Snohomish River Sediment, Seep and Outfall Sampling Technical Memorandum

Everett Smelter Cleanup Site
Lowland Area
FSID 2744, ISIS Cleanup Site ID 4298
Everett, Washington

for
Washington State Department of Ecology

June 25, 2013

GeoEngineers
Earth Science + Technology

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Project No. 0504-068-00

June 25, 2013

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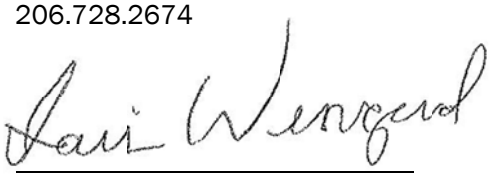

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1.0 INTRODUCTION

This memorandum summarizes the results of the Snohomish River west riverbank sediment, seep and outfall investigation activities completed at the Everett Smelter Lowland Area. The Lowland Area is a part of the Everett Smelter Cleanup Site and is generally located in northeast Everett, Washington (Figure 1). The Lowland Area includes multiple parcels and the rights-of-way adjacent to the parcels as shown in Figure 2.

The purpose of the Lowland Area study is to characterize metals concentrations in various environmental media within and near the Lowland Area in order to evaluate potential environmental impacts from the historical smelter activities.

Seep and outfall water samples, along with collocated sediment samples, were obtained along the shoreline of the Snohomish River approximately down gradient of the historical smelter facility in April 2013. The collected samples were analyzed for select metals including antimony, arsenic, cadmium, lead, mercury, and thallium. The sample collection and analysis activities were completed in general accordance with the Washington State Department of Ecology (Ecology)-approved Final Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) for the project dated August 31, 2012.

The purpose of this technical memorandum is to describe field activities completed as part of the sediment, seep and outfall investigation of the Lowland Area and to summarize the data resulting from analysis of the samples collected. The results of this and future field activities will be used to develop a preliminary Feasibility Study so that a Remedial Investigation and Cleanup Action Plan can be developed for the Lowland Area that is protective of human health and the environment.

2.0 FIELD INVESTIGATION

Fourteen potential sampling locations (seeps and outfalls) were identified during a reconnaissance of the shoreline of the Snohomish River completed by staff from both Ecology and GeoEngineers on August 16, 2012. The SAP provided criteria for triggering sampling and analysis at each of the 14 locations. Specifically, the SAP indicated that the sediment, seep and outfall locations to be sampled would be based upon results of monitoring well sampling and analysis completed adjacent to and in a presumed upgradient location from the identified seeps and/or outfall locations. The sampling and analysis results from the Lowland Area well monitoring completed in January and February 2013 triggered sampling criteria for 10 of the 14 seep and/or outfall locations identified. SAP Table 3 is summarized as Table 1 in this memorandum, with the rationale for sampling.

Seep, outfall water and sediment sample locations were approached on foot where readily accessible or were reached by using a boat operated by Research Support Services (RSS) of Bainbridge Island, Washington. The general approach for sampling seep/sediment locations and outfall/sediment locations was as follows:

- At each seep/sediment sampling locations (four locations), sediment was typically collected at the highest elevation where seeps were observed to be emerging from the shoreline on the day the sampling was performed. Where accessible on foot, sediment samples were collected first, and seep water was collected from the depression created by the sediment sampling. Samples were collected for total and dissolved metals (see Section 2.2, below).
- At each outfall/sediment sampling location, sediment was collected from the location directly below the outfall discharge point where outfall water was observed coming into contact with sediment on the day of sampling. Outfall water was collected directly into containers from the end of the pipe.

Sections 2.1 and 2.2 describe the sediment and water sampling activities.

2.1. River Sediment Sampling

River sediment sampling occurred on April 26, 29 and 30, 2013 at 10 locations along the west bank of the Snohomish River (Figure 2). Samples were obtained using either hand sampling or mechanical sampling equipment. Hand sampling equipment was used where sediment sampling locations were exposed at low tide and accessible by foot at the time of sampling. These techniques generally included collecting sediment using a stainless steel (SS) "cookie cutter," a SS spoon or hand auger. The mechanical sampling equipment included a modified Van Veen "power grab" deployed from a boat operated by RSS. This technique was used at locations where sediment was below tide levels at the time of sampling.

Sediment characteristics were recorded by a professional geologist at each sample location. The surface sediment sample collection forms are provided in Appendix A. At each location, the upper 10 centimeters (cm) of sediment was transferred from the sample collection equipment to an SS bowl, homogenized, and distributed to laboratory-prepared containers, as specified in the SAP. Field screening was completed as described in the SAP. Sediment samples were logged on a chain-of-custody form and stored in coolers on ice for transport and delivery to the analytical laboratory. Chemical analysis of the sediment samples was completed by Analytical Resources, Inc. (ARI) in Tukwila, Washington. A total of 10 samples with two duplicate samples were analyzed for metals including antimony, arsenic, cadmium, lead, mercury, and thallium by Environmental Protection Agency (EPA) Methods 6000/7000 series.

The horizontal coordinates of each sediment sample location was recorded with a handheld GPS device immediately following sample collection.

2.2. Riverbank Seep and Outfall Water Sampling

Riverbank seep and outfall water sampling occurred on April 26, 29 and 30, 2013 at the 10 locations (four seeps and six outfalls) along the west bank of the Snohomish River (Figure 2).

Two 500-milliliter (ml) polyethylene bottles with nitric acid preservative were filled with water from each sample location. One bottle was filled with water directly from the flowing seep or outfall for the total metals sample. For the dissolved metals sample, a decontaminated glass jar was filled with water directly from the flowing seep or outfall, and the water was transferred to the polyethylene bottle using a peristaltic pump and a disposable 0.45 micron water filter. Water quality parameters were measured using a YSI Model 556 multi-parameter meter and recorded on

the surface sediment sample collection forms (Appendix A). The horizontal coordinates of each water sample location were recorded using a handheld GPS device immediately following sample collection.

Seep and outfall samples were collected, logged on a chain-of-custody form in general accordance with the QAPP, placed in laboratory-supplied bottleware and stored in coolers on ice for transport and delivery to the analytical laboratory. Chemical analysis of the water samples was completed by ARI. A total of 10 samples with two duplicate samples were analyzed for total and dissolved metals including antimony, arsenic, cadmium, lead, mercury, and thallium by EPA Methods 6000/7000 series.

2.3. Decontamination

Sediment and water sampling equipment was decontaminated using the procedures specified in the QAPP.

2.4. Disposal of Investigation-Derived Materials

Incidental waste (i.e., disposable gloves, disposable tubing, paper towels, etc.) were disposed of off site as solid waste. Excess sediment was returned to the sampling location following sampling at each location.

2.5. Deviations From the SAP

Field activities were performed in general accordance with the Ecology-approved SAP, QAPP and HASP with the following exceptions:

- Location LLSP-07 was identified as a seep during the reconnaissance by Ecology and GeoEngineers on August 16, 2012. On the day of sampling (April 30, 2013), sampling personnel observed that the source of the water was actually an 18-inch diameter outfall. The location was therefore, renamed LLO-07.
- The SAP indicated that total and ferrous iron would be measured in seeps and outfalls, but due to the sampling methodology and the time limitations within the available tidal window, total and ferrous iron were not measured.
- The SAP indicated that turbidity would be measured in seeps and outfalls; however, due to the time constraints of the tidal window turbidity was not measured. Based on visual observations, turbidity is estimated to have likely exceeded the range of the instrument at the majority of seep and outfall locations.

3.0 RESULTS

3.1. Field Observations

Characteristics of selected sampling locations are briefly summarized below. The following locations were selected for discussion based on noteworthy field observations.

- Outfall LLO-02 consists of an approximately 24-inch-diameter pipe with a rubber tide gate attached to the end. At the time of sampling, the tide gate was partially buried in the mud

preventing it from closing completely. Water from the outfall was pooling in a depression at the mouth of the outfall. Sediment sample LLSD-13 was collected from within the area where the water was observed to pool.

- Outfall LLO-03 discharges within a box constructed of wooden timber bulkheads on three sides and a wooden screen on the fourth side that is apparently designed to prevent river debris from obstructing the outfall tide gate. Both the outfall and sediment sample locations were inaccessible by foot or by boat and therefore, were collected using sampling equipment with extendable handles to reach the target sampling locations.
- Water was observed draining out of the outfall LLO-07 18-inch pipe at approximately 5 gallons per minute with an orange filamentous bacterial growth inside and protruding from the end of the pipe down to the shoreline surface. The sediment on the shoreline surface within the flow path of the water from this pipe also had orange bacterial coatings.

3.2. Riverbank Seep and Outfall Water Quality Parameters

Water quality parameters including pH, conductivity, temperature, dissolved oxygen and oxidation-reduction potential were measured at all seep and outfall locations prior to sampling. Water quality parameter values measured during sample collection are presented in Table 2. The following summarizes the results for the water quality parameter measurements in seep and outfall water samples:

- pH ranged from approximately 6.36 to 7.19.
- Conductivity in the majority of samples ranged from 0.382 to 0.914 millisiemens per centimeter (mS/cm). Conductivity of LLO-05 was 0.060 mS/cm, and conductivity at LLSP-03 was 4.662 mS/cm.
- Temperature ranged from 9.23 to 14.83 degrees Celsius.
- Dissolved oxygen concentrations ranged from 3.33 to 11.12 milligrams per liter (mg/L) in the seep and outfall water samples.
- Oxidation-reduction potential measurements indicate the seep and outfall water is generally reducing or slightly oxidizing in the majority of locations (i.e., approximately -295.5 to 3.5 mV).

3.3. Chemical Analytical Results for River Sediment

Ten sediment samples with two duplicates were analyzed from the 10 sediment sample locations. The sediment samples were submitted for metals analysis including antimony, arsenic, cadmium, lead, mercury and thallium. The results for metals in sediment are presented in Table 3. Figure 3 presents the results of arsenic in sediment.

The following summarizes the results for the sediment samples:

- Antimony was not detected in any of the sediment samples.
- Arsenic was detected in all samples, with the majority of concentrations ranging from 7.7 to 48.9 milligrams per kilogram (mg/kg). One exception was location LLSD-19, where the arsenic concentration was 837 mg/kg. In general, arsenic levels were higher in the sediment samples

that were co-located with outfalls versus the sediment samples that were co-located with seeps.

- Cadmium was detected in all but one of the sediment samples (LLSD-19) at concentrations ranging from 0.5 to 1.1 mg/kg.
- Lead was detected in all but one of the sediment samples (LLSD-19) at concentrations ranging from 3 to 22 mg/kg. Lead concentrations tended to be higher in samples collected in the northern end of sampling area.
- Mercury was detected in all but two of the sediment samples (LLSD-14 and LLSD-17S) at concentrations ranging from 0.04 to 0.16 mg/kg.
- Thallium was not detected in any of the sediment samples analyzed.

The analytical laboratory deliverable is contained in Appendix C.

3.4. Chemical Analytical Results for Seep and Outfall Water

Ten water samples (i.e., four seeps and six outfalls) along with two duplicates were collected and submitted for dissolved and total metals analysis including antimony, arsenic, cadmium, lead, mercury and thallium. The results for dissolved and total metals in the seep and outfall water are presented in Table 4. Figure 3 presents the results of arsenic in water.

The following summarizes the results for the seep and outfall water samples:

- Dissolved antimony was detected in eight of the water samples collected at concentrations ranging from 0.2 to 0.6 micrograms per liter (µg/L). Total antimony was detected in six of the water samples at concentrations ranging from 0.2 to 0.7 µg/L.
- Dissolved and total arsenic was detected in all of the samples analyzed. The majority of the detected arsenic concentrations ranged from 0.8 to 44.7 µg/L. One exception was the outfall sample location LLO-07, where arsenic concentrations were 542 µg/L (dissolved) and 636 µg/L (total). In general, arsenic concentrations were lower in seeps (1.6 to 6.7 µg/L) compared to outfalls 0.8 to 636 µg/L (LLO-07).
- There were no detections of dissolved cadmium in the seep or outfall samples. Total cadmium was detected in one seep water sample at a concentration 0.1 µg/L (LLSP-08).
- Dissolved lead was detected in two outfall samples and three seep samples at concentrations ranging from 0.1 to 0.6 µg/L. Total lead was detected in four outfall samples and four seep samples at concentrations ranging from 0.1 to 4.5 µg/L.
- Dissolved mercury was detected at one seep sample (LLS-05) at a concentration of 0.0217 µg/L. Total mercury was detected in two seep samples at concentrations of 0.0278 µg/L (LLSP-05) and 0.0344 µg/L (LLSP-08).
- Thallium was not detected in any of the seep or outfall samples analyzed.

The analytical laboratory deliverable is contained in Appendix C.

3.5. Data Validation

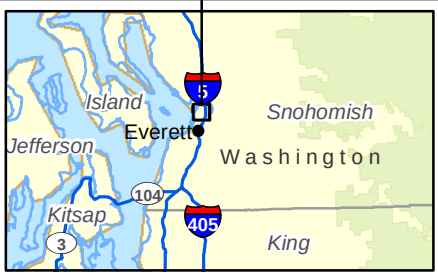
A data quality assessment was performed on all data in general conformance with an EPA "Stage-2B" validation. The data validation confirmed that the sample analytical results as qualified are acceptable for their intended use. The data quality assessment report is provided in Appendix B. The laboratory analytical reports are provided in Appendix C. The data were deemed acceptable for use as qualified.

4.0 LIMITATIONS

We have prepared this technical memorandum for the exclusive use of Washington State Department of Ecology and their authorized agents.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of environmental investigation in this area at the time this report was prepared. No warranty or other conditions express or implied should be understood.

Please refer to Appendix D titled "Report Limitations and Guidelines for Use" for additional information pertaining to use of this report.



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Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.
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Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Everett Smelter - Lowland Area

GeoEngineers

Figure 1

Path: \\sea\projects\0050406\GIS\0050406800_T1000_VicinityMap_Lowland.mxd Map Revised: 28 May 2013 tward

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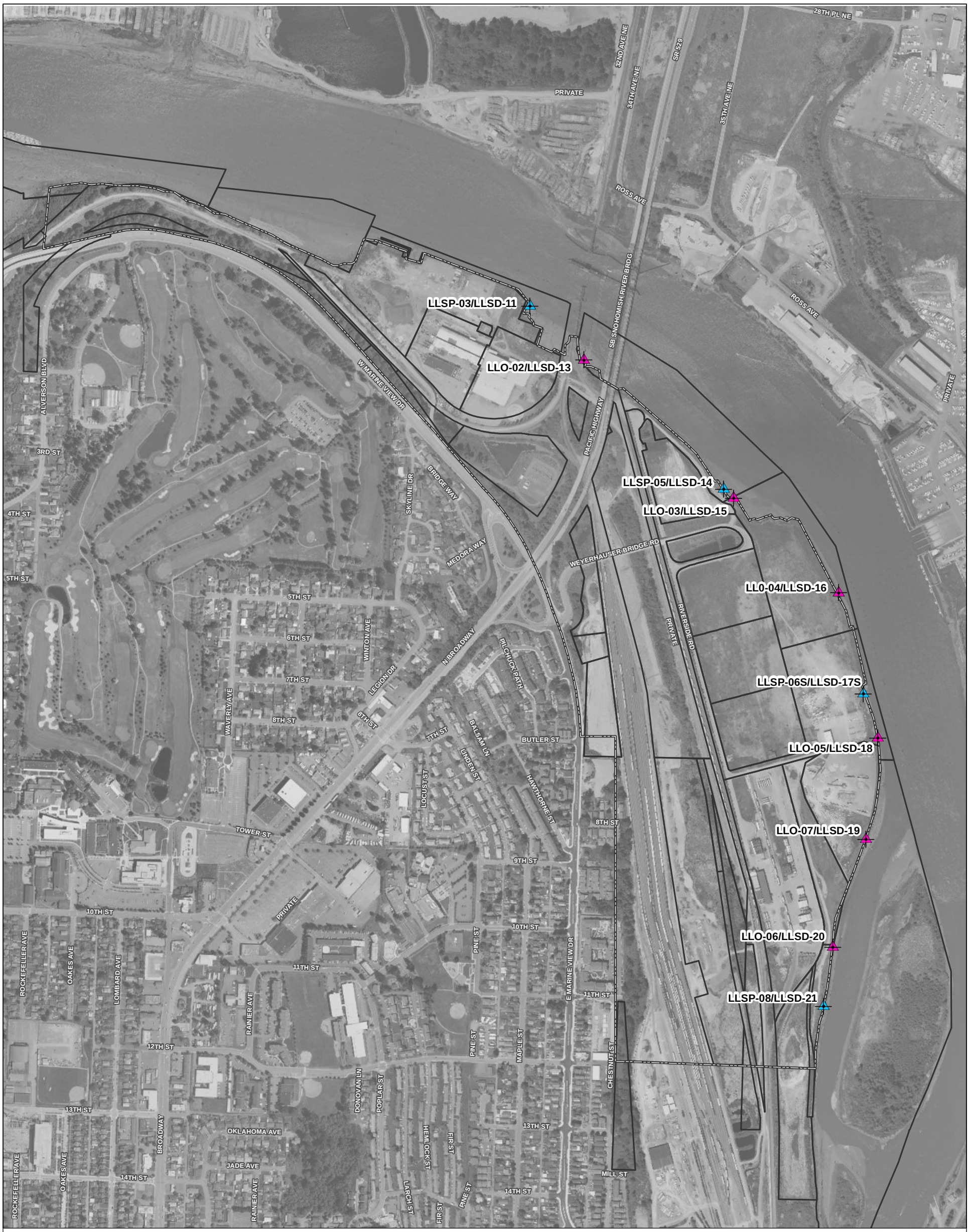

Legend

- Lowland Area
- Snohomish County Parcel Boundary

Investigation Locations

- Seep Water and Sediment Sample
- Outfall Water and Sediment Sample

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Feet

Notes:
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Data Source: Aerials Express Seattle, 2009. Snohomish County GIS, 2012.

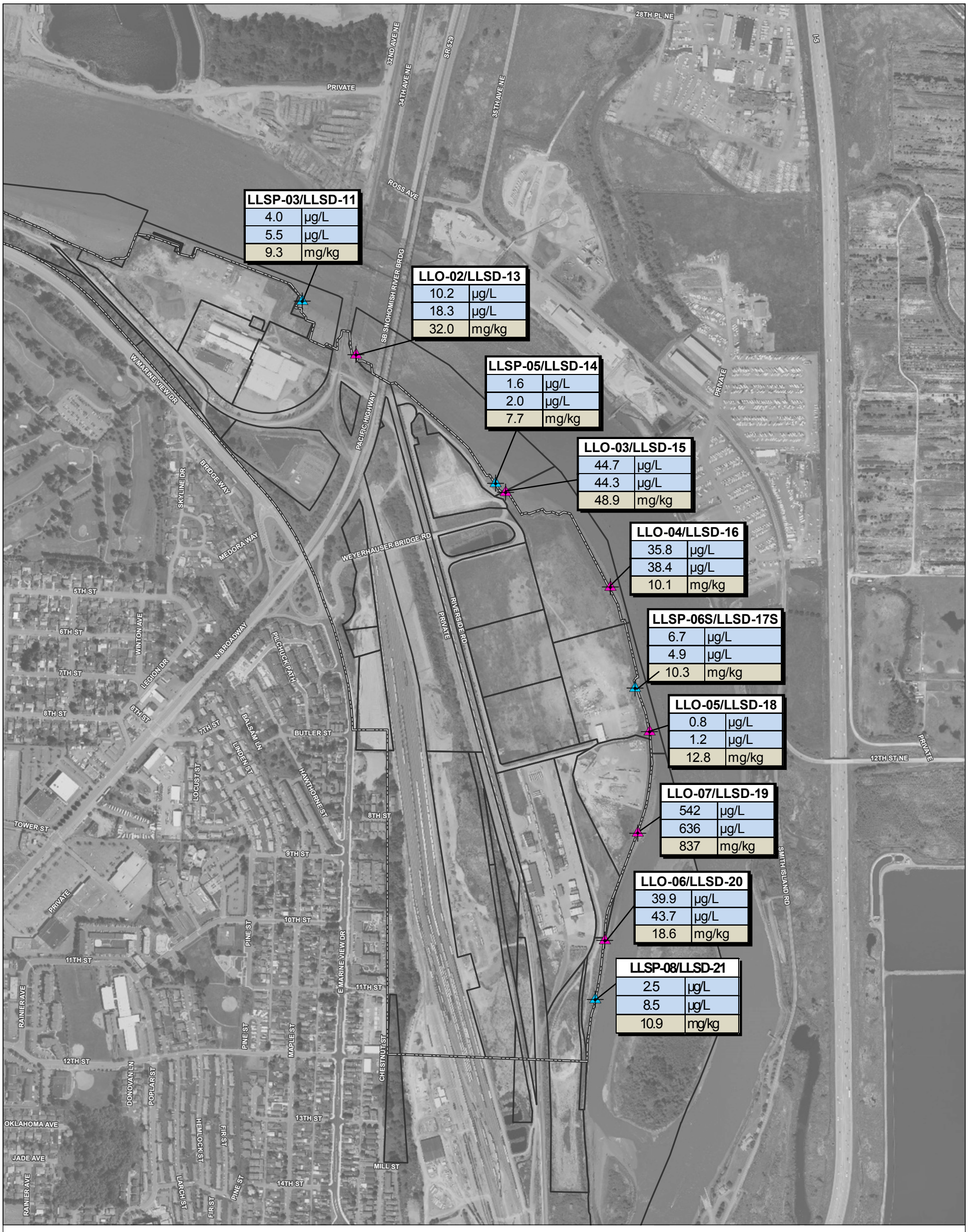
Lowland Investigation Locations

Everett Smelter - Lowland Area

GeoEngineers

Figure 2

Path: \\sea\projects\0\0504068\GIS\050406800_T1000_Water_and_Sed_Results.mxd Map Revised: 11 June 2013 bmagdasy



LLSP-03/LLSD-11	
4.0	µg/L
5.5	µg/L
9.3	mg/kg

LLO-02/LLSD-13	
10.2	µg/L
18.3	µg/L
32.0	mg/kg

LLSP-05/LLSD-14	
1.6	µg/L
2.0	µg/L
7.7	mg/kg

LLO-03/LLSD-15	
44.7	µg/L
44.3	µg/L
48.9	mg/kg

LLO-04/LLSD-16	
35.8	µg/L
38.4	µg/L
10.1	mg/kg

LLSP-06S/LLSD-17S	
6.7	µg/L
4.9	µg/L
10.3	mg/kg

LLO-05/LLSD-18	
0.8	µg/L
1.2	µg/L
12.8	mg/kg

LLO-07/LLSD-19	
542	µg/L
636	µg/L
837	mg/kg

LLO-06/LLSD-20	
39.9	µg/L
43.7	µg/L
18.6	mg/kg

LLSP-08/LLSD-21	
2.5	µg/L
8.5	µg/L
10.9	mg/kg

Legend

- Lowland Area
- Snohomish County Parcel Boundary

Investigation Locations

- Seep Water and Sediment Sample
- Outfall Water and Sediment Sample

Sample ID
Dissolved Arsenic in Water
Total Arsenic in Water
Arsenic in Sediment

N W E S

700 0 700

Feet

Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerials Express Seattle, 2009. Snohomish County GIS, 2012.

Water and Sediment Results – Arsenic

Everett Smelter - Lowland Area

GeoEngineers

Figure 3

Table 1

Rationale for Riverbank Seep, Outfall and Sediment Sample Locations

Everett Lowland

Everett, Washington

Investigation Location Designation	Adjacent Well(s)	Metals Concentrations in Adjacent Well(s) Greater Than PASL [1]?	Collect Seep/Outfall/Sediment Sample? [2]
LLSP-01/LLSD-08	MW-1501R	No	No
LLO-01/LLSD-09	MW-1501R	No	No
LLSP-02/LLSD-10	MW-1301R	No	No
LLSP-03/LLSD-11	MW-1202R	Yes	Yes
LLSP-04/LLSD-12	LLMW-03S/D	No	No
LLO-02/LLSD-13	LLMW-05S/D	Yes	Yes
LLSP-05/LLSD-14	LLMW-08S/D, LLMW-07S/D, LLMW-05S/D	Yes	Yes
LLO-03/LLSD-15	LLMW-08S LLMW-07S LLMW-05S	Yes	Yes
LLO-04/LLSD-16	LLMW-11S/D, LLMW-17S/D	Yes	Yes
LLSP-06/LLSD-17S	PZ-3B	Yes	Yes
LLO-05/LLSD-18	PZ-3B	Yes	Yes
LLO-06/LLSD-20	LLMW-22S/D	Yes	Yes
LLSP-07[3]/LLSD-19	PZ-2B	Yes	Yes
LLSP-08/LLSD-21	LLMW-23S/D	Yes	Yes

Notes:

[1] "PASL" = "Potentially applicable screening level." Although screening levels are to be developed in a supplemental remedial investigation report in the future, metals concentrations were screened against preliminary (potentially applicable) screening levels. The PASLs are: Antimony - 32 µg/L, Arsenic - 5 µg/L, Cadmium - 2 µg/L, Lead - 15 µg/L, Mercury - 2 µg/L and Thallium - no developed screening level.

[2] The SAP indicates to collect the seep/outfall/sediment sample if metals concentrations in the identified adjacent well are greater than screening levels.

[3] The source of what was identified as seep sample LLSP-07 was identified to actually be an outfall on the day of sampling. Therefore, LLSP-07 was renamed outfall sample LLO-07.

Table 2

Water Quality Parameters for Riverbank Seeps and Outfalls

Everett Lowland

Everett, Washington

Location Designation	pH	Conductivity (mS/cm)	Temperature (C)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)
Outfalls					
LLO-02	7.19	0.778	12.73	7.97	3.5
LLO-03	6.70	0.914	12.06	6.46	-50.5
LLO-04	6.45	0.460	10.63	5.86	-51.1
LLO-05	7.15	0.060	9.23	11.12	65.7
LLO-06	6.79	0.472	11.77	5.43	-40.0
LLO-07	6.36	0.604	11.57	6.35	-2.8
Seeps					
LLSP-03	6.95	4.662	14.75	3.33	-295.5
LLSP-05	6.88	0.382	12.74	6.33	-47.2
LLSP-06S	6.74	0.471	14.83	6.26	-37.1
LLSP-08	6.98	0.759	14.10	6.28	-89.2

Notes:

mS/cm - millisiemens per centimeter

C = degrees Celsius

mg/L = milligrams per liter

mV = millivolts

Table 3

Chemical Analytical Data – Sediment

Everett Lowland

Everett, Washington

Location Designation	Analyte	Antimony	Arsenic	Cadmium	Lead	Mercury	Thallium
	Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Sample ID						
LLSD-11	LLSD11-130429	10 U	**9.3**	**0.8**	**10**	**0.07**	0.4 U
	LLSD11-130429-DUP	10 U	**11.0**	**0.8**	**11**	**0.08**	0.4 U
LLSD-13	LLSD13-130429	10 U	**32.0**	**0.7**	**22**	**0.10**	0.4 U
LLSD-14	LLSD14-130426	7 U	**7.7**	**0.5**	**9**	0.03 U	0.3 U
LLSD-15	LLSD15-130426	8 U	**48.9**	**0.7**	**14**	**0.04**	0.3 U
LLSD-16	LLSD16-130429	8 U	**10.1**	**0.7**	**8**	**0.08**	0.3 U
LLSD-17S	LLSD17S-130429	6 U	**10.3**	**1.1**	**3**	0.03 U	0.2 U
LLSD-18	LLSD18-130429	8 U	**12.8**	**0.7**	**7**	**0.07**	0.3 U
	LLSD18-130429-DUP	9 U	**12.4**	**0.7**	**7**	**0.07**	0.3 U
LLSD-19	LLSD19-130430	20 U	**837**	0.9 U	9 U	**0.16**	0.4 U
LLSD-20	LLSD20-130429	7 U	**18.6**	**0.6**	**6**	**0.04**	0.3 U
LLSD-21	LLSD21-130426	10 U	**10.9**	**0.9**	**9**	**0.08**	0.4 U

Notes:

U = The analyte was not detected at the indicated reporting limit

Bold text indicates the analyte was detected.

mg/kg = milligram per kilogram

"DUP" = Field duplicate

Table 4

Chemical Analytical Data for Riverbank Seeps and Outfalls – Water

Everett Lowland

Everett, Washington

Location Designation	Analyte	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
	Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
	Sample ID												
Outfalls													
LLO-02	LL002-130429	**0.6**	**0.7**	**10.2**	**18.3**	0.1 U	0.1 U	**0.5**	**1.5**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-03	LL003-130426	**0.3**	**0.2**	**44.7**	**44.3**	0.1 U	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-04	LL004-130429	0.2 U	0.2 U	**35.8**	**38.4**	0.1 U	0.1 U	0.1 U	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-05	LL005-130429	0.2 U	0.2 U	**0.8**	**1.2**	0.1 U	0.1 U	0.1 U	**0.1**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-06	LL006-130429	**0.4**	**0.3**	**39.9**	**43.7**	0.1 U	0.1 U	**0.2**	**0.4**	0.0200 U	0.0200 U	0.2 U	0.2 U
	LL006-130429-DUP	**0.4**	**0.4**	**40.5**	**43.9**	0.1 U	0.1 U	**0.2**	**0.5**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-07	LL007-130429	**0.2**	0.2 U	**542**	**636**	0.1 U	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
Seeps													
LLSP-03	LLSP03-130429	**0.2**	0.2 U	**4.0**	**5.5**	0.1 U	0.1 U	**0.1**	**1.7**	0.0200 U	0.0200 U	0.2 U	0.2 U
	LLSP03-130429-DUP	0.2 U	0.2 U	**3.0**	**5.0**	0.1 U	0.1 U	**0.1**	**2.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLSP-05	LLSP05-130426	**0.3**	**0.3**	**1.6**	**2.0**	0.1 U	0.1 U	**0.6**	**1.1**	**0.0217**	**0.0278**	0.2 U	0.2 U
LLSP-06S	LLSP06S-130429	**0.6**	**0.5**	**6.7**	**4.9**	0.1 U	0.1 U	**0.2**	**1.4**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLSP-08	LLSP08-130429	**0.6**	**0.2**	**2.5**	**8.5**	0.1 U	**0.1**	0.1 U	**4.5**	0.0200 U	**0.0344**	0.2 U	0.2 U

Notes:

U = The analyte was not detected at the indicated reporting limit

Bold text indicates the analyte was detected

µg/L = microgram per liter

DUP = Field duplicate sample

APPENDIX A
Surface Sediment Sample Collection Forms

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett Lowland | Job No.: 0504-068-00 | Sample Name: LLSP-03 / LLSD-11

Date: 4/29/13 | Weather: sunny, light breeze, 50's

Field Personnel: Aaron Waggoner and Hannah McDonough

Subcontractor: RSS

Sample Method: (Hand Collection) Diver Van Veen Surface Grab

Target Sample Interval: 0-10 cm

Datum (Horizontal/Vertical): N/A — water sample time = 1350

Leadline Water Depth: — Sampled from Exposed Mudflat

Tide Elevation: — L(-2.41' @ 14:18)

Mudline Elevation: —

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1350	48.01648	-122.19051	NA	NA	NA	NA	NA	10 cm	0-10 cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble Gravel (Sand) Coarse Medium (Fine) (Silt) Clay Shell Wood — fine sandy silt

Sediment Color: Gray Olive Drab Olive Light Brown Dark Brown (Black) Other — lt brn in upper 2-cm, black for 2-7cm, grey for 7-10cm

Sediment Odor: None (H2S) Petroleum Other ____ odor Slight Moderate (Strong)

Redox Thickness: ____ Visible Horizons: brown to black to grey

Organisms: Bioclastic matter Biological Structures: none

Wood: (None) <25% 25-50% >50% Describe: ____

Debris: Yes (No) Describe: ____

Petroleum: (None) SS MS HS Product Describe: ____

T = 14.75°C ORP = 295.5

C = 4.662 mS/cm — Water Quality Parameters from LLSP-03

DO = 3.33 mg/L — Seep water

pH = 6.95 — Duplicate Samples from Seep water and Sediment

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SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett Lowland | Job No.: 0504-068-00 | Sample Name: LLO-02 / LLSD-13

Date: 4/29/13 | Weather: sunny, light breeze, 50's

Field Personnel: Aaron Wagner and Hannah McDougall

Subcontractor: RSS

Sample Method: (Hand Collection) Diver Van Veen Surface Grab

Target Sample Interval: 0-10 cm

Datum (Horizontal/Vertical): ~~N/A Global~~ N/A

Leadline Water Depth: 1 Pt. collected at low tide from tideflat w/ outfall pool (1320 water sample time)

Tide Elevation: ~ L(-2.41' @ 14:18)

Mudline Elevation: -

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1315	48.01543	-122.18888	NA	~~NA~~	NA	NA	NA	10 cm	0-10 cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | (Sand) Coarse Medium Fine | (Silt) Clay | Shell | Wood — Sandy silt w/ organics (~15%)

Sediment Color: Gray | Olive | Drab Olive | (Light Brown to 2cm Dark Brown) | Black | Other: dark grey 2-10 cm

Sediment Odor: None | H_2S | Petroleum | (Other: marine) | Slight | Moderate | Strong

Redox Thickness: 0-2cm of brown 2-10cm of Gray | Visible Horizons: light brn to gray

Organisms: none | Biological Structures: organic material in upper 2 cm

Wood: (None) | <25% | 25-50% | >50% | Describe:

Debris: Yes | (No) | Describe:

Petroleum: (None) | SS | MS | HS | Product | Describe:

T = 12.73°C ORP = 3.5

C = 0.778 mS/cm Water Quality Parameters from LLO-02

DO = 7.97 mg/L Outfall water

pH = 7.19

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett Lowland ECY | Job No.: 0504-068-00 | Sample Name: LLSP-05 / LLSD-14 - 130426

Date: 4/26/13 | Weather: partly cloudy, upper 50's

Field Personnel: Aaron Waggoner and Hannah McDonough

Subcontractor: N/A

Sample Method: Hand Collection | Diver | Van Veen | Surface Grab — sample time: 1330

Target Sample Interval: 0-10 cm

Datum (Horizontal/Vertical): N/A

Leadline Water Depth: unsubmerged tideflat Sample at low tide

Tide Elevation: 12 pm = low tide L(-2.39'@1200)

Mudline Elevation: —

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1305	48.01291	-122.18467	NA	NA	NA	NA	NA	10cm	10cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: Metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | f-c (Sand) | Coarse | Medium | Fine | w/ (Silt) | Clay | Shell | Wood — f-c to coarse SAND w/ silt

Sediment Color: Gray | Olive | Drab Olive | Light Brown | Dark Brown | Black | Other — upper grey brown medium grey w/ orange

Sediment Odor: None | H_2S | Petroleum | (Other) marine | (Slight) | Moderate | Strong

Redox Thickness: 8 cm of grey | Visible Horizons: vertical pockets of iron staining

Organisms: worm | Biological Structures: vertical burrows

Wood: None | <25% | 25-50% | >50% | Describe: trace organics (<5%) (twigs, reeds).

Debris: Yes | (No) | Describe:

Petroleum: (None) | SS | MS | HS | Product | Describe:

T = 12.74°C | ORP = -47.2

C = 0.382 mS/cm | Water Quality Parameters of LLSP-05

DO = 6.33 mg/l | Seep water

pH = 6.88

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett Lowland | Job No.: 0504-068-00 | Sample Name: LLSD15 - 130426 (LLO-03)

Date: 4/26/13 | Weather: cloudy

Field Personnel: Aaron Waggoner and Hannah McDonough

Subcontractor: N/A

Sample Method: (Hand Collection) Diver Van Veen Surface Grab (Hand taken)

Target Sample Interval: 0 - 10 cm

Datum (Horizontal/Vertical): N/A

Leadline Water Depth: — Collected at low tide from mudflat

Tide Elevation: — L (-2.39' @ 1200)

Mudline Elevation: —

sample time: 1430

sketch

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1430	48.01273	-122.18437	~~Yes~~/NA	~~Yes~~/NA	~~Yes~~/NA	~~Yes~~/NA	~~Yes~~/NA	10cm	10cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: Metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | (silty) Sand | Coarse | Medium | Fine | Silt | Clay | Shell | Wood — Silty SAND

Sediment Color: Gray | Olive | Drab Olive | Light Brown | (Dark Brown) | Black | Other — dark grey w/ fragments of brick.

Sediment Odor: None | H_2S | Petroleum | (Other) marine | (Slight) | Moderate | Strong

Redox Thickness: ~~grey~~ — | Visible Horizons: —

Organisms: — | Biological Structures: none

Wood: (None) | <25% | 25-50% | >50% | Describe:

Debris: (Yes) | No | Describe: large pieces of wood and piping in channel (Timbers/Driftwood)

Petroleum: (None) | SS | MS | HS | Product | Describe:

T = 12.06°C | ORP = -50.5

Cond = 0.914 ms/cm | turbidity = 4.72

DO = 6.46 | Water quality parameters from LLO-03

pH = 6.70 | outfall water

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SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett Lowland | Job No.: 0504-068-00 | Sample Name: LLO-04 / LLSD-16

Date: 4/29/13 | Weather: Windy, sunny, 50°F

Field Personnel: Aaron Wengrower

Subcontractor: RSS

Sample Method: Hand Collection | Diver | Van Veen | Surface Grab | Power Grab — Outfall sample at 1155

Target Sample Interval: 0-10ft

Datum (Horizontal/Vertical): N/A

Leadline Water Depth: 4 ft

Tide Elevation: – H(11.48@7:24) L(-2.41@14:18)

Mudline Elevation: —

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1420	48.01088	-122.18121	Y	Y	Y	Y	Y	0.7ft (21.3cm)	0 to 10cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | (Sand) Coarse Medium (Fine) | Silt | Clay | Shell | Wood

Sediment Color: Gray | Olive | Drab Olive | (Light Brown) | Dark Brown | Black | Other: light brown sand 0-2cm grey fine sand/silt 2-10cm

Sediment Odor: None | H_2S | Petroleum | (Other: marine) | Slight | Moderate | Strong

Redox Thickness: 2cm brown upper, Gray 2cm to 10cm | Visible Horizons: brown – grey

Organisms: none | Biological Structures: vertical burrows, trace organics

Wood: None | (<25%) | 25-50% | >50% | Describe:

Debris: Yes | (No) | Describe:

Petroleum: (None) | SS | MS | HS | Product | Describe:

T = 10.03°C | ORP = -51.1

SC = 0.046 mS/cm | DO = 5.86 mg/L | pH = 6.45 — Water Quality Parameters from LLO-04 Outfall water

Anchor got Stuck on bottom after Sampling

GeoEngineers

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project Everett Lowland Job No. 0504-068-00 Sample Name LLO-05/LLSD-18

Date 4/29/13 Weather sunny, breezy, 50's

Field Personnel Aaron Waggoner and Hannah McDonough

Subcontractor RSS

Sample Method: Hand Collection Diver Van Veen Surface Grab Boat ~~Power~~ Grab

Target Sample Interval 0-10 cm

Datum (Horizontal/Vertical) N/A

Leadline Water Depth ~10ft

Tide Elevation H(11.48 @ 7:24) L(-2.41 @ 14:18)

Mudline Elevation -

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1004	48.00800	-122.17997	Yes	Yes	Yes	yes	Yes	0.65' (16.6cm)	10 cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble Gravel (Sand) Coarse Medium Fine (Silt) Clay Shell Wood — Lt. br fine Sandy Silt

Sediment Color: Gray Olive Drab Olive (Light Brown) Dark Brown Black Other

Sediment Odor: None H_2S Petroleum (Other) marine (Slight) Moderate Strong

Redox Thickness: 0.3 - 0.65 = grey redox Visible Horizons: gray silt ~ 4 inches depth

Organisms: marine plants upper layer Biological Structures: -

Wood: None (<25%) 25-50% >50% Describe: sticks, bark dust

Debris: Yes (No) Describe

Petroleum: (None) SS MS HS Product Describe

T = 9.23 °C

C = 0.060 mS/cm ORP = 65.7

DO = 11.12 mg/L Water Quality Parameters from LLO-05

pH = 7.15 outfall water Duplicate of LLSD-18 Sediment only

SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Everett, Lowland | Job No. 0504068-00 | Sample Name: LLSP-06/LLSD-17 (S&D)

Date: 4/29/13 | Weather: sunny, 60's

Field Personnel: Aaron Waggoner and Hannah McDonough

Subcontractor: RSI

Sample Method: Hand Collection | Diver | Van Veen | Surface Grab

Target Sample Interval: 0-10 cm

Datum (Horizontal/Vertical): —

Leadline Water Depth: ~~0ft~~ Sampled from exposed shoreline

Tide Elevation: — at low tide (-2.41' @ 14:18)

Mudline Elevation: —

grand water sample above time = 14:40

grand water sample below time = 14:50

LLSP-05S from above silt layer

LLSP-05D from below silt layer

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	14:35	48.00887	-122.18042	NA	NA	NA	NA	NA	10cm	0-10cm
2	14:50	48.00888	-122.18035	NA	NA	NA	NA	NA	10 cm	0-10cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | (Sand) | Coarse | (Medium) | Fine | Silt | Clay | Shell | Wood — ~~med SAND, trace silt~~

Sediment Color: (Gray) | Olive | Drab Olive | Light Brown | Dark Brown | Black | Other: grey f-c SAND w/ mica

Sediment Odor: (None) | H_2S | Petroleum | Other | Slight | Moderate | Strong

Redox Thickness: 0 | Visible Horizons: lt brown

Organisms: | Biological Structures: none

Wood: (None) | <25% | 25-50% | >50% | Describe:

LLSP-05D description 0-7cm of fine to coarse sand lt. brown for 2cm then gray 2cm to 7cm, fine silty SAND gray 7cm to 10cm

Debris: Yes | (No) | Describe:

Petroleum: Shallow (None) | SS | MS | HS | Deep | Product | Describe:

T = 14.83 | ORP = -57.1 | T 12.01 | ORP -16.1

C = 0.471 mS/cm | Water Quality parameters | C 0.345

DO = 6.26 mg/L | from both Seep locations | DO 9.74(?)

pH = 6.74 | LLSP-06S&D | pH 7.89

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SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Ecology Everett Lowland | Job No.: 0504-068-00 | Sample Name: ~~LLSP-07~~ LLSD-19 / LLØ7

Date: 4/30/13 | Weather: Sunny Breezy 50°F

Field Personnel: Aaron Waggoner / Hannah McDonough

Subcontractor: N/A

Sample Method: Hand Collection | Diver | Van Veen | Surface Grab

Target Sample Interval: 0 to 10cm

Datum (Horizontal/Vertical): —

Leadline Water Depth: N/A collected at low tide

Tide Elevation: -1.(-2.38' @ 15:06)

Mudline Elevation: —

LLØ7 ~~LLSP07~~ Parameters

Temp 11.57 | Cond 0.604 mS/cm | DO 6.35 | pH 6.36 | ORP -2.8

Lt. orange w/ H_2S odor, mod. Turbidity ~200 NTU

"Outfall not seep"

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1750	48.00597	-122.18026	NA	NA	NA	NA	NA	10cm	0 to 10cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis: Metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | (Sand) | Coarse | Medium | Fine | Silt | Clay | Shell | Wood

Sediment Color: Gray | Olive | Drab Olive | Light Brown | (Dark Brown) | Black | Other

Sediment Odor: None | (H_2S) | Petroleum | Other | Slight | Moderate | (Strong)

Redox Thickness: ~~Undetermined~~ 6cm | Visible Horizons: 0-4cm Gravelly Matrix

Organisms: N/A | Biological Structures: N/A

Wood: (None) | <25% | 25-50% | >50% | Describe

Debris: Yes | (No) | Describe

Petroleum: (None) | SS | MS | HS | Product | Describe

Changed to LLØ7 from LLSPØ7 after discovering that there was an 18" steel outfall. Coarse crushed Gravel on surface of mud flat that has weathered from the bulkhead. Dark brown silty SAND occasional Gravel to 4cm then just Dark Gray silty Sand to 10 cm.

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SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project Everett Lowland Job No. 0501-068-00 Sample Name LLSD-20/LL0-06

Date 4/29/13 Weather Sunny, slight breeze, upper 50's

Field Personnel Aaron Waggoner and Hannah McDonagh

Subcontractor RSS

Sample Method: Hand Collection Diver · Van Veen Surface Grab (Boat Power Grab)

Target Sample Interval 0-10cm

Datum (Horizontal/Vertical) N/A outfall sample 1130

Leadline Water Depth 5ft

Tide Elevation - H(11.48@7:24) L(-2.41@14:18)

Mudline Elevation -

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1110	48.00382	-122.18119	Y	N	Y	Y	N		
2	1111			-	-	-	-	-		
3	1119			Y	Y	Y	Y	Y	0.6ft 18.3cm	~~0.6ft~~ 0 to 18.3cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached.

Laboratory Analysis:

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble, w/ (Gravel), (Sand), Coarse, Medium, Fine, Silt, Clay, Shell, Wood — light brn f SA w/ silt 0-4cm; light grey SA ~~w/ gravel~~ 4-7cm; grey SA w/ gravel 7-10cm

Sediment Color: Gray, Olive, Drab Olive, (Light Brown), Dark Brown, Black, Other

Sediment Odor: None, H_2S, Petroleum, Other marine, (Slight), Moderate, Strong

Redox Thickness: 4cm of brown oxidized Visible Horizons:

Organisms: Biological Structures: vertical burrows 0-1.5cm

Wood: None, (<25%), 25-50%, >50% Describe: Sticks > 1" diam in Power Grab,

Debris: Yes, (No) Describe:

Petroleum: (None), SS, MS, HS, Product Describe:

T= 11.77°C ORP= -40.0

C= 0.472 mS/cm Water Quality Parameter from LL0-06:

DO= 5.43 mg/L Outfall water

pH= 6.79 Duplicate of LLSD-20 Sediment only

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SURFACE SEDIMENT SAMPLE COLLECTION FORM

Project: Ecy - Everett Lowland | Job No. 0504-068-00 | Sample Name: LLSP-08/LLSD-21

Date: 4/26/13 | Weather: Sunny, Lt. breeze, 50°F

Field Personnel: Aaron Waggoner / Hannah McDonough

Subcontractor: N/A

Sample Method: Hand Collection | Diver | Van Veen | Surface Grab | Cookie Cutter

Target Sample Interval: 0 to 10 cm | sample time: 1130

Datum (Horizontal/Vertical): N/A

Leadline Water Depth: in Submerged Collected at low tide mud flat

Tide Elevation: Low Tide ~12PM -1.5' L (-2.39 @ 12:00)

Mudline Elevation: +

Run # or Comosite Pt	Time	Latitude (Northing)	Longitude (Easting)	Sample Criteria 1	2	3	4	5	Penetration Depth	Sample Depth
1	1120	48.00264	-122.18144	NA	NA	NA	NA	NA	10 cm	10 cm

Acceptance critiera: 1 Overlying water is present; 2 Water has low turbidity; 3 Sampler is not overfilled; 4 Sample surface is flat; 5 Desired sample depth is reached. * gradual sloping bank

Laboratory Analysis: Metals

SEDIMENT SAMPLE DESCRIPTION

Predominant Sediment Type: Cobble | Gravel | Sand | Coarse | Medium | Fine | (Silt) | Clay | Shell | Wood

Sediment Color: Gray | Olive | Drab Olive | Light Brown | Dark Brown | Black | Other — top 1cm = brown, remainder = dark grey

Sediment Odor: None | (H_2S) | Petroleum | Other ____ | Slight | (Moderate) | Strong

Redox Thickness: 9 cm | Visible Horizons: No

Organisms: No | Biological Structures: No

Wood: None | (<25%) | 25-50% | >50% | Describe: woody debris, reeds

Debris: (Yes) | No | Describe: old cable, sediment cloth, other, see photo

Petroleum: None | SS | MS | HS | Product | Describe: Yes, sheen, organic platy sheen

pH 6.98 | ORP: -89.2

DO 6.28 mg/L | Water Quality Parameters from LLSP-08

Cond 0.759 mS/cm | Seep Water

T 14.10 °C

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APPENDIX B
Data Quality Assessment Report

DATA VALIDATION REPORT

TOTAL/DISSOLVED METALS IN WATER BY METHODS EPA200.8/SW7470A
METALS IN SEDIMENT BY METHODS SW6010C/200.8/7471A

Primary Laboratory SDG	Samples Validated (Bold indicates the sample was qualified)
W045/ W046	LL002-130429, LL003-130426, LL004-130429, LL005-130429, LL006-130429, LL006-130429-DUP, LL007-130430, LLSP03-130429, LLSP03-130429-DUP, LLSP05-130426, LLSP06-130429, LLSP08-130426
W057	LLSD11-130429, LLSD11-130429-DUP, LLSD13-130429, LLSD14-130426, LLSD15-130426, LLSD16-130429, LLSD17-130429, LLSD18-130429, LLSD18-130429-DUP, LLSD19-130430, LLSD20-130429, LLSD21-130426

PROJECT: LOWLAND AREA (0504-068-00)

This report documents the results of an Environmental Protection Agency (EPA) level 2b data validation of analytical data from the analyses of water and sediment samples and the associated laboratory and field quality control (QC) samples. The review included the following:

- Chain of Custody
- Holding Times and Sample Preservation
- Instrument Calibration
- ICP Interference Check Sample
- Method and Calibration Blanks
- Laboratory Control Samples
- Matrix Spikes
- Laboratory Duplicates
- Field Duplicates

OBJECTIVE

The objective of the data validation was to review laboratory analytical procedures and quality control (QC) results to evaluate whether:

- The samples were analyzed using well-defined and acceptable methods that provide detection limits below applicable regulatory criteria;
- The precision and accuracy of the data are well defined and sufficient to provide defensible data; and
- The quality assurance/quality control (QA/QC) procedures utilized by the laboratory meet acceptable industry practices and standards.

Seven (7) stormwater outfall samples, twelve (12) sediment samples, and five (5) seep samples, including field duplicates, were analyzed by one or more of the analytical methods listed in the title of this appendix.

DATA PACKAGE COMPLETENESS

Analytical Resources Incorporated (ARI), located in Tukwila, Washington, analyzed the water samples evaluated as part of this data quality assessment. The laboratory provided all required deliverables for the assessment according to the National Functional Guidelines. The laboratory followed adequate corrective action processes and all identified anomalies were discussed in the case narratives.

DATA QUALITY ASSESSMENT SUMMARY

The results for each of the QC elements are summarized below. The data assessment was performed using guidance in the USEPA Contract Laboratory Program *National Functional Guidelines for Inorganic Data Review* (USEPA, 2010).

Chain-of-Custody Documentation

Chain-of-custody (COC) forms were provided with the laboratory analytical reports. There were no anomalies noted on the COC forms; proper COC protocols appear to have been followed for this sampling event.

Holding Times and Sample Preservation

The holding time is defined as the time that elapses between sample collection and sample analysis. The maximum holding time criteria of 6 months (28 days for mercury) is prescribed for the two metals analytical methods to help ensure that the analyte concentrations found at the time of analysis reflect the concentration present at the time of sample collection. Established holding times of 6 months (28 days for mercury) were met for all analyses.

Instrument Calibration

The laboratory followed the method requirements for satisfactory instrument calibration. Instrument calibration is necessary in order to ensure that the instrument is capable of producing acceptable quantitative data for the metals on the target analyte list in the QAPP. Initial Calibration Verification (ICV) demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. The Continuing Calibration Verification (CCV) demonstrates that the initial calibration is still valid by checking the performance of the instrument on any given day that samples are being analyzed.

Each calibration curve was made up of a blank and at least five calibration standards with all measurements being within the working range of the instrument. The calibration curves were fitted using linear regression and each curve had a correlation coefficient of ≥ 0.995.

The ICV/CCV standards were within 90% to 110% of the true value in all cases.

ICP Interference Check Sample

The Interference Check Sample verifies the analytical instrument's ability to overcome isobaric interferences typical of those found in samples. The laboratory analyzed this QC sample at the

proper frequency and location of the analytical run. All solution mixtures were within the control limit of 20% of the true value.

Method Blanks

Method blanks are analyzed to ensure that laboratory procedures and reagents do not introduce measurable concentrations of the analytes of interest. Method blanks were analyzed with each batch of samples, at a frequency of 1 per 20 samples. For all sample batches, method blanks were analyzed at the required frequency. None of the analytes of interest were detected above the reporting limits in any of the method blanks.

Matrix Spikes

Because the actual analyte concentration in an environmental sample is not known, the accuracy of a particular analysis is usually inferred by performing a matrix spike (MS) analysis. One aliquot of sample is analyzed in the normal manner, and then a second aliquot of the sample is spiked with a known amount of analyte concentration and analyzed. From these analyses, a percent recovery (%R) is calculated. In the event that a particular element is out of the recovery value control limits in the matrix spiked sample, the laboratory is required to analyze a "post-spiked" sample in order to further isolate any potential quality control issues with the given element.

Matrix spike analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for matrix spikes are 75% to 125% for all of the elements in this report.

The frequency requirements were met for all analyses, with the following exceptions:

All SDGs: The %R value for total antimony was less than the control limit of 80%. Appropriately, in each case the laboratory properly conducted a post-spiked sample. These post-spiked samples were spiked with a higher concentration of element solution as the matrix spike, however, they do not interact with acid and are never heated in the digestion process. The %R values for each of the post spike samples were within the 75% to 125% control limits.

In the process of determining the appropriate action for this potential outlier, it was also noted that the associated positive field results for total antimony were all far less than the specified screening level for this compound. Based on professional judgment, the total antimony reporting limits were not qualified, as there is no effect on the usefulness of the antimony data for this project.

Laboratory Control Samples (LCS)

A laboratory control sample is essentially a blank sample that is spiked with a known amount of analyte concentration and analyzed. It is to be treated much like a matrix spike, without the possibility for matrix interference. As there is no actual sample matrix in the analysis, the analytical expectations for accuracy and precision are usually more rigorous and qualification would apply to all samples in the batch, instead of the parent sample only.

Laboratory control sample analyses should be performed once per analytical batch or every 20 field samples, whichever is more frequent. The recovery criteria for laboratory control samples are specified in the laboratory documents as are the relative percent difference values. The frequency requirements were met for all analyses, and the %R/RPD values were within the proper control limits.

Laboratory Duplicates

Internal laboratory duplicate analyses are performed to monitor the precision of the analyses. Two separate aliquots of a sample are analyzed as distinct samples in the laboratory, and the RPD between the two results is calculated. Duplicate analyses should be performed once per analytical batch. If one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

Laboratory duplicates were analyzed at the proper frequency and the specified acceptance criteria were met for all analyses.

Field Duplicates

Field duplicate samples were collected and analyzed along with the reviewed sample batches. The duplicate samples were analyzed for the same parameters as the associated parent samples. As mentioned above for the laboratory duplicates the RPD is used as the criteria for assessing precision, unless one or more of the samples used has a concentration greater than five times the reporting limit for that sample, the absolute difference is used instead of the RPD.

The RPD control limits for water samples is 50%, while the RPD control limits for water samples is 35%. The absolute difference control limits for soil samples is twice the PQL value, while the absolute difference control limits for water samples is the same as the PQL value. There were four sets of field duplicates shown below for this phase of the sampling event:

- LLO06-130429 & LLO06-130429-DUP
- LLSP03-130429 & LLSP03-130429-DUP
- LLSD11-130429 & LLSD11-130429-DUP
- LLSD18-130429 & LLSD18-130429-DUP

The precision criteria for all target analytes were met for all sample pairs.

OVERALL ASSESSMENT

As was determined by this data quality assessment, the laboratory followed the specified analytical methods. Accuracy was acceptable, as demonstrated by the LCS and MS %R values. Precision was acceptable, as demonstrated by the laboratory duplicate and field duplicate RPD values.

All data, as reported, are acceptable for use.

APPENDIX C
Laboratory Deliverables (on attached CD)

APPENDIX D
Report Limitations and Guidelines for Use

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Environmental Services are Performed for Specific Purposes, Persons and Projects

GeoEngineers has performed this investigation of the Everett Smelter – Lowland Area in general accordance with the scope and limitations of our proposal, dated July 3, 2012. This report has been prepared for the exclusive use of Washington State Department of Ecology, and their authorized agents. This report is not intended for use by others, and the information contained herein is not applicable to other properties.

GeoEngineers structures our services to meet the specific needs of our clients. For example, an ESA study conducted for a property owner may not fulfill the needs of a prospective purchaser of the same property. Because each environmental study is unique, each environmental report is unique, prepared solely for the specific client and property. No one except Washington State Department of Ecology should rely on this environmental report without first conferring with GeoEngineers. Use of this report is not recommended for any purpose or project except the one originally contemplated.

This Environmental Report is Based on a Unique Set of Project-Specific Factors

This report has been prepared for the Everett Smelter – Lowland Area. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

If important changes are made to the project or property after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Reliance Conditions for Third Parties

Our report was prepared for the exclusive use of our Client. No other party may rely on the product of our services unless we agree to such reliance in advance and in writing. This is to provide our

1 Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with the Client and generally accepted environmental practices in this area at the time this report was prepared.

Environmental Regulations are Always Evolving

Some substances may be present in the vicinity of the subject property in quantities or under conditions that may have led, or may lead, to contamination of the subject property, but are not included in current local, state or federal regulatory definitions of hazardous substances or do not otherwise present current potential liability. GeoEngineers cannot be responsible if the standards for appropriate inquiry, or regulatory definitions of hazardous substances, change or if more stringent environmental standards are developed in the future.

Conditions Can Change

This environmental report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the subject property, by new releases of hazardous substances, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Please contact GeoEngineers before applying this report for its intended purpose so that GeoEngineers may evaluate whether changed conditions affect the continued applicability of the report.

Most Environmental Findings are Professional Opinions

Our interpretations of site conditions are based on field observations and analytical data from widely spaced sampling locations at the subject property. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an informed opinion about subsurface conditions throughout the property. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

Read These Provisions Closely

It is important to recognize that the geoscience practices (geotechnical engineering, geology and environmental science) are less exact than other engineering and natural science disciplines. Without this understanding, there may be expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory “limitations” provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you need to know more about how these “Report Limitations and Guidelines for Use” apply to your project or property.