	0.10	UJ	0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	UJ	0.10	U
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10	U	0.10	UJ	0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	UJ	0.10	U
Endrin	EPA 8081B	0.0023	0.037	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Endrin Aldehyde	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Endrin Ketone	EPA 8081B			0.10	U	0.10	UJ	0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	UJ	0.10	U
Heptachlor	EPA 8081B	0.0036	0.05	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Heptachlor Epoxide	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Methoxychlor	EPA 8081B			0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Toxaphene	EPA 8081B	0.0002	0.21	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Phenols (µg/L)																			
2,4-Dimethylphenol	EPA 8270D			1.0	U	1.0	UJ	1.0	U	1.0	U	1.0	UJ	1.0	U	1.0	U	1.0	UJ
o-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
p-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Pentachlorophenol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ
Phenol	EPA 8270D			1.0	U	**1.4**		1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Phthalates (µg/L)																			
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			1.0	U	**2.8**		**3.7**		1.0	U	**4.2**		1.0	U	1.0	U	1.0	UJ
Butyl benzyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Dibutyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Diethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Dimethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
Di-n-Octyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
PAHs (µg/L)																			
1-Methylnaphthalene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.010**		0.010	U
2-Methylnaphthalene	EPA 8270DSIM			0.010	U	**0.013**		0.010	U	0.010	U	**0.010**		0.010	U	**0.014**		0.010	U
Acenaphthene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.060**		0.010	U
Acenaphthylene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U
Anthracene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.15**		0.010	U
Benzo(a)anthracene	EPA 8270DSIM			0.010	U	**0.012**		**0.013**		0.010	U	0.010	U	0.010	U	**0.57**		0.010	U
Benzo(a)pyrene	EPA 8270DSIM			0.010	U	**0.020**		**0.022**		0.010	U	0.010	U	0.010	U	**0.54**		0.010	U
Benzo(g,h,i)perylene	EPA 8270DSIM			0.010	U	**0.038**		**0.037**	**J**	0.010	U	**0.015**		0.010	U	**0.33**		0.010	U
Benzofluoranthene	EPA 8270D/8270DSIM			0.010	U	**0.043**		**0.046**		0.010	U	**0.020**		0.010	U	**0.99**		0.010	U
Chrysene	EPA 8270D/8270DSIM			0.010	U	**0.046**		**0.046**		0.010	U	**0.020**		0.010	U	**0.58**	**J**	0.010	U
Dibenzo(a,h)anthracene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.14**		0.010	U
Dibenzofuran	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.042**		0.010	U
Fluoranthene	EPA 8270D/8270DSIM			**0.012**		**0.055**		**0.057**		**0.013**		**0.031**		**0.012**		**2.1**		0.010	U
Fluorene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.066**		0.010	U
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			0.010	U	**0.013**		**0.013**		0.010	U	0.010	U	0.010	U	**0.33**		0.010	U
Naphthalene	EPA 8260C/8270DSIM			0.015	U	**0.048**		**0.028**		**0.038**		**0.054**		**0.018**		0.024	U	**0.013**	
Phenanthrene	EPA 8270DSIM			**0.010**		**0.031**		**0.031**		0.010	U	**0.035**		0.010	U	**1.1**		0.010	U
Pyrene	EPA 8270D/8270DSIM			**0.011**		**0.067**		**0.068**		**0.014**		**0.031**		**0.013**		**1.2**		0.010	U
Total HPAHs	EPA 8270D/8270DSIM			**0.023**		**0.29**		**0.30**	**J**	**0.027**		**0.12**		**0.025**		**6.8**	**J**	0.010	U
Total LPAHs	EPA 8270D/8270DSIM			**0.010**		**0.079**		**0.059**		**0.038**		**0.089**		**0.018**		**1.4**		**0.013**	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4		SW6		SW7		TS		SW6		TS		BF2		BF3	
Location ID				DK3		DK3		DK3		DK3		DK4		DK4		SQ1		SQ1	
Sample ID				DK3-052011-W		DK3-050211-W		DK3-051111-W		DK3-040711-W		DK4-050211-W		DK4-040711-W		SQ1-020211-W		SQ1-042111-W	
Collection Date				5/20/2011		5/2/2011		5/11/2011		4/7/2011		5/2/2011		4/7/2011		2/2/2011		4/21/2011	
SVOCs (µg/L)																			
1,2,4-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,4-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Benzoic Acid	EPA 8270D			10	U	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ
Benzyl Alcohol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ
Hexachlorobenzene	EPA 8081B/8270D			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Hexachlorobutadiene	EPA 8081B/8260C			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Hexachloroethane	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ
N-Nitrosodiphenylamine	EPA 8270D			1.0	U	1.0	UJ	1.0	U	1.0	U	1.0	UJ	1.0	U	1.0	U	1.0	UJ
VOCs (µg/L)																			
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,1-Trichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1,2-Trichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,1-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2,3-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2,3-Trichloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2,4-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
1,2-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3,5-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
1,3-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
2-Hexanone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
4-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Acetone	EPA 8260C			5.0	U	9.6	U	5.0	U	5.0	U	10	U	5.0	U	5.0	U	5.0	U
Acrolein	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Acrylonitrile	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Bromobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromochloromethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromoethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromoform	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Bromomethane	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Carbon Disulfide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Carbon Tetrachloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
CFC-11	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
CFC-113	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chlorodibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Chloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4		SW6		SW7		TS		SW6		TS		BF2		BF3	
Location ID				DK3		DK3		DK3		DK3		DK4		DK4		SQ1		SQ1	
Sample ID				DK3-052011-W		DK3-050211-W		DK3-051111-W		DK3-040711-W		DK4-050211-W		DK4-040711-W		SQ1-020211-W		SQ1-042111-W	
Collection Date				5/20/2011		5/2/2011		5/11/2011		4/7/2011		5/2/2011		4/7/2011		2/2/2011		4/21/2011	
Chloroform	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	**0.3**		**0.4**	
Chloromethane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	0.5	UJ	0.5	U
cis-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
cis-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Cumene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Dibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Dichlorobromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Ethylene Dibromide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Methyl ethyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U
Methyl Iodide	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl isobutyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Methylene Chloride	EPA 8260C			4.9	U	1.3	U	1.7	U	3.6	U	1.0	U	4.3	U	2.9	U	2.2	U
n-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
n-Propylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
p-Isopropyltoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
sec-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Styrene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
tert-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Tetrachloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	**0.4**		**0.3**	
trans-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	**0.4**		0.2	U
Vinyl Acetate	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	UJ	1.0	U
Vinyl Chloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
BTEX (µg/L)																			
Benzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Ethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Toluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
m, p-Xylene	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
o-Xylene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Total Xylenes	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Brominated Diphenylethers (pg/L)																			
BDE-007	EPA 1614					0.537	U					0.457	U					1.01	U
BDE-008	EPA 1614					**1.86**	**CJ**					**2.06**	**CJ**					1.01	CU
BDE-010	EPA 1614					0.555	U					0.448	U					1.01	U
BDE-011	EPA 1614					C8						C8						C8	
BDE-012	EPA 1614					**1.34**	**CJ**					**0.789**	**CJ**					1.01	CU
BDE-013	EPA 1614					C12						C12						C12	
BDE-015	EPA 1614					1.41	U					0.966	U					1.01	U
BDE-017	EPA 1614					**18.7**	**CJ**					**8.33**	**CJ**					1.39	CU
BDE-025	EPA 1614					C17						C17						C17	
BDE-028	EPA 1614					**43.6**	**CJ**					14.8	CU					**2.5**	**CJ**
BDE-030	EPA 1614					0.854	U					0.0279	U					1.01	U
BDE-032	EPA 1614					0.615	U					0.256	U					1.01	U
BDE-033	EPA 1614					C28						C28						C28	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4	SW6	SW7	TS	SW6	TS	BF2	BF3
Location ID				DK3	DK3	DK3	DK3	DK4	DK4	SQ1	SQ1
Sample ID				DK3-052011-W	DK3-050211-W	DK3-051111-W	DK3-040711-W	DK4-050211-W	DK4-040711-W	SQ1-020211-W	SQ1-042111-W
Collection Date				5/20/2011	5/2/2011	5/11/2011	4/7/2011	5/2/2011	4/7/2011	2/2/2011	4/21/2011
BDE-035	EPA 1614				3.8 U			1.05 U			1.01 U
BDE-037	EPA 1614				1.85 U			1.48 U			1.01 U
BDE-047	EPA 1614				**1310**			**458**			**92.9**
BDE-049	EPA 1614				**69.4**			27.1 U			3.23 U
BDE-051	EPA 1614				7.46 U			2.79 U			1.01 U
BDE-066	EPA 1614				**59.5**			**20.2 J**			3.36 U
BDE-071	EPA 1614				10.9 U			3.89 U			1.01 U
BDE-075	EPA 1614				**5.25 J**			1.68 U			1.01 U
BDE-077	EPA 1614				2.21 U			0.0614 U			1.01 U
BDE-079	EPA 1614				12.3 U			**1.96 J**			1.01 U
BDE-085	EPA 1614				**73.9**			**28.8 J**			**4.21 J**
BDE-099	EPA 1614				**1760**			**630**			**91**
BDE-100	EPA 1614				**376**			**122**			**18.5 J**
BDE-105	EPA 1614				11.1 U			4.21 U			1.01 U
BDE-116	EPA 1614				18 U			7.33 U			1.45 U
BDE-119	EPA 1614				9.24 CU			5.9 CU			1.01 CU
BDE-120	EPA 1614				C119			C119			C119
BDE-126	EPA 1614				6.6 U			2.38 U			1.01 U
BDE-128	EPA 1614				74.3 U			34.6 U			8.57 U
BDE-138	EPA 1614				**56.2 CJ**			**26.1 CJ**			5.36 CU
BDE-140	EPA 1614				10.8 U			**7.37 J**			3.21 U
BDE-153	EPA 1614				**197**			**91.3**			10.3 U
BDE-154	EPA 1614				**147**			**75.4**			6.98 U
BDE-155	EPA 1614				11.1 U			7.72 U			1.98 U
BDE-166	EPA 1614				C138			C138			C138
BDE-181	EPA 1614				14.1 U			14.8 U			2.19 U
BDE-183	EPA 1614				**168**			**167**			9.21 U
BDE-190	EPA 1614				51.3 U			**52.4**			3.83 U
BDE-203	EPA 1614				225 U			**190**			6.43 U
BDE-206	EPA 1614				**854**			**540**			78 U
BDE-207	EPA 1614				**1460**			**1090**			**62**
BDE-208	EPA 1614				**1130**			**760**			25.9 U
BDE-209	EPA 1614				**15700**			**13700**			322 U
Total PBDEs	EPA 1614				**23400 CJ**			**18000 CJ**			**271 CJ**
Conventionals											
Alkalinity as Bicarbonate (mg/L)	SM2320			**257**	**45.6**	**32.6**	**38.3**	**8.6**	**37.6**	**168**	**178**
Alkalinity as Carbonate (mg/L)	SM2320			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Alkalinity, Total (mg/L)	SM2320			**257**	**45.6**	**32.6**	**38.3**	**8.6**	**37.6**	**168**	**178**
Chloride (mg/L)	EPA 300.0			**22.7**	**7.5**	**3.1**	**1420**	**6.3**	**1430**	**24.3**	**29.7**
Dissolved Organic Carbon (mg/L)	EPA 415.1			**4.23**	**7.11**	**3.84**	**3.36**	**5.20**	**2.55**	**2.69**	**2.66**
Hardness as CaCO3 (mg/L)	EPA 6010B			**290**	**55**	**38**	**490**	**9.7**	**500**	**280**	**280**
Nitrate (mg/L)	EPA 300.0			**0.4**	**0.4**	**0.1**	**0.3**	**0.3**	**0.3**	**1.9**	**1.2**
pH (su)	PH			**8.08**	**7.50**	**7.37**	**7.08**	**7.34**	**7.38**	**7.26**	**7.44**
Sulfate (mg/L)	EPA 300.0			**59.1**	**9.3**	**4.1**	**204**	**2.3**	**203**	**117**	**116**
Total Organic Carbon (mg/L)	EPA 415.1			**4.42**	**11.1**	**6.24**	**3.78**	**6.68**	**3.09**	**3.76**	**3.07**

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	BF4		SW6		SW7		TS		SW6		TS		BF2		BF3	
Location ID				DK3		DK3		DK3		DK3		DK4		DK4		SQ1		SQ1	
Sample ID				DK3-052011-W		DK3-050211-W		DK3-051111-W		DK3-040711-W		DK4-050211-W		DK4-040711-W		SQ1-020211-W		SQ1-042111-W	
Collection Date				5/20/2011		5/2/2011		5/11/2011		4/7/2011		5/2/2011		4/7/2011		2/2/2011		4/21/2011	
Total Solids (percent)	EPA 1614					**0.059**						**0.038**						**0.02**	
Total Suspended Solids (mg/L)	EPA 160.2			**9.8**		**63.0**		**59.8**		**20.9**		**15.0**		**18.8**		**474**		**2.4**	

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2		SW3		SW4		SW8		BF2		BF3		SW3		SW4	
Location ID				SQ1		SQ1		SQ1		SQ1		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ1-021111-W		SQ1-030411-W		SQ1-031511-W		SQ1-052511-W		SQ2-020211-W		SQ2-042111-W		SQ2-030411-W		SQ2-031511-W	
Collection Date				2/14/2011		3/5/2011		3/15/2011		5/26/2011		2/2/2011		4/21/2011		3/5/2011		3/15/2011	
PCBs (µg/L)																			
Aroclor 1016	EPA 8082			0.010	U	0.010	U	0.010	UJ	0.010	U	0.20	U	0.010	U	0.010	UJ	0.010	U
Aroclor 1221	EPA 8082			0.010	U	0.010	U	0.010	UJ	0.010	U	0.20	U	0.010	U	0.010	UJ	0.010	U
Aroclor 1232	EPA 8082			0.010	U	0.010	U	0.010	UJ	0.010	U	0.20	U	0.010	U	0.010	UJ	0.010	U
Aroclor 1242	EPA 8082			0.010	U	0.010	U	0.010	UJ	0.010	U	**5.6**		**0.018**		0.010	UJ	0.010	U
Aroclor 1248	EPA 8082			**0.013**		0.010	U	0.010	UJ	0.010	U	0.20	U	0.010	U	**0.058**	**J**	**0.011**	
Aroclor 1254	EPA 8082			**0.019**		**0.013**		0.010	UJ	0.010	U	**3.1**		**0.025**		**0.065**	**J**	0.010	U
Aroclor 1260	EPA 8082			0.010	U	0.010	U	0.010	UJ	0.010	U	**0.45**		0.010	U	0.043	UJ	0.010	U
Total PCBs	EPA 8082	0.03	10	**0.032**		**0.013**		0.010	UJ	0.010	U	**9.1**		**0.043**		**0.12**	**J**	**0.011**	
Metals – Total (µg/L)																			
Arsenic	EPA 200.8			**1.3**		**1.8**		**1.0**		**0.6**		**7.0**		**0.8**		**1.4**		**0.8**	
Cadmium	EPA 200.8			**0.3**		**0.3**		0.2	U	**0.1**		**2.9**		0.1	U	**0.3**		0.2	U
Calcium	EPA 6010B			**56100**		**28000**		**59700**		**70800**		**76400**		**64200**		**17500**		**49500**	
Chromium	EPA 200.8			**3.5**		**5.9**		**2.2**		**0.5**		**106**		**3.7**		**19.7**		**5.6**	
Copper	EPA 200.8			**24.8**		**31.8**		**11.7**		**9.7**		**310**		**8.8**		**25.2**		**10.2**	
Lead	EPA 200.8			**15**		**16**		**4**		**1.9**		**214**		**1.1**		**15**		**3**	
Magnesium	EPA 6010B			**16300**		**10300**		**17600**		**21900**		**23100**		**22600**		**6320**		**15300**	
Mercury	EPA 7470A			0.1	U	0.1	U	0.1	U	0.1	U	**2.2**		0.1	U	0.1	U	0.1	U
Nickel	EPA 200.8			**5.3**		**7.3**		**4.3**		**3.7**		**39.2**		**5.0**		**9.0**		**6.8**	
Selenium	EPA 200.8			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	**0.8**		0.5	U	0.5	U
Silver	EPA 200.8			0.2	U	0.2	U	0.2	U	0.2	U	**0.6**		0.2	U	0.2	U	0.2	U
Zinc	EPA 200.8			**71**		**140**		**48**		**62**		**310**	**J**	**24**		**113**		**44**	
Metals – Dissolved (µg/L)																			
Arsenic	EPA 200.8	36	69	**0.6**		**0.7**		**0.5**		**0.4**		**0.8**		**0.6**		**0.5**		**0.4**	
Cadmium	EPA 200.8	9.3	42	0.2	U	0.2	U	0.2	U	0.1	U	0.2	U	0.1	U	0.2	U	0.2	U
Chromium	EPA 200.8			0.5	U	**1.0**		**0.5**		0.5	U	0.5	U	1	U	**1.4**		**0.7**	
Copper	EPA 200.8	3.1	4.8	**5.6**		**7.9**		**4.2**		**5.7**		**1.2**		**4.8**		**6.2**		**3.8**	
Lead	EPA 200.8	8.1	210	1	U	1	U	1	U	0.1	U	1	U	0.1	U	1	U	1	U
Mercury	EPA 7470A	0.025	1.8	0.02	U	0.02	U	0.0200	U	0.0200	U	0.02	U	0.02	U	0.02	U	0.0200	U
Nickel	EPA 200.8	8.2	74	**1.7**		**2.0**		**2.4**		**3.3**		**8.8**		**4.6**		**4.9**		**4.6**	
Selenium	EPA 200.8	71	290	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U	**0.6**		0.5	U	0.5	U
Silver	EPA 200.8		1.9	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Zinc	EPA 200.8	81	90	**26**		**43**		**26**		**34**		**5**	**J**	**13**		**39**		**26**	
Pesticides (µg/L)																			
Aldrin	EPA 8081B	0.0019	0.71	0.050	U	0.050	U	0.050	U	0.050	U	0.34	U			0.050	U	0.050	U
alpha-BHC	EPA 8081B			0.050	U	0.050	U	0.050	UJ	0.050	UJ	0.050	UJ			0.050	U	0.050	UJ
beta-BHC	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	UJ	0.050	U			0.050	U	0.050	U
delta-BHC	EPA 8081B			0.050	UJ	0.050	UJ	0.050	UJ	0.050	UJ	0.050	U			0.050	UJ	0.050	UJ
Lindane	EPA 8081B		0.16	0.050	U	0.050	U	0.050	U	0.050	UJ	0.050	U			0.050	U	0.050	U
cis-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
Chlordane	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Total DDTs	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2		SW3		SW4		SW8		BF2		BF3		SW3		SW4	
Location ID				SQ1		SQ1		SQ1		SQ1		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ1-021111-W		SQ1-030411-W		SQ1-031511-W		SQ1-052511-W		SQ2-020211-W		SQ2-042111-W		SQ2-030411-W		SQ2-031511-W	
Collection Date				2/14/2011		3/5/2011		3/15/2011		5/26/2011		2/2/2011		4/21/2011		3/5/2011		3/15/2011	
Dieldrin	EPA 8081B	0.0019	0.71	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	UJ			0.10	U	0.10	UJ
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10	UJ	0.10	U	0.10	UJ	0.10	UJ	0.10	UJ			0.10	U	0.10	UJ
Endrin	EPA 8081B	0.0023	0.037	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Endrin Aldehyde	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U	0.10	U
Endrin Ketone	EPA 8081B			0.10	U	0.10	U	0.10	UJ	0.10	U	0.10	UJ			0.10	U	0.10	UJ
Heptachlor	EPA 8081B	0.0036	0.05	0.050	U	0.050	U	0.050	U	0.050	UJ	0.15	U			0.050	U	0.050	U
Heptachlor Epoxide	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
Methoxychlor	EPA 8081B			0.50	U	0.50	U	0.50	U	0.50	U	0.50	U			0.50	U	0.50	U
Toxaphene	EPA 8081B	0.0002	0.21	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U	5.0	U
Phenols (µg/L)																			
2,4-Dimethylphenol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
o-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
p-Cresol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Pentachlorophenol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U	5.0	U
Phenol	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Phthalates (µg/L)																			
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			**1.4**		1.8	U	1.0	U	1.0	U	**2.2**				1.9	U	1.0	U
Butyl benzyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Dibutyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Diethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Dimethyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Di-n-Octyl phthalate	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
PAHs (µg/L)																			
1-Methylnaphthalene	EPA 8270DSIM			0.010	U	**0.012**		0.010	U	0.010	U	**0.12**				0.010	U	0.010	U
2-Methylnaphthalene	EPA 8270DSIM			**0.016**		**0.021**		**0.010**		0.010	U	**0.15**				**0.016**		0.010	U
Acenaphthene	EPA 8270DSIM			**0.010**		**0.014**		0.010	U	0.010	U	**0.31**				**0.013**		0.010	U
Acenaphthylene	EPA 8270DSIM			0.010	U	0.010	U	0.010	U	0.010	U	0.10	U			0.010	U	0.010	U
Anthracene	EPA 8270DSIM			**0.012**		**0.016**		0.010	U	0.010	U	**0.75**				**0.013**		0.010	U
Benzo(a)anthracene	EPA 8270DSIM			**0.046**		**0.065**		**0.030**		0.010	U	**3.7**				**0.066**		**0.016**	
Benzo(a)pyrene	EPA 8270DSIM			**0.053**		**0.078**		**0.038**		0.010	U	**3.5**				**0.088**		**0.023**	
Benzo(g,h,i)perylene	EPA 8270DSIM			**0.050**		**0.12**		**0.048**		0.010	U	**2.2**				**0.11**		**0.030**	
Benzofluoranthene	EPA 8270D/8270DSIM			**0.11**		**0.16**		**0.084**		**0.012**		**6.2**				**0.19**		**0.051**	
Chrysene	EPA 8270D/8270DSIM			**0.078**	**J**	**0.19**		**0.071**		**0.010**		**3.6**	**J**			**0.17**		**0.046**	
Dibenzo(a,h)anthracene	EPA 8270DSIM			**0.016**		**0.030**		**0.016**		0.010	U	**0.98**				**0.032**		0.010	U
Dibenzofuran	EPA 8270DSIM			0.010	U	**0.017**		0.010	U	0.010	U	**0.19**				**0.013**		0.010	U
Fluoranthene	EPA 8270D/8270DSIM			**0.19**		**0.32**		**0.13**		**0.013**		**11**				**0.29**		**0.080**	
Fluorene	EPA 8270DSIM			**0.014**		**0.023**		0.010	U	0.010	U	**0.39**				**0.017**		0.010	U
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			**0.032**		**0.056**		**0.029**		0.010	U	**2.2**				**0.064**		**0.018**	
Naphthalene	EPA 8260C/8270DSIM			**0.038**		**0.048**		**0.040**		**0.017**		**0.10**				**0.044**		**0.033**	
Phenanthrene	EPA 8270DSIM			**0.089**		**0.14**		**0.061**		0.010	U	**5.6**				**0.12**		**0.039**	
Pyrene	EPA 8270D/8270DSIM			**0.13**		**0.34**		**0.11**		**0.012**		**7.0**				**0.30**		**0.070**	
Total HPAHs	EPA 8270D/8270DSIM			**0.7**	**J**	**1.4**		**0.56**		**0.047**		**40**	**J**			**1.3**		**0.33**	
Total LPAHs	EPA 8270D/8270DSIM			**0.16**		**0.24**		**0.10**		**0.017**		**7.2**				**0.21**		**0.072**	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2		SW3		SW4		SW8		BF2		BF3		SW3		SW4	
Location ID				SQ1		SQ1		SQ1		SQ1		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ1-021111-W		SQ1-030411-W		SQ1-031511-W		SQ1-052511-W		SQ2-020211-W		SQ2-042111-W		SQ2-030411-W		SQ2-031511-W	
Collection Date				2/14/2011		3/5/2011		3/15/2011		5/26/2011		2/2/2011		4/21/2011		3/5/2011		3/15/2011	
SVOCs (µg/L)																			
1,2,4-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U			0.5	U	0.5	U
1,2-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,3-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,4-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Benzoic Acid	EPA 8270D			10	U	10	U	10	U	10	U	10	U			10	U	10	U
Benzyl Alcohol	EPA 8270D			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U	5.0	U
Hexachlorobenzene	EPA 8081B/8270D			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
Hexachlorobutadiene	EPA 8081B/8260C			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U	0.050	U
Hexachloroethane	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
N-Nitrosodiphenylamine	EPA 8270D			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
VOCs (µg/L)																			
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,1,1-Trichloroethane	EPA 8260C			0.2	U	0.2	U	**0.3**		0.2	U	0.2	U			0.2	U	**0.3**	
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,1,2-Trichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,1-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,1-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,1-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,2,3-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U			0.5	U	0.5	U
1,2,3-Trichloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U			0.5	U	0.5	U
1,2,4-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	U			0.5	U	0.5	U
1,2-Dichloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,3,5-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
1,3-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
2,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
2-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
2-Hexanone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U	5.0	U
4-Chlorotoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Acetone	EPA 8260C			5.0	UJ	26	U	8.5	U	5.0	U	5.0	U			24	U	5.0	U
Acrolein	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U			5.0	U	5.0	U
Acrylonitrile	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Bromobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Bromochloromethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Bromoethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Bromoform	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Bromomethane	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Carbon Disulfide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Carbon Tetrachloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
CFC-11	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
CFC-113	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Chlorobenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Chlorodibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U
Chloroethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U	0.2	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2	SW3	SW4	SW8	BF2	BF3	SW3	SW4
Location ID				SQ1	SQ1	SQ1	SQ1	SQ2	SQ2	SQ2	SQ2
Sample ID				SQ1-021111-W	SQ1-030411-W	SQ1-031511-W	SQ1-052511-W	SQ2-020211-W	SQ2-042111-W	SQ2-030411-W	SQ2-031511-W
Collection Date				2/14/2011	3/5/2011	3/15/2011	5/26/2011	2/2/2011	4/21/2011	3/5/2011	3/15/2011
Chloroform	EPA 8260C			**0.3**	0.2 U	0.2 U	**0.4**	**0.3**		0.2 U	0.2 U
Chloromethane	EPA 8260C			0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U	0.5 U
cis-1,2-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
cis-1,3-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Cumene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Dibromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Dichlorobromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Ethylene Dibromide	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Methyl ethyl ketone	EPA 8260C			5.4 UJ	**5.6**	5.0 U	5.0 U	5.0 U		**5.1**	5.0 U
Methyl Iodide	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U	1.0 U
Methyl isobutyl ketone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U	5.0 U
Methylene Chloride	EPA 8260C			3.0 U	7.5 U	2.5 U	2.8 U	3.6 U		2.0 U	2.1 U
n-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
n-Propylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
p-Isopropyltoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
sec-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Styrene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
tert-Butylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Tetrachloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	**0.3**		0.2 U	0.2 U
trans-1,2-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
trans-1,3-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U	1.0 U
Trichloroethene	EPA 8260C			0.2 U	0.2 U	**0.3**	0.2 U	**0.3**		0.2 U	0.2 U
Vinyl Acetate	EPA 8260C			1.0 UJ	1.0 U	1.0 U	1.0 UJ	1.0 U		1.0 U	1.0 U
Vinyl Chloride	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
BTEX (µg/L)											
Benzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Ethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Toluene	EPA 8260C			0.3 U	0.4 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
m, p-Xylene	EPA 8260C			0.4 U	0.4 U	0.4 U	0.4 U	0.4 U		0.4 U	0.4 U
o-Xylene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U	0.2 U
Total Xylenes	EPA 8260C			0.4 U	0.4 U	0.4 U	0.4 U	0.4 U		0.4 U	0.4 U
Brominated Diphenylethers (pg/L)											
BDE-007	EPA 1614				3.74 U					2.79 U	
BDE-008	EPA 1614				2.74 CU					**3.21 CJ**	
BDE-010	EPA 1614				4.2 U					3.13 U	
BDE-011	EPA 1614				C8					C8	
BDE-012	EPA 1614				2.33 CU					**1.95 CJ**	
BDE-013	EPA 1614				C12					C12	
BDE-015	EPA 1614				2.71 U					**3.26 J**	
BDE-017	EPA 1614				**28.6 CJ**					**25.6 CJ**	
BDE-025	EPA 1614				C17					C17	
BDE-028	EPA 1614				**47.8 CJ**					**44.4 CJ**	
BDE-030	EPA 1614				3.34 U					2.59 U	
BDE-032	EPA 1614				2.76 U					2.14 U	
BDE-033	EPA 1614				C28					C28	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2		SW3		SW4		SW8		BF2		BF3		SW3		SW4	
Location ID				SQ1		SQ1		SQ1		SQ1		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ1-021111-W		SQ1-030411-W		SQ1-031511-W		SQ1-052511-W		SQ2-020211-W		SQ2-042111-W		SQ2-030411-W		SQ2-031511-W	
Collection Date				2/14/2011		3/5/2011		3/15/2011		5/26/2011		2/2/2011		4/21/2011		3/5/2011		3/15/2011	
BDE-035	EPA 1614					14.4	U									9.96	U		
BDE-037	EPA 1614					3.26	J									3.76	J		
BDE-047	EPA 1614					1590										1300			
BDE-049	EPA 1614					75.8										75			
BDE-051	EPA 1614					8.89	J									11.7	J		
BDE-066	EPA 1614					65.6										60.4			
BDE-071	EPA 1614					14.9	U									11.4	J		
BDE-075	EPA 1614					3.86	U									5.45	J		
BDE-077	EPA 1614					1.85	U									2.34	U		
BDE-079	EPA 1614					12.2	J									1.02	U		
BDE-085	EPA 1614					100										79.3			
BDE-099	EPA 1614					2140										1730			
BDE-100	EPA 1614					429										352			
BDE-105	EPA 1614					10.8	U									11.1	U		
BDE-116	EPA 1614					14.6	U									15	U		
BDE-119	EPA 1614					8	CU									8.22	CU		
BDE-120	EPA 1614					C119										C119			
BDE-126	EPA 1614					5.03	U									5.27	U		
BDE-128	EPA 1614					45.3	U									20.5	U		
BDE-138	EPA 1614					43.4	CJ									34	CJ		
BDE-140	EPA 1614					11.4	J									11	J		
BDE-153	EPA 1614					236										196			
BDE-154	EPA 1614					182										153			
BDE-155	EPA 1614					13.6	J									11.6	J		
BDE-166	EPA 1614					C138										C138			
BDE-181	EPA 1614					14.7	U									11.3	U		
BDE-183	EPA 1614					159										136			
BDE-190	EPA 1614					64.2	U									21.4	U		
BDE-203	EPA 1614					338										338			
BDE-206	EPA 1614					1760										1650			
BDE-207	EPA 1614					2850										2790			
BDE-208	EPA 1614					1840										1630			
BDE-209	EPA 1614					16100										14000			
Total PBDEs	EPA 1614					28000	CJ									24700	CJ		
Conventionals																			
Alkalinity as Bicarbonate (mg/L)	SM2320			128		73.3		134		173		168				48.7		118	
Alkalinity as Carbonate (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U	1.0	U
Alkalinity, Total (mg/L)	SM2320			128		73.3		134		173		168				48.7		118	
Chloride (mg/L)	EPA 300.0			19.6		32.4		23.4		28.9		29.5				23.3		22.0	
Dissolved Organic Carbon (mg/L)	EPA 415.1			4.37		5.88		4.85		5.73		2.76				4.65		4.46	
Hardness as CaCO3 (mg/L)	EPA 6010B			210		110		220		270		290		250		70		190	
Nitrate (mg/L)	EPA 300.0			1.1		0.7		1.8		1.0		1.9				0.5	U	1.6	
pH (su)	PH			7.47		7.38		7.33		7.36		7.48				7.46		7.28	
Sulfate (mg/L)	EPA 300.0			91.1		28.9		90.5		106		111				16.6		76.5	
Total Organic Carbon (mg/L)	EPA 415.1			5.83		9.46		6.64		6.28		3.46				7.48		5.57	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW2		SW3		SW4		SW8		BF2		BF3		SW3		SW4	
Location ID				SQ1		SQ1		SQ1		SQ1		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ1-021111-W		SQ1-030411-W		SQ1-031511-W		SQ1-052511-W		SQ2-020211-W		SQ2-042111-W		SQ2-030411-W		SQ2-031511-W	
Collection Date				2/14/2011		3/5/2011		3/15/2011		5/26/2011		2/2/2011		4/21/2011		3/5/2011		3/15/2011	
Total Solids (percent)	EPA 1614																		
Total Suspended Solids (mg/L)	EPA 160.2			**43.4**		**79.0**		**22.9**		**13.4**		**2640**		**7.0**		**56.4**		**17.6**	

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID / Location ID / Sample ID / Collection Date	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8 / SQ2 / SQ2-052511-W / 5/26/2011	TS / SQ2 / SQ2-040711-W / 4/7/2011	BF2 / SQ3 / SQ3-020211-W / 2/2/2011	BF3 / SQ3 / SQ3-042111-W / 4/21/2011	SW2 / SQ3 / SQ3-021111-W / 2/14/2011	SW3 / SQ3 / SQ3-030411-W / 3/5/2011	SW4 / SQ3 / SQ3-031511-W / 3/15/2011	SW8 / SQ3 / SQ3-052511-W / 5/26/2011
PCBs (µg/L)											
Aroclor 1016	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1221	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1232	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aroclor 1242	EPA 8082			0.010 U	0.010 U	0.033	0.074	0.19	0.010 U	0.010 U	0.20
Aroclor 1248	EPA 8082			0.010 U	0.018	0.010 U	0.010 U	0.010 U	0.049 J	0.10	0.010 U
Aroclor 1254	EPA 8082			0.010 U	0.012 U	0.015	0.041	0.089	0.024	0.057	0.11
Aroclor 1260	EPA 8082			0.010 U	0.010 U	0.010 U	0.010 U	0.019	0.010 U	0.017	0.034
Total PCBs	EPA 8082	0.03	10	0.010 U	0.018	0.048	0.12	0.3	0.073 J	0.17	0.34
Metals – Total (µg/L)											
Arsenic	EPA 200.8			0.8	0.7	1.0	0.9	1.2	1.1	1.1	1.7
Cadmium	EPA 200.8			0.1	0.1 U	0.2 U	0.1 U	0.3	0.2	0.3	0.4
Calcium	EPA 6010B			58200	44800	57600	60900	25600	37300	18200	20600
Chromium	EPA 200.8			12.2	4.2	14.0	2.4	11.7	6.0	7.9	6.4
Copper	EPA 200.8			9.6	4.3	9.4	9.0	20.6	18.8	18.8	31.7
Lead	EPA 200.8			2.3	1.5	2	2.3	16	11	14	15.5
Magnesium	EPA 6010B			19500	81800	31300	28200	8290	13000	5200	6460
Mercury	EPA 7470A			0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1
Nickel	EPA 200.8			5.5	5.4	5.5	3.7	4.4	4.5	4.7	5.4
Selenium	EPA 200.8			0.5	2 U	1.0	2 U	0.5 U	0.5 U	0.5 U	0.5 U
Silver	EPA 200.8			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	EPA 200.8			49	17	15 J	27	71 J	78	90	134
Metals – Dissolved (µg/L)											
Arsenic	EPA 200.8	36	69	0.5	0.5 U	0.7	0.7	0.5	0.5	0.4	0.7
Cadmium	EPA 200.8	9.3	42	0.1 U	0.1 U	0.2 U	0.1 U	0.2 U	0.2 U	0.2 U	0.1
Chromium	EPA 200.8			0.5 U	0.7	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.6
Copper	EPA 200.8	3.1	4.8	5.7	2.1	3.9	4.5	3.9	4.2	3.1	12.3
Lead	EPA 200.8	8.1	210	0.1	0.1 U	1 U	0.1 U	1 U	1 U	1 U	0.6
Mercury	EPA 7470A	0.025	1.8	0.0200 U	0.0200 U	0.02 U	0.02 U	0.02 U	0.02 U	0.0200 U	0.0200 U
Nickel	EPA 200.8	8.2	74	4.5	5.0	4.8	3.2	2.2	1.7	1.6	2.8
Selenium	EPA 200.8	71	290	0.5 U	2 U	0.8	0.9	0.5 U	0.5 U	0.5 U	0.5 U
Silver	EPA 200.8		1.9	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Zinc	EPA 200.8	81	90	34	10	10 J	16	35	34	34	72
Pesticides (µg/L)											
Aldrin	EPA 8081B	0.0019	0.71	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
alpha-BHC	EPA 8081B			0.050 UJ	0.050 U	0.050 UJ	0.050 U	0.050 U	0.050 U	0.050 UJ	0.050 UJ
beta-BHC	EPA 8081B			0.050 UJ	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 UJ
delta-BHC	EPA 8081B			0.050 UJ	0.050 UJ	0.050 U	0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ	0.050 UJ
Lindane	EPA 8081B		0.16	0.050 UJ	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 UJ
cis-Chlordane	EPA 8081B	0.004	0.09	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Chlordane	EPA 8081B			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Total DDTs	EPA 8081B			0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8	TS	BF2	BF3	SW2	SW3	SW4	SW8
Location ID				SQ2	SQ2	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3
Sample ID				SQ2-052511-W	SQ2-040711-W	SQ3-020211-W	SQ3-042111-W	SQ3-021111-W	SQ3-030411-W	SQ3-031511-W	SQ3-052511-W
Collection Date				5/26/2011	4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011
Dieldrin	EPA 8081B	0.0019	0.71	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10 U	0.10 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 UJ	0.10 U
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10 UJ	0.10 U	0.10 UJ	0.10 U	0.10 UJ	0.10 U	0.10 UJ	0.10 UJ
Endrin	EPA 8081B	0.0023	0.037	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Aldehyde	EPA 8081B			0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Endrin Ketone	EPA 8081B			0.10 U	0.10 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 UJ	0.10 U
Heptachlor	EPA 8081B	0.0036	0.05	0.050 UJ	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 UJ
Heptachlor Epoxide	EPA 8081B			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Methoxychlor	EPA 8081B			0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Toxaphene	EPA 8081B	0.0002	0.21	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenols (µg/L)											
2,4-Dimethylphenol	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
o-Cresol	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
p-Cresol	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Pentachlorophenol	EPA 8270D			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Phenol	EPA 8270D			1.0 U	1.0 U	**1.2**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Phthalates (µg/L)											
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	**1.1**	1.3 U	**1.8**	**1.5**
Butyl benzyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibutyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Diethyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dimethyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Di-n-Octyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
PAHs (µg/L)											
1-Methylnaphthalene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.011**	**0.015**	0.030 U	**0.038**
2-Methylnaphthalene	EPA 8270DSIM			0.010 U	0.010 U	**0.011**	0.010 U	**0.025**	**0.023**	0.030 U	**0.049**
Acenaphthene	EPA 8270DSIM			0.010 U	**0.014**	0.010 U	0.010 U	**0.012**	0.010 U	0.030 U	0.010 U
Acenaphthylene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.030 U	0.010 U
Anthracene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.011**	0.010 U	0.030 U	0.010 U
Benzo(a)anthracene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.049**	**0.038**	**0.096**	**0.029**
Benzo(a)pyrene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.054**	**0.050**	**0.14**	**0.035**
Benzo(g,h,i)perylene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.058**	**0.067**	**0.16**	**0.047**
Benzofluoranthene	EPA 8270D/8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.12**	**0.12**	**0.26**	**0.080**
Chrysene	EPA 8270D/8270DSIM			0.010 U	**0.010**	0.010 U	0.010 U	**0.082** J	**0.10**	**0.25**	**0.088**
Dibenzo(a,h)anthracene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.018**	**0.013**	**0.043**	0.010 U
Dibenzofuran	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.011**	0.010 U	0.030 U	0.010 U
Fluoranthene	EPA 8270D/8270DSIM			**0.011**	**0.018**	**0.016**	**0.011**	**0.19**	**0.16**	**0.38**	**0.12**
Fluorene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.016**	**0.011**	0.030 U	**0.015**
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	**0.035**	**0.035**	**0.094**	**0.022**
Naphthalene	EPA 8260C/8270DSIM			**0.017**	**0.016**	0.018 U	**0.028**	**0.056**	**0.057**	0.030 U	**0.045**
Phenanthrene	EPA 8270DSIM			0.010 U	**0.011**	**0.012**	0.010 U	**0.084**	**0.076**	**0.18**	**0.074**
Pyrene	EPA 8270D/8270DSIM			0.010 U	**0.019**	**0.014**	**0.015**	**0.14**	**0.17**	**0.38**	**0.11**
Total HPAHs	EPA 8270D/8270DSIM			**0.011**	**0.047**	**0.030**	**0.026**	**0.75** J	**0.75**	**1.8**	**0.53**
Total LPAHs	EPA 8270D/8270DSIM			**0.017**	**0.041**	**0.012**	**0.028**	**0.18**	**0.14**	**0.18**	**0.13**

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8	TS	BF2	BF3	SW2	SW3	SW4	SW8
Location ID				SQ2	SQ2	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3
Sample ID				SQ2-052511-W	SQ2-040711-W	SQ3-020211-W	SQ3-042111-W	SQ3-021111-W	SQ3-030411-W	SQ3-031511-W	SQ3-052511-W
Collection Date				5/26/2011	4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011
SVOCs (µg/L)											
1,2,4-Trichlorobenzene	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Benzoic Acid	EPA 8270D			10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Benzyl Alcohol	EPA 8270D			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Hexachlorobenzene	EPA 8081B/8270D			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Hexachlorobutadiene	EPA 8081B/8260C			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
Hexachloroethane	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
N-Nitrosodiphenylamine	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U
VOCs (µg/L)											
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1-Trichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	EPA 8260C			0.2 U	0.2 U	**0.2**	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,3-Trichloropropane	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2,4-Trimethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,2-Dichloroethane	EPA 8260C			0.2 U	0.2 U	**0.2**	**0.2**	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2,2-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Chlorotoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
4-Chlorotoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Acetone	EPA 8260C			12 U	5.5 U	5.0 U	5.0 U	5.2 UJ	11 U	7.1 U	24 U
Acrolein	EPA 8260C			5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ
Acrylonitrile	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromochloromethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromoethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromoform	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Disulfide	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CFC-11	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
CFC-113	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlorodibromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8		TS		BF2		BF3		SW2		SW3		SW4		SW8	
Location ID				SQ2		SQ2		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3	
Sample ID				SQ2-052511-W		SQ2-040711-W		SQ3-020211-W		SQ3-042111-W		SQ3-021111-W		SQ3-030411-W		SQ3-031511-W		SQ3-052511-W	
Collection Date				5/26/2011		4/7/2011		2/2/2011		4/21/2011		2/14/2011		3/5/2011		3/15/2011		5/26/2011	
Chloroform	EPA 8260C			**0.3**		0.2	U	**0.3**		**0.4**		0.2	U	0.2	U	0.2	U	0.2	U
Chloromethane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	U	0.5	UJ	0.5	U	0.5	U	0.5	U
cis-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	**0.4**		**0.3**		0.2	U	0.2	U	0.2	U	0.2	U
cis-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Cumene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Dibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Dichlorobromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Ethylene Dibromide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Methyl ethyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U	5.0	U	5.0	U
Methyl Iodide	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Methyl isobutyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
Methylene Chloride	EPA 8260C			2.6	U	6.5	U	4.9	U	2.2	U	1.5	U	2.9	U	2.7	U	3.6	U
n-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
n-Propylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
p-Isopropyltoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
sec-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Styrene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
tert-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Tetrachloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Trichloroethene	EPA 8260C			0.2	U	0.2	U	**0.4**		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Vinyl Acetate	EPA 8260C			1.0	UJ	1.0	U	1.0	U	1.0	U	1.0	UJ	1.0	U	1.0	U	1.0	UJ
Vinyl Chloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
BTEX (µg/L)																			
Benzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Ethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Toluene	EPA 8260C			0.6	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.7	U
m, p-Xylene	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
o-Xylene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
Total Xylenes	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Brominated Diphenylethers (pg/L)																			
BDE-007	EPA 1614									**1.25**	**J**			2.33	U				
BDE-008	EPA 1614									0.959	CU			1.72	CU				
BDE-010	EPA 1614									0.56	U			2.47	U				
BDE-011	EPA 1614									C8				C8					
BDE-012	EPA 1614									0.988	CU			1.48	CU				
BDE-013	EPA 1614									C12				C12					
BDE-015	EPA 1614									0.413	U			**2.98**	**J**				
BDE-017	EPA 1614									5.43	CU			**28.6**	**CJ**				
BDE-025	EPA 1614									C17				C17					
BDE-028	EPA 1614									6.19	CU			**36.4**	**CJ**				
BDE-030	EPA 1614									0.26	U			2.56	U				
BDE-032	EPA 1614									0.187	U			2.11	U				
BDE-033	EPA 1614									C28				C28					

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8		TS		BF2		BF3		SW2		SW3		SW4		SW8	
Location ID				SQ2		SQ2		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3	
Sample ID				SQ2-052511-W		SQ2-040711-W		SQ3-020211-W		SQ3-042111-W		SQ3-021111-W		SQ3-030411-W		SQ3-031511-W		SQ3-052511-W	
Collection Date				5/26/2011		4/7/2011		2/2/2011		4/21/2011		2/14/2011		3/5/2011		3/15/2011		5/26/2011	
BDE-035	EPA 1614									0.188	U			7.4	U				
BDE-037	EPA 1614									**0.749**	**J**			1.72	U				
BDE-047	EPA 1614									**197**				**1050**					
BDE-049	EPA 1614									9.36	U			**68.1**					
BDE-051	EPA 1614									2.14	U			6.36	U				
BDE-066	EPA 1614									8.61	U			46	U				
BDE-071	EPA 1614									2.18	U			7.81	U				
BDE-075	EPA 1614									0.899	U			3.2	U				
BDE-077	EPA 1614									0.162	U			1.02	U				
BDE-079	EPA 1614									2.09	U			1.02	U				
BDE-085	EPA 1614									**12**	**J**			**67.1**					
BDE-099	EPA 1614									**247**				**1430**					
BDE-100	EPA 1614									**46.8**	**J**			**294**					
BDE-105	EPA 1614									1.91	U			9.3	U				
BDE-116	EPA 1614									3.09	U			12.1	U				
BDE-119	EPA 1614									1.48	CU			6.63	CU				
BDE-120	EPA 1614									C119				C119					
BDE-126	EPA 1614									1.21	U			3.7	U				
BDE-128	EPA 1614									15.9	U			88.8	U				
BDE-138	EPA 1614									10.3	CU			53.1	CU				
BDE-140	EPA 1614									**6.43**	**J**			12.9	U				
BDE-153	EPA 1614									**37.1**	**J**			**176**					
BDE-154	EPA 1614									**26.1**	**J**			**132**					
BDE-155	EPA 1614									**4.35**	**J**			8.63	U				
BDE-166	EPA 1614									C138				C138					
BDE-181	EPA 1614									**3.21**	**J**			11.7	U				
BDE-183	EPA 1614									52.4	U			118	U				
BDE-190	EPA 1614									17.6	U			36.5	U				
BDE-203	EPA 1614									**236**				**233**					
BDE-206	EPA 1614									**981**				**945**					
BDE-207	EPA 1614									**2040**				**1670**					
BDE-208	EPA 1614									**1380**				**1190**					
BDE-209	EPA 1614									**19100**				**11400**					
Total PBDEs	EPA 1614									**24300**	**J**			**18700**	**CJ**				
Conventionals																			
Alkalinity as Bicarbonate (mg/L)	SM2320			**157**		**68.8**		**151**		**171**		**70.5**		**102**		**46.2**		**57.8**	
Alkalinity as Carbonate (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U
Alkalinity, Total (mg/L)	SM2320			**157**		**68.8**		**151**		**171**		**70.5**		**102**		**46.2**		**57.8**	
Chloride (mg/L)	EPA 300.0			**47.4**		**1120**		**251**		**171**		**20.6**		**28.2**		**9.8**		**30.8**	
Dissolved Organic Carbon (mg/L)	EPA 415.1			**8.47**		**2.98**		**2.85**		**7.13**		**3.93**		**3.78**		**3.51**		**13.6**	
Hardness as CaCO3 (mg/L)	EPA 6010B			**230**		**450**		**270**		**270**		**98**		**150**		**67**		**78**	
Nitrate (mg/L)	EPA 300.0			**1.1**		**0.5**		**1.4**		**1.1**		**0.5**		**0.9**		**0.5**		**0.2**	
pH (su)	PH			**7.48**		**7.42**		**7.53**		**7.40**		**7.60**		**7.53**		**7.31**		**7.00**	
Sulfate (mg/L)	EPA 300.0			**85.2**		**177**		**114**		**107**		**38.2**		**50.7**		**23.0**		**25.2**	
Total Organic Carbon (mg/L)	EPA 415.1			**10.9**		**3.92**		**3.22**		**7.85**		**5.36**		**6.13**		**5.03**		**16.6**	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	SW8	TS	BF2	BF3	SW2	SW3	SW4	SW8
Location ID				SQ2	SQ2	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3
Sample ID				SQ2-052511-W	SQ2-040711-W	SQ3-020211-W	SQ3-042111-W	SQ3-021111-W	SQ3-030411-W	SQ3-031511-W	SQ3-052511-W
Collection Date				5/26/2011	4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011
Total Solids (percent)	EPA 1614						**0.02**				
Total Suspended Solids (mg/L)	EPA 160.2			**9.6**	**14.3**	**5.1**	**8.6**	**43.8**	**35.6**	**48.4**	**61.6**

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS		BF2		BF3		SW2		SW3		SW4		SW8		TS	
Location ID				SQ3		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ3-040711-W		SQ4-020211-W		SQ4-042111-W		SQ4-021111-W		SQ4-030411-W		SQ4-031511-W		SQ4-052511-W		SQ4-040811-W	
Collection Date				4/7/2011		2/2/2011		4/21/2011		2/14/2011		3/5/2011		3/15/2011		5/26/2011		4/7/2011	
PCBs (µg/L)																			
Aroclor 1016	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	UJ	0.010	U	0.010	U
Aroclor 1221	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	UJ	0.010	U	0.010	U
Aroclor 1232	EPA 8082			0.010	U	0.018	U	0.010	U	0.010	U	0.010	U	0.010	UJ	0.010	U	0.010	U
Aroclor 1242	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	0.010	UJ	0.010	U	0.010	U
Aroclor 1248	EPA 8082			**0.014**		0.010	U	0.010	U	**0.014**		0.010	U	**0.020**	**J**	0.010	U	**0.013**	
Aroclor 1254	EPA 8082			0.010	U	0.010	U	0.010	U	**0.015**		0.010	U	**0.024**	**J**	**0.011**		**0.012**	
Aroclor 1260	EPA 8082			0.010	U	0.010	U	0.010	U	0.010	U	0.010	U	**0.018**	**J**	0.010	U	0.010	U
Total PCBs	EPA 8082	0.03	10	**0.014**		0.018	U	0.010	U	**0.029**		0.010	U	**0.062**	**J**	**0.011**		**0.025**	
Metals – Total (µg/L)																			
Arsenic	EPA 200.8			**1.1**		**2.5**		**2.6**		**2.4**		**1.8**		**2.4**				**1.3**	
Cadmium	EPA 200.8			0.1	U	0.2	U	0.1	U	**0.3**		0.2	U	**0.6**				**0.1**	
Calcium	EPA 6010B			**40400**		**41300**		**38500**		**20500**		**20000**		**13400**				**11900**	
Chromium	EPA 200.8			**4.4**		**20.5**		**3.2**		**12.5**		**10.3**		**25.6**				**7.1**	
Copper	EPA 200.8			**3.6**		**3.5**		**10.7**		**34.3**		**17.4**		**52.0**				**16.4**	
Lead	EPA 200.8			**0.9**		1	U	**9.0**		**17**		**8**		**39**				**8.2**	
Magnesium	EPA 6010B			**97000**		**10200**		**17200**		**4990**		**6230**		**2780**				**10800**	
Mercury	EPA 7470A			0.1	U	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U			0.1	U
Nickel	EPA 200.8			**3.4**		**4.8**		**4.7**		**7.2**		**4.5**		**10.0**				**4.5**	
Selenium	EPA 200.8			2	U	0.5	U	2	U	0.5	U	0.5	U	0.5	U			**0.6**	
Silver	EPA 200.8			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Zinc	EPA 200.8			**10**		**13**	**J**	**56**		**170**	**J**	**115**		**285**				**93**	
Metals – Dissolved (µg/L)																			
Arsenic	EPA 200.8	36	69	**0.8**		**2.3**		**2.1**		**1.0**		**1.2**		**0.6**				**0.6**	
Cadmium	EPA 200.8	9.3	42	0.1	U	0.2	U	0.1	U	0.2	U	0.2	U	0.2	U			0.1	U
Chromium	EPA 200.8			**0.5**		**0.8**		0.5	U	**1.7**		**1.3**		**2.1**				**0.6**	
Copper	EPA 200.8	3.1	4.8	**1.8**		**2.4**		**1.7**		**5.4**		**6.3**		**3.1**				**4.6**	
Lead	EPA 200.8	8.1	210	0.1	U	1	U	0.1	U	1	U	1	U	1	U			**0.4**	
Mercury	EPA 7470A	0.025	1.8	0.0200	U	0.02	U	0.02	U	0.02	U	0.02	U	0.0200	U			0.0200	U
Nickel	EPA 200.8	8.2	74	**3.0**		**4.2**		**2.5**		**1.9**		**2.3**		**1.4**				**1.9**	
Selenium	EPA 200.8	71	290	2	U	0.5	U	**0.6**		0.5	U	0.5	U	0.5	U			**0.5**	
Silver	EPA 200.8		1.9	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Zinc	EPA 200.8	81	90	**6**		**5**	**J**	**9**		**38**		**46**		**34**				**41**	
Pesticides (µg/L)																			
Aldrin	EPA 8081B	0.0019	0.71	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
alpha-BHC	EPA 8081B			0.050	U	0.050	UJ	0.050	U	0.050	U	0.050	U	0.050	UJ			0.050	U
beta-BHC	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
delta-BHC	EPA 8081B			0.050	UJ	0.050	U	0.050	UJ	0.050	UJ	0.050	UJ	0.050	UJ			0.050	UJ
Lindane	EPA 8081B		0.16	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
cis-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
Chlordane	EPA 8081B			0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U			0.050	U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U
Total DDTs	EPA 8081B			0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U			0.10	U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS	BF2	BF3	SW2	SW3	SW4	SW8	TS
Location ID				SQ3	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4
Sample ID				SQ3-040711-W	SQ4-020211-W	SQ4-042111-W	SQ4-021111-W	SQ4-030411-W	SQ4-031511-W	SQ4-052511-W	SQ4-040811-W
Collection Date				4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011	4/7/2011
Dieldrin	EPA 8081B	0.0019	0.71	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U		0.050 U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 UJ		0.10 U
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10 U	0.10 UJ	0.10 U	0.10 UJ	0.10 U	0.10 UJ		0.10 U
Endrin	EPA 8081B	0.0023	0.037	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U
Endrin Aldehyde	EPA 8081B			0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U		0.10 U
Endrin Ketone	EPA 8081B			0.10 U	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 UJ		0.10 U
Heptachlor	EPA 8081B	0.0036	0.05	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U		0.050 U
Heptachlor Epoxide	EPA 8081B			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U		0.050 U
Methoxychlor	EPA 8081B			0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U		0.50 U
Toxaphene	EPA 8081B	0.0002	0.21	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U
Phenols (µg/L)											
2,4-Dimethylphenol	EPA 8270D			1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U		1.0 U
o-Cresol	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
p-Cresol	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Pentachlorophenol	EPA 8270D			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U
Phenol	EPA 8270D			1.0 U	**2.2**	1.0 U	1.0 U	1.0 U	**0.8 J**		1.0 U
Phthalates (µg/L)											
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	**2.9**	2.3 U	**3.8**		**1.3**
Butyl benzyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.7 J**		1.0 U
Dibutyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Diethyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Dimethyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Di-n-Octyl phthalate	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
PAHs (µg/L)											
1-Methylnaphthalene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.011**	**0.012**	0.050 U		0.010 U
2-Methylnaphthalene	EPA 8270DSIM			0.010 U	**0.013**	0.010 U	**0.022**	**0.020**	0.050 U		**0.013**
Acenaphthene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.031**	**0.019**	0.050 U		**0.071**
Acenaphthylene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.050 U		**0.013**
Anthracene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.011**	0.010 U	0.050 U		**0.016**
Benzo(a)anthracene	EPA 8270DSIM			0.010 U	0.010 U	**0.014**	**0.046**	**0.034**	**0.16**		**0.036**
Benzo(a)pyrene	EPA 8270DSIM			0.010 U	0.010 U	**0.018**	**0.053**	**0.044**	**0.20**		**0.040**
Benzo(g,h,i)perylene	EPA 8270DSIM			0.010 U	0.010 U	**0.030**	**0.069**	**0.069**	**0.31**		**0.060**
Benzofluoranthene	EPA 8270D/8270DSIM			0.010 U	0.010 U	**0.037**	**0.11**	**0.095**	**0.42**		**0.085**
Chrysene	EPA 8270D/8270DSIM			0.010 U	0.010 U	**0.026**	**0.084 J**	**0.083**	**0.36**		**0.072**
Dibenzo(a,h)anthracene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.018**	**0.015**	**0.077**		**0.017**
Dibenzofuran	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.027**	**0.016**	0.050 U		**0.019**
Fluoranthene	EPA 8270D/8270DSIM			**0.012**	0.010 U	**0.038**	**0.21**	**0.15**	**0.69**		**0.12**
Fluorene	EPA 8270DSIM			0.010 U	0.010 U	0.010 U	**0.031**	**0.019**	**0.059**		**0.035**
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			0.010 U	0.010 U	**0.014**	**0.035**	**0.034**	**0.16**		**0.030**
Naphthalene	EPA 8260C/8270DSIM			**0.041**	**0.039**	**0.024**	**0.071**	**0.045**	0.050 U		**0.032**
Phenanthrene	EPA 8270DSIM			0.010 U	0.010 U	**0.017**	**0.11**	**0.093**	**0.37**		**0.10**
Pyrene	EPA 8270D/8270DSIM			**0.012**	0.010 U	**0.043**	**0.16**	**0.17**	**0.62**		**0.12**
Total HPAHs	EPA 8270D/8270DSIM			**0.024**	0.010 U	**0.22**	**0.78 J**	**0.69**	**3**		**0.58**
Total LPAHs	EPA 8270D/8270DSIM			**0.041**	**0.039**	**0.041**	**0.25**	**0.18**	**0.43**		**0.27**

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS	BF2	BF3	SW2	SW3	SW4	SW8	TS
Location ID				SQ3	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4
Sample ID				SQ3-040711-W	SQ4-020211-W	SQ4-042111-W	SQ4-021111-W	SQ4-030411-W	SQ4-031511-W	SQ4-052511-W	SQ4-040811-W
Collection Date				4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011	4/7/2011
SVOCs (µg/L)											
1,2,4-Trichlorobenzene	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U
1,2-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,3-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,4-Dichlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Benzoic Acid	EPA 8270D			10 U	10 U	10 U	10 U	10 U	10 U		10 U
Benzyl Alcohol	EPA 8270D			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U
Hexachlorobenzene	EPA 8081B/8270D			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U		0.050 U
Hexachlorobutadiene	EPA 8081B/8260C			0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U		0.050 U
Hexachloroethane	EPA 8270D			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
N-Nitrosodiphenylamine	EPA 8270D			1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U		1.0 U
VOCs (µg/L)											
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1,1-Trichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1,2-Trichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1-Dichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1-Dichloroethene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,1-Dichloropropene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,2,3-Trichlorobenzene	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U
1,2,3-Trichloropropane	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U
1,2,4-Trimethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U		0.5 U
1,2-Dichloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,2-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,3,5-Trimethylbenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
1,3-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
2,2-Dichloropropane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
2-Chlorotoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
2-Hexanone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U
4-Chlorotoluene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Acetone	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 UJ	7.0 U	10 U		16 U
Acrolein	EPA 8260C			5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U		5.0 U
Acrylonitrile	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Bromobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Bromochloromethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Bromoethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Bromoform	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Bromomethane	EPA 8260C			1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U		1.0 U
Carbon Disulfide	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Carbon Tetrachloride	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
CFC-11	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
CFC-113	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Chlorobenzene	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Chlorodibromomethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U
Chloroethane	EPA 8260C			0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U		0.2 U

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS		BF2		BF3		SW2		SW3		SW4		SW8		TS	
Location ID				SQ3		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ3-040711-W		SQ4-020211-W		SQ4-042111-W		SQ4-021111-W		SQ4-030411-W		SQ4-031511-W		SQ4-052511-W		SQ4-040811-W	
Collection Date				4/7/2011		2/2/2011		4/21/2011		2/14/2011		3/5/2011		3/15/2011		5/26/2011		4/7/2011	
Chloroform	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Chloromethane	EPA 8260C			0.5	U	0.5	U	0.5	U	0.5	UJ	0.5	U	0.5	U			0.5	U
cis-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
cis-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Cumene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Dibromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Dichlorobromomethane	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Ethylene Dibromide	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Methyl ethyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	UJ	5.0	U	5.0	U			5.0	U
Methyl Iodide	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U
Methyl isobutyl ketone	EPA 8260C			5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U			5.0	U
Methylene Chloride	EPA 8260C			3.4	U	1.6	U	1.8	U	5.3	U	1.3	U	2.3	U			1.3	U
n-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
n-Propylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
p-Isopropyltoluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
sec-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Styrene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
tert-Butylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Tetrachloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
trans-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
trans-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U
Trichloroethene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Vinyl Acetate	EPA 8260C			1.0	U	1.0	U	1.0	U	1.0	UJ	1.0	U	1.0	U			1.0	U
Vinyl Chloride	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
BTEX (µg/L)																			
Benzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Ethylbenzene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Toluene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
m, p-Xylene	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U			0.4	U
o-Xylene	EPA 8260C			0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U			0.2	U
Total Xylenes	EPA 8260C			0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U			0.4	U
Brominated Diphenylethers (pg/L)																			
BDE-007	EPA 1614							0.6	U			1.87	U						
BDE-008	EPA 1614							0.454	CU			1.38	CU						
BDE-010	EPA 1614							0.62	U			1.99	U						
BDE-011	EPA 1614							C8				C8							
BDE-012	EPA 1614							0.404	CU			1.19	CU						
BDE-013	EPA 1614							C12				C12							
BDE-015	EPA 1614							0.423	U			**1.76**	**J**						
BDE-017	EPA 1614							**8.24**	**CJ**			**15.2**	**CJ**						
BDE-025	EPA 1614							C17				C17							
BDE-028	EPA 1614							**15**	**CJ**			**30.2**	**CJ**						
BDE-030	EPA 1614							0.885	U			2.41	U						
BDE-032	EPA 1614							0.637	U			1.98	U						
BDE-033	EPA 1614							C28				C28							

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS		BF2		BF3		SW2		SW3		SW4		SW8		TS	
Location ID				SQ3		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ3-040711-W		SQ4-020211-W		SQ4-042111-W		SQ4-021111-W		SQ4-030411-W		SQ4-031511-W		SQ4-052511-W		SQ4-040811-W	
Collection Date				4/7/2011		2/2/2011		4/21/2011		2/14/2011		3/5/2011		3/15/2011		5/26/2011		4/7/2011	
BDE-035	EPA 1614							3.17	U			3.32	U						
BDE-037	EPA 1614							0.75	U			1.91	U						
BDE-047	EPA 1614							**847**				**892**							
BDE-049	EPA 1614							32.9	U			**50.7**							
BDE-051	EPA 1614							**5.71**	**J**			6.43	U						
BDE-066	EPA 1614							**41.9**	**J**			**44.6**	**J**						
BDE-071	EPA 1614							6.77	U			**8.53**	**J**						
BDE-075	EPA 1614							**2.06**	**J**			3.05	U						
BDE-077	EPA 1614							0.0741	U			0.999	U						
BDE-079	EPA 1614							10.2	U			0.999	U						
BDE-085	EPA 1614							**69.1**				**59.6**							
BDE-099	EPA 1614							**1620**				**1220**							
BDE-100	EPA 1614							**336**				**250**							
BDE-105	EPA 1614							10.6	U			8.66	U						
BDE-116	EPA 1614							17.1	U			11.3	U						
BDE-119	EPA 1614							8.17	CU			6.18	CU						
BDE-120	EPA 1614							C119				C119							
BDE-126	EPA 1614							6.24	U			3.43	U						
BDE-128	EPA 1614							13.9	U			142	U						
BDE-138	EPA 1614							**37.5**	**CJ**			57.7	CU						
BDE-140	EPA 1614							**10.7**	**J**			20.1	U						
BDE-153	EPA 1614							**251**				**177**							
BDE-154	EPA 1614							**166**				**124**							
BDE-155	EPA 1614							**12.7**	**J**			11.7	U						
BDE-166	EPA 1614							C138				C138							
BDE-181	EPA 1614							8.72	U			13.7	U						
BDE-183	EPA 1614							**246**				**288**							
BDE-190	EPA 1614							**26.4**	**J**			25.7	U						
BDE-203	EPA 1614							175	U			**419**							
BDE-206	EPA 1614							**435**				**1440**							
BDE-207	EPA 1614							**735**				**2550**							
BDE-208	EPA 1614							546	U			**1930**							
BDE-209	EPA 1614							**7460**				**14800**							
Total PBDEs	EPA 1614							**12300**	**CJ**			**24300**	**CJ**						
Conventionals																			
Alkalinity as Bicarbonate (mg/L)	SM2320			**41.3**		**122**		**126**		**55.0**		**64.6**		**33.6**				**30.8**	
Alkalinity as Carbonate (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0	U	1.0	U	1.0	U	1.0	U	1.0	U	1.0	U			1.0	U
Alkalinity, Total (mg/L)	SM2320			**41.3**		**122**		**126**		**55.0**		**64.6**		**33.6**				**30.8**	
Chloride (mg/L)	EPA 300.0			**1480**		**96.6**		**223**		**21.4**		**38.6**		**7.4**				**134**	
Dissolved Organic Carbon (mg/L)	EPA 415.1			**2.50**		**1.80**		**1.71**		**2.57**		**3.68**		**2.44**				**2.92**	
Hardness as CaCO3 (mg/L)	EPA 6010B			**500**		**140**		**170**		**72**		**76**		**45**				**74**	
Nitrate (mg/L)	EPA 300.0			**0.3**		0.1	U	0.1	U	0.1	U	0.2	U	**0.2**				**0.2**	
pH (su)	PH			**7.40**		**8.00**		**7.85**		**7.56**		**7.67**		**7.24**				**6.99**	
Sulfate (mg/L)	EPA 300.0			**211**		**31.3**		**42.6**		**8.8**		**9.4**		**3.8**				**23.1**	
Total Organic Carbon (mg/L)	EPA 415.1			**2.93**		**2.08**		**1.96**		**4.08**		**6.35**		**5.02**				**4.04**	

Table E–1. Whole Water Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	TS	BF2	BF3	SW2	SW3	SW4	SW8	TS
Location ID				SQ3	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4
Sample ID				SQ3-040711-W	SQ4-020211-W	SQ4-042111-W	SQ4-021111-W	SQ4-030411-W	SQ4-031511-W	SQ4-052511-W	SQ4-040811-W
Collection Date				4/7/2011	2/2/2011	4/21/2011	2/14/2011	3/5/2011	3/15/2011	5/26/2011	4/7/2011
Total Solids (percent)	EPA 1614					**0.02**					
Total Suspended Solids (mg/L)	EPA 160.2			**14.8**	**14.3**	**60.6**	**103**	**25.6**	**144**	**73.1**	**31.6**

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW5		SW5		SW7		SW7		SW7		SW7		SW8		SW8		BF1		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK2		DK3		DK3	
Sample ID				DK1A-042711-S		DK1B-042711-S		DK1A-051111-S		DK1B-051111-S		DK2A-051111-S		DK2B-051111-S		DK2A-052511-S		DK2B-052511-S		DK3A-012611-S		DK3B-012611-S	
Collection Date				4/27/2011		4/27/2011		5/11/2011		5/11/2011		5/11/2011		5/11/2011		5/26/2011		5/26/2011		1/27/2011		1/26/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				0.41		0.41		1.93		1.93		12.34		14.4		9.82		9.82		0.59		0.59	
Dioxins and Furans (ng/kg)																							
1,2,3,4,6,7,8-HPCDD	EPA 1613																					**3730**	
1,2,3,4,7,8-HXCDD	EPA 1613																					**60.7**	J
1,2,3,6,7,8-HXCDD	EPA 1613																					**173**	J
1,2,3,7,8,9-HXCDD	EPA 1613																					**198**	J
1,2,3,7,8-PECDD	EPA 1613																					**46.9**	J
2,3,7,8-TCDD	EPA 1613																					**19.8**	J
OCDD	EPA 1613																					**33100**	
1,2,3,4,6,7,8-HPCDF	EPA 1613																					**593**	
1,2,3,4,7,8,9-HPCDF	EPA 1613																					**39.2**	J
1,2,3,4,7,8-HXCDF	EPA 1613																					**46.6**	J
1,2,3,6,7,8-HXCDF	EPA 1613																					**35.9**	J
1,2,3,7,8,9-HXCDF	EPA 1613																					3.36	U
1,2,3,7,8-PECDF	EPA 1613																					13.2	UJ
2,3,4,6,7,8-HXCDF	EPA 1613																					**33.4**	J
2,3,4,7,8-PECDF	EPA 1613																					23.4	UJ
2,3,7,8-TCDF	EPA 1613																					**34.1**	
OCDF	EPA 1613																					**1470**	
Total HpCDD	EPA 1613																					**7470**	
Total HxCDD	EPA 1613																					**1520**	
Total PeCDD	EPA 1613																					**331**	
Total TCDD	EPA 1613																					**160**	
Total HpCDF	EPA 1613																					**1630**	
Total HxCDF	EPA 1613																					**986**	
Total PeCDF	EPA 1613																					**607**	
Total TCDF	EPA 1613																					**942**	
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613																					**183**	J
PCBs (mg/kg)																							
Aroclor 1016	EPA 8082			1.2	U			0.52	U			0.081	U			0.10	U						
Aroclor 1221	EPA 8082			1.2	U			0.52	U			0.081	U			0.10	U						
Aroclor 1232	EPA 8082			1.2	U			0.52	U			0.081	U			0.10	U						
Aroclor 1242	EPA 8082			1.2	U			0.52	U			0.081	U			0.10	U						
Aroclor 1248	EPA 8082			1.2	U			0.62	U			**0.13**				**0.25**							
Aroclor 1254	EPA 8082			1.2	U			**1.5**				**0.19**				**0.48**							
Aroclor 1260	EPA 8082			1.2	U			0.52	U			**0.11**				**0.26**	JN						
Total PCBs	EPA 8082	0.13	1	1.2	U			**1.5**				**0.42**				**1.0**	JN						
Metals – Total (mg/kg)																							
Arsenic	EPA 6010B	57	93									**20**											
Cadmium	EPA 6010B	5.1	6.7									**1.6**											
Chromium	EPA 6010B	260	270									**66**											
Copper	EPA 6010B	390	390									**155**											

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW5		SW5		SW7		SW7		SW7		SW7		SW8		SW8		BF1		BF1	
Location ID				DK1		DK1		DK1		DK1		DK2		DK2		DK2		DK2		DK3		DK3	
Sample ID				DK1A-042711-S		DK1B-042711-S		DK1A-051111-S		DK1B-051111-S		DK2A-051111-S		DK2B-051111-S		DK2A-052511-S		DK2B-052511-S		DK3A-012611-S		DK3B-012611-S	
Collection Date				4/27/2011		4/27/2011		5/11/2011		5/11/2011		5/11/2011		5/11/2011		5/26/2011		5/26/2011		1/27/2011		1/26/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				0.41		0.41		1.93		1.93		12.34		14.4		9.82		9.82		0.59		0.59	
Lead	EPA 6010B	450	530									83											
Mercury	EPA 7471A	0.41	0.59									0.10											
Silver	EPA 6010B	6.1	6.1									0.8	U										
Zinc	EPA 6010B	410	960									879											
PAHs (mg/kg)																							
1-Methylnaphthalene	EPA 8270D					3.9				1.3	U			0.52	U			0.48		0.68	J		
2-Methylnaphthalene	EPA 8270D	0.67	1.4			6.6				1.3	U			0.52	U			0.41		1.0			
Acenaphthene	EPA 8270D	0.5	0.73			1.7				1.3	U			0.52	U			0.10	U	0.85	U		
Acenaphthylene	EPA 8270D	1.3	1.3			1.2	U			1.3	U			0.52	U			0.10	U	0.85	U		
Anthracene	EPA 8270D	0.96	4.4			1.2	U			1.3				0.52	U			0.10	U	0.85	U		
Benzo(a)anthracene	EPA 8270D	1.3	1.6			1.2	U			1.3	U			0.69				0.20		1.0			
Benzo(a)pyrene	EPA 8270D	1.6	3			1.2	U			1.3	U			0.69				0.22		1.7			
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72			1.2	U			1.4				1.5				0.48		3.1			
Benzofluoranthene	EPA 8270D	3.2	3.6			1.2	U			1.3	U			1.7				0.67		3.7			
Chrysene	EPA 8270D	1.4	2.8			1.2	U			1.3				1.8				0.59		3.4			
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54			1.2	U			1.3	U			0.52	U			0.10	U	0.68	J		
Dibenzofuran	EPA 8270D	0.54	0.7			3.4				1.3	U			0.52	U			0.10	U	0.85	U		
Fluoranthene	EPA 8270D	1.7	2.5			1.2	U			1.3				3.1				0.63		3.6			
Fluorene	EPA 8270D	0.54	1			2.0				1.3	U			0.52	U			0.10	U	0.68	J		
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69			1.2	U			1.3	U			0.60				0.19		1.4			
Naphthalene	EPA 8270D	2.1	2.4			10				1.3	U			0.52	U			0.21		1.0			
Phenanthrene	EPA 8270D	1.5	5.4			1.2				1.3				1.6				0.42		1.9			
Pyrene	EPA 8270D	2.6	3.3			1.2	U			1.3	U			2.4				0.70		4.2			
Total HPAHs	EPA 8270D	12	17			1.2	U			4.1				13				3.7		22	J		
Total LPAHs	EPA 8270D	5.2	13			15				2.6				1.6				0.63		3.6	J		
Grain Size (percent)																							
Phi Scale -1 to 0	PSEP-PS											7.1											
Phi Scale <-1	PSEP-PS											0.7											
Phi Scale 0 to 1	PSEP-PS											12.9											
Phi Scale 1 to 2	PSEP-PS											16.3											
Phi Scale 2 to 3	PSEP-PS											15.4											
Phi Scale 3 to 4	PSEP-PS											9.8											
Phi Scale 4 to 5	PSEP-PS											7.0											
Phi Scale 5 to 6	PSEP-PS											10.2											
Phi Scale 6 to 7	PSEP-PS											8.3											
Phi Scale 7 to 8	PSEP-PS											5.3											
Phi Scale 8 to 9	PSEP-PS											2.8											
Phi Scale 9 to 10	PSEP-PS											1.6											
Phi Scale >10	PSEP-PS											2.6											
Percent Gravel (>2.0 mm)	PSEP-PS											0.7											

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW5	SW5	SW7	SW7	SW7	SW7	SW8	SW8	BF1	BF1
Location ID				**DK1**	**DK1**	**DK1**	**DK1**	**DK2**	**DK2**	**DK2**	**DK2**	**DK3**	**DK3**
Sample ID				**DK1A-042711-S**	**DK1B-042711-S**	**DK1A-051111-S**	**DK1B-051111-S**	**DK2A-051111-S**	**DK2B-051111-S**	**DK2A-052511-S**	**DK2B-052511-S**	**DK3A-012611-S**	**DK3B-012611-S**
Collection Date				**4/27/2011**	**4/27/2011**	**5/11/2011**	**5/11/2011**	**5/11/2011**	**5/11/2011**	**5/26/2011**	**5/26/2011**	**1/27/2011**	**1/26/2011**
Filter				**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Mass Of Solids (g)				**0.41**	**0.41**	**1.93**	**1.93**	**12.34**	**14.4**	**9.82**	**9.82**	**0.59**	**0.59**
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS							**61.5**					
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS							**30.8**					
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS							**7.0**					
Total Fines (Silt/Clay)	PSEP-PS							**37.8**					

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF4		BF4		SW6		SW6		SW7		SW7		TS		TS		SW6		SW6	
Location ID				DK3		DK3		DK3		DK3		DK3		DK3		DK3		DK3		DK4		DK4	
Sample ID				DK3A-052011-S		DK3B-052011-S		DK3A-050211-S		DK3B-050211-S		DK3A-051111-S		DK3B-051111-S		DK3A-040711-S		DK3B-040711-S		DK4A-050211-S		DK4B-050211-S	
Collection Date				5/20/2011		5/20/2011		5/2/2011		5/2/2011		5/11/2011		5/11/2011		4/7/2011		4/7/2011		5/2/2011		5/2/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				4.36		4.36		18.15		18.15		25.26		28.54		22.57		22.57		14.73		14.73	
Dioxins and Furans (ng/kg)																							
1,2,3,4,6,7,8-HPCDD	EPA 1613																						
1,2,3,4,7,8-HXCDD	EPA 1613																						
1,2,3,6,7,8-HXCDD	EPA 1613																						
1,2,3,7,8,9-HXCDD	EPA 1613																						
1,2,3,7,8-PECDD	EPA 1613																						
2,3,7,8-TCDD	EPA 1613																						
OCDD	EPA 1613																						
1,2,3,4,6,7,8-HPCDF	EPA 1613																						
1,2,3,4,7,8,9-HPCDF	EPA 1613																						
1,2,3,4,7,8-HXCDF	EPA 1613																						
1,2,3,6,7,8-HXCDF	EPA 1613																						
1,2,3,7,8,9-HXCDF	EPA 1613																						
1,2,3,7,8-PECDF	EPA 1613																						
2,3,4,6,7,8-HXCDF	EPA 1613																						
2,3,4,7,8-PECDF	EPA 1613																						
2,3,7,8-TCDF	EPA 1613																						
OCDF	EPA 1613																						
Total HpCDD	EPA 1613																						
Total HxCDD	EPA 1613																						
Total PeCDD	EPA 1613																						
Total TCDD	EPA 1613																						
Total HpCDF	EPA 1613																						
Total HxCDF	EPA 1613																						
Total PeCDF	EPA 1613																						
Total TCDF	EPA 1613																						
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613																						
PCBs (mg/kg)																							
Aroclor 1016	EPA 8082			0.11	U			0.055	U			0.040	U			0.022	U			0.068	U		
Aroclor 1221	EPA 8082			0.11	U			0.055	U			0.040	U			0.022	U			0.068	U		
Aroclor 1232	EPA 8082			0.11	U			0.055	U			0.040	U			0.022	U			0.14	U		
Aroclor 1242	EPA 8082			0.11	U			0.055	U			0.040	U			0.022	U			0.068	U		
Aroclor 1248	EPA 8082			0.23	U			**0.10**				**0.048**				**0.11**				0.068	U		
Aroclor 1254	EPA 8082			**0.39**				**0.12**				**0.063**				**0.17**				**0.12**			
Aroclor 1260	EPA 8082			0.11	U			**0.083**				**0.044**				**0.080**				**0.075**			
Total PCBs	EPA 8082	0.13	1	**0.39**				**0.31**				**0.15**				**0.36**				**0.19**			
Metals – Total (mg/kg)																							
Arsenic	EPA 6010B	57	93									**20**											
Cadmium	EPA 6010B	5.1	6.7									**2.8**											
Chromium	EPA 6010B	260	270									**89**											
Copper	EPA 6010B	390	390									**204**											

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF4		BF4		SW6		SW6		SW7		SW7		TS		TS		SW6		SW6	
Location ID				DK3		DK3		DK3		DK3		DK3		DK3		DK3		DK3		DK4		DK4	
Sample ID				DK3A-052011-S		DK3B-052011-S		DK3A-050211-S		DK3B-050211-S		DK3A-051111-S		DK3B-051111-S		DK3A-040711-S		DK3B-040711-S		DK4A-050211-S		DK4B-050211-S	
Collection Date				5/20/2011		5/20/2011		5/2/2011		5/2/2011		5/11/2011		5/11/2011		4/7/2011		4/7/2011		5/2/2011		5/2/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				4.36		4.36		18.15		18.15		25.26		28.54		22.57		22.57		14.73		14.73	
Lead	EPA 6010B	450	530									**139**											
Mercury	EPA 7471A	0.41	0.59									**0.17**											
Silver	EPA 6010B	6.1	6.1									0.6	U										
Zinc	EPA 6010B	410	960									**1080**											
PAHs (mg/kg)																							
1-Methylnaphthalene	EPA 8270D					**0.34**				**0.12**				0.26	U			0.11	U			**0.13**	
2-Methylnaphthalene	EPA 8270D	0.67	1.4			**0.64**				**0.16**				0.26	U			0.11	U			**0.18**	
Acenaphthene	EPA 8270D	0.5	0.73			0.34	U			0.11	U			0.26	U			0.11	U			0.068	U
Acenaphthylene	EPA 8270D	1.3	1.3			0.34	U			0.11	U			0.26	U			0.11	U			0.068	U
Anthracene	EPA 8270D	0.96	4.4			0.34	U			0.11	U			0.26	U			0.11	U			0.068	U
Benzo(a)anthracene	EPA 8270D	1.3	1.6			0.34	U			**0.21**				**0.46**				**0.12**				**0.18**	
Benzo(a)pyrene	EPA 8270D	1.6	3			0.34	U			**0.55**				**0.49**				**0.25**				**0.25**	
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72			**0.39**				**0.55**				**0.81**				**0.49**				**0.39**	
Benzofluoranthene	EPA 8270D	3.2	3.6			**0.55**				**0.66**				**1.1**				**0.53**				**0.55**	
Chrysene	EPA 8270D	1.4	2.8			**0.41**				**0.66**				**0.91**				**0.62**				**0.44**	
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54			0.34	U			0.11	U			0.26	U			0.11	U			0.068	U
Dibenzofuran	EPA 8270D	0.54	0.7			0.34	U			0.11	U			0.26	U			0.11	U			**0.11**	
Fluoranthene	EPA 8270D	1.7	2.5			**0.53**				**0.83**				**1.5**				**0.58**				**0.58**	
Fluorene	EPA 8270D	0.54	1			0.34	U			0.11	U			0.26	U			0.11	U			0.068	U
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69			0.34	U			**0.21**				**0.42**				**0.22**				**0.21**	
Naphthalene	EPA 8270D	2.1	2.4			**1.0**				**0.19**				**0.27**				0.11	U			**0.26**	
Phenanthrene	EPA 8270D	1.5	5.4			**0.34**				**0.41**				**0.70**				**0.19**				**0.31**	
Pyrene	EPA 8270D	2.6	3.3			**0.48**				**0.88**				**1.2**				**0.62**				**0.58**	
Total HPAHs	EPA 8270D	12	17			**2.3**				**4.6**				**7.0**				**3.4**				**3.2**	
Total LPAHs	EPA 8270D	5.2	13			**1.4**				**0.61**				**0.98**				**0.19**				**0.57**	
Grain Size (percent)																							
Phi Scale -1 to 0	PSEP-PS											**4.4**											
Phi Scale <-1	PSEP-PS											0.1	U										
Phi Scale 0 to 1	PSEP-PS											**7.7**											
Phi Scale 1 to 2	PSEP-PS											**7.2**											
Phi Scale 2 to 3	PSEP-PS											**8.9**											
Phi Scale 3 to 4	PSEP-PS											**16.0**											
Phi Scale 4 to 5	PSEP-PS											**6.2**											
Phi Scale 5 to 6	PSEP-PS											**14.3**											
Phi Scale 6 to 7	PSEP-PS											**12.0**											
Phi Scale 7 to 8	PSEP-PS											**9.7**											
Phi Scale 8 to 9	PSEP-PS											**5.7**											
Phi Scale 9 to 10	PSEP-PS											**3.4**											
Phi Scale >10	PSEP-PS											**4.5**											
Percent Gravel (>2.0 mm)	PSEP-PS											0.1	U										

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF4	BF4	SW6	SW6	SW7	SW7	TS	TS	SW6	SW6
Location ID				**DK3**	**DK3**	**DK3**	**DK3**	**DK3**	**DK3**	**DK3**	**DK3**	**DK4**	**DK4**
Sample ID				**DK3A-052011-S**	**DK3B-052011-S**	**DK3A-050211-S**	**DK3B-050211-S**	**DK3A-051111-S**	**DK3B-051111-S**	**DK3A-040711-S**	**DK3B-040711-S**	**DK4A-050211-S**	**DK4B-050211-S**
Collection Date				**5/20/2011**	**5/20/2011**	**5/2/2011**	**5/2/2011**	**5/11/2011**	**5/11/2011**	**4/7/2011**	**4/7/2011**	**5/2/2011**	**5/2/2011**
Filter				**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Mass Of Solids (g)				**4.36**	**4.36**	**18.15**	**18.15**	**25.26**	**28.54**	**22.57**	**22.57**	**14.73**	**14.73**
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS							**44.2**					
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS							**42.2**					
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS							**13.6**					
Total Fines (Silt/Clay)	PSEP-PS							**55.8**					

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW7	SW7	TS	TS	SW2	SW2	SW8	SW8	BF2	BF2
Location ID				DK4	DK4	DK4	DK4	SQ1	SQ1	SQ1	SQ1	SQ2	SQ2
Sample ID				DK4A-051111-S	DK4B-051111-S	DK4A-040711-S	DK4B-040711-S	SQ1A-021111-S	SQ1B-021111-S	SQ1A-052511-S	SQ1B-052511-S	SQ2A-020211-S	SQ2B-020211-S
Collection Date				5/11/2011	5/11/2011	4/7/2011	4/7/2011	2/14/2011	2/14/2011	5/26/2011	5/26/2011	2/2/2011	2/2/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				8.99	10.36	12.15	12.15	22.06	23.01	9.62	9.98	5.92	5.92
Dioxins and Furans (ng/kg)													
1,2,3,4,6,7,8-HPCDD	EPA 1613								**409**				**1440**
1,2,3,4,7,8-HXCDD	EPA 1613								**8.26**				**17.7** J
1,2,3,6,7,8-HXCDD	EPA 1613								**20.3**				**60.5**
1,2,3,7,8,9-HXCDD	EPA 1613								**21.0**				**45.4**
1,2,3,7,8-PECDD	EPA 1613								**4.35**				**10.1** J
2,3,7,8-TCDD	EPA 1613								**0.913** J				**2.87** J
OCDD	EPA 1613								**4160**				**17200**
1,2,3,4,6,7,8-HPCDF	EPA 1613								**93.4**				**269**
1,2,3,4,7,8,9-HPCDF	EPA 1613								**5.26**				**15.2**
1,2,3,4,7,8-HXCDF	EPA 1613								**7.30**				**22.0**
1,2,3,6,7,8-HXCDF	EPA 1613								**5.22**				**11.9** J
1,2,3,7,8,9-HXCDF	EPA 1613								**0.351** J				**0.595** J
1,2,3,7,8-PECDF	EPA 1613								**2.05**				**4.43** J
2,3,4,6,7,8-HXCDF	EPA 1613								**4.95**				**11.0** J
2,3,4,7,8-PECDF	EPA 1613								**3.28**				**9.02** J
2,3,7,8-TCDF	EPA 1613								**3.41**				**6.11**
OCDF	EPA 1613								**236**				**1040**
Total HpCDD	EPA 1613								**882**				**2850**
Total HxCDD	EPA 1613								**163**				**395**
Total PeCDD	EPA 1613								**31.9**				**70.4**
Total TCDD	EPA 1613								**16.7**				**41.4**
Total HpCDF	EPA 1613								**263**				**836**
Total HxCDF	EPA 1613								**151**				**385**
Total PeCDF	EPA 1613								**113**				**243**
Total TCDF	EPA 1613								**77.4**				**211**
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613								**19.8** J				**56.1** J
PCBs (mg/kg)													
Aroclor 1016	EPA 8082			0.11 U		0.041 U		0.023 U		0.10 U			
Aroclor 1221	EPA 8082			0.11 U		0.041 U		0.023 U		0.10 U			
Aroclor 1232	EPA 8082			0.11 U		0.041 U		0.023 U		0.10 U			
Aroclor 1242	EPA 8082			0.11 U		0.041 U		0.023 U		0.10 U			
Aroclor 1248	EPA 8082			0.11 U		**0.13**		0.28 U		0.47 U			
Aroclor 1254	EPA 8082			**0.19**		**0.091**		**0.19**		**0.71**			
Aroclor 1260	EPA 8082			0.11 U		**0.049**		**0.063**		**0.21**			
Total PCBs	EPA 8082	0.13	1	**0.19**		**0.27**		**0.26**		**0.91**			
Metals – Total (mg/kg)													
Arsenic	EPA 6010B	57	93	**20**				20 U		20 U			
Cadmium	EPA 6010B	5.1	6.7	**2.6**				**1.8**		**2.0**			
Chromium	EPA 6010B	260	270	**93**				**39**		**50**			
Copper	EPA 6010B	390	390	**224**				**173**		**229**			

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW7		SW7		TS		TS		SW2		SW2		SW8		SW8		BF2		BF2	
Location ID				DK4		DK4		DK4		DK4		SQ1		SQ1		SQ1		SQ1		SQ2		SQ2	
Sample ID				DK4A-051111-S		DK4B-051111-S		DK4A-040711-S		DK4B-040711-S		SQ1A-021111-S		SQ1B-021111-S		SQ1A-052511-S		SQ1B-052511-S		SQ2A-020211-S		SQ2B-020211-S	
Collection Date				5/11/2011		5/11/2011		4/7/2011		4/7/2011		2/14/2011		2/14/2011		5/26/2011		5/26/2011		2/2/2011		2/2/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				8.99		10.36		12.15		12.15		22.06		23.01		9.62		9.98		5.92		5.92	
Lead	EPA 6010B	450	530	167								143				115							
Mercury	EPA 7471A	0.41	0.59	0.24								0.41				0.92							
Silver	EPA 6010B	6.1	6.1	0.9	U							1	U			1	U						
Zinc	EPA 6010B	410	960	1260								678				902							
PAHs (mg/kg)																							
1-Methylnaphthalene	EPA 8270D					0.24	U			0.082								0.49		0.084	J		
2-Methylnaphthalene	EPA 8270D	0.67	1.4			0.24	U			0.14								0.33		0.12			
Acenaphthene	EPA 8270D	0.5	0.73			0.24	U			0.12								0.10	U	0.068	J		
Acenaphthylene	EPA 8270D	1.3	1.3			0.24	U			0.041								0.10	U	0.084	U		
Anthracene	EPA 8270D	0.96	4.4			0.24	U			0.049								0.11		0.14			
Benzo(a)anthracene	EPA 8270D	1.3	1.6			0.93				0.14								0.65		0.30			
Benzo(a)pyrene	EPA 8270D	1.6	3			1.2				0.20								0.80		0.54			
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72			1.8				0.29								1.0		0.71			
Benzofluoranthene	EPA 8270D	3.2	3.6			2.7				0.45								2.1		1.3			
Chrysene	EPA 8270D	1.4	2.8			2.1				0.40								1.9		0.88			
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54			0.43				0.082								0.28		0.084	U		
Dibenzofuran	EPA 8270D	0.54	0.7			0.24	U			0.20								0.16		0.17			
Fluoranthene	EPA 8270D	1.7	2.5			3.5				0.57								1.7		1.1			
Fluorene	EPA 8270D	0.54	1			0.24	U			0.21								0.15		0.084			
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69			0.97				0.16								0.60		0.37			
Naphthalene	EPA 8270D	2.1	2.4			0.35				0.099								0.21		0.10			
Phenanthrene	EPA 8270D	1.5	5.4			1.7				0.40								1.4		0.44			
Pyrene	EPA 8270D	2.6	3.3			2.4				0.45								1.8		0.98			
Total HPAHs	EPA 8270D	12	17			16				2.7								11		6.1			
Total LPAHs	EPA 8270D	5.2	13			2.1				0.91								1.9		0.83	J		
Grain Size (percent)																							
Phi Scale -1 to 0	PSEP-PS			2.3																			
Phi Scale <-1	PSEP-PS			0.1	U																		
Phi Scale 0 to 1	PSEP-PS			3.8																			
Phi Scale 1 to 2	PSEP-PS			5.4																			
Phi Scale 2 to 3	PSEP-PS			8.5																			
Phi Scale 3 to 4	PSEP-PS			7.8																			
Phi Scale 4 to 5	PSEP-PS			12.2																			
Phi Scale 5 to 6	PSEP-PS			21.1																			
Phi Scale 6 to 7	PSEP-PS			16.3																			
Phi Scale 7 to 8	PSEP-PS			9.9																			
Phi Scale 8 to 9	PSEP-PS			4.9																			
Phi Scale 9 to 10	PSEP-PS			2.7																			
Phi Scale >10	PSEP-PS			5.2																			
Percent Gravel (>2.0 mm)	PSEP-PS			0.1	U																		

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW7	SW7	TS	TS	SW2	SW2	SW8	SW8	BF2	BF2
Location ID				**DK4**	**DK4**	**DK4**	**DK4**	**SQ1**	**SQ1**	**SQ1**	**SQ1**	**SQ2**	**SQ2**
Sample ID				**DK4A-051111-S**	**DK4B-051111-S**	**DK4A-040711-S**	**DK4B-040711-S**	**SQ1A-021111-S**	**SQ1B-021111-S**	**SQ1A-052511-S**	**SQ1B-052511-S**	**SQ2A-020211-S**	**SQ2B-020211-S**
Collection Date				**5/11/2011**	**5/11/2011**	**4/7/2011**	**4/7/2011**	**2/14/2011**	**2/14/2011**	**5/26/2011**	**5/26/2011**	**2/2/2011**	**2/2/2011**
Filter				**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Mass Of Solids (g)				**8.99**	**10.36**	**12.15**	**12.15**	**22.06**	**23.01**	**9.62**	**9.98**	**5.92**	**5.92**
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS			**27.8**									
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS			**59.5**									
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS			**12.8**									
Total Fines (Silt/Clay)	PSEP-PS			**72.2**									

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF3		BF3		SW2		SW2		SW3		SW3		SW8		SW8		TS		TS	
Location ID				SQ2		SQ2		SQ2		SQ2		SQ2		SQ2		SQ2		SQ2		SQ2		SQ2	
Sample ID				SQ2A-042111-S		SQ2B-042111-S		SQ2A-021111-S		SQ2B-021111-S		SQ2A-030411-S		SQ2B-030411-S		SQ2A-052511-S		SQ2B-052511-S		SQ2A-040711-S		SQ2B-040711-S	
Collection Date				4/21/2011		4/21/2011		2/14/2011		2/14/2011		3/5/2011		3/5/2011		5/26/2011		5/26/2011		4/7/2011		4/7/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				1.66		1.66		9.47		9.94		0.96		0.96		8.76		9.16		8.22		8.22	
Dioxins and Furans (ng/kg)																							
1,2,3,4,6,7,8-HPCDD	EPA 1613									**1640**													
1,2,3,4,7,8-HXCDD	EPA 1613									**24.0**													
1,2,3,6,7,8-HXCDD	EPA 1613									**73.0**													
1,2,3,7,8,9-HXCDD	EPA 1613									**69.3**													
1,2,3,7,8-PECDD	EPA 1613									**13.9**													
2,3,7,8-TCDD	EPA 1613									**2.82**	J												
OCDD	EPA 1613									**36200**													
1,2,3,4,6,7,8-HPCDF	EPA 1613									**682**													
1,2,3,4,7,8,9-HPCDF	EPA 1613									**41.8**													
1,2,3,4,7,8-HXCDF	EPA 1613									**34.6**													
1,2,3,6,7,8-HXCDF	EPA 1613									**21.2**													
1,2,3,7,8,9-HXCDF	EPA 1613									**1.03**	J												
1,2,3,7,8-PECDF	EPA 1613									**5.60**													
2,3,4,6,7,8-HXCDF	EPA 1613									**22.2**													
2,3,4,7,8-PECDF	EPA 1613									**10.5**													
2,3,7,8-TCDF	EPA 1613									**7.61**													
OCDF	EPA 1613									**4320**													
Total HpCDD	EPA 1613									**3300**													
Total HxCDD	EPA 1613									**589**													
Total PeCDD	EPA 1613									**114**													
Total TCDD	EPA 1613									**57.0**													
Total HpCDF	EPA 1613									**1950**													
Total HxCDF	EPA 1613									**593**													
Total PeCDF	EPA 1613									**265**													
Total TCDF	EPA 1613									**216**													
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613									**81.1**	J												
PCBs (mg/kg)																							
Aroclor 1016	EPA 8082			0.60	U			0.053	U					0.52	U	0.11	U			0.061	U		
Aroclor 1221	EPA 8082			0.60	U			0.053	U					0.52	U	0.11	U			0.061	U		
Aroclor 1232	EPA 8082			0.60	U			0.053	U					0.52	U	0.11	U			0.061	U		
Aroclor 1242	EPA 8082			0.60	U			0.053	U					0.52	U	0.11	U			0.061	U		
Aroclor 1248	EPA 8082			2.4	U			**1.8**						**0.94**		**0.41**				**0.29**			
Aroclor 1254	EPA 8082			**6.6**				**1.1**						**1.1**		**0.37**				**0.23**			
Aroclor 1260	EPA 8082			1.5	U			**0.24**						0.52	U	**0.14**				**0.073**			
Total PCBs	EPA 8082	0.13	1	**6.6**				**3.1**						**2.1**		**0.91**				**0.60**			
Metals – Total (mg/kg)																							
Arsenic	EPA 6010B	57	93					20	U							20	U						
Cadmium	EPA 6010B	5.1	6.7					**4.5**								**3.2**							
Chromium	EPA 6010B	260	270					**87**								**80**							
Copper	EPA 6010B	390	390					**296**								**291**							

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF3	BF3	SW2	SW2	SW3	SW3	SW8	SW8	TS	TS
Location ID				SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2
Sample ID				SQ2A-042111-S	SQ2B-042111-S	SQ2A-021111-S	SQ2B-021111-S	SQ2A-030411-S	SQ2B-030411-S	SQ2A-052511-S	SQ2B-052511-S	SQ2A-040711-S	SQ2B-040711-S
Collection Date				4/21/2011	4/21/2011	2/14/2011	2/14/2011	3/5/2011	3/5/2011	5/26/2011	5/26/2011	4/7/2011	4/7/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				1.66	1.66	9.47	9.94	0.96	0.96	8.76	9.16	8.22	8.22
Lead	EPA 6010B	450	530			230				229			
Mercury	EPA 7471A	0.41	0.59			2.06				0.6			
Silver	EPA 6010B	6.1	6.1			1 U				1 U			
Zinc	EPA 6010B	410	960			1830				1420			
PAHs (mg/kg)													
1-Methylnaphthalene	EPA 8270D				0.60 U			2.3			0.44		0.073
2-Methylnaphthalene	EPA 8270D	0.67	1.4		0.66			2.3			0.39		0.17
Acenaphthene	EPA 8270D	0.5	0.73		0.60 U			0.94 J			0.11 U		0.15
Acenaphthylene	EPA 8270D	1.3	1.3		0.60 U			1.3 U			0.11 U		0.061 U
Anthracene	EPA 8270D	0.96	4.4		0.60 U			1.3 U			0.11 U		0.061 U
Benzo(a)anthracene	EPA 8270D	1.3	1.6		0.66			2.7			0.27		0.19
Benzo(a)pyrene	EPA 8270D	1.6	3		0.84			2.9			0.32		0.22
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72		1.4			4.3			0.55		0.30
Benzofluoranthene	EPA 8270D	3.2	3.6		2.1			7.3			0.84		0.45
Chrysene	EPA 8270D	1.4	2.8		1.6			6.5			0.83		0.49
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54		0.60 U			1.3 U			0.11 U		0.073
Dibenzofuran	EPA 8270D	0.54	0.7		0.60 U			1.9			0.13		0.15
Fluoranthene	EPA 8270D	1.7	2.5		2.0			13			0.78		0.71
Fluorene	EPA 8270D	0.54	1		0.60 U			1.7			0.12		0.12
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69		0.66			2.3			0.29		0.15
Naphthalene	EPA 8270D	2.1	2.4		1.3			2.8			0.26		0.11
Phenanthrene	EPA 8270D	1.5	5.4		1.1			6.6			0.68		0.35
Pyrene	EPA 8270D	2.6	3.3		2.5			9.8			0.96		0.50
Total HPAHs	EPA 8270D	12	17		12			48			4.8		3.0
Total LPAHs	EPA 8270D	5.2	13		2.4			13 J			1.1		0.73
Grain Size (percent)													
Phi Scale -1 to 0	PSEP-PS												
Phi Scale <-1	PSEP-PS												
Phi Scale 0 to 1	PSEP-PS												
Phi Scale 1 to 2	PSEP-PS												
Phi Scale 2 to 3	PSEP-PS												
Phi Scale 3 to 4	PSEP-PS												
Phi Scale 4 to 5	PSEP-PS												
Phi Scale 5 to 6	PSEP-PS												
Phi Scale 6 to 7	PSEP-PS												
Phi Scale 7 to 8	PSEP-PS												
Phi Scale 8 to 9	PSEP-PS												
Phi Scale 9 to 10	PSEP-PS												
Phi Scale >10	PSEP-PS												
Percent Gravel (>2.0 mm)	PSEP-PS												

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF3	BF3	SW2	SW2	SW3	SW3	SW8	SW8	TS	TS
Location ID				SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2	SQ2
Sample ID				SQ2A-042111-S	SQ2B-042111-S	SQ2A-021111-S	SQ2B-021111-S	SQ2A-030411-S	SQ2B-030411-S	SQ2A-052511-S	SQ2B-052511-S	SQ2A-040711-S	SQ2B-040711-S
Collection Date				4/21/2011	4/21/2011	2/14/2011	2/14/2011	3/5/2011	3/5/2011	5/26/2011	5/26/2011	4/7/2011	4/7/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				1.66	1.66	9.47	9.94	0.96	0.96	8.76	9.16	8.22	8.22
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS												
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS												
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS												
Total Fines (Silt/Clay)	PSEP-PS												

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF2		BF2		BF3		BF3		SW2		SW2		SW3		SW3		SW4		SW4	
Location ID				SQ3		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3		SQ3	
Sample ID				SQ3A-020211-S		SQ3B-020211-S		SQ3A-042111-S		SQ3B-042111-S		SQ3A-021111-S		SQ3B-021111-S		SQ3A-030411-S		SQ3B-030411-S		SQ3A-031511-S		SQ3B-031511-S	
Collection Date				2/2/2011		2/2/2011		4/21/2011		4/21/2011		2/14/2011		2/14/2011		3/5/2011		3/5/2011		3/15/2011		3/15/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				28.49		29.78		15.01		15.01		37.4		76		19.54		20.4		23.82		23.82	
Dioxins and Furans (ng/kg)																							
1,2,3,4,6,7,8-HPCDD	EPA 1613					**946**								**1180**								**2950**	
1,2,3,4,7,8-HXCDD	EPA 1613					**7.65**	**J**							**11.4**	**J**							**39.1**	
1,2,3,6,7,8-HXCDD	EPA 1613					**42.7**								**47.6**								**139**	
1,2,3,7,8,9-HXCDD	EPA 1613					**32.6**								**42.7**								**126**	
1,2,3,7,8-PECDD	EPA 1613					**9.24**	**J**							**9.99**	**J**							**33.3**	
2,3,7,8-TCDD	EPA 1613					**3.92**	**J**							**4.06**	**J**							**11.7**	
OCDD	EPA 1613					**18300**								**27500**								**54100**	
1,2,3,4,6,7,8-HPCDF	EPA 1613					**159**								**185**								**510**	
1,2,3,4,7,8,9-HPCDF	EPA 1613					**9.6**	**J**							**11.4**								**32.3**	
1,2,3,4,7,8-HXCDF	EPA 1613					**21.8**								**21.8**								**57.6**	
1,2,3,6,7,8-HXCDF	EPA 1613					**9.52**	**J**							**10.7**								**28.1**	
1,2,3,7,8,9-HXCDF	EPA 1613					**0.829**	**J**							**0.756**	**J**							**2.91**	**J**
1,2,3,7,8-PECDF	EPA 1613					**3.96**	**J**							**4.47**	**J**							**10.6**	**J**
2,3,4,6,7,8-HXCDF	EPA 1613					**6.86**	**J**							**8.59**								**20.8**	
2,3,4,7,8-PECDF	EPA 1613					**11.6**	**J**							**10.9**								**26.2**	
2,3,7,8-TCDF	EPA 1613					**7**								**6.56**								**15.6**	
OCDF	EPA 1613					**521**								**663**								**1750**	
Total HpCDD	EPA 1613					**1860**								**2340**								**5650**	
Total HxCDD	EPA 1613					**353**								**402**								**1060**	
Total PeCDD	EPA 1613					**77.4**								**78.3**								**236**	
Total TCDD	EPA 1613					**34**								**38.2**								**129**	
Total HpCDF	EPA 1613					**531**								**601**								**1660**	
Total HxCDF	EPA 1613					**307**								**329**								**911**	
Total PeCDF	EPA 1613					**317**								**263**								**668**	
Total TCDF	EPA 1613					**354**								**239**								**653**	
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613					**46.4**	**J**							**54.7**	**J**							**148**	**J**
PCBs (mg/kg)																							
Aroclor 1016	EPA 8082							1.3	U			0.27	U					0.049	U				
Aroclor 1221	EPA 8082							1.3	U			0.27	U					0.049	U				
Aroclor 1232	EPA 8082							1.3	U			0.27	U					0.049	U				
Aroclor 1242	EPA 8082							1.3	U			0.27	U					0.049	U				
Aroclor 1248	EPA 8082							**8.0**				**9.4**						**0.59**					
Aroclor 1254	EPA 8082							**5.5**				**4.8**						**0.43**					
Aroclor 1260	EPA 8082							1.4	U			**1.1**						**0.11**					
Total PCBs	EPA 8082	0.13	1					**13**				**15**						**1.1**					
Metals – Total (mg/kg)																							
Arsenic	EPA 6010B	57	93	**15**								**18**				10	U						
Cadmium	EPA 6010B	5.1	6.7	**3.3**								**3.9**				**2.6**							
Chromium	EPA 6010B	260	270	**63.6**								**77.6**				**61**							
Copper	EPA 6010B	390	390	**263**								**258**				**234**							

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF2	BF2	BF3	BF3	SW2	SW2	SW3	SW3	SW4	SW4
Location ID				SQ3	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3	SQ3
Sample ID				SQ3A-020211-S	SQ3B-020211-S	SQ3A-042111-S	SQ3B-042111-S	SQ3A-021111-S	SQ3B-021111-S	SQ3A-030411-S	SQ3B-030411-S	SQ3A-031511-S	SQ3B-031511-S
Collection Date				2/2/2011	2/2/2011	4/21/2011	4/21/2011	2/14/2011	2/14/2011	3/5/2011	3/5/2011	3/15/2011	3/15/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				28.49	29.78	15.01	15.01	37.4	76	19.54	20.4	23.82	23.82
Lead	EPA 6010B	450	530	**326**				**293**		**178**			
Mercury	EPA 7471A	0.41	0.59	**2.67**				**2.17**		**0.54**			
Silver	EPA 6010B	6.1	6.1	**1.3**				**1.0**		0.8 U			
Zinc	EPA 6010B	410	960	**354**				**587**		**1020**			
PAHs (mg/kg)													
1-Methylnaphthalene	EPA 8270D			**0.042**			**0.11**			**0.16**		0.25 U	
2-Methylnaphthalene	EPA 8270D	0.67	1.4	**0.060**			**0.12**			**0.16**		**0.29**	
Acenaphthene	EPA 8270D	0.5	0.73	**0.032**			**0.073**			**0.077 J**		0.25 U	
Acenaphthylene	EPA 8270D	1.3	1.3	0.018 U			0.067 U			0.13 U		0.25 U	
Anthracene	EPA 8270D	0.96	4.4	**0.053**			**0.093**			**0.15**		0.25 U	
Benzo(a)anthracene	EPA 8270D	1.3	1.6	**0.28**			**0.32**			**0.72**		**0.55**	
Benzo(a)pyrene	EPA 8270D	1.6	3	**0.39**			**0.39**			**0.77**		**0.55**	
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72	**0.25**			**0.49**			**1.1**		**0.76**	
Benzofluoranthene	EPA 8270D	3.2	3.6	**0.67**			**0.93**			**2.0**		**1.4**	
Chrysene	EPA 8270D	1.4	2.8	**0.56**			**0.63**			**1.7**		**1.3**	
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54	**0.077**			0.067 U			0.13 U		0.25 U	
Dibenzofuran	EPA 8270D	0.54	0.7	0.018 U			**0.080**			**0.15**		0.25 U	
Fluoranthene	EPA 8270D	1.7	2.5	**0.60**			**0.93**			**3.0**		**1.8**	
Fluorene	EPA 8270D	0.54	1	**0.042**			0.067 U			**0.16**		0.25 U	
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69	**0.18**			**0.27**			**0.56**		**0.36**	
Naphthalene	EPA 8270D	2.1	2.4	**0.053**			**0.14**			**0.20**		**0.34**	
Phenanthrene	EPA 8270D	1.5	5.4	**0.28**			**0.48**			**1.3**		**0.97**	
Pyrene	EPA 8270D	2.6	3.3	**0.67**			**0.93**			**2.3**		**2.4**	
Total HPAHs	EPA 8270D	12	17	**3.5**			**4.9**			**12**		**9.2**	
Total LPAHs	EPA 8270D	5.2	13	**0.46**			**0.80**			**1.9 J**		**1.3**	
Grain Size (percent)													
Phi Scale -1 to 0	PSEP-PS							**1.7**					
Phi Scale <-1	PSEP-PS							**0.1**					
Phi Scale 0 to 1	PSEP-PS							**2.7**					
Phi Scale 1 to 2	PSEP-PS							**22.4**					
Phi Scale 2 to 3	PSEP-PS							**35.7**					
Phi Scale 3 to 4	PSEP-PS							**14.1**					
Phi Scale 4 to 5	PSEP-PS							**2.5**					
Phi Scale 5 to 6	PSEP-PS							**4.8**					
Phi Scale 6 to 7	PSEP-PS							**3.8**					
Phi Scale 7 to 8	PSEP-PS							**3.8**					
Phi Scale 8 to 9	PSEP-PS							**3.2**					
Phi Scale 9 to 10	PSEP-PS							**2.3**					
Phi Scale >10	PSEP-PS							**2.8**					
Percent Gravel (>2.0 mm)	PSEP-PS							**0.1**					

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	BF2	BF2	BF3	BF3	SW2	SW2	SW3	SW3	SW4	SW4
Location ID				**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**	**SQ3**
Sample ID				**SQ3A-020211-S**	**SQ3B-020211-S**	**SQ3A-042111-S**	**SQ3B-042111-S**	**SQ3A-021111-S**	**SQ3B-021111-S**	**SQ3A-030411-S**	**SQ3B-030411-S**	**SQ3A-031511-S**	**SQ3B-031511-S**
Collection Date				**2/2/2011**	**2/2/2011**	**4/21/2011**	**4/21/2011**	**2/14/2011**	**2/14/2011**	**3/5/2011**	**3/5/2011**	**3/15/2011**	**3/15/2011**
Filter				**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Mass Of Solids (g)				**28.49**	**29.78**	**15.01**	**15.01**	**37.4**	**76**	**19.54**	**20.4**	**23.82**	**23.82**
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS							**76.6**					
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS							**14.9**					
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS							**8.3**					
Total Fines (Silt/Clay)	PSEP-PS							**23.2**					

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8		SW8		TS		TS		SW2		SW2		SW3		SW3		SW4		SW4	
Location ID				SQ3		SQ3		SQ3		SQ3		SQ4		SQ4		SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ3A-052511-S		SQ3B-052511-S		SQ3A-040711-S		SQ3B-040711-S		SQ4A-021111-S		SQ4B-021111-S		SQ4A-030411-S		SQ4B-030411-S		SQ4A-031511-S		SQ4B-031511-S	
Collection Date				5/26/2011		5/26/2011		4/7/2011		4/7/2011		2/14/2011		2/14/2011		3/5/2011		3/5/2011		3/15/2011		3/15/2011	
Filter				A		B		A		B		A		B		A		B		A		B	
Mass Of Solids (g)				19.49		19.49		13.97		13.97		35.99		55.53		29.56		30.74		30.71		30.71	
Dioxins and Furans (ng/kg)																							
1,2,3,4,6,7,8-HPCDD	EPA 1613													**2450**								**3840**	
1,2,3,4,7,8-HXCDD	EPA 1613													**43.8**	**J**							**91**	
1,2,3,6,7,8-HXCDD	EPA 1613													**143**								**235**	
1,2,3,7,8,9-HXCDD	EPA 1613													**109**								**208**	
1,2,3,7,8-PECDD	EPA 1613													**22.4**	**J**							**41.2**	
2,3,7,8-TCDD	EPA 1613													**2.48**	**J**							**3.74**	**J**
OCDD	EPA 1613													**19400**								**28800**	
1,2,3,4,6,7,8-HPCDF	EPA 1613													**416**								**749**	
1,2,3,4,7,8,9-HPCDF	EPA 1613													**28.5**								**39.6**	
1,2,3,4,7,8-HXCDF	EPA 1613													**31.7**								**48.8**	
1,2,3,6,7,8-HXCDF	EPA 1613													**22.5**								**37.2**	
1,2,3,7,8,9-HXCDF	EPA 1613													**1.64**	**J**							**4.25**	**J**
1,2,3,7,8-PECDF	EPA 1613													**6.74**	**J**							**10.3**	
2,3,4,6,7,8-HXCDF	EPA 1613													**19**								**30.8**	
2,3,4,7,8-PECDF	EPA 1613													**7.9**	**J**							**11.9**	
2,3,7,8-TCDF	EPA 1613													**4.07**								**5.87**	
OCDF	EPA 1613													**1010**								**1550**	
Total HpCDD	EPA 1613													**4780**								**8280**	
Total HxCDD	EPA 1613													**778**								**1370**	
Total PeCDD	EPA 1613													**98.7**								**158**	
Total TCDD	EPA 1613													**32.8**								**40.8**	
Total HpCDF	EPA 1613													**1210**								**2130**	
Total HxCDF	EPA 1613													**725**								**1270**	
Total PeCDF	EPA 1613													**239**								**383**	
Total TCDF	EPA 1613													**120**								**163**	
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613													**100**	**J**							**170**	**J**
PCBs (mg/kg)																							
Aroclor 1016	EPA 8082			0.51	U			0.036	U			0.014	U					0.033	U				
Aroclor 1221	EPA 8082			0.51	U			0.036	U			0.014	U					0.033	U				
Aroclor 1232	EPA 8082			0.51	U			0.036	U			0.014	U					0.033	U				
Aroclor 1242	EPA 8082			0.51	U			0.036	U			0.014	U					0.033	U				
Aroclor 1248	EPA 8082			**9.7**				**0.63**				0.069	U					**0.094**					
Aroclor 1254	EPA 8082			**5.1**				**0.42**				**0.11**						**0.14**					
Aroclor 1260	EPA 8082			**1.2**				**0.086**				**0.11**						**0.091**					
Total PCBs	EPA 8082	0.13	1	**16**				**1.1**				**0.22**						**0.32**					
Metals – Total (mg/kg)																							
Arsenic	EPA 6010B	57	93									**16**				20	U						
Cadmium	EPA 6010B	5.1	6.7									**2.2**				**2.7**							
Chromium	EPA 6010B	260	270									**81.6**				**92**							
Copper	EPA 6010B	390	390									**266**				**323**							

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8	SW8	TS	TS	SW2	SW2	SW3	SW3	SW4	SW4
Location ID				SQ3	SQ3	SQ3	SQ3	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4
Sample ID				SQ3A-052511-S	SQ3B-052511-S	SQ3A-040711-S	SQ3B-040711-S	SQ4A-021111-S	SQ4B-021111-S	SQ4A-030411-S	SQ4B-030411-S	SQ4A-031511-S	SQ4B-031511-S
Collection Date				5/26/2011	5/26/2011	4/7/2011	4/7/2011	2/14/2011	2/14/2011	3/5/2011	3/5/2011	3/15/2011	3/15/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				19.49	19.49	13.97	13.97	35.99	55.53	29.56	30.74	30.71	30.71
Lead	EPA 6010B	450	530					**166**		**241**			
Mercury	EPA 7471A	0.41	0.59					**0.21**		**0.30**			
Silver	EPA 6010B	6.1	6.1					0.5 U		1 U			
Zinc	EPA 6010B	410	960					**1590**		**2430**			
PAHs (mg/kg)													
1-Methylnaphthalene	EPA 8270D				**0.35**		**0.079**			0.25 U		0.36 U	
2-Methylnaphthalene	EPA 8270D	0.67	1.4		**0.31**		**0.11**			**0.18 J**		0.36 U	
Acenaphthene	EPA 8270D	0.5	0.73		0.15 U		**0.11**			0.25 U		0.36 U	
Acenaphthylene	EPA 8270D	1.3	1.3		0.15 U		0.036 U			0.25 U		0.36 U	
Anthracene	EPA 8270D	0.96	4.4		0.15 U		**0.036**			**0.15 J**		0.36 U	
Benzo(a)anthracene	EPA 8270D	1.3	1.6		**0.28**		**0.11**			**0.68**		**0.78**	
Benzo(a)pyrene	EPA 8270D	1.6	3		**0.33**		**0.15**			**0.68**		**0.81**	
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72		**0.36**		**0.19**			**1.2**		**1.2**	
Benzofluoranthene	EPA 8270D	3.2	3.6		**0.72**		**0.31**			**1.8**		**2.2**	
Chrysene	EPA 8270D	1.4	2.8		**0.51**		**0.28**			**1.6**		**2.0**	
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54		0.15 U		**0.050**			0.25 U		0.36 U	
Dibenzofuran	EPA 8270D	0.54	0.7		0.15 U		**0.16**			**0.19 J**		0.36 U	
Fluoranthene	EPA 8270D	1.7	2.5		**0.82**		**0.37**			**3.0**		**3.1**	
Fluorene	EPA 8270D	0.54	1		0.15 U		**0.16**			**0.19 J**		0.36 U	
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69		**0.21**		**0.10**			**0.54**		**0.52**	
Naphthalene	EPA 8270D	2.1	2.4		0.15 U		**0.079**			**0.17 J**		0.36 U	
Phenanthrene	EPA 8270D	1.5	5.4		**0.42**		**0.28**			**1.5**		**2.0**	
Pyrene	EPA 8270D	2.6	3.3		**0.77**		**0.31**			**2.7**		**3.6**	
Total HPAHs	EPA 8270D	12	17		**4.0**		**1.9**			**12**		**14**	
Total LPAHs	EPA 8270D	5.2	13		**0.42**		**0.67**			**2.0 J**		**2.0**	
Grain Size (percent)													
Phi Scale -1 to 0	PSEP-PS							**0.7**					
Phi Scale <-1	PSEP-PS							**0.3**					
Phi Scale 0 to 1	PSEP-PS							**0.7**					
Phi Scale 1 to 2	PSEP-PS							**1.1**					
Phi Scale 2 to 3	PSEP-PS							**2.6**					
Phi Scale 3 to 4	PSEP-PS							**3.3**					
Phi Scale 4 to 5	PSEP-PS							**1.0**					
Phi Scale 5 to 6	PSEP-PS							**8.8**					
Phi Scale 6 to 7	PSEP-PS							**15.9**					
Phi Scale 7 to 8	PSEP-PS							**19.4**					
Phi Scale 8 to 9	PSEP-PS							**17.0**					
Phi Scale 9 to 10	PSEP-PS							**13.4**					
Phi Scale >10	PSEP-PS							**15.7**					
Percent Gravel (>2.0 mm)	PSEP-PS							**0.3**					

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8	SW8	TS	TS	SW2	SW2	SW3	SW3	SW4	SW4
Location ID				SQ3	SQ3	SQ3	SQ3	SQ4	SQ4	SQ4	SQ4	SQ4	SQ4
Sample ID				SQ3A-052511-S	SQ3B-052511-S	SQ3A-040711-S	SQ3B-040711-S	SQ4A-021111-S	SQ4B-021111-S	SQ4A-030411-S	SQ4B-030411-S	SQ4A-031511-S	SQ4B-031511-S
Collection Date				5/26/2011	5/26/2011	4/7/2011	4/7/2011	2/14/2011	2/14/2011	3/5/2011	3/5/2011	3/15/2011	3/15/2011
Filter				A	B	A	B	A	B	A	B	A	B
Mass Of Solids (g)				19.49	19.49	13.97	13.97	35.99	55.53	29.56	30.74	30.71	30.71
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS							**8.4**					
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS							**45.1**					
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS							**46.1**					
Total Fines (Silt/Clay)	PSEP-PS							**91.2**					

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8		SW8		TS		TS	
Location ID				SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ4A-052511-S		SQ4B-052511-S		SQ4A-040711-S		SQ4B-040711-S	
Collection Date				5/26/2011		5/26/2011		4/7/2011		4/7/2011	
Filter				A		B		A		B	
Mass Of Solids (g)				15.73		15.73		8.51		8.51	
Dioxins and Furans (ng/kg)											
1,2,3,4,6,7,8-HPCDD	EPA 1613										
1,2,3,4,7,8-HXCDD	EPA 1613										
1,2,3,6,7,8-HXCDD	EPA 1613										
1,2,3,7,8,9-HXCDD	EPA 1613										
1,2,3,7,8-PECDD	EPA 1613										
2,3,7,8-TCDD	EPA 1613										
OCDD	EPA 1613										
1,2,3,4,6,7,8-HPCDF	EPA 1613										
1,2,3,4,7,8,9-HPCDF	EPA 1613										
1,2,3,4,7,8-HXCDF	EPA 1613										
1,2,3,6,7,8-HXCDF	EPA 1613										
1,2,3,7,8,9-HXCDF	EPA 1613										
1,2,3,7,8-PECDF	EPA 1613										
2,3,4,6,7,8-HXCDF	EPA 1613										
2,3,4,7,8-PECDF	EPA 1613										
2,3,7,8-TCDF	EPA 1613										
OCDF	EPA 1613										
Total HpCDD	EPA 1613										
Total HxCDD	EPA 1613										
Total PeCDD	EPA 1613										
Total TCDD	EPA 1613										
Total HpCDF	EPA 1613										
Total HxCDF	EPA 1613										
Total PeCDF	EPA 1613										
Total TCDF	EPA 1613										
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613										
PCBs (mg/kg)											
Aroclor 1016	EPA 8082			0.064	U			0.059	U		
Aroclor 1221	EPA 8082			0.064	U			0.059	U		
Aroclor 1232	EPA 8082			0.064	U			0.059	U		
Aroclor 1242	EPA 8082			0.064	U			0.059	U		
Aroclor 1248	EPA 8082			**0.25**				**0.094**			
Aroclor 1254	EPA 8082			**0.51**				**0.13**			
Aroclor 1260	EPA 8082			**0.13**				**0.071**			
Total PCBs	EPA 8082	0.13	1	**0.89**				**0.29**			
Metals – Total (mg/kg)											
Arsenic	EPA 6010B	57	93								
Cadmium	EPA 6010B	5.1	6.7								
Chromium	EPA 6010B	260	270								
Copper	EPA 6010B	390	390								

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8		SW8		TS		TS	
Location ID				SQ4		SQ4		SQ4		SQ4	
Sample ID				SQ4A-052511-S		SQ4B-052511-S		SQ4A-040711-S		SQ4B-040711-S	
Collection Date				5/26/2011		5/26/2011		4/7/2011		4/7/2011	
Filter				A		B		A		B	
Mass Of Solids (g)				15.73		15.73		8.51		8.51	
Lead	EPA 6010B	450	530								
Mercury	EPA 7471A	0.41	0.59								
Silver	EPA 6010B	6.1	6.1								
Zinc	EPA 6010B	410	960								
PAHs (mg/kg)											
1-Methylnaphthalene	EPA 8270D					**0.22**				**0.12**	
2-Methylnaphthalene	EPA 8270D	0.67	1.4			**0.18**				**0.16**	
Acenaphthene	EPA 8270D	0.5	0.73			**0.064**				**0.21**	
Acenaphthylene	EPA 8270D	1.3	1.3			0.064	U			0.12	U
Anthracene	EPA 8270D	0.96	4.4			0.064	U			0.12	U
Benzo(a)anthracene	EPA 8270D	1.3	1.6			**0.27**				**0.26**	
Benzo(a)pyrene	EPA 8270D	1.6	3			**0.23**				**0.35**	
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72			**0.44**				**0.58**	
Benzofluoranthene	EPA 8270D	3.2	3.6			**0.70**				**0.78**	
Chrysene	EPA 8270D	1.4	2.8			**0.76**				**0.62**	
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54			0.064	U			**0.12**	
Dibenzofuran	EPA 8270D	0.54	0.7			**0.083**				**0.31**	
Fluoranthene	EPA 8270D	1.7	2.5			**0.70**				**0.95**	
Fluorene	EPA 8270D	0.54	1			**0.095**				**0.31**	
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69			**0.17**				**0.28**	
Naphthalene	EPA 8270D	2.1	2.4			**0.16**				0.12	U
Phenanthrene	EPA 8270D	1.5	5.4			**0.89**				**0.69**	
Pyrene	EPA 8270D	2.6	3.3			**0.95**				**0.73**	
Total HPAHs	EPA 8270D	12	17			**4.2**				**4.7**	
Total LPAHs	EPA 8270D	5.2	13			**1.2**				**1.2**	
Grain Size (percent)											
Phi Scale -1 to 0	PSEP-PS										
Phi Scale <-1	PSEP-PS										
Phi Scale 0 to 1	PSEP-PS										
Phi Scale 1 to 2	PSEP-PS										
Phi Scale 2 to 3	PSEP-PS										
Phi Scale 3 to 4	PSEP-PS										
Phi Scale 4 to 5	PSEP-PS										
Phi Scale 5 to 6	PSEP-PS										
Phi Scale 6 to 7	PSEP-PS										
Phi Scale 7 to 8	PSEP-PS										
Phi Scale 8 to 9	PSEP-PS										
Phi Scale 9 to 10	PSEP-PS										
Phi Scale >10	PSEP-PS										
Percent Gravel (>2.0 mm)	PSEP-PS										

Table E–2. Filtered Solids Analytical Results for Baseflow, Storm Events, and Tidal Samples

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	SW8		SW8		TS		TS	
Location ID				**SQ4**		**SQ4**		**SQ4**		**SQ4**	
Sample ID				**SQ4A-052511-S**		**SQ4B-052511-S**		**SQ4A-040711-S**		**SQ4B-040711-S**	
Collection Date				**5/26/2011**		**5/26/2011**		**4/7/2011**		**4/7/2011**	
Filter				**A**		**B**		**A**		**B**	
Mass Of Solids (g)				**15.73**		**15.73**		**8.51**		**8.51**	
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS										
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS										
Percent Clay (<0.004 mm - 0.004 mm)	PSEP-PS										
Total Fines (Silt/Clay)	PSEP-PS										

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

BF = base flow; SW = storm water; TS = tidal sampling

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reporting limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for PAHs, it was assumed that the mass of solids captured on both the A and B filters was equal if no grain size and/or metals subsamples were removed. If subsamples were removed from the A filter, the mass of solids captured for the B filter was adjusted with a correction factor. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter B was increased by 5 percent.

In scenarios where the A filter was analyzed for PAHs and the B filter for dioxin/furan congeners, it was assumed that the mass of solids captured on the A and B filters was equal. The mass of solids on the B filter was determined from post sampling dry weight measurements made by ARI or Axys and applied to filter A. If grain size and/or metals subsamples were removed from filter A, a correction factor was used to account for their removal. For example, if the grain size and metals subsamples accounted for 5 percent of the wet weight of filter A, then the dried mass of solids captured for filter A was decreased by 5 percent.

In scenarios where the A filter was analyzed for PCB Aroclors and the B filter for dioxin/furan congeners, the mass of solids captured was calculated separately for each filter.

All results should be considered estimates.

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1		sed trap 1		sed trap 1		sed trap 2		sed trap 1		sed trap 2		sed trap 1		sed trap 2	
Location ID				DK1		DK1		DK2		DK2		DK3		DK3		DK4		DK4	
Sample ID				DK1-011911-T		DK1-050511-T		DK2-011911-T		DK2-050511-T		DK3-011911-T		DK3-050511-T		DK4-011911-T		DK4-050511-T	
Collection Date				1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011	
Dioxins and Furans (ng/kg)																			
1,2,3,4,6,7,8-HPCDD	EPA 1613					**1970**		**458**		**746**		**606**		**767**				**945**	
1,2,3,4,7,8-HXCDD	EPA 1613					**47.9**	J	**9.35**	J	**15.4**	J	**11.2**	J	**16**	J			**18.3**	J
1,2,3,6,7,8-HXCDD	EPA 1613					**101**	J	**22.3**		**36.5**	J	**29**		**39.3**	J			**44.5**	J
1,2,3,7,8,9-HXCDD	EPA 1613					**118**	J	**24.6**		**43.3**	J	**27.7**		**39**	J			**45.5**	J
1,2,3,7,8-PECDD	EPA 1613					**24.7**	J	**5**	J	**8.48**	J	**5.78**	J	**7.88**	J			**9.79**	J
2,3,7,8-TCDD	EPA 1613					**3.96**		**1.1**	J	**2.07**		**1.55**	J	**1.71**				**2.04**	
OCDD	EPA 1613					**13000**		**3460**		**5890**		**5700**		**6300**				**7730**	
1,2,3,4,6,7,8-HPCDF	EPA 1613					**379**		**86.5**		**134**		**113**		**161**				**193**	
1,2,3,4,7,8,9-HPCDF	EPA 1613					**20.1**		**6.64**	J	**8.08**		**7.97**	J	**10**				**11.6**	
1,2,3,4,7,8-HXCDF	EPA 1613					**29.9**		**6.42**	J	**11.8**		**8.35**	J	**12.6**				**14**	
1,2,3,6,7,8-HXCDF	EPA 1613					**19.7**		**4.39**	J	**7.34**		**5.51**	J	**8.32**				**10.1**	
1,2,3,7,8,9-HXCDF	EPA 1613					**0.956**	J	0.277	U	**0.393**	J	**0.306**	J	**0.497**	J			**0.505**	J
1,2,3,7,8-PECDF	EPA 1613					**4.49**	J	**1.32**	J	**2.05**	J	**1.86**	J	**2.32**	J			**3.28**	J
2,3,4,6,7,8-HXCDF	EPA 1613					**18.1**		**4.08**	J	**6.4**		**5.1**	J	**7.22**				**9.4**	
2,3,4,7,8-PECDF	EPA 1613					**6.9**	J	**1.9**	J	**3.28**	J	**2.67**	J	**3.37**	J			**4.58**	J
2,3,7,8-TCDF	EPA 1613					**4.12**		**1.8**	J	**2.76**		**2.54**	J	**2.52**				**4.74**	
OCDF	EPA 1613					**764**		**206**		**306**		**316**		**368**				**447**	
Total HpCDD	EPA 1613					**3490**		**919**		**1590**		**1170**		**1420**				**2030**	
Total HxCDD	EPA 1613					**725**		**169**		**284**		**200**		**270**				**357**	
Total PeCDD	EPA 1613					**114**		**23.3**		**47.3**		**29.2**		**43.3**				**65.4**	
Total TCDD	EPA 1613					**32.4**		**7.56**		**15.4**		**11.5**		**15.3**				**23.6**	
Total HpCDF	EPA 1613					**989**		**243**		**366**		**346**		**454**				**548**	
Total HxCDF	EPA 1613					**529**		**123**		**200**		**169**		**230**				**273**	
Total PeCDF	EPA 1613					**219**		**59.3**		**101**		**77.2**		**103**				**141**	
Total TCDF	EPA 1613					**124**		**36.9**		**63.7**		**50.3**		**58.6**				**84.5**	
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613					**92.7**	J	**20.6**	J	**34.7**	J	**26.2**	J	**34.6**	J			**42.0**	J
PCBs (mg/kg)																			
Aroclor 1016	EPA 8082			0.043	U			0.032	U			0.032	U			0.046	U		
Aroclor 1221	EPA 8082			0.043	U			0.032	U			0.032	U			0.046	U		
Aroclor 1232	EPA 8082			0.043	U			0.032	U			0.032	U			0.046	U		
Aroclor 1242	EPA 8082			0.043	U			0.032	U			0.032	U			0.046	U		
Aroclor 1248	EPA 8082			0.043	UJ			**0.039**	J			**0.089**	J			**0.27**	J		
Aroclor 1254	EPA 8082			**0.073**				**0.04**				**0.086**				**0.23**			
Aroclor 1260	EPA 8082			**0.071**				0.032	U			**0.042**				**0.1**			
Total PCBs	EPA 8082	0.13	1	**0.14**				**0.08**	J			**0.22**	J			**0.6**	J		
Metals – Total (mg/kg)																			
Arsenic	EPA 6010B	57	93					**11**				**11**							
Cadmium	EPA 6010B	5.1	6.7					**1.0**				**1.0**							
Chromium	EPA 6010B	260	270					**68.4**				**69.6**							
Copper	EPA 6010B	390	390					**115**				**141**							
Lead	EPA 6010B	450	530					**90**				**113**							
Mercury	EPA 7471A	0.41	0.59					**0.08**	J			**0.12**	J						
Silver	EPA 6010B	6.1	6.1					**1.4**	J			0.5	UJ						
Zinc	EPA 6010B	410	960					**475**				**470**							

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1	sed trap 1	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2
Location ID				DK1	DK1	DK2	DK2	DK3	DK3	DK4	DK4
Sample ID				DK1-011911-T	DK1-050511-T	DK2-011911-T	DK2-050511-T	DK3-011911-T	DK3-050511-T	DK4-011911-T	DK4-050511-T
Collection Date				1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011
Phenols (mg/kg)											
2,4-Dimethylphenol	EPA 8270D	0.029	0.029		0.24 UJ		0.15 UJ		0.12 UJ		0.17 UJ
o-Cresol	EPA 8270D	0.063	0.063		0.24 U		0.15 U		0.12 U		0.17 U
p-Cresol	EPA 8270D	0.67	0.67		5.4		5.2		1.4		0.65
Pentachlorophenol	EPA 8270D	0.36	0.69		1.2 UJ		0.76 UJ		0.58 UJ		0.84 UJ
Phenol	EPA 8270D	0.42	1.2		0.55		0.53		0.43		0.49
Phthalates (mg/kg)											
Bis(2-Ethylhexyl) Phthalate	EPA 8270D	1.3	1.9		10		16		9.0		13
Butyl benzyl phthalate	EPA 8270D	0.063	0.9		0.77		0.64		0.36		0.58
Dibutyl phthalate	EPA 8270D	1.4	5.1		0.24 U		0.21		0.13		0.26
Diethyl phthalate	EPA 8270D	0.2	1.2		0.24 U		0.15 U		0.38		0.17 U
Dimethyl phthalate	EPA 8270D	0.071	0.16		0.24 U		0.15 U		0.076 J		0.19
Di-n-Octyl phthalate	EPA 8270D	6.2			0.71 J		2.1		1.8 J		1.6 J
PAHs (mg/kg)											
1-Methylnaphthalene	EPA 8270D				0.24 U		0.084 J		0.064 J		0.17 U
2-Methylnaphthalene	EPA 8270D	0.67	1.4		0.24 U		0.16		0.12		0.11 J
Acenaphthene	EPA 8270D	0.5	0.73		0.24 U		0.092 J		0.058 J		0.17 U
Acenaphthylene	EPA 8270D	1.3	1.3		0.24 U		0.15 U		0.12 U		0.17 U
Anthracene	EPA 8270D	0.96	4.4		0.24 U		0.21		0.15		0.2
Benzo(a)anthracene	EPA 8270D	1.3	1.6		0.39		0.64		0.46		0.75
Benzo(a)pyrene	EPA 8270D	1.6	3		0.53 J		0.7		0.52 J		0.98 J
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72		0.44 J		0.66		0.41 J		0.94 J
Benzofluoranthene	EPA 8270D	3.2	3.6		1.2 J		1.4		1 J		2 J
Chrysene	EPA 8270D	1.4	2.8		0.94		1.1		0.82		1.5
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54		0.24 U		0.17		0.12 J		0.21 J
Dibenzofuran	EPA 8270D	0.54	0.7		0.24 U		0.084 J		0.064 J		0.17 U
Fluoranthene	EPA 8270D	1.7	2.5		1.6 J		2.3 J		1.4 J		2.5 J
Fluorene	EPA 8270D	0.54	1		0.24 U		0.13 J		0.07 J		0.084 J
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69		0.32 J		0.44		0.3 J		0.61 J
Naphthalene	EPA 8270D	2.1	2.4		0.24 U		0.84		0.56		0.2
Phenanthrene	EPA 8270D	1.5	5.4		0.83		1.3		0.78		1.3
Pyrene	EPA 8270D	2.6	3.3		1.2		1.8		1.1		2.1
Total HPAHs	EPA 8270D	12	17		6.6 J		9.2 J		6.0 J		12 J
Total LPAHs	EPA 8270D	5.2	13		0.83		2.6 J		1.6 J		1.8 J
SVOCs (mg/kg)											
1,2,4-Trichlorobenzene	EPA 8270D	0.031	0.051		0.24 U		0.15 U		0.12 U		0.17 U
1,2-Dichlorobenzene	EPA 8270D	0.035	0.05		0.24 U		0.15 U		0.12 U		0.17 U
1,3-Dichlorobenzene	EPA 8270D				0.24 U		0.15 U		0.12 U		0.17 U
1,4-Dichlorobenzene	EPA 8270D	0.11	0.12		0.24 U		0.15 U		0.12 U		0.17 U
Benzoic Acid	EPA 8270D	0.65	0.65		1.4 J		0.66 J		0.34 J		1.6 J
Benzyl Alcohol	EPA 8270D	0.057	0.073		0.24 U		0.28		0.29		0.33
Hexachlorobenzene	EPA 8270D	0.022	0.07		0.24 U		0.15 U		0.12 U		0.17 U
Hexachlorobutadiene	EPA 8270D	0.011	0.12		0.24 U		0.15 U		0.12 U		0.17 U
Hexachloroethane	EPA 8270D				0.24 U		0.15 U		0.12 U		0.17 U
N-Nitrosodiphenylamine	EPA 8270D	0.028	0.04		0.24 U		0.15 U		0.12 U		0.17 U

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1		sed trap 1		sed trap 1		sed trap 2		sed trap 1		sed trap 2		sed trap 1		sed trap 2	
Location ID				DK1		DK1		DK2		DK2		DK3		DK3		DK4		DK4	
Sample ID				DK1-011911-T		DK1-050511-T		DK2-011911-T		DK2-050511-T		DK3-011911-T		DK3-050511-T		DK4-011911-T		DK4-050511-T	
Collection Date				1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011	
Brominated Diphenylethers (pg/g)																			
BDE-007	EPA 1614					1.88	U	6.69	J	4.82	J	9.84	J	5.16	J			15.5	J
BDE-008	EPA 1614					8.37	CJ	9.84	CJ	15.5	CJ	11.6	CJ	10.2	CJ			12.9	CJ
BDE-010	EPA 1614					1.25	U	0.942	U	0.613	U	1.26	U	0.693	U			0.951	U
BDE-011	EPA 1614					C8		C8		C8		C8		C8				C8	
BDE-012	EPA 1614					6.81	CJ	8.02	CJ	14.5	CJ	10.1	CJ	8.69	CJ			10.8	CJ
BDE-013	EPA 1614					C12		C12		C12		C12		C12				C12	
BDE-015	EPA 1614					17.2	J	13.2	J	18.5	J	15.6	J	14.1	J			20.4	J
BDE-017	EPA 1614					209	C	164	C	155	C	192	C	230	C			385	C
BDE-025	EPA 1614					C17		C17		C17		C17		C17				C17	
BDE-028	EPA 1614					391	C	256	C	260	C	223	C	277	C			364	C
BDE-030	EPA 1614					6.59	U	1.82	U	1.55	U	3.91	U	1.54	U			1.63	U
BDE-032	EPA 1614					5.26	U	1.44	U	3.27	J	3.09	U	2.43	U			4.5	U
BDE-033	EPA 1614					C28		C28		C28		C28		C28				C28	
BDE-035	EPA 1614					54.3	U	22.9	U	41.3	U	24.6	U	22.6	U			54.5	U
BDE-037	EPA 1614					18.2	J	14.8	J	21.3	J	13.7	J	17.7	J			28.1	
BDE-047	EPA 1614					16100		13500		14200		10600		13300				23200	
BDE-049	EPA 1614					884		714		613		552		586				1120	
BDE-051	EPA 1614					70.7		88.4		63.3	J	63.1		63.4				104	
BDE-066	EPA 1614					709		477		530		380		458				959	
BDE-071	EPA 1614					91.9		88.6		63.2	J	63.6		77.3				139	
BDE-075	EPA 1614					34.9	J	29.8		25.4	J	21.6		23.1				39.1	J
BDE-077	EPA 1614					12.3	U	7.68	U	11.9	U	8.88	U	6.99	U			24.2	U
BDE-079	EPA 1614					23.7	J	27	U	27.6	J	19.2	U	15.2	U			49.5	J
BDE-085	EPA 1614					842		1060		911		584		1050				2360	
BDE-099	EPA 1614					17800		19100		16600		11900		19000				37500	
BDE-100	EPA 1614					3720		4100		3680		2680		3930				8130	
BDE-105	EPA 1614					27.6	U	39.1	U	25.3	U	19.6	U	26.1	U			49.7	U
BDE-116	EPA 1614					41.8	U	60.8	U	38.4	U	30.5	U	47.7	U			75.5	U
BDE-119	EPA 1614					144	C	33.3		86.5	CJ	16.7		159	C			259	
BDE-120	EPA 1614					C119		C119		C119		C119		C119				C119	
BDE-126	EPA 1614					12.8	U	21.2	U	10.9	U	10.1	U	12.9	U			23	U
BDE-128	EPA 1614					88.4	U	59.1	U	101	U	392	U	44.5	U			395	U
BDE-138	EPA 1614					326	C	383	C	386	C	313	C	396	C			1240	C
BDE-140	EPA 1614					94.7		89		103		65.6	U	103				496	
BDE-153	EPA 1614					2340		2390		2150		1470		2270				6510	
BDE-154	EPA 1614					1640		1720		1690		1030		1700				4640	
BDE-155	EPA 1614					77.6		108		89.9		68.9		109				244	
BDE-166	EPA 1614					C138		C138		C138		C138		C138				C138	
BDE-181	EPA 1614					96.2	U	47.5	U	74.1	U	58.1	U	78.6				883	
BDE-183	EPA 1614					3080		1350		1000		849		951				11900	
BDE-190	EPA 1614					531	U	175		234		161		255				3150	
BDE-203	EPA 1614					2370		1040		1450		1240		1560				12000	
BDE-206	EPA 1614					13000		14800		12600		16300		13100				100000	
BDE-207	EPA 1614					14300		15500		12000		13700		17500				91300	
BDE-208	EPA 1614					10600		6690		8510		7190		11000				64100	

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1		sed trap 1		sed trap 1		sed trap 2		sed trap 1		sed trap 2		sed trap 1		sed trap 2	
Location ID				DK1		DK1		DK2		DK2		DK3		DK3		DK4		DK4	
Sample ID				DK1-011911-T		DK1-050511-T		DK2-011911-T		DK2-050511-T		DK3-011911-T		DK3-050511-T		DK4-011911-T		DK4-050511-T	
Collection Date				1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011		1/19/2011		5/5/2011	
BDE-209	EPA 1614					**178000**	J	**232000**		**253000**		**270000**		**297000**				**1540000**	
Total PBDEs	EPA 1614					**266000**	CJ	**315000**	CJ	**330000**	CJ	**339000**	CJ	**384000**	CJ			**1910000**	CJ
Grain Size (percent)																			
Phi Scale -1 to 0	PSEP-PS							**5.3**				**2.4**							
Phi Scale <-1	PSEP-PS							**1.9**				**0.3**							
Phi Scale 0 to 1	PSEP-PS							**12.9**				**7.6**							
Phi Scale 1 to 2	PSEP-PS							**22.0**				**18.2**							
Phi Scale 2 to 3	PSEP-PS							**17.4**				**26.7**							
Phi Scale 3 to 4	PSEP-PS							**11.1**				**18.9**							
Phi Scale 4 to 5	PSEP-PS							0.1	U			0.1	U						
Phi Scale 5 to 6	PSEP-PS							**7.2**				**4.7**							
Phi Scale 6 to 7	PSEP-PS							**7.7**				**6.2**							
Phi Scale 7 to 8	PSEP-PS							**5.5**				**5.1**							
Phi Scale 8 to 9	PSEP-PS							**2.8**				**3.2**							
Phi Scale 9 to 10	PSEP-PS							**1.9**				**2.3**							
Phi Scale >10	PSEP-PS							**4.4**				**4.5**							
Percent Gravel (>2.0 mm)	PSEP-PS							**1.9**				**0.3**							
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS							**68.7**				**73.8**							
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS							**20.4**				**16.0**							
Percent Clay (<0.004 mm - 0.004 mm	PSEP-PS							**9.1**				**10.0**							
Total Fines (Silt/Clay)	PSEP-PS							**29.5**				**26.0**							
Conventionals																			
Total Organic Carbon (percent)	PLUMB, 1981					**15.9**				**11.5**				**6.32**				**7.3**	
Total Solids (percent)	EPA 160.3					**30.00**				**47.10**				**52.20**				**36.20**	

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

SQS - Washington State Sediment Quality Standard

CSL - Washington State Cleanup Screening Level

LAET - lowest apparent effects threshold

2LAET - second lowest apparent effects threshold

C - Coelution

J - Estimated concentration when the value is less than established reporting limits. quantitation limit.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2
Location ID				SQ1	SQ1	SQ2	SQ2	SQ3	SQ3	SQ4	SQ4
Sample ID				SQ1-011911-T	SQ1-050511-T	SQ2-011911-T	SQ2-050511-T	SQ3-011911-T	SQ3-050511-T	SQ4-011911-T	SQ4-050511-T
Collection Date				1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011
Dioxins and Furans (ng/kg)											
1,2,3,4,6,7,8-HPCDD	EPA 1613				**1630**	**945**	**1020**	**1280**	**1150**		**2070**
1,2,3,4,7,8-HXCDD	EPA 1613				**24.9 J**	**13.9**	**15.8 J**	**21.1 J**	**17.6 J**		**41.7 J**
1,2,3,6,7,8-HXCDD	EPA 1613				**88.6 J**	**44.3**	**55.5 J**	**68.7**	**52.5 J**		**114 J**
1,2,3,7,8,9-HXCDD	EPA 1613				**59.4 J**	**36.1**	**44.5 J**	**53**	**48.9 J**		**97.2 J**
1,2,3,7,8-PECDD	EPA 1613				**12 J**	**7.67 J**	**8.84 J**	**14 J**	**11 J**		**20.2 J**
2,3,7,8-TCDD	EPA 1613				**1.48**	**1.91 J**	**1.55**	**2.6 J**	**2.41**		**2.42**
OCDD	EPA 1613				**13900**	**9230**	**10300**	**12400**	**14500**		**15800**
1,2,3,4,6,7,8-HPCDF	EPA 1613				**387**	**207**	**236**	**230**	**217**		**646**
1,2,3,4,7,8,9-HPCDF	EPA 1613				**20.7**	**12.8**	**13.9**	**14.6 J**	**12.6**		**29.4**
1,2,3,4,7,8-HXCDF	EPA 1613				**59.1**	**20.5**	**28.4**	**26.5**	**24.2**		**29.6**
1,2,3,6,7,8-HXCDF	EPA 1613				**23**	**10.5 J**	**12.8**	**13.1 J**	**12.2**		**20.2**
1,2,3,7,8,9-HXCDF	EPA 1613				**1.92 J**	**0.665 J**	**0.828 J**	**0.906 J**	**0.913 J**		**1.48 J**
1,2,3,7,8-PECDF	EPA 1613				**10.4**	**4.03 J**	**5.41**	**5.06 J**	**4.43 J**		**5.06**
2,3,4,6,7,8-HXCDF	EPA 1613				**17.7**	**9.53 J**	**10.9**	**10.5 J**	**10.9**		**17.9**
2,3,4,7,8-PECDF	EPA 1613				**16.4 J**	**7.97 J**	**8.46 J**	**8.34 J**	**8.07 J**		**6.09 J**
2,3,7,8-TCDF	EPA 1613				**6.99**	**5.18**	**4.89**	**5.86**	**5.17**		**3.97**
OCDF	EPA 1613				**838**	**689**	**630**	**493**	**507**		**1420**
Total HpCDD	EPA 1613				**3350**	**2150**	**2220**	**2490**	**2390**		**4290**
Total HxCDD	EPA 1613				**520**	**328**	**392**	**444**	**396**		**691**
Total PeCDD	EPA 1613				**61.9**	**49.5**	**57.2**	**122**	**69.1**		**84.2**
Total TCDD	EPA 1613				**18.2**	**21.3**	**18.4**	**77.2**	**25**		**18.3**
Total HpCDF	EPA 1613				**1170**	**668**	**694**	**699**	**614**		**2250**
Total HxCDF	EPA 1613				**807**	**303**	**398**	**445**	**365**		**844**
Total PeCDF	EPA 1613				**296**	**163**	**173**	**198**	**201**		**192**
Total TCDF	EPA 1613				**84.7**	**95.2**	**78.1**	**114**	**122**		**74.5**
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613				**71.7 J**	**40.8 J**	**46.4 J**	**58.3 J**	**51.5 J**		**89.8 J**
PCBs (mg/kg)											
Aroclor 1016	EPA 8082			0.036 U		0.33 U		0.33 U		0.096 U	
Aroclor 1221	EPA 8082			0.036 U		0.33 U		0.33 U		0.096 U	
Aroclor 1232	EPA 8082			0.036 U		0.33 U		0.33 U		0.096 U	
Aroclor 1242	EPA 8082			0.036 U		**0.63**		**2.2 J**		0.096 U	
Aroclor 1248	EPA 8082			**0.1 J**		0.33 U		0.33 U		**0.26 J**	
Aroclor 1254	EPA 8082			**0.15**		**0.46**		**0.94 J**		**0.21**	
Aroclor 1260	EPA 8082			**0.11**		0.33 U		0.33 U		**0.16**	
Total PCBs	EPA 8082	0.13	1	**0.4 J**		**1.1**		**3.1 J**		**0.63 J**	
Metals – Total (mg/kg)											
Arsenic	EPA 6010B	57	93			**14**		**20**			
Cadmium	EPA 6010B	5.1	6.7			**5.8**		**3.0**			
Chromium	EPA 6010B	260	270			**62.2**		**67**			
Copper	EPA 6010B	390	390			**1640**		**343**			
Lead	EPA 6010B	450	530			**237**		**241**			
Mercury	EPA 7471A	0.41	0.59			**1.05 J**		**1.01 J**			
Silver	EPA 6010B	6.1	6.1			**0.7 J**		0.7 UJ			
Zinc	EPA 6010B	410	960			**624**		**699**			

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2
Location ID				SQ1	SQ1	SQ2	SQ2	SQ3	SQ3	SQ4	SQ4
Sample ID				SQ1-011911-T	SQ1-050511-T	SQ2-011911-T	SQ2-050511-T	SQ3-011911-T	SQ3-050511-T	SQ4-011911-T	SQ4-050511-T
Collection Date				1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011
Phenols (mg/kg)											
2,4-Dimethylphenol	EPA 8270D	0.029	0.029		0.25 UJ		0.21 UJ		0.16 UJ		0.23 UJ
o-Cresol	EPA 8270D	0.063	0.063		0.25 U		0.21 U		0.16 U		0.23 U
p-Cresol	EPA 8270D	0.67	0.67		**39**		**14**		**0.30**		**0.24**
Pentachlorophenol	EPA 8270D	0.36	0.69		1.3 UJ		1.0 UJ		0.80 UJ		**0.24** J
Phenol	EPA 8270D	0.42	1.2		**2.5**		**0.78**		**0.38**		**0.49**
Phthalates (mg/kg)											
Bis(2-Ethylhexyl) Phthalate	EPA 8270D	1.3	1.9		**13**		**13**		**9.4**		**22**
Butyl benzyl phthalate	EPA 8270D	0.063	0.9		**0.40**		**0.76**		**0.39**		**0.90**
Dibutyl phthalate	EPA 8270D	1.4	5.1		**0.29**		**0.28**		**0.26**		0.23 U
Diethyl phthalate	EPA 8270D	0.2	1.2		0.25 U		0.21 U		0.16 U		0.23 U
Dimethyl phthalate	EPA 8270D	0.071	0.16		0.25 U		0.21 U		0.16 U		**0.15** J
Di-n-Octyl phthalate	EPA 8270D	6.2			**0.56**		**0.60**		**0.52**		**1.8**
PAHs (mg/kg)											
1-Methylnaphthalene	EPA 8270D				0.25 U		**0.12** J		0.16 U		0.23 U
2-Methylnaphthalene	EPA 8270D	0.67	1.4		**0.15** J		**0.23**		**0.12** J		**0.19** J
Acenaphthene	EPA 8270D	0.5	0.73		0.25 U		**0.15** J		0.16 U		**0.27**
Acenaphthylene	EPA 8270D	1.3	1.3		0.25 U		0.21 U		0.16 U		0.23 U
Anthracene	EPA 8270D	0.96	4.4		**0.25**		**0.42**		**0.18**		**0.79**
Benzo(a)anthracene	EPA 8270D	1.3	1.6		**0.91**		**1.9**		**0.78**		**3.9**
Benzo(a)pyrene	EPA 8270D	1.6	3		**0.91**		**2**		**0.92**		**4.5**
Benzo(g,h,i)perylene	EPA 8270D	0.67	0.72		**1.1**		**1.9**		**0.91**		**3.9**
Benzofluoranthene	EPA 8270D	3.2	3.6		**2.1**		**4.3**		**2**		**9.8**
Chrysene	EPA 8270D	1.4	2.8		**1.9**		**3.2**		**1.6**		**6.8**
Dibenzo(a,h)anthracene	EPA 8270D	0.23	0.54		**0.28**		**0.5**		**0.24**		**1.3**
Dibenzofuran	EPA 8270D	0.54	0.7		**0.14** J		**0.16** J		**0.096** J		**0.32**
Fluoranthene	EPA 8270D	1.7	2.5		**3** J		**6.1** J		**2.7** J		**16** J
Fluorene	EPA 8270D	0.54	1		**0.16** J		**0.2** J		**0.1** J		**0.35**
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.6	0.69		**0.61**		**1.4**		**0.62**		**3.6**
Naphthalene	EPA 8270D	2.1	2.4		**0.23** J		**0.31**		**0.18**		**0.31**
Phenanthrene	EPA 8270D	1.5	5.4		**1.7**		**2.9**		**1.4**		**6.3**
Pyrene	EPA 8270D	2.6	3.3		**2.3**		**4.2**		**2**		**9.4**
Total HPAHs	EPA 8270D	12	17		**13** J		**26** J		**12** J		**59** J
Total LPAHs	EPA 8270D	5.2	13		**2.3** J		**4** J		**1.9** J		**8.0**
SVOCs (mg/kg)											
1,2,4-Trichlorobenzene	EPA 8270D	0.031	0.051		0.25 U		0.21 U		0.16 U		0.23 U
1,2-Dichlorobenzene	EPA 8270D	0.035	0.05		0.25 U		0.21 U		0.16 U		0.23 U
1,3-Dichlorobenzene	EPA 8270D				0.25 U		0.21 U		0.16 U		0.23 U
1,4-Dichlorobenzene	EPA 8270D	0.11	0.12		0.25 U		0.21 U		**0.10** J		0.23 U
Benzoic Acid	EPA 8270D	0.65	0.65		**0.59** J		**1.4** J		**1.2** J		**1.4** J
Benzyl Alcohol	EPA 8270D	0.057	0.073		**0.28**		**0.32**		**0.19**		**0.48**
Hexachlorobenzene	EPA 8270D	0.022	0.07		0.25 U		0.21 U		0.16 U		0.23 U
Hexachlorobutadiene	EPA 8270D	0.011	0.12		0.25 U		0.21 U		0.16 U		0.23 U
Hexachloroethane	EPA 8270D				0.25 U		0.21 U		0.16 U		0.23 U
N-Nitrosodiphenylamine	EPA 8270D	0.028	0.04		0.25 U		0.21 U		0.16 U		0.23 U

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2
Location ID				SQ1	SQ1	SQ2	SQ2	SQ3	SQ3	SQ4	SQ4
Sample ID				SQ1-011911-T	SQ1-050511-T	SQ2-011911-T	SQ2-050511-T	SQ3-011911-T	SQ3-050511-T	SQ4-011911-T	SQ4-050511-T
Collection Date				1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011
Brominated Diphenylethers (pg/g)											
BDE-007	EPA 1614				7.06 J	16 J	16 J	54	47.1		14 J
BDE-008	EPA 1614				15.5 CJ	13.7 CJ	24.9 CJ	28.4 CJ	26.8 CJ		24.6 CJ
BDE-010	EPA 1614				0.791 U	1.55 U	0.901 U	2.25 U	1.16 U		0.572 U
BDE-011	EPA 1614				C8	C8	C8	C8	C8		C8
BDE-012	EPA 1614				10.7 CJ	10.9 CJ	20.9 CJ	22.1 CJ	20 CJ		20.5 CJ
BDE-013	EPA 1614				C12	C12	C12	C12	C12		C12
BDE-015	EPA 1614				31.5	16.1 J	44.5	24.4 J	22.9 J		37
BDE-017	EPA 1614				245 C	446 C	500 C	531 C	476 C		487 C
BDE-025	EPA 1614				C17	C17	C17	C17	C17		C17
BDE-028	EPA 1614				494 C	299 C	582 C	336 C	327 C		775 C
BDE-030	EPA 1614				6.15 U	7.38 U	2.11 U	7.12 U	4.28 U		1.21 U
BDE-032	EPA 1614				6.3 J	5.83 U	5.06 J	5.63 U	3.42 U		8.57 J
BDE-033	EPA 1614				C28	C28	C28	C28	C28		C28
BDE-035	EPA 1614				164 U	34.2 U	81.8 U	50.6 U	41.6 U		74.9 U
BDE-037	EPA 1614				26.1	13.3 J	36.7	23.8 J	18.7 J		57.9
BDE-047	EPA 1614				20300	29700	27600	15300	16000		38600
BDE-049	EPA 1614				999	1310	1500	1140	936		1740
BDE-051	EPA 1614				89.3	173	128	112	84		166
BDE-066	EPA 1614				865	950	1090	622	584		1480
BDE-071	EPA 1614				112	331	158	134	105		196
BDE-075	EPA 1614				40.9 J	49.7	53.6 J	38.3	28.1 J		79.3 J
BDE-077	EPA 1614				17.1 U	10.1 U	22.2 J	16.3 U	11.4 J		39.5 J
BDE-079	EPA 1614				26.6 U	34.4 U	45.7 J	38.1 U	24 J		67 J
BDE-085	EPA 1614				1610	3180	2340	974	1160		3280
BDE-099	EPA 1614				29000	45400	37400	20700	20100		47300
BDE-100	EPA 1614				6140	11800	8420	4260	4310		11900
BDE-105	EPA 1614				40.6 U	133 U	38.5 U	28.3 U	29 U		95.4 U
BDE-116	EPA 1614				61.6 U	207 U	58.4 U	44 U	44.4 U		145 U
BDE-119	EPA 1614				169 C	113	240 C	24.1	115 C		258 C
BDE-120	EPA 1614				C119	C119	C119	C119	C119		C119
BDE-126	EPA 1614				18.5 U	80 U	16.9 U	14.5 U	13.3 U		44.9 U
BDE-128	EPA 1614				199 U	538 U	238 U	1040 U	381 U		610 U
BDE-138	EPA 1614				589 C	1350 C	1060 C	512 C	602 C		3110 C
BDE-140	EPA 1614				165	326	314	130	255		609
BDE-153	EPA 1614				3890	8890	6350	2670	2960		28200
BDE-154	EPA 1614				2620	6220	4260	1980	2310		10900
BDE-155	EPA 1614				127	397	121	134	81.2		312
BDE-166	EPA 1614				C138	C138	C138	C138	C138		C138
BDE-181	EPA 1614				165	73.3 U	159 U	226	366		363 U
BDE-183	EPA 1614				3640	2370	5380	2020	3600		103000
BDE-190	EPA 1614				639	358	846	710	1360		8490
BDE-203	EPA 1614				3180	2250	4240	4000	3790		19800
BDE-206	EPA 1614				18000	11400	25800	29600	30900		40900
BDE-207	EPA 1614				19200	13800	27000	36200	36500		94900
BDE-208	EPA 1614				12900	7700	18400	25900	22800		28900

Table E–3. Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2	sed trap 1	sed trap 2
Location ID				SQ1	SQ1	SQ2	SQ2	SQ3	SQ3	SQ4	SQ4
Sample ID				SQ1-011911-T	SQ1-050511-T	SQ2-011911-T	SQ2-050511-T	SQ3-011911-T	SQ3-050511-T	SQ4-011911-T	SQ4-050511-T
Collection Date				1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011	1/19/2011	5/5/2011
BDE-209	EPA 1614				**322000**	**143000**	**522000**	**411000**	**369000** J		**967000**
Total PBDEs	EPA 1614				**446000** CJ	**290000** CJ	**694000** CJ	**558000** CJ	**517000** CJ		**1410000** CJ
Grain Size (percent)											
Phi Scale -1 to 0	PSEP-PS					**2.3**		**3.3**			
Phi Scale <-1	PSEP-PS					**0.6**		**0.6**			
Phi Scale 0 to 1	PSEP-PS					**2.9**		**7.4**			
Phi Scale 1 to 2	PSEP-PS					**6.5**		**10.5**			
Phi Scale 2 to 3	PSEP-PS					**10.8**		**13.9**			
Phi Scale 3 to 4	PSEP-PS					**20.6**		**11.8**			
Phi Scale 4 to 5	PSEP-PS					**11.2**		**1.2**			
Phi Scale 5 to 6	PSEP-PS					**9.4**		**13.5**			
Phi Scale 6 to 7	PSEP-PS					**9.2**		**12.2**			
Phi Scale 7 to 8	PSEP-PS					**8.4**		**9.1**			
Phi Scale 8 to 9	PSEP-PS					**5.4**		**5.3**			
Phi Scale 9 to 10	PSEP-PS					**4.1**		**3.6**			
Phi Scale >10	PSEP-PS					**8.7**		**7.8**			
Percent Gravel (>2.0 mm)	PSEP-PS					**0.6**		**0.6**			
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS					**43.1**		**46.9**			
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS					**38.2**		**36.0**			
Percent Clay (<0.004 mm - 0.004 mm	PSEP-PS					**18.2**		**16.7**			
Total Fines (Silt/Clay)	PSEP-PS					**56.4**		**52.6**			
Conventionals											
Total Organic Carbon (percent)	PLUMB, 1981				**14.7**		**14.1**		**13.3**		**10.4**
Total Solids (percent)	EPA 160.3				**34.40**		**38.10**		**37.90**		**42.10**

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

SQS - Washington State Sediment Quality Standard

CSL - Washington State Cleanup Screening Level

LAET - lowest apparent effects threshold

2LAET - second lowest apparent effects threshold

C - Coelution

J - Estimated concentration when the value is less than established reporting limits.
quantitation limit.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load		Bed Load		Bed Load		Bed Load		non-event	
Location ID				DK1		DK3		SQ1		SQ1		SQ3	
Sample ID				DK1-050511-BT		DK3-040711-BT		SQ1-050511-BT		SQ1-061511-BT		SQ3-040711-BT	
Collection Date				5/5/2011		4/7/2011		5/5/2011		6/15/2011		4/7/2011	
Dioxins and Furans (ng/kg)													
1,2,3,4,6,7,8-HPCDD	EPA 1613			**3480**				**657**					
1,2,3,4,7,8-HXCDD	EPA 1613			**95.8**	**J**			**10.4**	**J**				
1,2,3,6,7,8-HXCDD	EPA 1613			**204**	**J**			**31.9**	**J**				
1,2,3,7,8,9-HXCDD	EPA 1613			**241**	**J**			**25.5**	**J**				
1,2,3,7,8-PECDD	EPA 1613			**45.9**	**J**			**5.31**	**J**				
2,3,7,8-TCDD	EPA 1613			**4.12**	**J**			**1.09**					
OCDD	EPA 1613			**20300**				**5880**					
1,2,3,4,6,7,8-HPCDF	EPA 1613			**445**				**154**					
1,2,3,4,7,8,9-HPCDF	EPA 1613			**32**				**9.55**					
1,2,3,4,7,8-HXCDF	EPA 1613			**67.9**				**19.1**					
1,2,3,6,7,8-HXCDF	EPA 1613			**33.9**				**8.92**					
1,2,3,7,8,9-HXCDF	EPA 1613			**1.68**	**J**			**0.576**	**J**				
1,2,3,7,8-PECDF	EPA 1613			**7.35**	**J**			**3.68**	**J**				
2,3,4,6,7,8-HXCDF	EPA 1613			**23.6**				**7.86**					
2,3,4,7,8-PECDF	EPA 1613			**11.6**	**J**			**6.04**	**J**				
2,3,7,8-TCDF	EPA 1613			**3.29**	**J**			**3.51**					
OCDF	EPA 1613			**486**				**382**					
Total HpCDD	EPA 1613			**5860**				**1390**					
Total HxCDD	EPA 1613			**1230**				**223**					
Total PeCDD	EPA 1613			**146**				**35.7**					
Total TCDD	EPA 1613			**24.2**				**14.2**					
Total HpCDF	EPA 1613			**1130**				**457**					
Total HxCDF	EPA 1613			**814**				**278**					
Total PeCDF	EPA 1613			**289**				**142**					
Total TCDF	EPA 1613			**96.5**				**72.1**					
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613			**167**	**J**			**29.2**	**J**				
PCBs (mg/kg)													
Aroclor 1016	EPA 8082			0.032	U	0.031	U	0.033	U	0.033	U		
Aroclor 1221	EPA 8082			0.032	U	0.031	U	0.033	U	0.033	U		
Aroclor 1232	EPA 8082			0.032	U	0.031	U	0.033	U	0.033	U		
Aroclor 1242	EPA 8082			0.032	U	0.031	U	0.033	U	0.033	U		
Aroclor 1248	EPA 8082			0.032	U	**0.035**		0.16	U	0.066	U		

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load		Bed Load		Bed Load		Bed Load		non-event	
Location ID				**DK1**		**DK3**		**SQ1**		**SQ1**		**SQ3**	
Sample ID				**DK1-050511-BT**		**DK3-040711-BT**		**SQ1-050511-BT**		**SQ1-061511-BT**		**SQ3-040711-BT**	
Collection Date				**5/5/2011**		**4/7/2011**		**5/5/2011**		**6/15/2011**		**4/7/2011**	
Aroclor 1254	EPA 8082			0.032	U	**0.066**		**0.25**		**0.13**			
Aroclor 1260	EPA 8082			0.032	U	0.031	U	**0.061**		**0.038**			
Total PCBs	EPA 8082	0.13	1	0.032	U	**0.10**		**0.31**		**0.17**			
Metals – Total (mg/kg)													
Arsenic	EPA 6010B	57	93	**10**		**11**		**12**		10	U		
Cadmium	EPA 6010B	5.1	6.7	**0.9**		**0.5**		**2.0**		**1.3**			
Chromium	EPA 6010B	260	270	**65**		**41.5**	**J**	**50.4**		**33**	**J**		
Copper	EPA 6010B	390	390	**103**		**52.3**		**230**		**175**	**J**		
Lead	EPA 6010B	450	530	**87**		**41**	**J**	**137**		**101**			
Mercury	EPA 7471A	0.41	0.59	**0.11**		**0.03**		**0.40**		**0.33**	**J**		
Silver	EPA 6010B	6.1	6.1	0.7	U	0.4	U	**0.8**	**J**	0.7	U		
Zinc	EPA 6010B	410	960	**539**		**266**	**J**	**623**		**630**			
Pesticides (mg/kg)													
Aldrin	EPA 8081B					0.0079	U						
alpha-BHC	EPA 8081B					0.0079	U						
beta-BHC	EPA 8081B					0.0079	U						
delta-BHC	EPA 8081B					0.0079	UJ						
Lindane	EPA 8081B					0.0079	U						
cis-Chlordane	EPA 8081B					0.0079	U						
trans-Chlordane	EPA 8081B					0.0079	U						
Chlordane	EPA 8081B					0.0079	U						
4,4'-DDD	EPA 8081B					0.016	U						
4,4'-DDE	EPA 8081B					0.016	U						
4,4'-DDT	EPA 8081B					0.016	U						
Total DDTs	EPA 8081B					0.016	U						
Dieldrin	EPA 8081B					0.016	U						
Endosulfan I	EPA 8081B					0.0079	U						
Endosulfan II	EPA 8081B					0.016	U						
Endosulfan Sulfate	EPA 8081B					0.016	U						
Endrin	EPA 8081B					0.016	U						
Endrin Aldehyde	EPA 8081B					0.016	U						
Endrin Ketone	EPA 8081B					0.016	U						
Heptachlor	EPA 8081B					0.0079	U						

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	**Method**	**Washington State SQS/LAET**	**Washington State CSL/2LAET**	**Bed Load**		**Bed Load**		**Bed Load**		**Bed Load**		**non-event**	
Location ID				**DK1**		**DK3**		**SQ1**		**SQ1**		**SQ3**	
Sample ID				**DK1-050511-BT**		**DK3-040711-BT**		**SQ1-050511-BT**		**SQ1-061511-BT**		**SQ3-040711-BT**	
Collection Date				**5/5/2011**		**4/7/2011**		**5/5/2011**		**6/15/2011**		**4/7/2011**	
Heptachlor Epoxide	EPA 8081B					0.0079	U						
Methoxychlor	EPA 8081B					0.079	U						
Toxaphene	EPA 8081B					0.79	U						
Phenols (mg/kg)													
2,4-Dimethylphenol	EPA 8270D	0.029	0.029	0.22	UJ	0.26	UJ	0.16	UJ	0.12	U		
o-Cresol	EPA 8270D	0.063	0.063	0.22	U	0.26	U	0.16	U	0.059	U		
p-Cresol	EPA 8270D	0.67	0.67	**4.8**		**2.2**		**14**		**9.5**			
Pentachlorophenol	EPA 8270D	0.36	0.69	1.1	U	1.3	U	0.79	U	0.59	U		
Phenol	EPA 8270D	0.42	1.2	**1.4**		**0.35**		**1.0**		**0.57**			
Phthalates (mg/kg)													
Bis(2-Ethylhexyl) Phthalate	EPA 8270D	1.3	1.9	**6.2**		**5.2**		**10**		**4.9**			
Butyl benzyl phthalate	EPA 8270D	0.063	0.9	**0.96**	**J**	**1.1**		**0.48**	**J**	**0.38**			
Dibutyl phthalate	EPA 8270D	1.4	5.1	**0.12**	**J**	0.26	U	**0.70**		**0.089**			
Diethyl phthalate	EPA 8270D	0.2	1.2	0.22	U	0.26	U	0.16	U	0.15	U		
Dimethyl phthalate	EPA 8270D	0.071	0.16	0.22	U	0.26	U	**0.16**		0.059	U		
Di-n-Octyl phthalate	EPA 8270D	6.2	--	0.22	U	0.26	U	0.16	U	0.059	U		
PAHs (mg/kg)													
1-Methylnaphthalene	EPA 8270DSIM			**0.016**		**0.036**		**0.059**		**0.064**			
2-Methylnaphthalene	EPA 8270DSIM	0.67	1.4	**0.028**		**0.064**		**0.1**		**0.1**			
Acenaphthene	EPA 8270D/8270DSIM	0.5	0.73	**0.024**		**0.031**		**0.11**	**J**	**0.18**			
Acenaphthylene	EPA 8270DSIM	1.3	1.3	0.015	U	0.019	U	**0.042**		**0.032**	**J**		
Anthracene	EPA 8270DSIM	0.96	4.4	**0.042**		**0.067**		**0.21**		**0.22**			
Benzo(a)anthracene	EPA 8270D/8270DSIM	1.3	1.6	**0.21**		**0.32**		**0.84**		**0.7**			
Benzo(a)pyrene	EPA 8270D/8270DSIM	1.6	3	**0.3**		**0.41**		**0.84**		**0.67**			
Benzo(g,h,i)perylene	EPA 8270D/8270DSIM	0.67	0.72	**0.36**		**0.46**		**0.9**		**0.38**	**J**		
Benzofluoranthene	EPA 8270D/8270DSIM	3.2	3.6	**0.67**		**0.76**		**2**		**1.7**			
Chrysene	EPA 8270D/8270DSIM	1.4	2.8	**0.43**		**0.63**		**1.5**		**1.2**			
Dibenzo(a,h)anthracene	EPA 8270D/8270DSIM	0.23	0.54	**0.077**		**0.13**	**J**	**0.25**		**0.13**	**JN**		
Dibenzofuran	EPA 8270D/8270DSIM	0.54	0.7	**0.02**		**0.035**		**0.11**	**J**	**0.14**			
Fluoranthene	EPA 8270D/8270DSIM	1.7	2.5	**0.59**		**1.2**		**2.4**		**2**			
Fluorene	EPA 8270D/8270DSIM	0.54	1	**0.02**		**0.035**		**0.14**	**J**	**0.19**			
Indeno(1,2,3-cd)pyrene	EPA 8270D/8270DSIM	0.6	0.69	**0.2**		**0.27**		**0.64**		**0.28**	**J**		
Naphthalene	EPA 8270D/8270DSIM	2.1	2.4	**0.039**		**0.24**	**J**	**0.15**	**J**	**0.12**			

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load		Bed Load		Bed Load		Bed Load		non-event	
Location ID				DK1		DK3		SQ1		SQ1		SQ3	
Sample ID				DK1-050511-BT		DK3-040711-BT		SQ1-050511-BT		SQ1-061511-BT		SQ3-040711-BT	
Collection Date				5/5/2011		4/7/2011		5/5/2011		6/15/2011		4/7/2011	
Phenanthrene	EPA 8270D/8270DSIM	1.5	5.4	**0.32**		**0.57**		**1.4**		**1.6**			
Pyrene	EPA 8270D/8270DSIM	2.6	3.3	**0.64**		**0.76**		**2.2**		**1.9**			
Total HPAHs	EPA 8270D/8270DSIM	12	17	**3.5**		**4.9**	**J**	**12**		**9**	**JN**		
Total LPAHs	EPA 8270D/8270DSIM	5.2	13	**0.44**		**0.94**	**J**	**2.1**	**J**	**2.3**	**J**		
SVOCs (mg/kg)													
1,2,4-Trichlorobenzene	EPA 8270D	0.031	0.051	0.22	U	0.26	U	0.16	U	0.059	U		
1,2-Dichlorobenzene	EPA 8270D	0.035	0.05	0.22	U	0.26	U	0.16	U	0.059	U		
1,3-Dichlorobenzene	EPA 8270D			0.22	U	0.26	U	0.16	U	0.059	U		
1,4-Dichlorobenzene	EPA 8270D	0.11	0.12	0.22	U	0.26	U	0.16	U	0.059	U		
Benzoic Acid	EPA 8270D	0.65	0.65	**2.6**		**0.45**	**J**	**0.66**	**J**	**0.82**	**J**		
Benzyl Alcohol	EPA 8270D	0.057	0.073			**0.21**	**J**			0.059	U		
Hexachlorobenzene	EPA 8081B/8270D	0.022	0.07	0.22	U	0.0079	U	0.16	U	0.059	U		
Hexachlorobutadiene	EPA 8081B/8270D	0.011	0.12	0.22	U	0.0079	U	0.16	U	0.30	U		
Hexachloroethane	EPA 8270D			0.22	U	0.26	U	0.16	U	0.059	U		
N-Nitrosodiphenylamine	EPA 8270D	0.028	0.04	0.22	U	0.26	U	0.16	U	0.059	U		
Brominated Diphenylethers (ng/kg)													
BDE-007	EPA 1614			3.31	U			3.38	U				
BDE-008	EPA 1614			3.74	CU			**8.51**	**CJ**				
BDE-010	EPA 1614			3.92	U			1.15	U				
BDE-011	EPA 1614			C8				C8					
BDE-012	EPA 1614			2.42	CU			**6.36**	**CJ**				
BDE-013	EPA 1614			C12				C12					
BDE-015	EPA 1614			**8.11**	**J**			**17.9**	**J**				
BDE-017	EPA 1614			**95.7**	**CJ**			**137**	**C**				
BDE-025	EPA 1614			C17				C17					
BDE-028	EPA 1614			**174**	**CJ**			**260**	**C**				
BDE-030	EPA 1614			5.67	U			4.19	U				
BDE-032	EPA 1614			4.41	U			5.52	U				
BDE-033	EPA 1614			C28				C28					
BDE-035	EPA 1614			44.8	U			232	U				
BDE-037	EPA 1614			9.2	U			**15.2**	**J**				
BDE-047	EPA 1614			**7500**				**13900**					

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load		Bed Load		Bed Load		Bed Load		non-event	
Location ID				DK1		DK3		SQ1		SQ1		SQ3	
Sample ID				DK1-050511-BT		DK3-040711-BT		SQ1-050511-BT		SQ1-061511-BT		SQ3-040711-BT	
Collection Date				5/5/2011		4/7/2011		5/5/2011		6/15/2011		4/7/2011	
BDE-049	EPA 1614			**436**				**583**					
BDE-051	EPA 1614			36.5	U			**59.9**	**J**				
BDE-066	EPA 1614			**320**				**521**					
BDE-071	EPA 1614			**54.3**	**J**			65	U				
BDE-075	EPA 1614			**17.8**	**J**			**27**	**J**				
BDE-077	EPA 1614			7.43	U			9.32	U				
BDE-079	EPA 1614			**14.9**	**J**			22.9	U				
BDE-085	EPA 1614			**401**				**1020**					
BDE-099	EPA 1614			**8620**				**18100**					
BDE-100	EPA 1614			**1800**				**3910**					
BDE-105	EPA 1614			17.4	U			20.3	U				
BDE-116	EPA 1614			27.6	U			30.8	U				
BDE-119	EPA 1614			**43.9**	**CJ**			**97**	**CJ**				
BDE-120	EPA 1614			C119				C119					
BDE-126	EPA 1614			7.94	U			8.89	U				
BDE-128	EPA 1614			598	U			93	U				
BDE-138	EPA 1614			**248**				**366**	**C**				
BDE-140	EPA 1614			56	U			**96**					
BDE-153	EPA 1614			**922**				**2040**					
BDE-154	EPA 1614			**755**				**1710**					
BDE-155	EPA 1614			60.9	U			**89.2**					
BDE-166	EPA 1614			C138				C138					
BDE-181	EPA 1614			**96.9**				101	U				
BDE-183	EPA 1614			**658**				**1670**					
BDE-190	EPA 1614			**251**				**415**					
BDE-203	EPA 1614			**1200**				**2140**					
BDE-206	EPA 1614			**5430**				**13500**					
BDE-207	EPA 1614			**7950**				**15000**					
BDE-208	EPA 1614			**5840**				**11200**					
BDE-209	EPA 1614			**127000**				**251000**					
Total PBDEs	EPA 1614			**170000**	**CJ**			**337000**	**CJ**				

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load		Bed Load		Bed Load		Bed Load		non-event	
Location ID				DK1		DK3		SQ1		SQ1		SQ3	
Sample ID				DK1-050511-BT		DK3-040711-BT		SQ1-050511-BT		SQ1-061511-BT		SQ3-040711-BT	
Collection Date				5/5/2011		4/7/2011		5/5/2011		6/15/2011		4/7/2011	
Grain Size (percent)													
Phi Scale -1 to 0	PSEP-PS			**9.2**		**21.7**		**2.1**		**8.5**		**2.9**	
Phi Scale <-1	PSEP-PS			**7.9**		**22.9**		**0.1**		**1.6**		**0.1**	
Phi Scale 0 to 1	PSEP-PS			**9.3**		**23.4**		**5.0**		**9.5**		**3.6**	
Phi Scale 1 to 2	PSEP-PS			**9.5**		**10.8**		**9.4**		**15.9**		**9.4**	
Phi Scale 2 to 3	PSEP-PS			**8.1**		**9.6**		**10.3**		**13.1**		**32.6**	
Phi Scale 3 to 4	PSEP-PS			**7.8**		**5.7**		**12.0**		**9.7**		**18.5**	
Phi Scale 4 to 5	PSEP-PS			**10.6**		0.1	U	**0.6**		**6.3**		0.1	U
Phi Scale 5 to 6	PSEP-PS			**13.9**		0.1	U	**14.4**		**10.3**		0.1	U
Phi Scale 6 to 7	PSEP-PS			**9.9**		**0.9**		**17.1**		**9.0**		0.1	U
Phi Scale 7 to 8	PSEP-PS			**5.9**		**1.8**		**12.5**		**6.7**		0.1	U
Phi Scale 8 to 9	PSEP-PS			**2.9**		**1.0**		**6.5**		**3.8**		**3.9**	
Phi Scale 9 to 10	PSEP-PS			**1.7**		**0.7**		**3.7**		**2.3**		**8.9**	
Phi Scale >10	PSEP-PS			**3.3**		**1.5**		**6.4**		**3.2**		**20.1**	
Percent Gravel (>2.0 mm)	PSEP-PS			**7.9**		**22.9**		**0.1**		**1.6**		**0.1**	
Percent Sand (<2.0 mm - 0.06 mm)	PSEP-PS			**43.9**		**71.2**		**38.8**		**56.7**		**67.0**	
Percent Silt (0.06 mm - 0.004 mm)	PSEP-PS			**40.3**		**2.7**		**44.6**		**32.3**		0.1	U
Percent Clay (<0.004 mm - 0.004 mm	PSEP-PS			**7.9**		**3.2**		**16.6**		**9.3**		**32.9**	
Total Fines (Silt/Clay)	PSEP-PS			**48.2**		**5.8**		**61.1**		**41.7**		**32.9**	
Conventionals													
Total Organic Carbon (percent)	PLUMB, 1981			**7.86**		**6.79**		**8.58**		**11.4**		**9.62**	
Total Solids (percent)	EPA 160.3			**44.40**		**60.80**		**53.30**		**41.80**		**8.70**	

Table E–4. Bed Load Sediment Trap Solids Analytical Results

Event ID	Method	Washington State SQS/LAET	Washington State CSL/2LAET	Bed Load	Bed Load	Bed Load	Bed Load	non-event
Location ID				DK1	DK3	SQ1	SQ1	SQ3
Sample ID				DK1-050511-BT	DK3-040711-BT	SQ1-050511-BT	SQ1-061511-BT	SQ3-040711-BT
Collection Date				5/5/2011	4/7/2011	5/5/2011	6/15/2011	4/7/2011

Bold results - Detected concentrations

yellow highlighted results - Washington State SQL/LAET Criteria Exceedance

blue highlighted results - Washington State CSL/2LAET Criteria Exceedance

SQS - Washington State Sediment Quality Standard.

CSL - Washington State Cleanup Screening Level.

LAET - lowest apparent effects threshold.

2LAET - second lowest apparent effects threshold.

C - Coelution.

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Total PBDEs - Total PBDEs values presented in this data report are a sum of the detected concentrations of the 46 reported PBDE congeners. There is no standard target analyte list for the various possible 209 PBDE congeners, so these "Total PBDE" values may not be directly comparable to other datasets.

Chlordane - cis-Chlordane, trans-Chlordane.

TOTAL Dioxin/Furan TEQ, ND*0.5 - 1,2,3,4,6,7,8-HPCDD, 1,2,3,4,7,8-HXCDD, 1,2,3,6,7,8-HXCDD, 1,2,3,7,8,9-HXCDD, 1,2,3,7,8-PECDD, 2,3,7,8-TCDD, OCDD, 1,2,3,4,6,7,8-HPCDF, 1,2,3,4,7,8,9-HPCDF, 1,2,3,4,7,8-HXCDF, 1,2,3,6,7,8-HXCDF, 1,2,3,7,8,9-HXCDF, 1,2,3,7,8-PECDF, 2,3,4,6,7,8-HXCDF, 2,3,4,7,8-PECDF, 2,3,7,8-TCDF, OCDF.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Table E–5. Whole Water Analytical Results for Events that failed to Meet Sampling Criteria

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	non-event		non-event	
Location ID				DK1		DK2	
Sample ID				DK1-030111-W		DK2-030111-W	
Collection Date				3/2/2011		3/2/2011	
PCBs (µg/L)							
Aroclor 1016	EPA 8082			0.010	U	0.010	U
Aroclor 1221	EPA 8082			0.010	U	0.010	U
Aroclor 1232	EPA 8082			0.010	U	0.010	U
Aroclor 1242	EPA 8082			0.010	U	0.012	U
Aroclor 1248	EPA 8082			0.010	U	0.010	U
Aroclor 1254	EPA 8082			0.010	U	0.012	U
Aroclor 1260	EPA 8082			0.010	U	0.010	U
Total PCBs	EPA 8082	0.03	10	0.010	U	0.012	U
Metals – Total (µg/L)							
Arsenic	EPA 200.8			**1.2**		**2.8**	
Cadmium	EPA 200.8			0.2	U	**0.3**	
Calcium	EPA 6010B			**36100**		**18300**	
Chromium	EPA 200.8			**0.8**		**7.4**	
Copper	EPA 200.8			**4.8**		**32.9**	
Lead	EPA 200.8			1	U	**16**	
Magnesium	EPA 6010B			**12300**		**5470**	
Mercury	EPA 7470A			0.1	U	0.1	U
Nickel	EPA 200.8			**3.9**		**7.4**	
Selenium	EPA 200.8			0.5	U	0.5	U
Silver	EPA 200.8			0.2	U	0.2	U
Zinc	EPA 200.8			**34**	**J**	**128**	**J**
Metals – Dissolved (µg/L)							
Arsenic	EPA 200.8	36	69	**1.0**		**1.4**	
Cadmium	EPA 200.8	9.3	42	0.2	U	0.2	U
Chromium	EPA 200.8			**0.6**		**0.9**	
Copper	EPA 200.8	3.1	4.8	**3.5**		**8.7**	
Lead	EPA 200.8	8.1	210	1	U	1	U
Mercury	EPA 7470A	0.025	1.8	0.02	U	0.02	U
Nickel	EPA 200.8	8.2	74	**2.9**		**2.0**	
Selenium	EPA 200.8	71	290	0.5	U	0.5	U
Silver	EPA 200.8		1.9	0.2	U	0.2	U
Zinc	EPA 200.8	81	90	**19**	**J**	**26**	**J**
Pesticides (µg/L)							
Aldrin	EPA 8081B	0.0019	0.71	0.050	U	0.050	U
alpha-BHC	EPA 8081B			0.050	U	0.050	U
beta-BHC	EPA 8081B			0.050	U	0.050	U
delta-BHC	EPA 8081B			0.050	UJ	0.050	UJ
Lindane	EPA 8081B		0.16	0.050	U	0.050	U
cis-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U
trans-Chlordane	EPA 8081B	0.004	0.09	0.050	U	0.050	U
Chlordane	EPA 8081B			0.050	U	0.050	U
4,4'-DDD	EPA 8081B	0.001	0.13	0.10	U	0.10	U
4,4'-DDE	EPA 8081B	0.001	0.13	0.10	U	0.10	U
4,4'-DDT	EPA 8081B	0.001	0.13	0.10	U	0.10	U

Table E–5. Whole Water Analytical Results for Events that failed to Meet Sampling Criteria

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	non-event		non-event	
Location ID				DK1		DK2	
Sample ID				DK1-030111-W		DK2-030111-W	
Collection Date				3/2/2011		3/2/2011	
Total DDTs	EPA 8081B			0.10	U	0.10	U
Dieldrin	EPA 8081B	0.0019	0.71	0.10	U	0.10	U
Endosulfan I	EPA 8081B	0.0087	0.034	0.050	U	0.050	U
Endosulfan II	EPA 8081B	0.0087	0.034	0.10	U	0.10	U
Endosulfan Sulfate	EPA 8081B	0.0087	0.034	0.10	UJ	0.10	UJ
Endrin	EPA 8081B	0.0023	0.037	0.10	U	0.10	U
Endrin Aldehyde	EPA 8081B			0.10	U	0.10	U
Endrin Ketone	EPA 8081B			0.10	U	0.10	U
Heptachlor	EPA 8081B	0.0036	0.05	0.050	U	0.050	U
Heptachlor Epoxide	EPA 8081B			0.050	U	0.050	U
Methoxychlor	EPA 8081B			0.50	U	0.50	U
Toxaphene	EPA 8081B	0.0002	0.21	5.0	U	5.0	U
Phenols (µg/L)							
2,4-Dimethylphenol	EPA 8270D			1.0	U	1.0	U
o-Cresol	EPA 8270D			1.0	U	1.0	U
p-Cresol	EPA 8270D			1.0	U	**0.5**	**J**
Pentachlorophenol	EPA 8270D			5.0	U	5.0	U
Phenol	EPA 8270D			**1.0**	**J**	**2.1**	
Phthalates (µg/L)							
Bis(2-Ethylhexyl) Phthalate	EPA 8270D			1.0	U	5.0	U
Butyl benzyl phthalate	EPA 8270D			1.0	U	1.0	U
Dibutyl phthalate	EPA 8270D			1.0	U	1.0	U
Diethyl phthalate	EPA 8270D			1.0	U	1.0	U
Dimethyl phthalate	EPA 8270D			1.0	U	1.0	U
Di-n-Octyl phthalate	EPA 8270D			1.0	U	1.0	U
PAHs (µg/L)							
1-Methylnaphthalene	EPA 8270DSIM			0.010	U	**0.018**	
2-Methylnaphthalene	EPA 8270DSIM			0.010	U	**0.032**	
Acenaphthene	EPA 8270DSIM			0.010	U	0.010	U
Acenaphthylene	EPA 8270DSIM			0.010	U	0.010	U
Anthracene	EPA 8270DSIM			0.010	U	**0.011**	
Benzo(a)anthracene	EPA 8270DSIM			0.010	U	**0.048**	
Benzo(a)pyrene	EPA 8270DSIM			0.010	U	**0.072**	
Benzo(g,h,i)perylene	EPA 8270DSIM			0.010	U	**0.13**	
Benzofluoranthene	EPA 8270D/8270DSIM			0.010	U	**0.15**	
Chrysene	EPA 8270D/8270DSIM			0.010	U	**0.15**	
Dibenzo(a,h)anthracene	EPA 8270DSIM			0.010	U	**0.025**	
Dibenzofuran	EPA 8270DSIM			0.010	U	0.010	U
Fluoranthene	EPA 8270D/8270DSIM			**0.010**		**0.20**	
Fluorene	EPA 8270DSIM			0.010	U	**0.011**	
Indeno(1,2,3-cd)pyrene	EPA 8270DSIM			0.010	U	**0.056**	
Naphthalene	EPA 8260C/8270DSIM			**0.042**		**0.059**	
Phenanthrene	EPA 8270DSIM			0.010	U	**0.10**	

Table E–5. Whole Water Analytical Results for Events that failed to Meet Sampling Criteria

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	non-event		non-event	
Location ID				DK1		DK2	
Sample ID				DK1-030111-W		DK2-030111-W	
Collection Date				3/2/2011		3/2/2011	
Pyrene	EPA 8270D/8270DSIM			**0.013**		**0.27**	
Total HPAHs	EPA 8270D/8270DSIM			**0.023**		**1.1**	
Total LPAHs	EPA 8270D/8270DSIM			**0.042**		**0.18**	
SVOCs (µg/L)							
1,2,4-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U
1,2-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U
1,3-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U
1,4-Dichlorobenzene	EPA 8260C			0.2	U	0.2	U
Benzoic Acid	EPA 8270D			10	U	**1.8**	**J**
Benzyl Alcohol	EPA 8270D			5.0	U	5.0	U
Hexachlorobenzene	EPA 8081B/8270D			0.050	U	0.050	U
Hexachlorobutadiene	EPA 8081B/8260C			0.050	U	0.050	U
Hexachloroethane	EPA 8270D			1.0	U	1.0	U
N-Nitrosodiphenylamine	EPA 8270D			1.0	U	1.0	U
VOCs (ug/L)							
1,1,1,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U
1,1,1-Trichloroethane	EPA 8260C			0.2	U	0.2	U
1,1,2,2-Tetrachloroethane	EPA 8260C			0.2	U	0.2	U
1,1,2-Trichloroethane	EPA 8260C			0.2	U	0.2	U
1,1-Dichloroethane	EPA 8260C			0.2	U	0.2	U
1,1-Dichloroethene	EPA 8260C			0.2	U	0.2	U
1,1-Dichloropropene	EPA 8260C			0.2	U	0.2	U
1,2,3-Trichlorobenzene	EPA 8260C			0.5	U	0.5	U
1,2,3-Trichloropropane	EPA 8260C			0.5	U	0.5	U
1,2,4-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U
1,2-Dibromo-3-chloropropane	EPA 8260C			0.5	U	0.5	U
1,2-Dichloroethane	EPA 8260C			0.2	U	0.2	U
1,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U
1,3,5-Trimethylbenzene	EPA 8260C			0.2	U	0.2	U
1,3-Dichloropropane	EPA 8260C			0.2	U	0.2	U
2,2-Dichloropropane	EPA 8260C			0.2	U	0.2	U
2-Chlorotoluene	EPA 8260C			0.2	U	0.2	U
2-Hexanone	EPA 8260C			5.0	U	5.0	U
4-Chlorotoluene	EPA 8260C			0.2	U	0.2	U
Acetone	EPA 8260C			5.0	U	9.2	U
Acrolein	EPA 8260C			5.0	U	5.0	U
Acrylonitrile	EPA 8260C			1.0	U	1.0	U
Bromobenzene	EPA 8260C			0.2	U	0.2	U
Bromochloromethane	EPA 8260C			0.2	U	0.2	U
Bromoethane	EPA 8260C			0.2	U	0.2	U
Bromoform	EPA 8260C			0.2	U	0.2	U
Bromomethane	EPA 8260C			1.0	U	1.0	U
Carbon Disulfide	EPA 8260C			0.2	U	0.2	U

Table E–5. Whole Water Analytical Results for Events that failed to Meet Sampling Criteria

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	non-event		non-event	
Location ID				DK1		DK2	
Sample ID				DK1-030111-W		DK2-030111-W	
Collection Date				3/2/2011		3/2/2011	
Carbon Tetrachloride	EPA 8260C			0.2	U	0.2	U
CFC-11	EPA 8260C			0.2	U	**0.3**	
CFC-113	EPA 8260C			0.2	U	0.2	U
Chlorobenzene	EPA 8260C			0.2	U	0.2	U
Chlorodibromomethane	EPA 8260C			0.2	U	0.2	U
Chloroethane	EPA 8260C			0.2	U	0.2	U
Chloroform	EPA 8260C			0.2	U	0.2	U
Chloromethane	EPA 8260C			0.5	U	0.5	U
cis-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U
cis-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U
Cumene	EPA 8260C			0.2	U	0.2	U
Dibromomethane	EPA 8260C			0.2	U	0.2	U
Dichlorobromomethane	EPA 8260C			0.2	U	0.2	U
Ethylene Dibromide	EPA 8260C			0.2	U	0.2	U
Methyl ethyl ketone	EPA 8260C			5.0	U	5.0	U
Methyl Iodide	EPA 8260C			1.0	U	1.0	U
Methyl isobutyl ketone	EPA 8260C			5.0	U	5.0	U
Methylene Chloride	EPA 8260C			2.9	U	4.4	U
n-Butylbenzene	EPA 8260C			0.2	U	0.2	U
n-Propylbenzene	EPA 8260C			0.2	U	0.2	U
p-Isopropyltoluene	EPA 8260C			0.2	U	0.2	U
sec-Butylbenzene	EPA 8260C			0.2	U	0.2	U
Styrene	EPA 8260C			0.2	U	0.2	U
tert-Butylbenzene	EPA 8260C			0.2	U	0.2	U
Tetrachloroethene	EPA 8260C			0.2	U	0.2	U
trans-1,2-Dichloroethene	EPA 8260C			0.2	U	0.2	U
trans-1,3-Dichloropropene	EPA 8260C			0.2	U	0.2	U
trans-1,4-Dichloro-2-butene	EPA 8260C			1.0	U	1.0	U
Trichloroethene	EPA 8260C			0.2	U	0.2	U
Vinyl Acetate	EPA 8260C			1.0	U	1.0	U
Vinyl Chloride	EPA 8260C			0.2	U	0.2	U
BTEX (µg/L)							
Benzene	EPA 8260C			0.2	U	0.2	U
Ethylbenzene	EPA 8260C			0.2	U	0.2	U
Toluene	EPA 8260C			0.2	U	0.2	U
m, p-Xylene	EPA 8260C			0.4	U	0.4	U
o-Xylene	EPA 8260C			0.2	U	0.2	U
Total Xylenes	EPA 8260C			0.4	U	0.4	U
Conventionals							
Alkalinity as Bicarbonate (mg/L)	SM2320			**71.7**		**57.4**	
Alkalinity as Carbonate (mg/L)	SM2320			1.0	U	1.0	U
Alkalinity as Hydroxide (mg/L)	SM2320			1.0	U	1.0	U
Alkalinity, Total (mg/L)	SM2320			**71.7**		**57.4**	
Chloride (mg/L)	EPA 300.0			**148**		**48.3**	
Dissolved Organic Carbon (mg/L)	EPA 415.1			**3.50**		**5.01**	
Hardness as CaCO3 (mg/L)	EPA 6010B			**140**		**68**	

Table E–5. Whole Water Analytical Results for Events that failed to Meet Sampling Criteria

Event ID	Method	Washington State Marine Water Quality Chronic	Washington State Marine Water Quality Acute	non-event		non-event	
Location ID				DK1		DK2	
Sample ID				DK1-030111-W		DK2-030111-W	
Collection Date				3/2/2011		3/2/2011	
Nitrate (mg/L)	EPA 300.0			**0.9**		0.3	U
pH (su)	PH			**7.42**		**7.53**	
Sulfate (mg/L)	EPA 300.0			**17.5**		**11.1**	
Total Organic Carbon (mg/L)	EPA 415.1			**4.33**		**9.35**	
Total Solids (percent)	EPA 160.3						
Total Suspended Solids (mg/L)	EPA 160.2			**2.6**		**74.0**	

Bold results - Detected concentrations

yellow highlighted results - Washington State Chronic Marine Water Quality Criteria Exceedance

blue highlighted results - Washington State Acute Marine Water Quality Criteria Exceedance

C - Coelution

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

N - Tentative identification.

Chlordane - cis-Chlordane, trans-Chlordane.

Total DDTs - 4,4'-DDD, 4,4'-DDE, 4,4'-DDT

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.

Total Xylenes - m, p-Xylene, o-Xylene.

Table E–6. Filtered Solids Analytical Results for Events that Failed to Meet Sampling Criteria

Event ID	Method	Washington State LAET	Washington State 2LAET	non-event	
Location ID				DK2	
Sample ID				DK2A-030111-S	
Collection Date				3/2/2011	
Filter				A	
Mass Of Solids (g)				12.99	
PCBs (mg/kg)					
Aroclor 1016	EPA 8082			0.038	U
Aroclor 1221	EPA 8082			0.038	U
Aroclor 1232	EPA 8082			0.038	U
Aroclor 1242	EPA 8082			0.038	U
Aroclor 1248	EPA 8082			**0.22**	
Aroclor 1254	EPA 8082			**0.28**	
Aroclor 1260	EPA 8082			**0.18**	
Total PCBs	EPA 8082	0.13	1	**0.69**	

Bold results - Detected concentrations
yellow highlighted results - Washington State SQL/LAET Criteria Exceedance
blue highlighted results - Washington State CSL/2LAET Criteria Exceedance
LAET - lowest apparent effects threshold.
2LAET - second lowest apparent effects threshold.
J - Estimated concentration when the value is less than established reporting limits.
U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
Total PCBs - Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254, Aroclor 1260.
All results should be considered estimates.

Table E–7. Filtered Solids Analytical Results for Samples where the Calculated Mass of Solids was Less than One Gram

Event ID	Method	BF1		BF1		SW1		BF2		BF2		SW4		SW4		SW4		SW4	
Location ID		DK1		DK1		DK1		SQ1		SQ1		SQ1		SQ1		SQ2		SQ2	
Sample ID		DK1A-012611-S		DK1B-012611-S		DK1A-012011-S		SQ1A-020211-S		SQ1B-020211-S		SQ1A-031511-S		SQ1B-031511-S		SQ2A-031511-S		SQ2B-031511-S	
Collection Date		1/27/2011		1/27/2011		1/21/2011		2/2/2011		2/2/2011		3/15/2011		3/15/2011		3/15/2011		3/15/2011	
Filter		A		B		A		A		B		A		B		A		B	
Mass Of Solids (g)		0		0		-0.32		-0.42		-0.42		-0.96		-0.96		-0.65		-0.65	
Dioxins and Furans (pg/sample)																			
1,2,3,4,6,7,8-HPCDD	EPA 1613			**4160**						**928**				**32500**				**808**	
1,2,3,4,7,8-HXCDD	EPA 1613			**76.7**	J					**13.3**	J			**831**				**13.4**	J
1,2,3,6,7,8-HXCDD	EPA 1613			**224**						44.1	U			**1740**				**40.8**	J
1,2,3,7,8,9-HXCDD	EPA 1613			**192**						**38.4**	J			**2110**				**31**	J
1,2,3,7,8-PECDD	EPA 1613			**45.5**	J					8.13	U			**430**				**6.14**	J
2,3,7,8-TCDD	EPA 1613			**7.94**	J					**3.03**	J			**59.3**	J			1.42	U
OCDD	EPA 1613			**31200**						**10300**				**249000**				**7230**	
1,2,3,4,6,7,8-HPCDF	EPA 1613			**641**						**179**				**5710**				**170**	
1,2,3,4,7,8,9-HPCDF	EPA 1613			**41.5**	J					**12.2**	J			**430**				**9.27**	J
1,2,3,4,7,8-HXCDF	EPA 1613			**68.4**	J					**17.9**	J			**410**				**19.7**	J
1,2,3,6,7,8-HXCDF	EPA 1613			**38.9**	J					12.4	U			**308**				**10.1**	J
1,2,3,7,8,9-HXCDF	EPA 1613			1.96	U					5.3	U			**15.7**	J			**0.762**	J
1,2,3,7,8-PECDF	EPA 1613			**12.1**	J					**4.47**	J			**89.3**				**4.44**	J
2,3,4,6,7,8-HXCDF	EPA 1613			**35.1**	J					**9.86**	J			**281**				**8**	J
2,3,4,7,8-PECDF	EPA 1613			**19.5**	J					**8.23**	J			**137**				**6.17**	J
2,3,7,8-TCDF	EPA 1613			**14**						**10.8**				**183**				**4.1**	J
OCDF	EPA 1613			**1240**						**578**				**16100**				**341**	
Total HpCDD	EPA 1613			**7150**						**1880**				**58900**				**1710**	
Total HxCDD	EPA 1613			**1310**						**269**				**14100**				**270**	
Total PeCDD	EPA 1613			**269**						**49.4**				**2880**				**35.1**	
Total TCDD	EPA 1613			**122**						**53.2**				**1120**				**21.2**	
Total HpCDF	EPA 1613			**1610**						**545**				**16100**				**462**	
Total HxCDF	EPA 1613			**1070**						**305**				**6980**				**318**	
Total PeCDF	EPA 1613			**575**						**352**				**2880**				**126**	
Total TCDF	EPA 1613			**406**						**292**				**2720**				**82.7**	
TOTAL Dioxin/Furan TEQ, ND*0.5	EPA 1613			**183**	J					**36.3**	J			**1590**	J			**33.8**	J

Table E–7. Filtered Solids Analytical Results for Samples where the Calculated Mass of Solids was Less than One Gram

Event ID	Method	BF1	BF1	SW1	BF2	BF2	SW4	SW4	SW4	SW4
Location ID		DK1	DK1	DK1	SQ1	SQ1	SQ1	SQ1	SQ2	SQ2
Sample ID		DK1A-012611-S	DK1B-012611-S	DK1A-012011-S	SQ1A-020211-S	SQ1B-020211-S	SQ1A-031511-S	SQ1B-031511-S	SQ2A-031511-S	SQ2B-031511-S
Collection Date		1/27/2011	1/27/2011	1/21/2011	2/2/2011	2/2/2011	3/15/2011	3/15/2011	3/15/2011	3/15/2011
Filter		A	B	A	A	B	A	B	A	B
Mass Of Solids (g)		0	0	-0.32	-0.42	-0.42	-0.96	-0.96	-0.65	-0.65
PAHs (µg)										
1-Methylnaphthalene	EPA 8270D	**0.3 J**		3.0 U	0.5 U		6.0 U		**1.7**	
2-Methylnaphthalene	EPA 8270D	**0.5 J**		3.0 U	**0.4 J**		6.0 U		**3.3**	
Acenaphthene	EPA 8270D	**0.3 J**		3.0 U	**0.3 J**		6.0 U		1.5 U	
Acenaphthylene	EPA 8270D	0.5 U		3.0 U	0.5 U		6.0 U		1.5 U	
Anthracene	EPA 8270D	0.5 U		3.0 U	0.5 U		6.0 U		1.5 U	
Benzo(a)anthracene	EPA 8270D	0.5 U		**4.5**	**0.6**		**10**		**1.8**	
Benzo(a)pyrene	EPA 8270D	**0.4 J**		**8.9**	**0.8**		**11**		**1.9**	
Benzo(g,h,i)perylene	EPA 8270D	**0.6**		**12**	**1.1**		**13**		**1.7**	
Benzofluoranthene	EPA 8270D	**0.9**		**20**	**1.9**		**28**		**4.2**	
Chrysene	EPA 8270D	**0.8**		**17**	**1.3**		**25**		**3.5**	
Dibenzo(a,h)anthracene	EPA 8270D	0.5 U		3.0 U	**0.3 J**		6.0 U		1.5 U	
Dibenzofuran	EPA 8270D	0.5 U		3.0 U	**0.8**		6.0 U		**2.1**	
Fluoranthene	EPA 8270D	**0.6**		**24**	**2.2**		**36**		**5.0**	
Fluorene	EPA 8270D	**0.3 J**		3.0 U	**0.3 J**		6.0 U		**1.7**	
Indeno(1,2,3-cd)pyrene	EPA 8270D	0.5 U		**6.1**	**0.7**		**7.2**		1.5 U	
Naphthalene	EPA 8270D	**0.4 J**		3.0 U	**0.4 J**		6.0 U		**4.4**	
Phenanthrene	EPA 8270D	**0.6**		**8.8**	**1.2**		**18**		**3.7**	
Pyrene	EPA 8270D	**0.9**		**22**	**1.6**		**40**		**5.8**	
Total HPAHs	EPA 8270D	**4.2 J**		**110**	**11 J**		**170**		**24**	
Total LPAHs	EPA 8270D	**1.6 J**		**8.8**	**2.2 J**		**18**		**9.8**	

Bold results - Detected concentrations

J - Estimated concentration when the value is less than established reporting limits.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

Percent Clay (<0.004 mm - 0.004 mm) - Phi Scale 8 to 9, Phi Scale 9 to 10, Phi Scale >10.

Percent Gravel (>2.0 mm) - Phi Scale <-1.

Percent Sand (<2.0 mm - 0.06 mm) - Phi Scale -1 to 0, Phi Scale 0 to 1, Phi Scale 1 to 2, Phi Scale 2 to 3, Phi Scale 3 to 4.

Percent Silt (0.06 mm - 0.004 mm) - Phi Scale 4 to 5, Phi Scale 5 to 6, Phi Scale 6 to 7, Phi Scale 7 to 8.

Total HPAHs - Benzo(a)anthracene, Benzo(a)pyrene, Benzo(g,h,i)perylene, Benzofluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Pyrene.

Total LPAHs - Acenaphthene or Acenaphthylene or Anthracene or Fluorene or Naphthalene or Phenanthrene.

All results should be considered estimates. Results were not compared to any regulatory criteria.

Table E-8. Chemicals Not Detected in Whole Water Samples

Analyte
PCBs (µg/L)
Aroclor 1016
Aroclor 1221
Aroclor 1232
Metals – Dissolved (µg/L)
Mercury
Silver
Pesticides (µg/L)
Aldrin
alpha-BHC
beta-BHC
delta-BHC
Lindane
cis-Chlordane
trans-Chlordane
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Total DDTs
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan Sulfate
Endrin
Endrin Aldehyde
Endrin Ketone
Heptachlor
Heptachlor Epoxide
Methoxychlor
Toxaphene
Phenols (µg/L)
2,4-Dimethylphenol
o-Cresol
p-Cresol
Pentachlorophenol
Phthalates (µg/L)
Dibutyl phthalate
Diethyl phthalate
Dimethyl phthalate
Di-n-Octyl phthalate
SVOCs (µg/L)
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzoic Acid
Benzyl Alcohol
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane
N-Nitrosodiphenylamine

EPA 808

VOCs (µg/L)
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,1-Dichloropropene
1,2,3-Trichlorobenzene
1,2,3-Trichloropropane
1,2,4-Trimethylbenzene
1,2-Dibromo-3-chloropropane
1,2-Dichloroethane
1,2-Dichloropropane
1,3,5-Trimethylbenzene
1,3-Dichloropropane
2,2-Dichloropropane
2-Chlorotoluene
2-Hexanone
4-Chlorotoluene
Acetone
Acrolein
Acrylonitrile
Bromobenzene
Bromochloromethane
Bromoethane
Bromoform
Bromomethane
Carbon Disulfide
Carbon Tetrachloride
CFC-11
CFC-113
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloromethane
cis-1,3-Dichloropropene
Cumene
Dibromomethane
Dichlorobromomethane
Ethylene Dibromide
Methyl Iodide
Methyl isobutyl ketone
Methylene Chloride
n-Butylbenzene
n-Propylbenzene
p-Isopropyltoluene
sec-Butylbenzene
Styrene
tert-Butylbenzene
trans-1,2-Dichloroethene
trans-1,3-Dichloropropene
trans-1,4-Dichloro-2-butene
Vinyl Acetate
Vinyl Chloride

BTEX (µg/L)
Benzene
Ethylbenzene
Toluene
m, p-Xylene
o-Xylene
Total Xylenes
Brominated Diphenylethers (pg/L)
BDE-010
BDE-030
BDE-032
BDE-035
BDE-077
BDE-105
BDE-116
BDE-119
BDE-126
BDE-128

Appendix G
Data Validation Report

(Included on CD)

EcoChem, INC.
Environmental Data Quality

DATA VALIDATION REPORT

WASHINGTON DOE TOXICS CLEANUP PROGRAM

ACCELERATED SOURCE TRACING STUDY
LOWER DUWAMISH WATERWAY, WA

Prepared for:

SAIC
18912 North Creek Parkway, Suite 101
Bothell, Washington 98011

Prepared by:

EcoChem, Inc.
710 Second Avenue, Suite 660
Seattle, Washington 98104

EcoChem Project: C4146-1

August 10, 2011

Approved for Release

Christine Ransom
Project Manager
EcoChem, INC.

PROJECT NARRATIVE

Basis for Data Validation

This report summarizes the results of the data validation performed on stormwater samples, filter bag sediment samples, and quality control (QC) sample data for the Accelerated Source Tracing Study – Lower Duwamish Waterway, Seattle, WA. Approximately 10% of the data received a full (EPA Stage 4 or EPA Stage 3) validation. The remaining data were validated at a summary level (EPA Stage 2B). Equipment rinsates received a compliance level review (EPA Stage 2A). A complete list of samples is provided in the **Sample Index**.

Dioxin/furan and polybrominated diphenylether (PBDE) analyses were performed by Axys Analytical, Sydney, British Columbia. Analytical Resources Inc (ARI), Tukwila, Washington performed all other analyses. The analytical methods and EcoChem project chemists are listed below.

Analysis	Method of Analysis	Primary Review	Secondary Review
Volatile Organic Compounds	SW8260C	Mark Brindle, Glenn Esler Dorothy Kerlin	Christine Ransom Melissa Swanson Christina Mott
Semivolatile Organic Compounds	SW8270D	Mark Brindle Eric Clayton Glenn Esler Dorothy Kerlin Christine Ransom	Christine Ransom Melissa Swanson Christina Mott
Polycyclic Aromatic Hydrocarbons (PAH)	SW8270D and 8270D-SIM	Mark Brindle Eric Clayton Glenn Esler Dorothy Kerlin Christine Ransom	Christine Ransom Melissa Swanson Christina Mott
PCB Aroclors	SW8082	Mark Brindle Glenn Esler Christine Ransom	Christine Ransom Melissa Swanson Christina Mott
Pesticides	SW8081B	Mark Brindle Glenn Esler Christine Ransom	Christine Ransom Melissa Swanson Christina Mott
Polybrominated diphenylethers (PBDE)	Axys MLA-033 (EPA 1614)	Melissa Swanson	Eric Strout Christine Ransom
Dioxin and Furan Compounds	Axys MLA-017 (EPA 1613B)	Mark Brindle Melissa Swanson	Eric Strout Christine Ransom
Metals and Mercury	SW6010B, EPA 200.8, SW7470A, SW7471A	Jeremy Maute Glenn Esler	Christine Ransom Melissa Swanson
Conventionals	EPA 300.0, 353.2, 150.1, 160.2, 160.3, 415.1, SM2320, Plumb, PSEP	Jeremy Maute Glenn Esler	Christine Ransom Melissa Swanson

The data were reviewed using guidance and quality control criteria documented in the analytical methods; *Combined Sampling and Analysis Plan and Quality Assurance Project Plan: Accelerated Source Tracing Study, Lower Duwamish Waterway, WA;* (SAIC, Dec. 21, 2010); *USEPA National Functional Guidelines for Organic Data Review* (EPA, 2008); *USEPA National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (EPA, 2002,2005); and *USEPA National Functional Guidelines for Inorganic Data Review* (EPA, 1994, 2004).

EcoChem's goal in assigning data validation qualifiers is to assist in proper data interpretation. If values are estimated (assigned a J), data may be used for site evaluation purposes but reasons for data qualification should be taken into consideration when interpreting sample concentrations. Data that have been rejected (R) should not be used for any purpose. Values with no data qualifier meet all data quality goals as outlined in the EPA Functional Guidelines.

Data qualifier definitions, reason codes, and validation criteria are included as **Appendix A**. **Appendix B** contains the Qualified Data Summary Table. Data validation worksheets are kept on file at EcoChem. A qualified laboratory electronic data deliverable (EDD) is also submitted with this report.

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
RY37	AST-FILTER-ER	RY37B			√			√					√							
	AST-ISCO-ER	RY37D	√	√	√	√	√	√												
SF68	DK2-012011-W	SF68A	√	√	√	√		√			√									
	DK2-012011-W	SF68D							√											
SF70	DK2-012011-W	SF70A								√										
SF75	DK1A-012011-S	SF75E													√					
SG55	DK1-012611-W	SG55C	√	√	√	√	√	√			√									
	DK2-012611-W	SG55D	√	√	√	√	√	√			√									
	DK3-012611-W	SG55E	√	√	√	√	√	√			√									
	DK1-012611-W	SG55H							√											
	DK2-012611-W	SG55I							√											
	DK3-012611-W	SG55J							√											
SG56	DK1-012611-W	SG56C								√										
	DK2-012611-W	SG56D								√										
	DK3-012611-W	SG56E								√										
SG60	DK1A-012611-S	SG60E													√					
	DK3A-012611-S	SG60G													√					
SH24	SQ1-020211-W	SH24A	√	√	√	√	√	√			√									
	SQ2-020211-W	SH24B	√	√	√	√	√	√			√									
	SQ3-020211-W	SH24C	√	√	√	√	√	√			√									
	SQ4-020211-W	SH24D	√	√	√	√	√	√			√									
	SQ1-020211-W	SH24E							√											
	SQ2-020211-W	SH24F							√											
	SQ3-020211-W	SH24G							√											
	SQ4-020211-W	SH24H							√											
SH25	SQ1-020211-W	SH25A								√										
	SQ2-020211-W	SH25B								√										
	SQ3-020211-W	SH25C								√										
	SQ4-020211-W	SH25D								√										
SH33	SQ1A-020211-S	SH33A													√					
	SQ2A-020211-S	SH33C													√					
	SQ3A-020211-S	SH33E													√					
	SQ3A-020211-S	SH33F																√		

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
SI89	SQ3-021111-W	SI89E	√	√	√	√	√	√			√									
	SQ4-021111-W	SI89F	√	√	√	√	√	√			√									
	SQ1-021111-W	SI89G	√	√	√	√	√	√			√									
	SQ3-021111-W	SI89K							√											
	SQ4-021111-W	SI89L							√											
	SQ1-021111-W	SI89M							√											
SI90	SQ3-021111-W	SI90D								√										
	SQ4-021111-W	SI90E								√										
	SQ1-021111-W	SI90F								√										
SJ02	SQ1A-021111-S	SJ02I											√							
	SQ1A-021111-S	SJ02J																√		
	SQ2A-021111-S	SJ02K											√							
	SQ2A-021111-S	SJ02L																√		
	SQ3A-021111-S	SJ02M											√							
	SQ3A-021111-S	SJ02N																√	√	
	SQ4A-021111-S	SJ02O											√							
	SQ4A-021111-S	SJ02P																√	√	
SL23	DK1-030111-W	SL23D	√	√	√	√	√	√			√									
	DK2-030111-W	SL23E	√	√	√	√	√	√			√									
	DK1-030111-W	SL23I							√											
	DK2-030111-W	SL23J							√											
SL24	DK1-030111-W	SL24D								√										
	DK2-030111-W	SL24E								√										
	DK2A-030111-S	SL23S											√							
SL81	SQ4A-030411-S	SL81I													√					
	SQ4A-030411-S	SL81J																√		
	SQ3A-030411-S	SL81K													√					
	SQ3A-030411-S	SL81L																√		
	SQ2A-030411-S	SL81M													√					
SL82	SQ4-030411-W	SL82E	√	√	√	√	√	√			√									
	SQ3-030411-W	SL82F	√	√	√	√	√	√			√									
	SQ2-030411-W	SL82G	√	√	√	√	√	√			√									
	SQ1-030411-W	SL82H	√	√	√	√	√	√			√									
	SQ4-030411-W	SL82M							√											
	SQ3-030411-W	SL82N							√											
	SQ2-030411-W	SL82O							√											
	SQ1-030411-W	SL82P							√											

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
SL83	SQ4-030411-W	SL83E								√										
	SQ3-030411-W	SL83F								√										
	SQ2-030411-W	SL83G								√										
	SQ1-030411-W	SL83H								√										
SN46	SQ1-031511-W	SN46C	√	√	√	√	√	√			√									
	SQ2-031511-W	SN46D	√	√	√	√	√	√			√									
	SQ3-031511-W	SN46E	√	√	√	√	√	√			√									
	SQ4-031511-W	SN46F	√	√	√	√	√	√			√									
	SQ1-031511-W	SN46I							√											
	SQ2-031511-W	SN46J							√											
	SQ3-031511-W	SN46K							√											
	SQ4-031511-W	SN46L							√											
SN47	SQ1-031511-W	SN47C								√										
	SQ2-031511-W	SN47D								√										
	SQ3-031511-W	SN47E								√										
	SQ4-031511-W	SN47F								√										
SN50	SQ1A-031511-S	SN50I													√					
	SQ2A-031511-S	SN50K													√					
	SQ3A-031511-S	SN50M													√					
	SQ4A-031511-S	SN50O													√					
SQ16	DK1-011911-T	SQ16A											√							
	DK2-011911-T	SQ16B											√					√	√	
	DK3-011911-T	SQ16C											√					√	√	
	DK4-011911-T	SQ16D											√							
	SQ1-011911-T	SQ16E											√							
	SQ2-011911-T	SQ16F											√					√	√	
	SQ3-011911-T	SQ16G											√					√	√	
	SQ4-011911-T	SQ16H											√							
SR07	DK3-040711-W	SR07A	√	√	√	√	√	√			√									
	DK4-040711-W	SR07B	√	√	√	√	√	√			√									
	SQ2-040711-W	SR07C	√	√	√	√	√	√			√									
	SQ3-040711-W	SR07D	√	√	√	√	√	√			√									
	DK3-040711-W	SR07E							√											
	DK4-040711-W	SR07F							√											
	SQ2-040711-W	SR07G							√											
	SQ3-040711-W	SR07H							√											
	SQ3-040711-BT	SR07I																	√	√
	DK3-040711-BT	SR07J											√	√		√	√		√	√

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
SR08	DK3-040711-W	SR08A								√										
	DK4-040711-W	SR08B								√										
	SQ2-040711-W	SR08C								√										
	SQ3-040711-W	SR08D								√										
SR16	SQ2A-040711-S	SR16A											√							
	SQ2B-040711-S	SR16C													√					
	SQ3A-040711-S	SR16D											√							
	SQ3B-040711-S	SR16F													√					
	SQ4A-040711-S	SR16G											√							
	SQ4B-040711-S	SR16I													√					
	DK3A-040711-S	SR16J											√							
	DK3B-040711-S	SR16L													√					
	DK4A-040711-S	SR16M											√							
	DK4B-040711-S	SR16O													√					
SR22	SQ4-040811-W	SR22A	√	√	√	√	√	√			√									
	SQ4-040811-W	SR22B							√											
SR23	SQ4-040811-W	SR23A								√										
SS11	DK3-040711-BT	SS11A																√		
ST39	SQ1-042111-W	ST39D	√	√	√	√	√	√			√									
	SQ3-042111-W	ST39E	√	√	√	√	√	√			√									
	SQ4-042111-W	ST39F	√	√	√	√	√	√			√									
	SQ2-042111-W	ST39G		√				√			√									
	SQ1-042111-W	ST39K							√											
	SQ3-042111-W	ST39L							√											
	SQ4-042111-W	ST39M							√											
	SQ2-042111-W	ST39N							√											
ST40	SQ1-042111-W	ST40D								√										
	SQ3-042111-W	ST40E								√										
	SQ4-042111-W	ST40F								√										
	SQ2-042111-W	ST40G								√										
ST58	SQ2A-042111-S	ST58A											√							
	SQ3A-042111-S	ST58C											√							
SU47	DK1-042711-W	SU47A	√	√	√	√	√	√			√									
	DK2-042711-W	SU47B	√	√	√	√	√	√			√									
	DK1-042711-W	SU47C							√											
	DK2-042711-W	SU47D							√											
SU48	DK1-042711-W	SU48A								√										
	DK2-042711-W	SU48B								√										
SU50	DK1A-042711-S	SU50A											√							

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
SU98	DK3-050211-W	SU98A	√	√	√	√	√	√			√									
	DK4-050211-W	SU98B	√	√	√	√	√	√			√									
	DK3-050211-W	SU98C							√											
	DK4-050211-W	SU98D							√											
	DK3A-050211-S	SU98E											√							
	DK4A-050211-S	SU98G											√							
SU99	DK3-050211-W	SU99A								√										
	DK4-050211-W	SU99B								√										
SV45	SQ2B-042111-S	SV45A													√					
	SQ3B-042111-S	SV45B													√					
	DK1B-042711-S	SV45C													√					
	DK3B-050211-S	SV45D													√					
	DK4B-050211-S	SV45E													√					
SV77	SQ4B-030411-S	SV77E											√							
	SQ3B-030411-S	SV77F											√							
	SQ2B-030411-S	SV77G											√							
SV80	DK1B-012011-S	SV80A																		
SW03	SQ1-050511-T	SW03A												√						√
	SQ2-050511-T	SW03B												√						√
	SQ3-050511-T	SW03C												√						√
	SQ4-050511-T	SW03D												√						√
	DK1-050511-T	SW03E												√						√
	DK2-050511-T	SW03F												√						√
	DK3-050511-T	SW03G												√						√
	DK4-050511-T	SW03H												√						√
	SQ1-050511-BT	SW03I											√	√		√		√	√	√
	DK1-050511-BT	SW03J											√	√		√		√	√	√
SW57	DK3-051111-W	SW57A	√	√	√	√	√	√			√									
	DK3-051111-W	SW57B							√											
	DK1A-051111-S	SW57C											√							
	DK1B-051111-S	SW57E													√					
	DK2A-051111-S	SW57F											√							
	DK2A-051111-S	SW57G																√	√	
	DK2B-051111-S	SW57H													√					
	DK3A-051111-S	SW57I											√					√		
	DK3A-051111-S	SW57J																	√	
	DK3B-051111-S	SW57K													√			√		
	DK4A-051111-S	SW57L											√							
	DK4A-051111-S	SW57M																√	√	
	DK4B-051111-S	SW57N													√					

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Analytical Resources, Inc.

			WATERS										SEDIMENTS							
SDG	SampleID	Lab ID	VOC	LL PCB	SVOC	PAH SIM	Pest	Tot Metals	Diss Metals	LL Hg	Conv	TSS	PCB	SVOC	PAH SVOC	PAH SIM	Pest	Metals	Grain Size	TOC
SW61	DK3-051111-W	SW61A								√										
SX87	DK3A-052011-S	SX87E											√							
	DK3B-052011-S	SX87G													√					
	DK1-052011-W	SX87A	√	√	√	√	√	√			√									
	DK3-0520-11-W	SX87B	√	√	√	√	√	√			√									
	DK1-052011-W	SX87C							√											
	DK3-0520-11-W	SX87D							√											
SX88	DK1-052011-W	SX88A								√										
	DK3-0520-11-W	SX88B								√										
SY66	DK1-052511-W	SY66A	√	√	√	√	√	√			√									
	SQ1-052511-W	SY66B	√	√	√	√	√	√			√									
	SQ2-052511-W	SY66C	√	√	√	√	√	√			√									
	SQ3-052511-W	SY66D	√	√	√	√	√	√			√									
	SQ4-052511-W	SY66E		√								√								
	DK1-052511-W	SY66F							√											
	SQ1-052511-W	SY66G							√											
	SQ2-052511-W	SY66H							√											
	SQ3-052511-W	SY66I							√											
SY67	DK1-052511-W	SY67A								√										
	SQ1-052511-W	SY67B								√										
	SQ2-052511-W	SY67C								√										
	SQ3-052511-W	SY67D								√										
SY79	SQ1A-052511-S	SY79A											√							
	SQ1A-052511-S	SY79B																√		
	SQ1B-052511-S	SY79C													√					
	SQ2A-052511-S	SY79D											√							
	SQ2A-052511-S	SY79E																√		
	SQ2B-052511-S	SY79F													√					
	SQ3A-052511-S	SY79G											√							
	SQ3B-052511-S	SY79I													√					
	SQ4A-052511-S	SY79J											√							
	SQ4B-052511-S	SY79L													√					
	DK2A-052511-S	SY79M											√							
	DK2B-052511-S	SY79O													√					
TA73	SQ1-061511-BT	TA73A												√		√		√	√	√

SAMPLE INDEX
Lower Duwamish Waterway - Accelerated Source Tracing Study
Axys Analytical

SDG Dioxins	SDG PBDE	Sample ID	Lab ID	Dioxin/Furans	PBDEs
WG35790		DK1B-012611-S	L16166-1	√	
		DK3B-012611-S	L16166-2	√	
		SQ1B-020211-S	L16166-3	√	
		SQ2B-020211-S	L16166-4	√	
		SQ3B-020211-S	L16166-5	√	
		SQ3B-021111-S	L16166-8	√	
		SQ4B-021111-S	L16166-9	√	
WG36100		SQ1B-021111-S	L16166-6	√	
		SQ2B-021111-S	L16166-7	√	
		SQ1B-031511-S	L16287-5	√	
		SQ2B-031511-S	L16287-6	√	
		SQ3B-031511-S	L16287-7	√	
		SQ4B-031511-S	L16287-8	√	
	WG36152	SQ4-030411-W	L16286-5		√
		SQ3-030411-W	L16286-6		√
		SQ1-030411-W	L16286-8		√
		SQ2-030411-W	L16286-7		√
WG36570	WG36570	DK2-011911-T	L16430-1	√	√
		DK3-011911-T	L16430-2	√	√
		SQ2-011911-T	L16430-3	√	√
		SQ3-011911-T	L16430-4	√	√
	WG36561	SQ1-042111-W	L16429-5		√
		SQ3-042111-W	L16429-6		√
		SQ4-042111-W	L16429-7		√
		DK1-042711-W	L16429-1		√
		DK2-042711-W	L16429-2		√
		DK3-050211-W	L16429-3		√
		DK4-050211-W	L16429-4		√
WG36676	WG36676	SQ1-050511-T	L16452-1	√	√
		SQ2-050511-T	L16452-2	√	√
		SQ3-050511-T	L16452-3	√	√
		SQ4-050511-T	L16452-4	√	√
		DK1-050511-T	L16452-5	√	√
		DK2-050511-T	L16452-6	√	√
		DK4-050511-T	L16452-8	√	√
		SQ1-050511-BT	L16452-9	√	√
		DK1-050511-BT	L16452-10	√	√
	WG36845	DK3-050511-T	L16452-7	√	√

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Volatile Organic Compounds by SW846 Method 8260C

This report documents the review of analytical data from the analyses of stormwater samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Rinsate Blank	EPA Stage 2A
SF68	1 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	3 Stormwater	EPA Stage 4
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	4 Stormwater	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times		Field Duplicates
1	Initial Calibration (ICAL)		Internal Standards
2	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks		Reporting Limits
2	Field (Equipment Rinsate) Blanks		Compound Identification
	Surrogate Compounds	2	Reported Results
2	Laboratory Control Samples (LCS/LCSD)	1	Calculation Verification
1	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)		

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside of these control limits, ranging from 0.6° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Initial Calibration

The initial calibration (ICAL) percent relative standard deviations (%RSD) were within the control limit of ±30%. The relative response factor (RRF) values were greater than the minimum of 0.05, with exceptions of acetone, acrolein, and 4-methyl-2-pentanone. The RRF values for these compounds are historically low. The responses were stable as indicated by the ICAL %RSD values; therefore no action was taken based on the low RRF values.

Continuing Calibration

The RRF values were greater than the minimum control limit, with the exceptions noted above. The RRF values for these analytes are historically low; therefore no action was taken. The values for percent difference (%D) were within the ±25% control limits, with some exceptions. For outliers indicative of a decrease in instrument response, associated positive results and non-detects were estimated (J/UJ-5B) to indicate a potential low bias. For outliers indicative of an increase in instrument response associated positive results only were estimated (J-5B) to indicate a potential high bias.

Outliers for the following analytes resulted in qualification of data.

SDG SI89: acetone and 2-butanone - (UJ-5B) low bias

SDG ST39: naphthalene - (UJ-5B) low bias

SDG SY66: acrolein and vinyl acetate - (UJ-5B) low bias

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate, AST-ISCO-ER, was submitted. This blank is associated with all stormwater and base flow samples. Methylene chloride, acetone, and toluene were detected in this blank. In order to determine the effect on the field samples, action levels were established at 5X the toluene concentration and 10X the acetone and methylene chloride concentrations (common laboratory contaminants). Positive results in the field samples that were less than the action levels were qualified as not-detected (U-6). See the **Qualified Data Summary Table** in **APPENDIX B** for a list of qualified results.

Surrogate Compounds

SDG RY37: The percent recovery (%R) for the surrogate compound 1,2-dichloroethane-d4 was greater than the upper control limit in Sample AST-ISCO-ER. The %R values for the other two surrogate compounds were within control limits. No action was taken for the single outlier.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

The following outliers resulted in qualification of data.

SDG SH24: chloromethane, vinyl acetate, and 2-butanone – (UJ-10) low bias

SDG SI89: chloromethane, vinyl acetate, and 2-butanone – (UJ-10) low bias

SDG SY66: vinyl acetate – (UJ-10) low bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the LCS/LCSD results.

Reported Results

The analyte 2-chloroethyl vinyl ether requires the collection of an unpreserved sample due to the highly reactive nature of the analyte. All of the VOA sample vials were received preserved to pH<2; all data for 2-chloroethyl vinyl ether were rejected (R-1).

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD %R values. Precision was acceptable as demonstrated by the LCS/LCSD relative percent difference values.

Data were estimated based on CCAL %D outliers. Data were qualified as not detected based on field blank contamination. Data for 2-chloroethyl vinyl ether were rejected because samples were acid preserved.

Data that have been rejected should not be used for any purpose.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Semivolatile Organic Compounds by Method 8270D

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a list of samples that were reviewed.

SDG	Number of Samples	Validation Level
SR07	1 Sediment	EPA Stage 2B
SW03	10 Sediment	EPA Stage 2B
TA73	1 Sediment	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1 Sample Receipt, Preservation, and Holding Times
Initial Calibration (ICAL)
2 Continuing Calibration (CCAL)
Laboratory Blanks
1 Field (Equipment Rinsate) Blanks
Surrogate Compounds
2 Laboratory Control Samples (LCS/LCSD)
1 Matrix Spike/Matrix Spike Duplicate (MS/MSD)
2 Internal Standards
Target Analyte List
1 Reporting Limits
Compound Identification
1 Reported Results

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received a sample cooler with a temperature outside of these control limits, at 0.6°C. This temperature outlier did not impact data quality and no qualifiers were assigned.

Continuing Calibration

All relative response factor (RRF) values were greater than the 0.05 minimum control limit. The values for percent difference (%D) were within the ±25% control limit, with the exceptions noted below. For outliers indicative of a decrease in instrument response, results in the associated samples were estimated (J/UJ-5B) to indicate a potential low bias. For outliers indicative of an increase in instrument response, positive results only in the associated samples were estimated (J-5B) to indicate a potential high bias.

Outliers for the following analytes resulted in qualification of data:

SDG SW03: benzoic acid and pentachlorophenol – (J-5B) high bias

Field (Equipment Rinsate) Blanks

There was no equipment rinsates associated with the samples in these SDG.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

The following outliers resulted in qualification of data:

SDG SR07: 2,4-dimethylphenol- (UJ-10) low bias

SDG SW03: LCS/LCSD (5/18/11): 2,4-dimethylphenol - (UJ-10) low bias; benzyl alcohol - rejected (R-10)

LCS/LCSD (5/17/11): 2,4-dimethylphenol - (UJ-10) low bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the LCS/LCSD recovery and relative percent difference (RPD) values.

Internal Standards

SDG SW03: The %R values for perylene-d12 were greater than the upper control limit in Samples

DK1-050511-T, DK3-050511-T, and DK4-050511-T. These samples were diluted and reanalyzed. All internal standard %R values were within control limits in the re-analyses and the results from the dilutions supported the results form the original analyses. In order to achieve the lowest possible reporting limits, the results from the original analyses should be used. The analytes quantitated using perylene-d12 were estimated (J-19) based on the IS outliers.

Reporting Limits

SDG SW03: Samples SQ1-050511-BT (6x), DK1-050511-BT (10x), DK1-050511-T (10x), DK3-050511-T (10x), and DK4-050511-T (10x) were analyzed at dilutions. The reporting limits were elevated accordingly.

SDG TA73: Sample SQ1-061511-BT was analyzed at 3x and 20x dilutions. The reporting limits were elevated accordingly.

Reported Results

SDG SW03: Samples DK1-050511-T, DK3-050511-T, and DK4-050511-T were re-analyzed at dilution due to internal standard outliers in the original analyses. In order to achieve the lowest possible reporting limits, the results from the original analyses should be used. Only the results from the original analyses were reported in the EDD; therefore no further action was necessary.

SDG TA73: The 4-methylphenol result in Sample SQ1-061511-BT exceeded the calibration linear range. The result was "E" flagged by the laboratory. The sample extract was diluted 20x and reanalyzed. For Sample SQ1-061511-BT, 4-methylphenol from the 20x dilution was reported in the EDD.

The laboratory could not identify indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene in the 3x dilution. These analytes were flagged "NA" (not analyzed) by the laboratory. The results from the 20x dilution should be used instead. The "NA" flagged results were flagged do-not-report (DNR-14).

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions previously noted, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD %R values. Precision was acceptable as demonstrated by the LCS/LCSD relative percent difference values.

Data were estimated based on CCAL %D, internal standard %R, and LCS/LCSD %R outliers. Data were rejected based on LCS/LCSD %R values less than 10%. Data were flagged as do-not-report (DNR) to indicate which result should not be used from multiple reported analyses

Data that have been rejected or flagged DNR are not useable for any purpose.

All other data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Semivolatile Organic Compounds by Method 8270D

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a list of samples that were reviewed.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SF68	1 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	3 Stormwater	EPA Stage 4
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	4 Stormwater	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicate (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
1	Continuing Calibration (CCAL)		Target Analyte List
2	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
2	Surrogate Compounds	1	Reported Results
1	Laboratory Control Samples (LCS)	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside of these control limits, ranging from 0.6° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

SDG ST39: Sample SQ1-042111-W was re-extracted and re-analyzed due to poor surrogate recoveries in the original analysis. The re-extraction was done after the holding time had expired; therefore results from the original analysis should be used.

Continuing Calibration

All relative response factor (RRF) values were greater than the 0.05 minimum control limit. The values for percent difference (%D) were within the ±25% control limit, with the exceptions noted below.

SDG SH24: The %D values for dibenzo(a,h)anthracene and benzo(g,h,i)perylene in the CCAL analyzed 2/08/11 on instrument NT4 were greater than the upper control limit. The %D values indicated a potential high bias. There were no positive results detected in the samples; therefore no qualification of data was necessary.

Laboratory Blanks

In order to determine the effect of method blank contamination on the associated field sample data, action levels were established at five times the blank concentration. Positive results in the associated samples that were less than the action levels were qualified as not-detected (U-7). No action was taken for non-detects. The following analytes were qualified in one or more samples based on method blank contamination.

***SDG SL23*:** bis(2-ethylhexyl)phthalate - (U-7)

***SDG SL82*:** bis(2-ethylhexyl)phthalate - (U-7)

SDG SU47: bis(2-ethylhexyl)phthalate - (U-7)

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate, AST-ISCO-ER, was submitted. This blank is associated with all stormwater and base flow samples. There were no target analytes detected.

Surrogate Compounds

SDG ST39: The percent recovery (%R) values for six of eight surrogate compounds were less than the lower control limits in Sample SQ1-042111-W. The sample was re-extracted and reanalyzed with all surrogate %R values within control limits. The results from the re-analysis confirmed the original results. Because the re-extraction was done after the holding time had expired, the results form the original analysis should be used. All results for the original analysis were estimated (UJ-13) to indicate a potential low bias.

SDG SU47: The %R value for 1,2-dichlorobenzene-d4 was less than the lower control limit in Sample DK1-042711-W. All other surrogate %R values were within control limits; therefore no qualifiers were assigned.

SDG SU98: The %R value for 2,4,6-tribromophenol was less than the lower control limit in Sample DK4-050211-W. All other surrogate %R values were within control limits; no qualifiers were assigned.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

The following outliers resulted in qualification of data.

SDG ST39: 2,4-dimethylphenol and n-nitrosodiphenylamine - (UJ-10) low bias

SDG SU98: 2,4-dimethylphenol, dibenzofuran, and n-nitrosodiphenylamine - (UJ-10) low bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the LCS/LCSD recovery and relative percent difference (RPD) values.

Reported Results

SDG ST39: Sample SQ1-042111-W was re-extracted and re-analyzed due to poor surrogate recoveries in the original analysis. The re-extraction was done after the holding time had expired; therefore results from the original analysis should be used. Both sets of results were reported in the data package, but only the results form the original analysis were reported in the EDD. See the **Surrogate Compounds** section for a discussion of qualifiers assigned.

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions previously noted, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD %R values. Precision was acceptable as demonstrated by the LCS/LCSD relative percent difference values.

Data were qualified as not detected based on method blank contamination. Data were estimated based on surrogate and LCS/LCSD recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Polycyclic Aromatic Hydrocarbons by Method 8270D

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a list of samples that were reviewed.

SDG	Number of Samples	Validation Level
SR07	1 Sediment	EPA Stage 2B
SW03	2 Sediment	EPA Stage 2B
TA73	1 Sediment	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blanks	2	Compound Identification
	Surrogate Compounds		Reported Results
	Laboratory Control Samples (LCS)		

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received a sample cooler with a temperature outside control limits, at 0.6°C. This temperature outlier did not impact data quality and no qualifiers were assigned.

Field (Equipment Rinsate) Blanks

There was no equipment rinsates associated with the samples in these SDG.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery and relative percent difference (RPD) values.

Compound Identification

SDG TA73: The dibenzo(a,h)anthracene result was flagged "M" by the laboratory. The analyte was detected and confirmed, but with low spectral match. The dibenzo(a,h)anthracene result was qualified as estimated and tentatively identified (NJ-14).

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was also acceptable as demonstrated by the LCS/LCSD RPD values.

One result for dibenzo(a,h)anthracene was qualified as an estimated, tentative identification.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway – Accelerated Source Tracing Study
Polycyclic Aromatic Hydrocarbons by Method 8270D

This report documents the review of analytical data from the analysis of filter bag samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a list of samples that were reviewed.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SF75	1 Filter Bag	EPA Stage 2B
SG60	2 Filter Bag	EPA Stage 2B
SH33	3 Filter Bag	EPA Stage 2B
SL81	3 Filter Bag	EPA Stage 4
SN46	4 Filter Bag	EPA Stage 2B
SN50	4 Filter Bag	EPA Stage 2B
SR16	5 Filter Bag	EPA Stage 2B
SV45	5 Filter Bag	EPA Stage 2B
SW57	4 Filter Bag	EPA Stage 2B
SX87	1 Filter Bag	EPA Stage 2B
SY79	5 Filter Bag	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
	Surrogate Compounds		Reported Results
	Laboratory Control Samples (LCS/LCSD)	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside control limits, ranging from 1.8° to 17.4°C. Where temperatures greater than the upper control limit occurred, there was insufficient time for the samples and coolers to achieve a lower temperature as the laboratory received the samples within 6 hours of collection. These temperature outliers did not impact data quality and no qualifiers were assigned.

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate, AST-FILTER-ER, was submitted. No target analytes were detected in this blank.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) recovery and relative percent difference values.

Calculation Verification

SDG SL81: Several results were verified by recalculation form the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD recoveries. Precision was also acceptable, as demonstrated by the LCS/LCSD RPD values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Polycyclic Aromatic Hydrocarbons by Method 8270D-SIM

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a list of samples that were reviewed.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SF68	1 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	3 Stormwater	EPA Stage 4
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	4 Stormwater	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
2	Continuing Calibration (CCAL)		Target Analyte List
2	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blank		Compound Identification
	Surrogate Compounds		Reported Results
2	Laboratory Control Samples (LCS)	1	Calculation Verification

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside control limits, ranging from 0.6° to 17.4°C. Where temperatures greater than the upper control limit occurred, there was insufficient time for the samples and coolers to achieve a lower temperature as the laboratory received the samples within 6 hours of collection. These temperature outliers did not impact data quality and no qualifiers were assigned.

Continuing Calibration

All values for the relative response factor (RRF) values were greater than the 0.05 minimum control limits. The values for percent difference (%D) were within the ±25% control limit, with the exceptions noted below.

SDG SF68: The %D value for chrysene in the CCAL analyzed 1/31/11on instrument NT11 was outside of the control limits and indicated a potential high bias. The positive chrysene result for Sample DK2-012011-W was estimated (J-5B).

Laboratory Blanks

In order to determine the effect of method blank contamination on the associated field sample data, action levels were established at five times the blank concentration. Positive results in the associated samples that were less than the action levels were qualified as not-detected (U-7). No action was taken for non-detects. The following analytes were qualified in one or more samples based on method blank contamination.

SDG SG55: naphthalene - (U-7)

SDG SH24: naphthalene - (U-7)

SDG SU47: naphthalene and 2-methylnaphthalene - (U-7)

SDG SX87: naphthalene - (U-7)

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate blank, AST-ISCO-ER, was submitted. This blank is associated with all stormwater and base flow samples. No target analytes were detected in this blank.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

Outliers for the following analytes resulted in qualification of data.

SDG SF68: 2-methylnaphthalene, fluorene, phenanthrene, anthracene, fluoranthene, and benzo(a)anthracene - (J-10) high bias

SDG SH75: anthracene, fluoranthene, and benzo(a)anthracene - (J-10) high bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the LCS/LCSD recovery and relative percent difference (RPD) values.

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery (%R) values. Precision was acceptable as demonstrated by the LCS/LCSD RPD values.

Data were estimated based on LCS/LCSD %R and continuing calibration %D outliers. Data were qualified as not-detected based on method blank contamination.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Polybrominated Diphenyl Ethers (PBDE) by Axys Method MLA-033
(EPA Draft 1614)

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Axys Analytical Services, Ltd. of Sidney, British Columbia, Canada. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
WG36570	4 Sediment	EPA Stage 4
WG36676	9 Sediment	EPA Stage 4
WG36845	1 Sediment	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	GC/MS Instrument Performance Check		Ongoing Precision and Recovery (OPR)
	Initial Calibration (ICAL)	1	Laboratory Duplicate
	Continuing Calibration (CCAL)	2	Compound Identification
1	Laboratory Blanks		Reported Results
	Labeled Compounds	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The temperature of the sample cooler upon receipt at the laboratory was 8.0°C. This temperature outlier did not impact data quality and no action was taken.

Laboratory Blanks

Method blanks were analyzed at the appropriate frequency. To assess the impact of each blank contaminant on the reported sample results, an action level was established at five times the concentration detected in the blank. Several PBDE compounds were detected in the method blanks; however, no results required qualification. All associated results were either greater than the action level or not-detected.

The laboratory assigned K-flags to values when a peak was detected but did not meet identification criteria. These values cannot be considered as positive identifications, but are "estimated maximum possible concentrations". When these occurred in the method blank the results were considered as false positives. No action levels were established for these analytes.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates or laboratory duplicates were not analyzed due to insufficient sample volume. Accuracy was assessed using the labeled compound and ongoing precision and recovery (OPR) standard results. Precision for the analytical batch could not be assessed; however OPR results within the laboratory control limits indicate acceptable laboratory precision from batch to batch.

Laboratory Duplicates

Laboratory duplicates were not analyzed due to insufficient sample volume. Precision for the analytical batch could not be assessed; however OPR results within the laboratory control limits indicate acceptable laboratory precision from batch to batch.

Compound Identification

The laboratory assigned a "K" flag to one or more analytes in all samples to indicate the ion ratio criterion were not met. Since the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy, an outlier indicates that the reported result may be a false positive. These "K" flagged results were qualified as not detected at elevated detection limits (U-22).

Calculation Verification

Several results were verified by recalculation form the raw data. No transcription or calculation errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. Accuracy was acceptable, as demonstrated by the labeled compound and OPR recoveries. Precision within each batch could not be evaluated.

Detection limits were elevated due to ion ratio outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Polybrominated Diphenyl Ethers (PBDE) by Axys Method MLA-033
(EPA Draft 1614)

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Axys Analytical Services, Ltd. of Sidney, British Columbia, Canada. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
WG36152	4 Stormwater	EPA Stage 4
WG36561	7 Stormwater	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	GC/MS Instrument Performance Check		Ongoing Precision and Recovery (OPR)
	Initial Calibration (ICAL)	1	Laboratory Duplicate
	Continuing Calibration (CCAL)	2	Compound Identification
2	Laboratory Blanks		Reported Results
1	Labeled Compounds	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The temperatures of some sample coolers upon receipt at the laboratory were 0°C. These temperature outliers did not impact data quality and no action was taken.

Laboratory Blanks

Method blanks were analyzed at the appropriate frequency. To assess the impact of each blank contaminant on the reported sample results, an action level was established at five times the concentration detected in the blank. Positive results less than the action levels were qualified as not detected (U-7).

The laboratory assigned K-flags to values when a peak was detected but did not meet identification criteria. These values cannot be considered as positive identifications, but are "estimated maximum possible concentrations". When these occurred in the method blank the results were considered as false positives. No action levels were established for these analytes.

The following results were qualified based on method blank contamination.

SDG WG36561: PBDE49 and PBDE209 - (U-7) Sample SQ1-042111-W

Labeled Compounds

SDG WG36561: The percent recovery for the labeled compound $^{13}C_{12}$-PBDE140 was greater than the upper control limit in Sample SQ1-042111-W. This analyte is a cleanup standard and not used in the quantitation of any target analytes. Because the recoveries for all other labeled compounds were acceptable, no action was taken.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates or laboratory duplicates were not analyzed due to insufficient sample volume. Accuracy was assessed using the labeled compound and ongoing precision and recovery (OPR) standard results. Precision for the analytical batch could not be assessed; however OPR results within the laboratory control limits indicate acceptable laboratory precision from batch to batch.

Laboratory Duplicates

Laboratory duplicates were not analyzed due to insufficient sample volume. Precision for the analytical batch could not be assessed; however OPR results within the laboratory control limits indicate acceptable laboratory precision from batch to batch.

Compound Identification

The laboratory assigned a "K" flag to one or more analytes in all samples to indicate the ion ratio criterion were not met. Since the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy, an outlier indicates that the reported result may be a false positive. These "K" flagged results were qualified as not detected at elevated detection limits (U-22).

Calculation Verification

Several results were verified by recalculation form the raw data. No transcription or calculation errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exception noted above, accuracy was acceptable, as demonstrated by the labeled compound and OPR recoveries. Precision within each batch could not be assessed.

Detection limits were elevated due to ion ratio outliers. Data were qualified as not detected due to method blank contamination.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
PCB Aroclors by SW846 Method 8082

This report documents the review of analytical data from the analyses of filter bag samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SJ02	4 Filter Bag	EPA Stage 2B
SL23	1 Filter Bag	EPA Stage 2B
SR16	5 Filter Bag	EPA Stage 2B
ST58	2 Filter Bag	EPA Stage 2B
SU50	1 Filter Bag	EPA Stage 2B
SU98	2 Filter Bag	EPA Stage 2B
SW57	4 Filter Bag	EPA Stage 2B
SX87	1 Filter Bag	EPA Stage 2B
SY79	5 Filter Bag	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)	1	Internal Standards
1	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks	2	Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
	Surrogate Compounds	2	Reported Results
	Laboratory Control Samples (LCS/LCSD)	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside of these control limits, ranging from 1.0° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Continuing Calibration

SDG SY79: The %D value on the ZB5 column for Aroclor 1260 peak #1 was greater than the 25% control limit in the 6/17/11 04:18 CCAL. All %D values were within control limits on the ZB35 column. No qualifiers were required.

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate blank, AST-FILTER-ER, was submitted. This rinsate is associated with all filter bag samples. No target analytes were detected in this blank.

Surrogate Compounds

SDG ST58: Both surrogates were diluted out in the analysis of Sample SQ3A-042111-S which was analyzed at a 200x dilution. No qualifiers were required.

SDG SY79: Both surrogates were diluted out in the analysis of Sample SQ3A-052511-S which was analyzed at a 100x dilution. No qualifiers were required.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results.

Internal Standards

SDG SL23: The percent recovery (%R) value for internal standard hexabromobiphenyl was less than the lower control limit on the ZB5 column in Sample DK2A-030111-S. The %R value for this internal standard was within control limits on the ZB35 column. No qualifiers were required.

Reporting Limits

The method reporting limits were sometimes greater than the limits specified in the QAPP. Several chromatograms indicated non-target background interference. The reporting limits for these analytes were flagged "Y" by the laboratory. These "Y" flagged results were qualified (U-22) to indicate the analyte is not-detected at an elevated reporting limit. The following results were qualified:

SDG SJ02: Sample SQA-021111-S – Aroclor 1248

SDG ST58: Sample SQ2A-042111-S – Aroclors 1248 & 1260
Sample SQ3A-042111-S – Aroclor 1260

SDG SU98: Sample DK4A-050211-S – Aroclor 1232

SDG SW57: Sample DK1A-051111-S – Aroclor 1248

SDG SX87: Sample DK3A-052011-S – Aroclor 1248

SDG SY79: Sample SQ1A-052511-S – Aroclor 1248

Reported Results

SDG SY79: The Aroclor 1260 result for Sample DK2A-052511-S was flagged as "P" by the laboratory indicating the relative percent difference (RPD) between the two analytical columns was greater than 40%, at 68%. This result was qualified as estimated and tentatively identified (NJ-3) to indicate a potential high bias.

Calculation Verification

SDG SY79: Several results were verified by recalculation form the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD recovery values. Precision was acceptable as demonstrated by the RPD values for the LCS/LCSD analyses.

Reporting limits were elevated based on non-target background interference. Data were estimated because confirmation criteria were not met.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
PCB Aroclors by SW846 Method 8082

This report documents the review of analytical data from the analyses of sediment samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
SQ16	8 Sediment	EPA Stage 2B
SR07	1 Sediment	EPA Stage 2B
SW03	2 Sediment	EPA Stage 2B
TA73	1 Sediment	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
2	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks	1	Reporting Limits
	Field (Equipment Rinsate) Blanks		Compound Identification
2	Surrogate Compounds	2	Reported Results
	Laboratory Control Samples (LCS/LCSD)		

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received a sample cooler with a temperature outside of these control limits, at 0.6°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Continuing Calibration (CCAL)

SDG SQ16: The percent difference (%D) values for individual peaks of several Aroclors were outside of the ±25% control limit on one column, but were within control limits on the other column. No qualifiers were assigned for these outliers. Refer to the Data Validation worksheets for a complete list of the %D outliers.

The average %D values for Aroclor 1248 were outside of the control limits on both columns in the 4/15/11 02:57 CCAL. The reporting limits and reported results were estimated (UJ/J-5B) in the associated samples.

Surrogate Compounds

SDG SQ16: The percent recovery (%R) value for TCMX was less than the lower control limit in Sample SQ2-011911-T. The DCBP %R value was within control limits. No qualifiers were required. For Sample SQ3-011911-T, the %R values for both TCMX and DCBP were greater than the upper control limits. The positive results were estimated (J-13) for this sample.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results.

Reporting Limits

SDG SQ16: Samples SQ1-011911-T (5x), SQ2-011911-T (10x), and SQ3-011911-T (10x) were analyzed at dilutions. The reporting limits were elevated accordingly.

The method reporting limits were sometimes greater than the limits specified in the QAPP. Several chromatograms indicated non-target background interference. The reporting limits for these analytes were flagged "Y" by the laboratory. These "Y" flagged results were qualified (U-22) to indicate the analyte is not-detected at an elevated reporting limit. The following results were qualified.

SDG SW03: SQ1-050511-BT: Aroclor 1248

Sample SQ1-050511-BT (5x) was analyzed at a dilution. The reporting limits were elevated accordingly.

SDG TA73: SQ1-061511-BT: Aroclor 1248

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD recoveries, with the exception noted above. Precision was acceptable as demonstrated by the relative percent difference values for the LCS/LCSD analyses.

Data were estimated based on surrogate recovery and continuing calibration outliers. Reporting limits were elevated based on non-target background interferences.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
PCB Aroclors by SW846 Method 8082

This report documents the review of analytical data from the analyses of stormwater samples and the associated field and laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SF68	1 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	4 Stormwater	EPA Stage 4
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	5 Stormwater	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%).

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spikes/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)	2	Internal Standards
1	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks	2	Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
	Surrogate Compounds	2	Reported Results
1	Laboratory Control Samples (LCS/LCSD)	1	Calculation Verification

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside of these control limits, ranging from 0.6° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Continuing Calibration

SDG SN46: The percent difference (%D) values on the ZB5 column for Aroclor 1260 peaks #1 and #2 were greater than the 25% control limit in the 3/23/11 05:56 CCAL. All %D values were within control limits on the ZB35 column. No qualifiers were required.

SDG SU98: The %D value on the ZB35 column for Aroclor 1260 peak #1 was greater than the 25% control limit in the 5/18/11 13:40 CCAL. All %D values were within control limits on the ZB5 column. No qualifiers were required.

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment rinsate blank, AST-ISCO-ER, is associated with all stormwater and base flow samples. No target analytes were detected in this blank.

Laboratory Control Sample

SDG SY66: A single laboratory control sample (LCS) was extracted and analyzed with the samples from this SDG. No laboratory control sample duplicate (LCSD) analysis was performed. Laboratory precision could not be evaluated.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results.

Internal Standards

SDG SH24: The percent recovery (%R) values for 1-bromo-2-nitrobenzene and hexabromobiphenyl were greater than the upper control limit for the LCSD on both columns. No qualifiers were assigned to the QC sample.

SDG SL82: The %R value for hexabromobiphenyl was less than the lower control limit for Sample SQ2-030411-W on the ZB5 column. The reporting limits and reporting limits were estimated (J/UJ-19) for this sample.

SDG SN46: The %R values on the ZB5 column for hexabromobiphenyl were less than the lower control limit for Samples SQ1-031511-W and SQ4-031511-W. All %R values were within control limits on the ZB35 column. No Aroclors were detected in Sample SQ1-031511-W. The Aroclor results for Sample SQ4-031511-W were reported from the ZB5 column. The reported results and reporting limits were estimated (J/UJ-19) for this sample.

SDG SY66: The %R value on the ZB5 column for hexabromobiphenyl was less than the lower control limit for Sample DK1-052511-W. The %R values were within control limits on the ZB35 column. No qualifiers were required.

Reporting Limits

The method reporting limits were sometimes greater than the limits specified in the QAPP. Several chromatograms indicated non-target background interference. The reporting limits for these analytes were flagged “Y” by the laboratory. These “Y” flagged results were qualified (U-22) to indicate the analyte is not-detected at an elevated reporting limit. The following results were qualified:

SDG SH24: SQ4-020211-W: Aroclor 1232

SDG SL23: DK2-030111-W: Aroclor 1242 and Aroclor 1254

SDG SL82: SQ2-030411-W: Aroclor 1260

SDG SR07: SQ2-04072011-W: Aroclor 1254

SDG SU47: DK2-042711-W: Aroclor 1232

Reported Results

SDG SL82: The Aroclor 1248 result for Sample SQ3-030411-W was flagged as "P" by the laboratory indicating the relative percent difference (RPD) between the two analytical columns was greater than 40%. This result was estimated (J-3) to indicate a potential high bias.

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were found.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory performed the specified analytical method. Accuracy was acceptable, as demonstrated by the surrogate and LCS/LCSD recoveries. Precision was also acceptable as demonstrated by the RPD values for the LCS/LCSD analyses.

Data were estimated because column confirmation criteria were not met and due to internal standard outliers. Reporting limits were elevated based on non-target background interferences.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Chlorinated Pesticides by SW846 Method 8081B

This report documents the review of analytical data from the analysis of one sediment sample and the associated laboratory quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
SR07	1 Sediment	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicate (MS/MSD)
	Initial Calibration (ICAL)		Internal Standards
	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
	Surrogate Compounds		Reported Results
2	Laboratory Control Samples (LCS/LCSD)		

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received the sample cooler with a temperature outside of these control limits, at 0.6°C. This temperature outlier did not impact data quality and no qualifiers were assigned.

Field (Equipment Rinsate) Blanks

There was no equipment rinsate associated with this sediment sample.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

Laboratory control sample recovery outliers for the following outliers resulted in qualification of data:

SDG SR07: delta-BHC - (UJ-10) low bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was acceptable as demonstrated by the LCS/LCSD relative percent difference values.

One data point was estimated based on LCS/LCSD recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Chlorinated Pesticides by SW846 Method 8081B

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory and field quality control (QC) samples. Analytical Resources, Inc., Tukwila, Washington, analyzed the samples. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Rinsate	EPA Stage 2A
SF68	2 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	3 Stormwater	EPA Stage 4
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	4 Stormwater	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)
	Initial Calibration (ICAL)	1	Internal Standards
1	Continuing Calibration (CCAL)		Target Analyte List
	Laboratory Blanks	2	Reporting Limits
1	Field (Equipment Rinsate) Blanks		Compound Identification
1	Surrogate Compounds		Reported Results
2	Laboratory Control Samples (LCS/LCSD)	1	Calculation Verification

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside of these control limits, ranging from 0.6° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Continuing Calibration

Continuing calibration (CCAL) percent difference (%D) values were within the control limits of +/- 25%, with some exceptions. In all cases, the %D outliers occurred on only one of either the primary or secondary column. No qualification of data was necessary based on CCAL %D values.

Field (Equipment Rinsate) Blanks

SDG RY37: One field blank, AST-ISCO-ER, was submitted. This rinsate is associated with all stormwater and base flow samples. No target analytes were detected in this blank.

Surrogate Compounds

SDG SU47: The %R values for surrogate, tetrachloro-meta-xylene (TCMX), were less than the lower control limit in the LCS/LCSD. TCMX was not recovered in the method blank. No action was taken as qualifiers are not assigned to QC samples.

SDG SU98: The %R value for TCMX was less than the lower control limit in the LCS. Qualifiers are not assigned to QC samples.

SDG SX87: The %R value for TCMX was less than the lower control limit in the LCS. The %R value for DCBP was less than the lower control limit in the LCSD. Qualifiers are not assigned to QC samples.

Laboratory Control Samples

Laboratory control sample/laboratory control sample duplicates (LCS/LCSD) were analyzed at the proper frequency. For LCS/LCSD recoveries that were less than the lower control limit, positive results and/or non-detects in the parent sample only were estimated (J/UJ-10) to indicate a potential low bias. If the recoveries were also less than 10%, positive results were estimated (J-10) and non-detects were rejected (R-10) due to the extreme low bias. For recoveries greater than the upper control limit, positive results only in the parent sample were estimated (J-10) to indicate a potential high bias. No action was taken if only one of the LCS or LCSD recoveries was outside of the control limit.

Laboratory control sample recovery outliers for the following analytes resulted in qualification of data.

SDG SG55: delta-BHC and endosulfan II - (UJ-10) low bias

SDG SH24: alpha-BHC, endosulfan II, endosulfan sulfate, and endrin ketone - (UJ-10) low bias

SDG SI89: delta-BHC and endosulfan II - (UJ-10) low bias

SDG SL23: delta-BHC and endosulfan sulfate – (UJ-10) low bias

SDG SL82: delta-BHC – (UJ-10) low bias

SDG SN46: alpha-BHC, delta-BHC, endosulfan II, endosulfan sulfate, and endrin ketone – (UJ-10) low bias

SDG SR07: delta-BHC – (UJ-10) low bias

SDG SR22: delta-BHC – (UJ-10) low bias

SDG ST39: delta-BHC – (UJ-10) low bias

SDG SU47: alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, heptachlor, aldrin, heptachlor epoxide, endosulfan I, dieldrin, endosulfan sulfate, endrin ketone, trans-chlordane, cis-chlordane, & hexachlorobenzene – (UJ-10) low bias

SDG SU98: alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, endosulfan II, endosulfan sulfate, & endrin ketone – (UJ-10) low bias

SDG SW57: alpha-BHC and delta-BHC – (UJ-10) low bias

SDG SX87: alpha-BHC and delta-BHC – (UJ-10) low bias

SDG SY66: alpha-BHC, beta-BHC, delta-BHC, gamma-BHC, heptachlor, & endosulfan sulfate – (UJ-10) low bias

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate (MS/MSD) analyses were not performed due to insufficient sample volume. Precision and accuracy were evaluated using the LCS/LCSD results.

Internal Standards

SDG SW57: The recovery for the internal standard 1-bromo-2-nitrobenzene was greater than the upper control limit on the CLP1 column. The recovery was acceptable on the CLP2 column; therefore no action was necessary.

Reporting Limits

SDG SH24: For Sample SQ2-020211-W, the reporting limits for heptachlor and aldrin were flagged with a "Y" by the laboratory to indicate non-target background interferences. These "Y" flagged results were qualified (U-22) to indicate the analyte is not-detected at an elevated reporting limit.

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the surrogate and LCS/LCSD percent recovery values. Precision was acceptable as demonstrated by the LCS/LCSD relative percent difference values.

Data were qualified based on LCS/LCSD recovery outliers. Reporting limits were elevated based on non-target background interference.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Dioxin & Furan Compounds by Axys Method MLA-017 (EPA 1613B)

This report documents the review of analytical data from the analyses of filter bag and sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Axys Analytical Services, Ltd. of Sidney, British Columbia, Canada. See the Sample Index for a list of samples that were reviewed.

SDG	Number of Samples	DV Level
WG35790	4 Filter Bag & 3 Sediment	EPA Stage 4
WG36100	3 Filter Bag	EPA Stage 4
WG36391	1 Sediment	EPA Stage 4
WG36570	4 Sediment	EPA Stage 4
WG36676	10 Sediment	EPA Stage 4

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. Laboratory QC results were also verified (10%). No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements reviewed are summarized in the following table:

1	Sample Receipt, Preservation, and Holding Times	2	Standard Reference Materials (SRM)
	System Performance and Resolution Checks		Ongoing Precision and Recovery (OPR)
	Initial Calibration (ICAL)		Target Analyte List
	Calibration Verification (CVER)	1	Reported Results
1	Method Blanks	2	Compound Identification
	Labeled Compounds	1	Calculation Verification
1	Matrix Spike/Matrix Spike Duplicates (MS/MSD)		

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

The validation guidance documents state that the cooler temperatures should be within an advisory temperature range of 2° to 6°C. The temperatures of some sample coolers were outside of these limits, ranging from 0° to 8°C. These temperature outliers did not impact data quality and no action was taken.

Method Blanks

One or more target analytes were detected in the method blanks. In order to assess the impact of blank contamination on the reported sample results, action levels were established at five times the blank concentrations. All results in the associated samples were greater than the action levels; therefore no qualification of data based on method blank contamination was required.

The laboratory assigned K-flags to results when a peak was detected but did not meet identification criteria. These values cannot be considered as positive identifications, but are "estimated maximum possible concentrations". When these occurred in the method blank the results were considered as false positives. No action levels were established for these analytes.

Matrix Spike/Matrix Spike Duplicates

Matrix spike/matrix spike duplicates or laboratory duplicates were not analyzed due to insufficient sample volume. Accuracy was assessed using the labeled compound, standard reference material, and ongoing precision and recovery (OPR) standard results. Precision for the analytical batch could not be assessed; however OPR results within the laboratory control limits indicate acceptable laboratory precision from batch to batch.

Standard Reference Materials

The standard reference material (SRM) NIST 1944 was analyzed with each batch. Results were within the control limits of ±20% of the 95% confidence interval, with the exceptions noted below. For recoveries less than the lower control limit, results in the associated samples were estimated (J/UJ-12) to indicate a potential low bias. For results greater than the upper control limit, positive results only tin the associated samples were estimated (J-12) to indicate a potential high bias.

Outliers for the following analytes resulted in qualification of data:

SDG WG35790: 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD, and 1,2,3,4,7,8-HxCDD - (J-12) high bias

SDG WG36100: 2,3,7,8-TCDD - (J-12) high bias

SDG WG36676: 1,2,3,7,8-PeCDD, 1,2,3,6,7,8-HxCDD, 1,2,3,7,8,9-HxCDD, 1,2,3,4,7,8-HxCDD, and 2,3,4,7,8-PeCDF - (J-12) high bias

Reported Results

All samples were analyzed at various dilution factors. The lower dilution factors were used by the laboratory to reduce the effects of interference present in the samples. When analyte concentrations were greater than the calibrated linear range of the instrument, the laboratory reanalyzed the samples at higher dilution factors. In all cases, the laboratory reported only the most appropriate positive result for each compound, from either the original or diluted analysis. No further action was necessary.

SDG WG35790: The dry weights of Samples SQ1B-021111-S and SQ2B-021111-S were not recorded prior to extraction. The laboratory removed these samples from the analytical batch. The samples were analyzed at the request of NewFields and submitted in SDG WG36100.

Compound Identification

All results for 2,3,7,8-TCDF were confirmed on a DB-225 column as required by the method. Although the 2,3,7,8-TCDF results from both columns were reported in the raw data, only the results from the DB-225 column were reported in the EDD. No action was necessary.

The laboratory assigned K-flags to numerous values to indicate that the criterion for ion abundance ratio was not met. Since the ion abundance ratio is the primary identification criterion for high resolution mass spectroscopy (HRMS), an outlier indicates that the reported value may be a false positive or estimated maximum possible concentration (EMPC). All laboratory K-flagged results were qualified as not detected (U-22) at the reported value.

Calculation Verification

Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical method. With the exceptions noted above, accuracy was acceptable as demonstrated by the labeled compound, SRM, and OPR recovery values. Precision within each batch could not be assessed.

Data were qualified as not detected due to ion ratio criteria outliers. Data were estimated due to SRM recovery outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Metals by Methods 6010B and 7470A

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Blank	EPA Stage 2A
SH33	1 Sediment	EPA Stage 2B
SJ02	4 Sediment	EPA Stage 2B
SL23	1 Sediment	EPA Stage 2B
SL81	2 Sediment	EPA Stage 4
SQ16	4 Sediment	EPA Stage 2B
SS11	1 Sediment	EPA Stage 2B
SU49	2 Sediment	EPA Stage 2B
SW03	2 Sediment	EPA Stage 2B
SW57	3 Sediment	EPA Stage 2B
SX87	1 Sediment	EPA Stage 2B
SY79	2 Sediment	EPA Stage 2B
TA73	1 Sediment	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

2	Sample Receipt, Preservation, and Holding Times	2	Laboratory Duplicates
	Initial Calibration		Interference Check Samples
	Calibration Verification		Serial Dilutions
2	Reporting Limit Standards		ICP-MS Internal Standards
1	Laboratory Blanks		Reporting Limits
1	Field Blanks	1	Reported Results
	Laboratory Control Samples (LCS)	1	Calculation Verification
2	Matrix Spikes (MS)		

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside the control limits, ranging from 1.7° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

SDG SQ16: All mercury samples were analyzed after the 28 day holding time had expired. All mercury results were estimated (J-1) to indicate potential a low bias.

Reporting Limit Standards

SDG SW03: The second reporting limit (RL) standard recovery for silver (132.7%) was greater than the upper control limit of 130%. The silver result in one associated field sample was estimated (J-14) to indicate a potential positive bias.

Laboratory Blanks

SDG SY79: Copper contamination was noted in the third instrument blank sample for 6010B analysis. No field sample results were associated with this outlier; no data were qualified.

Field Blanks

SDG RY37: One equipment blank, AST-FILTER-ER, was submitted. Positive results for copper and zinc were reported in AST-FILTER-ER. In order to determine the effect on the field samples, action levels were established at 5X the copper and zinc concentrations. All copper and zinc results in the sediment samples were greater than the action levels and no data were qualified.

Matrix Spikes

With the exceptions noted below, matrix spikes (MS) were analyzed at the proper frequency and recoveries were within the control limits of 75%-125%. For recoveries less than the lower control limit, results in the associated samples were estimated (J/UJ-8) to indicate a potential low bias. If the recovery was also less than 30%, then the result from the post-digestion spike was also evaluated. For recoveries greater than the upper control limit, positive results only in the associated samples were estimated (J-8) to indicate a potential high bias. No action was taken if the native concentration in the samples was greater than four times the spike added.

SDGs RY37, SH33, SL81, SU49, SW03, SW57, & SY79: MS samples were not analyzed due to insufficient sample mass. The laboratory control samples (LCS) were used to evaluate precision.

SDG SQ16: The MS percent recovery (%R) value for mercury (157%) was greater than the upper control limit of 125%. All mercury results in the associated samples were estimated (J/UJ-8) to indicate a potential high bias.

SDG SS11: The MS %R value for zinc (25.6%) was less than the lower control limit of 75%. A post digest spike sample was analyzed and the resulting zinc %R (99.4%) was within control limits. The zinc result in the associated field sample was estimated (J-8) to indicate a potential low bias.

SDG TA73: The MS %R values for copper (179%) and mercury (832%) were greater than the upper control limit of 125%. The copper and mercury results in the associated field sample were estimated (J-8) to indicate a potential high bias.

Laboratory Duplicates

The laboratory duplicate relative percent difference (RPD) control limit is 20% for results greater than 5x the RL. For results less than 5x the RL, the difference between the sample and duplicate must be less than 2x the RL. For laboratory precision outliers, results in the associated samples were estimated (J/UJ-9). The following outliers were noted:

SDGs RY37, SH33, SL81, SU49, SW03, SW57, & SY79: Laboratory duplicate analyses were not performed due to insufficient sample mass.

SDG SQ16: The results for silver were less than 5x the RL and the difference between the sample and duplicate was greater than 2x the RL. All silver results in the associated samples were estimated (J/UJ-9).

SDG SS11: The RPD values for chromium (46.9%) and lead (86.9%) were greater than the control limit of 20%. The chromium and lead results in the associated field sample were estimated (J-9).

SDG TA73: The RPD values for chromium (24.0%) and copper (28.0%) were greater than the control limit of 20%. The chromium and copper results in the associated field sample were estimated (J-9).

Reported Results

Several samples were not analyzed due to insufficient sample volume. The samples whose analyses were cancelled are listed below.

SDG SH33: Samples SQ1A-020211-S and SQ2A-020211-S were not analyzed.

SDG SL23: Sample DK2A-030111-S was not analyzed.

SDG SL81: Sample SQ2A-030411-S was not analyzed.

SDG SQ16: Samples DK1-011911-T, DK4-011911-T, SQ1-011911-T, and SQ4-011911-T were not analyzed.

SDG SW03: All samples, except for SQ1-050511-BT and DK1-050511-BT, were cancelled for metals analysis.

SDG SW57: Sample DK1A-051111-S was not analyzed.

SDG SX87: Sample DK3A-052011-S was not analyzed.

SDG SY79: Samples SQ3A-052511-S, SQ4A-052511-S, and DK2A-052511-S were not analyzed.

Calculation Verification

SDG SL81: Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. With the exceptions noted above, accuracy was acceptable, as demonstrated by the LCS and MS sample recoveries. Precision was acceptable as demonstrated by the laboratory duplicate RPD values, with the exceptions previously noted.

Data were estimated due to holding time outliers, a reporting limit standard recovery outlier, MS recovery outliers, and laboratory duplicate precision outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Total and Dissolved Metals by Methods 6010B, 200.8, &7470A

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory and field quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
RY37	1 Equipment Blank	EPA Stage 2A
SF68	1 Stormwater	EPA Stage 2B
SF70	1 Stormwater (LL Hg only)	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SG56	3 Stormwater (LL Hg only)	EPA Stage 2B
SH24	4 Stormwater	EPA Stage 2B
SH25	4 Stormwater (LL Hg only)	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SI90	3 Stormwater (LL Hg only)	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL24	2 Stormwater (LL Hg only)	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SL83	4 Stormwater (LL Hg only)	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SN47	4 Stormwater (LL Hg only)	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR08	4 Stormwater (LL Hg only)	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
SR23	1 Stormwater (LL Hg only)	EPA Stage 2B
ST39	4 Stormwater	EPA Stage 4
ST40	4 Stormwater (LL Hg only)	EPA Stage 4
SU45	3 Stormwater	EPA Stage 2B
SU46	3 Stormwater (LL Hg only)	EPA Stage 2B
SU47	2 Stormwater	EPA Stage 2B
SU48	2 Stormwater (LL Hg only)	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SU99	2 Stormwater (LL Hg only)	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SW61	1 Stormwater (LL Hg only)	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SX88	2 Stormwater (LL Hg only)	EPA Stage 2B
SY66	4 Stormwater	EPA Stage 2B
SY67	4 Stormwater (LL Hg only)	EPA Stage 2B

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed below.

1	Sample Receipt, Preservation, and Holding Times	1	Laboratory Duplicates
	Initial Calibration	2	Interference Check Samples
1	Calibration Verification		Serial Dilutions
2	Reporting Limit Standards		ICP-MS Internal Standards
	Laboratory Blanks		Reporting Limits
1	Field (Equipment Rinsate) Blanks	1	Reported Results
	Laboratory Control Samples (LCS)	1	Calculation Verification
1	Matrix Spikes (MS)		

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside the control limits, ranging from 0.6° to 15.1°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Calibration Verification

SDG SI89: Three continuous calibration verification (CCV) standard recoveries for selenium (113.8%, 112.7%, & 111.7%) were greater than the upper control limit of 110%. Selenium was not detected in the associated field samples; therefore no qualification of data was necessary based on the potential high bias.

SDG SN46: One CCV standard recovery for selenium (111.8%) was greater than the upper control limit of 110%. Selenium was not detected in the associated field samples; therefore no qualification of data was necessary based on the potential high bias.

Reporting Limit Standards

SDG SF70: The reporting limit (RL) standard recovery for mercury (178%) was greater than the upper control limit of 130%. Mercury was not detected in the associated samples; no qualification of data was necessary based on the potential high bias.

SDG SU45: The RL standard recovery for mercury (140%) was greater than the upper control limit of 130%. Mercury concentrations were greater than twice the RL in the associated samples; no qualification of data was necessary based on the potential high bias.

SDG SU47: The RL standard recovery for mercury (140%) was greater than the upper control limit of 130%. Mercury was not detected in the associated samples; no qualification of data was necessary based on the potential high bias.

SDG SX87: The RL standard recovery for selenium (64.0%) was less than the lower control limit of 70%. Selenium was not detected in the associated samples. Associated selenium results were estimated (UJ-14) to indicate a potential low bias.

Field (Equipment Rinsate) Blanks

SDG RY37: One equipment blank, AST-ISCO-ER, was submitted. No positive results were reported for Sample AST-ISCO-ER.

Matrix Spike

Matrix spike samples (MS) were not analyzed due to insufficient sample volume. The laboratory control sample (LCS) was used to evaluate laboratory accuracy.

Laboratory Duplicates

Laboratory duplicate samples were not analyzed due to insufficient sample volume. Laboratory precision could not be assessed.

ICP Interference Check Samples

SDGs SH24: The interference check sample analyses (ICSAB) %R value was greater than the upper control limit for zinc, at 126.5%. All zinc results were estimated (J-17) to indicate a high bias.

SDG SI89: The ICSAB %R value was greater than the upper control limit for zinc, at 123.5%. All associated zinc results were estimated (J-17) to indicate a high bias.

SDG SL23: The ICSAB %R value was greater than the upper control limit for zinc, at 120.5%. All associated zinc results were estimated (J-17) to indicate a high bias.

Reported Results

SDG SY66 & SY67: There was insufficient sample to perform metals analysis on sample SQ4-052511-W.

Calculation Verification

SDGs ST39 & ST40: Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the LCS recoveries. Laboratory precision could not be evaluated.

Data were estimated based on a reporting limit standard %R and ICP interference check sample %R outliers.

All data, as qualified, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Conventionals Analyses

This report documents the review of analytical data from the analysis of sediment samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
SH33	1 Sediment	EPA Stage 2B
SJ02	4 Sediment	EPA Stage 2B
SL23	1 Sediment	EPA Stage 2B
SL81	2 Sediment	EPA Stage 2B
SQ16	4 Sediment	EPA Stage 2B
SR07	2 Sediment	EPA Stage 2B
SW03	10 Sediment	EPA Stage 2B
SW57	3 Sediment	EPA Stage 2B
SY79	2 Sediment	EPA Stage 2B
TA73	1 Sediment	EPA Stage 2B

The analytical tests that were performed are summarized below.

Parameter	Method
Grain Size	PSEP
Total Solids	EPA 160.3M
Total Organic Carbon (SDGs SR07, SW03, & TA73 only)	Plumb, 1981

I. DATA PACKAGE COMPLETENESS

The laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1	Sample Receipt, Preservation, and Holding Times	1	Reference Materials
	Initial Calibration		Matrix Spikes (MS)
	Calibration Verification	1	Laboratory Duplicates
	Laboratory Blanks		Reporting Limits
	Laboratory Control Samples (LCS)	1	Reported Results

[1] ***Quality control results are discussed below, but no data were qualified.***
[2] ***Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.***

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside control limits, ranging from 0.6° to 9.6°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Reference Materials

SDGs SR07 & SW03: The standard reference material NIST 1941B was analyzed for total organic carbon (TOC). All recoveries were within the certified acceptance ranges.

Laboratory Duplicates

SDG SH33, SJ02, SL81, SQ16, SR07, SW03, SW57, & SY79: Laboratory duplicate samples were not performed due to insufficient sample size. Laboratory precision could not be evaluated.

Reported Results

Several samples could not be analyzed for all requested parameters due to insufficient sample volume. The samples with cancelled analyses are listed below.

SDG SH33: Sample SQ3A-020211-S was not analyzed for grain size. No parameters were analyzed for Samples SQ1A-020211-S and SQ2A-020211-S.

SDG SJ02: Samples SQ1A-021111-S and SQ2A-021111-S were not analyzed for grain size.

SDG SL23: No parameters were analyzed for Sample DK2A-030111-S.

SDG SL81: Sample SQ2A-030411-S was not analyzed for total solids. All samples were cancelled for grain size analysis.

SDG SQ16: Samples DK1-011911-T, DK4-011911-T, SQ1-011911-T, and SQ4-011911-T were not analyzed for grain size.

SDG SW03: All samples except for SQ1-050511-BT and DK1-050511-BT were cancelled for grain size analysis.

SDG SW57: No parameters were analyzed for Sample DK1A-051111-S.

SDG SY79: Samples SQ3A-052511-S, SQ4A-052511-S, and DK2A-052511-S were not analyzed for total solids. All samples were cancelled for grain size analysis.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the laboratory control sample and matrix spike recoveries. Precision was acceptable as demonstrate by the laboratory duplicate relative percent difference values.

No data were qualified for any reason.

All data, as reported, are acceptable for use.

DATA VALIDATION REPORT
Lower Duwamish Waterway - Accelerated Source Tracing Study
Conventionals Analyses

This report documents the review of analytical data from the analysis of stormwater samples and the associated laboratory quality control (QC) samples. Samples were analyzed by Analytical Resources, Inc., Tukwila, Washington. See the **Sample Index** for a complete list of samples.

SDG	Number of Samples	Validation Level
SF68	1 Stormwater	EPA Stage 2B
SG55	3 Stormwater	EPA Stage 2B
SH24	8 Stormwater	EPA Stage 2B
SI89	3 Stormwater	EPA Stage 2B
SL23	2 Stormwater	EPA Stage 2B
SL82	4 Stormwater	EPA Stage 2B
SN46	4 Stormwater	EPA Stage 2B
SR07	4 Stormwater	EPA Stage 2B
SR22	1 Stormwater	EPA Stage 2B
ST39	4 Stormwater	EPA Stage 3
SU45	4 Stormwater	EPA Stage 2B
SU47	2 Stormwater	EPA Stage 2B
SU98	2 Stormwater	EPA Stage 2B
SW57	1 Stormwater	EPA Stage 2B
SX87	2 Stormwater	EPA Stage 2B
SY66	5 Stormwater	EPA Stage 2B

The analytical tests that were performed are summarized below.

Parameter	Method
pH	EPA 150.1
Alkalinity	SM 2320
Total Suspended Solids	EPA 160.2
Chloride	EPA 150.1
N-Nitrate	EPA 150.1
Sulfate	EPA 150.1
Total Organic Carbon	EPA 415.1
Dissolved Organic Carbon	EPA 415.1
Hardness	SW6010B

I. DATA PACKAGE COMPLETENESS

With the exceptions below, the laboratory submitted all required deliverables. The laboratory followed adequate corrective action processes and all anomalies were discussed in the case narrative.

SDG SR22 & SX87: The raw data did not include the initial calibration for the anions analyses. The information was obtained from SDG SU98 and no further action was necessary.

SDG SY66: The raw data did not contain the initial calibration for the anions analyses. The laboratory was contacted and the required information was submitted. No further action was necessary.

II. EDD TO HARDCOPY VERIFICATION

A complete (100%) verification of the electronic data deliverable (EDD) results was performed by comparison to the hardcopy laboratory data package. No errors were found.

III. TECHNICAL DATA VALIDATION

The QC requirements that were reviewed are listed in the following table.

1	Sample Receipt, Preservation, and Holding Times	1	Matrix Spikes (MS)
	Initial Calibration	1	Laboratory Duplicates
	Calibration Verification		Reporting Limits
2	Laboratory Blanks	1	Reported Results
	Laboratory Control Samples (LCS)	1	Calculation Verification
1	Reference Materials		

[1] Quality control results are discussed below, but no data were qualified.
[2] Quality control outliers that impact the reported data were noted. Data qualifiers were issued as discussed below.

Sample Receipt, Preservation, and Holding Times

As stated in validation guidance documents, sample shipping coolers should arrive at the laboratory within the advisory temperature range of 2° to 6°C. The laboratory received sample coolers with temperatures outside control limits, ranging from 0.6° to 11.0°C. Where temperatures were greater than the upper control limit, it was noted that the samples were received within six hours of collection and there was insufficient time for the samples temperature to equilibrate with the ice used as a preservative. These temperature outliers did not impact data quality and no qualifiers were assigned.

Laboratory Blanks

To assess the impact of each blank contaminant on the reported sample results, an action level is established at five times (5x) the concentration detected in the blank. If a contaminant is detected in an associated field sample and the concentration is less than the action level, the result is qualified (U-7) at the reported concentration to indicate an elevation of the reporting limit. No action is taken if the sample result is greater than the action level or for non-detected results.

Various target analytes were detected in the method or instrument blanks, however only the following analytes required qualification based on blank contamination.

SDGs SL23, SL82, SU45, SU47: nitrate – not detected (U-7)

Reference Materials

The standard reference material ERA #P114506 was analyzed for alkalinity. The reference materials ERA #230109 and ERA #220109 were analyzed for chloride and sulfate. The standard reference material ERA #09127 was analyzed for N-nitrate. The standard reference material ERA #0513-10-06 was analyzed for total organic carbon (TOC) and dissolved organic carbon (DOC). All recoveries were within the certified acceptance ranges.

Matrix Spikes

SDGs SF68, SG55, SI89, SL82, SN46, SR07, ST39, SU45, SU47, SU98, SX87, SY66: Matrix spike samples (MS) were not analyzed for hardness analysis by 6010B due to insufficient sample volume. The laboratory control sample (LCS) was used to evaluate laboratory accuracy.

SDG SU45: MS analyses were only performed for TOC and DOC.

SDG SW57: MS samples were not analyzed for nitrate and sulfate analyses due to insufficient volume.

Laboratory Duplicates

SDGs SF68, SG55, SH24, SI89, SL82, SN46, SR07, ST39, SU45, SU47, SU98, SW57, SX87, & SY66: Laboratory duplicate samples were not analyzed for hardness analysis due to insufficient sample volume. Laboratory precision could not be assessed.

SDG SH24: Laboratory duplicate samples were not analyzed for total suspended solids (TSS).

SDG SU45: Laboratory duplicate samples were not analyzed for chloride, nitrate, and sulfate analysis.

SDG SW57: Laboratory duplicate samples were not analyzed for nitrate and sulfate analyses due to insufficient sample volume.

Reported Results

SDGs ST39: Sample SQ2-042111-W was received by the laboratory in a cracked carboy. The carboy broke during sample reception. A limited amount of sample volume was retained and analysis of Sample SQ2-042111-W was limited to TSS.

SDG SY66: There was insufficient sample to perform all analyses on sample SQ4-052511-W. Only total suspended solids analysis was performed on this sample.

Calculation Verification

SDG ST39: Several results were verified by recalculation from the raw data. No calculation or transcription errors were noted.

IV. OVERALL ASSESSMENT

As was determined by this evaluation, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the LCS, reference material, and MS sample recoveries. Precision was acceptable as demonstrated by the laboratory duplicate relative percent difference values.

Data were qualified as not detected due to laboratory blank contamination.

All data, as qualified, are acceptable for use.

EcoChem, INC.
Environmental Data Quality

APPENDIX A
DATA QUALIFIER DEFINITIONS
REASON CODES
AND CRITERIA TABLES

DATA VALIDATION QUALIFIER CODES
Based on National Functional Guidelines

The following definitions provide brief explanations of the qualifiers assigned to results in the data review process.

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.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents the approximate concentration.
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.

The following is an EcoChem qualifier that may also be assigned during the data review process:

DNR	Do not report; a more appropriate result is reported from another analysis or dilution.

DATA QUALIFIER REASON CODES

1	Holding Time/Sample Preservation
2	Chromatographic pattern in sample does not match pattern of calibration standard.
3	Compound Confirmation
4	Tentatively Identified Compound (TIC) (associated with NJ only)
5A	Calibration (initial)
5B	Calibration (continuing)
6	Field Blank Contamination
7	Lab Blank Contamination (e.g., method blank, instrument, etc.)
8	Matrix Spike(MS & MSD) Recoveries
9	Precision (all replicates)
10	Laboratory Control Sample Recoveries
11	A more appropriate result is reported (associated with "R" and "DNR" only)
12	Reference Material
13	Surrogate Spike Recoveries (a.k.a., labeled compounds & recovery standards)
14	Other (define in validation report)
15	GFAA Post Digestion Spike Recoveries
16	ICP Serial Dilution % Difference
17	ICP Interference Check Standard Recovery
18	Trip Blank Contamination
19	Internal Standard Performance (e.g., area, retention time, recovery)
20	Linear Range Exceeded
21	Potential False Positives
22	Elevated Detection Limit Due to Interference (i.e., laboratory, chemical and/or matrix)

EcoChem Validation Guidelines for Volatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C±2°C Water: HCl to pH < 2	J(+)/UJ(-) if greater than 6 deg. C **(EcoChem PJ)**	1
Hold Time	Waters: 14 days preserved 7 Days: unpreserved (for aromatics) Solids: 14 Days	J(+)/UJ(-) if hold times exceeded If exceeded by > 3X HT: J(+)/R(-) **(EcoChem PJ)**	1
Tuning	BFB Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	**(EcoChem PJ, see TM-06)** J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	**(EcoChem PJ, see TM-06)** If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	**(EcoChem PJ, see TM-06)** If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Storage Blank	One per SDG <CRQL	U(+) the specific analyte(s) results in all assoc.samples using the 5x or 10x rule	7
Trip Blank	Frequency as per project QAPP	Same as method blank for positive results remaining in trip blank after method blank qualifiers are assigned	18
Field Blanks (if required in QAPP)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Volatile Analysis by GC/MS (Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% **PJ if only one %R outlier**	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS *low conc. H2O VOA*	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS *regular VOA (H2O & solid)*	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% **(EcoChem PJ)**	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Added to all samples Within method control limits	J(+) if %R >UCL J(+)/UJ(-) if %R <LCL but >10% **(see PJ[1])** J(+)/R(-) if <10%	13
Internal Standard (IS)	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, **narrate and Notify PM**	19
Field Duplicates	**Use QAPP limits. If no QAPP:** Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (if either result < 5X RL)	Narrate and qualify if required by project **(EcoChem PJ)**	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants **See Technical Director for ID issues**	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	**See Technical Director if outliers**	14 21 (false +)

PJ[1] No action if there are 4+ surrogates and only 1 outlier.

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	<u>Water</u>: J(+)/UJ(-) if ext. > 7 and < 21 days J(+)/R(-) if ext > 21 days (EcoChem PJ) <u>Solids/Wastes</u>: J(+)/UJ(-) if ext. > 14 and < 42 days J(+)/R(-) if ext. > 42 days (EcoChem PJ) J(+)/UJ(-) if analysis >40 days	1
Tuning	DFTPP Beginning of each 12 hour period Method acceptance criteria	R(+/-) all analytes in all samples associated with the tune	5A
Initial Calibration (Minimum 5 stds.)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5A
	%RSD < 30%	(EcoChem PJ, see TM-06) J(+) if %RSD > 30%	5A
Continuing Calibration (Prior to each 12 hr. shift)	RRF > 0.05	(EcoChem PJ, see TM-06) If MDL= reporting limit: J(+)/R(-) if RRF < 0.05 If reporting limit > MDL: note in worksheet if RRF <0.05	5B
	%D <25%	(EcoChem PJ, see TM-06) If > +/-90%: J+/R- If -90% to -26%: J+ (high bias) If 26% to 90%: J+/UJ- (low bias)	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample (+) result is less than CRQL and less than appropriate 5X or 10X rule (raise sample value to CRQL)	7
		U(+) if sample (+) result is greater than or equal to CRQL and less than appropriate 5X and 10X rule (at reported sample value)	7
	No TICs present	R(+) TICs using 10X rule	7
Field Blanks (Not Required)	No results > CRQL	Apply 5X/10X rule; U(+) < action level	6

EcoChem Validation Guidelines for Semivolatile Analysis by GC/MS
(Based on Organic NFG 1999)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One per matrix per batch Use method acceptance criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One per matrix per batch Use method acceptance criteria	J(+) in parent sample if RPD > CL	9
LCS low conc. H2O SVOA	One per lab batch Within method control limits	J(+) assoc. cmpd if > UCL J(+)/R(-) assoc. cmpd if < LCL J(+)/R(-) all cmpds if half are < LCL	10
LCS regular SVOA (H2O & solid)	One per lab batch Lab or method control limits	J(+) if %R > UCL J(+)/UJ(-) if %R <LCL J(+)/R(-) if %R < 10% (EcoChem PJ)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	Minimum of 3 acid and 3 base/neutral compounds Use method acceptance criteria	Do not qualify if only 1 acid and/or 1 B/N surrogate is out unless <10% J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) if %R < 10%	13
Internal Standards	Added to all samples Acceptable Range: IS area 50% to 200% of CCAL area RT within 30 seconds of CC RT	J(+) if > 200% J(+)/UJ(-) if < 50% J(+)/R(-) if < 25% RT>30 seconds, narrate and Notify PM	19
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
TICs	Major ions (>10%) in reference must be present in sample; intensities agree within 20%; check identification	NJ the TIC unless: R(+) common laboratory contaminants See Technical Director for ID issues	4
Quantitation/ Identification	RRT within 0.06 of standard RRT Ion relative intensity within 20% of standard All ions in std. at > 10% intensity must be present in sample	See Technical Director if outliers	14 21 (false +)

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature	4°C ±2°	J(+)/UJ(-) if greater than 6 deg. C (EcoChem PJ)	1
Holding Time	Water: 7 days from collection Soil: 14 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext/analyzed > HT J(+)/R(-) if ext/analyzed > 3X HT (EcoChem PJ)	1
Resolution Check	Beginning of ICAL Sequence Within RTW Resolution >90%	Narrate (Use Professional Judgement to qualify)	14
Instrument Performance (Breakdown)	DDT Breakdown: < 20% Endrin Breakdown: <20% Combined Breakdown: <30% Compounds within RTW	J(+) DDT NJ(+) DDD and/or DDE R(-) DDT - If (+) for either DDE or DDD J(+) Endrin NJ(+) EK and/or EA R(-) Endrin - If (+) for either EK or EA	5A
Retention Times	Surrogates: TCX (+/- 0.05); DCB (+/- 0.10) Target compounds: elute before heptachlor epoxide (+/- 0.05) elute after heptachlor epoxide (+/- 0.07)	NJ(+)/R(-) results for analytes with RT shifts For full DV, use PJ based on examination of raw data	5B
Initial Calibration	Pesticides: Low=CRQL, Mid=4X, High=16X Multiresponse - one point Calibration %RSD<20% %RSD<30% for surr; two comp. may exceed if <30% Resolution in Mix A and Mix B >90%	J(+)/UJ(-)	5A
Continuing Calibration	Alternating PEM standard and INDA/INDB standards every 12 hours (each preceeded by an inst. Blank) %D < 25% Resolution >90% in IND mixes; 100% for PEM	J(+)/UJ(-) J(+)R(-) if %D > 90% PJ for resolution	5B
Method Blank	One per matrix per batch No results > CRQL	U(+) if sample result is < CRQL and < 5X rule (raise sample value to CRQL) U(+) if sample result is > or equal to CRQL and < 5X rule (at reported sample value)	7
Instrument Blanks	Analyzed at the beginning of every 12 hour sequence No analyte > 1/2 CRQL	Same as Method Blank	7
Field Blanks	Not addressed by NFG No results > CRQL	Apply 5X rule; U(+) < action level	6

EcoChem Validation Guidelines for Pesticides, PCBs, Herbicides, and Phenol by GC/ECD
(Based on Organic NFG 1999 & EPA SW-846 Methods 8081/8082/8041/8151)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
MS/MSD (recovery)	One set per matrix per batch Method Acceptance Criteria	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	One set per matrix per batch Method Acceptance Criteria	J(+) in parent sample if RPD > CL	9
LCS	One per SDG Method Acceptance Criteria	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
LCS/LCSD *(if required)*	One set per matrix and batch of 20 samples RPD < 35%	J(+)/UJ(-) assoc. cmpd. in all samples	9
Surrogates	TCX and DCB added to every sample %R = 30-150%	J(+)/UJ(-) if both %R = 10 - 60% J(+) if both >150% J(+)/R(-) if any %R <10%	13
Quantitation/ Identification	Quantitated using ICAL calibration factor (CF) RPD between columns <40%	J(+) if RPD = 40 - 60% NJ(+) if RPD >60% EcoChem PJ - See TM-08	3
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results for one sample	11
Sample Clean-up	GPC required for soil samples Florisil required for all samples Sulfur is optional Clean-up standard check %R within CLP limits	J(+)/UJ(-) if %R < LCL J(+) if %R > UCL	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate (Qualifiy if required by project QAPP)	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 4°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Extraction - Water: 30 days from collection *Note:* Under CWA, SDWA, and RCRA the HT for H2O is 7 days* Extraction - Soil: 30 days from collection Analysis: 40 days from extraction	J(+)/UJ(-) if ext > 30 days J(+)/UJ(-) if analysis > 40 Days EcoChem PJ, see TM-05	1
Mass Resolution	>=10,000 resolving power at m/z 304.9824 Exact mass of m/z 380.9760 w/in 5 ppm of theoretical value (380.97410 to 380.97790) . Analyzed prior to ICAL and at the start and end of each 12 hr. shift	R(+/-) if not met	14
Window Defining Mix and Column Performance Mix	Window defining mixture/Isomer specificity std run before ICAL and CCAL Valley < 25% (valley = (x/y)*100%) x = ht. of TCDD y = baseline to bottom of valley For all isomers eluting near 2378-TCDD/TCDF isomers (TCDD only for 8290)	J(+) if valley > 25%	5A (ICAL) 5B (CCAL
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD <30% for labeled compounds (%RSD <35% for labeled compounds under 1613b)	J(+) natives if %RSD > 20%	5A
	Abs. RT of $^{13}C_{12}$-1234-TCDD >25 min on DB5 >15 min on DB-225	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start and end of each 12 hour shift. %D+/-20% for native compounds %D +/-30% for labeled compounds (Must meet limits in Table 6, Method 1613B) (If %Ds in the closing CCAL are w/in 25%/35% the avg RF from the two CCAL may be used to calculate samples per Method 8290, Section 8.3.2.4)	Do not qualify labeled compounds. Narrate in report for labeled compound %D outliers. For native compound %D outliers: 8290: J(+)/UJ(-) if %D = 20% - 75% J(+)/R(-) if %D > 75% 1613: J(+)/UJ(-) if %D is outside Table 6 limits J(+)/R(-) if %D is +/- 75% of Table 6 limit	5B
	Abs. RT of $^{13}C_{12}$-1234-TCDD and ^{13}C12-123789-HxCDD +/- 15 sec of ICAL.	EcoChem PJ, see ICAL section of TM-05	
	RRT of all other compounds must meet Table 2 of 1613B.	EcoChem PJ, see TM-05	
	Ion Abundance ratios within QC limits (Table 8 of method 8290) (Table 9 of method 1613B)	EcoChem PJ, see TM-05	
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Field Blanks (Not Required)	No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	Concentrations must meet limits in Table 6, Method 1613B or lab limits.	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (recovery)	May not analyze MS/MSD %R should meet lab limits.	Qualify parent only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
MS/MSD (RPD)	May not analyze MS/MSD RPD < 20%	J(+) in parent sample if RPD > CL	9

EcoChem Validation Guidelines for Dioxin/Furan Analysis by HRMS
(Based on EPA Reg. 10 SOP, Rev. 2, 1996 & EPA SW-846, Methods 1613b and 8290)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Lab Duplicate	RPD <25% if present.	J(+)/UJ(-) if outside limts	9
Labeled Compounds / Internal Standards	*Method 8290:* %R = 40% - 135% in all samples *Method 1613B:* %R must meet limits specified in Table 7, Method 1613	J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%	13
Quantitation/ Identification	Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5 IA ratios meet limits in Table 9 of 1613B or Table 8 of 8290 RRTs w/in limits in Table 2 of 1613B	If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). if unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).	21
EMPC (estimated maximum possible concentration)	If quantitation idenfication criteria are not met, laboratory should report an EMPC value.	If laboratory correctly reported an EMPC value, qualify with U to indicate that the value is a detection limit.	14
Interferences	PCDF interferences from PCDPE	If both detected, change PCDF result to EMPC	14
Second Column Confirmation	All 2378-TCDF hits must be confirmed on a DB-225 (or equiv) column. All QC specs in this table must be met for the confirmation analysis.	Report lower of the two values. If not performed use PJ (see TM-05).	3
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used	11

EcoChem Validation Guidelines for PBDE Analysis by HRMS
(Based on EPA SW-846, Method 1614, draft, 8/2003)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler/Storage Temperature	Waters/Solids < 6°C Tissues <-10°C	EcoChem PJ, see TM-05	1
Holding Time	Samples : Up to one year if stored in the dark; <6°C for waters; <-10°C for solids/tissues. Extracts: Up to one year if stored in the dark; <-10°C.	J(+)/UJ(-) if HT > 1 year EcoChem PJ, see TM-05	1
Mass Resolution	>=5,000 resolving power at 554.9665 (or other significant fragment between 540 and 580) Analyzed prior to ICAL and at the beginning and end of each 12 hr. shift	R(+/-) if not met	14
Instrument Performance (all ICAL & CCAL)	PBDE209 RT must be >48 minutes Tailing factor for congener 99L in CS-3 standard must be <3.00 (Figure 13 in EPA Method 625; 40 CFR136, Appendix A)	Note in Narrative and use Professional Judgement to qualify	5A (ICAL) 5B (CCAL)
	If PBDEs other than 28, 47, 99, 100, 153, 154, 183, & 209 are to be determined: The valley height between PBDE-49 and PBDE-71 must be <40%. Valley Height = (x / y)*100% x = ht. of valley y = ht of shortest peak	J(+) if valley >40%	
Initial Calibration	Minimum of five standards %RSD < 20% for native compounds %RSD < 35% for labeled compounds (100% for PBDE-209L)	J(+) natives if %RSD > 20%	5A
	Ion Abundance ratios within QC limits (See Table 8 of Method 1614, draft)	EcoChem PJ, see TM-05	
	RRT of all compounds within limits (See Table 2 of Method 1614, draft)	EcoChem PJ, see TM-05	
	S/N ratio > 10 for all native and labeled compounds in CS1 std.	If <10, elevate Det. Limit or R(-)	

EcoChem Validation Guidelines for PBDE Analysis by HRMS
(Based on EPA SW-846, Method 1614, draft, 8/2003)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Continuing Calibration	Analyzed at the start of each 12 hour shift. %D +/-30% for most native compounds %D +/-50% for most labeled compounds (See limits for 209, 209L, and 139L in Table 6 of Method 1614, draft)	Do not qualify labeled compounds. Narrate labeled compound %D outliers in report. For native compound %D outliers: J(+)/UJ(-) natives if %D = 30% - 75% J(+)/R(-) if %D > 75%	5B
	Ion Abundance ratios within QC limits (See Table 8 of Method 1614, draft)	EcoChem PJ, see TM-05	
	RRT of all compounds within limits (See Table 2 of Method 1614, draft)	EcoChem PJ, see TM-05	
	Absolute RTs must be within +/-15 seconds of RT from ICAL		
	S/N ratio > 10	If <10, elevate Det. Limit or R(-)	
Method Blank	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	7
Rinse/Field Blank (if required)	One per matrix per batch No positive results	If sample result <5X action level, qualify U at reported value.	6
LCS / OPR	One per matrix per batch %R Values w/in limits stated in Table 6, Method 1614, draft	J(+) if %R > UCL J(+)/UJ(-) if %R < LCL J(+)/R(-) using PJ if %R <<LCL (< 10%)	10
MS/MSD (if required)	Accuracy: %R values within laboratory limits	Qualify parent sample only unless other QC indicates systematic problems: J(+) if both %R > UCL J(+)/UJ(-) if both %R < LCL J(+)/R(-) if both %R < 10% PJ if only one %R outlier	8
	Precision: RPD < 20%	J(+) in parent sample if RPD > 20%	9
Duplicate (if required)	RPD <25% if present.	J(+)/UJ(-) if outside limts	9

EcoChem Validation Guidelines for PBDE Analysis by HRMS
(Based on EPA SW-846, Method 1614, draft, 8/2003)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Labeled Compounds & Internal Standards	%R Values w/in limits specified in Method 1614, Table 6: 25% - 150% for most compounds; 20% - 200% for PBDE209L 139L (Clean-up Std): 30% - 135%	J(+)/UJ(-) if %R = 10% to LCL J(+) if %R > UCL J(+)/R(-) if %R < 10%	13
Quantitation/ Identification	Ions for analyte, IS, and rec. std. must max w/in 2 sec. S/N >2.5 Ion abundance (IA ratios) must meet limits stated in Table 8 of Method 1614, draft. Relative retention times (RRT) must be w/in limits stated in Table 2 of Method 1614, draft	If RT criteria not met, use PJ (see TM-05) If S/N criteria not met, J(+). if unlabelled ion abundance not met, change to EMPC If labelled ion abundance not met, J(+).	21
Interferences	Lock masses must not deviate +/- 20%	Change result to EMPC	14
Field Duplicates	Use QAPP limits. If no QAPP: Solids: RPD <50% OR absolute diff. < 2X RL (for results < 5X RL) Aqueous: RPD <35% OR absolute diff. < 1X RL (for results < 5X RL)	Narrate and qualify if required by project (EcoChem PJ)	9
Two analyses for one sample	Report only one result per analyte	"DNR" results that should not be used to avoid reporting two results	11

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration Tissues: Frozen	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r > 0.995	J(+)/UJ(-) if r < 0.995 (multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blank (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		(Refer to TM-02 for additional information)
			7

Reporting Limit Standard	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Sb, Pb, Tl)	R(-)/J(+) < 2x RL if %R <50% (< 30% Sb, Pb, Tl) J(+) < 2x RL, UJ(-) if %R 50-69% (30-49% Sb, Pb,Tl) J(+) < 2x RL if %R 130-180% (150-200% Sb, Pb, Tl) R(+) < 2x RL if %R > 180% (200% Sb, Pb, Tl)	14
Interference Check Samples (ICSA/ICSAB)	ICSAB %R 80 - 120% for all spiked elements | ICSA | < MDL for all unspiked elements except: K, Na	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R= 50 to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	

EcoChem Validation Guidelines for Metals Analysis by ICP
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Matrix Spikes	One per matrix per batch 75-125% for samples less than 4x spike level	J(+) if %R > 125% J(+)/UJ(-) if %R < 75% J(+)/R(-) if %R < 30% or J(+)/UJ(-) if Post Spike %R 75-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, spike at twice the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples >RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL (2x RL for solids) qualify all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample conc. > 50x MDL	J(+)/UJ(-) if %D >10% qualify all samples in batch	16
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	180 days from date sampled Frozen tissues - HT extended to 2 years	J(+)/UJ(-) if holding time exceeded	1
Tune	Prior to ICAL monitoring compounds analyzed 5 times wih Std Dev. $\leq$ 5% mass calibration <0.1 amu from True Value Resolution < 0.9 AMU @ 10% peak height or <0.75 amu @ 5% peak height	Use Professional Judgment to evaluate tune J(+)/UJ(-) if tune criteria not met	5A
Initial Calibration	Blank + minimum 1 standard If more than 1 standard, r>0.995	J(+)/UJ(-) if r<0.995 (for multi point cal)	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±10% of true value	J(+)/UJ(-) if %R 75-89% J(+) if %R = 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run ±10% of true value	J(+)/UJ(-) if %R = 75-89% J(+) if %R 111-125% R(+) if %R > 125% R(+/-) if %R < 75%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	After each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRI)	2x RL analyzed beginning of run Not required for Al, Ba, Ca, Fe, Mg, Na, K %R = 70%-130% (50%-150% Co,Mn, Zn)	R(-),(+) < 2x RL if %R < 50% (< 30% Co,Mn, Zn) J(+) < 2x RL, UJ(-) if %R 50-69% (30%-49% Co,Mn, Zn) J(+) < 2x RL if %R 130%-180% (150%-200% Co,Mn, Zn) R(+) < 2x RL if %R > 180% (200% Co, Mn, Zn)	14
Interference Check Samples (ICSA/ICSAB)	Required by SW 6020, but not 200.8 ICSAB %R 80% - 120% for all spiked elements | ICSA | < IDL (MDL) for all unspiked elements	For samples with Al, Ca, Fe, or Mg > ICS levels R(+/-) if %R < 50% J(+) if %R >120% J(+)/UJ(-) if %R = 50% to 79% Use Professional Judgment for ICSA to determine if bias is present see TM-09 for additional details	17
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7

EcoChem Validation Guidelines for Metals Analysis by ICP-MS
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Laboratory Control Sample (LCS)	One per matrix per batch Blank Spike: %R within 80%-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	10
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 75-125% for samples where results do not exceed 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% **or** J(+)/UJ(-) if Post Spike %R 75%-125% Qualify all samples in batch	8
Post-digestion Spike	If Matrix Spike is outside 75-125%, Spike parent sample at 2x the sample conc.	No qualifiers assigned based on this element	
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5 x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9
Serial Dilution	5x dilution one per matrix %D < 10% for original sample values > 50x MDL	J(+)/UJ(-) if %D >10% All samples in batch	16
Internal Standards	Every sample SW6020: 60%-125% of cal blank IS 200.8: 30%-120% of cal blank IS	J (+)/UJ (-) all analytes associated with IS outlier	19
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < AL in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff < RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must fall within range	J values over range	20

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Cooler Temperature and Preservation	Cooler temperature: 4°C ±2° Waters: Nitric Acid to pH < 2 For Dissolved Metals: 0.45um filter & preserve after filtration	EcoChem Professional Judgment - no qualification based on cooler temperature outliers J(+)/UJ(-) if pH preservation requirements are not met	1
Holding Time	28 days from date sampled Frozen tissues: HT extended to 6 months	J(+)/UJ(-) if holding time exceeded	1
Initial Calibration	Blank + 4 standards, one at RL r > 0.995	J(+)/UJ(-) if r<0.995	5A
Initial Calibration Verification (ICV)	Independent source analyzed immediately after calibration %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5A
Continuing Calibration Verification (CCV)	Every ten samples, immediately following ICV/ICB and at end of run %R within ±20% of true value	J(+)/UJ(-) if %R = 65%-79% J(+) if %R = 121-135% R(+/-) if %R < 65% R(+) if %R > 135%	5B

Initial and Continuing Calibration Blanks (ICB/CCB)	after each ICV and CCV
	every ten samples and end of run
	| blank | < IDL (MDL)
		Action level is 5x absolute value of blank conc.
		For (+) blanks, U(+) results < action level
		For (-) blanks, J(+)/UJ(-) results < action level
		refer to TM-02 for additional details
			7

Reporting Limit Standard (CRA)	conc at RL - analyzed beginning of run %R = 70-130%	R(-),(+)<2xRL if %R <50% J(+)<2x RL, UJ(-) if %R 50-69% J(+) <2x RL if %R 130-180% R(+)<2x RL if %R>180%	14
Method Blank	One per matrix per batch (batch not to exceed 20 samples) blank < MDL	Action level is 5x blank concentration U(+) results < action level	7
Laboratory Control Sample (LCS)	One per matrix per batch		10
	Blank Spike: %R within 80-120%	R(+/-) if %R < 50% J(+)/UJ(-) if %R = 50-79% J(+) if %R >120%	
	CRM: Result within manufacturer's certified acceptance range or project guidelines	J(+)/UJ(-) if < LCL, J(+) if > UCL	
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per matrix per batch 5% frequency 75-125% for samples less than 4x spike level	J(+) if %R>125% J(+)/UJ(-) if %R <75% J(+)/R(-) if %R<30% all samples in batch	8
Laboratory Duplicate (or MS/MSD)	One per matrix per batch RPD < 20% for samples > 5x RL Diff < RL for samples > RL and < 5x RL (Diff < 2x RL for solids)	J(+)/UJ(-) if RPD > 20% or diff > RL all samples in batch	9

EcoChem Validation Guidelines for Mercury Analysis by CVAA
(Based on Inorganic NFG 1994 & 2004)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	Blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5x RL: Water: RPD < 35% Solid: RPD < 50% For results < 5x RL: Water: Diff<RL Solid: Diff < 2x RL	J(+)/UJ(-) in parent samples only	9
Linear Range	Sample concentrations must be less than 110% of high standard	J values over range	20

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

<table>
<tr><th>VALIDATION
QC ELEMENT</th><th>ACCEPTANCE CRITERIA</th><th>ACTION</th><th>REASON CODE</th></tr>
<tr><td>Cooler Temperature and Preservation</td><td>Cooler Temperature 4°C ±2°C
Preservation: Method Specific</td><td>Use Professional Judgment to qualify based to qualify for coole temp outliers
J(+)/UJ(-) if preservation requirements not met</td><td>1</td></tr>
<tr><td>Holding Time</td><td>Method Specific</td><td>Professional Judgment
J(+)/UJ(-) if holding time exceeded
J(+)/R(-) if HT exceeded by > 3X</td><td>1</td></tr>
<tr><td>Initial Calibration</td><td>Method specific
r>0.995</td><td>Use professional judgment
J(+)/UJ(-) for r < 0.995</td><td>5A</td></tr>
<tr><td>Initial Calibration Verification (ICV)</td><td>Where applicable to method
Independent source analyzed immediately after calibration
%R method specific, usually 90% - 110%</td><td>R(+/-) if %R significantly < LCL
J(+)/UJ(-) if %R < LCL
J(+) if %R > UCL
R(+) if %R significantly > UCL</td><td>5A</td></tr>
<tr><td>Continuing Cal Verification (CCV)</td><td>Where applicable to method
Every ten samples, immed. following ICV/ICB and end of run
%R method specific, usually 90% - 110%</td><td>R(+/-) if %R significantly < LCL
J(+)/UJ(-) if %R < LCL
J(+) if %R > UCL
R(+) if %R significantly > UCL</td><td>5B</td></tr>
<tr><td>Initial and Continuing Cal Blanks (ICB/CCB)</td><td>Where applicable to method
After each ICV and CCV every ten samples and end of run
| blank| < MDL</td><td>Action level is 5x absolute value of blank conc.
For (+) blanks, U(+) results < action level
For (-) blanks, J(+)/UJ(-) results < action level
refer to TM-02 for additional details</td><td>7</td></tr>
<tr><td>Method Blank</td><td>One per matrix per batch
(not to exceed 20 samples)
blank < MDL</td><td>Action level is 5x absolute value of blank conc.
For (+) blk value, U(+) results < action level
For (-) blk value, J(+)/UJ(-) results < action level</td><td>7</td></tr>
<tr><td rowspan="2">Laboratory Control Sample</td><td>Waters:
One per matrix per batch
%R (80-120%)</td><td>R(+/-) if %R < 50%
J(+)/UJ(-) if %R = 50-79%
J(+) if %R >120%</td><td>10</td></tr>
<tr><td>Soils:
One per matrix per batch
Result within manufacturer's certified acceptance range</td><td>J(+)/UJ(-) if < LCL,
J(+) if > UCL</td><td>10</td></tr>
<tr><td>Matrix Spike</td><td>One per matrix per batch; 5% frequency
75-125% for samples less than 4 x spike level</td><td>J(+) if %R > 125% or < 75%
UJ(-) if %R = 30-74%
R(+/-) results < IDL if %R < 30%</td><td>8</td></tr>
<tr><td>Laboratory Duplicate</td><td>One per matrix per batch
RPD <20% for samples > 5x RL
Diff <RL for samples >RL and <5 x RL
(may use RPD < 35%, Diff < 2X RL for solids)</td><td>J(+)/UJ(-) if RPD > 20% or diff > RL
all samples in batch</td><td>9</td></tr>
</table>

EcoChem Validation Guidelines for Conventional Chemistry Analysis (Based on EPA Standard Methods)

VALIDATION QC ELEMENT	ACCEPTANCE CRITERIA	ACTION	REASON CODE
Field Blank	blank < MDL	Action level is 5x blank conc. U(+) sample values < action level in associated field samples only	6
Field Duplicate	For results > 5X RL: Water: RPD < 35% Solid: RPD < 50% For results < 5 x RL: Water: Diff<RL Solid: Diff < 2X RL	J(+)/UJ(-) in parent samples only	9

EcoChem, INC.
Environmental Data Quality

APPENDIX B
QUALIFIED DATA SUMMARY TABLE

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
RY37	AST-ISCO-ER	RY37D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SF68	DK2-012011-W	SF68A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SF68	DK2-012011-W	SF68A	SW8260C	Methylene Chloride	1.2	ug/l		U	6
SF68	DK2-012011-W	SF68A	SW8270DSIM	2-Methylnaphthalene	0.026	ug/l		J	10
SF68	DK2-012011-W	SF68A	SW8270DSIM	Benzo(a)anthracene	0.03	ug/l		J	10
SF68	DK2-012011-W	SF68A	SW8270DSIM	Chrysene	0.058	ug/l	Q	J	5B
SF68	DK2-012011-W	SF68A	SW8270DSIM	Fluoranthene	0.11	ug/l		J	10
SF68	DK2-012011-W	SF68A	SW8270DSIM	Phenanthrene	0.038	ug/l		J	10
SG55	DK1-012611-W	SG55C	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SG55	DK1-012611-W	SG55C	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SG55	DK1-012611-W	SG55C	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SG55	DK1-012611-W	SG55C	SW8270DSIM	Naphthalene	0.02	ug/l	B	U	7
SG55	DK2-012611-W	SG55D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SG55	DK2-012611-W	SG55D	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SG55	DK2-012611-W	SG55D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SG55	DK2-012611-W	SG55D	SW8270DSIM	Naphthalene	0.025	ug/l	B	U	7
SG55	DK3-012611-W	SG55E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SG55	DK3-012611-W	SG55E	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SG55	DK3-012611-W	SG55E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SG55	DK3-012611-W	SG55E	SW8270DSIM	Naphthalene	0.027	ug/l	B	U	7
SH24	SQ1-020211-W	SH24A	EPA200.8	Zinc	59	ug/l		J	17
SH24	SQ1-020211-W	SH24A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8260C	2-Butanone	5	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SH24	SQ1-020211-W	SH24A	SW8260C	Chloromethane	0.5	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	10
SH24	SQ1-020211-W	SH24A	SW8270DSIM	Naphthalene	0.024	ug/l	B	U	7
SH24	SQ2-020211-W	SH24B	EPA200.8	Zinc	310	ug/l		J	17
SH24	SQ2-020211-W	SH24B	SW8081B	Aldrin	0.34	ug/l	Y	U	22
SH24	SQ2-020211-W	SH24B	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SH24	SQ2-020211-W	SH24B	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SH24	SQ2-020211-W	SH24B	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SH24	SQ2-020211-W	SH24B	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SH24	SQ2-020211-W	SH24B	SW8081B	Heptachlor	0.15	ug/l	Y	U	22
SH24	SQ2-020211-W	SH24B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SH24	SQ3-020211-W	SH24C	EPA200.8	Zinc	15	ug/l		J	17
SH24	SQ3-020211-W	SH24C	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SH24	SQ3-020211-W	SH24C	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SH24	SQ3-020211-W	SH24C	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SH24	SQ3-020211-W	SH24C	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SH24	SQ3-020211-W	SH24C	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SH24	SQ3-020211-W	SH24C	SW8270DSIM	Naphthalene	0.018	ug/l	B	U	7
SH24	SQ4-020211-W	SH24D	EPA200.8	Zinc	13	ug/l		J	17

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SH24	SQ4-020211-W	SH24D	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SH24	SQ4-020211-W	SH24D	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SH24	SQ4-020211-W	SH24D	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SH24	SQ4-020211-W	SH24D	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SH24	SQ4-020211-W	SH24D	SW8082	Aroclor 1232	0.018	ug/l	Y	U	22
SH24	SQ4-020211-W	SH24D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SH24	SQ1-020211-W	SH24E	EPA200.8	Zinc	9	ug/l		J	17
SH24	SQ2-020211-W	SH24F	EPA200.8	Zinc	5	ug/l		J	17
SH24	SQ3-020211-W	SH24G	EPA200.8	Zinc	10	ug/l		J	17
SH24	SQ4-020211-W	SH24H	EPA200.8	Zinc	5	ug/l		J	17
SI89	SQ3-021111-W	SI89E	EPA200.8	Zinc	71	ug/l		J	17
SI89	SQ3-021111-W	SI89E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SI89	SQ3-021111-W	SI89E	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SI89	SQ3-021111-W	SI89E	SW8260C	2-Butanone	5	ug/l	U	UJ	5B,10
SI89	SQ3-021111-W	SI89E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SI89	SQ3-021111-W	SI89E	SW8260C	Acetone	5.2	ug/l	Q	UJ	5B,6
SI89	SQ3-021111-W	SI89E	SW8260C	Chloromethane	0.5	ug/l	U	UJ	10
SI89	SQ3-021111-W	SI89E	SW8260C	Methylene Chloride	1.5	ug/l		U	6
SI89	SQ3-021111-W	SI89E	SW8260C	Toluene	0.2	ug/l		U	6
SI89	SQ3-021111-W	SI89E	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	10
SI89	SQ4-021111-W	SI89F	EPA200.8	Zinc	170	ug/l		J	17
SI89	SQ4-021111-W	SI89F	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SI89	SQ4-021111-W	SI89F	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SI89	SQ4-021111-W	SI89F	SW8260C	2-Butanone	5	ug/l	U	UJ	5B,10
SI89	SQ4-021111-W	SI89F	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SI89	SQ4-021111-W	SI89F	SW8260C	Acetone	5	ug/l	U	UJ	5B
SI89	SQ4-021111-W	SI89F	SW8260C	Chloromethane	0.5	ug/l	U	UJ	10
SI89	SQ4-021111-W	SI89F	SW8260C	Methylene Chloride	5.3	ug/l		U	6
SI89	SQ4-021111-W	SI89F	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	10
SI89	SQ1-021111-W	SI89G	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SI89	SQ1-021111-W	SI89G	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SI89	SQ1-021111-W	SI89G	SW8260C	2-Butanone	5.4	ug/l		UJ	5B,10
SI89	SQ1-021111-W	SI89G	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SI89	SQ1-021111-W	SI89G	SW8260C	Acetone	5	ug/l	U	UJ	5B
SI89	SQ1-021111-W	SI89G	SW8260C	Chloromethane	0.5	ug/l	U	UJ	10
SI89	SQ1-021111-W	SI89G	SW8260C	Methylene Chloride	3	ug/l		U	6
SI89	SQ1-021111-W	SI89G	SW8260C	Toluene	0.3	ug/l		U	6
SI89	SQ1-021111-W	SI89G	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	10
SJ02	SQ1A-021111-S	SJ02I	SW8082	Aroclor 1248	6.2	ug	Y	U	22
SJ02	SQ4A-021111-S	SJ02O	SW8082	Aroclor 1248	2.5	ug	Y	U	22
SL23	DK1-030111-W	SL23D	EPA200.8	Zinc	34	ug/l		J	17
SL23	DK1-030111-W	SL23D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL23	DK1-030111-W	SL23D	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SL23	DK1-030111-W	SL23D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL23	DK1-030111-W	SL23D	SW8260C	Methylene Chloride	2.9	ug/l		U	6
SL23	DK2-030111-W	SL23E	EPA200.8	Zinc	128	ug/l		J	17

QUALIFIED DATA SUMMARY TABLE
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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SL23	DK2-030111-W	SL23E	EPA300.0	Nitrate	0.3	mg/L		U	7
SL23	DK2-030111-W	SL23E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL23	DK2-030111-W	SL23E	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SL23	DK2-030111-W	SL23E	SW8082	Aroclor 1242	0.012	ug/l	Y	U	22
SL23	DK2-030111-W	SL23E	SW8082	Aroclor 1254	0.012	ug/l	Y	U	22
SL23	DK2-030111-W	SL23E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL23	DK2-030111-W	SL23E	SW8260C	Acetone	9.2	ug/l		U	6
SL23	DK2-030111-W	SL23E	SW8260C	Methylene Chloride	4.4	ug/l		U	6
SL23	DK2-030111-W	SL23E	SW8270D	bis(2-Ethylhexyl)phthalate	5	ug/l	B	U	7
SL23	DK1-030111-W	SL23I	EPA200.8	Zinc	19	ug/l		J	17
SL23	DK2-030111-W	SL23J	EPA200.8	Zinc	26	ug/l		J	17
SL82	SQ4-030411-W	SL82E	EPA300.0	Nitrate	0.2	mg/L		U	7
SL82	SQ4-030411-W	SL82E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL82	SQ4-030411-W	SL82E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL82	SQ4-030411-W	SL82E	SW8260C	Acetone	7	ug/l		U	6
SL82	SQ4-030411-W	SL82E	SW8260C	Methylene Chloride	1.3	ug/l		U	6
SL82	SQ4-030411-W	SL82E	SW8270D	bis(2-Ethylhexyl)phthalate	2.3	ug/l	B	U	7
SL82	SQ3-030411-W	SL82F	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL82	SQ3-030411-W	SL82F	SW8082	Aroclor 1248	0.049	ug/l	P	J	3
SL82	SQ3-030411-W	SL82F	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL82	SQ3-030411-W	SL82F	SW8260C	Acetone	11	ug/l		U	6
SL82	SQ3-030411-W	SL82F	SW8260C	Methylene Chloride	2.9	ug/l		U	6
SL82	SQ3-030411-W	SL82F	SW8270D	bis(2-Ethylhexyl)phthalate	1.3	ug/l	B	U	7
SL82	SQ2-030411-W	SL82G	EPA300.0	Nitrate	0.5	mg/L		U	7
SL82	SQ2-030411-W	SL82G	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1016	0.01	ug/l	U	UJ	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1221	0.01	ug/l	U	UJ	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1232	0.01	ug/l	U	UJ	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1242	0.01	ug/l	U	UJ	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1248	0.058	ug/l		J	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1254	0.065	ug/l		J	19
SL82	SQ2-030411-W	SL82G	SW8082	Aroclor 1260	0.043	ug/l	Y	UJ	19,22
SL82	SQ2-030411-W	SL82G	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL82	SQ2-030411-W	SL82G	SW8260C	Acetone	24	ug/l		U	6
SL82	SQ2-030411-W	SL82G	SW8260C	Methylene Chloride	2	ug/l		U	6
SL82	SQ2-030411-W	SL82G	SW8260C	Toluene	0.2	ug/l		U	6
SL82	SQ2-030411-W	SL82G	SW8270D	bis(2-Ethylhexyl)phthalate	1.9	ug/l	B	U	7
SL82	SQ1-030411-W	SL82H	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SL82	SQ1-030411-W	SL82H	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SL82	SQ1-030411-W	SL82H	SW8260C	Acetone	26	ug/l		U	6
SL82	SQ1-030411-W	SL82H	SW8260C	Methylene Chloride	7.5	ug/l		U	6
SL82	SQ1-030411-W	SL82H	SW8260C	Toluene	0.4	ug/l		U	6
SL82	SQ1-030411-W	SL82H	SW8270D	bis(2-Ethylhexyl)phthalate	1.8	ug/l	B	U	7
SN46	SQ1-031511-W	SN46C	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SN46	SQ1-031511-W	SN46C	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SN46	SQ1-031511-W	SN46C	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SN46	SQ1-031511-W	SN46C	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SN46	SQ1-031511-W	SN46C	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1016	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1221	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1232	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1242	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1248	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1254	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8082	Aroclor 1260	0.01	ug/l	U	UJ	19
SN46	SQ1-031511-W	SN46C	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SN46	SQ1-031511-W	SN46C	SW8260C	Methylene Chloride	2.5	ug/l		U	6
SN46	SQ2-031511-W	SN46D	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SN46	SQ2-031511-W	SN46D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SN46	SQ2-031511-W	SN46D	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SN46	SQ2-031511-W	SN46D	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SN46	SQ2-031511-W	SN46D	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SN46	SQ2-031511-W	SN46D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SN46	SQ2-031511-W	SN46D	SW8260C	Methylene Chloride	2.1	ug/l		U	6
SN46	SQ3-031511-W	SN46E	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SN46	SQ3-031511-W	SN46E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SN46	SQ3-031511-W	SN46E	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SN46	SQ3-031511-W	SN46E	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SN46	SQ3-031511-W	SN46E	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SN46	SQ3-031511-W	SN46E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SN46	SQ3-031511-W	SN46E	SW8260C	Acetone	7.1	ug/l		U	6
SN46	SQ3-031511-W	SN46E	SW8260C	Methylene Chloride	2.7	ug/l		U	6
SN46	SQ4-031511-W	SN46F	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SN46	SQ4-031511-W	SN46F	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SN46	SQ4-031511-W	SN46F	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SN46	SQ4-031511-W	SN46F	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SN46	SQ4-031511-W	SN46F	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1016	0.01	ug/l	U	UJ	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1221	0.01	ug/l	U	UJ	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1232	0.01	ug/l	U	UJ	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1242	0.01	ug/l	U	UJ	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1248	0.02	ug/l		J	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1254	0.024	ug/l		J	19
SN46	SQ4-031511-W	SN46F	SW8082	Aroclor 1260	0.018	ug/l		J	19
SN46	SQ4-031511-W	SN46F	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SN46	SQ4-031511-W	SN46F	SW8260C	Methylene Chloride	2.3	ug/l		U	6
SQ16	DK1-011911-T	SQ16A	SW8082	Aroclor 1248	43	ug/kg	U	UJ	5B
SQ16	DK2-011911-T	SQ16B	SW6010B	Silver	1.4	mg/kg		J	9
SQ16	DK2-011911-T	SQ16B	SW7471A	Mercury	0.08	mg/kg		J	1,8
SQ16	DK2-011911-T	SQ16B	SW8082	Aroclor 1248	39	ug/kg		J	5B
SQ16	DK3-011911-T	SQ16C	SW6010B	Silver	0.5	mg/kg	U	UJ	9
SQ16	DK3-011911-T	SQ16C	SW7471A	Mercury	0.12	mg/kg		J	1,8

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SQ16	DK3-011911-T	SQ16C	SW8082	Aroclor 1248	89	ug/kg		J	5B
SQ16	DK4-011911-T	SQ16D	SW8082	Aroclor 1248	270	ug/kg		J	5B
SQ16	SQ1-011911-T	SQ16E	SW8082	Aroclor 1248	100	ug/kg		J	5B
SQ16	SQ2-011911-T	SQ16F	SW6010B	Silver	0.7	mg/kg		J	9
SQ16	SQ2-011911-T	SQ16F	SW7471A	Mercury	1.05	mg/kg		J	1,8
SQ16	SQ3-011911-T	SQ16G	SW6010B	Silver	0.7	mg/kg	U	UJ	9
SQ16	SQ3-011911-T	SQ16G	SW7471A	Mercury	1.01	mg/kg		J	1,8
SQ16	SQ3-011911-T	SQ16G	SW8082	Aroclor 1242	2200	ug/kg		J	13
SQ16	SQ3-011911-T	SQ16G	SW8082	Aroclor 1254	940	ug/kg		J	13
SQ16	SQ4-011911-T	SQ16H	SW8082	Aroclor 1248	260	ug/kg		J	5B
SR07	DK3-040711-W	SR07A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SR07	DK3-040711-W	SR07A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SR07	DK3-040711-W	SR07A	SW8260C	Methylene Chloride	3.6	ug/l		U	6
SR07	DK3-040711-W	SR07A	SW8260C	Toluene	0.2	ug/l		U	6
SR07	DK4-040711-W	SR07B	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SR07	DK4-040711-W	SR07B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SR07	DK4-040711-W	SR07B	SW8260C	Methylene Chloride	4.3	ug/l		U	6
SR07	SQ2-040711-W	SR07C	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SR07	SQ2-040711-W	SR07C	SW8082	Aroclor 1254	0.012	ug/l	Y	U	22
SR07	SQ2-040711-W	SR07C	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SR07	SQ2-040711-W	SR07C	SW8260C	Acetone	5.5	ug/l		U	6
SR07	SQ2-040711-W	SR07C	SW8260C	Methylene Chloride	6.5	ug/l		U	6
SR07	SQ2-040711-W	SR07C	SW8260C	Toluene	0.2	ug/l		U	6
SR07	SQ3-040711-W	SR07D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SR07	SQ3-040711-W	SR07D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SR07	SQ3-040711-W	SR07D	SW8260C	Methylene Chloride	3.4	ug/l		U	6
SR07	DK3-040711-BT	SR07J	SW8081B	delta-BHC	7.9	ug/kg	U	UJ	10
SR07	DK3-040711-BT	SR07J	SW8270D	2,4-Dimethylphenol	260	ug/kg	U	UJ	10
SR22	SQ4-040811-W	SR22A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SR22	SQ4-040811-W	SR22A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SR22	SQ4-040811-W	SR22A	SW8260C	Methylene Chloride	1.3	ug/l		U	6
SS11	DK3-040711-BT	SS11A	SW6010B	Chromium	41.5	mg/kg		J	9
SS11	DK3-040711-BT	SS11A	SW6010B	Lead	41	mg/kg		J	9
SS11	DK3-040711-BT	SS11A	SW6010B	Zinc	266	mg/kg		J	8
ST39	SQ1-042111-W	ST39D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
ST39	SQ1-042111-W	ST39D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
ST39	SQ1-042111-W	ST39D	SW8260C	Methylene Chloride	2.2	ug/l		U	6
ST39	SQ1-042111-W	ST39D	SW8270D	1,2,4-Trichlorobenzene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	1,2-Dichlorobenzene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	1,3-Dichlorobenzene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	1,4-Dichlorobenzene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	1-Methylnaphthalene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	2,4-Dimethylphenol	1	ug/l	U	UJ	10,13
ST39	SQ1-042111-W	ST39D	SW8270D	2-Methylnaphthalene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	2-Methylphenol	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	4-Methylphenol	1	ug/l	U	UJ	13

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
ST39	SQ1-042111-W	ST39D	SW8270D	Acenaphthene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Acenaphthylene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Anthracene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Benzo(a)anthracene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Benzo(a)pyrene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Benzo(g,h,i)perylene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Benzoic Acid	10	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Benzyl Alcohol	5	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	bis(2-Ethylhexyl)phthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Butylbenzylphthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Chrysene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Dibenz(a,h)anthracene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Dibenzofuran	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Diethylphthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Dimethylphthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Di-n-Butylphthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Di-n-Octyl phthalate	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Fluoranthene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Fluorene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Hexachlorobenzene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Hexachlorobutadiene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Hexachloroethane	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Indeno(1,2,3-cd)pyrene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Naphthalene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	N-Nitrosodiphenylamine	1	ug/l	U	UJ	10,13
ST39	SQ1-042111-W	ST39D	SW8270D	Pentachlorophenol	5	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Phenanthrene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Phenol	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Pyrene	1	ug/l	U	UJ	13
ST39	SQ1-042111-W	ST39D	SW8270D	Total Benzofluoranthenes	1	ug/l	U	UJ	13
ST39	SQ3-042111-W	ST39E	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
ST39	SQ3-042111-W	ST39E	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
ST39	SQ3-042111-W	ST39E	SW8260C	Methylene Chloride	2.2	ug/l		U	6
ST39	SQ3-042111-W	ST39E	SW8270D	2,4-Dimethylphenol	1	ug/l	U	UJ	10
ST39	SQ3-042111-W	ST39E	SW8270D	N-Nitrosodiphenylamine	1	ug/l	U	UJ	10
ST39	SQ4-042111-W	ST39F	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
ST39	SQ4-042111-W	ST39F	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
ST39	SQ4-042111-W	ST39F	SW8260C	Methylene Chloride	1.8	ug/l		U	6
ST39	SQ4-042111-W	ST39F	SW8270D	2,4-Dimethylphenol	1	ug/l	U	UJ	10
ST39	SQ4-042111-W	ST39F	SW8270D	N-Nitrosodiphenylamine	1	ug/l	U	UJ	10
ST58	SQ2A-042111-S	ST58A	SW8082	Aroclor 1248	4	ug	Y	U	22
ST58	SQ2A-042111-S	ST58A	SW8082	Aroclor 1260	2.5	ug	Y	U	22
ST58	SQ3A-042111-S	ST58C	SW8082	Aroclor 1260	21	ug	Y	U	22
SU47	DK1-042711-W	SU47A	EPA300.0	Nitrate	0.2	mg/L		U	7
SU47	DK1-042711-W	SU47A	SW8081B	Aldrin	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SU47	DK1-042711-W	SU47A	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	cis-Chlordane	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Dieldrin	0.1	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Endosulfan I	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Heptachlor Epoxide	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	Hexachlorobenzene	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8081B	trans-Chlordane	0.05	ug/l	U	UJ	10
SU47	DK1-042711-W	SU47A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SU47	DK1-042711-W	SU47A	SW8260C	Acetone	5.7	ug/l		U	6
SU47	DK1-042711-W	SU47A	SW8260C	Methylene Chloride	4.9	ug/l		U	6
SU47	DK1-042711-W	SU47A	SW8270D	bis(2-Ethylhexyl)phthalate	1.2	ug/l	B	U	7
SU47	DK1-042711-W	SU47A	SW8270DSIM	Naphthalene	0.037	ug/l	B	U	7
SU47	DK2-042711-W	SU47B	EPA300.0	Nitrate	0.3	mg/L		U	7
SU47	DK2-042711-W	SU47B	SW8081B	Aldrin	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	cis-Chlordane	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Dieldrin	0.1	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Endosulfan I	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Heptachlor Epoxide	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	Hexachlorobenzene	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8081B	trans-Chlordane	0.05	ug/l	U	UJ	10
SU47	DK2-042711-W	SU47B	SW8082	Aroclor 1232	0.012	ug/l	Y	U	22
SU47	DK2-042711-W	SU47B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SU47	DK2-042711-W	SU47B	SW8260C	Acetone	7.4	ug/l		U	6
SU47	DK2-042711-W	SU47B	SW8260C	Methylene Chloride	2.3	ug/l		U	6
SU47	DK2-042711-W	SU47B	SW8270D	bis(2-Ethylhexyl)phthalate	2.7	ug/l	B	U	7
SU47	DK2-042711-W	SU47B	SW8270DSIM	2-Methylnaphthalene	0.01	ug/l	B	U	7
SU47	DK2-042711-W	SU47B	SW8270DSIM	Naphthalene	0.028	ug/l	B	U	7
SU98	DK3-050211-W	SU98A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SU98	DK3-050211-W	SU98A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SU98	DK3-050211-W	SU98A	SW8260C	Acetone	9.6	ug/l		U	6
SU98	DK3-050211-W	SU98A	SW8260C	Methylene Chloride	1.3	ug/l		U	6
SU98	DK3-050211-W	SU98A	SW8270D	2,4-Dimethylphenol	1	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8270D	Dibenzofuran	1	ug/l	U	UJ	10
SU98	DK3-050211-W	SU98A	SW8270D	N-Nitrosodiphenylamine	1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	Endosulfan II	0.1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	Endrin Ketone	0.1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SU98	DK4-050211-W	SU98B	SW8260C	Acetone	10	ug/l		U	6
SU98	DK4-050211-W	SU98B	SW8260C	Methylene Chloride	1	ug/l		U	6
SU98	DK4-050211-W	SU98B	SW8270D	2,4-Dimethylphenol	1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8270D	Dibenzofuran	1	ug/l	U	UJ	10
SU98	DK4-050211-W	SU98B	SW8270D	N-Nitrosodiphenylamine	1	ug/l	U	UJ	10
SU98	DK4A-050211-S	SU98G	SW8082	Aroclor 1232	2	ug	Y	U	22
SW03	SQ1-050511-T	SW03A	SW8270D	2,4-Dimethylphenol	250	ug/kg	U	UJ	10
SW03	SQ1-050511-T	SW03A	SW8270D	Benzoic Acid	590	ug/kg	J	J	5B
SW03	SQ1-050511-T	SW03A	SW8270D	Pentachlorophenol	1300	ug/kg	U	UJ	5B
SW03	SQ2-050511-T	SW03B	SW8270D	2,4-Dimethylphenol	210	ug/kg	U	UJ	10
SW03	SQ2-050511-T	SW03B	SW8270D	Benzoic Acid	1400	ug/kg	J	J	5B
SW03	SQ2-050511-T	SW03B	SW8270D	Pentachlorophenol	1000	ug/kg	U	UJ	5B
SW03	SQ3-050511-T	SW03C	SW8270D	2,4-Dimethylphenol	160	ug/kg	U	UJ	10
SW03	SQ3-050511-T	SW03C	SW8270D	Benzoic Acid	1200	ug/kg	J	J	5B
SW03	SQ3-050511-T	SW03C	SW8270D	Pentachlorophenol	800	ug/kg	U	UJ	5B
SW03	SQ4-050511-T	SW03D	SW8270D	2,4-Dimethylphenol	230	ug/kg	U	UJ	10
SW03	SQ4-050511-T	SW03D	SW8270D	Benzoic Acid	1400	ug/kg	J	J	5B
SW03	SQ4-050511-T	SW03D	SW8270D	Pentachlorophenol	240	ug/kg	J	J	5B
SW03	DK1-050511-T	SW03E	SW8270D	2,4-Dimethylphenol	240	ug/kg	U	UJ	10
SW03	DK1-050511-T	SW03E	SW8270D	Benzo(a)pyrene	530	ug/kg		J	19
SW03	DK1-050511-T	SW03E	SW8270D	Benzo(g,h,i)perylene	440	ug/kg		J	19
SW03	DK1-050511-T	SW03E	SW8270D	Benzoic Acid	1400	ug/kg	J	J	5B
SW03	DK1-050511-T	SW03E	SW8270D	Di-n-Octyl phthalate	710	ug/kg		J	19
SW03	DK1-050511-T	SW03E	SW8270D	Indeno(1,2,3-cd)pyrene	320	ug/kg		J	19
SW03	DK1-050511-T	SW03E	SW8270D	Pentachlorophenol	1200	ug/kg	U	UJ	5B
SW03	DK1-050511-T	SW03E	SW8270D	Total Benzofluoranthenes	1200	ug/kg		J	19
SW03	DK2-050511-T	SW03F	SW8270D	2,4-Dimethylphenol	150	ug/kg	U	UJ	10
SW03	DK2-050511-T	SW03F	SW8270D	Benzoic Acid	660	ug/kg	J	J	5B
SW03	DK2-050511-T	SW03F	SW8270D	Pentachlorophenol	760	ug/kg	U	UJ	5B
SW03	DK3-050511-T	SW03G	SW8270D	1-Methylnaphthalene	64	ug/kg	J	J	19
SW03	DK3-050511-T	SW03G	SW8270D	2,4-Dimethylphenol	120	ug/kg	U	UJ	10
SW03	DK3-050511-T	SW03G	SW8270D	Benzo(a)pyrene	520	ug/kg		J	19

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SW03	DK3-050511-T	SW03G	SW8270D	Benzo(g,h,i)perylene	410	ug/kg		J	19
SW03	DK3-050511-T	SW03G	SW8270D	Benzoic Acid	340	ug/kg	J	J	5B
SW03	DK3-050511-T	SW03G	SW8270D	Dibenz(a,h)anthracene	120	ug/kg		J	19
SW03	DK3-050511-T	SW03G	SW8270D	Di-n-Octyl phthalate	1800	ug/kg		J	19
SW03	DK3-050511-T	SW03G	SW8270D	Indeno(1,2,3-cd)pyrene	300	ug/kg		J	19
SW03	DK3-050511-T	SW03G	SW8270D	Pentachlorophenol	580	ug/kg	U	UJ	5B
SW03	DK3-050511-T	SW03G	SW8270D	Total Benzofluoranthenes	1000	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	2,4-Dimethylphenol	170	ug/kg	U	UJ	10
SW03	DK4-050511-T	SW03H	SW8270D	Benzo(a)pyrene	980	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	Benzo(g,h,i)perylene	940	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	Benzoic Acid	1600	ug/kg	J	J	5B
SW03	DK4-050511-T	SW03H	SW8270D	Dibenz(a,h)anthracene	210	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	Di-n-Octyl phthalate	1600	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	Indeno(1,2,3-cd)pyrene	610	ug/kg		J	19
SW03	DK4-050511-T	SW03H	SW8270D	Pentachlorophenol	840	ug/kg	U	UJ	5B
SW03	DK4-050511-T	SW03H	SW8270D	Total Benzofluoranthenes	2000	ug/kg		J	19
SW03	SQ1-050511-BT	SW03I	SW6010B	Silver	0.8	mg/kg		J	14
SW03	SQ1-050511-BT	SW03I	SW8082	Aroclor 1248	160	ug/kg	Y	U	22
SW03	SQ1-050511-BT	SW03I	SW8270D	2,4-Dimethylphenol	160	ug/kg	U	UJ	10
SW03	SQ1-050511-BT	SW03I	SW8270D	Benzyl Alcohol	160	ug/kg	U	R	10
SW03	DK1-050511-BT	SW03J	SW8270D	2,4-Dimethylphenol	220	ug/kg	U	UJ	10
SW03	DK1-050511-BT	SW03J	SW8270D	Benzyl Alcohol	220	ug/kg	U	R	10
SW57	DK3-051111-W	SW57A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SW57	DK3-051111-W	SW57A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SW57	DK3-051111-W	SW57A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SW57	DK3-051111-W	SW57A	SW8260C	Acetone	5	ug/l		U	6
SW57	DK3-051111-W	SW57A	SW8260C	Methylene Chloride	1.7	ug/l		U	6
SW57	DK1A-051111-S	SW57C	SW8082	Aroclor 1248	1.2	ug	Y	U	22
SX87	DK1-052011-W	SX87A	EPA200.8	Selenium	0.5	ug/l	U	UJ	14
SX87	DK1-052011-W	SX87A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SX87	DK1-052011-W	SX87A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SX87	DK1-052011-W	SX87A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SX87	DK1-052011-W	SX87A	SW8260C	Methylene Chloride	3.7	ug/l		U	6
SX87	DK1-052011-W	SX87A	SW8270DSIM	Naphthalene	0.014	ug/l	B	U	7
SX87	DK3-052011-W	SX87B	EPA200.8	Selenium	0.5	ug/l	U	UJ	14
SX87	DK3-052011-W	SX87B	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SX87	DK3-052011-W	SX87B	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SX87	DK3-052011-W	SX87B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SX87	DK3-052011-W	SX87B	SW8260C	Methylene Chloride	4.9	ug/l		U	6
SX87	DK3-052011-W	SX87B	SW8270DSIM	Naphthalene	0.015	ug/l	B	U	7
SX87	DK1-052011-W	SX87C	EPA200.8	Selenium	0.5	ug/l	U	UJ	14
SX87	DK3-052011-W	SX87D	EPA200.8	Selenium	0.5	ug/l	U	UJ	14
SX87	DK3A-052011-S	SX87E	SW8082	Aroclor 1248	1	ug	Y	U	22
SY66	DK1-052511-W	SY66A	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SY66	DK1-052511-W	SY66A	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SY66	DK1-052511-W	SY66A	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
SY66	DK1-052511-W	SY66A	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SY66	DK1-052511-W	SY66A	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SY66	DK1-052511-W	SY66A	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SY66	DK1-052511-W	SY66A	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SY66	DK1-052511-W	SY66A	SW8260C	Acetone	14	ug/l	Q	U	6
SY66	DK1-052511-W	SY66A	SW8260C	Acrolein	5	ug/l	U	UJ	5B
SY66	DK1-052511-W	SY66A	SW8260C	Methylene Chloride	2.4	ug/l		U	6
SY66	DK1-052511-W	SY66A	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	5B,10
SY66	SQ1-052511-W	SY66B	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SY66	SQ1-052511-W	SY66B	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SY66	SQ1-052511-W	SY66B	SW8260C	Acrolein	5	ug/l	U	UJ	5B
SY66	SQ1-052511-W	SY66B	SW8260C	Methylene Chloride	2.8	ug/l		U	6
SY66	SQ1-052511-W	SY66B	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	5B,10
SY66	SQ2-052511-W	SY66C	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SY66	SQ2-052511-W	SY66C	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SY66	SQ2-052511-W	SY66C	SW8260C	Acetone	12	ug/l	Q	U	6
SY66	SQ2-052511-W	SY66C	SW8260C	Acrolein	5	ug/l	U	UJ	5B
SY66	SQ2-052511-W	SY66C	SW8260C	Methylene Chloride	2.6	ug/l		U	6
SY66	SQ2-052511-W	SY66C	SW8260C	Toluene	0.6	ug/l		U	6
SY66	SQ2-052511-W	SY66C	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	5B,10
SY66	SQ3-052511-W	SY66D	SW8081B	alpha-BHC	0.05	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8081B	beta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8081B	delta-BHC	0.05	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8081B	Endosulfan Sulfate	0.1	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8081B	gamma-BHC (Lindane)	0.05	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8081B	Heptachlor	0.05	ug/l	U	UJ	10
SY66	SQ3-052511-W	SY66D	SW8260C	2-Chloroethylvinylether	1	ug/l	U	R	1
SY66	SQ3-052511-W	SY66D	SW8260C	Acetone	24	ug/l	Q	U	6
SY66	SQ3-052511-W	SY66D	SW8260C	Acrolein	5	ug/l	U	UJ	5B
SY66	SQ3-052511-W	SY66D	SW8260C	Methylene Chloride	3.6	ug/l		U	6
SY66	SQ3-052511-W	SY66D	SW8260C	Toluene	0.7	ug/l		U	6
SY66	SQ3-052511-W	SY66D	SW8260C	Vinyl Acetate	1	ug/l	U	UJ	5B,10
SY79	SQ1A-052511-S	SY79A	SW8082	Aroclor 1248	4.5	ug	Y	U	22
SY79	DK2A-052511-S	SY79M	SW8082	Aroclor 1260	2.6	ug	P	NJ	3
TA73	SQ1-061511-BT	TA73A	SW6010B	Chromium	33	mg/kg		J	9
TA73	SQ1-061511-BT	TA73A	SW6010B	Copper	175	mg/kg		J	8,9

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
TA73	SQ1-061511-BT	TA73A	SW7471A	Mercury	0.33	mg/kg		J	8
TA73	SQ1-061511-BT	TA73A	SW8082	Aroclor 1248	66	ug/kg	Y	U	22
TA73	SQ1-061511-BT	TA73A	SW8270D	Benzo(g,h,i)perylene	300	ug/kg	NA	DNR	14
TA73	SQ1-061511-BT	TA73A	SW8270D	Dibenz(a,h)anthracene	300	ug/kg	NA	DNR	14
TA73	SQ1-061511-BT	TA73A	SW8270D	Indeno(1,2,3-cd)pyrene	300	ug/kg	NA	DNR	14
TA73	SQ1-061511-BT	TA73A	SW8270DSIM	Dibenz(a,h)anthracene	130	ug/kg	M	NJ	14
WG35790	DK1B-012611-S	L16166-1 W	E1613	1,2,3,4,7,8-HXCDD	76.7	PG/sample	DJ	J	12
WG35790	DK1B-012611-S	L16166-1 W	E1613	1,2,3,7,8,9-HXCDF	1.96	PG/sample	KDJ	U	22
WG35790	DK1B-012611-S	L16166-1 W	E1613	1,2,3,7,8-PECDD	45.5	PG/sample	DJ	J	12
WG35790	DK1B-012611-S	L16166-1 W	E1613	2,3,7,8-TCDD	7.94	PG/sample	DJ	J	12
WG35790	DK3B-012611-S	L16166-2 LW	E1613	1,2,3,4,7,8-HXCDD	35.8	PG/sample	DJ	J	12
WG35790	DK3B-012611-S	L16166-2 LW	E1613	1,2,3,7,8-PECDD	27.7	PG/sample	DJ	J	12
WG35790	DK3B-012611-S	L16166-2 LW	E1613	1,2,3,7,8-PECDF	7.77	PG/sample	KDJ	U	22
WG35790	DK3B-012611-S	L16166-2 LW	E1613	2,3,4,7,8-PECDF	13.8	PG/sample	KDJ	U	22
WG35790	DK3B-012611-S	L16166-2 LW	E1613	2,3,7,8-TCDD	11.7	PG/sample	DJ	J	12
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	1,2,3,4,7,8-HXCDD	13.3	PG/sample	DJ	J	12
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	1,2,3,6,7,8-HXCDD	44.1	PG/sample	KDJ	U	22
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	1,2,3,6,7,8-HXCDF	12.4	PG/sample	KDJ	U	22
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	1,2,3,7,8,9-HXCDF	5.3	PG/sample	KDJ	U	22
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	1,2,3,7,8-PECDD	8.13	PG/sample	KDJ	U	22
WG35790	SQ1B-020211-S	L16166-3 LW	E1613	2,3,7,8-TCDD	3.03	PG/sample	DJ	J	12
WG35790	SQ2B-020211-S	L16166-4 W	E1613	1,2,3,4,7,8-HXCDD	105	PG/sample	D	J	12
WG35790	SQ2B-020211-S	L16166-4 W	E1613	1,2,3,7,8-PECDD	60	PG/sample	DJ	J	12
WG35790	SQ2B-020211-S	L16166-4 W	E1613	2,3,7,8-TCDD	17	PG/sample	D	J	12
WG35790	SQ3B-020211-S	L16166-5 W	E1613	1,2,3,4,7,8-HXCDD	7.65	PG/G	DJ	J	12
WG35790	SQ3B-020211-S	L16166-5 W	E1613	1,2,3,7,8-PECDD	9.24	PG/G	DJ	J	12
WG35790	SQ3B-020211-S	L16166-5 W	E1613	2,3,7,8-TCDD	3.92	PG/G	D	J	12
WG35790	SQ3B-021111-S	L16166-8 LW	E1613	1,2,3,4,7,8-HXCDD	11.4	PG/G	D	J	12
WG35790	SQ3B-021111-S	L16166-8 LW	E1613	1,2,3,7,8-PECDD	9.99	PG/G	D	J	12
WG35790	SQ3B-021111-S	L16166-8 LW	E1613	2,3,7,8-TCDD	4.06	PG/G	D	J	12
WG35790	SQ4B-021111-S	L16166-9 LW	E1613	1,2,3,4,7,8-HXCDD	43.8	PG/G	D	J	12
WG35790	SQ4B-021111-S	L16166-9 LW	E1613	1,2,3,7,8-PECDD	22.4	PG/G	D	J	12
WG35790	SQ4B-021111-S	L16166-9 LW	E1613	2,3,7,8-TCDD	2.48	PG/G	DJ	J	12
WG36100	SQ1B-021111-S	L16166-6 LW	E1613	2,3,7,8-TCDD	21	PG/sample	D	J	12
WG36100	SQ2B-021111-S	L16166-7 LW	E1613	2,3,7,8-TCDD	28	PG/sample	D	J	12
WG36100	SQ1B-031511-S	L16287-5 LW	E1613	2,3,7,8-TCDD	59.3	PG/sample	D	J	12
WG36100	SQ2B-031511-S	L16287-6 LW	E1613	2,3,7,8-TCDD	1.42	PG/sample	KDJ	U	22
WG36100	SQ4B-031511-S	L16287-8 LW	E1613	2,3,7,8-TCDD	3.74	PG/G	D	J	12
WG36152	SQ4-030411-W	L16286-5	AXYS MLA-033	2,2',4,6'-TEBDE	6.43	PG/L	KJ	U	22
WG36152	SQ4-030411-W	L16286-5	AXYS MLA-033	3,3',4-TRIBDE	3.32	PG/L	KJ	U	22
WG36152	SQ4-030411-W	L16286-5	AXYS MLA-033	3,4,4'-TRIBDE	1.91	PG/L	KJ	U	22
WG36152	SQ3-030411-W	L16286-6	AXYS MLA-033	2,2',3,4,4',5',6-HPBDE	118	PG/L	KB	U	22
WG36152	SQ3-030411-W	L16286-6	AXYS MLA-033	2,2',4,6'-TEBDE	6.36	PG/L	KJ	U	22
WG36152	SQ3-030411-W	L16286-6	AXYS MLA-033	2,3',4,4'-TEBDE	46	PG/L	KJ	U	22
WG36152	SQ3-030411-W	L16286-6	AXYS MLA-033	2,3',4',6-TEBDE	7.81	PG/L	KJ	U	22
WG36152	SQ3-030411-W	L16286-6	AXYS MLA-033	3,3',4-TRIBDE	7.4	PG/L	KJ	U	22

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
WG36152	SQ2-030411-W	L16286-7	AXYS MLA-033	3,3',4-TRIBDE	9.96	PG/L	KJ	U	22
WG36152	SQ1-030411-W	L16286-8	AXYS MLA-033	2,3',4',6-TEBDE	14.9	PG/L	KJ	U	22
WG36152	SQ1-030411-W	L16286-8	AXYS MLA-033	3,3',4-TRIBDE	14.4	PG/L	KJ	U	22
WG36152	SQ1-030411-W	L16286-8	AXYS MLA-033	4,4'-DIBDE	2.71	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',3,3',4,5,5',6,6'-NOBDE	1080	PG/L	KB	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',3,4,4',5,5',6-OCBDE	232	PG/L	KB	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	2.05	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',3,4,4',5'-HXBDE	27.7	PG/L	CKBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',3,4,4',6'-HXBDE	5.79	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,2',4-TRIBDE	16.4	PG/L	CKJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,3',4,4',6-PEBDE	10	PG/L	CKBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,3',4,4'-TEBDE	53.8	PG/L	KB	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,3',4',6-TEBDE	10.7	PG/L	KBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,4,4',6-TEBDE	2.16	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,4,4'-TRIBDE	29.3	PG/L	CKBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,4',6-TRIBDE	0.599	PG/L	KBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,4-DIBDE	1.15	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	2,6-DIBDE	0.949	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	3,3',4,4'-TEBDE	2.6	PG/L	KJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	3,3',4-TRIBDE	3.92	PG/L	KBJ	U	22
WG36561	DK1-042711-W	L16429-1	AXYS MLA-033	3,4,4'-TRIBDE	2.66	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,3',4,4',5,5',6-NOBDE	448	PG/L	K	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,4,4',5,5',6-OCBDE	171	PG/L	KB	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	9.4	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,4,4',5',6-HPBDE	103	PG/L	KB	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,4,4',5'-HXBDE	23.1	PG/L	CKBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',3,4,4',6'-HXBDE	8.19	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',4,4',6,6'-HXBDE	8.09	PG/L	KBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,2',4,6'-TEBDE	6.26	PG/L	KBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,3,3',4,4',5,6-HPBDE	22.9	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,3',4,4',6-PEBDE	9.44	PG/L	CKBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,3,4,5,6-PEBDE	12.2	PG/L	KBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,3',4',6-TEBDE	8.12	PG/L	KBJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,4,4',6-TEBDE	4.84	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,4'-DIBDE	1.23	PG/L	CKJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	2,4-DIBDE	0.691	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	3,3',4,4'-TEBDE	0.888	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	3,4,4'-TRIBDE	2.35	PG/L	KJ	U	22
WG36561	DK2-042711-W	L16429-2	AXYS MLA-033	4,4'-DIBDE	1.77	PG/L	KBJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,2',3,4,4',5,5',6-OCBDE	225	PG/L	KB	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	14.1	PG/L	KJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,2',4,4',6,6'-HXBDE	11.1	PG/L	KBJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,2',4,6'-TEBDE	7.46	PG/L	KBJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,3,3',4,4',5,6-HPBDE	51.3	PG/L	K	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,3',4,4',6-PEBDE	9.24	PG/L	CKBJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	2,3',4',6-TEBDE	10.9	PG/L	KBJ	U	22

QUALIFIED DATA SUMMARY TABLE
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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	3,3',4,4'-TEBDE	2.21	PG/L	KJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	3,3',4,5'-TEBDE	12.3	PG/L	KJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	3,3',4-TRIBDE	3.8	PG/L	KBJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	3,4,4'-TRIBDE	1.85	PG/L	KJ	U	22
WG36561	DK3-050211-W	L16429-3	AXYS MLA-033	4,4'-DIBDE	1.41	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	14.8	PG/L	KJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,2',4,4',6,6'-HXBDE	7.72	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,2',4,5'-TEBDE	27.1	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,2',4,6'-TEBDE	2.79	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,3',4,4',6-PEBDE	5.9	PG/L	CKBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,3,4,5,6-PEBDE	7.33	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,3',4',6-TEBDE	3.89	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,4,4',6-TEBDE	1.68	PG/L	KJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,4,4'-TRIBDE	14.8	PG/L	CKBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,4',6-TRIBDE	0.256	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	2,4-DIBDE	0.457	PG/L	KJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	3,3',4-TRIBDE	1.05	PG/L	KBJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	3,4,4'-TRIBDE	1.48	PG/L	KJ	U	22
WG36561	DK4-050211-W	L16429-4	AXYS MLA-033	4,4'-DIBDE	0.966	PG/L	KBJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',3,3',4,4',5,5',6,6'-DEBDE	322	PG/L	BJ	U	7
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',3,3',4,4',5,5',6-NOBDE	78	PG/L	K	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',3,3',4,5,5',6,6'-NOBDE	25.9	PG/L	KBJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',3,4,4',5,5',6-OCBDE	6.43	PG/L	KBJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',3,4,4',5',6-HPBDE	9.21	PG/L	KBJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',4,4',5,5'-HXBDE	10.3	PG/L	KBJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',4,4',5,6'-HXBDE	6.98	PG/L	KJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',4,5'-TEBDE	3.23	PG/L	BJ	U	7
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,2',4-TRIBDE	1.39	PG/L	CKJ	U	22
WG36561	SQ1-042111-W	L16429-5 i	AXYS MLA-033	2,3',4,4'-TEBDE	3.36	PG/L	KBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',3,3',4,4'-HXBDE	15.9	PG/L	KJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',3,4,4',5',6-HPBDE	52.4	PG/L	KB	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',3,4,4',5'-HXBDE	10.3	PG/L	CKBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',4,5'-TEBDE	9.36	PG/L	KBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',4,6'-TEBDE	2.14	PG/L	KBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,2',4-TRIBDE	5.43	PG/L	CKJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,3,3',4,4',5,6-HPBDE	17.6	PG/L	KJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,3',4,4'-TEBDE	8.61	PG/L	KBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,3',4',6-TEBDE	2.18	PG/L	KBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,4,4',6-TEBDE	0.899	PG/L	KJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,4,4'-TRIBDE	6.19	PG/L	CKBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	2,4'-DIBDE	0.959	PG/L	CKJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	3,3',4,4'-TEBDE	0.162	PG/L	KJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	3,3',4,5'-TEBDE	2.09	PG/L	KJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	3,4-DIBDE	0.988	PG/L	CKBJ	U	22
WG36561	SQ3-042111-W	L16429-6	AXYS MLA-033	4,4'-DIBDE	0.413	PG/L	KBJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	2,2',3,3',4,5,5',6,6'-NOBDE	546	PG/L	KB	U	22

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	2,2',3,4,4',5,5',6-OCBDE	175	PG/L	KB	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	8.72	PG/L	KJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	2,2',4,5'-TEBDE	32.9	PG/L	KBJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	2,3',4',6-TEBDE	6.77	PG/L	KBJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	3,3',4,5'-TEBDE	10.2	PG/L	KJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	3,3',4-TRIBDE	3.17	PG/L	KBJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	3,4,4'-TRIBDE	0.75	PG/L	KJ	U	22
WG36561	SQ4-042111-W	L16429-7	AXYS MLA-033	4,4'-DIBDE	0.423	PG/L	KBJ	U	22
WG36570	DK2-011911-T	L16430-1 LW	AXYS MLA-033	3,3',4,4'-TEBDE	7.68	PG/G	KDJ	U	22
WG36570	DK2-011911-T	L16430-1 LW	AXYS MLA-033	3,3',4,5'-TEBDE	27	PG/G	KD	U	22
WG36570	DK2-011911-T	L16430-1 LW	AXYS MLA-033	3,3',4-TRIBDE	22.9	PG/G	KD	U	22
WG36570	DK2-011911-T	L16430-1 LW	E1613	1,2,3,7,8,9-HXCDF	0.277	PG/G	KDJ	U	22
WG36570	DK3-011911-T	L16430-2 LW	AXYS MLA-033	2,2',3,4,4',6'-HXBDE	65.6	PG/G	KD	U	22
WG36570	DK3-011911-T	L16430-2 LW	AXYS MLA-033	3,3',4,4'-TEBDE	8.88	PG/G	KDJ	U	22
WG36570	DK3-011911-T	L16430-2 LW	AXYS MLA-033	3,3',4,5'-TEBDE	19.2	PG/G	KDJ	U	22
WG36570	DK3-011911-T	L16430-2 LW	AXYS MLA-033	3,3',4-TRIBDE	24.6	PG/G	KD	U	22
WG36570	SQ2-011911-T	L16430-3 LW	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	73.3	PG/G	KD	U	22
WG36570	SQ2-011911-T	L16430-3 LW	AXYS MLA-033	3,3',4,4'-TEBDE	10.1	PG/G	KDJ	U	22
WG36570	SQ2-011911-T	L16430-3 LW	AXYS MLA-033	3,3',4,5'-TEBDE	34.4	PG/G	KD	U	22
WG36570	SQ2-011911-T	L16430-3 LW	AXYS MLA-033	3,3',4-TRIBDE	34.2	PG/G	KD	U	22
WG36570	SQ3-011911-T	L16430-4 LW	AXYS MLA-033	3,3',4,4'-TEBDE	16.3	PG/G	KDJ	U	22
WG36570	SQ3-011911-T	L16430-4 LW	AXYS MLA-033	3,3',4,5'-TEBDE	38.1	PG/G	KD	U	22
WG36570	SQ3-011911-T	L16430-4 LW	AXYS MLA-033	3,3',4-TRIBDE	50.6	PG/G	KD	U	22
WG36676	SQ1-050511-T	L16452-1	AXYS MLA-033	3,3',4-TRIBDE	164	PG/G	K	U	22
WG36676	SQ1-050511-T	L16452-1	E1613	1,2,3,4,7,8-HXCDD	24.9	PG/G		J	12
WG36676	SQ1-050511-T	L16452-1	E1613	1,2,3,6,7,8-HXCDD	88.6	PG/G		J	12
WG36676	SQ1-050511-T	L16452-1	E1613	1,2,3,7,8,9-HXCDD	59.4	PG/G		J	12
WG36676	SQ1-050511-T	L16452-1	E1613	1,2,3,7,8-PECDD	12	PG/G		J	12
WG36676	SQ1-050511-T	L16452-1	E1613	2,3,4,7,8-PECDF	16.4	PG/G		J	12
WG36676	SQ1-050511-T	L16452-1 W	AXYS MLA-033	3,3',4,4'-TEBDE	17.1	PG/G	KDJ	U	22
WG36676	SQ1-050511-T	L16452-1 W	AXYS MLA-033	3,3',4,5'-TEBDE	26.6	PG/G	KDJ	U	22
WG36676	DK1-050511-BT	L16452-10	E1613	1,2,3,4,7,8-HXCDD	95.8	PG/G		J	12
WG36676	DK1-050511-BT	L16452-10	E1613	1,2,3,6,7,8-HXCDD	204	PG/G		J	12
WG36676	DK1-050511-BT	L16452-10	E1613	1,2,3,7,8,9-HXCDD	241	PG/G		J	12
WG36676	DK1-050511-BT	L16452-10	E1613	1,2,3,7,8-PECDD	45.9	PG/G		J	12
WG36676	DK1-050511-BT	L16452-10	E1613	2,3,4,7,8-PECDF	11.6	PG/G	J	J	12
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	2,2',3,4,4',6'-HXBDE	56	PG/G	K	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	2,2',4,4',6,6'-HXBDE	60.9	PG/G	KJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	2,2',4,6'-TEBDE	36.5	PG/G	KBJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	2,4'-DIBDE	3.74	PG/G	CKJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	3,3',4,4'-TEBDE	7.43	PG/G	KJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	3,3',4-TRIBDE	44.8	PG/G	KJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	3,4,4'-TRIBDE	9.2	PG/G	KJ	U	22
WG36676	DK1-050511-BT	L16452-10 i	AXYS MLA-033	3,4-DIBDE	2.42	PG/G	CKJ	U	22
WG36676	SQ2-050511-T	L16452-2	AXYS MLA-033	3,3',4-TRIBDE	81.8	PG/G	K	U	22
WG36676	SQ2-050511-T	L16452-2	E1613	1,2,3,4,7,8-HXCDD	15.8	PG/G		J	12

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SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
WG36676	SQ2-050511-T	L16452-2	E1613	1,2,3,6,7,8-HXCDD	55.5	PG/G		J	12
WG36676	SQ2-050511-T	L16452-2	E1613	1,2,3,7,8,9-HXCDD	44.5	PG/G		J	12
WG36676	SQ2-050511-T	L16452-2	E1613	1,2,3,7,8-PECDD	8.84	PG/G		J	12
WG36676	SQ2-050511-T	L16452-2	E1613	2,3,4,7,8-PECDF	8.46	PG/G		J	12
WG36676	SQ2-050511-T	L16452-2 W	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	159	PG/G	KBD	U	22
WG36676	SQ3-050511-T	L16452-3	AXYS MLA-033	3,3',4-TRIBDE	41.6	PG/G	K	U	22
WG36676	SQ3-050511-T	L16452-3	E1613	1,2,3,4,7,8-HXCDD	17.6	PG/G		J	12
WG36676	SQ3-050511-T	L16452-3	E1613	1,2,3,6,7,8-HXCDD	52.5	PG/G		J	12
WG36676	SQ3-050511-T	L16452-3	E1613	1,2,3,7,8,9-HXCDD	48.9	PG/G		J	12
WG36676	SQ3-050511-T	L16452-3	E1613	1,2,3,7,8-PECDD	11	PG/G		J	12
WG36676	SQ3-050511-T	L16452-3	E1613	2,3,4,7,8-PECDF	8.07	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4	E1613	1,2,3,4,7,8-HXCDD	41.7	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4	E1613	1,2,3,6,7,8-HXCDD	114	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4	E1613	1,2,3,7,8,9-HXCDD	97.2	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4	E1613	1,2,3,7,8-PECDD	20.2	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4	E1613	2,3,4,7,8-PECDF	6.09	PG/G		J	12
WG36676	SQ4-050511-T	L16452-4 i	AXYS MLA-033	3,3',4-TRIBDE	74.9	PG/G	K	U	22
WG36676	DK1-050511-T	L16452-5	E1613	1,2,3,4,7,8-HXCDD	47.9	PG/G		J	12
WG36676	DK1-050511-T	L16452-5	E1613	1,2,3,6,7,8-HXCDD	101	PG/G		J	12
WG36676	DK1-050511-T	L16452-5	E1613	1,2,3,7,8,9-HXCDD	118	PG/G		J	12
WG36676	DK1-050511-T	L16452-5	E1613	1,2,3,7,8-PECDD	24.7	PG/G		J	12
WG36676	DK1-050511-T	L16452-5	E1613	2,3,4,7,8-PECDF	6.9	PG/G	J	J	12
WG36676	DK1-050511-T	L16452-5 i2	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	96.2	PG/G	KB	U	22
WG36676	DK1-050511-T	L16452-5 i2	AXYS MLA-033	2,3,3',4,4',5,6-HPBDE	531	PG/G	KB	U	22
WG36676	DK1-050511-T	L16452-5 i2	AXYS MLA-033	2,4-DIBDE	1.88	PG/G	KJ	U	22
WG36676	DK1-050511-T	L16452-5 i2	AXYS MLA-033	3,3',4,4'-TEBDE	12.3	PG/G	KJ	U	22
WG36676	DK1-050511-T	L16452-5 i2	AXYS MLA-033	3,3',4-TRIBDE	54.3	PG/G	KJ	U	22
WG36676	DK2-050511-T	L16452-6	E1613	1,2,3,4,7,8-HXCDD	15.4	PG/G		J	12
WG36676	DK2-050511-T	L16452-6	E1613	1,2,3,6,7,8-HXCDD	36.5	PG/G		J	12
WG36676	DK2-050511-T	L16452-6	E1613	1,2,3,7,8,9-HXCDD	43.3	PG/G		J	12
WG36676	DK2-050511-T	L16452-6	E1613	1,2,3,7,8-PECDD	8.48	PG/G		J	12
WG36676	DK2-050511-T	L16452-6	E1613	2,3,4,7,8-PECDF	3.28	PG/G	J	J	12
WG36676	DK2-050511-T	L16452-6 i	AXYS MLA-033	3,3',4-TRIBDE	41.3	PG/G	K	U	22
WG36676	DK2-050511-T	L16452-6 W	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	74.1	PG/G	KBDJ	U	22
WG36676	DK2-050511-T	L16452-6 W	AXYS MLA-033	3,3',4,4'-TEBDE	11.9	PG/G	KDJ	U	22
WG36676	DK3-050511-T	L16452-7	E1613	1,2,3,4,7,8-HXCDD	16	PG/G		J	12
WG36676	DK3-050511-T	L16452-7	E1613	1,2,3,6,7,8-HXCDD	39.3	PG/G		J	12
WG36676	DK3-050511-T	L16452-7	E1613	1,2,3,7,8,9-HXCDD	39	PG/G		J	12
WG36676	DK3-050511-T	L16452-7	E1613	1,2,3,7,8-PECDD	7.88	PG/G		J	12
WG36676	DK3-050511-T	L16452-7	E1613	2,3,4,7,8-PECDF	3.37	PG/G	J	J	12
WG36676	DK4-050511-T	L16452-8	E1613	1,2,3,4,7,8-HXCDD	18.3	PG/G		J	12
WG36676	DK4-050511-T	L16452-8	E1613	1,2,3,6,7,8-HXCDD	44.5	PG/G		J	12
WG36676	DK4-050511-T	L16452-8	E1613	1,2,3,7,8,9-HXCDD	45.5	PG/G		J	12
WG36676	DK4-050511-T	L16452-8	E1613	1,2,3,7,8-PECDD	9.79	PG/G		J	12
WG36676	DK4-050511-T	L16452-8	E1613	2,3,4,7,8-PECDF	4.58	PG/G	J	J	12
WG36676	DK4-050511-T	L16452-8 i	AXYS MLA-033	2,4',6-TRIBDE	4.5	PG/G	KJ	U	22

QUALIFIED DATA SUMMARY TABLE
Lower Duwamish Waterway - Accelerated Source Tracing Study

SDG	Sample ID	Lab ID	Method	Analyte	Result	Units	Lab Qualifiers	DV Qualifiers	DV Reason Code
WG36676	DK4-050511-T	L16452-8 i	AXYS MLA-033	3,3',4-TRIBDE	54.5	PG/G	K	U	22
WG36676	DK4-050511-T	L16452-8 W	AXYS MLA-033	3,3',4,4'-TEBDE	24.2	PG/G	KDJ	U	22
WG36676	SQ1-050511-BT	L16452-9	E1613	1,2,3,4,7,8-HXCDD	10.4	PG/G		J	12
WG36676	SQ1-050511-BT	L16452-9	E1613	1,2,3,6,7,8-HXCDD	31.9	PG/G		J	12
WG36676	SQ1-050511-BT	L16452-9	E1613	1,2,3,7,8,9-HXCDD	25.5	PG/G		J	12
WG36676	SQ1-050511-BT	L16452-9	E1613	1,2,3,7,8-PECDD	5.31	PG/G		J	12
WG36676	SQ1-050511-BT	L16452-9	E1613	2,3,4,7,8-PECDF	6.04	PG/G		J	12
WG36676	SQ1-050511-BT	L16452-9 i	AXYS MLA-033	2,4',6-TRIBDE	5.52	PG/G	KJ	U	22
WG36676	SQ1-050511-BT	L16452-9 i	AXYS MLA-033	2,4-DIBDE	3.38	PG/G	KJ	U	22
WG36676	SQ1-050511-BT	L16452-9 i	AXYS MLA-033	3,3',4-TRIBDE	232	PG/G	K	U	22
WG36676	SQ1-050511-BT	L16452-9 W	AXYS MLA-033	2,2',3,4,4',5,6-HPBDE	101	PG/G	KBD	U	22
WG36676	SQ1-050511-BT	L16452-9 W	AXYS MLA-033	2,3',4',6-TEBDE	65	PG/G	KBDJ	U	22
WG36676	SQ1-050511-BT	L16452-9 W	AXYS MLA-033	3,3',4,4'-TEBDE	9.32	PG/G	KDJ	U	22
WG36676	SQ1-050511-BT	L16452-9 W	AXYS MLA-033	3,3',4,5'-TEBDE	22.9	PG/G	KDJ	U	22
WG36845	DK3-050511-T	L16452-7 RLWi	AXYS MLA-033	2,4',6-TRIBDE	2.43	PG/G	KDJ	U	22
WG36845	DK3-050511-T	L16452-7 RLWi	AXYS MLA-033	3,3',4,4'-TEBDE	6.99	PG/G	KDJ	U	22
WG36845	DK3-050511-T	L16452-7 RLWi	AXYS MLA-033	3,3',4,5'-TEBDE	15.2	PG/G	KBDJ	U	22
WG36845	DK3-050511-T	L16452-7 RLWi	AXYS MLA-033	3,3',4-TRIBDE	22.6	PG/G	KDJ	U	22