Final Supplemental Remedial Investigation Report

Everett Smelter Lowland Area
Everett, Washington

for
Washington State Department of Ecology

February 8, 2016

GeoEngineers
Earth Science + Technology

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File No. 0504-068-01

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1.0 INTRODUCTION

This report presents the results of the supplemental remedial investigation (SRI) for the Everett Smelter Lowland Area (*Lowland* or *Lowland Area)* located in northeast Everett, Washington (Figure 1-1). This SRI has been completed on behalf of the Washington State Department of Ecology (Ecology) who is performing the work under a bankruptcy settlement agreement with ASARCO, the prior owner of the smelter, to address environmental impacts from the smelter.

The Everett Smelter Site is comprised of two areas: the Upland Area and the Lowland Area. The Lowland Area is generally situated between Marine View Drive and the Snohomish River and is located east of the Everett Smelter Upland Area where a former lead smelter and an associated arsenic extraction facility operated from approximately 1892 to 1912 (Hydrometrics, 1995). The general area that was occupied by the former smelter is shown in relation to the Upland and Lowland areas in Figure 1-2.

The geographic extent of the Everett Smelter Cleanup Site shown in Figure 1-2 was identified as part of work performed under a Community Protection Measures program and the boundaries of the Upland and Lowland areas were identified in Exhibit A of the Enforcement Order for the "Everett Smelter" Site (DE 97TC-N119; Ecology, March 14, 1997). The 1997 Enforcement Order and Everett Smelter Site Final Cleanup Action Plan (FCAP) for the Upland Area (Ecology, 1999) describe that separate cleanup actions would be implemented for the Upland and Lowland areas. The FCAP also states that cleanup of the Lowland Area may require additional remedial actions in the Upland Area to address contamination in the Lowland Area (ex. groundwater contamination). The final boundary of the Lowland Area will be based on the extent of contamination that is determined to be the result of impacts from the smelter.

Operations at the former smelter facility resulted in soil and groundwater contamination of the Lowland Area with metals. Smelter-related contaminant sources can be generally grouped into three categories:

- Slag that was poured from the Upland Area down a slope east of the smelter onto the Lowland Area during smelter operations;
- Fallout from smelter "smokestack" (stack) emissions; and
- Residual contaminated materials that were left in the ground at the time the smelter was demolished.

Smelter-related contamination was largely undocumented until its discovery in 1990 (SAIC, 2010). The list of metals that has been investigated related to former smelter operations includes arsenic, lead, cadmium, mercury, thallium, antimony, zinc and copper. However, arsenic is the primary contaminant of concern resulting from smelter operations. Other industrial operations previously located in the Lowland Area have also contributed to arsenic contamination in portions of the Lowland Area.

The boundary between the Upland and Lowland Areas is generally Marine View Drive. The Lowland Area includes the relatively steep slope that extends from adjacent to and east of Marine View Drive, down to the generally flat area that extends from the base of the slope to the Snohomish River. Before the early 1900s, the low, generally flat area comprising the majority of the Lowland Area was a floodplain of the Snohomish River. Approximately 5 to 15 feet of fill has been placed over the area from the early 1900s to present (2014). Most of the fill placed in the Lowland Area was dredged from the Snohomish River (ASARCO, 2000).

There have been multiple previous investigations of the Upland and Lowland Areas. A remedial investigation and feasibility study (RI/FS) was performed for the Upland Area (Hydrometrics, 1995) as well as a Cleanup Action Plan (CAP) (Ecology, 1999) that identified the cleanup approach to be implemented in the Upland Area. An initial RI was also performed for the Lowland Area that provided a compilation of the data that was available from the multiple investigations of the Lowland Area (ASARCO, 2000).

Portions of the Upland Area have been remediated by Ecology in accordance with the Upland Area CAP. The portion of the Upland Area where the arsenic extraction facility was located was investigated and remediated between 1999 and 2007 (Ecology, 2013). Cleanup of Upland residential properties surrounding the former arsenic extraction facility is currently being performed by Ecology and is expected to be complete by approximately 2022.

The purpose of this SRI is to present the results of investigations of smelter-related contamination in the Lowland Area. This SRI:

- Summarizes the entire Site history and the history of the Lowland Area;
- Provides a description of current Lowland Area conditions;
- Presents the results from the investigation of soil, water, and sediment including the results of recent investigations performed in 2011 through 2014;
- Identifies the conceptual site model; and
- Defines the nature and extent of contamination in comparison to applicable cleanup standards.

This SRI has been completed in accordance with the Model Toxics Control Act (MTCA) and in coordination with Ecology.

2.0 SITE BACKGROUND AND HISTORY

This section presents the site background and history for the plant and the Lowland portion of the Everett Smelter Cleanup (ESC) Site. Specifically, the following sections provide the site background including location and setting, current zoning and land use, property ownership and identified subareas of the Lowland Area within the ESC Site. The following sections also present the history of the smelter facility and Lowland Area and summarizes previous investigations and investigations locations that provide data to support characterization of the Lowland Area.

2.1. Site Location and Setting

The Everett Smelter Cleanup Site was identified in October 1990 when soil and groundwater samples were collected near East Marine View Drive that contained elevated metals concentrations (Ecology, 1999). Subsequent studies performed throughout the 1990's showed elevated metals concentrations throughout portions of the Upland and Lowland areas. The boundary of the Lowland Area has generally been identified to include the area shown in Figure 2-1.

The Everett Smelter Lowland Area is generally situated between Marine View Drive and the Snohomish River in northeast Everett, Washington. Marine View Drive and the Snohomish River define the western, northern and eastern boundaries of the Lowland Area. The southern boundary is generally a line extending eastward from 12th Street to the Snohomish River (Figure 2-1).

The Lowland Area includes the relatively steep slope that extends from adjacent to and east of Marine View Drive down to the generally flat area that extends from the base of the slope to the Snohomish River. The elevation of Marine View Drive at the former location of the smelter facility west of the Lowland Area ranges from approximately Elevation 54 to 57 feet (NAVD 88). The elevation of the flat area that comprises the majority of the Lowland Area between the base of the slope and the Snohomish River ranges from approximately Elevation 12 to 17 feet (NAVD 88).

The relatively steep, northeast-facing slope located adjacent to and east of Marine View Drive is mostly vegetated with trees and brush. The flat portion of the Lowland Area between the base of the slope and the Snohomish River is predominantly unpaved and is vegetated with trees, brush, and grass. Paved areas within the Lowland Area are associated with industrial/commercial facilities and roadways.

Multiple road and railroad right-of-ways (ROWs) are present within and adjacent to the Lowland Area. The road ROWs include Marine View Drive, Pacific Highway (also known as State Route 529 or Highway 529), Weyerhaeuser Bridge Road and Riverside Drive. Other private roadways are also present that provide access to industrial/commercial facilities and operations. The Pacific Highway and Weyerhaeuser Bridge Road ROWs include bridge structures that cross over railroad. An aboveground natural gas installation operated by Puget Sound Energy (PSE) is located in the Shadow Development/Blunt Family LLC subarea (described below). ROWs present on the Lowland Area and the Pacific Highway bridge structure also cross over the Snohomish River. Railroad ROWs traverse the Lowland Area generally from south to north.

Multiple buildings are present in the Lowland Area associated with industrial/commercial operations. Multiple utilities are also present in the Lowland Area that support the industrial/commercial operations. Known underground utilities include power, water, storm and sanitary sewer, telephone, fiber-optic cable and natural gas. Surface water and stormwater runoff is conveyed from wetlands, ponds and basins in the Lowland Area via ditches and pipes to the Snohomish River (described in further detail in Section 4).

Aboveground utilities include power and telephone lines supported on utility poles. A Public Utility District (PUD) substation is located in the Lowland Area north of the intersection of Marine View Drive and Pacific Highway.

Bulkheads, constructed of timber, exist along the majority of the shoreline of the Snohomish River in the Lowland Area. A paved shoreline trail, currently closed to the public, is located along a portion of the Snohomish River. A separate section of paved trail, also currently closed to the public, is located adjacent to a portion of the BNSF railroad tracks.

There are no known water supply wells within the Lowland area. The nearest water wells are City of Everett irrigation supply wells located more than 1/2 mile west of the Lowland Area.

2.2. Current Zoning and Land Use

The Lowland Area is zoned for industrial and commercial use. A portion of the property in the Lowland Area south of the intersection of East Marine View Drive and Pacific Highway is zoned C-2 "Heavy Commercial – Light Industrial" and a portion of the property on the northern boundary of the Lowland Area is zoned M-S "Marine Services." The remaining properties within the Lowland Area are zoned M-2 "Heavy Manufacturing" according to a City of Everett Zoning Map (Figure 2-2). In general, the property uses in the Lowland Area are industrial in nature and include recycling facilities and transfer stations, a substation, rail transport, bus repair and materials storage.

Zoning in the Upland Area west of the Lowland is, from north to south, "Public Park Zone," "Single Family – Low and Medium Density," "Multiple Family – High Density" and "General Commercial" (Figure 2-2). Land use west of the Lowland Area predominantly includes residential use and park land (i.e., a golf course and other smaller parks).

2.3. Property Ownership and Subarea Description

The approximately 250-acre Lowland Area is comprised of multiple parcels of property under both public and private ownership. Figure 2-3 identifies the properties that comprise the Lowland Area and presents the current (2013) property ownership. The following sections describe the Lowland Area in more detail based on subareas identified within the Lowland Area. Subarea delineation is generally based on the property ownership and location within the Lowland Area. The subareas described in the following sections are shown on Figure 2-4. Multiple cleanup sites are present in the Lowland Area resulting from previous activities not related to the Everett Smelter as discussed in Section 2.4.

2.3.1. Benson Subarea

The 12-acre Benson subarea is located adjacent to and east of the former smelter facility (Figure 2-4). The area includes three parcels owned by Benson and Wolken Properties Limited Liability Company (LLC) (i.e., 29050800401900, 29050800400100 and 290508004001100) (Figures 2-3). The subarea also includes the Weyerhaeuser Bridge Road ROW that traverses the Benson subarea and the eastern portion of the West Marine View Drive ROW and southern portion of the Pacific Highway ROW. The Benson subarea is bounded on the east by BNSF railroad ROW and Viola Ousler Park to the south.

The Benson subarea includes the vegetated, relatively steep east-facing slopes adjacent to East Marine View Drive, Weyerhaeuser Bridge Road and Pacific Highway as well as the lower portion of the property between the base of the slope and the BNSF property. The parcels are in the process of being filled to raise the elevation of the ground surface.

Two surface water features are present within the Benson subarea. The southernmost feature is a ditch located south of the Weyerhaeuser Bridge Road that receives runoff from the adjacent steep, vegetated slope. Water flows north in the southernmost feature through a culvert to a second surface water feature located north of the Weyerhaeuser Bridge Road that is approximately 0.5 acres in size. A sign adjacent to the feature indicates that the area is a “City of Everett Wetland.” Water from the City of Everett wetland appears to flow generally northeast in ditches and pipes towards an outfall on the Snohomish River.

During operation of the smelter, slag was poured down the slope onto the Benson subarea. A portion of the slag was later removed (Hydrometrics, 1995). However, slag still remains at the site. Slag is further discussed as part of the Lowland Area history in Section 2.4.

2.3.2. Riverside Business Park Subarea

The Riverside Business Park subarea encompasses the eastern portion of the Lowland Area between BNSF property and the Snohomish River (Figure 2-4). The Riverside Business Park subarea is comprised of multiple parcels owned by the Port of Everett, Cymbaluk Marshal LLC, Snohomish County, and M.A.P. #2 LLC (Figure 2-3). The Weyerhaeuser Bridge Road provides access to the Riverside Business Park from Marine View Drive. Riverside Road runs along the western boundary of the Riverside Business Park and intersects with Weyerhaeuser Bridge Road on the northern portion of the Business Park subarea. The Riverside Business Park subarea is the previous location of Weyerhaeuser Mill B. Weyerhaeuser Mill B is further discussed as part of the Lowland Area history in Section 2.4.

The Riverside Business Park subarea includes portions (the non-in-water portions) of eight parcels owned by the Port of Everett (i.e., 29050800402700, 2905080040200, 29050800402800, 29050900300800, 29050800402500, 29050800402600, 29050900301000, and 29050900300900) and totaling approximately 60 acres (Figure 2-3). The Port of Everett property in the Riverside Business Park is currently undeveloped. The central portion of the Port of Everett property in the Riverside Business Park is being filled to raise the ground surface elevation.

A stormwater basin lined with a mat made of bentonite clay (i.e., bentomat) that was built in 2002 is located south of the Weyerhaeuser Bridge Road. The basin receives stormwater from Riverside Road and discharges through underground pipes to an outfall on the shoreline of the Snohomish River. Several other stormwater outfalls are located along the shoreline of the Riverside Business Park subarea that also discharge to the Snohomish River.

A 5.3-acre parcel owned by Cymbaluk Marshall and Katherine Family LLC (i.e., 29050800402100) is located in the northern portion of the Riverside Business Park subarea north of the Weyerhaeuser Bridge Road. The Cymbaluk Marshall and Katherine Family LLC property is surrounded by Port of Everett Property. An approximately 800-foot long paved trail is located on the Port of Everett property between the Cymbaluk Marshall and Katherine Family LLC property and the Snohomish River. The trail is currently closed to the public. The Everett Shoreline Public Access Plan indicates that the ultimate goal is to build a continuous trail along the shoreline of the Snohomish River that would go through the Riverside Business Park Subarea (City of Everett, 2002).

The Cymbaluk Marshall and Katherine Family LLC property is paved except for the northern portion of the property where a bentomat-lined stormwater basin and vegetated area are located. The basin receives stormwater from the northern portion of Riverside Road, and discharges in underground pipe to the Snohomish River. Stormwater from the paved portion of the Cymbaluk Marshall and Katherine Family LLC property combines with stormwater that discharges from the stormwater basin and discharges in the same outfall. One large building is located on the property that is used for bus repair.

A 16-acre parcel owned by Snohomish County (29051600200100) is located in the southern portion of the Riverside Business Park subarea. The Snohomish County property is used for transshipment of solid waste and is comprised of paved, gravel surfaced and vegetated areas. Several portable buildings as well as rail lines are located on the Snohomish County property that support transfer station operations.

An 8.4-acre parcel (29051600200500), currently owned by M.A.P. #2, LLC is also located in the southern portion of the Riverside Business Park and Lowland Area. The northern portion of the property is paved and the southern portion has gravel surfaced and vegetated areas.

The property owned by M.A.P. #2 LLC is the former location of the Weyerhaeuser Mill E and Koppers Facility. The Koppers Facility was a former wood treatment facility that has undergone remediation to remove and/or contain contaminated soil and groundwater. Weyerhaeuser Mill E and former Koppers wood treatment facility are further discussed as part of the Lowland Area history in Section 2.4.

A vegetated levee and/or bulkheads constructed of wood are located along the shoreline of the Snohomish River and form the eastern boundary of the Riverside Business Park subarea.

2.3.3. Snohomish County PUD Subarea

The Snohomish County PUD subarea is located north of the intersection of Pacific Highway and West Marine View Drive (Figure 2-4) and includes an approximately 7-acre parcel owned by the Snohomish County PUD (29050800400300) (Figure 2-3). The southeast portion of the subarea also includes the adjacent relatively, steep slope comprising the northern portion of the Pacific Highway ROW. A paved access road enters the subarea from West Marine View Drive. The Snohomish County PUD subarea is bounded on the north and northeast by BNSF property.

The relatively flat portion of the subarea includes an electrical substation. The PUD substation is a gravel surfaced area surrounded by chain link fence. The substation is the location of a former Weyerhaeuser demolition debris landfill. The demolition debris landfill is further discussed as part of the Lowland Area history in Section 2.4.

Vegetated areas surround the substation and a surface water pond is located northwest and northeast of the substation. The pond likely receives runoff from the Snohomish County PUD subarea including the slopes comprising the eastern portion of the Marine View Drive ROW as well as the northern portion of the Pacific Highway ROW. Surface water from the pond is conveyed through pipes toward BNSF property and the Snohomish River.

2.3.4. Shadow Development/Blunt Family LLC Subarea

The Shadow Development/Blunt Family LLC subarea is located on the northern portion of the Lowland Area (Figure 2-4) and includes three parcels owned by Shadow Development (29050800102100, 29050800101900 and 29050800402300), one parcel owned by the Blunt Family LLC (29050800102000), and one small parcel owned by Puget Sound Energy (29050800102300) (Figure 2-3). The approximately 32-acre subarea is bounded by BNSF ROW on the west and south and the Snohomish River on the north and east except for an approximately 0.9-acre triangular-shaped parcel surrounded on all sides by BNSF ROW.

The main portion of this subarea is an active industrial site approximately half of which contains paved surfaces. An access road enters the main portion of the subarea from Marine View Drive. A group of buildings supports activities occurring in the subarea that includes handling and storage of recycled materials. Bulkheads constructed of wood are located along most of the shoreline of the Snohomish River and form the north and east boundary of the subarea. The smaller, triangular-shaped parcel is undeveloped and covered with vegetation including trees, brush and grass.

An approximately 600-foot long paved trail is located along the southwestern side of the subarea adjacent to the BNSF ROW (Figure 2-4). The trail is currently closed to the public. The Everett Shoreline Public Access Plan indicates that the location of the paved trail is an “alternate trail” route under the plan. The ultimate goal is to build a continuous trail along the shoreline of the Snohomish River that would go through the subarea (City of Everett, 2002). The Shadow Development/Blunt Family LLC subarea is the previous location of Weyerhaeuser Mill C. Weyerhaeuser Mill C is further discussed as part of the Lowland Area history in Section 2.4.

2.3.5. Slope Subarea

The Slope subarea is in the northern portion of the Lowland Area and consists of the relatively steep northeast-facing slope located between Marine View Drive and BNSF railroad ROW. Unlike the remaining portion of the Lowland Area, the Slope subarea has likely remained relatively unaltered since the operation of the smelter and no significant fill is known to have been placed on the Slope subarea.

The Slope subarea is approximately 8 acres in size and is comprised of parcels owned by Shadow Development (29050800402200) and Everett Delta Power Company LLC (2905080020110) as well as the northeast portion of the West Marine View Drive ROW and BNSF ROW. The Slope subarea is covered with vegetation including trees, brush and grass. The slope subarea contains a 1.91-acre area identified as American Legion Park in the Green Everett Partnership 20-Year Forest Management Plan (Green Everett Partnership, 2013). American Legion Park is shown on Figure 2-4.

2.3.6. BNSF Subarea

The BNSF subarea includes all property owned by BNSF and included in BNSF ROWs in the Lowland Area. The BNSF subarea traverses the Lowland Area generally from south to north and is generally comprised of relatively flat land. Much of the area is covered by railroad ballast and railroad tracks. The portion of the BNSF subarea that is not covered by ballast and track is typically vegetated with trees, brush and grass. The majority of the BNSF property in the Lowland Area is part of the BNSF “Delta” yard, which is a rail switching yard. The BNSF properties are being investigated separately and are not being evaluated as part of this SRI.

2.4. Site History

2.4.1. Smelter Facility

This section presents a summary of the history of the former smelter facility based on the information provided in previous site investigation reports. A detailed history of smelter development and operations is presented in the initial RI report for the Everett Smelter Site (Hydrometrics, 1995) and the Smelter Area Investigation Report (Hydrometrics, 1998). Key events and activities in the history of smelter development, operation and closure include the following (Hydrometrics, 1995):

Year(s)	Events/Activities
1892	Land for the smelter was purchased from Everett Land Company by Puget Sound Reduction Company and construction of the smelter began.
1894	Lead smelting initiated.
1898	Arsenic extraction facilities were added to the smelter, the first in the United States, and arsenic extraction began.
1901	The smelter was expanded to produce more arsenic than was previously produced. Records are not complete, however arsenic production was 1,353 tons in 1902.
1902	The smelter was sold to the Federal Mining and Smelting Company and then to American Smelting and Refining Company (ASARCO).
April 1902	The smelter was temporarily closed (Mining American, 1904).
February or March 1904	The smelter was re-opened (Hydrometrics, 1995; Mining American, 1904).
May 1904 to January 1908	119,495 tons of ore was smelted and 30,733 tons of lead was produced.
February 1908	Lead smelting ceased at the smelter but arsenic extraction continued.
February 1912	Arsenic extraction was shut down and the smelter began being dismantled. Some in-ground materials such as foundations, parts of flues and waste products were left in the ground.
1915	Everett smelter stacks were toppled for brick recovery.
1917	Dismantling completed.
1920s – 1930s	ASARCO sold the smelter properties. The last property was sold in 1936.
1930s – 1940s	Former smelter property developed for residential purposes.
1956	The East Marine View Drive/Pacific Highway interchange was constructed.
October 1990	Everett Smelter Site discovery.

The smelter facility covered approximately 19 acres of the approximately 26 acres of smelter property (Hydrometrics, 1995). Figure 1-2 shows the approximate location of the former smelter property. The location and layout of the former smelter facility is presented in Figure 2-5, and Figure 2-6 shows a generalized schematic of facility processes.

Lead smelting operations began in 1894. Lead bullion and dorè bars (lead containing relatively high concentrations of silver and gold) were the primary products produced at the smelter facility. Arsenic extraction and production of arsenic trioxide was added in 1898. The primary source of ore for the facility was the Monte Cristo mining district east of Everett. However, ore was also imported from nearly all of the mines located in northwest Washington. The majority of the ore contained relatively high arsenic concentrations (as high as 27 percent arsenic).

Lead ore was transported by rail to the smelter and stored in bins. Low sulfur ore was placed in blast furnaces in a reducing environment (i.e., mixed with coke or lime), which created lead, matte and slag, which separated based on density. Lead and matte were recovered for sale or refining and slag was disposed of on site by pouring the slag down the steep slope east of the smelter (into the Lowland Area and specifically onto the Benson subarea). Blast furnace emissions were conveyed through dust chambers and flues before reaching the stacks. Flue dust settled out in the dust chambers for recovery and re-introduction into the blast furnace. The emissions that passed through the dust chambers and flues were released from stacks.

Arsenic ore, and lead ore that contained high concentrations of sulfur, were first roasted in large ovens before being placed in the blast furnace and processed as described above. The emissions from roasting were conveyed in dust chambers to flues and then released from stacks. Flue-dust was collected in the dust chambers and transported to an arsenic processing area. The flue-dust was then roasted in the arsenic processing area releasing arsenic gas. The arsenic gas was cooled in flues in the arsenic kitchens and relatively pure arsenic trioxide (76 percent arsenic by mass) was collected in cells in the arsenic kitchens. This arsenic trioxide was stored in bins before off-site transport for sale.

The available records indicate that 30,733 tons of lead were produced from 119,495 tons of ore between 1904 and 1908 and arsenic trioxide production was 1,353 tons in 1902 (Hydrometrics, 1995). Available sources also indicate arsenic trioxide production was 300 tons in 1901 and 590 tons in 1903 (Society of Chemical Industry, 1904).

Waste products included slag as well as the particulate emissions from the smelter stacks. Although metals concentrations in facility emissions were reduced by being passed through dust chambers and flues, stack emissions likely contained what would be considered relatively high metals concentrations today.

After closure of the smelter, the majority of the aboveground smelter facilities were dismantled. Much of the machinery was taken to Tacoma for construction of the Tacoma smelter. Certain aboveground structures appear to have been demolished and the demolition debris spread around within structure footprints. Some at-grade/in-ground portions of the smelter, as well as the stacks, were left in place. In 1915 the stacks were toppled for brick recovery.

ASARCO sold the smelter facility properties in the 1920s and 1930s with the last smelter property being sold in 1936. The area was subsequently redeveloped predominantly for residential use.

The City of Everett used some of the slag that remained on the Benson subarea after closure of the smelter facility. A 1933 agreement between ASARCO and the City of Everett granted the City the right to remove up to 4,000 cubic yards of slag per year.

The interchange for Marine View Drive and Pacific Highway was constructed within the former smelter facility area in 1956. According to the Smelter Area Investigation Report (Hydrometrics, 1998), review of aerial photographs before, during and after construction indicated that a large scale cut and fill occurred to create the interchange and excavation work “appears to have removed all residual smelter material” in the interchange area. The excavated material appears to have been used to create the west approach for the Weyerhaeuser Bridge Road and as fill to create the south bound lane of Pacific Highway.

2.4.2. Lowland Area History

2.4.2.1. *Overview*

This section presents an overview of the early development of the Lowland Area. Figure 2-7 is a schematic cross section of the Lowland Area that presents the hydrogeologic features described in this section. Additional detail concerning the Site geology and hydrogeology is provided in Section 4.0.

In the late 1800s, during the time of smelter operations, the Lowland Area was an estuarine wetland area influenced by riverine processes of the Snohomish River. Surface soils throughout the majority of the Lowland Area consisted of fine-grained alluvial deposits of silt and clay as well as peat except in areas where these finer grained materials were replaced by channel deposits consisting of coarser grained silty sands and sandy silts. Alluvium comprised predominantly of sand is present beneath the silt, clay, peat and channel deposits. The only known significant development in the Lowland Area during the period of smelter operation was railroad infrastructure.

During the smelter's operations, two byproducts were deposited on the historic native surface in the Lowland Area. The byproducts included slag, which was poured down the slope east of the smelter onto the Lowland Area in what is now the Benson subarea and fallout from smelter stack emissions that was deposited on the native surface of the Lowland Area. Slag is a byproduct of the lead smelting process and generally consists of a dark, sometimes vitreous material similar to basalt that is a combination of coke, lime and metal ore. Stack emissions likely included fine particulates containing elevated concentrations of metals including arsenic.

The approximate elevation of the ground surface in the Lowland Area in the late 1800s was 5 to 15 feet lower than the present day ground surface. The present surface elevation in the Lowland Area is the result of multiple episodes of filling. The predominant source of the fill, especially deeper fill, is material dredged from the Snohomish River (Hydrometrics, 1995). Fill comprised of dredged material is up to approximately 10 feet thick and typically consists of fine to coarse sands. Other fill, especially closer to the present day ground surface, includes gravely sand, crushed rock, and bark, and is up to 5 feet thick.

Two aquifers are present in the Lowland area: a shallow, water-table aquifer that is present in the fill placed on the historic native surface and a deep confined aquifer that is in the alluvium. The aquifers are separated by an aquitard that is comprised of the silt, clay, and peat deposits.

Specific records of filling of the Lowland Area were not available for review. However, much of the filling is understood to have occurred by 1915 as the Weyerhaeuser Mill B facility was constructed and occupied approximately 72 acres of the Lowland Area east of the former smelter and BNSF railroad tracks (see Section 2.4.2.2).

Cascade Insulation Company reportedly operated a rock wool plant at the base of the slope east of the former smelter on the present day Benson property between approximately 1944 and 1955. Other Benson property operations included an auto recycling operation circa 1968 and a beauty bark/topsoil business from 1975 to 1985 (Saltbush, 1999). The rock wool manufacturing process consists of melting slag, then blasting the slag with high pressure steam to create mineral fibers or "wool" for insulation products. Some of the slag does not turn into fibers during the process and falls out of the high pressure steam process as globules or short, needle-shaped particles. The particles are typically silt- to fine-grained sand in size. The rock wool plant used slag from the Everett smelter in its process and may have left fine-grained slag byproduct on site.

The extent of slag deposited in the Lowland Area during smelter operations was shown on a 1913 topographic survey. The current extent of slag present in the Lowland Area was estimated in 2000 (ASARCO, 2000) based on the presence of slag in soil borings. The horizontal extent of slag in 1913 and 2000 are shown on Figure 2-5. The estimated horizontal extent of slag in the Lowland Area in 2000 is larger compared to the extent identified in 1913. However, the thickness of the slag deposited in the Lowland Area in 1913 was greater than in 2000. The thickness of the slag deposit in 1913 is estimated to have ranged between approximately 25 and 35 feet over the extent of deposition whereas the thickness of the slag in 2000 ranged from approximately 25 feet on the western portion of the slag deposit to between approximately 5 to 10 feet on the eastern portion of the slag deposit. The change in the extent of slag in the Lowland Area likely results from the excavation and use of the slag by the City of Everett as part of the 1933 agreement between ASARCO and the City of Everett and Cascade Insulation's use of the slag for rock wool.

2.4.2.2. *Weyerhaeuser Operations*

The Weyerhaeuser operations within the Lowland Area began in 1914/1915. Weyerhaeuser's operations were generally performed on three sites in the Lowland Area that included the Weyerhaeuser Everett East site, Weyerhaeuser Everett Mill E/Koppers Facility site and Weyerhaeuser Everett West site. A fourth area, known as the Weyerhaeuser demolition landfill, is also present within the Lowland Area. The approximate locations of these sites are shown relative to the Lowland Area on Figure 2-8. The following sections summarize Weyerhaeuser's operations on each of the sites.

<u>Weyerhaeuser Everett East (W-East) Site</u>

The Weyerhaeuser Everett East (W-East) site, the former location of Weyerhaeuser Mill B, is an Ecology cleanup site (Cleanup Site ID: 2495 and Facility Site ID: 11) and the contaminants associated with the former W-East site operations are being addressed under a Consent Decree (No. 972027738) between Ecology and Weyerhaeuser dated 1997. The former Mill B facilities at the W-East site were previously situated on approximately 72 acres of the Lowland Area and were generally located on properties that are currently owned by the Port of Everett, Cymbaluk Marshal & Katherine Family LLC, and Snohomish County. Descriptions of the history of Mill B on the W-East Site are provided in the Soil Conditions and Data Gap Report (SAIC, 2010) and Ecology's Period Review for the W-East site (Ecology, 2012). Key events and activities at Mill B and the W-East site include the following:

Year(s)	Events/Activities
1914/1915	Weyerhaeuser purchased the W-East site. The ground surface of the W-East site was raised with material dredged from the Snohomish River and Mill B was constructed in 1915 in the northern/central portion of the site (Ecology, 2012).
1915 to 1979	Weyerhaeuser Mill B operated. Mill B facilities included a saw mill, planing mill, power house, dip tanks containing sapstain (pentachlorophenol in either water or diesel), sapstain spray booths, lumber drying and storage sheds and several above ground and underground tanks used to store fuels (Ecology, 1997b).
1953 to 1992	The southern portion of the W-East site was used to store wood chips and other material from Mill B and/or a Kraft Pulp Mill (a Weyerhaeuser mill located on an adjacent property immediately north of the W-East site) (Ecology, 1997a).

Year(s)	Events/Activities
1979	Weyerhaeuser Mill B operations ceased (Ecology, 1997b).
1980/1982	Mill B was substantially dismantled by mid-1980s. Pilings that supported major mill structures were sawed off below ground level during demolition (Ecology, 2012). In 1982, a fire broke out during demolition and destroyed several former Mill B structures including a remanufacturing building, the powerhouse and a machine shop (Ecology, 1997b and SAIC, 2010).
1982 to 1996	The areas affected by the 1982 fire (generally located in the northern/central portions of the W-East site) were used for chip storage (Ecology, 1997b).
1992 to 2005	Weyerhaeuser performed environmental investigation, remediation and monitoring to address contamination associated with Mill B operations that was identified to include petroleum hydrocarbons, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and pentachlorophenol (PCP) (EMCON, 1994b; EMCON, 1995b; DOF, 1996; DOF, 1997a; DOF, 1997b; Shaw, 2003; SAIC, 2010; Ecology, 2009a; PES, 2011; and Ecology, 2012). Weyerhaeuser entered into a Consent Decree in 1997 (No. 972027738) with Ecology and Ecology issued an approved Cleanup Action Plan (Ecology, 1997a) for the W-East site. Metals were not part of the Consent Decree (DOF, 1997b; Ecology, 2012). A Restrictive Covenant was recorded for the W-East site (Weyerhaeuser, 1997).
1998	The Port of Everett purchased a majority of the W-East site (Ecology, 2012) to construct the Riverside Business Park. By October 1998, Weyerhaeuser removed the majority of the wood debris (sawdust, wood chips, etc.) from the southern portion of the W-East site as per the requirements of the Snohomish Health District. Approximately 1,400 cubic yards of wood debris was reportedly not removed. The USACE placed material dredged from the Snohomish River on the southern portion of the W-East site in late 1998 (Ecology, 2012).
2000/2001	The Port of Everett raised the surface elevation of the W-East site above the 100-year flood plain (i.e., approximately 1 to 4 feet) by filling with dredged sand, constructed an access road and two stormwater drains, and installed utilities in the process of redeveloping the site for an industrial, warehousing, and manufacturing business park (Ecology, 2012; SAIC, 2010) referred to as the Riverside Business Park.
2002	An independent cleanup action was performed at the W-East site by the Port of Everett that included excavation of approximately 1,300 cubic yards of arsenic-impacted soil from the northern end of the W-East site along the access road (Riverside Road) north of the bridge (Weyerhaeuser Bridge Road) The excavated soil was relocated to an area at the east end of the eastern bridge approach and contained and covered with a geosynthetic clay liner cap and a 1-foot layer of topsoil (Landau, 2002; SAIC, 2010). The remedial excavation areas were backfilled with sand dredged from the Snohomish River.
2005	Sierra Pacific collected information on soil, groundwater, sediment and outfall water quality as part of an assessment of the property for potential purchase. An upgradient exploration location (GP-10) contained PCP concentrations in exceedance of the Consent Decree groundwater cleanup level in both the shallow and deep aquifers. The results indicate that PCP contamination remains at the site upgradient of the conditional point of compliance (Ecology, 2012; SAIC, 2010). Ecology determined that groundwater at two compliance wells located in the northern and central portions of the site were not in compliance for cPAHs (MW-102S) and PCP (MW-RA-8-3). Ecology approved decommissioning all monitoring wells at the W-East site with the exception of well MW-RA-8-3 where PCP was consistently out of compliance (SAIC, 2010).
2008	The Port of Everett performed groundwater monitoring activities in order to update arsenic groundwater quality data (Landau, 2008).

Year(s)	Events/Activities
2009	Ecology approved Weyerhaeuser's proposal of resuming groundwater monitoring at the only groundwater compliance well (MW-RA-8-3) at the W-East site that was out of compliance (Ecology, 2009a).
2009 to 2011	Weyerhaeuser completed eight quarters of groundwater monitoring to monitor PCP in the groundwater compliance well MW-RA-8-3 (SAIC, 2010). Following groundwater monitoring, Ecology reported in the Periodic Review that compliance well MW-RA-8-3 was in compliance (PES, 2011) (Ecology, 2012).
2012	Ecology completed a Periodic Review of the W-East site (Ecology, 2012). The Periodic Review reported that the physical cleanup actions completed to date at the W-East site are largely effecive in protecting human health and the environment as long as the Restrictive Covenants are in place and its provisions are followed. The Review reported that arsenic contamination in groundwater remains to be evaluated at the W-East site. Ecology reported that groundwater arsenic contamination at W-East site is believed to be originated off site and is being assessed as part of a different Ecology site - Everett Smelter Lowland (Ecology, 2012).
2017	Ecology's next Periodic Review of the W-East site is due (Ecology, 2012).

Weyerhaeuser Everett Mill E/Koppers Facility (W-Mill E) Site

The Weyerhaeuser Everett Mill E/Koppers Facility (W-Mill E) site is an Ecology cleanup site (Cleanup Site ID: 2903 and Facility Site ID: 12) and the contamination associated with the former W-Mill E site operations are being addressed under a Consent Decree (No. 982087186) between Ecology and Weyerhaeuser dated 1998. The former W-Mill E site facilities were previously situated on approximately 8.4 acres of the Lowland Area and were generally located on a property currently owned by MAP#2, LLC. Descriptions of the history of the W-Mill E Site are provided in the Soil Conditions and Data Gap Report (SAIC, 2010), Ecology's Period Review for the W-Mill E site (Ecology, 2009b) and recent groundwater monitoring reports completed for the W-Mill E site (AES, 2009b, AES, 2010, AES, 2011 and AES, 2012). Key events and activities at the W-Mill E site include the following:

Year(s)	Events/Activities
1915 to 1948	The W-Mill E site was part of Weyerhaeuser Mill B and was used for lumber storage (Ecology, 1998).
1948	Weyerhaeuser leased 6.6 acres of the W-Mill E to the American Lumber and Treating Company (ALTC). ALTC constructed a wood-treatment facility and began wood treatment operations (Ecology, 1998; SAIC, 2010).
1954	Koppers Company acquired ALTC (Ecology, 1998).
1948 to 1963	Wood treatment operations conducted at the the W-Mill E site (Ecology, 1998).
1963	ALTC/Koppers Company lease with Weyerhaeuser expired. Beginning in 1963, Weyerhaeuser gradually converted the former wood-treatment facility into an equipment maintenance facility (Ecology, 1998).
1963 to 1984	Weyerhaeuser operated the equipment maintenance facility at the W-Mill E site. The equipment maintenance facility operations included maintenance and fueling of vehicle and engines and the use and storage of various fuels and solvents (Ecology, 1998).
1971	Weyerhaeuser constructed a small-diameter log sawmill (W-Mill E) at the northeast end of the W-Mill E site while the equipment maintenance facility was still operational (Ecology, 1998).
1971 to 1984	W-Mill E was operated to produce dimensional lumber (Ecology, 1998).

Year(s)	Events/Activities
1988	W-Mill E was demolished (Ecology, 1998).
1990 to 1998	Weyerhaeuser performed remedial investigations, feasibility study (Hart Crowser, 1991; EMCON, 1994a; EMCON, 1997), entered into a Consent Decree (No. 982087186) with Ecology and Ecology issued an approved Cleanup Action Plan (Ecology, 1998) for the W-Mill E site.
1998 to 1999	Pursuant to the Consent Decree, Weyerhauser performed remedial actions at the W-Mill E site that included: excavation of contaminated soil, backfilling excavations with fill consisting of dredged sand from Snohomish River; placing dredged sand over the site to facilitate drainage, cover contaminated soil, and provide a base for an asphalt cap; installing a low permeability vertical barrier around an area containing non-aqueous phase liquid (NAPL) and highly contaminated residual soil; covering the area within the vertical barrier with an asphalt cap, and installing six piezometers at the site (three inside and three outside the vertical barrier) (AES, 2009a). Weyerhaeuser prepared and implemented a compliance monitoring plan to evaluate the performance and long-term effectiveness of the site remediation (EMCON, 1998). Chemical parameters for groundwater compliance monitoring included gasoline-, diesel- and oil-range petroleum hydrocarbons, pentachlorophenol (PCP) and arsenic. A Restrictive Covenant was recorded for the W-Mill E site (Ecology, 2009b).
1999 to 2008	Compliance monitoring activities performed (AES, 2009a).
2005	MAP#2, LLC. purchased the W-Mill E site from Weyerhaeuser (AES, 2009a).
2006	Pacific Topsoils, Inc., who leased the W-Mill E site from MAP#2, LLC., took over annual compliance monitoring activities (AES, 2009a).
2009	A Periodic Review of the W-Mill E site was completed by Ecology (Ecology, 2009b). Based on the review, Ecology recommended 5 additional years of compliance monitoring and implementation of a corrective action if the results of the additional 5 years of monitoring indicate similar or rising exceedances of groundwater arsenic concentrations as compared to prior 10 years of monitoring (SAIC, 2010).
2009 to 2012	Pacific Topsoils, Inc., implemented four annual compliance monitoring events required by Ecology (AES, 2009b, AES, 2010, AES, 2011 and AES, 2012) for the W-Mill E site. Arsenic was detected at a concentration of 616 µg/L in shallow groundwater within the Koppers facility in 2012 (AES 2012).
2014	Ecology's next Periodic Review of the W-West site (Ecology, 2009b).

Weyerhaeuser Everett West (W-West) Site

The Weyerhaeuser Everett West (W-West) site, the former location of the Weyerhaeuser Mill C, is an Ecology cleanup site (Cleanup Site ID: 2902 and Facility Site ID: 10) and the contamination associated with the former W-West site operations are being addressed under a Consent Decree (No. 942075592) between Ecology and Weyerhaeuser dated 1994. The former Weyerhaeuser Mill C facilities at W-West site were previously situated on approximately 35 acres and were generally located on properties that are currently owned by Shadow Development (Parcel No. 29050800101900, 29050800102100 and 29050800402300), Blunt Family LLC (Parcel No. 29050800102000) and Puget Sound Energy/Gas (Parcel No. 29050800102300). Descriptions of the history of the W-West site are provided in the Soil Conditions and Data Gap Report (SAIC, 2010), Ecology's Period Review for the W-West site (Ecology, 2009c), Groundwater Compliance Monitoring Plan Addendum (Floyd Snider, 2011), and recent groundwater monitoring reports completed for the W-West site (Floyd Snider, 2012a and b). Key events and activities at the W-West site include the following:

Year(s)	Events/Activities
1926	Weyerhaeuser began Mill C operations at the W-West site. Mill C operations included processing and sawing logs into lumber (Ecology, 2003a).
1953	Weyerhaeuser's Kraft Pulp Mill (Mill C) began operations at the W-West site. The Kraft Pulp Mill facilities included wood chip silos, pulp processing tanks, bleach plant, a warehouse, machine room, maintenance building, and a lube-oil storage shed (Ecology, 2003a).
1963	Weyerhaeuser began another wood board manufacturing operation, Mill D, at the W-West site.
1971	The Mill D operations shut down.
1976	The Mill C operations shut down.
1992 to 1994	Weyerhaeuser performed site assessment, enviromental investigations, and interim actions at the site (EMCON, 1994c; Weyerhaeuser, 1994)
1994 to 1995	Weyerhaeuser entered into a Consent Decree (No. 942075592) with Ecology (Ecology, 1994). Pursuant to the Consent Decree, Weyerhaeuser performed a remedial action consisting of removal of aboveground Bunker C fuel storage tank, excavation and off-site disposal of soil from eight areas, and backfilling with sand dredged from the Snohomish River (SAIC, 2010). Weyerhaeuser prepared and implemented a compliance monitoring plan to evaluate the performance and long-term effectiveness of the site remediation (Shaw, 2004). Chemical parameters for groundwater compliance monitoring included diesel- and oil-range petroleum hydrocarbons and arsenic. A Restrictive Covenant was recorded for the W-West site (Ecology, 2009c).
1995 to 2011	Compliance monitoring activities performed (Shaw, 2004; Delta, 2006; Floyd Snider, 2011).
2009	In March 2009, Weyerhaeuser made a request for removal of the W-West site Consent Decree to Ecology. However, Ecology determined that it was premature to remove the Consent Decree (Pacific Environmental, 2009a; Ecology, 2009c). In August 2009, a Periodic Review of the W-West site was completed by Ecology. The 2009 Periodic Review concluded that 1) soils with total petroleum hydrocarbons greater than MTCA cleanup levels were present in selected areas at the W-West site. However, the remedy at the W-West site appears to prevent human exposure to the contamination by ingestion and direct contact with soils; 2) the Restrictive Covenant at the site continues to be effective in protecting human health and the environment from exposure to hazardous substances and no additional cleanup actions for soil contamination are required; and 3) groundwater remains contaminated with arsenic and therefore, this route of exposure is still present and the cleanup is incomplete. However, due to evidence from an upgradient monitoring well that the arsenic may be coming from off site, Ecology noted that efforts are being made to resolve possible off-site sources of arsenic in groundwater (Ecology, 2009c; SAIC, 2010).
2011	Weyerhaeuser submitted a Groundwater Compliance Monitoring Plan Addendum to Ecology to restore the groundwater compliance monitoring well network at the site and to meet groundwater monitoring requirements (Floyd Snider, 2011).
2011 and 2013	Groundwater monitoring activities performed (Floyd Snider, 2012a; Floyd Snider, 2012b). Compliance was obtained in July 2013.

Year(s)	Events/Activities
2014	In 2014 a Period Review was completed by Ecology. The following conclusions have been made as a result of this periodic review: 1) Soil cleanup actions completed appear to be protective of human health and the environment. Soils cleanup levels have not been met at the standard point of compliance for the Site as two areas have TPH remaining (CS-1513 and CS-1514) according to Section 2 of the covenant; however, the cleanup action has been determined to comply with cleanup standards since the long-term integrity of the containment system is ensured, and the requirements for containment technologies are being met. 2) The Restrictive Covenant for the property is in place and continues to be effective in protecting public health and the environment from exposure to hazardous substances and protecting the integrity of the cleanup action. 3) Groundwater monitoring conducted between December 2011 and July 2013 demonstrated that groundwater meets cleanup levels at the conditional point of compliance established at the property boundary (Floyd|Snider, 2013). Groundwater sampling will no longer be required for the periodic review. The Department of Ecology has determined that the requirements of the Restrictive Covenant continue to be met. No additional cleanup actions for the soil contamination are required by the property owner. Groundwater has met cleanup levels. Ecology has determined that the Weyerhaeuser Everett West Site meets the requirements for removal from the Hazardous Sites List (WAC 173-340-330(7). Ecology proposes to remove the Site from the Hazardous Sites List subsequent to, and after consideration of, public comment (Ecology, 2014).

Weyerhaeuser Demolition Landfill

The Weyerhaeuser demolition landfill site was remediated in 1992 under Ecology guidance (SAIC, 2010). According to one drawing showing a general location sketch (Emcon, 1994d), the demolition landfill is situated on approximately 7 acres and is located on what is now Snohomish PUD property.

Little is known regarding the historical activities associated with the demolition landfill. According to the Soil Conditions and Data Gap Report (SAIC, 2010), construction and wood debris, trash and lime from Weyerhaeuser Mills C and D were disposed of in the landfill. A seprate report indicates tThe landfill operated from 1952 to 1986, and contains bricks, wood boards, sawdust, wood chips, lime and miscellaneous metal debris (Hydrometrics, 1995). According to the Soil Conditions and Data Gap Report (SAIC, 2010), the contamination associated with the landfill was remediated in 1992 under Ecology guidance.

2.5. Cultural and Historical Resources

The Everett Peninsula has been inhabited by people for more than 10,000 years (Oakley, 2005). A principle village of the Snohomish tribe named Hibulb was located at the northwest point of the Everett peninsula where the mouth of the Snohomish River and Port Gardiner Bay meet. This location provided food and transportation for the tribe. Although this cultural site lies outside of the Lowland Area boundary, the Lowland Area resides within the Snohomish River delta that hosted tribal activities such as hunting and fishing.

More recent historical activities in the Lowlands have included the existence of rail activity since approximately the late 1800s and wood products industries since the early 1900s. The rail activities continue to be present in the Lowland Area and include the BNSF Delta rail switchyard and rail lines. However, with the exception of timber piling and bulkheads along the Snohomish River shoreline, very few remnant features of the wood products industries remain in the Lowland today. The former Weyerhaeuser lumber mills, Kraft pulp mill and wood treatment facilities have been dismantled. One additional remnant historical feature located in the Benson Subarea is a concrete foundation believed to be the foundation of a structure associated with a former rock wool manufacturing facility.

2.6. Previous Investigations and Cleanups

2.6.1. Upland Area Cleanup

After discovery of the Everett Smelter Site in the 1990s, the Upland Area was studied extensively. The Upland Area of the Smelter Site was divided into the Former Arsenic Trioxide Processing Area (also known as the "Fenced Area") and the Peripheral Area. The Fenced Area is shown on Figure 2-9. Soil in the Fenced Area was found to be contaminated with metals and smelter residuals such as demolition debris and almost pure arsenic trioxide. Arsenic trioxide (As_2O_3) is approximately 76 percent arsenic, or approximately 760,000 milligrams per kilogram (mg/kg) arsenic. The Peripheral Area included the less contaminated area generally surrounding the Fenced Area. Groundwater and surface water in the Upland Area were also identified to be contaminated with metals. The concentrations of arsenic in groundwater and seep water in the Upland Area were up to 47,000 microgram per liter (µg/L) and 14,000 µg/L), respectively.

A remedial investigation of the Upland Area (Hydrometrics, 1995) determined that arsenic was the primary contaminant of concern. Other metals including lead, cadmium, antimony, thallium and mercury were also identified to be of concern. However, it was determined that remedial actions to address arsenic contamination would address contamination by other metals (Ecology, 1999). Furthermore, the remedial investigation determined that remedial actions to address soil contamination would address groundwater, surface water and storm drain sediment contamination.

ASARCO purchased all of the residential properties within the Fenced Area by 1995. The fenced area was cleaned up in the mid-2000s in accordance with the Everett Smelter Site Final Cleanup Action Plan (Ecology, 1999). The Fenced Area cleanup included the following:

- Removing highly contaminated material containing greater than 3,000 mg/kg arsenic within the Former Arsenic Trioxide Processing Area. This material was disposed of in a hazardous waste landfill in Idaho.
- Removing approximately 60,000 cubic yards of soil with arsenic concentrations between 150 and 3,000 mg/kg. The soil was used as subgrade below a capped area in Tacoma at the ASARCO On-site Containment Facility.
- Installing a clean fill cap over the entire Fenced Area at least 2 feet thick.

Ecology began cleaning up homes in the Peripheral Area in 1999. Ecology has cleaned up or overseen cleanup between then and present (2015), Cleanup began with the most contaminated properties and continue at this writing. The remedial actions currently being performed in the Upland Area include the following:

- Removing accessible soil with arsenic concentrations greater than 20 mg/kg that is within 12 inches of the surface and backfilling the excavations with clean soil.
- Removing accessible soil from depths greater than 12 inches with arsenic concentrations greater than specific remediation levels and backfilling with clean soil.

Cleanup of residential properties in the Upland Area surrounding the former arsenic extraction facility is currently being performed by Ecology and is expected to be complete by approximately 2022.

2.6.2. Lowland Area Investigations

Multiple investigations were performed in the 1990's that provide data to characterize the Lowland Area. The results from those investigations were presented in RI reports previously prepared for the Upland and Lowland Areas. The following sections describe the investigation activities presented in the previous RI reports that characterize the Lowland Area.

2.6.2.1. Remedial Investigation Everett Smelter Site

An RI was prepared for the Everett Smelter Site in 1995 (Hydrometrics, 1995). The RI focused on the Upland Area. However, the RI also included information and investigation results for the Lowland Area. The RI summarized 13 previous investigations performed within the Upland and Lowland areas between 1988 and 1995. The RI presented the results for the following investigation activities that characterized the Lowland Area:

- Soil investigation including soil sampling from 16 Lowland borings and monitoring wells.
- Surface water investigation including surface water sampling at six Lowland locations.
- Groundwater investigation including sampling and hydrogeological testing at a total of 19 groundwater monitoring wells. Hydrogeological testing included slug tests, a tidal study, monthly water level measurements, grain size analyses and permeability tests.
- Investigation of the "slag area," including three borings in the "slag area" (SL-1, SL-3 and SL-4) and submittal of slag samples for total, TCLP and SPLP metals analyses.

2.6.2.2. *Supplemental Investigation of the Everett Smelter Site Lowland Area*

A supplemental investigation of the Lowland Area was performed and the results were presented in the Supplemental Investigation of the Everett Smelter Site Lowland Area report (Hydrometrics, 1996). The Supplemental Investigation report presents the results for the following:

- Soil and groundwater sampling at 43 Hydropunch™ locations.
- Drilling and sampling of 10 soil borings in the Lowland Area (LB-1 through LB-10) to further refine the lateral and vertical extent of slag.
- Collection of 11 surface grab samples from 0 to 6 inches deep underneath the Pacific Highway overpass area to investigate the presence of smelter debris in surface fill.
- Slug tests and a tidal study performed on selected wells.
- Surface water investigation including review of maps and field visits to observe catch basins, ditches and outfalls from the Uplands to the Lowland Area.

2.6.2.3. *Smelter Area Investigation Report, Everett Smelter Site*

An investigation of the Everett Smelter Site was performed in 1998 (ASARCO, 1998). The majority of sampling locations were within the Upland portion of the former smelter facility area. However, some of the sampling locations were located within or adjacent to the Lowland Area. The Smelter Area Investigation included the following activities that characterized the Lowland Area:

- Collection of soil samples from 16 borings and four surface samples from the Pacific Highway overpass.
- Collection of soil samples from thee "till" borings located along East Marine View Drive (a fourth till boring was performed further to the west in the Upland Area).
- Submittal of four samples for SPLP analysis.

2.6.2.4. *Comprehensive Lowland Area Remedial Investigation Report for the Everett Smelter Site*

The Comprehensive Lowland Area RI report was prepared in 2000 (ASARCO, 2000). The report summarized the results of previous reports (described above) and provided the results of additional investigation activities that included the following:

- Collection of soil samples along four transects on the slope east of the former smelter facility.
- Collection of soil samples from seven borings, four Hydropunch™ borings and 12 monitoring wells.
- Collection of soil samples from three boring on the Benson property.
- Submittal of seven soil samples from three borings for SPLP analysis.
- Collection of groundwater samples from 17 Hydropunch™ borings and 16 monitoring wells.
- Measurement of water levels on four occasions at 60 to 100 groundwater monitoring well and surface water locations.
- Slug testing at three monitoring well locations.
- Surface water sampling at nine locations.

2.6.3. Summary of Previous Investigation Locations Used in the SRI

This SRI utilizes information from the previous investigations, described above, as well as the results of supplemental investigations completed for Ecology in 2011 through 2014, described in Section 3.0. The results from soil samples collected from previous investigation locations and analyzed for metals are utilized in combination with the results of soil sampling performed as part of the SRI to characterize the nature and extent of soil contamination in the Lowland Area. Additionally, existing groundwater monitoring wells and groundwater monitoring wells installed as part of this SRI were sampled, and the results of groundwater sampling performed as part of the SRI is used to characterize the nature and extent of groundwater contamination in the Lowland Area.

The previous soil investigation locations utilized in this SRI as well as information concerning the associated study include the following:

Study Name	Study Year(s)	Previous Soil Investigation Locations utilized for the Supplemental RI
MTCA Site Discovery - Weyerhaeuser Mill B Property (Hart Crowser, 1990)	1990	AB-3 through AB-6, PC-18A, RR-1, WP-1
Remedial Investigation -Weyerhaeuser-Everett Mill E Site (EMCON, 1994a)	1990-1994	HC-11, HC-24 through HC-26 MW-11D2, MW-34, TP-20, TP-23, TP-25, TP-28, TP-29, TP-30, TP-31

Study Name	Study Year(s)	Previous Soil Investigation Locations utilized for the Supplemental RI
Unpublished data as reported in Everett Smelter Remedial Investigation (HYDROMETRICS, 1995)	1991	SAIC-S42, SAIC-S44, SAIC-S51, SAIC-S54, SAIC-S60, SAIC-S61, SAIC-S69 through SAIC-S71, SAIC-S81, SAIC-S82, T-1
Final Report for the Everett Slag Site (SAIC, 1991)	1991	SS1, SS2, SS3
Phase 1 Assessment – Weyerhaeuser East (EMCON, 1994b)	1992-1994	A3-5, A10-5
Compilation of Assessment Documents – Weyerhaeuser West (EMCON, 1994c)	1992-1994	Grab-1-1292 through Grab-6-1292, SB-1101, SB-1104, SB-1202, SB-1304, SB-1305, TP-1202, TP-1207, TP-1401, TP-1402, TP-1404, TP-1701, TP-1702, TP-92-26 through TP-92-30
Everett Smelter Remedial Investigation (Hydrometrics, 1995)	1992-1995	EV-3-S, EV-4B, EV-5, EV-6A, EV-6B, EV-7A, EV-7B, EV-8A, EV-8B, EV-9A, EV-9B, MW-1 through MW-3, MW-4B, MW-5, SL-1, SL-3, SL-4
Supplemental Lowland Investigation (Hydrometrics, 1996)	1995-1996	B-5, B-6, EV-10 through EV-14, HP-01, HP-02, HP-04 through HP-21, HP-24 through HP-43, LB-1 through LB-10, SB-4 through SB-8
Environmental Assessment – Weyerhaeuser East: South End (DOF, 1996)	1996	TP-SE-1 through TP-SE-4, TP-SE-8 through TP-SE-16
Smelter Area Investigation (ASARCO, 1998)	1998	HA-1 through HA-16 SA-24, SAI-SS1 TB-1, TB-2
Comprehensive Lowland RI (ASARCO, 2000)	1998-1999	1T, 1M, 1B, 2T, 2M, 2T, 3T, 3M, 3B, 4T, 4M, 4B, EV-15A/B, EV-16A, EV-17B, EV-18B, EV-20B, EV-21A/B, EV-22A/B, EV-23A/B, HP-45 through HP-48, LB-11 through LB-20, MW-107D, MW-109D
Soil Sample Collection – Boyd Benson property (Hydrometrics, 1999)	1998-1999	LB-21 through LB-23
Environmental Soil Sampling – East Marine View Drive Widening & Utility Improvement Project (HWA, 2006)	2004-2006	BH-6, BH-7 SP-20 through SP-26
Proposed development sampling – Weyerhaeuser East (Geomatrix, 2005)	2005	GP-1 through GP-11

The previous soil investigation locations utilized in the SRI are shown on Figure 2-10 and the samples collected from the previous investigation locations and utilized in this SRI to characterize the nature and extent of metals contamination in the Lowland Area are summarized in Table 2-1.

Certain monitoring wells sampled in the past were decommissioned. However, some were still available for sampling during this SRI. The previous groundwater investigation locations utilized in this SRI as well as information concerning the associated study include the following:

Study Name	Study Year(s)	Previous Groundwater Monitoring Well Locations Utilized for the Supplemental RI
Everett Smelter Remedial Investigation (Hydrometrics, 1995)	1992-1995	EV-6A, EV-6B, EV-7B
Compilation of Assessment Documents – Weyerhaeuser West (EMCON, 1994c)	1993	MW1701
Comprehensive Lowland RI (ASARCO, 2000)	1998-1999	EV-19B, EV-20B, EV-22A, EV-22B
Remedial action performed on Weyerhaeuser Mill E/Koppers Site (AES, 2009a)	1998-1999	PZ1B, PZ2B, PZ3B
Groundwater compliance monitoring well network update – Weyerhaeuser Everett West Site (Floyd Snider, 2012a)	2011	MW1202R, MW1203R, MW1301R, MW1501R
Unknown	Unknown	"Unknown"

The groundwater monitoring wells installed as part of previous investigations and used to define the nature and extent of groundwater contamination are further described in as part of the supplemental investigation activities in Section 3.0.

The results of previous sampling and analysis of water and sediment in wetlands and ponds and at outfalls to the Snohomish River as part of investigation of the Lowland Area are discussed in Section 6.0.

2.6.4. Lowland Area Data Gaps

The Comprehensive Lowland Area RI (ASARCO, 2000) was the last investigation of the Lowland Area prior to this SRI. Data gaps remained after completion of the Comprehensive Lowland Area RI. Additionally, the Upland Area cleanup was performed in the mid-2000s and the effect of the Upland Area cleanup on the Lowland was not known. Therefore, the SRI was performed to supplement the Comprehensive Lowland Area RI and to fill the following data gaps with respect to Smelter contamination in the Lowland Area:

- Characterization of the nature and extent of contamination in groundwater in the shallow and deep aquifers.
- Characterization of the nature and extent of contamination in water and sediment in wetland and pond areas within the Lowland Area.
- Characterization of the nature and extent of contamination in water from outfalls and seeps and sediment at the western shoreline of the Snohomish River.
- The nature and extent of contamination at the historical native surface within the Lowland Area.

The following section describes supplemental investigation activities performed to fill these data gaps.

3.0 SUPPLEMENTAL INVESTIGATION

3.1. Overview

Supplemental investigation was performed in 2011 through 2014 to fill data gaps in characterizing the geology/hydrogeology and nature and extent of contamination from the smelter in soil, water and sediment in the Lowland Area.

Investigation activities completed in 2011 through 2013 included sampling and analysis of soil, water and sediment at locations across the Lowland Area. Sections 3.1 through 3.5 describe the investigation activities that were competed in 2011 through 2013 and Figure 3-1 through Figure 3-4 identify the investigation locations. The groundwater investigation included installation of multiple monitoring wells upgradient of the Lowland Area in the Upland Area to further characterize groundwater and identify the western extent of contamination in the deep aquifer.

In 2014 a focused source-area investigation was performed that included sampling and analysis of soil in Marine View Drive. The objective of the investigation was to identify the source of contamination to deep groundwater in the Lowland Area. The focused source-area investigation activities are described in Section 3.6 and Figure 3-5 identifies the investigation locations.

The investigation activities were completed in general accordance with the Ecology-approved Sampling and Analysis Plans (SAPs), Quality Assurance Project Plans (QAPPs), and addenda prepared for the project (GeoEngineers, 2011; 2012; 2013a; 2014). The supplemental investigation activities performed in 2011 through 2013 included the following:

- Drilling of 89 soil borings;
- Collection and analysis of 229 soil samples from 56 of the 89 soil borings;
- Completion of a total of 78 soil borings as groundwater monitoring wells (33 in the shallow aquifer and 45 in the deep aquifer; 73 in the Lowland and 5 in the Upland);
- Collection and analysis of groundwater samples from 95 monitoring wells including the 78 newly installed monitoring wells and 17 pre-existing monitoring wells;
- Collection and analysis of water samples from four surface water features (wetlands or ponds), two stormwater management basins and six outfalls to the Snohomish River;
- Collection and analysis of sediment samples from four surface water features and two stormwater management basins;
- A reconnaissance of the Snohomish River shoreline to locate seeps and outfalls for potential sampling. The reconnaissance was performed using a boat and crew provided by Ecology;
- Collection and analysis of seep samples from four locations on the western shoreline of the Snohomish River;
- Collection and analysis of sediment samples from 10 locations on the western shoreline of the Snohomish River;
- Hydrogeological testing that included "snapshot" groundwater level measurements, tidal studies and hydraulic conductivity testing.

The supplemental investigation activities performed in 2014 as part of the focused, source-area investigation included the following:

- Drilling of 43 soil borings; and
- Collection and analysis of 128 soil samples from the soil borings.

The results of investigation activities performed in 2011 through 2014 were documented in individual technical memorandums prepared upon completion of specific activities. The technical memorandums described the field activities performed and present the results of the specific investigation activities that were performed. The technical memorandums are presented in Appendix A.

3.2. Soil Sampling and Analysis

3.2.1. Soil Investigation Locations and Sampling

Soil samples were collected from 56 locations as part of the investigation of the Lowland Area in 2011 through 2013. The locations where soil samples were collected are shown on Figure 3-1. A summary of the investigation locations and soil samples that were collected is provided in Table 3-1. Soil samples were obtained during the investigation from soil borings advanced using mechanical and manual methods. Soil samples were collected from forty eight soil borings that were completed using mechanical drilling and coring equipment. Soil samples were also collected from eight locations that were completed using hand tools on the steep slopes located on the northwestern portion of the Lowland Area.

Mechanical equipment used to advance the soil borings and to collect soil samples included the following (See Table 3-1):

- Hollow-stem auger (HSA) drill rig;
- Direct push coring rig; and
- Sonic core drill rig.

Hollow-stem auger drilling techniques involved advancement of 4¼-inch inside diameter (ID) hollow stem augers and collection of soil samples using a split-spoon sampler (Standard Penetration Test (SPT) sampler or "California spoon" sampler). The spit-spoon sampler was advanced 18 inches ahead of the augers into undisturbed soil deposits using a standardized, automatic hammer. Upon retrieval, the sampler was opened so that a geologist could examine the soil, perform field screening tests and collect soil samples for chemical analysis. Split-spoon samples were collected continuously from the surface to an approximate depth of 30 feet. Soil samples were collected at approximate 5- to 10-foot intervals at depths greater than 30 feet using hollow-stem auger drilling.

Direct push coring techniques involved advancement of a 5-foot-long core sampler with an acetate liner. Core samples were continuously collected from the surface to an approximate total depth of 20 feet using a pneumatic hammer. Upon retrieval, the core sampler was opened so that a geologist could examine the soil, perform field screening tests and collect soil samples for chemical analysis.

Sonic core drilling techniques involved advancement of an 8-inch to 10-inch diameter casing and sample collection using a 6-inch to 8-inch diameter core barrel. The core samples were continuously collected in either 5-foot or 10-foot sample intervals. The core barrel was advanced ahead of the casing into the undisturbed soil deposits. Samples collected in the core barrel were retrieved and then extruded so that a geologist could examine the soil, perform field screening tests and collect soil samples for chemical analysis.

The soil samples collected using mechanical drilling techniques were logged by a geologist on boring log forms following the ASTM International (ASTM) D 2487 Unified Soil Classification System (USCS) and ASTM D 2488 Visual-Manual Procedure. The boring logs prepared as part of previous and supplemental investigations are provided in Appendix B.

Soil samples for chemical analysis were collected from specific stratigraphic units to characterize the nature and extent of contamination resulting from the smelter operations. In the Lowland Area, excluding the steep slope area, soil samples were generally collected from each of the following four stratigraphic units:

- Fill placed on top of the historic native surface and comprising the shallow aquifer;
- The top 2 inches of historic native surface that was generally comprised of silt deposits;
- From deeper within the native silt deposits present between the shallow and deep aquifers; and
- Soil below the native silt deposits (alluvium or deep silt) that was within deep aquifer.

At locations upgradient of the Lowland Area (i.e., within the Upland Area), at least one soil sample was collected from each of the following four stratigraphic units:

- Fill placed on top of glacial till present in the Upland Area;
- The top 2 inches of the native surface above the glacial till;
- From deeper within the glacial till present in the Upland Area; and
- Soil below the glacial till (outwash) that was within the deep aquifer.

Additional soil samples were also collected where, based on field observations, the soil conditions, the presence of additional water bearing zones or field screening indicated that additional data may be warranted.

Hand tools were used to excavate shallow cores to collect surface soil samples from the steep slope in the northwestern portion of the Lowland Area. Initially, hand tools were used to remove the “duff” layer (the layer that consisted of greater than 50 percent organic matter) at each location. Then, a decontaminated shovel was used to excavate a core at least 12 inches deep. A portable XRF analyzer was used to measure arsenic and lead concentrations at various depths in the sidewall of the excavated core. The “default” sample interval was the historic native surface from 0- to 1-foot deep as per the Sampling and Analysis Plan (SAP) (GeoEngineers, 2012). However, a shorter sample interval was selected at one location (LLS-05) where the XRF results indicated elevated arsenic concentrations were present in a narrower interval based on different soil horizons encountered in the excavation.

Soil samples collected for chemical analysis at each location were thoroughly homogenized and then placed in laboratory-supplied sample containers (glass jars). The soil samples were logged on a chain-of-custody form and placed in coolers with ice for transport and delivery to the analytical laboratory. Chemical analysis of soil samples was completed by Analytical Resources, Inc. (ARI) in Tukwila, Washington. All soil samples were collected and analyzed in general accordance with the project QAPPs.

All borings and/or wells were backfilled and/or completed in general accordance with Washington State law (WAC 173-160).

3.2.2. Soil Sample Analyses

Soil sample analyses included the following:

- Metals analysis including antimony, arsenic, cadmium, lead, mercury, and thallium was performed on 229 soil samples from 58 soil borings (Table 3-1) using Environmental Protection Agency (EPA) Methods 6010/200.8/7470.
- Grain-size analysis was performed on 14 soil samples collected from eight soil borings (LLMW-03, LLMW-06, LLMW-07, LLMW-08, LLMW-11, LLMW-12, LLMW-13 and LLMW-18) using ASTM D 421/D422.
- Total organic carbon (TOC) analysis was performed on 18 soil samples from 17 soil borings (LLMW-03, LLMW-04, LLMW-05, LLMW-06, LLMW-07, LLMW-08, LLMW-10, LLMW-11, LLMW-12, LLMW-13, LLMW-14, LLMW-16, LLMW-17, LLMW-18, LLMW-20, LLMW-27 and LLMW-29) using Plumb (1981).
- Synthetic Precipitation Leaching Procedure (SPLP) analysis was performed on eight samples collected from five soil borings (LLMW-14, LLMW-15, LLMW-27, LLMW-29, LLMW-33) using EPA Method 200.8.

The laboratory analytical reports for all analyses of soil samples are provided in Appendix A. A data quality review was completed on the analytical data resulting from laboratory analysis of soil samples. The data quality assessment reports are provided in Appendix A.

3.3. Groundwater Sampling and Analysis

3.3.1. Groundwater Investigation Locations and Sampling

Groundwater from a total of 95 monitoring wells was sampled in six sampling events as part of the investigation of the Lowland Area in 2011 through 2013. The monitoring wells that were sampled included the 78 wells installed as part of the investigation as well as 17 preexisting monitoring wells located in the Lowland Area and upgradient of the Lowland Area. The monitoring well locations where groundwater samples were collected are shown on Figure 3-2. A summary of the monitoring well locations, well screen depths, intended aquifer to be sampled and sampling events are provided in Table 3-2.

An initial groundwater sampling event was performed in the winter of 2012 following the installation of 10 well pairs (i.e., 20 wells) on the eastern boundary of the Benson Subarea (wells BP-01S/D through BP-10 S/D) (Table 3-2). The well pairs that were sampled consisted of one well installed in the shallow aquifer and one well installed in the deep aquifer (i.e., shallow aquifer/deep aquifer well pairs). A second groundwater sampling event was conducted in the summer of 2012 that included three preexisting wells (EV-20B, EV-22A and EV-22B) installed in the shallow and deep aquifers and located on the western boundary of the Benson Subarea. The results of the two initial groundwater sampling events indicated that the arsenic concentrations in groundwater were substantially elevated on the Benson Subarea and similar to the arsenic concentrations detected during previous investigation activities performed in the 1990s.

Additional groundwater investigation was subsequently performed that included the installation of 58 new groundwater monitoring wells throughout the Lowland Area and upgradient of the Lowland Area. Forty-six of the monitoring wells were installed as shallow aquifer/deep aquifer well pairs (wells with an LLMW-##S/D designation) at 23 locations as shown on Figure 3-2. Nine of the wells were installed as deep wells (wells with an LLMW-##D designation), either adjacent to existing shallow wells or where shallow groundwater was not encountered. Three wells (BP-04D2, BP-05D2 and BP-07D2) were installed deeper within the deep aquifer, adjacent to three shallow aquifer/deep aquifer well pairs (BP-04S/D, BP-05S/D and BP-07S/D) on the Benson Subarea to further characterize the vertical extent of metals in groundwater. The wells in each well pair, including the three wells installed deeper in the deep aquifer are spaced approximately 4 to 5 feet apart. Soil samples were collected from each of the soil borings advanced to install a monitoring well in the deep aquifer as described in Section 3.2.1. The horizontal coordinates and vertical elevations of each well were surveyed after well installation was completed.

The groundwater investigation also included 17 preexisting groundwater wells that were installed during previous investigations conducted in the Lowland Area between the 1990s and 2010. Sixteen of the 17 preexisting wells were sampled as part of the investigation. One of the preexisting wells (EV-13) was not sampled because groundwater was not observed in the well during the sampling events.

Quarterly groundwater sampling was performed in 2013 as part of the groundwater investigation. The quarterly groundwater sampling events occurred in January/February (Q1-2013), April/May (Q2-2013), August/September (Q3-2013) and November (Q4-2013) of 2013 (Table 3-2). The quarterly sampling events included a combination of the new and preexisting wells present in the Lowland Area as well as the upgradient of the Lowland Area. The four quarters of sampling in 2013 form the basis for the evaluation of the nature and extent of groundwater contamination in Section 6.

3.3.2. Groundwater Sample Collection Methodology

Each groundwater monitoring well sampled as part of the investigation of the Lowland Area (new or preexisting) was developed prior to the initial groundwater sampling event. Well development for the new monitoring wells was completed to remove water that may have been introduced into the well during drilling, stabilize the filter pack and formation materials surrounding the well screen and restore the hydraulic connection between the well screen and the surrounding soil. Well development for the preexisting monitoring wells was performed to remove soil or solids that may have accumulated in the well since the last time the well had been sampled and to restore the hydraulic connection between the well screen and the surrounding soil. During development, each well screen interval was gently surged with a decontaminated stainless steel bailer and groundwater in the well was removed using a decontaminated, submersible pump and tubing. A minimum of five well volumes of water was removed from each well.

Groundwater sampling was completed after well development. Groundwater elevations were measured and recorded upon initiation of sampling at each well using an electronic water level indicator. Groundwater purging and sample collection was completed using low-flow/low-turbidity sampling techniques to minimize the suspension of sediment in the groundwater samples. The wells were purged and groundwater samples were obtained from the wells using dedicated polyethylene tubing and either a peristaltic pump or submersible well pump. Submersible pumps, were used when groundwater depths were greater than the peristaltic pump lift capacity (depths greater than approximately 30 feet). Groundwater was purged from the wells at a rate of up to 0.5 liters per minute.

A water quality measuring system (Horiba U-22, YSI 556 or YSI Professional Plus) with a flow-through cell was used to monitor water quality parameters during purging including pH, electrical conductivity, dissolved oxygen, temperature, and oxidation-reduction potential. Turbidity was measured using a separate turbidimeter (Hach 2100P or LaMotte 2020e). Samples were collected from the wells after the measured values for the water quality parameters varied by less than 10 percent on three consecutive measurements. The water quality parameters measured in the field were documented on field logs.

Following completion of well purging, the flow through cell was disconnected and groundwater samples were collected in laboratory-prepared containers. The samples that were collected for analysis of dissolved parameters were filtered in the field using disposable 0.45-micron filters. The groundwater samples that were collected were logged on the chain-of-custody form and placed in coolers with ice for transport and delivery to the analytical laboratory. All groundwater samples were collected and analyzed in general accordance with the project QAPP.

3.3.3. Groundwater Sample Analyses

Analyses performed on groundwater samples included a combination of the following:

- Total and dissolved metals including antimony, arsenic, cadmium, lead, mercury, and thallium by EPA Methods 200.8 and SW7470A.
- Arsenic speciation in general accordance with the procedures specified in the *Field Sample Collection Method for Arsenic Speciation in Water* (GeoEngineers, 2013b).
- Total organic carbon (TOC) and dissolved organic carbon (DOC) by Method SM5310B.
- Cations including calcium, iron, magnesium, manganese, potassium and sodium by EPA Method 3010A.
- Anions including chloride, nitrate, nitrite, phosphorus and sulfate by EPA Method 300.0.
- Alkalinity, carbonate, bicarbonate and hydroxide by Method SM2320.
- Ferrous and total iron (Fe) using colorimetric field test kits.

All groundwater sample analyses were performed by ARI in Tukwila, Washington except for arsenic speciation which was performed by Applied Speciation in Bothell, Washington. Additionally, ferrous and total iron were measured in the field using Hach brand colorimetric field test kits.

The laboratory analytical reports for all analyses performed on groundwater samples are provided in Appendix A. Additionally, a data quality review was performed on the analytical data resulting from laboratory analysis of groundwater samples. The data quality assessment reports are provided in Appendix A.

3.4. Surface Water, Stormwater, Seep and Sediment Sampling and Analysis

3.4.1. Surface Water, Stormwater, Seep and Sediment Investigation Locations and Sampling

Water and collocated sediment samples were collected from surface water ponds, stormwater basins, stormwater outfalls and seeps in 2013. The surface water, stormwater basin and outfall, and seep and sediment sampling locations are shown on Figure 3-3. A summary of the sample location types, location identification, and water and sediment sample collection methods are provided in Table 3-3.

Surface water and collocated sediment samples were collected from four locations (LLSW-01/ LLSD-01, LLSW-02/LLSD-02, LLSW-04/LLSD-04 and LLSW-05/LLSD-05) in three surface water ponds within the Lowland Area in conjunction with the Q1-2013 groundwater sampling event (Figure 3-3). Two of the initial surface water sampling locations (LLSW-04 and LLSW-05) were also sampled in conjunction with the Q2, Q3, and Q4 sampling events in 2013.

Stormwater and collocated sediment samples were also collected at three locations (LLSW-03/LLSD-03, LLSW-06/LLSD-06 and LLSW-07/LLSD-07) from within two lined stormwater basins located in the Lowland Area in conjunction with the Q1-2013 groundwater sampling event (Figure 3-3). The two stormwater basins are engineered stormwater management units that are lined and are maintained by the property owners (Port of Everett and Cymbaluk Family LLC).

Outfall and seep sampling locations along the Snohomish River were chosen based on an August 16, 2012 boat reconnaissance of the shoreline that identified seeps and outfalls for potential sampling. Stormwater and collocated sediment samples were collected from six stormwater outfall locations (LLO-02/LLSD-13, LLO-03/LLSD-15, LLO-04/LLSD-16, LLO-05/LLSD-18, LLO-06/LLSD-20, LLO-07/LLSD-19) on the western shoreline of the Snohomish River in conjunction with the Q2-2013 groundwater sampling event. In accordance with the SAP, stormwater and collocated sediment samples were not collected from LLO-01 because dissolved arsenic concentrations were less than 5 µg/L in the adjacent monitoring well prior to the stormwater/sediment sampling event. Seep water and collocated sediment samples were also collected from four locations (LLSP-03/LLSD-11, LLSP-05/LLSD-14, LLSP-06S/LLSD-17S and LLSP-08/LLSD-21) on the western shoreline of the Snohomish River in conjunction with the Q2-2013 groundwater sampling event.

3.4.2. Surface Water, Stormwater, Seep and Sediment Sample Collection Methods

Water samples from the surface water ponds and stormwater basins were initially collected using disposable polyethylene tubing and a peristaltic pump. To collect the samples with the peristaltic pump, the tubing inlet was placed approximately 6 to 8 inches beneath the water surface. Water was purged at a rate of approximately 0.5 liters per minute. A water quality measuring system (Horiba U-22 or YSI 556) with a flow-through cell was used to monitor water quality parameters during purging that included pH, electrical conductivity, dissolved oxygen, temperature, and oxidation-reduction potential. The water flowing through the cell was discharged on land adjacent to the pond so as not to disturb the water or cause elevated turbidity at the sampling location. Turbidity was measured using a Hach turbidimeter. The field measurements were documented on field logs.

Following measurement of water quality parameters, the flow-through cell was disconnected and ferrous and total iron were measured using Hach colorimetric field test kits and surface water samples were collected in laboratory supplied sample containers. The samples that were collected for analysis of dissolved parameters were filtered in the field using disposable 0.45-micron filters.

Water samples from the surface water ponds, stormwater basins, stormwater outfalls and seeps were grab samples that were collected directly into the laboratory-provided sample containers. The grab samples for total metals analysis at each location were collected by submerging the sample bottle in the water or placing the sample bottle in the path of the flowing water. At each sample location a grab sample was also collected in a decontaminated 32 ounce glass jar and then transferred with a peristaltic pump through a 0.45 micron filter to collect samples for dissolved parameter analysis. The water quality parameters were also measured and documented on field logs at each sampling location.

Sediment sampling was performed at each location following collection of surface water, stormwater and seep samples. The sediment samples were collected from the surface material located directly beneath where the water samples were collected. Samples were collected of surface sediment comprising the top 10 centimeters (cm) (from the surface to a depth of 10 cm) of sediment using one of the following sample techniques:

- Stainless steel hand auger sampler,
- Stainless steel "cookie cutter," or
- Modified Van Veen "power grab" sampler deployed from a boat.

At each sediment sampling location the surface sediment was transferred from the sample collection equipment to a stainless steel bowl so that a geologist could examine the sediment, perform field screening tests, log the material and collect sediment samples for chemical analysis. The sediment characteristics were recorded by a geologist on the sediment sample collection forms. The horizontal coordinates of each sediment sample location was identified using a handheld GPS device immediately following sample collection and recorded on the sample collection forms.

Sediment samples collected for chemical analysis were thoroughly homogenized and then placed in laboratory-supplied sample containers (glass jars). The sediment samples were logged on a chain-of-custody form and stored in coolers with ice for transport and delivery to the analytical laboratory. All sediment samples were collected and analyzed in general accordance with the project QAPP.

3.4.3. Surface Water, Stormwater, Seep, and Sediment Sample Analyses

Analyses performed on surface water, stormwater and seep samples included a combination of the following:

- Total and dissolved metals including antimony, arsenic, cadmium, lead, mercury, and thallium by EPA Methods 200.8 and SW7470A.
- Arsenic speciation in general accordance with the procedures specified in the *Field Sample Collection Method for Arsenic Speciation in Water* (GeoEngineers, 2013b).
- TOC and DOC by Method SM5310B.
- Cations including calcium, iron, magnesium, manganese, potassium and sodium by EPA Method 3010A.
- Anions including chloride, nitrate, nitrite, phosphorus and sulfate by EPA Method 300.0
- Alkalinity, carbonate, bicarbonate and hydroxide by Method SM2320.
- Ferrous and total iron (Fe) using Hach brand colorimetric field test kits.

Sediment samples were analyzed for metals including antimony, arsenic, cadmium, lead, mercury, and thallium by EPA Methods 6010/200.8/7470.

Chemical analysis of surface water, stormwater, seep and sediment samples was completed by ARI in Tukwila, Washington. The laboratory analytical reports for the analyses performed on surface water, stormwater, seep and sediment samples are provided in Appendix A. A data quality review was completed on the analytical data resulting from laboratory analysis of the samples. The data quality review reports are provided in Appendix A.

3.5. Hydrogeological Testing

3.5.1. Snapshot Water Level Measurements

Groundwater levels were measured at selected shallow and deep aquifer monitoring wells during each quarterly sampling event performed in 2013 (Q1-2013, Q2-2013, Q3-2013 and Q4-2013). The groundwater level measurements were performed within a three-hour period to provide a snapshot of groundwater levels during each sampling event and within a specific tidal cycle. The monitoring wells where the snapshot water level measurements were performed during each sampling event are identified on Table 3-2 and shown on Figure 3-4.

Two teams of field personnel were deployed to collect the water level measurements from the selected wells in the prescribed amount of time during each quarterly sampling event. At each well an electronic water level indicator was used to measure the depth to groundwater below the top of the monitoring well PVC casing (i.e., top of casing). The depth to groundwater measurements collected during each snapshot were converted to groundwater elevations using the surveyed elevation of the top of casing at each monitoring well. The time and depth to groundwater measurement was recorded on field forms. The groundwater elevations were used to develop groundwater contour maps to determine groundwater flow direction and gradient. The results from snapshot water level measurements are presented in Section 4.

3.5.2. Tidal Studies

Two 72-hour tidal studies were completed using selected monitoring wells in conjunction with groundwater sampling performed in Q1-2013 and Q4-2013. The tidal studies were completed to evaluate the potential influence of tidal variations and changes in the level of surface water in the Snohomish River on shallow and deep groundwater levels. Monitoring well pairs at varying distances from the Snohomish River shoreline were selected for the tidal studies to evaluate the lateral and vertical influences of tidal action on groundwater. Twelve monitoring wells were included in the tidal study performed in Q1-2013. The results of that study indicated that the tidal response extended beyond the wells located at the western limit of the study. Therefore, a second tidal study was performed in Q4-2013 that included the 12 wells evaluated as part of the initial study and 4 additional wells located further west from the Snohomish River Shoreline. The wells that were monitored as part of the tidal studies are identified on Table 3-2 and shown on Figure 3-4.

The studies recorded groundwater/potentiometric level response to tidal fluctuations using pressure transducers temporarily installed in each well. Additionally, a pressure transducer was installed in the Snohomish River near monitoring wells LLMW-08S/D to directly monitor and record the surface water level in the Snohomish River for comparison to water levels recorded in monitoring wells in the Lowland Area.

The water-level sensors were removed from the monitoring wells and River after completion of the data collection and the data was downloaded for analysis.

The data generated as part of the tidal studies were analyzed using the Serfes (1987) method to identify the mean groundwater elevations and flow direction for the shallow and deep aquifers and the Ferris (1951) method to identify the hydraulic diffusivity of the deep aquifer. The results from the Q4 tidal stud are presented in Section 4.

3.5.3. Hydraulic Conductivity Testing

Hydraulic conductivity testing included performing slug tests and drawdown testing on selected groundwater monitoring wells. The following sections discuss the field activities and data analysis for slug and drawdown tests.

3.5.3.1. *Slug Tests*

Slug tests were performed on selected monitoring well pairs in conjunction with groundwater sampling performed in Q1-2013 to evaluate the hydraulic conductivity (*K*) within the shallow and deep aquifers. The wells where slug testing was performed are identified on Table 3-2 and shown on Figure 3-4. The wells where slug testing was performed were selected because the wells are generally located downgradient of the former smelter location and between the former smelter and the Snohomish River and are generally evenly distributed within the Lowland Area.

Prior to conducting the slug test in each well, a decontaminated electronic water-level sensor consisting of a pressure transducer and automated datalogger (INW Model PT2X vented transducer with a 15-psi range) was installed in the well and depth to groundwater was measured manually using a decontaminated electronic water level indicator. The depth to groundwater was measured to document the static groundwater level prior to initiating the slug tests. Then a falling head slug test and rising head slug test were performed.

The falling head slug test was performed by rapidly lowering a decontaminated slug constructed of a sealed and weighted 5-foot-long section of polyvinyl chloride (PVC) pipe of known volume into the well causing the water level to rise rapidly above the initial, static water level. The groundwater level was then monitored until it returned (fell) to the approximate initial water level. A rising head slug test was then conducted by rapidly removing the slug from the well causing the water level to fall rapidly below the initial level. The groundwater level was monitored until it returned (rose) to the approximate initial water level. The hydraulic response was measured by pressure transducer, which was programmed to record the hydraulic pressure at 1-second intervals as well as with manual electronic water level indicator measurements before, during, and after each slug test.

Data from the falling head and/or rising head tests were used to estimate hydraulic conductivity at each well using the Bouwer-Rice (1976) method. The results from the slug tests are presented in Section 4.

3.5.3.2. *Drawdown Testing*

Short-duration drawdown testing was performed on wells LLMW-11S/D, LLMW-16D, and BP05S/D/D2 in conjunction with slug tests in Q1-2013 to provide additional hydraulic conductivity data for the shallow and deep aquifers in the Lowland Area (Table 3-2 and Figure 3-4).

During the drawdown tests, wells were pumped for 30 minutes using decontaminated submersible pumps to allow a cone of depression in the groundwater aquifer to propagate beyond the radius of influence achieved during slug tests to observe the aquifer response over a larger area. The aquifer response to the removal of water by the pumping, as well as the recovery of the groundwater in the aquifer following the end of pumping, provided additional hydraulic characterization of the soil around each tested well.

Prior to conducting the drawdown test in each well, a decontaminated pressure transducer was installed in the well and depth to groundwater was measured manually using a decontaminated electronic water level indicator to document the initial static groundwater level. Then the groundwater was pumped from the well using a submersible pump. The groundwater level was monitored throughout the pumping and recovery phases of each drawdown test until the water level returned to the static pre-test level.

A pressure transducer was also installed in the Snohomish River near monitoring wells LLMW-08S/D to monitor and record the river stage and tidal elevations during each test so that the effects of changes in the tidal elevation could be identified and a tidal correction applied to water levels for the analysis of the drawdown and recovery phases.

Drawdown data was initially analyzed using the Cooper-Jacob (1946) analytical method for data collected during the pumping phase and using the Theis Recovery Method (1935) for the data collected during the recovery phase. Data collected from wells that were tidally influenced required correction to compensate for the groundwater level changes due to tidal influences described below over the duration of the test. The results from the draw down testing are presented in Section 4.

3.6. Focused Source Area Investigation

3.6.1. Focused Source Area Investigation Locations and Sampling

The results from investigations of contamination in deep groundwater indicated that the source of the contamination was located in the area near the intersection of Marine View Drive and Weyerhaeuser Bridge Road. As a result, a focused, source area investigation was performed in 2014. The source area was suspected to be associated with the former smelter flue and dust chamber structures and flue and dust chamber materials that remain in place beneath Marine View Drive.

Forty-four soil borings (LLSB-04 through LLSB-47) were completed in two, 3-day sampling events performed March 26 through 28, 2014 and April 29 through May 1, 2014. The first sampling event included drilling 22 soil borings (LLSB-04 through LLSB-25) to characterize arsenic-contaminated material in the general historical location of the former smelter flue and dust chambers that are upgradient of where the highest concentrations of arsenic were detected in groundwater. The results of the first sampling event showed that elevated arsenic and lead concentrations in soil were present beyond the extent of the initial investigation area. Therefore, a second sampling event was completed that included drilling an additional 22 soil borings (LLSB-26 through LLSB-47) to further characterize the extent of elevated arsenic and lead concentrations in soil.

The locations of the borings are shown in Figure 3-5, and a summary of the borings and soil samples that were collected is provided in Table 3-4. Figure 3-5 also shows the outline of the approximate, former location of the flue and dust chambers. Borings were drilled using direct push methods and soil was collected from the borings in up to 5-foot lengths in disposable 1.75-inch diameter PVC sleeves inside a

Macro-Core® sampler. Borings were backfilled in general accordance with Washington State law (WAC 173-160) and the City of Everett Public Works Permit.

The borings were drilled at least several feet into native weathered till with maximum boring depths ranging between 10 and 21 feet below ground surface (bgs). Arsenic and lead concentrations were measured and recorded in the field using an X-ray fluorescence (XRF) analyzer on approximate 6-inch to 1-foot intervals the full length of each core and soil samples were collected for laboratory analyses.

3.6.2. Focused Source Area Investigation Analyses

Laboratory analyses performed on selected individual sample intervals or composited intervals included:

- Total arsenic and/or total RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) in soil by EPA Method 200.8 or 6010C.
- SPLP on soil for total arsenic by EPA Method 1312 using simulated "western" rainwater with a pH of 5 as the leachate.
- Column leaching tests on soil by ASTM Method D 4874 using deionized water as the leachate.
- Total arsenic on water samples collected from column leaching tests by EPA Method 200.8 or 6010C.
- Permeameter testing on soil by ASTM Method D 5084.

Chemical analysis of soil samples was completed by ARI in Tukwila, Washington. The laboratory analytical reports for the analyses performed on soil samples are provided in Appendix A. A data quality review was completed on the analytical data resulting from laboratory analysis of the samples. The data quality review reports are provided in Appendix A.

4.0 ENVIRONMENTAL SETTING

4.1. Physical Conditions

4.1.1. Climate

The climate in Everett is classified maritime, which includes mild summer and winter temperatures due to the proximity to the Pacific Ocean to the west and the Cascade mountains to the east. The average annual temperature is 51.8°F (NOAA, 2010). Daily mean high and low temperatures for August are 75.5°F and 54.0°F and the daily mean high and low temperatures for January are 48.0°F and 34.4°F (NOAA, 2010). Average annual precipitation in the area is approximately 38.44 inches with the highest monthly precipitation in November at an average of 5.5 inches and the lowest monthly precipitation in August at an average of 1.2 inches (NOAA, 2010). Average annual snowfall in Everett is 5.8 inches (Ecology, 1999). Approximately 10 inches of evapotranspiration occurs annually (Hydrometrics, 1995). Dominant yearly wind directions as measured in central Everett in 1992 and 1996 were southeast to east-southeast (Hydrometrics, 1995; Kelley et al., 2003). During the summer, a sea breeze prevails from the west to northwest (Ecology, 1999). Wind speeds generally do not exceed 10 knots with average wind speeds ranging from approximately 4 to 7 knots (Hydrometrics, 1995). During the winter, storms move inland from the Pacific Ocean but lose most of the precipitation in the Olympic Mountains to the west of Everett. Weather systems from the north and south of Everett converge over what is known as the Puget Sound "convergence zone" and produce greater precipitation in Everett than in regions to the north or south. The Cascade Mountains to the east shelter the region from the effects of cold air masses that develop east of the mountains during the winter.

4.1.2. Topography

The elevation of Marine View Drive adjacent to the former location of the smelter ranges from approximately 60 to 70 feet (NAVD 88) (Figure 4-1). The elevation of the flat area that comprises the majority of the Lowland Area between the base of the slope and the Snohomish River ranges from approximately 10 to 20 feet (NAVD 88). The elevation of the Lowland Area is generally above the 100-year floodplain (WEST, 2007). The slope in the western portion of the Lowland Area, adjacent to and east of Marine View Drive, is relatively steep and is generally 2 feet horizontal to 1 foot vertical (2H:1V).

The depth of the Port of Everett stormwater basins are approximately 6 feet (Port of Everett, 2001). The depths of the remaining inland surface water features are not known precisely. Certain small wetlands and ditches may be seasonally dry within the Lowland Area. Based on general inspection of surrounding topography, it is estimated that the maximum depths of larger ponds, such as the pond in the PUD subarea, are likely no more than approximately 6 or 8 feet during the majority of storm events.

The portion of the Snohomish River adjacent to the Lowland Area is from approximately river mile (RM) 0.5 to RM 2.5. The width of the river adjacent to the Lowlands (as measured between levees or bulkheads) ranges between approximately 600 and 1,000 feet. Ferry Baker Island is located in the middle of the Snohomish River adjacent to the southern portion of the Lowland Area. A profile of the Snohomish River channel bottom along the deepest part of the river channel (i.e., thalweg profile) performed in 2007 (WEST, 2007) indicates the deepest part of the river channel adjacent to the Lowland Area generally ranges in elevation from approximately -8 feet to -25 feet (NAVD 88) although it is as deep as -35 feet (NAVD 88) where the Pacific Highway and BNSF bridges cross the river.

The elevation of surface water in the river is tidally influenced adjacent to the Lowland Area. The water level in the river was observed to range from between approximately -2 and 12 feet (NAVD 88) during two tidal studies performed in 2013. Water levels in Port Gardner were approximately -4 to 10 feet (NAVD 88) during the same period.

4.1.3. Site Drainage

This section presents a description of drainage in the Lowland Area. The description of Site drainage is based on information provided in the Comprehensive Lowland RI (ASARCO, 2000), review of additional Site drawings (PTI, 1994 and Port of Everett, 2001), and observations of the Lowland Area during field activities performed as part of the supplemental investigation. Field observations were performed as part Site reconnaissance and sampling of water present in various surface features and from outfalls, seeps and sediment present on the shoreline of the Snohomish River. The drainage features, identified based on the sources of information identified above, are shown on Figure 4-2.

The Lowland Area includes features that contain and convey water including wetlands, ditches, culverts and pipes, ponds and stormwater basins. The features contain and convey stormwater runoff from precipitation falling on the Lowland Area including runoff from paved and unpaved surfaces at the Site. In addition to stormwater runoff, certain features are likely to be hydraulically connected to groundwater in the shallow aquifer and receive groundwater discharge from the shallow aquifer.

Drainage from the Lowland Area discharges from outfalls located on the shoreline of the Snohomish River. Outfalls that were observed during field reconnaissance performed in August 2012 were labelled LLO-01 through LLO-06 (Figure 4-2). Another outfall, LLO-07, was identified during shoreline outfall, seep and sediment sampling activities. Additionally, Figure 4-2 shows two outfalls (WK002 and WK004) that were not observed during the field reconnaissance but that are shown on a site drawing (PTI, 1994) that became available for review after the reconnaissance was performed.

The following sections describe the drainage in the Lowland Area associated with identified outfalls on the Snohomish River.

4.1.3.1. *Drainage to Outfall LLO-02*

Drainage from the Lowland Area that discharges from outfall LLO-02 originates from portions of the Benson, PUD, Slope and BNSF Subareas as well as from a portion of the Upland Area that includes a portion of Marine View Drive and the Pacific Highway interchange area (Figure 4-2).

Two surface water features are present within the Benson subarea. The southernmost feature is a ditch located south of the Weyerhaeuser Bridge Road and receives runoff from the adjacent steep, vegetated slope. Water flows north in the ditch and then through a culvert under the abutment of the Weyerhaeuser Bridge Road. Water flows to a wetland located north of the Weyerhaeuser Bridge Road (Figure 4-2). The wetland north of the Weyerhaeuser Bridge Road receives the stormwater from the culvert as well as runoff from the adjacent abutments of the Weyerhaeuser Bridge Road and Pacific Highway and discharges the water through a culvert under BNSF railroad tracks to the northeast.

A pond located on the PUD subarea receives runoff from portions of the adjacent, surrounding PUD and Slope Subareas and possibly a portion of the BNSF ROW. Water flows to the south and east via a ditch, under the Pacific Highway Bridge and combines with stormwater from the wetland located north of the Weyerhaeuser Bridge Road abutment described above.

A City-owned outfall is also located under Pacific Highway abutment. The City outfall reportedly discharges stormwater runoff from a portion of Marine View Drive and Pacific Highway (ASARCO, 2000).

Shallow groundwater discharges to the surface water features as evidenced by observed flow from the features even after extended periods of no precipitation. Hydrogeochemical facies comparisons between shallow groundwater and water in the surface water features also support the interconnection between groundwater and surface water, as described in Section 6.

The Comprehensive Lowland Area RI report indicates the water features described above drain via culverts and ditches on BNSF ROWs to outfall LLO-02 to the Snohomish River (Figure 4-2).

4.1.3.2. *Drainage to Outfalls LLO-03, LLO-04 and LLO-05*

Drainage from the Lowland Area that discharges from outfalls LLO-03, LLO-04 and LLO-05 originates from portions of the Port of Everett Riverside Business Park Subarea.

The Lowland Area has two engineered stormwater basins that are connected to a stormwater drainage system constructed along Riverside Road (Figure 4-2). The design of the stormwater drainage system is shown on Port of Everett Riverside Business Park Record Drawings (Port of Everett, 2001). The system utilizes both gravity flow and pressurized flow from pump stations to convey stormwater to the stormwater basins and outfall LLO-03. As shown on Figure 4-2, Riverside Road extends approximately 1,000 feet north and 2,200 feet south of the Weyerhaeuser Bridge Road. The northern stormwater basin was constructed to collect stormwater runoff from the portion of Riverside Road that is generally north of the Weyerhaeuser Bridge Road (i.e., the portion of Riverside Road adjacent to the Cymbaluk property). The southern stormwater basin collects stormwater runoff from the portion of Riverside Road south of the Weyerhaeuser Bridge Road. Water from both stormwater basins ultimately discharges to the Snohomish River at outfall LLO-03.

Outfalls LLO-04 and LLO-05 are also shown on Port of Everett Riverside Business Park Record Drawings (Port of Everett, 2001). An underdrain system located in the central portion of the business park is shown connected to the outfall LLO-04 (Figure 4-2). The depth of the underdrain system is not shown on the record drawings. The record drawings indicate that the drainage to outfall LLO-05 is from an area currently operated by Nickel Bros LLC that is north of former Mill E/Koppers Facility. The stormwater pipe is connected to a catch basin located in the paved area adjacent to a building used by Nickel Bros LLC. The paved area is used as an equipment laydown yard while the building houses an office and maintenance shop.

4.1.3.3. *Drainage to Outfalls LLO-01, LLO-06 and LLO-07*

Limited information is known about drainage that discharges from outfalls LLO-01, LLO-06 and LLO-07.

Outfall LLO-01 was identified on the northern portion of the Lowland Area during the August 16, 2012 shoreline reconnaissance (Figure 4-2). The outfall is located in the BNSF Subarea approximately 70 feet northwest of the Shadow Development Subarea. Neither the outfall nor possible connections to the outfall are shown on drawings or in reports available for review as part of preparation for this SRI.

Outfall LLO-06 was also identified during the initial shoreline reconnaissance event in August 2012. This outfall is located on the southern portion of the Port of Everett Riverside Business Park Subarea. This outfall is fitted with a tide gate and discharges water from an unknown source.

Outfall LLO-07 was identified during outfall, seep and sediment sampling performed in April 2013. The outfall consists of a pipe that penetrates a timber bulkhead that extends along the shoreline of the former Mill E/Koppers Facility. Neither the outfall nor possible connections are shown on drawings or reports available for review as part of preparation of this SRI. As discussed in Section 2, the Mill E/Koppers Facility is a cleanup site with a containment area and cap (Ecology, 2009). Surface water from above the containment area/cap reportedly flows via ditches that drain to the Snohomish River (Ecology, 2009). The outfall was identified south of the containment area. Water from an unknown source was observed draining from this outfall during the April 2013 sampling event.

4.1.3.4. *Drainage to Outfalls WK002 and WK004*

Outfalls WK002 and WK004 located at the Shadow Development/Blunt Family Subarea reportedly served the former Weyerhaeuser Kraft pulp mill facility (PTI, 1994). These outfalls were not observed during the August 16, 2012 Site reconnaissance. The outfalls operated under NPDES permit number WA-000300-00 at the time the Kraft mill was shut down in 1992. During mill operation, WK002 reportedly discharged noncontact cooling water and stormwater runoff while outfall WK004 discharged backwash from the mill's water filtration system (PTI, 1994).

4.1.4. Sea Level Rise

The elevation of surface water within the Snohomish River adjacent to the Lowland Area is influenced by tidal fluctuations of marine water in Port Gardner. Future sea level rise could increase flooding along coastal areas including the Lowland Area. The median estimate for the rise of the water level in Puget Sound is 13 inches by the year 2100 (Ecology, 2008). A study undertaken at a site upgradient of the Lowland Area at approximately RM 6, indicated sea level rise would raise the 100-year flood elevations by approximately 11 inches over 100 years (GeoEngineers, 2008).

The ground surface elevation in the Lowland Area has historically been raised by filling. The Port of Everett is in the process of filling a portion of the Riverside Business Park. The purpose of the filling is to keep the area that is being filled above the 100-year floodplain elevations. Therefore, sea level rise is considered to have a minimal impact on the Lowland Area in the foreseeable future.

4.2. Geology

4.2.1. Introduction

This section describes the geology of the Everett Smelter Site including the Lowland Area and adjacent portion of the Upland Area. The near-surface geology (less than 500-foot depth) at the Everett Smelter Site is the result of two distinct geologic processes. The Upland Area is the result of glacial processes and glacial deposits. While the broad scale geology of the Lowland Area is also glacially derived, the near-surface deposits are the result of post-glacial, estuarine processes. The transition between the two geologic areas is essentially the boundary between the Upland and Lowland Areas. The Lowland area geology is further divided into eastern and western areas.

Geologic cross sections were prepared based on information documented in boring logs prepared during previous and supplemental investigations of the Everett Smelter Site. The geologic cross section locations and borings used for the cross sections are shown on Figure 4-3. Cross Section A-A' on Figure 4-4 is an east-west geologic section from the Upland Area through the Lowland to the Snohomish River. Cross Section B-B' on Figure 4-5 is located north of Cross Section A-A' and is an east-west section that includes the Weyerhaeuser Bridge Road abutment and the area where slag was previously poured from the Upland onto the Lowland Area. Cross Section C-C' on Figure 4-6 is a north-south section that transects the PUD and Benson Subareas and includes the abutments for both the Weyerhaeuser Bridge Road and Pacific Highway. Note that information (e.g., elevations, level of detail) on recent boring logs is more accurate compared to older boring logs, and that elevations of some previous investigations had to be estimated based on information obtained from more recent adjacent borings. The boring logs collected as part of previous and supplemental investigations are provided in Appendix B.

In general, the geology of the Lowland Area consists of *fill* at the surface underlain by *silt* and/or channel deposits (estuarine deposits) that is further underlain by *alluvium* of the Snohomish River. The geology of the Upland Area consists of a relatively thin layer of *fill* that is typically reworked till fill, underlain by glacial *till* that is further underlain by glacial *outwash*. The geologic units as well as hydrogeologic units described in Section 4.3 are summarized in Table 4-1.

The geologic units in the Lowland and Upland areas are described in the following sections.

4.2.2. Upland Area Geology

The geology of the Upland Area is largely shaped by the advance and retreat of glaciers during late Pleistocene glaciation approximately 13,000 years ago. According to mapping of the regional geology, the Upland Area is identified as Vashon till, a very dense, unsorted mixture of clay- through boulder-sized materials deposited directly by the advancing glacier (Minard, 1985). Locally, the till is overlain by fill of various depths. The till, which is 3 to 60 feet thick, is relatively impermeable. Water may penetrate the upper, weathered till (the upper 3 to 6 feet) or fill (the upper 5 to 20 feet). However, water then likely ponds and moves laterally along the un-weathered till surface (ASARCO, 2000). The till is capable of maintaining very steep slopes, such as the slope that comprises the western portion of the Lowland Area.

Beneath the till is Vashon advance outwash. The outwash comprises a thick layer of predominantly sand and gravel with occasional layers of fine grained sand and silt, especially in the lower portions of the unit. The outwash was deposited in meltwater streams flowing from the advancing glacier. The unit tends to coarse upwards due to increasing proximity to the glacier. However, the coarser deposits may be eroded (missing) locally. The outwash is likely thicker than 300 feet in the Everett Smelter Site area and is relatively permeable (Minard, 1985). In the Upland Area, the upper 10 to 20 feet of outwash is dry (Figures 4-4 and 4-5). Where saturated, the outwash forms an extensive aquifer in the Everett region. The elevation of the contact between the till and outwash is above the elevation of the surface of the Lowland Area and the outwash "daylights" at the lower portion of the steep slope present in the western portion of the Lowland Area. Like the till, the outwash also maintains relatively steep slopes. Mineralogically, the till and outwash are similar.

Borings and excavations completed in the Upland Area generally confirm the geology identified above, including the presence of fill, weathered till, unweathered till and outwash deposits. The observed lithology in a boring advanced on the western portion of the Upland Area as part of the supplemental investigation (LLMW-35D), included till fill from the surface to 5 feet bgs, till from 5 feet to 69 feet bgs, and outwash to the full depth explored (92 feet bgs [elevation -1 foot NAVD 88]) (Figure 4-4). Soils encountered in borings advanced on the eastern portion of the Upland Area as part of the supplemental investigation (LLMW-24D, LLMW-25D, LLMW-27D, LLMW-29D and LLMW-31D) showed the same sequence of fill, till and outwash.

Boring LLMW-35D advanced in the Upland Area identifies that fill is less than 5 feet thick in the area where the exploration was performed. Ecology files documenting the Upland cleanup indicate the fill thickens to the east to East Marine View Drive, where fill is up to approximately 20 feet thick. Borings EV-13, EV-19B and LLMW-27D indicate fill under Marine View Drive ranges from approximately 5 feet on the west side to approximately 20 feet on the east (Figures 4-4 and 4-5). These and other borings completed east of the former smelter identify that the till extends as far east as the east side of Marine View Drive, but no further. For example, glacial till was encountered from approximately 13 feet to 33 feet bgs in EV-19B, but glacial till was not encountered in a boring in the Weyerhaeuser Bridge Road abutment (EV-20B) (Figure 4-5).

4.2.3. Lowland Area Geology

4.2.3.1. *Eastern Lowland Area Geology*

After the retreat of glaciers from the area, the Snohomish River valley was likely a shallow marine deltaic area. As the river delta prograded (advanced towards Port Gardner), marine sediments were buried under tens to hundreds of feet of Holocene alluvium and estuary deposits (silt and sand deposited by the river). The geology of the eastern portion of the Lowland, including the BNSF Subarea, Shadow Development/ Blunt Family Subarea, Snohomish PUD Subarea, and Port of Everett Riverside Business Park Subarea, consists of recent fill overlying the Holocene alluvium and estuary deposits that are associated with the Snohomish River.

The fill consists of loose to dense silty sand to sandy silt, with occasional gravel. The majority of the fill is reported to have been dredged from the Snohomish River and placed on the Lowland surface episodically from the early 1900s to the present (ASARCO, 2000). Fill thickness ranges from approximately 7 to 15 feet. The fill contains debris in localized areas that includes wood debris, likely from former Weyerhaeuser operations, or slag that likely originated from the former smelter and that was deposited on the Benson Subarea and later redistributed as fill. Wood debris was encountered in four borings located in the Riverside Business Park Subarea and Shadow Development/Blunt Family Subareas (LLMW-01, LLMW-06, LLSB-01 and LLSB-03). Slag is visible at the ground surface on portions of the Benson and BNSF Subareas and slag was identified in a boring on the Cymbaluk property (HP-47) within the Riverside Business Park Subarea. The presence of slag is discussed further in Section 4.2.3.2.

Silt deposits are located beneath the fill throughout the majority of the Lowland area, typically as a layer of soft silt or soft silt with organics. Several inches to approximately 1 foot of peat is often present on top of the silt layer. The top of the silt/peat is the historic native surface that was exposed to atmospheric deposition during the time of smelter operations. The silt forms a confining layer between the shallow, unconfined aquifer located in the surface fill and underlying deep aquifer located in the alluvium. The silt deposits are approximately 1 foot to 13 feet thick, thinning towards the Snohomish River (Figure 4-4).

Alluvium is located beneath the silt. The upper portion of the alluvium consists of loose to medium dense sand with trace silt while the lower portion of the alluvium contains interbedded sands and silts. The alluvium extends to depths greater than 100 feet bgs in the Lowland Area (Figure 4-4).

Four relatively deep borings were drilled as part of the supplemental investigation of the Lowland Area to elevations ranging between approximately -55 to -80 feet (NAVD 88) (BP-04D2, BP-05D2, BP-07D2 and LLMW-36D). Additionally, three geotechnical explorations performed in the Lowland Area as part of a separate project were advanced to elevations ranging between approximately -77 to -85 feet (NAVD 88) (ETB-20, CPT-17 and CPT-20). A finding from the deep explorations is that the alluvium in the Lowland, previously reported to consist of permeable sandy material to full exploration depths, actually consists of an upper, permeable sand that transitions to a lower alluvium characterized by interbedded sands and silts. The top of the lower alluvium is encountered at depths beginning at Elevation -35 to -60 NAVD 88 (Figure 4-4). The lower alluvium is expected to be less permeable compared to the upper alluvium.

4.2.3.2. *Western Lowland Area Geology*

The geology of the western portion of the Lowland (the area comprised by the Benson Subarea, Slope Subarea, and Pacific Highway abutment) is different from the geology of the eastern Lowland Area; the western portion of the Lowland Area includes the transition between the Upland and Lowland.

Fill And Slag

No fill is present on the slope in the northwestern portion of the Lowland in the Slope Subarea. Rather, colluvium comprises the surface in the Slope Subarea. The present day ground surface in the Slope Subarea is considered likely to be the historic native surface that was exposed to atmospheric deposition during the time of smelter operations. Conversely, considerable fill is present on the western portion of the Lowland Area that comprises the abutments of Pacific Highway and the Weyerhaeuser Bridge Road as well as on the southern portion of the Benson Subarea (Figure 4-6).

Abundant slag is present on portions of the Benson Subarea including at the ground surface. Multiple borings have investigated the extent of the slag and the present extent of slag is shown on Figures 4-3 through 4-6. Slag is concentrated in the former location of a "slag pile" and is also found in other areas above and around the former slag pile area mixed with soil (i.e., where soil is the dominant component). Slag, a lead smelting byproduct, was poured down the hillside from the Upland Area where the smelter was located onto the Lowland Area. Slag is a dense, dark colored, fractured material resembling basalt. The slag is often angular and can have oxidized surfaces due to its iron content. It can be solid or vesicular with the cavities having formed from escaping gasses during cooling. Fine-grained slag, a possible consequence of the rock wool operation, is also noted in multiple boring logs from the Lowland Area (WP-1, HP-19, HP-20, HP-24, HP-26, LB-1, EV-7A, EV-8A and EV-9A, and possibly HP-21).

The largest quantity of slag was present on the Site in 1912 at the time of smelter shutdown. The extent of slag is shown on a 1913 topographic survey (Hydrometrics, 1995) (Figure 4-3). According to the 1913 topographic drawing, the average vertical thickness of the slag pile was 25 feet to 35 feet.

Some slag was removed since smelter operations ceased in 1912. Based on a 1933 agreement with Asarco (ASARCO, 2000) the City of Everett was allowed to remove up to 4,000 cubic yards of slag per year. As discussed in Section 2.0, a "rock wool" operation by Cascade Insulation Company was located in the Lowland Area at the base of the slag pile during the 1950s (Hydrometrics, 1996). The result of the City's slag removal activities as well as the rock wool operation likely reduced the overall volume of the slag pile. The quantity of slag in the slag pile in 1913 has not been estimated. The volume of the slag pile in 2000 was estimated by Hydrometrics to be approximately 54,000 cubic yards.

The western abutment of Pacific Highway appears to have initially been constructed in the early 1900s based on a review of historic maps and aerial photographs. The abutment is not present on an 1884/1885 map (U.S. Coast and Geodetic Survey, 1885). However, it is visible in an aerial photograph dated circa 1928. The topography suggests that considerable fill, on the order of 40 feet thick, was placed to create the abutment. Smelter debris was likely used under the southbound lane (i.e., the northern portion) of the abutment as well as Weyerhaeuser Bridge abutment during construction of the Pacific Highway interchange in 1956 (ASARCO, 1998; ASARCO, 2000). Deep borings have not been completed in the western abutment of Pacific Highway. However, 11 surficial soil samples were collected (Hydrometrics, 1996) and 16 shallow hand augers were also performed (ASARCO, 1998) in the abutment. Brick and wood debris, typical of smelter demolition debris, was found in the surficial abutment fill on the south side of the highway (under the northbound lane).

The western Weyerhaeuser Bridge Road abutment is comprised of approximately 50 feet of fill, the lower portion of which is slag. Multiple borings have been advanced in the western abutment of the Weyerhaeuser Bridge Road (SL-1, SL-3, SL-4, EV-6A and EV-6B). All of these borings encountered approximately 30 feet of fill over 12 to 22 feet of slag (Figures 4-5 and 4-6). Borings SB-3 through SB-8 were also advanced in the western abutment of the Weyerhaeuser Bridge Road, all in relatively close proximity (Hydrometrics, 1996 – Appendix D). Although boring logs were not included in the report, tables included in Appendices C and D to the report indicate SB-3 encountered slag and SB-4 did not encounter slag. Boring SB-4 encountered approximately 45 to 50 feet of fill overlying silt to the full depth explored (55 feet bgs). Boring SB-4 is shown on cross section Figure 4-6. However, the other SB borings are not shown on Figure 4-6 because they were located very close to SB-4 but did not extend as deep as SB-4.

<u>Channel Deposits</u>

An additional difference between eastern and western Lowland Area geology is the occasional absence of the silt layer where it is replaced by channel deposits. Channel deposits are typically silty sands with occasional thin silt layers. The channel deposits are more permeable than the silt layer. Channel deposits were identified near the base of the slope in borings HP-26, EV-6A, EV-6B, EV-17B and LLMW-36D. Channel deposits were also potentially identified in the southeastern portion of the Benson Subarea in boring BP-09S/D. The location of channel deposits is shown on Figures 4-4 through 4-6.

4.3. Hydrogeology

4.3.1. Introduction

This section describes the hydrogeology of the Everett Smelter Site Lowland Area and the adjacent portion of the Upland Area. Four aquifers were evaluated as part of the supplemental investigation of the Lowland Area. The aquifers that were evaluated include the shallow and deep aquifers that are present in the Lowland Area and the shallow and deep aquifers present in the Upland Area. The aquifers present in the Upland Area discharge to the Lowland aquifers. The hydrogeologic units and associated aquifers are summarized in Table 4-1.

Hydrogeologic testing was performed in monitoring wells installed during previous and supplemental investigations of the Everett Smelter Site. Testing consisted of slug and drawdown tests, as well as snapshot groundwater level monitoring and tidal studies as indicated on Table 3-2. The monitoring well locations are shown on Figure 3-2. Construction details for the monitoring wells are presented in Table 4-2. The monitoring well completion logs are provided in Appendix B.

The following sections describe the hydrogeologic units and associated aquifers and the results of hydrogeologic testing performed at the Lowland Area.

4.3.2. Upland Area Hydrogeology

As described in Section 4.3.1, the Upland Area is comprised of a thin layer of fill or weathered till, underlain by till, and further underlain by advance outwash. The fill/weathered till comprises the shallow aquifer in the Upland Area, although water is rarely present in the aquifer. The outwash present beneath the till comprises the deep aquifer (Table 4-1).

4.3.2.1. *Upland Area Fill / Weathered Till and Shallow Aquifer*

The fill/weathered till in the Upland Area is approximately 5 to 20 feet thick. A total of nine wells were installed in the fill/weathered till. Of the nine wells, five wells were always dry (EV-10, EV-12, EV-14, LLMW-27S and LLMW-29S) and two wells contained water initially but then were also observed to be dry (EV-11 and EV-13). Monitoring wells EV-1 and EV-4A were the only wells installed in the fill/weathered till that contained water during multiple sampling rounds. EV-1 was located upgradient of the smelter cleanup area and EV-4A was located near the northeast corner of the intersection of East Marine View Drive and the Weyerhaeuser Bridge Access Road (ASARCO, 2000).

Although little to no groundwater has been observed in wells installed in the fill/weathered till in the Upland Area, saturated areas reportedly occur in thin sand lenses or following recharge from precipitation (Minard, 1985). For the purpose of this SRI, the shallow, intermittently wet zone present in the uplands is called the shallow aquifer. Where present, this water likely ponds and then flows laterally downslope to the east, where it may encounter outwash as well as fill deposits and then flow vertically downward (for example near well EV-20B, Figure 4-5). Although this water does not likely represent a significant source of recharge to aquifers in the Lowland Area, it likely provided (and may be continuing to provide) a contaminant transport pathway from the shallow aquifer in the Upland Area to the deep and shallow aquifers in the Lowland Area.

During the focused source area investigation performed in 2014, fill was observed to be present from the ground surface to the surface of the weathered till. The depth to the surface of the weathered till typically increased from approximately 7 feet bgs in the western portion of the investigation area to approximately 15 feet bgs in the eastern portion of the investigation area. The fill generally consisted of brown or gray (occasionally orange) sands to silty sands with varying amounts of gravel. It frequently contained remnant smelter debris such as brick fragments, brick and mortar, wood debris as well as other debris such as pieces of metal. Small amounts of slag were observed in the fill in four borings (LLSB-33, LLSB-40, LLSB-41 and LLSB-42).

Groundwater was not encountered during the source area investigation. Fill and native weathered till were however, observed to be moist to wet at various horizons in borings located within and adjacent to the flue and dust chamber alignment on the western and central portions and one location in the eastern portion of the investigation area. Although moisture was not generally observed in borings on the eastern portion of the investigation area, mottling was observed at multiple locations indicating that soil has been wet in the past. The observations of moisture present in fill and weathered till during the investigation indicate that water periodically infiltrates, likely in the unpaved area west of the investigation area, and migrates beneath the road and to the east. Although this water does not likely represent a significant source of recharge to aquifers in the Lowland Area, it likely provided, and potentially continues to provide, a contaminant transport pathway from the shallow aquifer in the Upland Area to the deep and shallow aquifers in the Lowland Area.

It should be further noted infiltration of water likely occurred historically over a much broader area prior to paved roadway construction. Water may have historically migrated along the flue structure from the former location of the smoke stack at the western end of the flue structure to the eastern end of the flue structure within the investigation area.

4.3.2.2. *Upland Till*

The till is up to 60 feet thick and separates the shallow and deep aquifers in the Upland Area. The unweathered till is generally dry and was observed to be saturated in only one Upland Area exploration location (TB-4) at a depth of 39 to 43 feet (ASARCO, 2000). Because of this, the unweathered till is not considered a water-bearing unit and as such does not constitute an aquifer in the Upland Area. Groundwater percolating through the overlying fill and weathered till tends to pond at the top of the unweathered till surface and flows laterally along the surface (Minard, 1985).

4.3.2.3. *Upland Area Outwash and Deep Aquifer*

Borings completed in the Upland Area have not penetrated the entire thickness of the outwash deposits and therefore, the thickness of the outwash is not known. The outwash is reportedly as thick as 100 meters (328 feet) in the area (Minard, 1985). The upper portion of the outwash is dry, with groundwater typically encountered 10 to 20 feet below the contact with the overlying till (at an approximate elevation of 13 feet NAVD 88).

The outwash deposits comprise the deep aquifer in the Upland Area and the aquifer is considered a water table (unconfined) aquifer because the unit is not fully saturated to the upper confining unit (till). Groundwater in this unit is likely largely supplied from recharge at locations in the Upland Area where the till is either thin or absent, or where excavations or incised channels/surface water bodies penetrate the till allowing water to percolate into the underlying outwash deposits. Based on the results of water level measurements performed during the supplemental investigation and the results of previous investigations of the Site, the deep aquifer in the Upland Area and deep aquifer in the Lowland Area are considered to be in hydraulic continuity with the deep aquifer in the Upland Area discharging to the deep aquifer in the Lowland Area (Figure 4-4).

4.3.3. Lowland Area Hydrogeology

As described in Section 4.3.1, the Lowland Area is comprised of fill, underlain by silt that is occasionally replaced by channel deposits, which are further underlain by alluvium of the Snohomish River. The fill unit comprises the shallow aquifer in the Lowland Area. The alluvium present beneath the silt/channel deposits, comprises the deep aquifer (Table 4-1).

4.3.3.1. *Lowland Area Fill and Shallow Aquifer*

The fill in the Lowland Area is typically 7 to 15 feet thick and is largely comprised of silty sand to sandy silt, with occasional gravel. The shallow aquifer in the Lowland Area consists of a relatively thin (0 to 10 feet thick) zone of saturation that occurs in the surface fill, generally at or within several feet of the ground surface. Water levels in this aquifer are primarily controlled by precipitation as evidenced by a difference in water table elevations of as much as 3 feet between wet and dry seasons (Table 4-3). Upon infiltration into the fill unit, water perches on the underlying silt (described in Section 4.3.3.2), which limits vertical (downward) movement of groundwater. Runoff from the Upland Area may also contribute to recharge of the shallow aquifer in the Lowland Area.

The wetlands in the Benson Subarea and surface water pond in the PUD Subarea are likely in hydraulic communication with shallow aquifer groundwater based on data collected as part of the supplemental investigation. Groundwater is typically found at or within several feet of the ground surface in monitoring wells in the vicinity of the wetlands and pond. Furthermore, surface water flow in the wetlands and pond occurs even after extended periods without precipitation. Additionally, arsenic concentrations are similar in the wetlands and adjacent shallow monitoring wells in the Benson Subarea and arsenic concentrations are similar in the PUD pond and adjacent monitoring wells. The stormwater basins in the Port of Everett Riverside Business Park likely have limited or no connection to shallow groundwater as the basins are lined with low permeability "bentomat."

4.3.3.2. *Lowland Silt*

The silt present beneath the fill in the Lowland Area is typically 1 foot to 13 feet thick and is comprised of very soft to medium stiff silt, often with abundant organics, including occasional peat observed at the top of the silt. The silt acts as an aquitard to hydraulic flow, which inhibits the flow of groundwater and separates the shallow and deep aquifers in the Lowland Area.

4.3.3.3. *Lowland Area Alluvium and Deep Aquifer*

Borings completed in the Lowland Area have not penetrated the entire thickness of the alluvium and therefore, the thickness of the alluvium is not known. The alluvium consists of relatively transmissive sand in the upper portion where the majority of Lowland Area deep wells are screened and interbedded silts and sands in the lower portion.

The deep aquifer in the Lowland Area occurs in the alluvium, which is fully saturated. Due to the overlying silt aquitard, the deep aquifer is confined. Hydrogeologic testing of the deep aquifer has demonstrated that the aquifer is in hydraulic communication with the Snohomish River and that the potentiometric surface of the deep aquifer is influenced by changes in the water level in the Snohomish River, including changes due to tidal fluctuations (see Section 4.5.2.2 and technical memorandums in Appendix A). As a result of the presence of the overlying silt aquitard, recharge to the deep aquifer is predominantly from regional -flow from the deep aquifer in the Upland Area.

4.4. Areas of Recharge/Discharge

Regional groundwater recharge is controlled by precipitation and water in surface water bodies. Precipitation and surface water in the Upland Area is assumed to pond and then flow laterally on the glacial till that is a mantle over much of the upland Everett area until more transmissive formations allow vertical flow into deeper outwash deposits. Groundwater entering the deep aquifer in the Upland Area from recharge moves horizontally and discharges to the shallow and deep aquifers in the Lowland Area (see Figure 4-4). Although precipitation is considered the primary recharge mechanism for groundwater in the shallow aquifer, which is perched on silt and does not appear to receive significant recharge from Upland flow, some groundwater entering the shallow aquifer may be discharging from the deep aquifer in the Upland Area (Figure 4-4).

The shallow aquifer in the Lowland Area exchanges surface water with unlined wetlands, ponds and ditches, and ultimately discharges to the Snohomish River. The deep aquifer in the Lowland area discharges to the Snohomish River.

4.5. Tidal Influence

4.5.1. Introduction

Two tidal studies were performed as part of the supplemental investigation of the Lowland Area in February (Q1) and November, 2013 (Q4) focused in the area between the former smelter and Snohomish River. The tidal study performed in February 2013 included monitoring groundwater levels in six shallow and deep monitoring well pairs (BP-05S/D, BP-08S/D, MW-06S/D, MW-11S/D, MW-12S/D, MW-13S/D) installed at varying distances from the shoreline of the Snohomish River to evaluate the tidal influence on groundwater across the Site. The tidal study performed in November 2013 included the six shallow/deep well pairs monitored in February 2013 as well as four additional monitoring wells installed in the deep aquifers (a total of 10 deep monitoring wells) on the western portion of the Lowland Area (EV-7B, EV-20B, and MW-36D) and in the Upland Area (MW-35D) to further evaluate the extent of tidal influence on groundwater in the deep aquifer. Section 3.5.2 and the technical memorandums presented in Appendix A provide additional detail concerning the methodology used and results of the tidal studies.

The results of the two tidal studies were evaluated to identify where tidal effects were observed in groundwater at the Site. Where present, the effects of tidal fluctuations on groundwater levels in individual monitoring wells were analyzed to identify the following:

- The effect of tidal fluctuations on groundwater gradients (Section 4.5.3);
- The length of time it took for the tidal effect observed at the shoreline to reach an individual monitoring well location, which is identified as the time lag and presented in hours; and
- The magnitude of the tidal influence on the groundwater level in the well relative to distance from the shoreline, which is identified as the stage ratio and presented as a percent (%).

The time lag and stage ratio were then used to calculate the diffusivity for the aquifer, which relates to transmissivity, storativity, and hydraulic conductivity which control the storage and flow of groundwater in the aquifer. This analytical method estimates "bulk" hydraulic parameters for the aquifer which provides an overall estimate for the aquifer where the testing is performed, in contrast to the hydraulic parameters measured at individual monitoring well locations (e.g., slug tests, drawdown tests, etc.) that provide hydraulic parameters for a specific location or portion of the aquifer. The monitoring wells used in both the February and November 2013 tidal studies, as well as the mean groundwater elevation and calculated time lag and stage ratios, are presented in Table 4-4.

The results of the two tidal studies were similar, as determined by comparing the time lag and stage ratios for wells used during both studies. Because the results of the two studies were similar, only figures from the results of the second, more comprehensive tidal study conducted in November 2013 are presented in the discussion below. Hydraulic conductivity values determined during the November tidal study, slug testing, and drawdown testing are discussed in Section 4.5.3 below.

4.5.2. Tidal Study Results

4.5.2.1. *Lowland Area Shallow Aquifer*

The tidal study results indicate that there is no appreciable tidal effect on groundwater levels in monitoring wells completed in the shallow aquifer. However, the presence of bulkheads along the shoreline in the

Lowland Area may be inhibiting any potential hydraulic connection between the Snohomish River and the shallow aquifer.

Figure 4-7 presents a comparison of the water level in the Snohomish River to the groundwater level in a monitoring well installed in the shallow aquifer located approximately 600 feet from the shoreline (MW-13S). As identified in Figure 4-7, there is no discernible effect of the river stage height (water level in the Snohomish River) on the groundwater level in the well as the groundwater level remained relatively unchanged through multiple tidal cycles that included up to approximately 14 feet of change in the adjacent water level in the Snohomish River. The results presented in Figure 4-7 are typical for monitoring wells installed in the shallow aquifer of the Lowland Area that were monitored as part of the tidal study. Groundwater in the shallow aquifer appears to be hydraulically distinct from surface water in the Snohomish River as well as groundwater within the deep aquifer.

4.5.2.2. *Lowland and Upland Area Deep Aquifers*

Groundwater levels in wells completed in the deep aquifer in the Lowland Area showed a direct hydraulic response to tidal fluctuations in the Snohomish River. Figure 4-8 presents a comparison of the water level in the Snohomish River to the groundwater level in a monitoring well installed in the deep aquifer located approximately 600 feet from the shoreline (MW-13D). As identified in Figure 4-8, there is high degree of correlation between the river stage height and the groundwater level in the well. The results presented in Figure 4-8 are typical for monitoring wells installed in the deep aquifer of the Lowland Area that were monitored as part of the tidal studies.

The tidal effect was observed on groundwater in the Lowland Area deep aquifer to a maximum distance of approximately 1,700 feet inland from the river at monitoring well location LLMW-36D (Figure 4-9). Monitoring well LLMW-36D is installed in alluvium located at the western boundary of the Lowland Area and is adjacent to the outwash present in the Upland Area (Figure 4-4). A discernible tidal response was not observed in groundwater at monitoring wells EV-20B and LLMW-35D, which are installed in outwash in the Upland Area further from the shoreline than LLMW-36D. Figure 4-10 presents a comparison of the water level in the Snohomish River to the groundwater level in monitoring well LLMW-35D installed in the deep aquifer located in the Upland Area approximately 2,130 feet from the shoreline.

At the well locations that were monitored as part of the Q4 tidal study, the lag time ranged from approximately 1/2 hour for the well located approximately 50 feet from the Snohomish River (LLMW-11D) to approximately 3.5 hours for the monitoring well located on the western boundary of the Lowland Area, approximately 1,700 feet from the Snohomish River (LLMW-36D). The stage ratio ranged from approximately 70 percent for the well located approximately 50 feet from the Snohomish River (LLMW-11D) to approximately 4 percent for the monitoring well located on the western boundary of the Lowland Area (LLMW-36D). The tidal response observed at well LLMW-36D, located near the outwash contact, matched the general form of the river stage heights (Figure 4-9). However, the fluctuations were of a much lower magnitude (4 percent stage ratio) than those observed in wells located closer to the river (Appendix A, Q4 Memorandum, Figures F-15 through F-26). This response likely indicates that LLMW-36D is very near the inland limit of tidal influence.

The large distance of observed tidal effect on groundwater in the Lowland Area deep aquifer further supports the interpretation that the deep aquifer in the Lowland Area is a confined aquifer system. The observations from the tidal studies indicate that the confined system creates a conduit for a tidal "wave" of increased hydraulic head to propagate inland below the confining silt layer during high tides. It may be that a response was not observed at EV-20B and LLMW-35D and the response at monitoring well LLMW-36D was dampened by the unconfined characteristics of the adjacent outwash located in the Upland Area. It is also possible that groundwater in the deep aquifer in the Upland Area acts as a recharge boundary for the deep aquifer in the Lowland Area as suggested by steep gradients between outwash and alluvium-screened wells (see Section 4.5.3.2) and that tidal influence into the deep aquifer in the Upland Area could be somewhat limited by these gradients.

4.5.3. Groundwater Gradients and Flow

4.5.3.1. *Introduction*

Groundwater gradients and flow direction at the Site were characterized based on the results of snapshot groundwater level monitoring and tidal studies performed as part of the supplemental investigation. Four snapshot groundwater level monitoring events were performed in up to 55 shallow and deep aquifer wells spread across the Lowland Area to obtain area-wide groundwater gradients. The results of all snapshot water level monitoring events are provided in the technical memorandums in Appendix A. The following sections present the groundwater gradients and flow direction for the shallow and deep aquifers in the Lowland Area based on the results of snapshot groundwater level monitoring events and tidal studies.

4.5.3.2. *Horizontal Hydraulic Gradients*

Area-wide groundwater gradients and flow direction in the shallow and deep aquifers were characterized based on the results of four snapshot water level measurement events. Table 4-3 presents the groundwater elevations recorded during each of the snapshot water level measurement events. Figures 4-11 and 4-12 show the results for snapshot water level measurements recorded around low tide between 8:00 am and 11:00 am on September 4, 2013 for the shallow aquifer and deep aquifer, respectively. The results for the three additional snapshot water level measurement events are provided in Appendix A.

Average horizontal gradients and flow direction for groundwater in the shallow and deep aquifers were determined based on the results of the tidal studies. The average groundwater elevation for each well location included in the tidal study was calculated by averaging the groundwater elevations measured over the 72-hour tidal study at the location. The average elevations for each well location were then used to calculate the average horizontal gradient in feet per foot between wells (feet of elevation change per horizontal foot). Figures 4-13 and 4-14 present the average groundwater elevations in the shallow and deep aquifers, respectively, based on the results of the tidal study performed in November, 2013. Table 4-7 presents the average groundwater gradients calculated for the shallow and deep aquifers based on the results of the tidal studies.

Lowland Area Shallow Aquifer

The average groundwater flow direction in the shallow aquifer based on the results of the tidal study is toward the east-northeast toward the Snohomish River (Figure 4-13). In general, average horizontal groundwater gradients in the shallow aquifer are steeper in the western portion of the Lowland Area adjacent to the steep slope (0.011 ft/ft between BP-05S and LLMW-12S) and flatten out in the central and eastern portion the Lowland Area and near the shoreline (0.00055 ft/ft between LLMW-12S and LLMW-11S). The steep gradient observed on the western portion of the Lowland Area may be due to recharge from the outwash where the outwash abuts the shallow fill in the Lowland Area (Figures 4-4 and 4-5), as well as stormwater runoff and infiltration from the slope. The average horizontal gradient between wells BP-05S and MW-12S was 0.011 ft/ft (Table 4-7). The Lowland area shallow aquifer is not tidally influenced.

Surface drainage features, heterogeneity in the fill, and modification of land through addition or removal of fill likely create variations in hydraulic gradient and groundwater flow in the shallow aquifer. This is evident in the September 2013 snapshot groundwater elevations (Figure 4-11) where localized variations in flow direction and gradient were observed in several parts of the Lowland Area. In the northern portion of the Riverside Park Subarea localized "mounding" of shallow groundwater was observed around well LLMW-06S. The "mounding" of groundwater may be associated with placement of fill on this portion of the Riverside Business Park Subarea. In the Benson Subarea near Weyerhaeuser Bridge Road, groundwater flow direction becomes northeasterly, flowing toward the northern portion of the Riverside Park Subarea. South of the Pacific Highway Bridge, shallow groundwater flow is easterly before changing to a northeasterly direction north of the bridge. Surface drainage features (ditches, culverts, etc.) may be affecting shallow groundwater flow in this part of the Lowland Area.

In the eastern portion of the Lowland Area, a localized groundwater "mound" is visible surrounding LLMW-13S (Figure 4-11). Fill has recently been placed in the area of LLMW-13S that has raised the surface elevation above the elevation of the surrounding area. The locally elevated groundwater levels in this area may be due to the placement and compaction of the recent fill resulting in reduced infiltration through the fill.

The mean groundwater flow direction in the shallow aquifer observed during the tidal studies is similar to that observed during the groundwater snapshot events. However, fewer wells were monitored during the tidal studies, so localized changes in flow direction are not as apparent from the tidal study data. The mean groundwater elevations calculated from the tidal study data indicate an average northeasterly groundwater gradient (Figure 4-13).

<u>Lowland Area Deep Aquifer</u>

The average groundwater flow direction in the deep aquifer based on the results of the tidal study is east toward the Snohomish River (Figure 4-14). Average horizontal groundwater gradients in the deep aquifer are much steeper in the western portion of the Lowland Area adjacent to the Upland Area (0.010 ft/ft between LLMW-35D and BP-05D) and flatten out in central and eastern portions the Lowland Area and near the shoreline (0.0021 ft/ft between BP-05D and MW-12D). The steeper gradient observed on the western portion of the Lowland Area is likely due to recharge from the outwash where the outwash abuts the alluvium in the Lowland Area (Figures 4-4 and 4-5).

The results of snapshot groundwater level monitoring events also indicate a flow direction toward the east in the deep aquifer during low tide as shown in Figure 4-12. The horizontal gradient in the deep aquifer in the Lowland Area was observed to reverse flow direction briefly during high tides measured during both tidal studies. The tidally influenced reversal of the groundwater gradient in the deep aquifer was observed to a distance of approximately 1,000 feet from the shoreline of the Snohomish River at monitoring well LLMW-12D during the tidal studies. Additionally, the snapshot groundwater level monitoring event performed in November 2013 captured the reversal of groundwater flow during a high tide: The elevations observed at monitoring locations near the shoreline of the Snohomish River LLMW-11D, LLMW-13D, and LLMW-12D) were higher than elevations observed in wells further from the shoreline (Table 4-3).

The average groundwater flow direction in the deep aquifer observed during the tidal studies is generally similar to the flow direction observed during the groundwater snapshot water level monitoring events performed during low tides (Figures 4-12 and 4-14). Due to the relatively homogeneous nature of the deep aquifer (as compared to the fill in the shallow aquifer), fewer small-scale changes in groundwater gradient are observed in the snapshot groundwater elevations (compare Figures 4-11 and 12).

4.5.3.3. *Vertical Hydraulic Gradients*

Vertical hydraulic gradients can be calculated by measuring groundwater levels in two wells located in close proximity but with well screens completed at different depth intervals providing that the formation is saturated between the well screens. Based on observations during drilling, the silt aquitard that separates the shallow and deep aquifers generally appeared to be saturated. Multiple monitoring well pairs are present in the Lowland Area with well screens installed in the shallow and deep aquifers that were monitored as part of the supplemental investigation and which provide water level data for analysis of vertical hydraulic gradients at the site. Data from the tidal study performed in November 2013 was used to evaluate changes in vertical hydraulic gradients during tidal fluctuations.

<u>Lowland Area Shallow/Deep Aquifer Vertical Hydraulic Gradients</u>

The groundwater level measurements from the four snapshot groundwater level monitoring events were evaluated to characterize the vertical hydraulic gradients between the shallow and deep aquifers in the Lowland Area. Vertical gradients were calculated for each well pair measured as part of each snapshot groundwater monitoring event. The vertical hydraulic gradients for the shallow and deep aquifers based on the snapshot groundwater level measurements are presented in Table 4-5.

The vertical hydraulic gradient is generally downward from the shallow aquifer to the deep aquifer in the Lowland Area as indicated by the majority of positive values in Table 4-5. An upward gradient (as indicated by negative values in Table 4-5) was observed during nine measurements. The wells exhibiting an upward vertical gradient were located on the shoreline and the upward gradient was the result of tidal effects on groundwater in the deep aquifer monitoring well during the time of the groundwater level measurement. The locations exhibiting upward gradients also exhibited downward gradients during one or more measurements indicating that the upward gradient was transient condition and not the consistent gradient at the location.

Vertical hydraulic gradients were also calculated for the well pairs monitored as part of the tidal study performed in November 2013 using the transducer data collected during the tidal study. The water level measurements were taken at one minute intervals by the transducers during the 72-hour tidal study that encompassed three full tidal cycles were analyzed to evaluate vertical hydraulic gradients in response to tidal fluctuations. Figure 4-15 presents the vertical gradients measured in well pairs installed in the shallow and deep aquifers in the Lowland at locations at varying distances from the Snohomish River.

The results from the tidal study show that the magnitude of the vertical hydraulic gradient at each well pair correlates with tidal fluctuations. As shown in Figure 4-15, as the tide was rising, the vertical gradient at monitoring well LLMW-06S/D located nearest to the shoreline of the Snohomish River became less positive (less of a downward vertical gradient) because the pressure was increasing in the deep aquifer as the tide pushed water into the aquifer. As the tidal “wave” propagated inland, a similar response was observed in wells located further inland from the river. The last wells to respond were BP-05S/D and BP-08S/D, which are located in the Benson Subarea. When the tide was ebbing and the water level in the river was going down, the vertical hydraulic gradients at the well pairs became more positive (more downward). Wells

LLMW-06S/D was the only well pair monitored as part of the tidal study to exhibit an upward vertical gradient. The upward gradient at LLMW-06S/D was observed for between three to four hours during high tide periods (Figure 4-15). The results indicate that the vertical hydraulic gradients for groundwater near the shoreline of the river are likely upward during high tide periods.

The presence of a transient upward vertical gradient at the shoreline during high tide periods is supported by the results of the vertical gradients measured as part of snapshot groundwater level monitoring. As shown in Table 4-5, there was an upward vertical gradient at six well pairs near the shoreline (MW-1203R/LLMW-01D, LLMW-05S/D, LLMW-06S/D, LLMW-07S/D, LLMW-08S/D, LLMW-17S/D) of the Snohomish River during snapshot groundwater level monitoring performed as part of the fourth quarter (Q4) of groundwater monitoring. The Q4 snapshot groundwater level monitoring was performed during a high tide period on November 5, 2013. Conversely, during the third quarter (Q3) groundwater snapshot, taken during low tide, none of the wells showed upward vertical hydraulic gradients (Table 4-5).

Lowland Area Deep Aquifer Vertical Hydraulic Gradients

The groundwater level measurements from two snapshot groundwater level monitoring events for three well pairs (BP-04D/D2, BP-05D/D2, BP-07D/D2) were evaluated to characterize the vertical hydraulic gradients within the deep aquifer in the Lowland Area. The groundwater levels measured in the wells installed in the upper portion of the deep aquifer (wells designated with a D) comprised of sand and the groundwater levels in the wells installed in the lower portion of the deep aquifer (wells designated with a D2) comprised of interbedded sand and silt layers were used.

The results for the three well pairs exhibited an upward vertical hydraulic gradient during both snapshot groundwater monitoring events as indicated by the negative values in Table 4-5. The water levels in the wells installed in the lower portion of the deep aquifer (wells designated with a D2) were up to 4 feet higher than water levels in the wells in the upper portion of the deep aquifer (wells designated with a D). These results indicate that deeper groundwater is moving vertically upward within the deep aquifer in the Lowland Area. The presence of an upward vertical gradient is further supported by the observation of heaving sands in the lower alluvium during advancement of the BP-05D2, suggesting high pressure at depth and upward flow. The upward gradient may be due to recharge from deeper groundwater or groundwater flow from the deep aquifer in the Upland Area toward the river.

4.5.3.4. *Hydraulic Conductivities*

The hydraulic conditions in the shallow and deep aquifers were evaluated by performing slug tests on 18 well pairs, short-duration drawdown tests on three well pairs, and two separate tidal studies utilizing data collected from well pairs located in the Lowland Area (Table 3-2). Analytical methodology and procedures for calculating the hydraulic conductivities are presented in Appendix A.

Hydraulic Conductivity Values Based On Slug And Drawdown Testing

Hydraulic conductivity (K) values calculated from slug and drawdown test data for the shallow aquifer in the Lowland Area ranged from approximately 2 ft/day to 250 ft/day. The average hydraulic conductivity for the shallow aquifer based on slug and drawdown test data is 72 ft/day. The wide range of values calculated for the shallow aquifer reflects the heterogeneous nature of the fill though the values all fall within the range for silty sand to sand aquifers.

Hydraulic conductivity values for the deep aquifer in the Lowland Area ranged from approximately 2 ft/day to 245 ft/day and the average hydraulic conductivity in the deep aquifer based on slug and drawdown test data is 76 ft/day. The wide range of values calculated for the deep aquifer may reflect heterogeneities within the deep aquifer alluvium. However, the values all fall within the range for silty sand to sand aquifers.

The hydraulic conductivity values calculated for the shallow and deep aquifers in the Lowland Area based on slug and drawdown test are consistent with values for unconsolidated silty sand and sand deposits. As discussed in Sections 4.3.7 and 4.3.9, the fill that comprises the shallow aquifer and alluvium that comprises the upper portion of the deep aquifer are predominantly sand or silty sand.

The values resulting from slug and drawdown test data are considered estimates of the hydraulic conductivity at the test location or in a localized portion of the aquifer where the test was performed due to the relatively small radius of influence generated during slug and drawdown testing. The hydraulic conductivity values determined during slug and drawdown testing are presented in Table 4-4.

Hydraulic Conductivity Values Based On Tidal Study Data

Hydraulic conductivity values were also calculated from the tidal study data for the deep aquifer using aquifer diffusivity values calculated from both time lag and tidal efficiency. Based on the observed tidal responses in the deep aquifer, bulk hydraulic conductivity values for the deep aquifer in the Lowland Area were 23 ft/day and 29 ft/day for the first and second tidal studies, respectively. The hydraulic conductivity values are generally similar to the average values calculated from slug and drawdown test data for the deep aquifer. Hydraulic conductivity values calculated using tidal studies are considered bulk values for the aquifer because a large portion of the aquifer is monitored during the tidal study. The results of the tidal study can be considered an average for the portion of the aquifer monitored during the tidal study. Hydraulic conductivity values for the tidal studies are presented in Table 4-4.

The hydraulic conductivity values determined for the deep aquifer in the Lowland Area, based on the tidal study, are consistent with conductivity values for unconsolidated sand deposits.

4.5.3.5. *Groundwater Velocities*

Groundwater velocities can be estimated using values for hydraulic conductivity, groundwater gradients, and effective porosity. Site-specific values for hydraulic conductivity and average groundwater gradient (over the 72-hour tidal studies) were used to calculate the average velocity between six well pairs at the Lowland Area. Site-specific effective porosity values were not available and average literature values for soil type were used to estimate velocities. Groundwater velocities calculated for the Lowland Area should therefore be considered estimates for the area tested. The horizontal groundwater velocities are presented in Table 4-7.

Shallow Aquifer

Average groundwater velocities for the shallow aquifer in the Lowland Area were calculated using monitoring wells BP-05S and LLMW-12S and monitoring wells LLMW-12S and LLMW-11S. The location of the wells are shown on Figures 4-11 and 4-13.

The average groundwater velocity calculated using monitoring wells BP-05S and LLMW-12S was consistent between the two tidal studies and was 3.23 and 3.68 feet per day. The groundwater velocity calculated using monitoring wells LLMW-12S and LLMW-11S was estimated at 0.26 feet per day during the first tidal study. The results indicate that groundwater velocities in the shallow aquifer are fastest on the western portion of the Lowland Area near the slope. This is likely due to recharge from the Upland Area, which results in faster velocities near the slope and slower velocities as the water spreads out toward the river.

Deep Aquifer

Average groundwater velocities were calculated for the Upland Area using monitoring wells LLMW-35D and LLMW-36D. The average groundwater velocities in the Lowland Area were calculated using wells LLMW-36D and BP-05D, BP-05D and LLMW-12D, and LLMW-12D and LLMW-11D. The location of the wells are shown on Figures 4-12 and 4-14. The estimated horizontal groundwater velocities are presented in Table 4-7.

The average groundwater velocity for the deep aquifer in the Upland Area was estimated at 0.04 feet per day, which reflects a relatively flat water table. The average groundwater velocity in the deep aquifer on the western portion of the Lowland Area calculated use monitoring wells LLMW-36D and BP-05D, located hydraulically downgradient of the Upland Area, was 2.05 feet per day during the second tidal study. This value reflects the relatively steep hydraulic gradient where the deep aquifer in the Upland Area discharges to the deep aquifer in the Lowland Area (Figures 4-4 and 4-14). The average groundwater velocity to the east calculated using of wells BP-05D and LLMW-12D are much slower though relatively consistent between the two tidal studies, at 0.59 and 0.69 feet per day. Similarly, the average groundwater velocity in the eastern portion of the Lowland Area calculated using of wells LLMW-12D and LLMW-11D was slow but also consistent between the two tidal studies, at 0.17 and 0.20 feet per day. The slower groundwater velocities reflect the lower overall hydraulic gradient in the central and eastern portions of the Lowland Area. Since these values take into account periods of slowed and reversed groundwater flow direction, as observed during the tidal studies, the velocities are considered average, and velocities may be higher during low tide periods.

4.6. Natural Resources

4.6.1. Introduction

This section presents a general description of natural resources present in the Lowland Area. The information presented is based on field observations during supplemental investigation of the Lowland Area. Note that detailed natural resources characterization (wetland delineation, etc.) was not performed as part of the SRI. The natural resources are described in the following sections based on the subareas discussed in Section 2.0 and shown on Figure 2-4.

4.6.2. Benson Subarea

The Benson Subarea includes vegetated, relatively steep east-facing slopes adjacent to East Marine View Drive, Weyerhaeuser Bridge Road and Pacific Highway. Vegetation along the slopes primarily include Himalayan Blackberry, Scotch broom, and coniferous and deciduous trees. Vegetation present in the flat portion of the Benson Subarea between the base of the slope and BNSF property consists predominantly of grasses.

Two wetlands are located adjacent to the base of the vegetated slopes. Amphibians have been observed in the southernmost wetland and carved fallen trees suggest the presence of beavers. The northernmost wetland contains cattails, reeds and other grasses. Obvious signs of wildlife were not observed in the northernmost wetland during field visits at various times of the year. Crows, pigeons and doves were observed to utilize an overhead power line that traverses the subarea.

4.6.3. Riverside Business Park Subarea

The northern portion of the Riverside Business Park Subarea consists of the Cymbaluk property, a portion of Riverside Road, the Weyerhaeuser Bridge overpass and two stormwater basins. The Cymbaluk property is paved with asphalt, except for several small landscaped areas. In 2009, the Port of Everett performed an ecological restoration and bank stabilization project along the shoreline east of the Cymbaluk Property (Port of Everett, 2009). The restoration included the creation of a 50-foot shoreline riparian buffer, placement of topsoil and planting of up to 1,700 trees and native understory riparian vegetation.

The central portion of the Riverside Business Park subarea is covered with compacted fill in the west and vegetation in the east. A wood bulkhead is located along much of the central portion of the Subarea. Vegetation includes grasses, Himalayan Blackberry and Scotch broom. Coyotes, Blacktail deer, field mice and rabbits have been observed within the vegetated area. An Osprey nest was observed on a utility pole adjacent to the river.

The southern portion of the Riverside Business Park Subarea contains paved surfaces, several buildings, as well as vegetated areas. The vegetation consists of mowed grasses adjacent to industrial areas and Scotch broom and Himalayan Blackberry adjacent to a dirt road that is present adjacent to the Snohomish River in the southern portion of the subarea.

4.6.4. Snohomish County PUD Subarea

The PUD Subarea includes a substation that is gravel surfaced. There are mowed grass areas outside the substation area. A pond is located north and northwest of the substation. Coyote, garter snakes, great blue heron, red-winged blackbird and other bird species, and tadpoles have been observed in or adjacent to the pond during field visits.

4.6.5. Shadow Development/Blunt Family LLC Subarea

The majority of the Shadow Development/Blunt Family Subarea is used for industrial activity and is comprised of buildings or paved surfaces. The north and east portions of the subarea are covered by degraded pavement and Himalayan Blackberry, Scotch broom and small trees. Wood timber bulkheads are located along most of the shoreline and form the north and east boundary of the subarea. A triangular-shaped parcel, surrounded by BNSF ROW, is undeveloped and covered with vegetation including trees, brush and grass. Wildlife was not observed on the subarea during field visits, however it is likely the area is used seasonally by birds such as osprey.

4.6.6. Slope Subarea

The Slope Subarea consists of a northeast-facing slope that is covered with vegetation including deciduous and conifer trees, blackberry, brush and grass. Small terrestrial animals and birds, similar to those observed in other portions of the Lowland Area, were also observed in the Slope Subarea.

4.6.7. BNSF Subarea

The BNSF Subarea along the Lowland Area consists of relatively flat land. Much of the area is covered by railroad ballast and railroad tracks although some areas are vegetated with trees, brush and grass. The BNSF Subarea also likely includes water features and may support wildlife similar to the areas described above.

4.6.8. Snohomish River

The Snohomish River, which bounds the Lowland Area on the north, east, and south is a major tributary to Puget Sound. The river is classified as a maritime waterway and provides recreational opportunities for fishermen and boaters. Harbor seals, river otters and various bird species have been observed in or adjacent to the river. According to the Washington State Department of Fish and Wildlife *Salmonid Stock Inventory (WDFW*, 2002), the Snohomish watershed supports a healthy stock of coho, pink, and chum salmon as well as steelhead.

The shoreline or the Snohomish River predominantly consists of a wood timber bulkhead in the central portion of the Lowland Area. The shoreline in the northern portion of the Lowland Area is comprised of riprap and the shoreline in the southern portion of the Lowland Area is comprised of grass-covered bank areas.

5.0 PRELIMINARY CLEANUP LEVELS AND INDICATOR HAZARDOUS SUBSTANCES

This section presents the preliminary cleanup levels (PCULs) and indicator hazardous substances (IHSs) for the Lowland Area. Development of the PCULs is described in Section 5.1 and selection of the IHSs for the Lowland Area is described in Section 5.2.

PCULs were developed for the Lowland Area for the chemicals that were analyzed in each medium. Media in the Lowland Area were analyzed for the chemicals of concern for the Everett Smelter Site which include antimony, arsenic, cadmium, lead, mercury and thallium (Ecology, 1999). Metals analyses performed on soil samples as part of previous investigations also included barium, chromium, copper, nickel, selenium, silver, and zinc. PCULs were also developed for soil for these additional metals.

The PCULs were then compared to the results of chemical analyses to identify the IHSs for each medium. IHSs for the Lowland Area were selected in accordance with WAC 173-340-703 and are used to help define the Site cleanup requirements.

5.1. Preliminary Cleanup Levels

This section presents the preliminary cleanup levels (PCULs) developed for use in evaluating the extent of contamination and potential risks to human health and the environment at the Lowland Area Site from the historical operation of the Everett Smelter. MTCA specifies that cleanup levels for a Site must be set in consideration of the reasonable maximum exposure that is expected to occur at the Site. Reasonable maximum exposure is defined as "the highest exposure that can be expected to occur for a human or other living organisms at a site under current and potential future site use" (WAC 173-340-200).

In accordance with MTCA, PCULs were developed based on the reasonable maximum exposure anticipated to occur for humans and ecological receptors exposed to soil, groundwater, surface water and sediment at the Site. A conceptual Site exposure model was developed to illustrate the sources of contamination, contaminant transport mechanisms, exposure media, potential receptors and exposure pathways and to identify the reasonable maximum exposure as the basis for developing PCULs for the Site. Figure 5-1 presents the conceptual Site exposure model developed for the Lowland Area.

As described in Section 2.4, several cleanup Sites within the Lowland Area that have contamination resulting from historical activities and operations not related to the Everett Smelter are being managed under separate agreements with Ecology. Therefore, screening levels as well as cleanup levels for other Sites within the Lowland Area Site have been evaluated on a site-specific basis. The PCULs identified in this section are for screening contaminant concentrations present in Lowland Site media resulting from historical smelter operations.

PCULs were developed for metals detected in soil, groundwater, surface water and sediment at the Lowland Area Site using numerical criteria listed in Ecology's online Cleanup Levels and Risk Calculations (CLARC) database (Ecology, 2013a), criteria in state and federal regulations and toxicity data. The screening levels for these media are presented in Tables 5-1 through 5-8. The derivation of soil and sediment PCULs are presented in Tables 5-9 through 5-11. The PCULs have been developed in accordance with MTCA (WAC 173-340-720 through 745) and the Sediment Management Standards (SMS; Chapter 173-204 WAC).

5.1.1. Soil Preliminary Cleanup Levels

This section presents the PCULs developed for soil present within the Everett Smelter Lowland Area. PCULs for soil were developed for protection of human health and the environment in consideration of Site use, transport pathways, receptors, and exposure scenarios (Figure 5-1).

PCULs were developed for soil for protection of human health for the following receptors and exposure scenarios:

- Industrial workers in Lowland Area.
- Site Visitors utilizing public access areas within the Lowland Area.
- Potential trespassers accessing the Lowland Area from adjacent non-industrial areas (i.e., residential areas west of the Lowland Area along Marine View Drive).

PCULs were also developed for soil for the following ecological receptors and exposure scenarios:

- Wildlife in the Lowland Area.
- Biota, plants and wildlife in the managed forest area within the Lowland Area.

MTCA (WAC 173-340-705[6]) specifies that the cleanup level for a given constituent shall not be set at a level lower than the natural background concentration or the practical quantitation limit (PQL), whichever is higher. Preliminary soil cleanup levels were selected based on the lowest of the applicable numerical risk-based criteria and then adjusted based on background concentrations. The background metals concentrations used are the Puget Sound Region 90th percentile values reported by Ecology (1994), with the exception of arsenic. The background value for arsenic of 20 mg/kg is the MTCA Method A soil cleanup level and the natural background concentration for soil in the State of Washington specified in MTCA (MTCA Table 745-1).

The following sections further describe the PCULs for soil based on protection of human and ecological receptors as well as the approach for identifying soil cleanup levels for protection of groundwater and surface water.

5.1.1.1. *Consideration of Site Use*

PCULs for soil for human and ecological receptors were developed in consideration of current and future site use in the Lowland Area. Properties in the Lowland Area are "Industrial Properties" as defined under MTCA. Industrial properties are defined as "properties that are or have been characterized by, or are committed to, traditional industrial uses such as processing or manufacturing of materials, marine terminal and transportation areas and facilities, fabrication, assembly, treatment, or distribution of manufactured products, or storage of bulk materials, that are… zoned for industrial use by a city or county conducting land use planning…" (WAC 173-340-200).

The Lowland Area has been characterized by traditional industrial uses. Rail transportation, mill and smelter activities were historically performed on properties within the Lowland Area. As identified in Section 2.2, shown on Figure 2-2 and defined in the Everett Municipal Code (Everett Municipal Code 2014), the Lowland Area is also zoned for uses that meet the use requirement of industrial properties defined in

MTCA. Current and future uses of the Lowland Area include recycling facilities, transfer station, substation, rail transportation, bus repair, and materials storage that are industrial uses.

PCULs for soil for human and ecological receptors are based on industrial use except in limited, specific locations within the Lowland Area where visitors or trespassers can access the site and the managed forested area on the Site as discussed in the following sections.

5.1.1.2. *Preliminary Soil Cleanup Levels for Protection of Human Health*

The preliminary soil cleanup levels developed for protection of human health are presented in Table 5-1. PCULs for soil for human health include industrial land use except in limited, specific locations within the Lowland Area where site visitors or a trespasser might access the site. The following sections describe the PCULs for the human health exposure scenarios.

<u>Industrial Land Use</u>

The MTCA Method C soil cleanup levels for protection of human health for industrial land use are based on the direct contact of an adult worker with soil at the Site. The MTCA standard Method C soil cleanup levels for industrial land use [WAC 173-340-745(5)(b)] obtained from Ecology's CLARC database or calculated using equations in WAC 173-340-745(5)(b)(iii)(B) are PCULs for soil based on current and future use in the Lowland Area for industrial purposes. The PCULs developed based on industrial land use are applicable to soil from the surface to a depth of 15 feet [WAC 173-340-740(6)(d)].

<u>Site Visitor</u>

Modified Method B preliminary soil cleanup levels for protection of human health were developed for a potential exposure pathway to site visitors at current and future public access areas. One park is currently identified to be present in the Lowland Area. American Legion Park is identified to be located on approximately 2.0 acres of the central portion of the Slope Subarea (Green Everett Partnership, 2013) (Figure 2-4). Two additional public access areas are present in the Lowland Area. The Everett Shoreline Public Access Plan (City of Everett, 2002) includes a proposal for future development of a system of trails to provide public access to and along shorelines within the City of Everett including the Lowland Area. The zoning for property in the Lowland Area includes allowance for development of public park and recreation facilities. Actual plans for the development of additional, public access, parks and/or recreational facilities are not known to exist. The site visitor exposure pathway potentially exists and the preliminary screening level is to be applied in the portion of the Slope Subarea that comprises American Legion Park as well as the public access areas on the northern portion of the Lowland Area (Figure 2-4).

The site visitor preliminary soil cleanup levels were calculated using the modified Method B soil cleanup level equations in WAC 173-340-740(3)(c) and the default exposure parameter values with the exception of exposure frequency, which was set at 48 days per year. This exposure frequency value assumes that a site visitor would frequent the site, on average, 4 times per month. The chemical-specific and exposure parameter values used to calculate the site visitor preliminary soil cleanup levels are included in Table 5-9. The preliminary soil cleanup level based on the site visitor scenario is to be applied to soil from the surface to a depth of 1.0 feet. Site visitors are typically not expected to contact soil below one foot. The top 1-foot of soil is a typical depth interval used to evaluate exposure to near surface soil.

<u>Trespasser</u>

Modified Method B preliminary soil cleanup levels for protection of human health were also developed for the portion of the Lowland Area adjacent to the Marine View Drive ROW as there is a potential current and future exposure pathway to trespassers in this area. The Marine View Drive ROW is located along the western boundary of the Lowland Area and includes a roadway and sidewalks for vehicle and pedestrian transit. Fencing and other mechanisms of security that would restrict access to this portion of the Site are not generally present. Therefore, although the portion of the Lowland Area Site adjacent to the Marine View Drive ROW is a relatively steep slope, a trespasser could access the Site at locations along the Marine View Drive ROW. The location where a trespasser exposure pathway potentially exists and where the preliminary screening level is to be applied in the portions of the Lowland Area between the Marine View Drive ROW and the BNSF Subarea. Access to BNSF property is generally controlled due to safety and security considerations. The applicable area includes the PUD, Benson and Slope Subareas, excluding American Legion Park.

The trespasser preliminary soil cleanup levels were calculated using the modified Method B soil cleanup level equations in WAC 173-340-740(3)(c). However, because site trespassers are assumed to be adults, the exposure parameter values were changed to reflect adult exposure. Similar to the site visitor scenario described above, the trespasser exposure frequency was set at 48 days per year. This exposure frequency value assumes that a trespasser would frequent the site, on average, 4 times per month. The remaining exposure parameter values were obtained from Ecology's draft SCUM II guidance as noted in Table 5-9 (Ecology, 2012). Table 5-9 also includes chemical-specific parameter values used to calculate the trespasser preliminary soil cleanup levels. The preliminary soil cleanup level based on the trespasser scenario are to be applied to soil from the surface to a depth of 1.0 feet, a depth below which trespassers are typically not expected to contact soil. The top 1-foot of soil is a typical depth interval used to evaluate exposure to near surface soil.

5.1.1.3. *Preliminary Soil Cleanup Levels for Protection of Ecological Receptors*

A site-specific Terrestrial Ecological Evaluation (TEE) is required for the Lowland Area because the Site does not qualify for exclusion under WAC 173-340-7491[1] and the Site meets the requirements for conducting a site-specific TEE outlined in WAC 173-340-7491[2]. MTCA specifies that the Method C soil cleanup levels for industrial properties shall be concentrations that result in no significant adverse effects on the protection and propagation of wildlife established using the procedures specified in WAC 173-340-7490 through 173-340-7494 [WAC 173-340-745(5)(b)(ii)]. Therefore, the preliminary site-specific terrestrial ecological soil cleanup levels for the Lowland Area are the wildlife ecological soil indicator concentrations from MTCA Table 749-3.

Location-specific preliminary terrestrial ecological cleanup levels were developed for soil in the Lowland Area based on potential current and future exposure pathways related to urban forest habitat in American Legion Park. While this portion of the Site is zoned industrial, this relatively steep sloped forested area is one of the urban forests identified in the Green Everett Partnership's March 2013 "20-Year Forest Management Plan;" the Green Everett Partnership plan includes goals for restoring and maintaining forested parklands in Everett. WAC 173-340-7490(3)(b) requires that plants and soil biota should also be considered when "soil contamination is located on an area of an industrial property where vegetation must be maintained to comply with local government land use regulations." While the Green Everett Partnership plan is not a land use regulation, the plan is consistent with the intent of WAC 173-340-7490(3)(b). Therefore, the lowest of the indicator soil concentrations for protection of plants, soil biota, and wildlife were selected as preliminary site-specific terrestrial ecological cleanup levels for this portion of the Site.

The preliminary soil cleanup levels developed based on terrestrial ecological receptors are applicable to soil in the Lowland Area from the surface to a depth of 6 feet which is the MTCA conditional point of compliance for terrestrial ecological evaluations [WAC 173-340-7490(4)] except in areas where the assumed exposure pathways are incomplete due to the presence of physical barriers (ex., pavement, structures, etc.) that currently exist or will exist in the future based on land use or a remedy implemented at the Site [WAC 173-340-7493(2)(a)(ii)].

The preliminary soil cleanup levels developed for protection of terrestrial ecological receptors in the Lowland Area are presented in Table 5-2.

5.1.1.4. *Preliminary Soil Cleanup Levels for Protection of Groundwater and Surface Water*

Multiple sources of contamination to groundwater and surface water are present in soil in and adjacent to the Lowland Area. The sources of contamination to groundwater and surface water resulting from historical smelter operations present in soil include slag, smelter stack emissions, residual arsenic trioxide and flue dust. Material previously present in the former arsenic processing area of the Upland Area that was remediated between 2002 and 2006 was also a significant source of contamination to groundwater and surface water in the Lowland Area. There are Sites within the Lowland Area with contaminated soil contributing to groundwater and surface water contamination that is not related to the smelter. The physical and chemical properties of the potential sources of contamination to groundwater and surface water in the Lowland Area vary substantially. A combination of sources is present in each of the subareas of the Site.

Due to the number and types of source material and because multiple sources contribute to contamination in subareas of the Site, development of cleanup levels for soil using the standard MTCA fixed parameter three-phase partitioning model (WAC 173-340-747[4]) that are protective of groundwater and surface water quality across the Site is not appropriate. Instead, remedial actions will be developed that are protective of groundwater and surface water as part of the FS that include actions to address soil and other sources of contaminants.

5.1.2. Groundwater Preliminary Cleanup Levels

MTCA specifies that groundwater cleanup levels shall be based on estimates of the highest beneficial use and reasonable maximum exposure expected to occur under both current and potential future site use conditions (WAC 173-340-720[1][a]). PCULs for groundwater were developed in consideration of current and future site use in the Lowland Area and groundwater highest beneficial use. MTCA (WAC 173-340-720[1]) specifies that the use of groundwater as drinking water and for other domestic uses is the highest beneficial use and reasonable maximum exposure for groundwater unless groundwater is considered non-potable. MTCA provides criteria for identifying whether groundwater is non-potable to support determining the highest beneficial use of groundwater at a Site. The highest beneficial use and reasonable maximum exposure for groundwater in the Lowland Area is as surface water in the Lowland Area and Snohomish River because groundwater in the Lowland Area is non-potable. The following section presents the criteria specified in MTCA for identifying whether groundwater is non-potable and describes the conditions in the Lowland Area that support a non-potable classification for groundwater.

5.1.2.1. *Evaluation of Groundwater Potability and Identification of Highest Beneficial Use*

Groundwater in the Lowland Area is classified as non-potable based on an evaluation of the MTCA criteria specified in WAC 173-340-720(2) and conditions in the Lowland Area. The following presents the MTCA criteria and a description of conditions in the Lowland Area in response to the MTCA criteria that support groundwater being classified as non-potable:

WAC 173-340-720*(2)(a)* *The ground water does not serve as a current source of drinking water*.

No drinking water supply wells are present in the Lowland Area based on review of Ecology's water well database (Ecology, 2014). Drinking water in the Lowland Area is supplied by the City of Everett (City of Everett, 2012a). The source of the City of Everett's drinking water is the Sultan River located approximately 30 miles east of Everett (City of Everett, 2012b).

WAC 173-340-720*(2)(c)* *The department determines it is unlikely that hazardous substances will be transported from the contaminated ground water to ground water that is a current or potential future source of drinking water, as defined in (a) and (b) of this subsection [i.e., -720(2)], at concentrations which exceed ground water quality criteria published in Chapter 173-200 WAC*.

Contaminated groundwater in the Lowland Area occurs in the shallow aquifer and upper portion of the deep aquifer. The shallow aquifer is limited in size as it is comprised of a relatively thin layer of fill materials (i.e., approximately 10 feet thick) between the western boundary of the Lowland Area the slope adjacent to Marine View Drive and the Snohomish River. The fill material comprising the shallow aquifer is present on the historical native surface comprised of silt that acts to limit the vertical transport of contaminants. Groundwater in the shallow aquifer flows toward and discharges into the Snohomish River. Groundwater in the deep aquifer within the Lowland Area also flows toward the Snohomish River. Groundwater in the upper portion of the deep aquifer also discharges to the Snohomish River. Based on data collected as part of the SRI, groundwater in the shallow aquifer and upper portion of the deep aquifer will not flow toward other aquifers that may be a current or potential future source of drinking water.

WAC 173-340-720*(2)(d)* *Even if ground water is classified as a potential future source of drinking water…, the department recognizes that there may be sites where there is an extremely low probability that the ground water will be used for that purpose because of the site's proximity to surface water that is not suitable as a domestic water supply. An example of this situation would be shallow ground waters in close proximity to marine waters such as on Harbor Island in Seattle. At such sites, the department may allow ground water to be classified as non-potable if each of the following conditions can be demonstrated. These determinations must be for reasons other than that the ground water or surface water has been contaminated by a release of a hazardous substance at the site*.

WAC 173-340-720*(2)(d)(i)* *There are known or projected points of entry of the ground water into the surface water*.

Groundwater in the shallow aquifer and upper portion of the deep aquifer at the Site discharge into the Snohomish River.

WAC 173-340-720*(2)(d)(ii)* *The surface water is not classified as a suitable domestic water supply source under Chapter 173-201A WAC*.

Water in the Snohomish River adjacent to the Lowland Area is brackish and is not suitable as a domestic water supply. The salinity of water in the Snohomish River in the portion of the river encompassing the

Lowland Area has been measured to be approximately 15 parts per thousand (ppt) (Snohomish County, 2013; Ecology, 1995). The Water Quality Standards for Surface Water of the State of Washington specifies that the marine water quality apply at all locations where the salinity is greater than 1 ppt [WAC 173-201A-260(3)]. Based on the salinity and applicability of marine surface water criteria to water in the Snohomish River adjacent to the Lowland Area, the water in the Snohomish River adjacent to the Lowland Area is not suitable for drinking water and domestic water supply.

> *(2)(d)(iii) The ground water is sufficiently hydraulically connected to the surface water that the ground water is not practicable to use as a drinking water source.*

The results of the hydrogeologic investigation of groundwater in the Lowland Area showed that tidal fluctuations in the Snohomish River affect groundwater elevations in monitoring wells from adjacent to the Snohomish River to the western boundary of the Lowland Area (the slope adjacent to Marine View Drive) (see Section 4.5.2.2). The results of the hydrogeologic investigation show that the deep aquifer at the Site is directly connected to brackish water in the Snohomish River and that it is not practicable to utilize the deep aquifer for domestic water supply due to the potential for drawing brackish water into the aquifer (i.e., salt water intrusion).

As groundwater is non-potable, use of groundwater for domestic uses is not considered the highest beneficial use or reasonable maximum exposure for groundwater in the Lowland Area. Groundwater in the Lowland Area ultimately discharges to surface water in the Lowland Area and in the Snohomish River, the highest beneficial use and reasonable maximum exposure for groundwater is as surface water (Figure 5-1). The following sections describe the PCULs for groundwater based on protection of surface water in the Lowland Area and protection of surface water in the Snohomish River.

5.1.2.2. *Preliminary Groundwater Cleanup Levels for Protection of Surface Water in the Lowland Area*

PCULs for groundwater in the shallow aquifer within the Lowland Area were developed based on surface water quality criteria for protection of freshwater aquatic organisms. The surface water features that are present in the Lowland Area, which the preliminary groundwater cleanup levels were developed to be protective of, consist of wetland and pond areas. Cleanup levels for groundwater in the shallow aquifer based on human consumption of aquatic organisms from surface water in the Lowland Area are not included because surface water features present in the Lowland Area are limited in size and do not support species in sufficient quantity for regular human consumption.

Where groundwater from the shallow aquifer discharges to the Snohomish River, the preliminary groundwater cleanup levels for protection of surface water in the Snohomish River are applicable as discussed in the following section. As discussed in Section 5.1.3, surface water from the Lowland Area will need to meet the water quality criteria for the Snohomish River prior to discharge into the Snohomish River.

As specified in MTCA (WAC 173-340-730[3][b]), state and federal water quality criteria were considered to identify the preliminary groundwater cleanup levels. The freshwater quality criteria that were considered included the acute and chronic criteria for protection of aquatic species identified in the following:

- Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC);
- National Toxics Rule (40 CFR Part 131); and

- National Recommended Water Quality Criteria (Clean Water Act Section 304).

Preliminary groundwater cleanup levels were selected based on the lowest of the numerical criteria identified above and then adjusted upward based on the PQL, where appropriate. MTCA (WAC 173-340-705 [6]) specifies that the cleanup level for a given constituent shall not be set at a level below the natural background concentration or PQL, whichever is higher. The PCUL for mercury, based on the numerical criteria identified above, was less than the PQL. Therefore, the PQL for mercury was identified as the PCUL. The PQL for mercury was obtained from Analytical Resources Incorporated (ARI), of Tukwila, Washington which is a Washington-certified laboratory. The PQL for mercury is the lowest practicably attainable value using conventional, accepted low-level analytical methods.

The preliminary groundwater cleanup levels developed based on protection of surface water in the Lowland Area are applicable to groundwater throughout the shallow aquifer except where groundwater in the shallow aquifer discharges to the Snohomish River as discussed in the following section. The preliminary groundwater cleanup levels developed based on protection of surface water in the Lowland Area are not applicable to groundwater in the deep aquifer. Groundwater in the deep aquifer within the Lowland Area does not discharge to surface water in the Lowland Area because a silt layer separates groundwater in the deep aquifer from groundwater in the shallow aquifer.

The preliminary groundwater cleanup levels for protection of surface water in the Lowland Area are presented in Table 5-3.

5.1.2.3. *Preliminary Groundwater Cleanup Levels for Protection of Surface Water in the Snohomish River*

PCULs for groundwater for protection of surface water in the Snohomish River were developed based on surface water quality criteria for protection of marine aquatic organisms and human health based on consumption of aquatic organisms. Marine surface water criteria are applied to water in the Snohomish River as the salinity in surface water in Snohomish River adjacent to the Lowland Area is greater than 1 ppt (Snohomish County 2013; Ecology, 1995). The Water Quality Standards for Surface Water of the State of Washington specifies that the marine water quality criteria apply at all locations where the salinity is greater than 1 ppt [WAC 173-201A-260(3)].

As specified in MTCA (WAC 173-340-730[3][b]), state and federal water quality criteria were considered to identify the PCULs. The marine water quality criteria that were considered included the acute and chronic criteria for protection of aquatic species and criteria for protection of human health identified in the following:

- Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC);
- National Toxics Rule (40 CFR Part 131); and
- National Recommended Water Quality Criteria (Clean Water Act Section 304).

MTCA Method B surface water cleanup levels were also calculated for metals. These standard formula values are based on fish consumption and were either obtained from Ecology's CLARC database or calculated using equations in MTCA [WAC 173-340-730(3)(b)(iii)].

Preliminary groundwater cleanup levels were selected based on the lowest of the numerical criteria identified above. The preliminary groundwater cleanup levels were then adjusted based on background concentrations for arsenic only. The background value for arsenic in groundwater is based on the MTCA Method A groundwater cleanup level, which is identified as the regulatory background concentration for arsenic in Washington state.

The preliminary groundwater cleanup levels developed based on protection of surface water in the Snohomish River are applicable to groundwater throughout the deep aquifer and groundwater in the shallow and deep aquifers where groundwater in the shallow and deep aquifers discharge to the Snohomish River. The preliminary groundwater cleanup levels for protection of surface water in the Snohomish River are presented in Table 5-4.

5.1.3. Surface Water Preliminary Cleanup Levels

The preliminary surface water cleanup levels for the Lowland Area and the Snohomish River are the same as the PCULs for groundwater for protection of surface water discussed in Section 5.1.2 and presented in Table 5-3 (Lowland Area) and Table 5-4 (Snohomish River), respectively.

MTCA specifies that surface water cleanup levels shall be based on estimates of the highest beneficial use and reasonable maximum exposure expected to occur under both current and potential future site use conditions [WAC 173-340-730(1)(a)]. PCULs for surface water were developed in consideration of current and future site use in the Lowland Area and surface water highest beneficial use (Figure 5-1). The highest beneficial use and reasonable maximum exposure for surface water in the Lowland Area and Snohomish River are presented in the following sections.

5.1.3.1. *Lowland Area*

The preliminary surface water cleanup levels developed for surface water in the Lowland Area are based on protection of freshwater aquatic organisms and are applicable to water present in wetland and pond areas and other surface waters within the jurisdiction of the State of Washington [WAC 173-201A-010(2)]. The preliminary surface water cleanup levels developed for freshwater in the Lowland Area are not considered to be applicable to stormwater as stormwater is regulated under the National Pollutant Discharge Elimination System (NPDES) program. However, the results for samples of stormwater collected from the Lowland Area are compared to the PCULs for surface water to evaluate sources of contamination and contaminant transport pathways.

5.1.3.2. *Snohomish River*

The preliminary surface water cleanup levels developed for surface water in the Snohomish River are based on protection of marine aquatic organisms in the Snohomish River and people consuming aquatic organisms from the river. The preliminary surface water cleanup levels are applicable to water in the Snohomish River adjacent to the Site and to surface water from the Lowlands Area prior to entering the river.

5.1.4. Sediment Preliminary Cleanup Levels

Preliminary sediment cleanup levels were developed for sediment present in surface water features present in the Lowland Area (ponds and wetlands) and sediment in the Snohomish River adjacent to the Site. According to the Sediment Management Standards (SMS) (Chapter 173-204 WAC; revisions effective September 2013), sediment cleanup levels are defined as “the concentration or level of biological effects of a contaminant in sediment determined by the department to be protective of human health and the environment." Sediment cleanup levels are initially established at the sediment cleanup objective (SCO) and may be adjusted up to, but not to exceed, the cleanup screening level (CSL).

According to SMS [WAC 173-340-560(3)], SCOs for a chemical are set as the highest of the following levels:

- The lowest risk-based level protective of human health (based on a cancer risk of 1 x 10^{-6} or a hazard quotient of 1), benthic organisms or ecological receptors;
- Natural background; or
- PQLs.

According to SMS [WAC 173-340-560(4)] CSLs for a chemical are set as the highest of the following levels:

- The lowest risk-based level protective of human health (based on a cancer risk of 1 x 10^{-5} or a hazard quotient of 1), benthic organisms or ecological receptors;
- Regional background; or
- PQLs.

SMS provides numerical criteria for the SCOs and CSLs (WAC 173-204-562, Table 4) for protection of benthic organisms. Background values are also considered under SMS in the development of SCOs and CSLs. Risk based levels for protection of human health are based on direct contact and bioaccumulation of contaminants. The PCULs identified for sediment are discussed in the following sections and presented in Tables 5-5 through 5-7.

5.1.4.1. *Preliminary Sediment Cleanup Levels for Protection of Benthic Organisms*

Regulatory criteria for freshwater sediment in the Lowland Area and marine sediment in the Snohomish River are provided under SMS (Chapter 173-204 WAC). SMS standards include the SCO and CSL for both chemical and biological endpoints. SCO criteria correspond to sediment concentrations or biological responses below which adverse effects (acute or chronic) to benthic invertebrates or human health are unlikely. CSL criteria correspond to concentrations or effects thresholds above which adverse effects are anticipated and represent the maximum allowed chemical concentrations and biological effects for use in evaluating cleanup alternatives. Chemical concentrations or biological effects falling between the SCO and CSL represent potential minor adverse effects.

SMS provides numerical criteria for chemical concentrations present in freshwater and marine sediment. The SMS numerical SCO and CSL criteria for freshwater and marine sediment are presented are included in Table 5-5 (Lowland Area - Freshwater) and Tables 5-6 and 5-7 (Snohomish River – Marine).

5.1.4.2. *Preliminary Cleanup Levels for Protection of Human Direct Contact with Sediment*

Preliminary sediment cleanup levels were calculated based on human health exposure to sediment in the Snohomish River via dermal contact and ingestion. Because people are not expected to have significant exposure to sediment in surface water features in the Lowland Area, human health direct contact sediment cleanup levels were not calculated for sediment in the Lowland Area. The equations and parameter values used to calculate the preliminary sediment cleanup levels are from Ecology's *Draft Sediment Cleanup User's Manual II* (Ecology, 2012; Equations 9-7 and 9-8 and Table 9-2). The preliminary sediment cleanup levels for the Snohomish River based on sediment ingestion and dermal contact shown in Table 5-6 (SCO) and Table 5-7 (CSL) represent the values for three potential receptors that were evaluated that include a child exposed during beach play, an adult exposed during clamming and an adult exposed during net fishing (subsistence harvesting). The SCO values are based on a cancer risk of 1 x 10^{-6} or a hazard quotient of 1. The CSL values are based on a cancer risk of 1 x 10^{-5} or a hazard quotient of 1.

Children exposed to sediment during beach play and adults during clamming are assumed to be exposed primarily to intertidal, shoreline sediment. Beach play may also take place in the subtidal area. However, because the subtidal sediments are underwater, the potential exposure to subtidal sediment is expected to be minimal relative to intertidal sediment. The net fishing potential exposure scenario includes exposure to both intertidal and subtidal sediment.

A preliminary sediment cleanup level for beach play, clamming and net fishing cannot be developed for lead using the procedures outlined in Ecology's *Draft Sediment Cleanup User's Manual II* because EPA has not identified the necessary consensus toxicity factors for lead. Therefore, the preliminary sediment cleanup level for lead was set at 250 mg/kg, which is the MTCA Method A soil cleanup level.

5.1.4.3. *Preliminary Sediment Cleanup Levels Based on Bioaccumulation*

The SMS does not provide risk-based cleanup levels for chemicals that pose risks to human and ecological receptors as a result of bioaccumulation. However, a basic framework for incorporating the bioaccumulation exposure pathway is provided in the recently adopted SMS Rule revision (effective September 2013). The following describes the risk-based sediment PCULs for human health and ecological receptors based on bioaccumulation.

Human Health

Preliminary bioaccumulation sediment cleanup levels were calculated based on people consuming fish and shellfish exposed to Site-related contamination in Snohomish River sediment. In other words, species of fish that people may catch at the Site, but that are not expected to be exposed to Site-related contamination (salmon and pelagic fish), are not included in the fish consumption rates discussed below. Cleanup levels for sediment in the Lowland Area for protection of human health based on bioaccumulation are not included because surface water features present in the Lowland Area are limited in size and are not likely to support species in sufficient quantity for regular human consumption. The equations and parameter values, with one exception described below, used to calculate the preliminary sediment cleanup levels are from Ecology's Draft Sediment Cleanup User's Manual II (Ecology, 2012; Equations 9-4 and 9-6 and Table 9-1).

Fish ingestion rates for the subsistence fishers are based on the Tulalip tribal adult fish consumption rates (Toy et al., 1996). The fish ingestion rate used is the 95th percentile Tulalip consumption rate for bottom fish (EPA, 2007). The fish ingestion rate used for this Site does not represent the total amount of fish the Tulalip tribal adults are expected to consume daily, rather the rate represents the amount of fish and shellfish that may be regularly exposed to Site sediment that the adult tribal members are anticipated to consume (that is, bottom and pelagic fish plus clams, mussels and crabs). Salmon consumption was not included because salmon are migratory and exposure to sediment adjacent to the Lowland Area is expected to be minimal.

Fish/shellfish ingestion rates used for this evaluation are as follows:

- Dungeness crab = 31.1 g/day
- Clams and mussels = 50.8 g/day

- Bottom fish = 7.5 g/day
- Pelagic fish – 8.1 g/day

Bioaccumulation factors (BAF) used to calculate the preliminary bioaccumulation sediment cleanup levels are described below.

The preliminary bioaccumulation sediment cleanup levels for the Snohomish River are shown in Table 5-6 (SCO) and Table 5-7 (CSL). The SCO values are based on a cancer risk of 1 x 10^{-6} or a hazard quotient of 1; the CSL values are based on a cancer risk of 1 x 10^{-5} or a hazard quotient of 1.

Ecological

Preliminary bioaccumulation sediment screening levels protective of ecological receptors were derived using Equation 1 below and acceptable tissue levels (ATL) for aquatic or aquatic-dependent organisms and BAF values for aquatic life and aquatic-dependent wildlife presented in Table 5-8.

$$Equation\ 1: CUL = \frac{ATL}{BAF}$$

Where:
CUL = preliminary sediment cleanup level
ATL = acceptable tissue level
BAF = bioaccumulation factor

The acceptable tissue levels used for the ecological evaluation were from Draft SCUM II and the Sediment Evaluation Framework (Ecology, 2012 and RSET, 2009), with the exception of the aquatic life (aquatic organisms) value for cadmium, which was from the Oregon Department of Environmental Quality (ODEQ, 2007).

Bioaccumulation Factors

In order to calculate a bioaccumulation sediment screening level from an acceptable tissue concentration, the relationship between sediment and tissue at a site must be measured or predicted. Site-specific BAFs are often used to estimate this relationship for metals. Existing BAFs (published from other studies) can be used at sites where site-specific data are not available. Arsenic, cadmium and mercury BAFs were derived for bivalves, crustacean and fish for Port Angeles Harbor (NewFields, 2013). The lead BAF used is the recommended sediment-to-benthic bioconcentration factor for lead from draft EPA guidance (EPA, 1999).

5.1.4.4. *Background*

Natural and regional background values are considered under SMS in the development of SCOs and CSLs. Because soil is the primary source of sediment from the Site, both sediment in the Lowland Area and on the shoreline of the Snohomish River, soil background values for Puget Sound were used for the natural and regional background sediment values, with the exception of arsenic (Ecology, 1994). The background value for arsenic was set at 20 mg/kg, which is the MTCA Method A soil cleanup level for industrial properties and the natural background concentration for soil in the State of Washington (MTCA Table 745-1).

5.2. Indicator Hazardous Substances

IHSs for the Lowland Site were selected in accordance with WAC 173-340-703 and are used to help define the Site cleanup requirements. This process was used to identify the contaminants that are of primary concern at the Site and to identify individual hazardous substances that contribute only a small percentage of the overall threat to human health and the environment. The first step in determining Lowland IHSs in each medium (soil, groundwater, surface water and sediment) was to identify the frequency and magnitude at which individual contaminants (i.e., metals) exceeded the PCULs for each medium. The frequency at which a contaminant exceeds the PCULs is termed the "exceedance frequency". The magnitude by which a contaminant exceeds the PCULs is termed the "exceedance factor" (EF). The EF is derived by dividing the detected concentration by the PCUL concentration. Contaminants were initially considered as potential IHSs if they met either of the following criteria:

1. The contaminant had an exceedance frequency of at least 10 percent, or
2. The contaminant had an EF of 2 or more.

Contaminants were then further evaluated to select IHSs in each medium based on evaluation of a combination of other considerations that include the following:

1. Co-occurrence of contaminants at concentrations greater than PCULs. In general, a contaminant may not be selected as an IHS if it is detected less frequently at the same locations as another contaminant(s) (i.e., co-occurs with another contaminant exceeding PCULs) that is identified as an IHS. Co-occurrence was determined by inspection of the analytical results for samples from each medium at each location.
2. Presence in multiple interconnected media at concentrations greater than PCULs. In general, if a contaminant is present in multiple media at concentrations greater than PCULs, it may be selected as an IHS even with relatively low exceedance frequencies and EFs.
3. Low detection frequency, exceedance frequency and EF. In general, a contaminant may initially be considered an IHS based on an EF greater than two but may not ultimately be selected as an IHS if the contaminant is infrequently detected, has a low exceedance frequency and only slightly exceeds a PCUL.
4. Presence at concentrations similar to background concentrations at the Site. In general, a contaminant may not be selected as an IHS if it is present within the range of background concentrations present at the Site.

The selection of IHSs for soil, groundwater, seeps, surface water and sediment is summarized in Tables 5-12 through 5-15. These tables present frequency of detection summary statistics and information for the contaminants detected in each matrix as well as a description of other considerations that were evaluated as part of the selection of IHSs for media at the Site. Table 5-16 summarizes the selected IHSs for each medium at the Site. As the source of water discharging from seeps on the Snohomish River shoreline is groundwater, the IHSs for groundwater are applicable to seeps. IHSs have not been developed for stormwater and stormwater solids in the Lowland Area as stormwater is regulated under the NPDES program. Similarly, IHSs have not been developed for water discharged from outfalls on the Snohomish River shoreline in the Lowland Area as outfalls are also regulated under the NPDES program. However, the

IHSs for surface water are used to evaluate the results for stormwater and outfall samples and the IHSs for sediment are used to evaluate the results for stormwater solids samples.

5.2.1. Soil Indicator Hazardous Substances

IHSs were selected for "shallow soil" (fill, soil at the historical native surface, silt and till) separate from "deeper soil" (alluvium and outwash). IHSs were selected separately as shallow and deeper soil are effectively separated by the silt and till causing contaminant sources and characteristics, exposure pathways and potential receptors to be significantly different for shallow soil and deeper soil.

As shown in Table 5-12, the following contaminants were selected as IHSs for shallow soil:

- **Arsenic:** Arsenic is an IHS for shallow soil based on exceedance frequency, EF and because arsenic is an IHS for multiple interconnected media at the Site including shallow aquifer groundwater, surface water and sediment in the Lowland Area and seeps and sediment on the Snohomish River shoreline.
- **Lead:** Lead is an IHS for shallow soil based on exceedance frequency and EF and lead was detected at concentrations greater than the PCUL over a substantial portion of the Benson Subarea.
- **Mercury:** Mercury is selected as an IHS for shallow soil because mercury is an IHS in multiple interconnected media including shallow aquifer groundwater present in fill, surface water and sediment in the Lowland Area and seeps and sediment on the Snohomish River shoreline.

Other contaminants in shallow soil that met the initial IHS selection criteria (cadmium, chromium, copper and zinc) were further evaluated for selection as IHSs. None of these contaminants was selected as an IHS based on evaluation of other considerations as presented in Table 5-12. Other contaminants in shallow soil (antimony, barium, nickel, selenium, silver and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria (exceedance frequency or EF) and other considerations did not warrant their selection as an IHS (Table 5-12).

As also shown in Table 5-12, the following contaminant was selected as an IHS for deeper soil:

- **Arsenic:** Arsenic is an IHS for deeper soil based on EF and because arsenic is an IHS in multiple interconnected media including deep aquifer groundwater present in alluvium and outwash and seeps and sediment on the Snohomish River shoreline.

Other contaminants in deeper soil (antimony, cadmium, chromium, copper, lead, mercury, thallium and zinc) were not selected as IHSs as they did not meet the initial IHS selection (i.e., exceedance frequency or EF) criteria and other considerations did not warrant their selection as an IHS (Table 5-12).

5.2.2. Groundwater Indicator Hazardous Substances

IHSs were selected for the shallow aquifer groundwater separate from the deep aquifer groundwater at the Site. IHSs were selected separately because shallow and deep aquifer groundwater are effectively separated by the silt throughout much of the Lowland Area causing contaminant sources and characteristics, exposure pathways and potential receptors to be significantly different for groundwater in the shallow and deep aquifers.

As shown in Table 5-13, the following contaminants were selected as IHSs for shallow groundwater:

- **Arsenic:** Arsenic is an IHS for shallow aquifer groundwater based on exceedance frequency, EF and because it is an IHS for multiple interconnected media at the Site including shallow soil; surface water and sediment in the Lowland Area and seeps and sediment in the Snohomish River.
- **Lead:** Lead is an IHS for shallow groundwater based on EF and because it is an IHS for shallow soil.
- **Mercury:** Mercury is an IHS for shallow aquifer groundwater based on exceedance frequency, EF, and because it is an IHS for multiple interconnected media at the Site including shallow soil; surface water and sediment in the Lowland Area and seeps and sediment in the Snohomish River.

The other contaminant in shallow aquifer groundwater that met the initial IHS selection criteria (cadmium) was further evaluated for selection as an IHS. The contaminant was not selected as an IHS based on evaluation of other considerations as presented in Table 5-13. Other contaminants in shallow aquifer groundwater (antimony and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria and other considerations did not warrant there selection as IHS (Table 5-13).

As also shown in Table 5-13, the following contaminant was selected as an IHS for deep aquifer groundwater:

- **Arsenic:** Arsenic is an IHS for deep aquifer groundwater based on exceedance frequency, EF and because arsenic is an IHS for multiple interconnected media at the Site including deeper soil, seeps and sediment on the Snohomish River shoreline.

Mercury met the initial IHS selection criteria and was further evaluated for selection as an HIS for deep aquifer groundwater but was not selected as an IHS based on evaluation of other considerations as presented in Table 5-13. Other contaminants in deep aquifer groundwater (antimony, cadmium, lead and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria and other considerations did not warrant there selection as IHS (Table 5-13).

5.2.3. Surface Water Indicators Hazardous Substances

As shown in Table 5-14, the following contaminants were selected as IHSs for surface water in the Lowland Area:

- **Arsenic:** Arsenic is an IHS for surface water in the Lowland Area based on exceedance frequency and because it is an IHS for multiple interconnected media at the Site including shallow soil; shallow groundwater and sediment in the Lowland Area.
- **Mercury:** Mercury is an IHS for surface water in the Lowland Area based on exceedance frequency and because it is an IHS for multiple interconnected media at the Site including shallow soil; shallow groundwater and sediment in the Lowland Area.

Other contaminants in surface water in the Lowland Area (antimony, cadmium, lead and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria and other considerations did not warrant there selection as an IHS (Table 5-14).

5.2.4. Sediment Indicator Hazardous Substances

IHSs were selected for sediment in ponds and wetlands in the Lowland Area separate from sediment on the Snohomish River shoreline. IHSs were selected separately for sediment in the Lowland Area and on the shoreline of the Snohomish River as sediment in the Lowland Area and on the Snohomish River shoreline are located in different portions of the Site causing contaminant sources, exposure pathways and potential receptors to be significantly different.

As shown in Table 5-15, the following contaminants were selected as IHSs for sediment in ponds and wetlands in the Lowland Area:

- **Arsenic:** Arsenic is an IHS for sediment in the Lowland Area based on exceedance frequency, EF and because arsenic is an IHS for multiple interconnected media at the Site including shallow soil; shallow aquifer groundwater and surface water in the Lowland Area.
- **Mercury:** Mercury is selected as an IHS for sediment in the Lowland Area based on exceedance frequency, EF and because mercury is an IHS for multiple interconnected media including shallow soil; shallow aquifer groundwater and surface water in the Lowland Area.

Other contaminants in sediment in the Lowland Area that met the initial IHS selection criteria (cadmium and lead) were further evaluated for selection as an IHS. None of these contaminants was selected as an IHS based on evaluation of other considerations as presented in Table 5-15. Other contaminants in sediment in the Lowland Area (antimony and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria and other considerations did not warrant there selection as IHS (Table 5-15).

As also shown in Table 5-15, the following contaminants were selected as IHSs for sediment on the Snohomish River shoreline:

- **Arsenic:** Arsenic is an IHS for sediment on the Snohomish River shoreline based on exceedance frequency, EF and because arsenic is an IHS for multiple interconnected media including deep aquifer groundwater and seeps on the Snohomish River shoreline.
- **Mercury:** Mercury is an IHS for sediment on the Snohomish River shoreline based on exceedance frequency, EF and because it is an IHS for multiple interconnected media at the Site including seeps on the Snohomish River shoreline.

Other contaminants in sediment on the Snohomish River shoreline (antimony, cadmium, lead and thallium) were not selected as IHSs as they did not meet the initial IHS selection criteria and other considerations did not warrant there selection as an IHS (Table 5-15).

6.0 NATURE AND EXTENT OF CONTAMINATION

This section describes the nature and extent of contamination in the Lowland Area Site. It also includes a portion of the Marine View Drive ROW between the former Fenced Area and Lowland Area as contamination in the ROW extends into the Lowland Area. The nature and extent of contamination is described for Site media including soil, groundwater, surface water and sediment. The results of the analysis of samples of stormwater, stormwater solids and water from outfalls in the Lowland Area performed as part of supplemental investigations of the Site are also presented.

The results presented here are based on the analyses of IHSs (arsenic, lead and mercury) on samples of Site media performed as part of previous investigations described in Section 2.0 and supplemental investigations described in Section 3.0. The description of the nature and extent of contamination in the Marine View Drive ROW is based on analyses performed as part of previous investigations and a focused source area investigation. Analytical results are compared to the PCULs presented in Tables 5-1 through 5-11. IHSs are identified in Tables 5-12 through 5-16.

6.1. Soil

6.1.1. Introduction

The nature and extent of contamination in shallow soil (fill, soil at the historical native surface, silt and till) is presented separate from the nature and extent of contamination in deeper soil (alluvium and outwash). Shallow and deeper soils are effectively separated by the silt and till causing contaminant, sources, contaminant characteristics, exposure pathways and potential receptors to be significantly different for shallow soil and deeper soil. The nature and extent of contamination is presented for each of the subareas that have been defined for the Site.

The results for individual soil samples are compared to PCULs based on the potential receptors (humans and ecological receptors) and exposure scenarios (ex., human health industrial exposure, human health trespasser, ecological industrial, etc.) applicable to the samples based on location to identify the extent of contamination. The analytical results for soil samples collected from greater than 15 feet bgs are compared to the PCULs for the human health industrial exposure to describe the extent of contamination.

Table 6-1 presents summaries of the frequency of detection of metals in shallow and deeper soil in the Lowland Area. Tables 6-2 through 6-9 present the results for metals in shallow soil in each Lowland subarea as well as the adjacent Marine View Drive ROW, Pacific Highway ROW and BNSF property. Table 6-10 presents the results of the focused source area investigation performed in the Marine View Drive ROW. Table 6-11 presents the results for metals in all samples of deeper soil. Tables 6-2 through 6-11 identify the PCULs applied to each soil sample and highlight metals concentrations that are greater than the PCULs. Finally, Table 6-12 presents the results of total organic carbon analyses performed on soil in the Lowland Area.

Figure 6-1 identifies the locations where soil samples have been collected and used to characterize the nature and extent of contamination in soil. Figure 6-1 also identifies the area where a focused source area investigation was performed in the Marine View Drive ROW. Figure 6-2 identifies the focused source area investigation locations. Figures 6-3A through 6-3C present the results for arsenic in shallow soil samples in the Lowland Area. Figure 6-4 presents the results for lead in shallow soil samples in the Benson Subarea and adjacent portions of the Marine View Drive and Pacific Highway ROWs, BNSF property and Snohomish

County PUD Subarea. Figures 6-5 and 6-6 present the maximum concentrations of arsenic and lead detected, respectively, measured as part of the focused source area investigation. Finally, Figure 6-7 presents the results for arsenic in deeper soil samples.

6.1.2. Overview of the Nature and Extent of Contamination in Soil

Arsenic exceeded the PCULs in 28 percent of shallow soil samples and 3.5 percent of deeper soil samples. (Table 6-1). Lead exceeded the PCULs in 22 percent of shallow soil samples but did not exceed the PCULs in deeper soil samples. Mercury did not exceed PCULs in soil samples.

In general, the concentrations of arsenic, lead, and mercury resulting from smelter operations generally decrease in the Lowland Area with increased distance from the area where slag was deposited in the Lowland Area on the Benson Subarea and where the former exhaust flue and dust chamber structures were present in the Marine View Drive ROW. The following sections describe the nature and extent of contamination in each subarea and the Marine View Drive ROW starting with the Benson Subarea.

6.1.3. Shallow Soil

The IHSs for shallow soil (fill, native surface soil, silt and till) are arsenic, lead, and mercury. The nature and extent of contamination of these metals in each subarea is discussed below.

6.1.3.1. *Benson Subarea*

Shallow soil samples were generally collected from the surface to a depth of approximately 25 feet bgs in the Benson Subarea. However, samples at greater depths were collected from locations in the area associated with the bridge embankment for the Weyerhaeuser Bridge Road (ex. EV-6A/B, SL-3, and SB-4) (Table 6-2).

Arsenic concentrations detected in the Benson Subarea range from 3 to 7,940 mg/kg. Arsenic was detected at concentrations greater than the PCULs at the Benson Subarea in fill at the surface down to the native surface soil and silt. Arsenic was detected at concentrations greater than the PCULs in samples collected from 66 investigation locations in the Benson Subarea (Table 6-2). The highest arsenic concentrations (concentrations greater than 1,000 mg/kg) were detected in samples collected from the central portion of the Benson Subarea (WP-1, LB-11, HP-05, LB-2, EV-20B, LB-19, LB-1, HP-20, LB-3, AB-3, EV-9A and HP-24) (Table 6-2 and Figure 6-3A). The samples with the highest arsenic concentrations were generally collected from depths of between 5 and 15 feet bgs and were comprised of fill (WP-1, LB-11, LB-2, EV-20B, LB-3, and EV-9A), native surface soil (HP-05, LB-19, and LB-15) and slag or fill containing slag (LB-1, HP-20, EV-9A and HP-24) (Table 6-2). The highest arsenic concentration in the Benson Subarea was detected at WP-1 in a sample comprised of fill collected from 6 to 6.5 feet bgs (Table 6-2 and Figure 6-3A).

The concentrations of arsenic in samples from the Benson Subarea identified to be comprised of slag range from 124 to 1,344 mg/kg (Table 6-2). Arsenic concentrations in the same range and greater were detected in samples of fill not identified to contain slag and in native surface soil indicating that historical sources other than slag (arsenic trioxide, flue dust, smelter emissions) have contributed to elevated arsenic concentrations in the Benson Subarea.

The detected concentrations of arsenic west of the Benson Subarea within the Marine View Drive ROW range from 2.4 to 11,810 mg/kg (Table 6-3 and Figure 6-3A). The arsenic concentrations present in soil within the Marine View Drive ROW were greater than the PCUL (88 mg/kg). The highest arsenic concentration detected as part of previous investigations in the Marine View Drive ROW was at location EV-13 located within an area containing structural debris from a former smelter exhaust flue and dust chambers. A focused source area investigation was performed in the Marine View Drive ROW to further characterize arsenic and lead concentrations associated with the remnant exhaust flue and dust chamber adjacent to EV-13. The results of the focused source area investigation are described in the following section (Section 6.1.3.2).

The arsenic concentrations detected in samples collected from locations in the southern portion of the Benson Subarea (HP-12, LB-21, LB-22, BP-10D, SAIC-SS1 and LLMW-31D) range from 3 to 61 mg/kg and are less than the PCULs (Table 6-2 and Figure 6-3A). Arsenic concentrations detected at sampling locations east of the Benson Subarea on BNSF property range from 3 to 335 mg/kg. Samples collected from four locations (AB-4, AB-6, HP-14 and HP15) located on the BNSF property contained arsenic concentrations greater than the PCULs (Table 6-4 and Figure 6-3A). However, arsenic concentrations were less than the PCULs in samples from 10 locations on the BNSF property (HP-28, HP-07, HP-06, HP-15, HP-16, MW-4B, HP-25, HP-08, MW-3 and MW-02) (Table 6-4 and Figure 6-3A). Arsenic concentrations detected at locations on the northern portion of the Benson Subarea (HA-4, HA-8, HA-12, HA-16, EV-23A/B, HP-01 and BP-01D) ranged from 6 to 215 mg/kg (Table 6-2 and Figure 6-3A). Five samples collected from three northern locations (HA-12, HA-16 and EV-23A/B) contained arsenic at concentrations that were greater than the PCULs. Arsenic concentrations were also detected at two locations in the Pacific Highway ROW greater than the PCULs (HA-3 and HA-10) (Table 6-5 and Figure 6-3A). Arsenic concentrations detected at locations northwest of the Benson Subarea in the Marine View Drive ROW (LLMW-24D, LLMW-25D, EV-14, SAIC-S81, SAIC-S82 and SAI-SS1) range from 2 to approximately 55 mg/kg and are less than the PCULs (Table 6-3 and Figure 6-3A).

Arsenic with concentrations greater than the PCULs in fill and native surface soil at the Benson Subarea is bounded by underlying silt with concentrations less than the PCULs. Samples of the silt underlying the fill and native surface soil were collected at 36 locations in the Benson Subarea (Table 6-2). Silt samples with arsenic concentrations less than the PCULs were detected at all 36 locations (Figure 6-3A).

Lead concentrations detected in the Benson Subarea range from 2 to 24,230 mg/kg (Table 6-2). Similar to arsenic, lead was detected at concentrations greater than the PCULs at the Benson Subarea in fill at the surface down to the native surface soil and silt. Lead was detected at concentrations greater than the PCULs in samples collected from 58 investigation locations in the Benson Subarea. Also similar to arsenic, the highest lead concentrations (concentrations greater than 1,000 mg/kg) were detected in samples collected from the central portion of the Benson Subarea (Table 6-2 and Figure 6-4). However, elevated lead concentrations were also detected in samples collected from the northern portion of the Benson Subarea and in the adjacent Pacific Highway ROW (Tables 6-2 and 6-5 and Figure 6-4). Samples with lead concentrations greater than 1,000 mg/kg were collected from 40 investigation locations in the Benson Subarea. The samples with the highest lead concentrations were generally collected from the surface to depths of between approximately 15 and 20 feet bgs. However, samples with elevated lead concentrations were detected at greater depth in the embankment for the Weyerhaeuser Bridge Road (EV-6A/B, SL-1, SL-3 and SL-4). The samples with the highest lead concentrations were predominantly comprised of slag or fill containing slag (Table 6-2). The highest lead concentrations in the Benson Subarea were detected at EV-6A in samples comprised of slag collected from approximately 30 to 46.5 feet bgs in the bridge embankment for the Weyerhaeuser Bridge Road (Table 6-2 and Figure 6-4).

Lead concentrations generally decrease with increased distance from the slag in the central portion of the Benson Subarea. The lead concentrations detected in samples collected from investigation locations on the southern portion of the Benson Subarea (LB-12 through LB-15, SAIC-S54, EV-16A, HP-12, LB-21, LB-22, SAIC-S51, BP-09D and BP-10D) range from 2 to approximately 400 mg/kg and are less than the PCULs except at two locations (LB-23 and LLMW-31D) (Table 6-2 and Figure 6-4). Samples collected from two locations east of the Benson Subarea on the BNSF property (AB-4 and AB-6) contain lead at concentrations ranging from 11 to 9,510 mg/kg and greater than the PCULs (Table 6-3 and Figure 6-4). However, lead concentrations were less than the PCULs in samples from 12 locations on the BNSF property (HP-28, HP-07, HP-06, HP-15, HP-16, MW-4B, HP-25, HP-27, HP-08, MW-3, HP-14 and MW-02) (Table 6-3 and Figure 6-4). Lead concentrations detected at locations northwest of the Benson Subarea in the Marine View Drive ROW (LLMW-24D, LLMW-25D, EV-14, SAIC-S81, SAIC-S82 and SAI-SS1) range from 2 to approximately 164 mg/kg and are less than the PCULs (Table 6-5 and Figure 6-4). Lead concentrations detected in samples collected in the Marine View Drive ROW adjacent to the Benson Subarea range from 2 to 900 mg/kg and are less than the PCULs except at one location (EV-18B at 1,789 mg/kg). However, lead was detected at concentrations greater than the PCULs in samples tested as part of the focused source area investigation as discussed below.

Lead with concentrations greater than the PCULs in fill and native surface soil at the Benson Subarea is bounded by underlying silt with concentrations less than the PCULs. Similar to arsenic, silt samples with lead concentrations less than the PCULs were detected at 36 locations.

Mercury was detected in soil samples but at concentrations less than the PCULs (Table 6-2).

6.1.3.2. *Focused Source Area Investigation in the Marine View Drive Row*

A focused investigation was performed in a portion of the Marine View Drive ROW suspected of having arsenic contaminated fill as well as debris that is a significant source of the elevated arsenic concentrations in Lowland groundwater (Figure 6-1 and 6-2). The investigation focused on an area beneath East Marine View Drive where it was suspected that structural materials (brick and mortar) from a former smelter exhaust flue and dust chambers were located (Figure 6-2). The investigation also included measuring lead concentrations in the soil and debris. The results of the focused source area investigation were presented in a technical memorandum that is provided in Appendix A. The results of the focused source area investigation are summarized in this section.

Forty-four soil borings (LLSB-04 through LLSB-47) were completed in the Marine View Drive ROW as part of the focused source area investigation (Figure 6-2). Arsenic and lead concentrations were measured using an X-ray fluorescence (XRF) analyzer in samples collected from the boring.

The arsenic concentrations ranged from 2 to 35,100 mg/kg (Table 6-10). The highest arsenic concentration measured was from fill and debris at a depth of 5.2 to 5.4 feet bgs at LLSB-07 located within the historical alignment of the exhaust flue and dust chambers (Table 6-10 and Figure 6-5). The maximum arsenic concentration at each investigation location were at or greater than 1,000 mg/kg. Arsenic concentrations were greater than the PCUL in fill and/or till at all 44 investigation locations. Arsenic concentrations at and greater than 1,000 mg/kg were measured in fill or till from the surface to 18 feet bgs. Arsenic was also detected at concentrations greater than 1,000 mg/kg at multiple previous sample locations in the Marine View Drive ROW south of the focus area (EV-13, SP-26, LLMW-27D, EV-11, SP-23, EV-10, SP-22 and SP-21).

The lead concentrations measured in the investigation area ranged from 3 to 15,100 mg/kg. (Table 6-10). The highest lead concentration, 15,100 mg/kg at LLSB-09, was also within the historical alignment in fill containing remnant structure debris (Table 6-10 and Figure 6-6). Lead concentrations greater than the PCUL were measured in fill at 25 of 44 boring locations. Lead concentrations greater than the PCUL were measured at depths ranging from 2 to 10 feet bgs (Table 6-10). Lead concentrations detected in samples collected as part of previous investigations are generally less than the PCULs in the other portions of the Marine View Drive ROW.

6.1.3.3. *Port of Everett Riverside Business Park*

Shallow soil samples were collected from the Riverside Business Park subarea from the surface to a depth of approximately 23 feet bgs.

Arsenic was detected in fill and native surface soil at concentrations greater than the PCULs in four areas within the Riverside Business Park Subarea.

Arsenic was detected in samples of fill collected from five locations (HP-35, HP-46, HP-47, HP-48 and MW-107D) in the northern portion of the Riverside Business Park Subarea around the eastern access ramp of the Weyerhaeuser Bridge Road at concentrations greater than the PCULs (Table 6-6 and Figure 6-3B). The concentrations greater than the PCULs were predominantly identified in samples at depth of 0.5 to 2.0 feet bgs.

Arsenic was detected in samples of fill soil collected from three locations (TP-20, TP-30 and LLMW-19D) adjacent to the former Mill E / Koppers Facility in the south central portion of the Riverside Business Park Subarea at concentrations greater than the PCULs (Table 6-6 and Figure 6-3B). The concentrations greater than the PCULs were predominantly identified in samples at depths between approximately 1 and 4 feet bgs.

Arsenic was detected in a sample of fill collected from one location (TP-SE-14) on the southern portion of the Riverside Business Park Subarea at a concentration greater than the PCULs (Table 6-6 and Figure 6-3B). No other samples on the southern portion of Riverside Business Park Subarea contained arsenic at concentrations greater than the PCULs.

Arsenic was also detected at concentrations greater than the PCULs in samples of native surface soil collected from four locations (LLMW-09D, LLMW-14D, LLMW-18D and LLMW-21D) situated along the western boundary of the Riverside Business Park Subarea. Arsenic was not detected at a concentration greater than the PCULs in any other samples collected from native surface soil in the remaining portion of the Riverside Business Park Subarea (Table 6-3 and Figure 6-3B).

Lead was detected in samples of fill collected from five locations (HP-35, HP-46, HP-47, MW-107D and MW-109D) in the northern portion of the Riverside Business Park at concentrations greater than the PCULs (Table 6-6). The samples of fill with lead concentrations greater than the PCULs were collected from the surface to a depth of 2.0 feet bgs. Lead was not detected at a concentration greater than the PCULs in any other samples collected in the remaining portion of the Riverside Business Park Subarea.

Mercury was detected in soil samples but at concentrations less than the PCULs (Table 6-6).

6.1.3.4. *Snohomish County PUD Subarea*

Shallow soil samples were collected at the Snohomish County PUD Subarea from the surface to a depth of 19 feet bgs.

Arsenic was only detected in one sample collected from investigation location EV-22A/B at 20 to 22 feet bgs in the Snohomish County PUD Subarea at a concentration greater than the PCULs (Table 6-7 and Figure 6-3C). Lead was also detected in the same sample at a concentration greater than the PCULs. Arsenic and lead were also detected at concentrations greater than the PCULs in the adjacent Marine View Drive and Pacific Highway ROWs (Tables 6-3 and 6-5 and Figure 6-3A and 6-3C).

Mercury was detected in soil samples at concentrations less than the PCULs (Table 6-7).

6.1.3.5. *Shadow Development / Blunt Family Subarea*

Shallow soil samples were collected from the surface to a depth of 21 feet bgs at the Shadow Development / Blunt Family Subarea.

Arsenic was only detected in surface grab samples of fill collected from two locations (Grab-3-1292 and Grab-4-1292) in the eastern end of the Shadow Development/Blunt Family Subarea at concentrations greater than the PCULs (Table 6-8 and Figure 6-3C). Arsenic was not detected at concentrations greater than the PCULs in any other soil samples including samples comprised of native surface soil.

Lead was detected in one sample collected from SB-1101 on the eastern boundary of the Shadow Development / Blunt Family Subarea at concentrations greater than the PCUL.

Mercury was detected in soil samples but at concentrations less than the PCULs (Table 6-8).

6.1.3.6. *Slope Subarea*

Soil at the surface in the Slope Subarea is believed to be the historical native surface of the Site. Samples from the Slope Subarea were collected from the surface to a depth of approximately 1 foot bgs to evaluate potential impacts from smelter operations. Samples were collected at the eastern end of the Slope Subarea adjacent to the intersection of Marine View Drive and the Pacific Highway from greater depths.

Arsenic concentrations were less than the PCULs in samples collected from the native surface soil at locations in the western portion of the Slope Subarea (LLS-01 through LLS-04) (Table 6-9 and Figure 6-3C). Arsenic was detected in soil samples collected from five locations (LLS-05, LLS-06, LLS-07, LLS-08 and HA-1) in the eastern portion of the Slope Subarea at concentrations greater than the PCULs. These samples were collected from the surface soil at four locations (LLS-05 through LLS-08) and fill at one location (HA-1). Lead was also detected at concentrations greater than the PCULs in samples of fill collected from location HA-1 as well as native surface soil at one location, LLS-07 (Table 6-9). Arsenic and lead were also detected at concentrations greater than the PCULs in the adjacent portion of the Marine View Drive and Pacific Highway ROWs (Tables 6-3 and 6-5 and Figure 6-3A and 6-3C).

Mercury was detected in soil samples but at concentrations less than the PCULs (Table 6-9).

6.1.4. Deeper Soil

The IHS for deeper soil (alluvium and outwash) is arsenic. Deeper soil samples were collected from 68 locations in the Lowland Area and were generally from depths of approximately 15 to 70 feet bgs. However, samples of alluvium and outwash were also collected from depths up to approximately 100 feet bgs.

Arsenic concentrations detected in alluvium and outwash samples range from 1.2 to 396 mg/kg (Table 6-1). The highest arsenic concentrations were detected in alluvial soil collected from locations in the Benson Subarea (BP-04D2, BP-05D, BP-06D, BP07D2, EV-7B, HP-04 and LLMW-36D) and in the adjacent Marine View Drive ROW (LLMW-27D, LLMW-29D and TB-1) (Table 6-11 and Figure 6-7). Arsenic concentrations from 116 to 396 mg/kg were detected in soil from approximately 29 to 31 feet bgs at three locations (BP-05D, BP-06D, and LLMW-36D) (Table 6-11). Arsenic was either not detected or detected at concentrations less than approximately 75 mg/kg in all other samples of alluvium and outwash at the Site.

6.1.5. Total Organic Carbon

Total organic carbon (TOC) analysis was performed on samples comprised of fill, native surface soil, alluvium and outwash. Only one sample of native surface soil was analyzed for TOC. The TOC concentration in the native surface soil sample was 2.93 percent (Table 6-12). The TOC concentrations in fill samples ranged from 0.247 to 28.3 percent. The TOC concentrations in alluvium ranged from 0.222 to 3.06 percent and the TOC concentrations in outwash samples were 0.129 to 0.538 percent.

6.2. Groundwater

6.2.1. Introduction

This section presents the nature and extent of contamination for groundwater in the shallow and deep aquifers present in the Lowland Area. The nature and extent of contamination in the shallow and deep aquifers are described separately because they are predominantly separated by a silt layer. As a result, contaminant sources, contaminant characteristics, exposure pathways and potential receptors are different for each aquifer. The nature and extent of contamination is presented for each of the subareas that have been defined for the Site.

This section also presents the results for groundwater monitoring performed in the Marine View Drive ROW adjacent to the Lowland Area at LLMW-24D, LLMW-25D, LLMW-27D and LLMW-29D and at one monitoring well located west of Marine View Drive (LLMW-35D). This groundwater monitoring was completed to support characterization of the nature and extent of groundwater in the Lowland Area.

The groundwater data is based on samples collected in January and February (first quarter or Q1), April and May (second quarter or Q2), August and September (third quarter or Q3) and October and November (fourth quarter or Q4) 2013. Total and dissolved metals analyses were performed on the groundwater samples. The IHSs for shallow groundwater are arsenic, lead and mercury and the IHS for deep groundwater is arsenic. In general, arsenic and lead were analyzed during Q1 through Q4 while mercury was only analyzed during Q1 and Q2.

The PCULs for groundwater are based on protection of surface water in the Lowland Area and Snohomish River. The results for individual groundwater samples are compared to PCULs based on location and the potential receiving water (i.e., surface water in the Lowland Area or Snohomish River). The PCULs for arsenic and lead are based on the dissolved metals fraction and the PCUL for mercury is based on the total metals fraction.

The results of groundwater monitoring are presented in Tables 6-13 through 6-29. Table 6-13 presents summaries of the frequency of detection of metals in groundwater in the shallow and deep aquifers in the Lowland Area. Tables 6-14- through 6-23 compare the results of quarterly monitoring in the shallow and deep aquifers to the PCULs and highlight concentrations that are greater than the PCULs. Table 6-24 presents the results of arsenic speciation performed on groundwater samples from selected wells in the Lowland Area. Tables 6-25 through 6-28 present the groundwater quality parameter measurements in the shallow and deep aquifers recorded during groundwater monitoring at the Site. Tables 6-29 and 6-30 present the results of conventional analyses performed in Q3 and Q4.

Figure 3-2 identifies the locations where samples were collected as part of quarterly monitoring in 2013 that form the basis for characterization of the nature and extent of contamination in groundwater. Ten wells (BP-04D2, BP-07D2, EV-7B, EV-13, LLMW-11S, LLMW-27S, LLMW-29S, and LLMW-33S, LLMW-35D and LLMW-36D) shown on Figure 3-2 were not monitored during every quarter because all the wells did not contain sufficient groundwater volumes (were dry) during specific monitoring events to sample or the wells had not been installed at the time of sampling. Figures 6-8 through 6-11 present the results for dissolved arsenic in groundwater in the shallow aquifer. Figure 6-12 presents the results for mercury in groundwater in the shallow aquifer, surface water, stormwater, seeps and outfalls. Figures 6-13 through 6-16 present the results for dissolved arsenic in the groundwater of the deep aquifer. In Figures 6-8 through 6-16, the locations where the arsenic or mercury concentrations exceed the PCULs are highlighted on the figures. Figure 6-17 presents the results of arsenic speciation analyses on groundwater in the shallow and deep aquifers and surface water in the central portion of the Lowland Area. Figures 6-18 through 6-21 present major ion composition results (Piper diagrams) for selected wells in the shallow and deep aquifers and for surface water in the Lowland Area. Piper diagrams present the composition results for samples from selected wells to identify relationships between groundwater at the well locations.

6.2.2. Overview of the Nature and Extent of Metals Contamination in Groundwater

Arsenic was detected at concentrations greater than the PCULs in 28 percent of groundwater samples collected from the shallow aquifer and 45 percent of groundwater samples collected from the deep aquifer (Table 6-13). Lead and mercury were detected at concentrations greater than the PCULs in 9 percent and 15 percent, respectively, of groundwater samples collected from the shallow aquifer.

A comparison of the total and dissolved metals results for groundwater in the shallow and deep aquifers shows that in general, the total and dissolved metals results for arsenic and mercury are similar (Tables 6-14 to 6-17 and 6-19 to 6-22). This suggests that arsenic and mercury are predominantly present in the dissolved form. The total lead concentrations were typically detected at higher concentrations than the dissolved lead concentrations indicating that a component of the lead result is associated with particulates present in the groundwater samples.

In general, similar to soil, the concentrations of arsenic in groundwater resulting from smelter operations generally decrease in the Lowland Area with increased distance from the source area (arsenic kitchens) and where slag was deposited in the Lowland Area on the Benson Subarea.

6.2.3. Nature and Extent of Metals Contamination in Shallow Aquifer Groundwater

Shallow groundwater IHSs are arsenic, lead and mercury. The following sections describe the nature and extent of contamination in each subarea.

6.2.3.1. *Benson Subarea*

Shallow aquifer monitoring wells installed in the Benson Subarea include BP-01S through BP-10S and EV-6A. Dissolved arsenic concentrations in shallow groundwater from the Benson Subarea were generally higher than in other subareas and ranged from 24.3 µg/L to 289 µg/L (Table 6-18). This is likely the result of the presence of source material in and west of the subarea.

The dissolved arsenic concentrations in shallow groundwater from the Benson Subarea were greater than the PCUL (150 µg/L) in four wells (BP-07S, BP-09S, BP-10S and EV-6A) (Table 6-18 and Figures 6-8 through 6-11). The highest dissolved arsenic concentrations in the Benson Subarea were detected in groundwater from BP-09S. The dissolved arsenic concentrations were greater than the PCUL in groundwater from BP-09S during all four quarters of monitoring. The dissolved arsenic concentrations were greater than the PCUL in groundwater from BP-07S during three quarters (Q1, Q2 and Q4), from BP-10S during two quarters (Q3 and Q4) and from EV-6A during two quarters of monitoring (Q2 and Q3). Monitoring well EV-6A is located in the central portion of the Benson Subarea and the boring log shows that the well is partially screened in slag. Dissolved arsenic was not detected at concentrations greater than the PCUL in the closest adjacent monitoring wells on the Riverside Business Park (LLMW-09S, LLMW-10S, LLMW-12S, LLMW-14S, LLMW-15S and LLMW-18S) and Snohomish County PUD (EV-22A) subareas during quarterly groundwater monitoring (Table 6-18 and Figures 6-8 through 6-11). Groundwater was not present in the shallow monitoring wells installed in the Marine View Drive ROW (EV-13, LLMW-27S, and LLMW-29S) (the monitoring wells were dry) during quarterly monitoring performed in 2013.

The dissolved lead concentrations in shallow groundwater from the Benson Subarea were generally higher than in other subareas and ranged from non-detect (less than 0.1 µg/L) to 103 µg/L (Tables 6-14 to 6-17). The dissolved lead concentrations in shallow groundwater were greater than the PCUL (2.2 µg/L) in two wells (BP-03S and EV-6A). The highest dissolved lead concentrations were measured in monitoring well EV-6A. The dissolved lead concentrations were greater than the PCUL in groundwater from EV-6A during all four quarters of monitoring (Tables 6-14 through 6-17). The dissolved lead concentration in groundwater from BP-03S (9.6 µg/L) was slightly greater than the PCUL (8.1 µg/L) during one quarter of monitoring (Q1) (Table 6-14). The presence of lead in groundwater from EV-6A is likely the result of well EV-6A being partially screened in slag.

Total mercury was detected in groundwater from two wells in the Benson Subarea (EV-6A and BP-09S) at concentrations greater than the PCUL. The PCUL for mercury in shallow groundwater is the analytical detection limit (0.02 µg/L) (Table 5.3). Total mercury was detected in groundwater from monitoring well EV-6A at 0.0404 µg/L in Q1 and 0.0478 µg/L in Q2 (Tables 6-14 and 6-15). Total mercury was detected in groundwater from monitoring well BP-09S at 0.0394 µg/L in Q1 (Figure 6-12). Arsenic was detected in shallow groundwater at concentrations greater than the PCUL when mercury was greater than the PCUL in BP-09S and EV-6A (Q2).

6.2.3.2. *Port of Everett Riverside Business Park*

Shallow aquifer monitoring wells installed in the Port of Everett Riverside Business Park Subarea include LLMW-05S through LLMW-23S and PZ1B through PZ-3B.

Dissolved arsenic concentrations in shallow groundwater from the Riverside Business Park Subarea ranged from 1.1 µg/L to 192 µg/L during quarterly groundwater monitoring with one exception (Table 6-18). Arsenic concentrations detected at monitoring well LLMW-16S ranged from 216 µg/L to 1,700 µg/L.

Shallow groundwater at nine locations had detected concentrations of arsenic greater than the PCULs. These locations are in the northern (LLMW-05S, LLMW-07S and LLMW-08S), central (LLMW-16S) and southern portions (PZ-1B through PZ-3B, LLMW-22S and LLMW-23S) of the Riverside Business Park Subarea (Table 6-18 and Figures 6-8 through 6-11).

The monitoring wells on the northern portion of the Riverside Business Park with arsenic concentrations greater than the PCUL (LLMW-05S, LLMW-07S and LLMW-08S) are located along the shoreline of the Snohomish River. The dissolved arsenic concentrations in shallow groundwater were greater than the PCUL in all four quarters of monitoring (Tables 6-14 through 6-18 and Figures 6-8 through 6-11). Arsenic concentrations in soil were also greater than the PCULs in the northern portion of the Riverside Business Park Subarea.

The dissolved arsenic concentrations in shallow groundwater at LLMW-16S were the highest detected in the Lowland Area. The dissolved arsenic concentrations detected in shallow groundwater from wells surrounding LLMW-16S were generally one to two orders of magnitude less than the concentrations detected in groundwater from LLMW-16S, and less than the PCULs in groundwater from monitoring well LLMW-17S located between LLMW-16S and the Snohomish River during all four quarters of monitoring.

The dissolved arsenic concentrations in groundwater from PZ-1B through PZ-3B, LLMW-22S and LLMW-23S were greater than the PCULs in two or more quarters of monitoring. PZ-1B through PZ-3B, LLMW-22S and LLMW-23S are located at and adjacent to the former Mill E / Koppers facility where wood was treated with chromated copper arsenate between 1948 and 1963 (see Section 2.4.2.2).

Dissolved lead was infrequently detected in shallow groundwater from the Riverside Business Park Subarea (Tables 6-14 through 6-17). The dissolved lead concentrations in shallow groundwater from the Riverside Business Park Subarea were greater than the PCULs in two wells LLMW-08S (30.5 µg/L) and LLMW-14S (2.3 µg/L) in Q1. However, dissolved lead was either not detected or detected at concentrations less than the PCULs during the remaining three quarters of monitoring.

Total mercury concentrations in shallow groundwater from the Riverside Business Park Subarea were greater than applicable PCULs in two wells (LLMW-22S and PZ-3B). Total mercury was detected in LLMW-22S (0.0351 µg/L) during Q1 and PZ-3B (0.0712 µg/L) during Q2 at concentrations greater than the PCULs (Tables 6-14 and 6-15 and Figure 6-12).

6.2.3.3. *Snohomish County PUD Subarea*

Monitoring wells installed in the Snohomish County PUD Subarea to monitor groundwater in the shallow aquifer include LLMW-04S and EV-22A.

Dissolved arsenic concentrations in shallow groundwater from the Snohomish County PUD Subarea ranged from 3.1 µg/L to 11.8 µg/L and were less than the PCUL (i.e., 150 µg/L) (Tables 6-14 through 6-18).

The dissolved lead concentrations in shallow groundwater from the Snohomish County PUD Subarea ranged from non-detect (less than 0.1 µg/L) to 5.2 µg/L (Tables 6-14 to 6-17). The dissolved lead concentrations were greater than the applicable PCUL (i.e., 2.2 µg/L) in EV-22A during Q1 (5.2 µg/L), Q2 (4.6 µg/L) and Q3 (3.5 µg/L) monitoring events. Although the dissolved lead concentration was greater than the applicable PCUL in groundwater from EV-22A, the concentration in shallow groundwater in LLMW-04S, located next to the surface water pond on the Snohomish PUD Subarea, and samples of surface water from the pond were less than the PCULs (see Section 6.3).

Total mercury concentrations in shallow groundwater from the Snohomish PUD Subarea were also greater than the PCUL (i.e., 0.02 µg/L) in groundwater from EV-22A during Q1 (0.0366 µg/L) and Q2 (0.0213 µg/L) (Tables 6-14 and 6-15). Although the total mercury concentration was greater than the applicable PCUL in EV-22A, the total mercury concentration in shallow groundwater in LLMW-04S located next to the surface water pond on the Snohomish PUD Subarea and a sample of surface water from the pond (LLSW-01) were less than the PCULs (see Section 6.3).

6.2.3.4. *Shadow Development / Blunt Family Subarea*

Monitoring wells installed in the Shadow Development / Blunt Family Subarea to monitor groundwater in the shallow aquifer include LLMW-03S, MW-1202R, MW-1203R, MW-1301R, MW-1501R, MW-1701 and a well designated as "UNK" (for "unknown," because there is no information on its history available for review).

Dissolved arsenic concentrations in shallow groundwater from the Shadow Development / Blunt Family Subarea ranged from 0.7 µg/L to 10 µg/L during quarterly groundwater monitoring except at monitoring well UNK (Table 6-18). The arsenic concentrations detected at monitoring well UNK ranged from 71.6 µg/L to 158 µg/L. Dissolved arsenic concentrations were greater than the PCULs in three wells (MW-1301R, MW-1501R and UNK) (Table 6-18 and Figures 6-8 through 6-11). These dissolved arsenic concentrations exceeded the applicable PCULs in MW-1301R during Q3 (5.6 µg/L), MW-1501R during Q3 (10 µg/L) and Q4 (6 µg/L) and in UNK during Q4 (158 µg/L).

The dissolved lead concentrations in shallow groundwater from the Shadow Development / Blunt Family Subarea ranged from non-detect (less than 0.1 µg/L) to 0.7 µg/L except at monitoring well UNK. The dissolved lead concentrations at UNK ranged from 3.1 µg/L to 8.8 µg/L (Tables 6-14 to 6-17). The dissolved lead concentrations in groundwater from UNK were greater than the PCUL during all four quarters of monitoring. Although the dissolved lead concentrations were greater than the PCUL in groundwater from UNK, the dissolved lead concentrations were consistently less than the PCULs in adjacent shallow aquifer monitoring wells MW-1501R and MW-1301R.

Total mercury concentrations in shallow groundwater from monitoring well UNK were greater than the PCUL during Q1 (0.0599 µg/L) and Q2 (0.0401 µg/L) (Tables 6-14 and 6-15). Similar to lead, the total mercury concentrations were greater than the PCUL in groundwater from UNK, and consistently less than the PCULs in the adjacent shallow aquifer monitoring wells.

This area is also known as the "Weyerhaeuser West" Site. Monitoring wells MW-1202R, MW-1203R, MW-1301R, and MW-1501R were sampled periodically between December 2011 and July 2013 as required by Consent Decree No. 942075592. Samples were analyzed for contaminants of concern, including dissolved arsenic. Dissolved arsenic was consistently less than the cleanup level (5 µg/L) specified in the Consent Decree. Ecology has indicated that compliance with the Consent Decree has been achieved and Ecology anticipates removing the site from the hazardous sites list after public comment (Ecology, 2014). It should be further noted that multiple wells with no dissolved arsenic exceedances are located between the smelter and the Weyerhaeuser West site, including EV-22A, LLMW-03S, LLMW-04S and MW-1701.

6.2.3.5. *Slope Subarea*

There are no monitoring wells in the Slope Subarea.

6.2.4. Nature and Extent of Metals Contamination in Deep Aquifer Groundwater

This section presents the results for metals analyses performed on groundwater samples collected from the deep aquifer in the Lowland Area, Marine View Drive ROW (LLMW-24D, LLMW-25D, LLMW-27D and LLMW-29D) and at an up gradient well located west of Marine View Drive ROW (LLMW-35D).

Arsenic is the IHS for deep groundwater in the Lowland Area and has been detected at locations in multiple subareas at concentrations greater than the PCUL for protection of surface water in the Snohomish River (5 µg/L). The following sections describe the nature and extent of contamination in each subarea.

6.2.4.1. *Benson Subarea Deep Groundwater*

Monitoring wells installed in the Benson Subarea to monitor groundwater in the deep aquifer include BP-01D through BP-10D, BP-04D2, BP-05D2, BP-07D2, EV-6B, EV-7B, EV-19B, EV-20B and LLMW-36D. Monitoring wells installed in the Marine View ROW to monitor groundwater in the deep aquifer include LLMW-24D, LLMW-25D, LLMW-27D and LLMW-29D. One additional monitoring well, LLWM-35D, was installed in the deep aquifer located west of Marine View Drive ROW to support characterization of deep groundwater in the Lowland Area.

Dissolved arsenic concentrations in deep groundwater from the Benson Subarea were consistently higher than in any other subareas and were detected at concentrations up to 18,600 µg/L (Table 6-23). The higher arsenic concentrations in deep groundwater in the Benson Subarea are likely the result of its proximity to sources associated with historical smelter operations. As discussed in Section 6.1.3.2, a focused investigation was performed in a portion of the Marine View Drive ROW suspected of having arsenic contaminated fill as well as debris that is a significant source of the elevated arsenic concentrations in deep groundwater.

The highest dissolved arsenic concentrations in deep groundwater have consistently been detected in wells located in the central portion of the Benson Subarea (EV-19B, EV-20B, EV-7B, BP-04D, BP-05D, BP-06D, and BP-07D) and one well located in the Marine View Drive ROW (LLMW-27D) (Table 6-23 and Figures 6-13 through 6-16). The dissolved arsenic concentrations detected in these wells ranged from 814 µg/L to 18,600 µg/L during quarterly monitoring in 2013 and were greater than the PCUL for deep groundwater that is based on protection of surface water in the Snohomish River (5 µg/L). These high dissolved arsenic concentrations are generally bounded on the north, south, and west by wells with dissolved arsenic concentrations at or below the PCUL. The dissolved arsenic concentrations in monitoring wells BP-01D, BP-02D, BP-03D and BP-08D through BP-10D ranged from less than the PCUL to 26.1 µg/L. Arsenic concentrations in BP-01D through BP-03D, and BP-08D were below the PCUL.

The dissolved arsenic concentrations in groundwater from monitoring wells LLMW-24D, LLMW-25D and LLMW-35D located west of the Benson Subarea were consistently below the PCUL. Dissolved arsenic concentrations in monitoring well LLMW-29 located in the Marine View Drive ROW ranged from 4.5 µg/L to 6.5 µg/L and were only slightly greater than the PCUL. Dissolved arsenic concentrations were consistently less than the PCUL in monitoring well LLMW31D located on the southwest corner of the Benson Subarea (Table 6-23 and Figures 6-13 through 6-16).

Three deeper wells (BP-04D2, BP-05D2 and BP-07D2) were installed with screened intervals at depths 60 to 80 feet bgs; deeper than the 20 to 35 foot bgs screened intervals for other deep wells (Table 3-2). These deeper wells were installed to characterize the vertical extent of groundwater contamination in the deep aquifer. Monitoring well BP-05D2 was installed and sampled during all four quarters of groundwater monitoring and BP-04D2 and BP-07D2 were installed in August 2013 and were sampled in Q3 and Q4. Concentrations of dissolved arsenic were consistently below the PCUL in BP-04D2 during quarterly groundwater monitoring. Dissolved arsenic concentrations were less than the PCUL in groundwater from BP-05D2 during monitoring in Q3 and Q4 but exceeded the PCUL during Q1 (25.6 µg/L) and Q2 (5.4 µg/L). Dissolved arsenic concentrations in BP-07D2 were greater than the PCUL during Q3 (47.1 µg/L) and Q4 (32.9 µg/L). The results of groundwater monitoring in the three deeper wells indicate that the dissolved arsenic concentrations are greater than the PCUL at depths between approximately 70 to 80 feet bgs.

The arsenic contamination present in deep groundwater in the central portion of the Benson Subarea extends to deep groundwater in the Riverside Business Park Subarea. The groundwater gradient measured in the deep aquifer indicates that deep groundwater flow is predominantly from the Benson Subarea toward the Riverside Business Park Subarea and the Snohomish River (see Section 4.5.3 and Figure 4-11).

Two additional monitoring wells in the southern portion of the Benson Subarea (BP-09D and BP-10D) contained dissolved arsenic concentrations greater than the PCUL. The dissolved arsenic concentrations detected in BP-09D ranged from 22.4 to 26.1 µg/L. The dissolved arsenic concentrations detected in BP-10D ranged from 5.8 to 8.3 µg/L. The dissolved arsenic concentrations in BP-09D and BP-10D that are greater than the PCUL are generally bounded on the north, south, east and west by wells with dissolved arsenic concentrations below the PCUL. The dissolved arsenic concentrations were consistently less than the PCUL in monitoring wells BP-08D, LLMW-33D, LLMW-34D, LLMW-15D, LLMW-18D, LLMW-21D and LLMW-31D located north, south, east and west of BP-09D and BP-10D.

6.2.4.2. *Port of Everett Riverside Business Park Deep Groundwater*

Monitoring wells installed in the Riverside Business Park Subarea to monitor groundwater in the deep aquifer include LLMW-05D through LLMW-23D.

Dissolved arsenic concentrations in deep groundwater from the Riverside Business Park Subarea ranged from 0.3 µg/L to 2,120 µg/L during quarterly groundwater monitoring (Table 6-23). The highest dissolved arsenic concentrations in deep groundwater in the Riverside Business Park Subarea were detected in monitoring wells located east and downgradient of the highest concentrations detected in the Benson Subarea. The dissolved arsenic concentrations in monitoring wells LLMW-12D, LLMW-13D and LLMW-14D located on the west side of the subarea were consistently greater than the PCUL and ranged from 22.4 µg/L to 2,120 µg/L (Table 6-23 and Figures 6-13 through 6-16). The dissolved arsenic concentrations in monitoring wells LLMW-11D and LLMW-17D, located adjacent to the Snohomish River and east and downgradient of monitoring wells LLMW-12D, LLMW-13D and LLMW-14D and the Benson Subarea, were also greater than the PCUL. The dissolved arsenic concentrations in LLMW-17D were greater than the PCUL during all four quarters and during Q3 (8.3 µg/L) and Q4 (8.4 µg/L) for LLMW-11D.

The dissolved arsenic concentrations in deep groundwater from two monitoring wells located on the northern portion of the Riverside Business Park (LLMW-06D and LLMW-07D) were also greater than the

PCUL. The dissolved arsenic concentration in LLMW-06D was greater than the PCUL during Q1 (5.5 µg/L) and concentrations were greater than the PCUL in LLMW-07D during Q1 (5.9 µg/L) and Q2 (9.9 µg/L) (Table 6-23 and Figures 6-13 through 6-16). Monitoring well LLMW-07D is located adjacent to the Snohomish River. A seep sample (LLSP-05) collected from the Snohomish River shoreline adjacent to monitoring well LLMW-07D during monitoring in Q2 had a dissolved arsenic concentration (1.6 µg/L) that was less than the PCUL for protection of surface water in the Snohomish River.

The dissolved arsenic concentrations in deep groundwater from two monitoring wells located on the southern portion of the Riverside Business Park (LLMW-19D and LLMW-20D) were also greater than the PCUL. The dissolved arsenic concentrations in deep groundwater from LLMW-19D was greater than the PCUL during Q2 (16.2 µg/L), Q3 (25.9 µg/L) and Q4 (31.4 µg/L). The dissolved arsenic concentrations in LLWM-20D, located adjacent to the Snohomish River, ranged from 8.7 to 34.2 µg/L and were greater than the PCUL during all four quarters of groundwater monitoring. Monitoring wells LLMW-19D and LLMW-20D are located adjacent to the containment area at the Mill E / Koppers facility where wood was treated with chromated copper arsenate between 1948 and 1963. The dissolved arsenic concentrations were less than the PCUL in all of the wells surrounding LLMW-19D and LLMW-20D and between elevated arsenic concentrations on the Benson and Riverside Business Park Subareas (LLMW-15D, LLMW-16D, LLMW-18D, LLMW-21D and LLMW-22D).

6.2.4.3. *Snohomish County PUD Subarea Deep Groundwater*

Monitoring wells installed in the Snohomish County PUD Subarea to monitor groundwater in the deep aquifer include LLMW-04D and EV-22B.

Dissolved arsenic was detected at concentrations greater than the PCUL in deep groundwater at the Snohomish County PUD Subarea. Dissolved arsenic was detected at a concentration slightly greater than the PCUL in EV22B during monitoring in Q3 (5.1 µg/L) but was less than the PCUL during monitoring in Q1 (3.3 µg/L), Q2 (1.4 µg/L) and Q4 (1.7 µg/L) (Table 6-23 and Figures 6-13 through 6-16). Dissolved arsenic concentrations in groundwater from LLMW-04D were greater than the PCUL during monitoring in Q1 (31.1 µg/L) and Q4 (9.0 µg/L) and were at or less than the PCUL in Q2 (5.0 µg/L) and Q3 (1.5 µg/L).

6.2.4.4. *Shadow Development / Blunt Family Subarea Deep Groundwater*

Monitoring wells installed in the Shadow Development / Blunt Family Subarea to monitor groundwater in the deep aquifer include LLMW-01D, LLMW-02D and LLMW-03D.

Dissolved arsenic was detected at concentrations greater than the PCUL in deep groundwater at one monitoring well location (LLMW-01D) at the Shadow Development / Blunt Family Subarea. The dissolved arsenic concentration at LLMW-01D, located adjacent to the Snohomish River shoreline, ranged from 21.2 µg/L to 29.6 µg/L and was greater than the PCUL during all four quarters of monitoring (Table 6-23 and Figures 6-13 through 6-16). The dissolved arsenic concentrations in deep groundwater from LLMW-02D and LLMW-03D ranged from 0.3 µg/L to 2.4 µg/L during all four quarters of monitoring and were consistently less than the PCUL.

6.2.4.5. *Slope Subarea*

There are no monitoring wells in the Slope Subarea.

6.2.5. Groundwater Arsenic Speciation

6.2.5.1. *Introduction*

Arsenic speciation analysis was performed on groundwater samples from selected shallow and deep groundwater aquifer monitoring wells and surface water ponds in the Lowland Area during monitoring performed in Q2, Q3 and Q4. In general, sample locations were selected from the Benson, Riverside Business Park, and Snohomish PUD subareas (Figure 6-17). Not all locations were sampled every quarter. Specifically, EV-7B, LLMW-35D and LLMW-36D were not sampled during Q2 because they had not been installed and/or monitored until Q3 and LLMW-11S was dry during Q3 and Q4. Furthermore, as speciation data is more meaningful in samples with high arsenic concentrations, sampling was not performed during all quarters at shallow and deep well pairs where either well (i.e., shallow or deep monitoring well) had low arsenic concentrations which included BP-01, LLMW-04S, LLMW-05, LLMW-06, LLMW-08, LLMW-16, LLMW-25 and LLSW-01 or surface water monitoring locations with low arsenic concentrations which included LLSW-02.

The speciation analysis was performed on the dissolved arsenic fractions in groundwater and surface water samples to quantify the concentrations of arsenic species including:

- Arsenate or arsenic V (As V) which is arsenic in the +5 oxidation state;
- Arsenite or arsenic III (As III) which is arsenic in the +3 oxidation state; and
- Monomethylarsonic acid (MMA) and dimethylarsinic acid (DMA) which are organoarsenicals typically produced by biological organisms.

Arsenic speciation results are presented in Table 6-24 and shown on Figure 6-17. The arsenate ratios presented in the table and figure are calculated by dividing the arsenate concentration by the sum of arsenate and arsenite detected in each sample. Figure 6-17 presents the arsenate ratios, along with the total arsenic concentrations for the samples collected of shallow and deep groundwater and surface water in the Lowland Area.

The arsenate ratio is presented because it can be used along with other data (dissolved oxygen, Fe(II)/Fe(III) ratios, reduction/oxidation (redox) potential) as an indication of redox conditions. In general, oxidizing conditions favor the presence of arsenate (i.e., a higher arsenate ratio), while reducing conditions favor the presence of arsenite (low arsenate ratio). However, it should be noted that stable forms of As III are common in oxidizing waters and stable forms of As V are common in reducing waters (Henke, 2009). Arsenic chemistry is discussed further in Section 7.

The results of arsenic speciation analyses performed on samples of groundwater from the shallow and deep aquifers are described in the following sections. The results of arsenic speciation analyses on surface water samples is presented with the results for analyses of shallow groundwater.

6.2.5.2. *Shallow Aquifer Groundwater and Surface Water in the Lowland Area*

Arsenic speciation was performed on selected shallow groundwater and surface water samples (Table 6-24 and Figure 6-17). The total arsenic concentrations (sum of arsenate, arsenite, MMA, and DMA) detected in the speciation analyses in shallow groundwater ranged from 1.744 µg/L to 2,026 µg/L. Arsenate and arsenite were detected in all of the shallow groundwater samples. MMA was not detected in any samples of shallow groundwater and DMA was only detected in one sample (LLMW-04S). MMA and DMA are typically absent or only present in low concentrations in most natural waters (groundwater) (Henke, 2009).

Arsenic speciation was performed on surface water samples from monitoring locations LLSW-01, LLSW-02, LLSW-04 and LLSW-05 (Figure 6-17). The total arsenic concentrations detected in the speciation analyses on surface water ranged from 2.75 µg/L to 367 µg/L. Arsenate and arsenite were detected in all of the surface water samples. MMA was detected LLSW-01 in Q1, and DMA was detected in LLSW-01, LLSW-02, and LLSW-05. While DMA comprised less than one percent of sample LLSW-05, DMA comprised 12 percent of LLSW-02, and 48 percent of LLSW-01. MMA and DMA can be produced through biologic activity (Henke, 2009) and the presence of MMA and DMA in the surface water samples (and absence in groundwater samples) is anticipated.

Arsenate ratios in the shallow groundwater samples ranged from 7 percent to 97 percent. An evaluation of temporal changes in arsenate ratios was performed in wells sampled during two or three quarters to assess potential patterns. In Q2, arsenate ratios ranged from approximately 20 percent to 40 percent (median 30 percent) except for LLMW-11S, located near the Snohomish River shoreline, which had an arsenate ratio of 74 percent. In Q3, arsenate ratios ranged from 10 to 20 percent (median 23 percent) with the exception of BP-01S (71 percent), LLMW-06S (51 percent), and LLMW-13S (84 percent). In Q4, arsenate ratios were the most variable ranging from 9 percent to 97 percent (median 29 percent). Temporal changes in arsenate ratios could be due to changing redox conditions in the shallow aquifer, and/or biologic activity. For example, the low arsenate ratios observed in Q3 (comparatively abundant arsenite) could be due to higher groundwater temperatures and hence increased biologic activity. The Q3 sampling event occurred in August/September 2013, and was the sampling event when temperatures were highest. Sanders et al. (1994) observed extensive arsenic reduction in an otherwise arsenate-predominated estuary during the warmer months. Other potential causes for the observed temporal differences in arsenate ratios include aquifer redox changes due to seasonality differences including but not necessarily limited to precipitation differences and differences in the level of the water table.

In the shallow aquifer, arsenate ratios increased between sampling events in BP-01S, EV-6A, LLMW-06S, and LLMW-13S, decreased between sampling events in LLMW-05S, LLMW-08S, LLMW-12S, and LLMW-16S, and were variable in BP-04S, BP-05S, and BP-07S. The most consistent wells included LLMW-08S and LLMW-16S where arsenate ratios were typically within ten percent between Q2 and Q3. The least consistent wells included EV-6A and LLMW-13S, where arsenate ratios differed by approximately 60 to 70 percent between selected quarters.

Arsenate ratios in the surface water samples ranged from 50 to 98 percent (median 72 percent). The higher arsenate ratios in the surface water samples compared to arsenate ratios in the shallow aquifer is anticipated given the greater concentration of dissolved oxygen in the surface water samples (Section 6.2.6). As with groundwater from the shallow, the median arsenate ratios in surface water decreased between Q2 and Q3.

6.2.5.3. *Deep Aquifer Speciation*

Arsenic speciation was performed on selected deep groundwater samples (Table 6-24 and Figure 6-17). The total arsenic concentrations (sum of arsenate, arsenite, MMA, and DMA) detected in the speciation analyses in deep groundwater ranged from non-detect to 18,932 µg/L. Arsenate was detected in all of the groundwater samples in Q2 (17 samples), 11 out of 20 samples in Q3, and all of the samples in Q4 (13 samples). Arsenite was detected in 12 out of 17 samples in Q2, 14 out of 20 samples in Q3, and 10 out of 13 samples in Q4. MMA was not detected in the majority of samples; but where detected, (BP-07D, EV-19B, EV-20B, and LLMW-27D) it comprised only 0.4 to 0.5 percent of the samples. DMA was not detected in any samples.

Arsenate ratios in the deep groundwater samples ranged from 0 percent to 100 percent. In the deep aquifer, arsenate ratios were greater than approximately 90 percent in wells BP-05D, BP-07D, EV-19B, EV-20B, and LLMW-27D. BP-01D and LLMW-16D also had high arsenate ratios (100 percent). However, they were only sampled during one or two quarters, and the total arsenic concentrations (sum of arsenate and arsenite) in BP-01D and LLMW-16S were consistently very low (less than 0.283 µg/L). The wells with consistently high concentrations of arsenic and high arsenate ratios (BP-05D, BP-07D, EV-19B, EV-20B, and LLMW-27D) are located near to (and downgradient of) where arsenic concentrations are highest in groundwater from the deep aquifer and the source of deep groundwater contamination. Monitoring wells EV-19B, EV-20B and LLMW-27D have relatively high dissolved oxygen (3.4 to 9.6 mg/L) and redox potential (52 to 134.3 mV) compared to other deep wells. (By comparison, the single deep well to the west (LLMW-35D), and most deep wells to the east have low dissolved oxygen (typically less than 1 to 2 mg/L) and are generally reducing.) It is possible that the relatively high dissolved oxygen and redox potentials in EV-19B, EV-20B and LLMW-27D are responsible for the consistently high arsenate ratios observed in these wells. This will be discussed in Section 7. Another possible explanation for the high arsenate ratios in these wells may be an As V contaminant source in the adjacent Marine View Drive ROW.

Arsenate ratios decreased between sampling events in BP-04D, BP-05D2, LLMW-05D, LLMW-06D, LLMW-08D, LLMW-11D, LLMW-12D, and LLMW-36D; were consistent in BP-05D, BP-07D, EV-7B, EV-19B, EV-20B and LLMW-27D; and were variable in EV-6B, and LLMW-13D. Other wells were only sampled once or had very low total arsenic concentrations or were not detected. The most consistent wells included BP-05D, BP-07D, EV-19B, EV-20B, and LLMW-27D where the arsenate ratios were always greater than approximately 90 percent. The least consistent wells included BP-05D2, EV-6B, LLMW-05D, LLMW-06D, and LLMW-08D where arsenate ratios differed by approximately 30 to 80 percent amongst the various quarters.

6.2.6. Water Quality Parameters

Water quality parameters including pH, electrical conductivity, temperature, dissolved oxygen, oxidation/reduction potential, iron, and turbidity were measured in groundwater from each shallow and deep monitoring well location during all four quarters of monitoring. Salinity and total dissolved solids were also measured in groundwater during Q3 and Q4. The water quality parameter measurements are summarized in Tables 6-25 through 6-28. Selected parameters are discussed in the following sections.

6.2.6.1. *Shallow Aquifer Water Quality Parameters*

The measured values for water quality parameters in shallow groundwater were generally consistent over the four monitoring events.

The pH ranged from approximately 6 to 7 in shallow groundwater monitoring wells. The pH of groundwater from the monitoring well UNK on the Shadow Development / Blunt Family Subarea was consistently the highest at the Site with a pH ranging from 8.05 to 11.53.

The conductivity ranged from 2.79 to 2,158 mS/m in shallow groundwater. The median conductivity during each quarter ranged from 44 to 71 mS/m. The highest conductivity values were measured in monitoring well LLMW-22S in Q1 (720 mS/m) and Q2 (257 mS/m), in PZ-3B in Q3 (383 mS/m) and in LLMW-07S in Q4 (2,158 mS/m).

Median dissolved oxygen was generally less than 1 mg/L. Shallow wells with relatively high dissolved oxygen (greater than 3 mg/L) during the four quarters included:

- Q1: LLMW-33S (7 mg/L).
- Q2: BP-01S (5.62 mg/L); LLMW-11S (3.03 mg/L); LLMW-14S (7.68 mg/L); LLMW-17S (6.6 mg/L); and LLMW-33S (4.4 mg/L).
- Q3: BP-01S (3.9 mg/L); BP-06S (3.4 mg/L); LLMW-03S (3.2 mg/L); LLMW-10S (3.9 mg/L); LLMW-13S (3.8 mg/L); LLMW-16S (3.3 mg/L); LLMW-17S (8.8 mg/L); and PZ-3B (3.38 mg/L).
- Q4: PZ-3B (4.45 mg/L).

The shallow groundwater conditions were generally reducing, with median ORP ranging from -64 mV to -114 mV. Shallow groundwater in only seven wells had oxidizing conditions (EV-6A, LLMW-11S, LLMW-17S, LLMW-33S, LLMW-34S, PZ-2B and PZ-3B) during groundwater monitoring performed in Q1 through Q4.

Median turbidity was 7.2 NTU during Q1. However, median turbidity fell to less than 3.6 NTUs during subsequent quarters likely due to increased time between sampling and well installation activities.

Salinity during Q3 was generally less than 1 part per thousand (ppt) except at LLMW-22S (5.81 ppt), MW1501R (1.7 ppt), and PZ-3B (2.25 ppt). Salinity during Q4 was generally less than 1 ppt except at LLMW-07S (16.92 ppt), LLMW-08S (2.23 ppt), LLMW-22S (16.22 ppt), LLMW-23S, MW1202R (1.84 ppt), MW1501R (10.42 ppt), and PZ-3B (1.38 ppt).

6.2.6.2. *Deep Aquifer Water Quality Parameters*

The measured values for water quality parameters in deep groundwater were generally consistent over the four monitoring events.

The pH was generally in the range of approximately 5.5 to 8 at the majority of wells. The pH of groundwater was comparatively elevated in Q3 in LLMW-18D (11.22), LLMW-21D (9.72), and LLMW-35D (8.9).

Conductivity ranged from 9.3 mS/m to 660 mS/m. Median conductivity ranged from 38 to 60 mS/m during the four quarters.

Median dissolved oxygen was generally less than 0.8 mg/L. Dissolved oxygen was relatively high (2 to 10 mg/L) in wells EV-19B, EV-20B, LLMW-25D, LLMW-27D and LLMW-29D.

Groundwater in deep aquifer monitoring wells was generally reducing, with median ORP ranging from -75 mV to -100 mV. Nine deep wells were consistently oxidizing (1 to 151 mV) (EV-19B, EV-20B, LLMW-20D, LLMW-24D, LLMW-25D, LLMW-27D, LLMW-29D, LLMW-31D, and LLMW-33D).

Median turbidity was 12.3 NTU during Q1. However, median turbidity fell to less than 4.4 during subsequent quarters likely due to increased time between sampling and well installation activities.

Salinity during Q3 was generally less than 1 ppt except at EV-22B (2.45 ppt), LLMW-20D (3.6 ppt), and LLMW-22D (1.44 ppt). Salinity during Q4 was generally less than 1 ppt except at EV-22B (2.24 ppt), LLMW-07D (1.96 ppt), LLMW-08D 3.38 ppt), LLMW-20D (3.49 ppt), and LLMW-24D (1.43 ppt).

6.2.7. Conventional Parameters

Analysis for conventional parameters was performed on groundwater samples from selected shallow and deep groundwater aquifer monitoring wells and surface water ponds in the Lowland Area during monitoring performed in Q3 and Q4. Analysis of conventional parameters was performed on groundwater and surface water samples to quantify the concentrations of:

- Total organic carbon (TOC) and dissolved organic carbon (DOC). TOC and DOC are measures of the organic carbon content of water.
- Cations including calcium, magnesium, manganese, potassium and sodium. Cations are positively charged ions.
- Anions including chloride, nitrate, nitrite, phosphorus and sulfate. Anions are negatively charged ions.
- Alkalinity, carbonate, bicarbonate and hydroxide. Alkalinity, carbonate and bicarbonate comprise the carbonate system; along with hydroxide, they constitute a water's acid-neutralizing capacity.

The results of conventional parameter analyses are presented for monitoring performed during Q3 and Q4 in Tables 6-29 and 6-30, respectively.

Calcium, magnesium, potassium, sodium, chloride, sulfate, carbonate and bicarbonate data can be used to plot Piper diagrams which allow the compositions of many samples to be represented on a single figure to discern major groupings (Freeze and Cherry, 1979) as discussed below. Piper diagrams that plot the results for Q3 and Q4 are shown on Figures 6-18 through 6-21.

The results of analyses for conventional parameters performed on samples of groundwater from the shallow and deep aquifers are described in the following sections. The results of analyses for conventional parameter on surface water samples is presented with the results for analyses of shallow groundwater.

6.2.7.1. *Shallow Aquifer Groundwater and Surface Water Conventional Parameters*

Conventional parameter analyses were performed on shallow groundwater samples from selected Benson and Riverside Business Park Subarea monitoring locations listed in Tables 6-29 and 6-30.

Carbonate, hydroxide and nitrite were not detected in shallow groundwater samples collected during monitoring in Q3 and Q4. Nitrate and phosphorus were only detected in one or two samples at low concentrations (less than 0.3 mg/L as N or P). Alkalinity ranged from 109 to 578 mg/L as $CaCO_3$, and was in the form of bicarbonate. TOC ranged from 2.66 to 20.2 mg/L and was predominantly in the form of DOC as the TOC and DOC concentrations were similar. These results, as well as the results for the remaining conventional parameters were generally in the range expected for shallow groundwater, with the exception of elevated sodium and chloride in LLMW-08S (possibly due to a marine influence), and elevated iron in BP-01S, LLMW-05S, LLMW-13S and LLMW-16S (Tables 6-28 and 6-20). LLMW-16S in particular contained very high iron (94.2 mg/L in Q3 and 33.20 mg/L in Q4). Groundwater from LLMW-16S also had unusually high arsenic as discussed in Section 6.2.3.

Conventional parameter analyses were performed on surface water samples from monitoring locations LLSW-04 and LLSW-05 located in the Benson Subarea. Carbonate, hydroxide, nitrite and phosphorus were not detected in surface water samples and nitrate was only detected in one sample (Table 6-28). Alkalinity ranged from 16.5 to 140 mg/L as $CaCO_3$ and was in the form of bicarbonate. TOC ranged from 2.85 to 8.36 mg/L and was predominantly in the form of DOC. These results, as well as the results for the remaining conventional parameters were generally in the range expected for surface water, with the exception of low sodium and/or chloride in LLSW-04 and LLSW-05 during Q3. It is possible the low sodium and/or chloride was a result of the samples having been collected after a heavy rainfall when the surface water features were rain-diluted.

Shallow groundwater and surface water plot similarly in the Piper diagrams presented in Figures 6-18 and 6-19. The majority of shallow groundwater and surface water samples plot as *calcium bicarbonate* to *magnesium bicarbonate-type* (Freeze and Cherry, 1979) with the exception of LLMW-08S. LLMW-08S plots as *sodium potassium chloride-type.* LLMW-16S contains a higher proportion of magnesium than other samples of shallow groundwater and surface water.

6.2.7.2. *Deep Aquifer Groundwater Conventional Parameters*

Conventional parameter analyses were performed on deep groundwater samples from selected Benson and Riverside Business Park Subarea monitoring locations listed in Tables 6-29 and 6-30.

Carbonate, hydroxide and nitrite were not detected in deep groundwater samples collected during monitoring in Q3 and Q4. Nitrate and phosphorus were detected in approximately half the samples, typically at low concentrations (less than 1 to 2 mg/L as N or P). Alkalinity ranged from 91.8 to 395 mg/L as $CaCO_3$ and was in the form of bicarbonate. TOC ranged from 1.57 to 13 mg/L and was predominantly in the form of DOC as the TOC and DOC concentrations were similar. These results, as well as the results for the remaining conventional parameters were generally in the range expected for deep groundwater, with the exception of elevated sodium and chloride in LLMW-08D possibly due to a marine influence.

Deep aquifer groundwater in wells on and west of the Benson subarea generally plot as *calcium bicarbonate* to magnesium *bicarbonate-type*. Deep aquifer groundwater in wells on the Riverside Business Park subarea plot as *sodium bicarbonate to potassium-bicarbonate-type.* One possible explanation for the observed difference is that ion exchange is occurring as the groundwater moves toward the marine-influenced Snohomish River. Specifically, the groundwater is becoming enriched in sodium, as calcium and magnesium are removed from solution.

As expected, conventionals concentrations between quarters were most consistent in the deep aquifer, somewhat less consistent in the shallow aquifer, and least consistent in the surface water samples. These differences could be due to the extents to which changes in seasonal environmental conditions affect the different water regimes.

Most shallow/deep well pairs do not plot similarly; this suggests that the waters are not mixed. One exception is LLMW-08S and LLMW-08D which both plot as sodium chloride-type, typical of having a marine influence.

6.3. Surface Water and Stormwater in the Lowland Area

6.3.1. Introduction

This section presents the results for surface water sampling and analysis from ponds and wetlands and stormwater from basins in the Lowland Area. The surface water and stormwater results are described separately because contaminant sources and characteristics, exposure pathways and potential receptors are different for surface water and stormwater. Monitoring of stormwater and/or surface water was performed in 2013 and included sampling and analysis in Q1 through Q4.

Total and dissolved metals analyses were performed on the surface water and stormwater samples. The IHSs for surface water are arsenic and mercury. Arsenic was analyzed during Q1 through Q4 while mercury was analyzed during Q1 and Q2.

Table 6-31 presents the results for metals analyses on surface water and stormwater samples and compares the results to the PCULs. Table 6-32 presents the water quality parameter measurements for surface water and stormwater recorded during monitoring at the Site. The results of arsenic speciation for surface water in the Lowland Area was described in Section 6.2.5 and presented in Table 6-24.

Figure 3-3 identifies the locations where samples of surface water and stormwater were collected. Figures 6-8 through 6-11 present the results for dissolved arsenic concentrations in surface water and stormwater with the results for shallow groundwater in the Lowland Area. Figure 6-12 presents the results for total mercury in surface water and stormwater with the results for shallow groundwater, seeps and outfalls in the Lowland Area.

6.3.2. Metals in Surface Water in the Lowland Area

This section presents the results for arsenic and mercury analyses performed on samples collected from LLSW-01, LLSW-02 which are located in the Snohomish County PUD Subarea and LLSW-04 and LLSW-05 located on the Benson Subarea (Figure 3-3).

Dissolved arsenic was detected at concentrations greater than the PCUL for protection of surface water in the Lowland Area (150 µg/L) at LLSW-04 during Q1 (263 µg/L) and Q2 (486 µg/L), and at LLSW-05 during Q1 (233 µg/L) (Table 6-31 and Figures 6-8 through 6-11). Dissolved arsenic concentrations were substantially less the PCUL in samples collected from LLSW-01 and LLSW-02 located in the Snohomish County PUD Subarea.

Total mercury exceeded the PCUL (0.02 µg/L) at three surface water sampling locations during Q1 that included LLSW-02 (0.0217 µg/L), LLSW-04 (0.0234 µg/L) and LLSW-05 (0.413 µg/L) (Table 6-31 and Figure 6-12). The total mercury concentration in surface water from LLSW-02 was only slightly greater than the PCUL. The total mercury concentrations were less than the PCUL in surface water samples collected in Q2.

ASARCO reported total and/or dissolved arsenic results for surface water samples collected in 1999 (ASARCO, 2000). The arsenic results reported by ASARCO were comparable to the results obtained during this SRI.

6.3.3. Metals in Stormwater in the Lowland Area

This section presents the results for arsenic and mercury analyses performed on stormwater samples collected from LLSW-03, LLSW-06 and LLSW-07 which are located in stormwater basins in the Riverside Business Park Subarea (Figure 3-3). Stormwater is regulated under the NPDES program. However, the results for stormwater samples are compared to the PCULs to evaluate whether stormwater is a source of contaminants at the Site.

Arsenic and mercury were not detected at concentrations greater than PCULs in stormwater samples.

6.3.4. Arsenic Speciation Analyses on Surface Water

Arsenic speciation analysis was performed on surface water samples from monitoring locations LLSW-01, LLSW-02 during Q2 and LLSW-04 and LLSW-05 during Q2 and Q3. The results of arsenic speciation on surface water is presented in Section 6.2.5 with the results of arsenic speciation analyses on groundwater from the shallow and deep aquifers. The results of arsenic speciation analyses are presented in Table 6-24 and on Figure 6-17.

6.3.5. Surface Water and Stormwater Quality Parameters

Water quality parameters including pH, electrical conductivity, temperature, dissolved oxygen, oxidation/reduction potential, total and ferrous iron, and turbidity were measured in surface water and stormwater samples (Table 6-32). PH, electrical conductivity, temperature and dissolved oxygen were measured in all surface water and stormwater samples. Total and ferrous iron were measured during monitoring in Q1. Oxidation/reduction potential and turbidity were measured during Q1, Q3 and Q4.

The pH of surface water ranged from approximately 6.5 to 7.5 while the pH of stormwater ranged from approximately 5.5 to 6.5 (Table 6-32). Conductivity for both waters generally ranged from approximately 10 to 75 mS/cm. Dissolved oxygen in surface water and stormwater generally ranged from approximately 2 to 8 mg/L but was as high as approximately 11 mg/L in surface water and approximately 14 mg/L in stormwater samples. Oxidizing conditions were present in the surface water and stormwater samples as the oxidation/reduction potential ranged from approximately 2 to 160 mV.

6.3.6. Conventional Parameter Analyses on Surface Water

Analysis of conventional parameters was performed on surface water samples from monitoring locations LLSW-04 and LLSW-05 during Q3 and Q4. The results of conventional parameter analyses on surface water is presented in Section 6.2.5 with the results of arsenic speciation analyses on groundwater from the shallow and deep aquifers. The results of conventional parameters analyses are presented in Tables 6-29 and 6-30 and on Figures 6-18 and 6-19.

6.4. Sediment and Stormwater Solids in the Lowland Area

6.4.1. Introduction

This section presents the results for sediment from surface water ponds and wetlands, as well as stormwater solids from stormwater basins in the Lowland Area. The results for sediment are described separate from the results for stormwater solids at the Site because contaminant sources and characteristics, exposure pathways and potential receptors are different for sediment and stormwater solids. The results for sediment and stormwater solids are based on sampling and analysis performed during monitoring in Q2. The sediment and stormwater solids sampling locations were collocated with the surface water and stormwater sampling locations discussed in Section 6.3.

The analytical results from sediment and stormwater solids are compared to the PCULs which are based on protection of ecological receptors in the Lowland Area. Table 6-33 presents the results and compares the results to the PCULs. Figure 6-22 presents the results for arsenic and Figure 6-23 presents the results for mercury.

6.4.2. Metals in Sediment in the Lowland Area

This section presents the results for arsenic and mercury analyses performed on sediment samples collected from LLSD-01 and LLSD-02 which are located in the Snohomish County PUD Subarea and LLSD-03 and LLSD-04 located on the Benson Subarea (Figure 3-3). Arsenic and mercury are the IHSs for sediment in the Lowland Area (section 5.2).

The arsenic concentrations in sediment samples from LLSD-04 (219 mg/kg) and LLSD-05 (157 mg/kg) located in the Benson Subarea were substantially greater than the PCUL (20 mg/kg) (Table 6-33 and Figure 6-22). Elevated concentrations of arsenic were detected in soil, groundwater and surface water in the Benson Subarea.

The detected concentration of mercury (0.15 mg/kg) was greater than the PCUL (0.07 mg/kg) in the sample collected from LLSD-05 (Table 6-33 and Figure 6-23).

6.4.3. Metals in Stormwater Solids in the Lowland Area

This section presents the results for arsenic and mercury analyses performed on samples of stormwater solids collected from LLSD-03, LLSD-06 and LLSD-07 which are located in stormwater basins in the Riverside Business Park Subarea (Figure 3-3). The IHSs evaluated for stormwater solids are arsenic and mercury.

Arsenic was detected in all of the samples, ranging from 11.5 to 105 mg/kg µg/L. The arsenic concentration in the sample from LLSD-06 (105 mg/kg) was greater than the PCUL (20 mg/kg) (Table 6-33 and Figure 6-22). The mercury concentration (0.1 mg/kg) also exceeded the PCUL (0.07 mg/kg).

Sediment sampling was performed in 2012 at three locations in the Riverside Business Park Subarea. Two of the sample locations, #1 and #3, were very close to sampling locations LLSD-06 and LLSD-07, respectively. The results for #1 and #3 were comparable to results obtained at LLSD-06 and LLSD-07 (Appendix C).

6.5. Seeps and Outfalls on the Snohomish River Shoreline

6.5.1. Introduction

This section presents the results for sampling and analysis of water from seeps and outfalls that directly discharge into the Snohomish River on the shoreline of the Lowland Area. The results for seeps are described separate from the results for outfalls at the Site because the contaminant sources and characteristics, exposure pathways and potential receptors are different. The results for seeps and outfalls are based on sampling and analysis performed in Q2.

The analytical results from analysis of seep and outfall samples are compared to the PCULs which are based on protection of surface water in the Snohomish River. Table 6-34 presents the results for metals analyses on seep and outfall samples and compares the results for seeps and outfalls to the PCULs. Table 6-35 presents the water quality parameter measurements for water from seeps and outfalls recorded during sampling in Q2.

Figure 3-3 identifies the locations where seep and outfall samples were collected. Figure 6-24 presents the dissolved arsenic concentrations in seeps and outfalls on Snohomish River shoreline. Figure 6-12 presents the results for total mercury in seeps and outfalls on Snohomish River shoreline.

6.5.2. Metals in Seeps on the Snohomish River Shoreline

Seep sample locations include LLSP-03, LLSP-05, LLSP-06S and LLSP-08 which are located on the Shadow Development / Blunt Family and Riverside Business Park subareas (Figure 3-3). Arsenic and mercury are the IHSs for seeps on the Snohomish River shoreline.

Dissolved arsenic was detected at a concentration greater than the PCUL (5 µg/L) at LLSP-06 (6.7 µg/L) (Table 6-34 and Figure 6-24). LLSP-06 is located in the Riverside Business Park Subarea in proximity to monitoring wells LLMW-16S and PZ-3B which consistently had arsenic concentrations greater than the PCUL (Figures 6-8 through 6-11).

Total mercury was detected at concentrations greater than the PCUL (0.025 µg/L) at LLSP-05 (0.0278 µg/L) and LLSP-08 (0.0344 µg/L) located in the northern and southern portions of the Riverside Business Park Subarea (Table 6-34 and Figure 6-12). Total mercury was also detected in shallow groundwater at a concentration greater than the PCUL at monitoring well LLMW-22S (0.0351 µg/L) located in proximity to LLSP-08 (Table 6-13). Total mercury was not detected in shallow groundwater at concentrations greater than the PCUL in monitoring well locations in proximity to LLSP-05 (Figure 6-12).

6.5.3. Metals in Outfalls on the Snohomish River Shoreline

Outfall sample locations include LLO-02 through LLO-07 which are located on the Shadow Development / Blunt Family and Riverside Business Park subareas (Figure 3-3). Arsenic and mercury are the IHSs evaluated for outfalls.

Dissolved arsenic concentrations in all outfall samples except LLO-05 exceeded the PCUL of 5 µg/L, generally ranging between approximately 10 and 45 µg/L. Dissolved arsenic was detected at a concentration of 542 µg/L in the sample from LLO-07 located adjacent to the former Mill E / Koppers facility where wood was historically treated with chromated copper arsenate (Figure 6-24).

Total mercury was not detected in any outfall samples.

Outfall sampling was performed in 2005 at five locations (OF-1 through OF-5) in the Lowland Area. The results for outfall samples collected in 2005 were comparable to results obtained during this SRI (Appendix C).

6.5.4. Water Quality Parameters in Seeps and Outfalls

Water quality parameters including pH, electrical conductivity, temperature, dissolved oxygen and oxidation/reduction potential were measured in all samples of water collected from seeps and outfalls.

The pH of water from the seeps was approximately 7 while the pH of water from outfalls ranged from approximately 6.5 to 7 (Table 35). Conductivity of seep water generally ranged from approximately 40 to 75 mS/cm with the exception of water from LLO-03 which had a conductivity of 466 mS/cm. Conductivity of water from the outfalls generally ranged from approximately 50 to 90 mS/cm with the exception of water from LLO-05 which had a conductivity of 6.0 mS/cm. Dissolved oxygen in seep water ranged from approximately 3 to 6 mg/L while the dissolved oxygen in water from the outfalls ranged from approximately 6 mg/L to 8 mg/L with the exception of water from LLO-05 which had dissolved oxygen at approximately 11 mg/L. Reducing conditions were present in seep water as the oxidation/reduction potential ranged from approximately -40 to -300 mV. Reducing conditions were also present in water from the outfalls except at the two locations (LLO-02 and LLO-05) were the measured dissolved oxygen was the highest (Table 6-35).

6.6. Sediment on the Snohomish River Shoreline

6.6.1. Introduction

This section presents the results for sediment samples collected from the western shoreline of the Snohomish River in the Lowland Area. The results for sediment samples are based on sampling and analysis performed during monitoring in Q2. The sediment sampling locations were collocated with the seep and outfall sampling locations discussed in Section 6.5.

The analytical results from sediment analysis are compared to the PCULs for sediment from the Snohomish River shoreline, which are based on protection of human health and ecological receptors.

The results of metals analyses on sediment from the Snohomish River shoreline are presented in Table 6-36. Table 6-36 presents the results for metals analyses on sediment and compares the results to the PCULs. Figure 6-22 presents the results arsenic and Figure 6-23 presents the results for mercury in sediment on the Snohomish River shoreline.

6.6.2. Metals in Sediment on the Snohomish River Shoreline

The sediment sample locations include LLSD-11 and LLSD-13 through LLSD-21 (Figure 3-3). Sediment samples collocated with seep samples include LLSD-11, LLSD-14, LLSD-17 and LLSD-21. Sediment samples collocated with outfall samples include LLSD-13, LLSD-15, LLSD-16, LLSD-18, LLSD-19 and LLSD-20. Arsenic and mercury are the IHSs for sediment on the Snohomish River shoreline.

The arsenic concentrations in sediment samples from LLSD-13 (32.0 mg/kg), LLSD-15 (48.9 mg/kg) and LLSD-19 (837 mg/kg) were greater than the PCUL (20 mg/kg) (Table 6-36 and Figure 6-22), and were collocated with outfall samples (see Section 6.5.3).

The mercury concentrations in sediment samples from LLSD-21 (0.08 mg/kg) LLSD-13 (0.10 mg/kg), LLSD-16 (0.08 mg/kg) and LLSD-19 (0.16 mg/kg) were greater than the PCUL (0.07 mg/kg). The mercury concentrations in sediment samples from LLSD-21 and LLSD-16 (0.08 mg/kg) were only slightly greater than the PCUL (0.07 mg/kg) (Table 6-36 and Figure 6-23). Additionally, the concentration of mercury in the duplicate sample collected from location LLSD-11 (0.08 mg/kg in sample LLSD11-130429-DUP in Table 6-35) was also slightly greater than the PCUL.

Sediment sampling was performed in 2005 at five locations (OF-1 through OF-5) on the Snohomish River shoreline. The results for outfall samples collected in 2005 were comparable to results obtained during this SRI (Appendix C).

7.0 FATE AND TRANSPORT

This section describes the fate and transport of contaminants in the Lowland Area resulting from historical operations at the former Everett Asarco smelter facility. For the purposes of this report, the term fate is defined as the eventual disposition of a contaminant in the environment either by destruction or long-term deposition. Transport is defined as processes that move contaminants through the various media in the environment. The physical and chemical properties of source material(s) and the geochemical and environmental processes present at the Site ultimately control the fate and transport of contaminants in the Lowland Area.

Arsenic, in particular, is sensitive to environmental changes that influence the physical and chemical processes which control fate and transport. Arsenic cycles between As(III) and As(V) in response to changes in environmental conditions. Environmental conditions change more readily in the shallow groundwater aquifer and surface water compared to the deep groundwater aquifer. The shallow and deep groundwater aquifers are generally reducing which favors arsenite [As(III)], with the notable exception of deep groundwater in wells near the source area which is oxidizing and favors arsenate [As(V)].

The sources of contamination at the Site; environmental chemistry of arsenic, lead and mercury; and transport pathways are discussed in the following sections to describe the fate and transport of contaminants in the Lowland Area.

7.1. Contaminant Sources

Multiple contaminant sources resulting from the historical operation of the Everett smelter have been identified as potential contributors to contamination in the Lowland Area including the following:

1. Arsenic trioxide;
2. Flue dust;
3. Slag;
4. Exhaust emissions from smelter stacks; and
5. Soil and debris that has been contaminated by arsenic trioxide, flue dust, slag and stack emissions.

These sources are described below, including their physical and chemical properties.

7.1.1. Arsenic Trioxide

7.1.1.1. *Historical Site Sources of Arsenic Trioxide*

Arsenic trioxide was produced at the smelter from 1898 to 1912. Arsenic trioxide is a white crystalline powder that was a refined end-product of the smelting process. Annual arsenic trioxide production ranged between 300 and 1,400 tons (Society of Chemical Industry, 1904; Hydrometrics, 1995). The primary arsenic ore was arsenopyrite (FeAsS) (Hydrometrics, 1995).

Residual arsenic trioxide remained in the ground in the Upland Area at the time of the smelter's closure in 1912. The residual arsenic trioxide was discovered during investigation of the Site in the early 1990s. The arsenic trioxide was often found mixed with other smelter debris in and/or adjacent to the foundations of historical structures where the material was historically processed, handled and stored (ASARCO, 1998). Arsenic trioxide was most commonly discovered in the interior of the former "Fenced Area" and included the area where the former arsenic process dust chambers, bins, ovens, mill and kitchens were located (Figures 2-5 and 2-9). The cleanup of the Fenced Area was completed in the mid-2000s and focused on removal of arsenic trioxide.

7.1.1.2. *Chemical Characteristics of Arsenic Trioxide*

Arsenic trioxide has the chemical formula As_2O_3, and is approximately 76 percent arsenic by mass (760,000 mg/kg). A sample was previously collected from the former Fenced Area that was identified as residual arsenic trioxide (S-111 in Table 7-1). The total arsenic concentration in the sample was 727,000 mg/kg. The lead concentration was 26 mg/kg, and the mercury concentration was 0.5 mg/kg. Other metals were not detected. The oxidation state of arsenic in pure arsenic trioxide is +3 [As(III)]. However arsenic trioxide can weather (oxidize) over time, creating a solid that is a mixture of crystalline As_2O_3 and amorphous arsenic pentoxide (As_2O_5) (Hydrometrics, 1995). The oxidation state of arsenic in arsenic pentoxide is +5 [As(V)].

The solubility of arsenic trioxide ranges from 11.9 grams per liter at 0 degrees Celsius to 20.1 grams per liter at 25 degrees Celsius (11,900,000 to 20,100,000 µg/L) (Lide, 2005). The solubility of arsenic pentoxide is 658 grams per liter at 25 degrees C (658,000,000 µg/L) (Lide, 2005). These solubilities indicate small amounts of either arsenic trioxide or arsenic pentoxide are capable of causing elevated arsenic concentrations in water.

7.1.1.3. *Transport of Contaminants From Arsenic Trioxide Processing Facility*

During operation of the arsenic trioxide processing facility between 1898 and 1912, arsenic trioxide was likely spilled onto surfaces exposed to stormwater. The spilled arsenic trioxide likely dissolved in stormwater and arsenic was transported either as overland flow or upon infiltration into unpaved surfaces, as groundwater flow. As a result, arsenic was transported from the source area to Site media in the Marine View Drive ROW and Lowland Area.

After closure and demolition of the smelter, arsenic trioxide left on the ground likely continued to dissolve and cause arsenic to be transported in stormwater and groundwater. Earthwork occurred in and around the historical smelter site after closure, as well as increases in paved surface coverage. The Upland cleanup performed in the mid-2000s removed arsenic trioxide from the fenced area. However, elevated arsenic concentrations (approximately 40,000 mg/kg) remain in the area of the focused source area investigation. Arsenic dissolved in shallow groundwater in the focused source area flows down into deep groundwater in the Lowland Area.

7.1.2. Flue Dust

7.1.2.1. *Historical Site Sources of Flue Dust*

Flue dust was the precursor to arsenic trioxide at the Everett Asarco Smelter. Arsenic concentrations in flue dust are approximately 25,000 mg/kg and lead concentrations are less than 100 mg/kg (ASARCO, 1998). Flue dust was produced from the roasting ore for the production of arsenic trioxide at the Everett smelter.

Like arsenic trioxide, flue dust was historically spilled on the ground and remained in the ground after smelter closure. Flue dust was found mixed with other smelter debris in and/or adjacent to the historical foundations of structures where it was historically handled, processed and stored. The areas where flue dust was historically located were predominantly within the arsenic trioxide processing area/Fenced Area. However, an exhaust flue and dust chambers were also located outside of the Fenced Area within the current alignment of the Marine View Drive ROW at the location of the intersection of Marine View Drive and the Weyerhaeuser Bridge Access Road (Figures 2-5 and 3-5: ASARCO, 1998). A focused source area investigation was performed (Section 6.1.3.2) to evaluate whether materials associated with the former flue and dust chambers was a source to arsenic contamination in groundwater (Appendix A). Remnant debris (bricks and mortar) from the former flue and dust chamber structures is present at the Site and contains elevated arsenic concentrations indicating that flue dust is a source material within the investigation area.

7.1.2.2. *Chemical Characteristics of Flue Dust*

The physical characteristics of flue dust have not been previously described in environmental investigation reports prepared for the Site. However samples containing flue dust have been analyzed for arsenic and lead. The highest arsenic concentration measured in a sample containing flue dust was 28,579 mg/kg (TP-3, 3 to 4 feet bgs; Table 7-1). The lead concentration in the sample was 51 mg/kg. No other metals analyses were performed.

The solubility of flue dust is not known. However, SPLP testing has been performed on a sample of smelter debris that was identified to contain 'residual roasting plant flue dust' (TP-7 in Table 7-1). This sample had a total arsenic concentration of 10,644 mg/kg. SPLP leachate contained arsenic at a concentration of 9,100 µg/L. As part of the focused source area investigation SPLP testing was performed on a sample (LLSB-07 in Table 7-1) likely containing flue dust in debris. The sample was comprised of debris (bricks and mortar) that was collected from the alignment of an exhaust flue and dust chambers in the Marine View Drive ROW. The total arsenic concentration in the sample was 40,100 mg/kg. SPLP leachate from the sample contained arsenic at a concentration of 18,200 µg/L.

Based on the results of leachate testing on the samples of residual flue dust, a small amount of flue dust is capable of causing elevated arsenic concentrations in water.

7.1.2.3. *Transport of Contaminants From Flue Dust*

Similar to arsenic trioxide, flue dust was likely dissolved in stormwater and subsequently transported from the source areas in stormwater and/or groundwater, causing contamination of soil in the Marine View Drive ROW and/or Lowland Area. Water that would have provided a transport mechanism and been contaminated with dissolved arsenic originating from the flue dust includes stormwater in the Fenced Area and along the exhaust flue and dust chambers that were historically located in the Marine View Drive ROW, shallow groundwater in the Upland shallow aquifer and Lowland shallow and/or deep groundwater.

Flue dust is a historical source of contamination to the Lowland Area and is likely not currently present at the Site in its original form (dust or powder). Soil and debris that has been mixed with and contaminated by flue dust is a current source in the area where remnants of the historical flue and dust chamber debris is present in the Marine View Drive ROW. The flue dust contaminated soil and debris appears to periodically come into contact with groundwater flowing from the Upland area and therefore, provides an ongoing transport mechanism.

7.1.3. Slag

7.1.3.1. *Historical Site Sources of Slag*

Slag is a by-product of the lead smelting process. The main lead ores processed at the Everett smelter to produce lead bullion were galena (PbS) and jamesonite ($Pb_4FeSb_6S_{14}$). The relative proportion of metals present in slag was reported to be 75 percent zinc, 20 percent lead, 4 percent barium and less than a total of 1 percent for all other metals combined including, but not limited to, arsenic, cadmium, chromium, copper, mercury, nickel, selenium and silver.

The following description of slag was provided in the previous reports for the Site (Hydrometrics 1995; 2000):

> Slag is a by-product of the lead smelting process, and generally resembles a dark, fractured rock much like basalt. Its color ranges from gray to black, with occasional rusty surfaces due to oxidation of iron-bearing constituents. Slag is a hard material with a rough surface, and tends to break into sharp fragments when crushed. Its appearance can vary from massive to vesicular, the latter variety having been caused by entrapment of gas during the cooling process. The texture of slag can range from predominantly crystalline, which is the result of gradual cooling, to amorphous (vitrified or glassy) caused by rapid cooling.

During operation of the smelter, slag was poured down the slope east of the smelter from the Upland onto the Lowland Area in the area that is now identified as the Benson Subarea. A 'slag pile' was created that was approximately 25 to 35 feet thick. The approximate extent of slag in 1913 is shown in Figure 2-5. In the 1930s, after smelter operations had ceased, slag was excavated from the slag pile and used as fill in other areas. Additionally, a rock wool facility located in the Benson Subarea, used the slag as a feedstock for the production of rock wool, further reducing the volume of the slag pile. However, the rock wool operation also left a waste product consisting of fine slag globules ("shot") and short, needle-shaped slag particles (Section 2.4.2.1).

The quantity of slag that remains in the Benson Subarea is estimated to be 54,000 cubic yards (ASARCO, 2000). The estimated extent of the slag is shown in Figure 4-3 and the extent of slag is shown in cross section in Figures 4-4 through 4-6.

7.1.3.2. *Chemical Characteristics of Slag*

Various sampling events have shown that Everett Smelter slag contains arsenic at concentrations up to approximately 2,000 mg/kg and lead concentrations up to 25,000 mg/kg. Slag is a heterogeneous solid and therefore, has a range of solubilities. SPLP analyses for arsenic and lead were performed by Hydrometrics (1995) and ASARCO (1998) on samples of slag and crushed slag. The total arsenic concentrations in the samples ranged between 360 to 787 mg/kg. Arsenic concentrations in the SPLP analyses of the leachate ranged from non-detect (at a reporting limit of 100 µg/L) to 1,300 µg/L. The total lead concentrations in the slag samples ranged between 8,500 and 18,800 mg/kg and lead was not detected in SPLP analyses of the leachate at a reporting limit of 100 µg/L.

7.1.3.3. *Transport of Contaminants from Slag*

Slag is a current as well as a historical source of contamination to the Lowland Area. Approximately 54,000 cubic yards of slag is estimated to be present in the Benson Subarea. Slag has also been identified to be present on the northern portion of the Riverside Business Park Subarea at investigation location HP-47 where slag was likely used as fill. Due to burial, slag that is present in the Benson Subarea is in constant contact with shallow groundwater in the Lowland Area. A portion of the slag is also present at the ground surface on the slope east of Marine View Drive and is exposed to precipitation. At HP-47, slag was observed at a depth of 0.5 to 1.0 feet bgs. The slag and underlying soil was described on the boring log as dry or "moist to dry" indicating the slag was not in contact with groundwater.

7.1.4. Stack Emissions

7.1.4.1. *Historical Source of Stack Emissions*

Stack emissions occurred at the historical smelter facility between 1894 and 1912.

7.1.4.2. *Chemical Characteristics of Stack Emissions*

The physical and chemical characteristics of Everett Smelter stack emissions have not been described in previous reports. However, stack emissions would have likely consisted of mercury gases, as well as gases and particulate matter that contained elevated concentrations of arsenic, cadmium, and lead (Hutchinson and Meema, 1987). The form of the arsenic that was present in stack emissions would have been arsenic trioxide [(As_2O_3), As(III)] (Hutchinson and Meema, 1987).

7.1.4.3. *Transport of Contaminants by Stack Emissions*

Deposition from stack emissions were carried by the wind and contaminated the historic native surface surrounding the Smelter during the time of smelter operation. The predominant wind directions near the smelter were northeast and southwest (Ecology, 1999; Hydrometrics, 1995). The historic native surface in the Lowland area was subsequently covered with fill except in the Slope Subarea. The historic native surface is in constant contact with shallow aquifer groundwater except on the Slope Subarea where precipitation is periodically in contact with the historic native surface.

Stack emissions are a historical source of contamination. However, the soil contaminated by the stack emissions is a current source of contamination.

7.1.5. Contaminated Soil and Debris

7.1.5.1. *Historical Source to Contaminated Soil and Debris*

Shallow soil (fill, native surface soil and till) as well as debris in the Lowland Area and adjacent Marine View Drive ROW has become contaminated with source material or by contaminant transport from historical and existing sources at the Site. Elevated concentrations of arsenic, lead and mercury are present in soil and debris where residual source material (slag and/or stack emissions) is present in fill and native surface soil. Shallow soil have also become contaminated with elevated concentrations of arsenic where arsenic has been transported from sources to soil and debris downgradient of source material. The resulting contaminated shallow soil causes elevated arsenic concentrations in water as indicated by the results of SPLP and column leaching tests.

7.1.5.2. *Chemical Characteristics of Historically Contaminated Soil and Debris*

Fill and native surface soil in the Benson Subarea that is identified to contain slag has lead concentrations up to 11,500 mg/kg and arsenic concentrations up to 2,207 mg/kg (Table 6-2). SPLP testing was performed on samples containing slag that had arsenic concentrations ranging from 220 to 550 mg/kg. SPLP leachate from the samples contained arsenic at concentrations ranging from 110 to 1,400 µg/L (Table 7-1). As described in Section 6.2.3, lead was not detected in SPLP analyses of slag samples.

Elevated arsenic, lead and mercury concentrations were detected in native surface soil in the Lowland Area indicating deposition of smelter stack emissions. For example, at two locations in the Riverside Business Park Subarea (LLMW-14D and LLMW-15D) native surface soil contained arsenic at concentrations of 203 and 63.8 mg/kg, lead at concentrations of 395 and 105 mg/kg and mercury at 0.23 and 0.20 mg/kg, respectively. SPLP testing was performed on the samples from the two locations and leachate from the samples contained arsenic at concentrations of 130 and 106 µg/L (Table 7-1). SPLP testing was performed on an additional sample of native surface soil from the Benson Subarea with a total arsenic concentration of 300 mg/kg. SPLP leachate from the sample contained arsenic at a concentration of 335 µg/L.

Elevated arsenic concentrations were detected in fill and till in the Marine View Drive ROW located downgradient of the exhaust flue and dust chambers during the focused source area investigation. SPLP testing was performed on four samples collected from fill and till in the investigation area (Comp-1 through Comp-3 and LLSB-29-5.2-5.5) with arsenic concentrations ranging from 1,190 to 17,800 mg/kg. SPLP leachate from the samples contained arsenic at concentrations ranging from 6,380 to 10,500 µg/L. Column leaching studies were also performed on the three of the samples (Comp-1 through Comp-3) collected from downgradient of the flue and dust chambers. The arsenic concentrations in leachate from the column leaching studies ranged from 10,911 to 21,700 µg/L (Table 7-1). Arsenic concentrations in samples collected from the Marine View Drive ROW downgradient of the former Fenced Area range from 56 to 1,330 mg/kg. SPLP leachate from samples collected from the fill and till contained arsenic concentrations ranging from approximately 8 to 1,810 mg/kg (Table 7-1).

7.1.5.3. *Transport Of Contaminants Related to Historically Contaminated Soil and Fill*

Contaminated soil is a current and historical source at the Site. Contaminated soil is predominantly present in the Marine View Drive ROW and western portion of the Lowland Area adjacent to the former smelter where slag was deposited on the Site and where elevated concentrations of arsenic are present in soil. Additionally, stack emissions have contaminated the historical native surface over much of the Lowland Area. The saturated portions of contaminated soil in both the shallow and deep aquifers is in constant contact with groundwater. Contaminated soil is also subject to precipitation.

7.2. Environmental Chemistry

This section presents the environmental chemistry for arsenic, lead and mercury as the basis for describing the fate and transport of the IHSs in the Lowland Area.

7.2.1. Arsenic

The environmental chemistry for arsenic at the Site was previously presented in the Everett Smelter RI (Hydrometrics, 1995). That information has been supplemented with information from additional sources and is presented in this section (Henke, 2009).

Arsenic chemistry is complex. Arsenic bonds with a wide variety of other elements, producing inorganic and organic compounds with a range of mobilities.

Arsenic exists in the environment in four oxidation states that include +3, +5, 0 and -3. The two most common oxidation states are +3 and +5. Arsenic solids (e.g., ore, arsenic trioxide, arsenic pentoxide) and arsenic dissolved in water can change oxidation states in response to environmental redox conditions. However, the change is generally slow (Henke, 2009). Some ores can contain elemental arsenic (0 oxidation state) and very reducing conditions can create gaseous arsine (-3 oxidation state). However, 0 and -3 arsenic are unlikely to exist in appreciable amounts at the Site.

The main arsenic ore processed at the Everett smelter was arsenopyrite (FeAsS) and the main product was arsenic trioxide (As_2O_3; also known as arsenolite) which was produced from flue dust. Some crystalline or amorphous arsenic trioxide may also be present in slag. The oxidation state of arsenic in arsenic trioxide and flue dust is +3. Arsenic trioxide may be stable in dense subsurface soils where oxygen is not readily abundant. When exposed to oxygen (at the ground surface or in near-surface soils), some arsenic trioxide may weather to arsenic pentoxide (As_2O_5), although this process is slow. The oxidation state of arsenic in arsenic pentoxide is +5.

When arsenic solids (arsenic trioxide, arsenic pentoxide, etc.) dissolve in water, they form either arsenate (H_3AsO_4) and associated acid dissociation products (oxyanions including $H_2AsO_4^-$, $HAsO_4^{2-}$, and AsO_4^{3-}) or arsenite (H_3AsO_3) and associated acid dissociation products: (oxyanions $H_2AsO_3^-$, $H_2AsO_3^{2-}$, and AsO_3^{3-}). Whether arsenates or arsenites predominate in water depends on pH, redox, other chemicals present in the water and biologic activity. Typically, oxygenated waters favor arsenates, although biologic activity can maintain appreciable levels of arsenites. Reducing waters favor the presence of arsenite. Most natural waters contain both arsenate and arsenite. In one study of arsenic-spiked Lake Washington lake water, Vagliasindi and Benjamin (2001) reported that oxidation and reduction of arsenic seemed to be proceeding simultaneously.

Once dissolved in water, arsenic may remain dissolved or it may participate in biotic or abiotic reactions that remove it from water (Henke, 2009). Removal mechanisms include adsorption or absorption onto or into soil or other solids, precipitation, and co-precipitation. Adsorption refers to accumulation of arsenic on a solid surface, where the adsorbed material does not constitute a majority of the substance. Adsorption can occur through ion exchange, whereby an arsenic oxyanion displaces a compound on a solid surface. Compounds that may be displaced by arsenic are hydroxide, water, and other chemicals. Absorption refers to arsenic being assimilated into the interior of a solid. Absorption may occur when arsenic migrates into the pores of solids (Fetter, 1993) or when arsenic exchanges places with another atom within a mineral (Krauskopf and Bird, 1995). Adsorption and absorption are often difficult to distinguish, and are therefore treated together as sorption. Precipitation refers to dissolved arsenic species such as arsenate and/or arsenite oxyanions reacting with dissolved cations to form a relatively insoluble solid, with arsenic as a major component of the solid. Co-precipitation is when arsenic represents a minor element that sorbs into the lattices of other precipitating chemicals.

Materials onto/into which arsenic may sorb (adsorb/absorb) include soil and organic matter: aluminum, iron, and manganese oxides and hydroxides. These materials' affinity for arsenic tend to increase with increased surface area and increased positive surface charges. Clays in particular, can have a high affinity for arsenic. Soils have a maximum adsorption capacity which is closely related to the cation exchange capacity (CEC) and anion exchange capacity (AEC) of the soil. Laboratory studies have been performed on materials that adsorb (adsorbents) metals. In a review of studies of common adsorbents (minerals and metals), Chiban et al. (2011) found that maximum adsorption capacities for dissolved As(III) ranged from 30 micrograms As(III) per gram of adsorbent (equivalent to 30 mg/kg) to 30,000 micrograms As(III) per gram of adsorbent (equivalent to 30,000 mg/kg). Maximum adsorption capacities for dissolved As(V) ranged from 60 micrograms As(V) per gram adsorbent (60 mg/kg) to 50,000 micrograms As(V) per gram of adsorbent (50,000 mg/kg). The wide ranges indicate that arsenic sorption can vary considerably depending on the adsorbent.

At typical environmental pHs (4 to 9), the predominant arsenates expected to be in water include $H_2AsO_4^-$ and $HAsO_4^{2-}$ and the predominant arsenite expected to be in water is H_3AsO_3. As a general rule, the single and double negative charges on $H_2AsO_4^-$ and $HAsO_4^{2-}$ make these ions more likely to interact with other chemical species and sorb to solid materials. The zero charge on H_3AsO_3 makes it comparatively less likely to participate in sorption/chemical reaction and therefore, makes H_3AsO_3 (arsenite) generally more mobile in water.

Other materials compete with arsenic for sorption sites or cause surface chemistries to be less favorable for arsenic sorption. Dissolved anions such as phosphorous, sulfate, and silica, and dissolved organics such as fulvic acid (low-molecular-weight humic acids) are examples of materials that compete with arsenic or hinder arsenic sorption. The results of conventional testing at the Site do not indicate a definitive pattern when comparing arsenic concentrations to the concentrations of phosphorous and sulfate measured in selected wells during Q3 and Q4.

The processes described above represent movement of arsenic between solid and liquid phases and are reversible to varying degrees. Generally speaking, adsorption represents "loosely held" arsenic, absorption represents arsenic in a relatively stable solid phase, and precipitation/coprecipitation can represent permanent or near-permanent removal from water. Therefore, arsenic transport could be characterized as cycling between sorbed and aqueous phases due to seasonal or other environmental changes that affect pH, redox, concentrations of other chemicals present in the water, and biologic activity. More extreme environmental conditions are necessary for arsenic to cycle between the aqueous phase and being precipitated/co-precipitated.

In addition to the inorganic forms of arsenic discussed above, arsenic can be biologically transformed to various organic compounds. The most common organoarsenicals include monomethylarsenic acid (MMA) and dimethylarsenic acid (DMA). As discussed in Section 6, organoarsenicals were rarely detected in surface and groundwater at the site.

Volatile forms of arsenic include arsines, methyl-arsines, fluorinated arsenics, MMA and DMA. Of these, only arsines, methyl-arsines, MMA and DMA are expected to be present at the site. The volatile forms of arsenic are produced through biological activity (microbes and fungi).

7.2.2. Lead

The environmental chemistry for lead at the Site was previously presented in the Everett Smelter RI (Hydrometrics, 1995), and has been supplemented with information from additional sources and presented in this section (Weiner, 2008; AIHA, 2004).

In general, lead is less mobile than arsenic in the environment. Lead bonds with a wide variety of other elements producing inorganic and organic compounds.

Lead exists in the environment in three oxidation states that include +4 (tetravalent lead), +2 (divalent lead) and 0 (elemental lead). Of these, the +2 oxidation state is most common. Unlike arsenic, lead is unlikely to change oxidation states in response to typical environmental redox conditions. Tetravalent lead exists only under very oxidizing conditions and is unlikely to exist naturally in appreciable amounts at the Site. Elemental lead is also rare in the natural environment and is unlikely to exist in appreciable amounts at the Site.

The main lead ores processed at the Everett smelter were galena (PbS) and jamesonite ($Pb_4FeSb_6S_{14}$) and the main smelter products were lead bullion and gold/silver dorè bars. Slag was produced as a by-product of lead smelting. The relative proportion of metals in slag was reported to be 75 percent zinc, 20 percent lead, and 4 percent barium and less than a total of 1 percent for all other metals combined including, but not limited to, arsenic, cadmium, chromium, copper, mercury, nickel, selenium and silver. Lead sesquioxide, also known as lead trioxide, (Pb_2O_3 which is also written as PbO,PbO_2) (AIHA, 2004) has been identified in slag at the site. The oxidation states of lead in lead sesquioxide include +2 and +4. Other forms of lead suspected to be present at the Site include cerussite ($PbCO_3$) and anglesite ($PbSO_4$).

Lead is considered to have low to very low solubility or to be insoluble. Anglesite is considered to have low solubility and the solubility was reported to be 0.044 g/L at 25 degrees Celsius (44,000 µg/L) (Lide, 2005). The solubility of elemental lead in waters of varying hardness was reported to be 30 µg/L to 500 µg/L (Eisler, 2000). Other forms of lead do not readily dissolve in water under natural conditions and are considered to have low solubility or to be insoluble.

When lead does dissolve in water, it can form lead hydroxide [$Pb(OH)_2$], lead(II) carbonate ($PbCO_3$), lead(IV) carbonate [$Pb(CO_3)_2^{2-}$] or a variety of other compounds in which lead complexes with hydroxide (OH^-), chlorine (Cl^-), bicarbonate (HCO_3^-), and sulfate (SO_4^{2-}). These lead compounds may be relatively short lived, however, as lead readily forms insoluble precipitates with sulfur (S^{2-}), phosphate (PO_4^{3-}), or other anions. Lead sorbs easily onto soil or other solids and also readily precipitates and coprecipitates.

Widely distributed materials onto/into which lead sorbs (adsorb/absorb) include soil and organic matter: aluminum, iron, manganese oxides, and hydroxides. Like arsenic, these materials' affinity for lead tends to increase with increased surface area and increased positive surface charges.

The processes described above represent movement of lead between solid and liquid phases. In general, adsorbed lead can only be released back into water under highly acidic conditions. Precipitated or coprecipitated lead is even less likely to go into solution.

Volatile lead compounds include tetramethyl lead and tetraethyl lead. These are manufactured compounds that do not occur in nature; they are not expected to be present at the site as a result of the Smelter.

7.2.3. Mercury

The environmental chemistry for mercury at the Site was not previously presented in Everett Smelter reports. The description below is based on Lide (2005); USDOE (2008); EPA (2007); and Grieco (2007).

Mercury exists in three primary oxidation states; 0 (elemental mercury), +1 (mercurous) and +2 (mercuric). Elemental mercury is rarely found in nature. Mercury is most commonly found in a +2 oxidation state as the mineral cinnabar [mercuric sulfide (HgS)]. In addition to mercuric sulfide, common forms of mercury compounds found most often in the environment include mercuric chloride ($HgCl_2$), mercuric oxide (HgO, or montroydite), mercurous oxide (Hg_2O) and methyl mercury (CH_3Hg). Methyl mercury is most commonly formed when mercury enters soil or sediments and is acted upon by anaerobic microorganisms.

Mercury was likely released to the atmosphere as part of smelter operations as a result of burning fuels (coal or/or coke both of which often contain mercury) in the smelter power plant, furnaces, ovens, and roasters and from the roasting of ore for lead and arsenic trioxide production. Mercury is often present in coal in the form mercuric sulfide and it sublimates at furnace temperatures of 1,100^{0}F or greater. Mercury appears to primarily be present in historic native surface soil and shallow groundwater and to a lesser extent, fill soil in the Benson Subarea.

The solubility of mercury and compounds that contain mercury varies widely. Mercuric sulfide is considered to be relatively insoluble with a solubility value reported at less than 1 x 10^{-5} g/L (equivalent to less than 1.0 µg/L). Elemental mercury has a low solubility of 5.6 x 10^{-5} g/L (equivalent to 5.6 µg/L) whereas methyl mercury and mercuric chloride are considered to be very soluble in water with reported solubilities of 1.0 g/L and 69.0 g/L (equivalent to 1,000,000 and 69,000,000 µg/L), respectively.

Mercury and inorganic compounds containing mercury (HgS, $HgCl_2$, HgO, and Hg_2O) are typically strongly adsorbed to soil and sediment and desorb very slowly. Similar to arsenic, mercury adsorption is the accumulation of mercury on the surface of a solid where the adsorbed mercury does not constitute a majority of the substance. Clay minerals adsorb mercury ions best under slightly acidic conditions (pH ~6). Iron oxides generally adsorb mercury ions under neutral soil conditions (pH ~7). Most mercury ions are adsorbed by organic matter in acidic soils. When organic matter is not present however, mercury becomes relatively more mobile in soils (particularly acidic soils) and can leach to groundwater or evaporate to the atmosphere. TOC concentrations in nine samples of native surface soil and fill in the Lowland Area ranged from approximately 0.3 to 28.2 mg/kg. Dissolved organic carbon concentrations in shallow groundwater from the majority of 11 monitoring wells ranged between approximately 5 mg/L to 15 mg/L.

The adsorption capacity of soils with respect to mercury is not fully understood as most adsorbent studies relate to the development of treatment systems comprised of resin beds for municipal wastewater treatment.

Once dissolved in water, mercury compounds typically form electrochemically neutral complexes with water such as $HgCl_2O$, which leads to increased mobility in the media. In some aquatic systems biotic methylation appears to produce almost all the methyl mercury with sulfate-reducing bacteria serving as the primary facilitator of the methylation process. Degradation (demethylation) of methyl mercury is also controlled by microbial processes but photodegradation is also important within the photic (light reaching) zones of aquatic systems. The production (and degradation) of methyl mercury is complex, and is highly dependent on such factors as the availability of mercury(II), oxygen concentration, pH, redox potential, presence of sulfur compounds, salinity, sunlight, and the nature and presence of organic carbon and other organic and inorganic agents.

Elemental mercury is volatile. However, it is not expected to be present at the Site.

7.3. Transport Pathways

This section presents the transport pathways that move contaminants through the media in the Lowland Area. The transport pathways are further discussed as part of the Conceptual Site Model (Section 8.0).

7.3.1. Soil, Slag and Debris

Multiple sources have contributed contaminants to soil in the Lowland Area. Specific sources include disposal of slag in the Benson Subarea, deposition of stack emissions in the Lowland area as well as transport of contaminants to soil from groundwater. Physical processes that can transport contaminated soil include human disturbance and natural processes including movement by wind and water. Chemical processes described in Section 7.2 including sorption, precipitation and co-precipitation affect the transport of contaminants present in the soil.

Physical transport of contaminated soil, slag and debris resulting from smelter operations has historically occurred at the Site. Development of the Lowland Area included placing between approximately 5 and 10 feet of fill on the historical native surface of the Site. The fill is predominantly material dredged from the Snohomish River. Slag was historically deposited on the Benson Subarea, and a portion of the slag was removed for reuse elsewhere. Slag was identified in boring HP-47 at a depth of 0.5 to 1 foot bgs indicating that slag was reused as fill on the northern portion of the Riverside Business Park Subarea. Additionally, the boring logs for investigation locations EV-6A, SL-1, SL-3 and SL-4 in the western approach to the Weyerhaeuser Bridge Road indicate that soil containing smelter debris (brick) was used as fill to construct the western approach. The transport of contaminated soil, slag and debris caused elevated contaminant concentrations related to smelter operations in these two areas.

The filling that historically occurred, and development that has occurred more recently, has largely covered source material. Covering materials include dredged material, imported soil, pavement, and structures. Contaminant transport is reduced or eliminated in the covered areas. The historical native surface where deposition from stack emissions historically occurred is covered with fill and pavement or structures except in the Slope Subarea. Slag placed on the Benson Subarea is also largely covered by imported fill soil. However, slag is present at the surface of the slope on the western boundary, and soil with arsenic and lead concentrations greater than the PCULs is present at or near the surface of the Benson Subarea. Current development has included additional filling within the Benson and Riverside Business Park subareas to raise the existing surface elevation.

The areas where contaminated soil and/or slag are present at or near the surface are largely covered in vegetation or pavement reducing transport by erosion from wind and water. Relatively dense vegetation is present on the Slope and Benson subareas where arsenic and lead are present at concentrations greater than the PCULs. Asphalt and concrete pavement covers the Marine View Drive ROW where arsenic concentrations are greater than the PCUL. However, human disturbance (excavation etc.) could uncover, remove, or cause physical transport of contaminated soil and/or slag.

Contaminants present in soil, slag and debris could also be transported in water that comes in contact with these materials. Contaminants are retained in soil through sorption, precipitation, and co-precipitation processes. The analytical results for soil, groundwater and surface water indicate that lead and mercury sorb particularly strongly to soil in the Lowland Area. For example, lead concentrations in fill and slag from the Benson Subarea are up to approximately 25,000 mg/kg, while shallow groundwater dissolved lead concentrations in wells BP-01S through BP-10S are generally non-detect, or less than the PCUL. Similarly, where mercury is detected in soil it is rarely detected in dissolved form in groundwater. Arsenic is more likely to sorb and desorb from soil in response to changing environmental conditions. Additionally, soil has a maximum adsorptive capacity beyond which, contaminants would not be expected to continue to adsorb regardless of environmental conditions.

The results of the focused source area investigation highlight the differences in sorption mechanisms for arsenic and lead at the Site. Results indicate that arsenic and lead have been transported by water from debris in the exhaust flue and dust chamber alignment to fill and weathered till located downgradient of the debris. The transport of lead is limited to within several feet of the former structures. Arsenic found in soil away from the structures has been transported by water significantly farther than lead, with arsenic concentrations up to approximately 3,000 mg/kg in fill and weathered till up to 50 feet downgradient of the structures (Figure 6 in Appendix A). Arsenic concentrations are 400 mg/kg in alluvium at BP-06D approximately 1,000 feet from the focused source area investigation (Figure 6-7). Arsenic concentrations between approximately 3,000 and 5,000 mg/kg were detected in fill and weathered till downgradient of the flue and dust chamber structures which may indicate the maximum adsorptive capacity for fill and weathered till soils in the investigation area. Other soil in the Lowland Area is expected to have different maximum adsorptive capacities.

7.3.2. Groundwater

Multiple sources contribute contaminants to groundwater in the shallow and deep aquifers. Specific sources to shallow groundwater in the Lowland Area include slag and soil and debris that has been contaminated by arsenic trioxide, flue dust, slag and stack emissions. Specific sources that likely contribute contaminants to deep groundwater in the Lowland Area include slag and soil and debris that has been contaminated by flue dust and slag. Chemical processes including sorption, precipitation and co-precipitation affect release of contaminants from the sources to groundwater. Once contaminants are in shallow and deep groundwater, physical processes such as advection, dispersion, diffusion, mixing and dilution act to transport and attenuate the contaminants in shallow and deep groundwater.

Advection is the process of contaminants being transported within a moving medium such as groundwater. While being advected, contaminants are subjected to other physical processes including dispersion, diffusion, mixing and dilution. Dispersion is a transport process that results from contaminants traveling along flow pathways of differing velocities on a micro-scale. Diffusion results from contaminants moving from areas of higher concentrations to area of lower concentrations. Mixing is the process of two or more water sources interacting. Dilution in the shallow aquifer could occur as a result of precipitation infiltrating into the shallow aquifer. These physical processes do not reduce the overall load of contaminants but can affect the contaminant concentrations in groundwater. Contaminants in groundwater can be redistributed in soil as described in Section 7.3.1 or could discharge to surface water in the Lowland Area or the Snohomish River.

7.3.2.1. *Shallow Groundwater*

Advection and dispersion as well as diffusion and dilution are important physical transport processes in the shallow groundwater aquifer. The groundwater flow direction in the shallow aquifer was observed to be to the east / northeast and the groundwater velocity was estimated to be approximately 0.26 feet per day to 3.5 feet per day. The specific groundwater flow directions and velocities are expected to be variable due to the heterogeneity of the fill comprising the shallow aquifer, and potentially due to the presence of subsurface features or infrastructure (i.e., utilities, shoreline bulkheads, etc.). The physical effects of dispersion are supported by the observation of more diffuse and variable contaminant concentrations in shallow groundwater in comparison to the observation of an arsenic plume in the deep aquifer. Dilution is likely occurring as a result of precipitation infiltrating into groundwater within the shallow aquifer.

Lead and mercury are generally less mobile than arsenic in groundwater because lead and mercury readily sorb to solids. The extent to which arsenic is mobilized .and transported is dependent on geophysical parameters such as pH, redox, the presence of other chemicals in the water and biologic activity. Similar to the physical transport processes, chemical processes are likely more variable in the shallow aquifer due to the heterogeneity of the fill. Chemical processes occurring in the shallow aquifer can promote arsenic sorption to soil, reducing overall loading to discharge areas.

The analytical results for soil and shallow groundwater indicate that physical and/or chemical processes occurring in the shallow aquifer are affecting transport of arsenic, lead and mercury. Although elevated lead concentrations are present in fill and slag in the Benson Subarea, lead was infrequently detected in the dissolved fraction of groundwater at a concentration greater than the PCULs indicating that lead is adsorbed to solids. The results of analyses identify that lead is predominantly sorbed to solids as the total lead concentrations in shallow groundwater samples (samples that were not filtered) are substantially greater than the concentrations in the samples analyzed for dissolved lead.

Mercury was detected in fill, native surface soil and silt in the Lowland Area. However, mercury was infrequently detected in shallow groundwater. The results of analyses identify that mercury is predominantly sorbed to solids as mercury was more frequently detected in results for total mercury analyses than the results for dissolved mercury analyses.

The concentrations of arsenic in shallow groundwater indicate that physical processes (advection, dispersion, diffusion, and dilution) are transporting arsenic from the multiple sources present in the Lowland Area. Overall, the physical process of advection is transporting arsenic to the east / northeast based on the groundwater gradient in the Lowland Area.

7.3.2.2. *Deep Groundwater*

Advection and dispersion as well as diffusion, mixing and dilution are important physical transport processes in the deep groundwater aquifer. Contaminants are being advected from sources in the Marine View Drive ROW and Benson Subarea towards the Snohomish River. Groundwater flow in the deep aquifer is to the east / northeast and the groundwater velocity has been estimated to be approximately 0.18 feet per day to 2 feet per day. Physical processes such as dispersion, diffusion, mixing and dilution are acting to lower contaminant concentrations. Dispersion, mixing and dilution in particular are expected to have a greater effect on contaminants in the deep aquifer compared to the shallow aquifer because the deep aquifer is tidally influenced. In a tidally influenced aquifer, alternating flow directions and gradients can greatly increase contaminant dispersal. Furthermore, marine water enters the aquifer during the rising tide, causing mixing and dilution prior to discharge during the falling tide.

Physical and/or chemical processes occurring in the deep aquifer are affecting the transport of arsenic, lead and mercury. Lead and mercury did not exceed PCULs except in two samples. Results indicate that lead and mercury are predominantly sorbed to solids as total lead and mercury were more frequently detected than dissolved lead and mercury.

Physical processes are transporting arsenic from multiple sources present in Marine View Drive ROW and Benson Subarea to the east toward the Snohomish River. Dissolved arsenic concentrations for groundwater from the deep aquifer near the source areas and in the Benson Subarea range from approximately 1,000 µg/L to 18,600 µg/L. Elevated arsenic concentrations extend from Marine View Drive ROW east to LLMW-12D in the Riverside Business Park Subarea. Arsenic concentrations at LLMW-12D ranged from 1,670 µg/L to 2,120 µg/L during monitoring performed in 2013. Dissolved arsenic concentrations in deep groundwater diminish further to the east and were 22.4 µg/L to 82.7 µg/L at LLMW-13D, and 1.2 µg/L to 8.4 µg/L at LLMW-11D adjacent to the Snohomish River shoreline.

An evaluation of the estimated groundwater travel time between the source areas and Snohomish River and the actual plume migration rate supports that physical and/or chemical processes are attenuating arsenic in deep groundwater. Using the slowest estimated groundwater velocity rate of 0.18 feet per day, the groundwater travel time between the source area in the Marine View Drive ROW and the Snohomish River (approximate 2,000 feet) is approximately 30 years. It has been over 100 years since smelter closure in 1912, yet significantly elevated arsenic concentrations (are currently hundreds of feet from the river (LLMW-12D). The processes that are likely affecting transport of arsenic in the deep aquifer are sorption and mixing. Arsenic is observed to be adsorbing to soil downgradient of the source area in the Marine View Drive ROW.

The results of conventional analyses on samples of deep groundwater further support that physical and/or chemical processes are affecting the transport of arsenic in the deep aquifer. Piper diagrams for groundwater in the deep aquifer (Figures 6-20 and 6-21) indicate that deep groundwater in the Benson Subarea plots as *calcium bicarbonate/magnesium bicarbonate-type.* Deep groundwater in the Riverside Business Park Subarea plots as *sodium bicarbonate/potassium-bicarbonate-type.* One possible explanation for the observed difference in groundwater facies is that mixing and/or ion exchange is occurring. Arsenic and other compounds are likely undergoing ion exchange.

7.3.3. Surface Water in the Lowland Area

Surface water transport pathways include ditches and culverts, ponds, and wetlands. Surface water from the Lowland Area ultimately discharges to the Snohomish River through outfalls. Specific sources of contaminants to surface water include discharge of contaminated groundwater to surface water and release of contaminants from sediment.

Transport processes in surface water are similar to transport processes in shallow groundwater. Advection of contaminants occurs as surface water flows across the Lowland Area. Dispersion and diffusion also likely cause changes in contaminant concentrations in surface water. Surface water is also diluted by precipitation.

Chemical processes including sorption, precipitation, and co-precipitation also affect contaminant transport in surface water. Similar to groundwater, lead and mercury are generally less mobile in surface water compared to arsenic. Lead and mercury sorb particularly strongly to soil and sediment in the Lowland Area. Surface water is generally more oxidizing than groundwater favoring the formation of arsenate as opposed to arsenite. The surface water samples collected in the Lowland Area and analyzed for arsenic speciation support the formation of arsenate in surface water. Arsenic present in surface water samples were comprised of approximately 50 to 100 percent arsenate. Arsenate is generally less mobile than arsenite. Sorption, precipitation and co-precipitation of contaminants present in surface water can reduce overall loading to discharge areas.

7.3.4. Sediment

This section describes the transport of contaminants in sediment in surface water features in the Lowland Area (ponds and wetlands) and sediment in the Snohomish River adjacent to the Site. Chemical processes that occur in sediment that affect contaminant transport include sorption, precipitation and co-precipitation.

7.3.4.1. *Sediment in the Lowland Area*

The sources of contaminants to sediment in ponds and wetlands in the Lowland Area include contaminated groundwater discharging to sediment, contaminated stormwater runoff coming into contact with sediment and erosion of contaminated soil.

Analytical results indicate that lead and mercury sorb particularly strongly to sediment in the Lowland Area. Lead was detected in sediment at most sample locations but was only detected at low concentrations in the overlying surface water except where the lead concentration was significantly elevated. The highest lead concentration measured in sediment within the Lowland Area was 532 mg/kg at sample location LLSD-05 in the Benson Subarea. The overlying water sample LLSW-05 contained dissolved lead at 2.3 µg/L. A comparison of the results for mercury in sediment and dissolved mercury in the overlying water at sediment sampling locations in the Lowland Area indicates the same pattern. At six sampling locations, mercury was detected in sediment, but dissolved mercury was not detected in overlying water. Similar to lead, only where the mercury concentration is significantly elevated is mercury present in dissolved water analyses. For example, the mercury concentration in sediment at LLSD-05 was 0.15 mg/kg and the mercury concentration in the overlying water sample LLSW-05 contained dissolved mercury at a concentration of 0.0291 µg/L.

Sorption / desorption of arsenic from sediment is dependent upon arsenic solubility and environmental conditions including, but not limited to, pH, redox, concentrations of other chemicals present in water in contact with sediment and biologic activity. These parameters have not been measured directly in sediment. However, the pH and redox of the overlying water was measured at all sediment sampling locations. Surface water samples were generally oxidizing which is favorable for the presence of arsenate. Arsenic speciation results were consistent with oxidizing conditions as arsenate comprised 50 to 100 percent of the surface water samples. The pH of overlying water was in the range of 6 to 7.7 at all sediment sampling locations. The pH conditions measured in the overlying water appear to be favorable for arsenate sorbing to sediment.

Sediment containing arsenic, lead and mercury can be transported as a result of being entrained in water. Sediment entrainment in surface water in the Lowland Area is likely to be low in ponds and wetlands a majority of the time given the low surface water gradient and high amount of vegetation in ponds and wetlands at the site which inhibits rapid water movement. However, entrainment may periodically occur in surface water in the Lowland Area during large storm events that cause rapid water movement.

7.3.4.2. *Sediment on the Snohomish River Shoreline*

The sources of contaminants to sediment on the Snohomish River shoreline include contaminated groundwater discharging to sediment, contaminated water discharging from outfalls on the shoreline of the Snohomish River, and erosion of contaminated soil (native surface soil) from the shoreline.

The analytical results for sediment and dissolved metals concentrations in co-located seep samples indicate that lead and mercury sorb particularly strongly to sediment on the Snohomish River shoreline. Lead was detected in sediment at most sample locations along the Snohomish River but was only detected at low concentrations in the seep water. Median lead concentrations in sediment and dissolved lead in seep water were 9 mg/kg and 0.1 µg/L, respectively. A comparison of the results for mercury in sediment and dissolved mercury in seep water indicates a similar pattern at the majority of sample locations. Mercury was detected at three out of five sediment sampling locations, but dissolved mercury was only detected in one seep sample.

Sorption/desorption of arsenic from sediment is dependent upon arsenic solubility and environmental conditions including, but not limited to, pH, redox, concentrations of other chemicals present in water in contact with sediment and biologic activity. Similar to Lowland Area sediment, Snohomish River sediment has not been tested for environmental parameters like pH, redox, and biologic activity. However, the dissolved arsenic concentrations were low at all seep sample locations. Concentrations were less than 5 µg/L at 4 out of 5 locations, and 6.7 µg/L at one location.

Transport of sediment from the shoreline of the Snohomish River due to entrainment in water likely occurs during large storm events.

7.3.5. Air

The transport of contaminants in air resulting from stack emissions was a historical transport pathway that caused deposition of contaminants in soil in the area surrounding the smelter onto the historic native surface. Currently there are two processes that could result in the transport of contaminants in air that include resuspension of contaminated soil particles and volatilization of metals. As discussed in Section 7.2, the only volatile metal likely to exist at the site is arsenic, specifically in the form of arsine, methyl-arsines, MMA or DMA.

The majority of the Lowland Area has been covered with fill. The fill prevents resuspension of contaminated soil particles. The areas not covered by fill include the Slope Subarea and an area where slag is present on the slope in the Benson Subarea. Metals concentrations on the Slope subarea are relatively low and there is abundant vegetative cover. Therefore, resuspension of contaminated soil particles is not a significant transport pathway in this area. Metals concentrations in slag present on the slope in the Benson Subarea are relatively high. However, the exposed slag is not subject to resuspension because it is essentially a rock-like material.

Volatilization of arsenic (arsine, methyl-arsines, MMA and DMA) is the result of microbial and/or fungal activity that produces gaseous arsenic compounds. Production of gaseous arsenic compounds is slow: Multiple researchers have found that less than 0.5 percent of arsenic in various media is volatilized by microbial activity even after 30 days of laboratory incubation (Turpeinen et al., 2002; Gao and Burau, 1997; Huang et al., 2012). The low concentrations of MMA and DMA in shallow groundwater and surface water samples collected from the Lowland Area is in agreement with the findings from the research. MMA and DMA were typically not detected in shallow groundwater at the site. MMA and DMA were detected surface water samples but at low concentrations up to 1.44 µg/L.

8.0 CONCEPTUAL SITE MODEL

This section presents the conceptual site model (CSM) for the Lowland Area. The CSM identifies potential or suspected sources of hazardous substances, types and concentrations of hazardous substances, potentially contaminated Site media, actual and potential exposure pathways, and receptors (WAC 173-340-200). The CSM provides the basis for evaluating the contamination from specific sources and transport pathways, and identifies exposure pathways that pose a potential risk to receptors. The CSM for the Lowland Area Site is graphically depicted in Figures 8-1 and 8-2. Figure 8-1 shows potential sources of contamination and transport pathways. Figure 8-2 shows the associated exposure pathways and receptors.

The following sections summarize the geology and hydrogeology that serves as a basis for the identified transport pathways and also presents the sources of contamination, transport, exposure pathways, and receptors.

8.1. Geology

As described in Section 4.2, the near surface geology of the Everett Smelter Site (less than 500 foot depth) is the result of two distinct processes, glacial and fluvial. The near surface geology in the Upland Area is the direct result of glacial processes and glacial deposits and the near surface geology in the Lowland Area is the result post-glacial alluvial processes. The contact between the two is generally the boundary between the Upland and Lowland Areas. The following sections summarize the geology of the Upland and Lowland Areas to support identification of transport pathways at the Site.

8.1.1. Upland Area Geology

The geology of the Upland Area is comprised of the following stratigraphic units (Figure 4-4):

- Fill consisting of sand to silty sand with varying amounts of gravel as well as debris in areas is present from the surface to depths ranging from several feet in the western portion of Marine View Drive ROW to approximately 20 feet on the eastern portion of the Marine View Drive ROW.
- Weathered till consisting of sand with silt to silty sand with varying amounts of gravel is present beneath the fill and is approximately 3 to 6 feet thick.
- Till consisting of dense to very dense sand with silt to silty sand with varying amounts of gravel is present beneath the weathered till and is approximately 40 feet thick on the western portion of the Marine View Drive ROW and 3 feet thick on the eastern portion of the Marine View Drive ROW.
- Outwash consisting of dense sand is present beneath the till.

8.1.2. Lowland Geology

The geology of the Lowland Area is generally comprised of the following stratigraphic units (Figures 4-4 through 4-8):

- Fill that includes the following:
    - Slag, fill mixed with slag and/or sand to silty sand with varying amounts of gravel and debris. The fill is located in the Benson Subarea and is generally 10 to 15 feet thick but up to approximately 50 feet thick at the western bridge abutments for Pacific Highway and Weyerhaeuser Bridge Road.

- Silty sand to sandy silt comprised largely of dredge fill, occasionally containing wood debris. The fill is located in the eastern portion of the Lowland Area outside the Benson Subarea and is generally 7 to 15 feet thick.

- Silt beneath the fill that ranges from 1 to 13 feet thick that is soft and moist and that contains trace to occasionally abundant organics. Up to one foot of peat is present at the surface of the silt. The peat/silt surface is native surface.
- Channel deposits consisting of sand beneath the fill is located in the western portion of the Lowland Area.
- Alluvium beneath the silt and channel deposits consisting of loose to dense sand with trace silt in the in the upper portion, and interbedded sands and silts in the lower portion that extends to depths greater than 100 feet bgs.

8.2. Hydrogeology

As described in Section 4.3, the hydrogeology of the Everett Smelter Site includes four aquifers. The aquifers include a shallow aquifer and a deep aquifer in the Lowland Area and a shallow and deep aquifer in the Upland Area. The shallow and deep aquifers in the Upland Area discharge to the shallow and deep aquifers in the Lowland Area, respectively. The following sections summarize the hydrogeology of the Upland and Lowland Areas to support identification of transport pathways at the Site.

8.2.1. Upland Hydrogeology

The hydrogeology of the Upland Area consists of the following (Figure 8-1):

- A shallow unconfined aquifer in the fill and weathered till. The aquifer is only periodically saturated, likely immediately following storm events. As such, groundwater “flow” in the aquifer is considered “transient” flow (lasting for a short time). When flowing, groundwater travels laterally and downslope to the east toward the Lowland Area and discharges to the aquifers in the Lowland Area. The estimated “groundwater velocity” in the shallow aquifer is 0.14 ft/day[1]. The transient groundwater discharges to the Lowland Area as follows:
    - Into the outwash and vertically downward to groundwater in the deep aquifer present in the outwash, approximately 50 feet bgs. This is shown as Pathway #1 in Figure 8-1.
    - Shallow subsurface flow to groundwater in the shallow aquifer in the Lowland Area. This is shown as Pathway #2 in Figure 8-1.
- A confining layer comprised of till between the shallow and deep aquifers.
- A deep unconfined aquifer in outwash beneath the till. The aquifer is recharged to a small degree by discharge from the shallow aquifer, but predominantly from recharge in other areas of Everett including but not limited to the Everett Smelter Site. Groundwater flows east and discharges to the deep aquifer

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[1] Typically groundwater velocity is not calculated for unsaturated conditions. However, the groundwater velocity in the shallow aquifer has been estimated to be 0.14 ft/day based on the following information and methodology. Hydrometrics (1995) performed slug tests on monitoring wells including well EV-1 in the shallow till located on the west side of the Upland Area. Hydraulic conductivity of the shallow till was estimated to be 0.3 ft/day. Applying this value to the gradient of the fill/weathered till contact between EV-13 and EV-20, and assuming a porosity of 0.25, yields a groundwater velocity of 0.14 ft/day. This velocity is an estimate due to the uncertainty associated with the available information.

in the Lowland Area and possibly to the shallow aquifer in Lowland Area. The groundwater flow velocity in the deep aquifer is estimated to be 0.04 feet per day.

8.2.2. Lowland Hydrogeology

The hydrogeology of the Lowland Area consists of the following (Figure 8-1):

- A shallow unconfined aquifer in the fill. The aquifer is recharged by precipitation and by groundwater from the Upland Area shallow and deep aquifers. Groundwater flows generally east / northeast and discharges to surface water features in the Lowland area (ponds, ditches and wetland) and the Snohomish River. The groundwater flow velocity in the shallow aquifer varies from 0.26 to 3.5 feet per day.
- A confining layer comprised of silt between the shallow and deep aquifers.
- A deep confined aquifer in the alluvium beneath the silt. The aquifer is recharged to a small degree by the shallow aquifer in the Upland Area, and recharged to a greater degree by the Upland Area deep aquifer. Groundwater is tidally influence including periodic gradient reversals. However, groundwater generally flows east / northeast and discharges to the Snohomish River. The groundwater flow velocity in the deep aquifer is estimated to be 0.18 to 2 feet per day.

8.3. Sources of Contamination

Contaminant sources to the Lowland Area from former smelter operations include debris and soil in the Marine View Drive ROW, slag, aerial deposition and contaminated soil. The following sections summarize the sources of contamination to support the description of the CSM for the Site. The contaminant sources are shown on Figures 8-1 and 8-2.

8.3.1. Contaminated Soil in the Marine View Drive ROW

The highest arsenic concentrations present at the Everett Smelter Site are in remnant debris and soil within the historical alignment of flue and dust chamber structures within the Marine View Drive ROW identified as part of the focused source area investigation. The maximum arsenic concentration measured by XRF was 35,100 mg/kg (Table 6-10). Additionally, the maximum arsenic concentration at 43 out of 44 locations in the investigation area was greater than 1,000 mg/kg. Soil with arsenic concentrations of approximately 1,000 mg/kg are present at depths of up to 18 feet bgs. Soil in the Marine View Drive ROW exceeded the PCUL for arsenic (88 mg/kg) in every boring and from the majority of sampling intervals. SPLP and column leaching tests indicate that the soil readily leaches arsenic at concentrations up to 21,700 μg/L. The remnant debris and soil within the historical alignment of flue and dust chamber structures within the Marine View Drive ROW is the likely source of elevated arsenic concentrations in groundwater in the Lowland Area deep aquifer and potentially contributes to elevated arsenic concentrations in the Lowland Area shallow aquifer (described further in Sections 8.4.1 and 8.4.3).

Lead concentrations were also elevated in the soil samples collected from Marine View Drive ROW as high as 15,100 mg/kg. The PCUL for lead (1,000 mg/kg) was exceeded in over half of the borings completed, typically in a narrow depth interval (Table 6-10).

Arsenic was also detected at concentrations greater than 1,000 mg/kg in multiple locations along the Marine View Drive ROW (EV-13, SP-26, LLMW-27D, EV-11, SP-23, EV-10, SP-22 and SP-21) adjacent to the focused source area. The samples of soil with arsenic and lead concentrations greater than the PCULs were present beneath asphalt and concrete pavement in the Marine View Drive ROW.

8.3.2. Slag in the Benson Subarea

The highest lead concentrations present at the Everett Smelter Site have been identified in samples of slag collected from within the Benson Subarea. The slag contains lead concentrations as high as 24,230 mg/kg and frequently contains lead up to 15,000 mg/kg (Table 6-2 and Figure 6-4). Soil in the Benson Subarea exceeds the PCULs for lead in the majority of investigation locations and often at every soil interval.

Arsenic concentrations are elevated in the slag and range from 124 mg/kg to 1,344 mg/kg (Table 6-2). Soil in the Benson Subarea exceeds the arsenic PCULs in the majority of investigation locations and often at every soil interval.

Mercury comprised a small proportion of the metals present in slag (Section 7.1.3). Mercury concentrations detected in slag ranged from 0.1 to 0.5 mg/kg but do not exceed the PCULs in the Benson Subarea.

Analytical results indicate that slag is capable of leaching arsenic and lead to groundwater, however not as readily as soil. Detected arsenic concentrations in SPLP tests on slag were 410 to 1,300 µg/L. Lead was not detected (at reporting limit of 100 µg/L) in the results of SPLP testing on three slag samples. However, the results of analyses on groundwater for dissolved lead from monitoring well EV-6A, which is screened in slag, contained dissolved lead at concentrations ranging from 24.9 µg/L to 103 µg/L. However, dissolved lead was not frequently detected and when detected, concentrations were relatively low in the majority of Benson Subarea wells.

8.3.3. Aerial Deposition

Aerial deposition was a historical source and ceased with the closure of the Everett Asarco Smelter (1912). The historical native surface around the smelter was contaminated with arsenic, lead and mercury by aerial deposition. Arsenic concentrations at the historical native surface generally ranged from greater than 20 mg/kg to 313 mg/kg. At two locations in the Riverside Business Park Subarea (LLMW-14D and LLMW-15D) native surface soil contained arsenic at concentrations of 203 and 63.8 mg/kg, lead at concentrations of 395 and 105 mg/kg and mercury at 0.23 and 0.20 mg/kg, respectively. SPLP testing was performed on the samples from the two locations and leachate from the samples contained arsenic at concentrations of 130 and 106 µg/L (Table 7-1). SPLP testing was performed on an additional sample of native surface soil from the Benson Subarea with a total arsenic concentration of 300 mg/kg. SPLP testing of the leachate from the sample contained arsenic at a concentration of 335 µg/L.

8.3.4. Contaminated Soil

Soil in the Lowland Area has become contaminated with source material or by contaminant transport from historical and existing sources at the Site. Elevated concentrations of arsenic, lead and mercury are present in soil and debris where residual source material is present in fill and/or at soil at the historical native surface. Shallow soil (fill, native surface soil and till) is contaminated where arsenic has been transported from sources to soil downgradient of source material. The resulting contaminated shallow soil causes elevated concentrations of arsenic in water as indicated by the results of SPLP tests.

8.4. Transport Pathways

Groundwater, surface water, and sediment transport pathways are described in this section and shown on Figure 8-1. The transport pathways applicable to each media are presented in the following sections to support the description of the CSM for the Site.

8.4.1. Shallow Groundwater

Shallow groundwater is contaminated with arsenic and to a lesser extent lead and mercury. The concentrations of dissolved arsenic and lead and total mercury were greater than the PCULs in groundwater samples collected from the shallow aquifer in the Lowland Area. Specific contaminant transport pathways involving shallow groundwater include the following:

- Transport of contaminants from soil and debris in the Marine View Drive ROW in transient shallow groundwater flow followed by lateral and downward migration to groundwater in the shallow aquifer in the Lowland Area (Pathway 1 in Figure 8-1).
- Transport of contaminants from soil and debris in the Marine View Drive ROW in transient shallow groundwater flow followed by lateral and downward migration to groundwater in the deep aquifer (Pathway 2 in Figure 8-1).
- Transport in shallow groundwater through channel deposits to deep groundwater (Pathway 3 in Figure 8-1).
- Transport in shallow groundwater discharging to sediment and/or surface water in the Lowland Area (Pathway 6 in Figure 8-1).
- Transport of contaminants from slag or fill mixed with slag in shallow groundwater toward the Snohomish River (Pathway 8 in Figure 8-1).
- Transport from historical native surface soil in shallow groundwater toward the Snohomish River (Pathway 10 in Figure 8-1).
- Infiltration of contaminated shallow groundwater into underground pipes and discharge to the Snohomish River shoreline (Pathway 11 in Figure 8-1).
- Discharge of shallow groundwater through sediment at seeps on the Snohomish River shoreline (Pathway 12 in Figure 8-1).

8.4.2. Surface Water in the Lowland Area

Surface water in the Lowland Area (ponds, wetlands and ditches) is contaminated with arsenic and mercury. The analytical results for surface water samples exceeded the PCULs for dissolved arsenic and total mercury in the Benson Subarea and total mercury in the Snohomish County PUD Subarea. Specific contaminant transport pathways involving surface water in the Lowland Area include the following:

- Transport in runoff flowing into surface waters in the Lowland Area (Pathway 4 in Figure 8-1).
- Surface water flow into ditches and culverts that discharges through outfall LLO-02 to the Snohomish River shoreline (Pathway 5 in Figure 8-1).
- Potential recharge from surface water in the Lowland Area through sediment to shallow groundwater (Pathway 7 in Figure 8-1).

8.4.3. Deep Groundwater

Deep groundwater in the Lowland Area is contaminated with arsenic. Dissolved arsenic concentrations were greater than the PCULs in groundwater samples collected from the deep aquifer. Specific contaminant transport pathways involving deep groundwater include the following:

- Transport from deep groundwater present in outwash to deep groundwater in alluvium in the Lowland Area (the lower portion of Pathway 2 in Figure 8-1).
- Transport in deep groundwater toward the Snohomish River (Pathway 9 in Figure 8-1).
- Discharge of deep groundwater through sediment at seeps on the Snohomish River shoreline (Pathway 13 in Figure 8-1).

8.4.4. Sediment in the Lowland Area

Sediment in surface water features (ponds, wetlands and ditches) in the Lowland Area is contaminated with arsenic and mercury. The concentrations of arsenic and mercury were greater than the PCULs for sediment in the Lowland Area in the Benson Subarea. Specific contaminant transport pathways involving sediment in surface water features in the Lowland Area include the following:

- Transport of suspended sediment in surface water flowing through ditches and culverts and discharging through an outfall to the Snohomish River shoreline (Pathway 5 in Figure 8-1).

8.4.5. Sediment in the Snohomish River

Sediment on the Snohomish River shoreline is contaminated with arsenic and mercury. Arsenic concentrations are highest where outfalls discharge to sediment on the Snohomish River shoreline and were greater than the PCUL at three sampling locations. Mercury was detected at concentrations greater than the PCUL at five sampling locations. Specific contaminant transport pathways involving sediment on the Snohomish River shoreline include the following:

- Transport of sediment on Snohomish River shoreline by erosion (Pathway 14 in Figure 8-1).

8.5. Exposure Pathways and Receptors

This section describes the potential exposure pathways and receptors at the Lowland Area Site. The potential exposure pathways and receptors were identified as part of the conceptual site exposure model that was the basis for development of the PCULs described in Section 5.0. PCULs were developed for protection of human health and the environment in consideration of current and future Site use, transport pathways, exposure pathways and receptors. Figure 5-1 presents the conceptual site exposure model for the Lowland Area. Figure 8-2 graphically depicts the exposure pathways and receptors. The following sections further describe the potential exposure pathways and receptors for Site media.

8.5.1. Contaminated Soil and Slag

The exposure pathways for soil and slag for human and ecological receptors were developed in consideration of the current and future use of the Lowland Area for industrial purposes as described in Section 5.1.1.

The exposure pathways and receptors for soil and slag include the following:

- Industrial workers in Lowland Area – This exposure pathway is based on protection of human health for industrial land use from direct contact of an adult worker with contaminated soil and/or slag resulting from historical smelter operations (Exposure pathway 1 in Figure 8-2).
- Potential trespassers accessing the Lowland Area from adjacent non-industrial areas - This exposure pathway is based on protection of human health from direct contact with contaminated soil from Smelter operations for the portion of the Lowland Area adjacent to the Marine View Drive ROW as there is a potential current and future exposure pathway to trespassers in this area (Exposure pathway 3 in Figure 8-2).
- Site visitors utilizing public access areas within the Lowland Area – This exposure pathway is based on protection of human health from direct contact of site visitors with contaminated soil and/or slag resulting from Smelter operations at current and future public access areas (Exposure pathway 3 in Figure 8-2).
- Wildlife in the Lowland Area - This exposure pathway is based on protection of wildlife on industrial properties and is based on no significant adverse effects for the protection and propagation of wildlife (Exposure pathway 4 in Figure 8-2).
- Biota, plants and wildlife in the managed forest area within the Lowland Area – This exposure pathway is based on protection of terrestrial species within the urban forest habitat in American Legion Park (Exposure pathway 5 in Figure 8-2).

8.5.2. Groundwater and Surface Water

The exposure pathways for groundwater were developed in consideration of highest beneficial use of groundwater. The highest beneficial use for groundwater in the Lowland Area is as surface water in the Lowland Area and Snohomish River because groundwater in the Lowland Area is non-potable as described in Section 5.1.2.1.

The exposure pathways and receptors for groundwater and surface water include the following:

- Freshwater aquatic organisms in ponds and wetlands in the Lowland Area – This exposure pathway is based on protection of freshwater aquatic organisms from contaminants in surface water and shallow groundwater discharging to surface water in ponds and wetlands in the Lowland Area (Exposure pathway 6 in Figure 8-2).
- Individuals consuming aquatic organisms in the Snohomish River - This exposure pathway is based on protection human health from consumption of marine aquatic organisms exposed to contaminants in shallow and deep groundwater discharging to surface water in the Snohomish River adjacent to the Lowland Area (Exposure pathway 7 in Figure 8-2).
- Marine aquatic organisms - This exposure pathway is based on protection of marine aquatic organisms from contaminants in shallow and deep groundwater discharging to surface water in the Snohomish River adjacent to the Lowland Area (Exposure pathway 8 in Figure 8-2).

8.5.3. Sediment

The exposure pathways for sediment for human health and ecological receptors were developed in consideration of exposure resulting from human and aquatic organism contact with the sediment and human consumption of aquatic organisms.

The exposure pathways and receptors for sediment include the following:

- Freshwater benthic organisms in ponds and wetlands in the Lowland Area – This exposure pathway is based on protection of freshwater benthic organisms from contaminants in sediment in ponds and wetlands in the Lowland Area (Exposure pathway 9 in Figure 8-2).
- Subsistence consumption of aquatic organisms from the Snohomish River - This exposure pathway is based on protection of human health from consumption of marine aquatic organisms for subsistence that are exposed to contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area (Exposure pathway 10 in Figure 8-2).
- Children playing on shoreline beach - This exposure pathway is based on protection of human health, specifically children, from direct contact with contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area (Exposure pathway 11 in Figure 8-2).
- Subsistence fishing and clamming in the Snohomish River - These exposure pathways are based on protection of human health from direct contact with contaminants in sediment on the Snohomish River shoreline while subsistence net fishing and clamming (Exposure pathway 12 in Figure 8-2).
- Marine benthic organisms and human health in the Snohomish River - This exposure pathway is based protection of marine benthic organisms from contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area (Exposure pathway 13 in Figure 8-2).

9.0 CONCLUSIONS

The purpose of this SRI is to present the data necessary to characterize the nature and extent of contamination from historical smelter operations to develop and evaluate remedial action alternatives. Sufficient data has been collected and presented in this SRI to characterize the nature and extent of contamination for soil, groundwater, surface water, sediment and water from outfalls in the Lowland Area. The data show that contaminants are present at concentrations exceeding PCULS in these media as a result of smelter operations requiring remediation. The FS will identify remedial alternatives to address contamination resulting from historical smelter operations. The media and areas requiring evaluation of remedial alternatives have been identified in this section and are based on sources of contamination related to the smelter operations, characterization of the nature and extent of contamination, and transport and exposure pathways. The following sections identify the media and areas that will be evaluated for cleanup in the FS for the Everett Smelter Lowland Area.

9.1. Benson Subarea

Contaminant concentrations are greater than the PCULs in multiple media present on the Benson Subarea as a result of the historical smelter operations. The contaminated media requiring evaluation of remedial alternatives include the following:

- Soil and slag;
- Shallow groundwater;
- Deep groundwater;
- Surface water; and
- Sediment.

These contaminated media require evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and slag exceed the PCULs (Table 6-2). Contaminants and slag were directly deposited on subarea soils as a result of releases from the historical smelter. The areas where the concentrations of arsenic and lead exceed the PCULs in soil and slag in the Benson Subarea are shown in Figure 9-1.
- The soil and slag are the source of arsenic, lead and mercury concentrations exceeding the PCULs in shallow groundwater in the Benson Subarea (BP-03S, BP-07S, BP-09S, BP-10S, EV-6A) (Tables 6-14 through 6-17). The locations where shallow groundwater contained concentrations of arsenic, lead and mercury exceeding the PCUL are shown in Figure 9-2.
- The soil, slag and shallow groundwater are a contributing source to arsenic concentrations exceeding the PCULs in shallow groundwater adjacent to the Snohomish River shoreline on northern portion of Riverside Business Park Subarea (LLMW-05S, LLMW-07S, and LLMW-08S) (Figure 9-2). The approximate shallow groundwater flow direction and locations where shallow groundwater contained arsenic concentrations exceeding the PCUL in the northern portion of the Riverside Business Park Subarea are shown in Figure 9-2.
- The soil and transient shallow groundwater flow from west of the Benson Subarea below the Marine View Drive ROW are a source to arsenic concentrations exceeding the PCUL in deep groundwater in the

Benson Subarea (BP-04D through BP-07D, BP-09D, BP-10D, EV-6B and EV-20B) and Riverside Business Park (LLMW-12D through LLMW-14D) including deep monitoring wells adjacent the Snohomish River shoreline (LLMW-11D and LLMW-17D) (Tables 6-19 through 6-22). The approximate deep groundwater flow gradient and locations where arsenic concentrations have exceeded the PCUL in deep groundwater in the Benson and Riverside Business Park subareas are shown in Figure 9-3.

- The soil, slag and shallow groundwater are a source to arsenic and mercury concentrations exceeding the PCULs in surface water (LLSW-04 and LLSW-05) and sediment (LLSD-04 and LLSD-05) (Tables 6-33 and 6-34) in the Benson Subarea. The locations where surface water and sediment concentrations exceeded the PCULs in the Benson Subarea are shown in Figure 9-4.
- Surface water in the Benson Subarea is a contributing source to water discharging from an outfall containing arsenic at a concentration exceeding the PCUL (LLO-02) (Table 6-34) and where arsenic and mercury are present at concentrations exceeding the PCULs in sediment on the Snohomish River shoreline (LLSD-13) (Table 6-36). The locations where outfall water and sediment concentrations exceeded the PCULs on the Snohomish River shoreline as a result of contribution from historical smelter operations are shown in Figure 9-4.

9.2. Marine View Drive ROW

Contaminant concentrations are greater than the PCULs in multiple media present within the Marine View Drive ROW. The contaminated media requiring evaluation of remedial alternatives include the following:

- Soil and debris;
- Shallow groundwater; and
- Deep groundwater.

These contaminated media require evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and debris exceed the PCULs (Tables 6-3 and 6-10). Contamination was directly deposited on soil and debris in the ROW as the result of releases from the historical smelter. The area where the concentrations of arsenic and lead exceed the PCULs in soil and debris in the Marine View Drive ROW are shown in Figure 9-1.
- Soil and debris in the Marine View Drive ROW is a contributing source to arsenic concentrations greater than the PCUL in shallow groundwater in the Benson Subarea (BP-03S, BP-07S, BP-09S, BP-10S, EV-6A) (Tables 6-14 through 6-17). The locations where shallow groundwater contained arsenic concentrations exceeding the PCUL in the Benson Subarea are shown in Figure 9-2.
- Soil, debris and transient shallow groundwater flow are a source to arsenic concentrations exceeding the PCUL in deep groundwater in the Marine View Drive ROW (EV-19B, LLMW-27D and LLMW-29D) as well as the Benson Subarea (BP-04D through BP-07D, BP-09D, BP-10D, EV-6B and EV-20B) and Riverside Business Park (LLMW-12D through LLMW-14D) including deep monitoring wells adjacent the Snohomish River shoreline (LLMW-11D and LLMW-17D) (Table 6-19 through Table 6-22). The approximate deep groundwater flow gradient and locations where arsenic concentrations exceeded the PCUL in deep groundwater in the Marine View Drive ROW, Benson and Riverside Business Park subareas are shown in Figure 9-3.

- Soil, debris and transient shallow groundwater flow in the Marine View Drive ROW are a contributing source to arsenic concentrations exceeding the PCUL in surface water (LLSW-04 and LLSW-05) and sediment (LLSD-04 and LLSD-05) (Tables 6-31 and 6-33) in the Benson Subarea. The locations where surface water and sediment concentrations exceeded the PCUL in the Benson Subarea are shown in Figure 9-4.

9.3. Riverside Business Park Subarea

Contaminant concentrations are greater than the PCULs in multiple media in specific areas of the Riverside Business Park Subarea. The contaminated media in the Riverside Business Park Subarea requiring evaluation of remedial alternatives include the following:

- Soil and slag;
- Shallow groundwater;
- Deep groundwater;
- Seep and outfall water; and
- Sediment.

These contaminated media require evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic in historical native surface soil in three areas along the western boundary of the Riverside Business Park Subarea exceed the PCULs (LLMW-09D, LLMW-14D, LLMW-18D and LLMW-21D) (Table 6-6). The contamination was directly deposited on the subarea soils by aerial deposition from the historical smelter operations. The areas where the concentrations of arsenic exceed the PCULs in historical native surface soil in the Riverside Business Park Subarea are shown in Figure 9-1.
- The concentrations of arsenic and lead in soil and slag in the northern portion of the Riverside Business Park Subarea exceed the PCULs (HP-35, HP-46 through HP-48, MW-107D) (Table 6-6). The area where the concentrations of arsenic and lead exceed the PCULs in soil and slag are shown in Figure 9-1.
- The soil and slag in the northern portion of the Riverside Business Park Subarea is a contributing source to arsenic concentrations exceeding the PCULs in shallow groundwater adjacent to the Snohomish River shoreline (LLMW-05S, LLMW-07S and LLMW-08S) (Tables 6-14 through 6-17) and may be contributing to arsenic concentrations exceeding the PCULs in deep groundwater in this area (LLMW-06D through LLMW-07D) (i.e., LLMW-07D) (Table 6-19 through Table 6-22). The locations where shallow and deep groundwater contained arsenic concentrations exceeding the PCUL are shown in Figures 9-2 and 9-3.
- Groundwater in the deep aquifer in the central portion of the Riverside Business Park Subarea contains arsenic concentrations exceeding the PCULs (LLMW-12D through LLMW-14D) from the Benson Subarea and is the transport pathway and source of arsenic concentrations exceeding the PCULS in deep monitoring wells adjacent the Snohomish River shoreline (LLMW-11D and LLMW-17D) (Table 6-19 through Table 6-22). The approximate deep groundwater flow gradient and locations where arsenic concentrations exceeded the PCUL in deep groundwater are shown in Figure 9-3.
- The soil, slag and shallow groundwater in the northern portion of the Riverside Business Park Subarea are a contributing source to water containing arsenic exceeding the PCUL discharging from an outfall

(LLO-03) (Table 6-34 and Figure 9-4) and where arsenic exceeds the PCUL in sediment on the Snohomish River shoreline (LLSD-15) (Table 6-36 and Figure 9-4). The pipes that discharge to the outfall run through the area with contaminated soil, slag and shallow groundwater (Figures 9-1, 9-2 and 9-4).

- The historical native surface soil and shallow groundwater on the western portion of the Riverside Business Park Subarea are a contributing source to water containing arsenic exceeding the PCUL discharging from an outfall (LLO-04) (Table 6-34 and Figure 9-4) and where mercury exceeds the PCUL for sediment on the Snohomish River shoreline (LLSD-16) (Table 6-36 and Figure 9-4). The pipes that discharge to the outfall run through the areas with contaminated historical native surface soil and shallow groundwater (Figures 9-1, 9-2 and 9-4).

Contaminant concentrations exceeding the PCULs that are not directly attributable to historical smelter operations were also identified in multiple media at multiple locations on the southern portion of the Riverside Business Park Subarea. Elevated concentrations were detected in samples of media collected from multiple locations adjacent to the former Koppers Facility at the Mill E Site. Contamination associated with the former Koppers facility at the Mill E Site is being addressed under a consent decree between Ecology and Weyerhaeuser (Section 2.4.2.2). Therefore, further evaluation of the non-smelter related contamination will not be completed as part of the FS.

Arsenic concentrations exceeding the PCUL for the Lowland Area were also detected in shallow groundwater (LLMW-16S; Figure 9-2) and an adjacent seep on the Snohomish River Shoreline (LLSP-06; Figure 9-4) in the central portion of the Riverside Business Park Subarea. No direct connectivity between the elevated arsenic concentrations at these locations and the historical smelter operations was identified. Therefore, further evaluation of the non-smelter related contamination will not be completed as part of the FS.

9.4. Snohomish County PUD Subarea and Pacific Highway ROW

Contaminant concentrations are greater than the PCULs in multiple media present within the Snohomish County PUD Subarea and adjacent Pacific Highway ROW that is the result of historical smelter operations. The contaminated media requiring evaluation of remedial alternatives include the following:

- Soil and debris;
- Shallow groundwater;
- Deep groundwater; and
- Surface water.

These contaminated media require evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and debris exceed the PCULs (Table 6-5). The contamination was directly deposited on area soils as the result of direct releases from the historical smelter. The areas where the concentrations of arsenic and lead exceed the PCULs in soil and debris in the Snohomish PUD Subarea and Pacific Highway ROW are shown in Figure 9-1.
- Soil and debris is a source to lead and mercury concentrations exceeding the PCULs in shallow groundwater in the Snohomish PUD Subarea (EV-22A) (Tables 6-14 through 6-17). The location where the shallow groundwater contained arsenic concentrations exceeding the PCUL is shown in Figure 9-2.

- Arsenic and mercury concentrations in deep groundwater exceed the PCUL in the Snohomish County PUD Subarea (LLMW-04D and EV-22B) (Table 6-19 through Table 6-22). The locations where deep groundwater contains arsenic concentrations exceeding the PCULs are shown in Figure 9-3.
- Shallow groundwater in the Snohomish County PUD Subarea is a contributing source to mercury concentrations exceeding the PCUL in surface water (LLSW-02) (Table 6-31) in the Lowland Area. The location where the mercury concentration exceeded the PCUL in surface water is shown in Figure 9-4.
- Surface water in the Snohomish County PUD Subarea is a contributing source to water discharging from an outfall where mercury exceeds the PCUL in sediment on the Snohomish River shoreline (LLSD-13) (Table 6-36). The location where the mercury concentration in sediment is greater than the PCUL is shown in Figure 9-4.

9.5. Shadow Development/Blunt Family Subarea

Contaminant concentrations exceeding the PCULs were detected in multiple media at the Shadow Development/Blunt Family Subarea. The contamination identified on the Shadow Development/Blunt Family Subarea was not identified to be the direct result of releases from the historical smelter operations but are likely the result of other historical activities or operations occurring at the subarea.

The Shadow Development/Blunt Family Subarea is the former Mill C Site. Contamination associated with the former Mill C Site is being addressed under a consent decree between Ecology and Weyerhaeuser (Section 2.4.2.2). Therefore, further evaluation of the non-smelter related contamination will not be completed as part of the FS.

9.6. Slope Subarea

Contaminant concentrations exceed the PCULs in historical native surface soil in the Slope Subarea that are the result of aerial deposition from the historical smelter operations. Therefore, evaluation of cleanup alternatives is required as part of the FS to identify an appropriate remedy for the subarea of the Site.

The concentrations of lead and/or arsenic in historical native surface soil in southern portion of the Slope Subarea exceed the PCULs (LLS-05 through LLS-08; Table 6-9). The areas where the concentrations of arsenic and lead exceed the PCULs in historical native surface soil in the Slope Subarea are shown in Figure 9-1.

9.7. Summary

Smelter contamination is present in media in multiple areas within the Lowland Site and the adjacent Marine View Drive ROW requiring remediation. Portions of the following subareas require remediation as a result of smelter contamination:

- Benson Subarea;
- Riverside Business Park Subarea;
- Snohomish County PUD Subarea; and
- Slope Subarea.

A portion of the Marine View Drive ROW requires remediation as smelter contamination is present that is a source to media in the Lowland Site. The FS will identify and evaluate remedial alternatives for these areas. The areas requiring evaluation in the FS are shown in Figure 9-5.

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Table 2-1

Summary of Previous Soil Investigation Locations and Sampling

Everett Lowland
Everett, Washington

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
AB-3	10/1/1990	2.5-4	Lowland Fill
		7.5-8.5	Lowland Fill
		12.5-14	Lowland Silt
AB-4	10/1/1990	2.5-4	Lowland Fill
		5-6.5	Lowland Fill
		7.5-8	Lowland Fill
		8-9	Lowland Fill
		10-11.5	Lowland NS
AB-5	10/1/1990	2.4-4	Lowland Fill
		5-6	Lowland Fill
		7.5-8.5	Lowland Fill
		10-11.5	Lowland NS
AB-6	10/1/1990	2.5-4	Lowland Fill
		5-6	Lowland Fill
		7.5-9	Lowland Fill
		12.5-14	Lowland Silt
PC-18A	10/1/1990	0-0	Lowland Fill
RR-1	10/1/1990	0-0	Lowland Fill
WP-1	10/1/1990	5-5.75	Lowland Fill
		5-5.75	Lowland Fill
		5.75-6.5	Lowland Fill
		7-7	Lowland Fill
		7.5-8	Lowland Fill
		8-9	Lowland Fill
		8.5-10	Silt Deposits
		9-11	Silt Deposits
		9.5-12	Silt Deposits
		10-13	Silt Deposits
HC-11	8/10/1992	2-2	Lowland Fill
HC-24	5/29/1990	2.5-4	Lowland Fill
		7.5-9	Silt Deposits
HC-25	5/29/1990	2.5-4	Lowland Fill
		6.5-8	Silt Deposits
HC-26	5/29/1990	2.5-4	Lowland Fill
		6.5-8	Silt Deposits
MW-11D2	7/15/1992	10.5-10.5	Lowland NS
MW-34	7/29/1992	3-3	Lowland Fill
TP-20	10/18/1993	1-1	Lowland Fill
		3-3	Lowland Fill
TP-23	10/18/1993	1-1	Lowland Fill
		3-3	Lowland Fill
TP-25	10/18/1993	1-1	Lowland Fill
		3-3	Lowland Fill
TP-28	10/18/1993	2-2	Lowland Fill
TP-29	10/18/1993	2-2	Lowland Fill
TP-30	10/18/1993	2-2	Lowland Fill
TP-31	10/18/1993	2-2	Lowland Fill
SAIC-S42	5/1/1991	0-2	Upland Fill
		6-6	Upland Fill
		12-12	Upland Fill
		24-24	Upland Fill
		36-36	Upland Fill
SAIC-S44	5/1/1991	0-2	Lowland Fill
SAIC-S51	5/1/1991	0-2	Upland Fill
SAIC-S54	5/1/1991	0-2	Lowland Fill
SAIC-S60	5/1/1991	0-0.17	Lowland Fill
SAIC-S61	5/1/1991	0-0.17	Lowland Fill
SAIC-S69	5/1/1991	0-0.17	Lowland Fill
		0.5-0.5	Lowland Fill
		1-1	Lowland Fill
		2-2	Lowland Fill
		3-3	Lowland Fill

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
SAIC-S70	5/1/1991	0-0.17	Lowland Fill
SAIC-S71	5/1/1991	0-0.17	Lowland Fill
SAIC-S81	5/1/1991	0-0.17	Lowland Fill
SAIC-S82	5/1/1991	0-0.17	Lowland Fill
T-1	May 1991		Upland Fill
			Upland Fill
			Upland Fill
SS1	2/12/1991	0-0.17	Upland Fill
SS2	2/12/1991	0-0.5	Lowland Fill
SS3	2/12/1991	0-0.5	Lowland Fill
A3-05	12/1/1994	1-2.9	Lowland Fill
A10-05	12/1/1994	0.7-1.3	Lowland Fill
GRAB-1-1292	12/2/1992	0.17-0.5	Lowland Fill
GRAB-2-1292	12/2/1992	0.17-0.5	Lowland Fill
GRAB-3-1292	12/2/1992	0.17-0.5	Lowland Fill
GRAB-4-1292	12/2/1992	0.17-0.5	Lowland Fill
GRAB-5-1292	12/2/1992	0.17-0.5	Lowland Fill
GRAB-6-1292	12/2/1992	0.17-0.5	Lowland Fill
SB-1101	6/11/1993	3-4.5	Lowland Fill
SB-1104	6/23/1993	0.5-1	Lowland Fill
SB-1202	6/11/1993	1.5-3	Lowland Fill
SB-1304	6/8/1993	3-4.5	Lowland Fill
SB-1305	6/8/1993	3-4.5	Lowland Fill
TP-1202	5/27/1993	2-10	Lowland Fill
TP-1207	5/27/1993	6-10.5	Lowland Fill
TP-1401	5/26/1993	3.5-8	Lowland Fill
TP-1402	5/26/1993	7-9.5	Lowland Fill
TP-1404	5/26/1993	6-10	Lowland Fill
TP-1701	5/26/1993	1-6.5	Lowland Fill
TP-1702	5/26/1993	0.5-4.5	Lowland Fill
TP-92-26	9/2/1992	1.5-2	Lowland Fill
TP-92-27	9/2/1992	1.5-2	Lowland Fill
TP-92-28	9/2/1992	1.5-2	Lowland Fill
TP-92-29	9/2/1992	1.5-2	Lowland Fill
TP-92-30	9/2/1992	1.5-2	Lowland Fill
EV-3-S	1/22/1993	1-2.5	Upland Till/Fill
		1-2.5	Upland Till/Fill
		4-5.5	Upland Till/Fill
		8.5-10	Upland Till/Fill
		10-11.5	Upland Till/Fill
		14.5-16.9	Upland Till/Fill
		24-25.5	Upland Till/Fill
		34-35.5	Outwash
		44-45.5	Outwash
		49-50.5	Outwash
EV-4B	1/20/1993	0-1	Upland Till/Fill
		1.5-3	Upland Till/Fill
		4.5-6	Upland Till/Fill
		9-10.5	Upland Till/Fill
		15-17	Upland Till/Fill
		24-25.5	Upland Till/Fill
		39-40.5	Outwash
		55.5-57.5	Outwash
EV-5	1/26/1993	0-1	Lowland Fill
		1.5-3	Lowland Fill
		4.5-6	Lowland Fill
		9-10.5	Silt
		25-26.5	Alluvial Sand
		13.5-15	Silt
EV-6A	8/17/1993	0-1.5	Lowland Fill
		2-3.5	Lowland Fill
		5-5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Lowland Fill
		25-26.5	Lowland Fill
		30-31.5	Slag
		45-46.5	Slag
		50-51.5	Silt

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
EV-6B	8/25/1993	60-61.5	Channel Deposits
		67.5-68	Channel Deposits
		68-68.5	Channel Deposits
	8/24/1993	54-55.5	Slag
EV-7A	8/16/1993	0-1.5	Lowland Fill
		2-3.5	Lowland Fill
		4-5.5	Lowland Fill
		10-11.5	Slag
		14-15.5	Silt
EV-7B	8/20/1993	17-18.5	Silt
		28-29.5	Alluvial Sand
EV-8A	8/16/1993	0-1.5	Lowland Fill
		2-3.5	Slag
		4-5.5	Slag
		10-11.5	Silt
EV-8B	8/19/1993	22-23.5	Alluvial Sand
		15-16.5	Silt
EV-9A	8/16/1993	0-1.5	Lowland Fill
		2-3.5	Lowland Fill
		4-5.5	Lowland Fill
		8-9.5	Slag
		14-15.5	Slag
		16-17.5	Silt
EV-9B	8/23/1993	18-19.5	Silt
		23-24.5	Alluvial Sand
		28-29.5	Alluvial Sand
MW-1	2/3/1993	0-1	Lowland Fill
		1.5-3	Lowland Fill
		4.5-6	Lowland Fill
		9-10.5	Lowland Silt
		13.5-15	Lowland Silt
		19.5-21	Lowland Silt
MW-2	4/13/1993	0-0.5	Lowland Fill
		1-2.5	Lowland Fill
		4-5.5	Lowland Fill
		8.5-10	Lowland Fill
MW-3	4/12/1993	0-0.16	Lowland Fill
		1-2.5	Lowland Fill
		4-5.5	Lowland Fill
		8.5-9	Lowland Fill
		9-9.5	Silt
		10-11.5	Silt
MW-4B	4/12/1993	0-0.16	Lowland Fill
		1-2.5	Lowland Fill
		4-5.5	Lowland Fill
		8.5-10	Silt
	4/13/1993	15-16.5	Silt
		20-21.5	Alluvial Sand
MW-5	4/13/1993	0-0.5	Lowland Fill
		1-2.5	Lowland Fill
		4-5.5	Lowland Fill
		8.5-10	Silt
SL-1	2/5/1993	8-14	Slag
		27-27	Slag
SL-3	2/5/1993	55-60	Slag
		12-15	Slag
SL-4	2/4/1993	18-20	Slag
		28-34	Slag
B-5	9/7/1995	0-2	Upland Till/Fill
		2-3	Upland Till/Fill
		5-5.5	Upland Till/Fill
		10-10.75	Upland Till/Fill
		15-16	Upland Till/Fill
B-6	9/7/1995	0-0.16	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-5.5	Upland Till/Fill
		10-11	Upland Till/Fill
		15-15.5	Upland Till/Fill

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
EV-10	2/22/1996	0-0.5	Upland Till/Fill
		2-2.8	Upland Till/Fill
		2.8-3.5	Upland Till/Fill
		5-5.5	Upland Till/Fill
		10-10.5	Upland Till/Fill
		10.5-11	Upland Till/Fill
EV-11	2/21/1996	0-0.5	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-6.5	Upland Till/Fill
		10-11.5	Upland Till/Fill
		12.5-13.5	Upland Till/Fill
EV-12	2/23/1996	0-0.5	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-6.5	Upland Till/Fill
		10.5-11.5	Upland Till/Fill
		12.5-13.5	Upland Till/Fill
EV-13	2/22/1996	0-0.5	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-5.5	Upland Till/Fill
		5.5-6.5	Upland Till/Fill
		10-11.5	Upland Till/Fill
EV-14	2/23/1996	0-0.5	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-6.5	Upland Till/Fill
		10-11.5	Upland Till/Fill
HP-01	8/23/1995	0-0.5	Lowland Fill
		5-7	Silt
		10-12	Silt
HP-02	8/24/1995	0.25-0.5	Lowland Fill
		1.5-3	Slag
		5-6.5	Slag
		10-12	Slag
		15-17	Silt
HP-04	8/24/1995	0.25-0.5	Lowland Fill
		0.5-2	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Peat
		12.5-14	Silt
		22-24	Alluvial Sand
HP-05	8/25/1995	0.25-0.5	Lowland Fill
		0.5-2.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Peat
		15-16.5	Silt
		20-20.5	Silt
HP-06	8/25/1995	0.25-0.5	Lowland Fill
		5-6.5	Lowland Fill
		15-16.5	Channel Deposits
		17.5-19	Channel Deposits
		20-21.5	Alluvial Sand
HP-07	8/29/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16	Channel Deposits
HP-08	8/31/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Silt
HP-09	8/31/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
HP-10	8/30/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Silt
HP-11	8/29/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
HP-12	9/1/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Lowland Fill
HP-13	8/31/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		12-13.5	Silt
HP-14	9/1/1995	0-0.16	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Silt
HP-15	12/5/1995	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6	Lowland Fill
		10-11.5	Silt
HP-16	12/7/1995	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Silt
HP-17	12/8/1995	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Silt
HP-18	12/11/1995	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Silt
		15-16.5	Silt
HP-19	12/12/1995	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Silt
HP-20	12/13/1995	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Silt
HP-21	12/14/1995	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Slag
		20-21.5	Channel Deposits
HP-24	1/8/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Silt
HP-25	1/9/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
HP-26	1/10/1996	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Silty Sand
		20-21.5	Silty Sand
HP-27	1/11/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Silt
HP-28	1/11/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Silt
HP-29	1/18/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Silt
HP-30	1/18/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		8-9.5	Silt
HP-31	1/19/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		8-9.5	Silt
HP-32	1/19/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Silt
HP-33	1/20/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		8-9.5	Silt
HP-34	1/20/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		8-9.5	Silt
HP-35	1/21/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		8-9.5	Silt
HP-36	1/22/1996	0-0.5	Lowland Fill
		12-13.5	Silt
HP-37	1/22/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Silt
HP-38	1/23/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Silt
HP-39	1/23/1996	2-3.5	Lowland Fill
		5-6.5	Silt
HP-40	1/24/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
HP-41	1/24/1996	2-3.5	Lowland Fill
		5-6.5	Alluvial Sand
		9-10.5	Alluvial Sand
		12-13.5	Alluvial Sand
HP-42	1/25/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
HP-43	1/25/1996	2-3.5	Lowland Fill
		5-6.5	Alluvial Sand
		10-11.5	Alluvial Sand

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
LB-1	2/23/1996	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Slag
LB-2	2/26/1996	0-0.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
LB-3	2/27/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Slag
LB-4	2/27/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
LB-5	2/27/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
LB-6	2/27/1996	0-0.5	Lowland Fill
		2-3.5	Slag
		5-6.5	Slag
		10-11.5	Slag
		15-16.5	Silt
LB-7	2/28/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Slag
		10-11.5	Silt
LB-8	2/29/1996	0-0.5	Slag
		2-3.5	Slag
LB-9	2/29/1996	0-0.5	Slag
		2-3.5	Slag
		5-6.5	Silt
LB-10	2/29/1996	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
SB-4	4/16/1996	4.5-5	Lowland Fill
		9.5-10	Lowland Fill
		14.5-15	Lowland Fill
		19.5-20	Lowland Fill
		24.5-25	Lowland Fill
		29.5-30	Lowland Fill
		34.5-35	Lowland Fill
		39.5-40	Lowland Fill
		44.5-45	Lowland Fill
		51.5-52	Silt
		55-55.5	Silt
SB-5	4/16/1996	8-8.5	Lowland Fill
		13-13.5	Lowland Fill
		18-18.5	Lowland Fill
		23-23.5	Lowland Fill
SB-6	4/16/1996	8-8.5	Lowland Fill
		13-13.5	Lowland Fill
		18-18.5	Lowland Fill
SB-7	4/16/1996	6-6.5	Lowland Fill
		9.5-10	Lowland Fill
		14.5-15	Lowland Fill
SB-8	4/16/1996	4.5-5	Lowland Fill
		9.5-10	Lowland Fill
		16-16.5	Lowland Fill
		21-21.5	Lowland Fill
TP-SE-1	5/17/1996	9-9	Lowland Silt
TP-SE-2	5/17/1996	13-13	Lowland Silt
TP-SE-3	5/17/1996	15-15	Lowland Silt
TP-SE-4	5/17/1996	12-12	Lowland Silt
TP-SE-8	5/17/1996	6.5-6.5	Lowland Fill
		13-13	Lowland Silt

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
TP-SE-9	5/17/1996	10-10	Lowland Fill
		12.5-12.5	Lowland Fill
TP-SE-10	5/17/1996	11.5-11.5	Lowland Fill
		15-15	Lowland Silt
TP-SE-11	5/17/1996	12-12	Lowland Fill
		14-14	Lowland Silt
TP-SE-12	5/17/1996	11.5-11.5	Lowland Fill
		14-14	Lowland Fill
		16-16	Lowland Silt
TP-SE-13	5/17/1996	13.5-13.5	Lowland Silt
TP-SE-14	5/17/1996	9.5-9.5	Lowland Fill
		11-11	Lowland Silt
TP-SE-15	5/17/1996	9-9	Lowland Silt
TP-SE-16	5/17/1996	3-3	Lowland Fill
		6-6	Lowland Silt
HA-1	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-2	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-3	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-4	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-5	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-6	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-7	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
HA-8	4/8/1998	0-0.5	Upland Fill
		0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-9	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-10	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-11	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-12	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-13	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
HA-14	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-15	4/9/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
HA-16	4/8/1998	0-0.5	Upland Fill
		0.5-1	Upland Fill
		2-2.5	Upland Fill
		4-4.5	Upland Fill
SA-24	4/1/1998	0-1	Upland Till/Fill
		1-2	Upland Till/Fill
		2-3	Upland Till
		3-4	Upland Till
		4-5	Upland Till
SAI-SS1	1998	0-2	Lowland Fill
TB-1	4/1/1998	0-0.5	Fill
		2-3.5	Fill
		5-6.5	Fill
		10-11.5	Till/Fill
		15-16.5	Till
		20-21.5	Till
		25-26.5	Till
		30-31.5	Till
		35-36.5	Outwash
TB-2	3/31/1998	0-0.5	Fill
		2-3.5	Fill
		5-6.5	Fill
		10-11.5	Till/Fill
		15-16.5	Till
		20-21.5	Till
		30-31.5	Till
		35-36.5	Outwash
1T	8/28/1998	0-1	Bluff Fill
1M	8/28/1998	0-1	Bluff Fill
1B	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
2T	8/28/1998	0-1	Bluff Fill
2M	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
2B	8/28/1998	0-1	Bluff Fill
3T	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
		2-3	Bluff Fill
3M	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
3B	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
4T	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
4M	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
4B	8/28/1998	0-1	Bluff Fill
		1-2	Bluff Fill
EV-15A/B	9/29/1998	0-0.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
EV-16A	9/29/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
EV-17B	9/23/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Slag
		10-11.5	Channel Deposits
		15-16.5	Channel Deposits
		20-21.5	Alluvial Sand
		25-26.5	Alluvial Sand
EV-18B	9/24/1998	1-1.25	Upland Till/Fill
		2-3.5	Upland Till/Fill
		5-6.5	Upland Till/Fill
		10-11.5	Upland Till/Fill
		15-16.5	Upland Till/Fill
		20-21.5	Upland Till/Fill
		25-26.5	Upland Till/Fill
		30-31.5	Outwash
		35-36.5	Outwash
		40-41.5	Outwash
		45-46.5	Outwash
EV-20B	9/28/1998	0-0.5	Upland Till/Fill
		5-6.5	Upland Till/Fill
		10-11.5	Upland Till/Fill
		15-16.5	Upland Till/Fill
		20-21.5	Upland Till/Fill
EV-21A/B	2/8/1999	8-9.5	Lowland Fill
		0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Silt
		20-21.5	Alluvial Sand
EV-22A/B	9/22/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		15-16.5	Lowland Fill
		20-21.5	Silt
		25-26.5	Alluvial Sand
		30-31.5	Alluvial Sand
EV-23A/B	9/30/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
HP-45	9/23/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Peat
		20-21.5	Alluvial Sand
		25-26.5	Alluvial Sand
HP-46	2/9/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Silt
		5-6.5	Silt
		10-11.5	Silt
		15-16.5	Alluvial Sand
		20-21.5	Alluvial Sand
HP-47	2/9/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Slag
		5-6.5	Silt
	2/10/1999	15-16.5	Alluvial Sand
		20-21.5	Alluvial Sand

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
HP-48	2/10/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Silt
		10-11.5	Silt
		15-16.5	Alluvial Sand
LB-11	8/25/1998	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
LB-12	8/26/1998	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
LB-13	8/26/1998	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
LB-14	8/26/1998	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	
LB-15	8/26/1998	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
LB-16	8/27/1998	0-2	Slag
		5-7	Slag
LB-17	8/27/1998	0-2	Lowland Fill
		5-7	Slag
LB-18	8/27/1998	0-2	Slag
		5-7	Slag
LB-19	9/29/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		4-5.5	Lowland Fill
		6-7.5	Lowland Fill
		8-9.5	Peat
		10-11.5	Silt
LB-20	9/29/1998	0-0.5	Lowland Fill
		2-3.5	Lowland Fill
		4-5.5	Lowland Fill
		6-7.5	Lowland Fill
		8-9.5	Lowland Fill
		10-11.5	Silt
MW-107D	2/4/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Alluvial Sand
		20-21.5	Alluvial Sand
MW-109D	2/3/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Silt
		15-16.5	Alluvial Sand
		20-21.5	Alluvial Sand

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
LB-21	5/11/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Silt
		11.5-13.5	Lowland Silt
		13.5-15.5	Lowland Silt
LB-22	5/11/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Silt
		11.5-13.5	Lowland Silt
		13.5-15.5	Lowland Silt
LB-23	5/11/1999	0-0.5	Lowland Fill
		0.5-2	Lowland Fill
		2-3.5	Lowland Fill
		5-6.5	Lowland Fill
		10-11.5	Lowland Fill
		11.5-13.5	Lowland NS
		13.5-15.5	Lowland Silt
BH-3	5/26/2004	3-4	Upland Till
		5-6	Upland Till
BH-4	5/27/2004	0-1	Weathered Till
		3-4	Till
BH-5	5/28/2004	0-1	Weathered Till
		2-3	Weathered Till
BH-6	5/28/2004	2-3	Upland Fill
		3-4	Upland Fill
		4-5	Upland Fill
BH-7	5/28/2004	1-2	Upland Fill
		3-4	Upland Fill
		5-6	Upland Fill
SP-4	5/26/2004	0-1	Upland Fill
		1-2	Upland Fill
SP-5	5/26/2004	0-1	Upland Fill
		1-2	Till
SP-6	5/26/2004	0-1	Upland Fill
		1-2	Till
SP-7	5/26/2004	0-1	Upland Fill
		1-2	Till
SP-8	5/26/2004	0-1	Upland Fill
		1-2	Fill/Weathered Till
		0-1	Upland Fill
SP-9	5/26/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
		4-5	Upland Fill
		5-6	Upland Fill
SP-10	5/26/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
SP-11	5/26/2004	0-1	Upland Fill
		1-2	Weathered Till
		2-3	Fill/Weathered Till
SP-12	5/26/2004	0-1	Upland Fill
		1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
		6-8	Upland Fill
SP-13	5/28/2004	0-1	Weathered Till
		1-2	Till
SP-14	5/27/2004	0-1	Upland Fill
		1-2	Upland Fill
		2-3	Fill/Weathered Till
		3-4	Fill/Weathered Till
		4-5	Till

Table 2-1. Summary of Previous Soil Investigation Locations and Sampling

Location Identification	Sample Date	Sample Interval (feet bgs)[1]	Stratigraphic Unit
SP-15	5/27/2004	0-1	Upland Fill
		2-3	Upland Fill
		5-6	Upland Fill
		6-8	Upland Fill
		8-10	TIll
SP-16	5/28/2004	0-1	Upland Fill
		1-2	Upland Fill
		2-3	Weathered Till
SP-17	5/28/2004	0-1	Upland Fill
		1-2	Weathered Till
		2-3	Weathered Till
SP-18	5/28/2004	0-1	Upland Fill
		1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
		4-5	Upland Fill/Till
SP-19	5/27/2004	0-1	Till
		1-2	TIll
SP-20	5/28/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
		4-5	Upland Fill
		5-6	Upland Fill
SP-21	5/28/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Upland Fill
		4-5	Upland Fill
		5-6	Upland Fill/Till
SP-23	5/27/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Weathered Till
		4-5	Weathered Till
		5-6	Weathered Till
		8-10	Till
SP-24	5/27/2004	1-2	Upland Fill
		3-4	Upland Fill
		5-6	Upland Fill
		8-10	Upland Fill
		10-12	Upland Fill
SP-25	5/27/2004	1-2	Upland Fill
		3-4	Upland Fill
		5-6	Upland Fill
		8-10	Upland Fill
		10-12	Upland Fill
SP-26	5/27/2004	1-2	Upland Fill
		2-3	Upland Fill
		3-4	Weathered Till
		4-5	Till
		5-6	Till
GP-1	5/10/2005	1-10	Lowland Fill
GP-2	5/10/2005	1-10	Lowland Fill
GP-3	5/10/2005	2-9	Lowland Fill
GP-4	5/11/2005	2-6	Lowland Fill
GP-5	5/11/2005	4-6	Lowland Fill
GP-6	5/11/2005	2-6	Lowland Fill
GP-7	5/10/2005	4-12	Lowland Fill
GP-8	5/10/2005	6-11	Lowland Fill
GP-9	5/11/2005	5-8	Lowland Fill
GP-10	5/11/2005	5-8	Lowland Fill
GP-11	5/11/2005	4-7	Lowland Fill

Notes:
[1] Many samples were historically reported as depth ranges (i.e. 2-4 feet); certain samples were reported as discrete depths (i.e., 0 feet, or 1 foot).

Table 3-1

Summary of Supplemental Soil Investigation Locations and Sampling

Everett Lowland
Everett, Washington

Investigation Location	Soil Boring/Core Identification	Total Depth (feet bgs)	Drilling Method	Sample Identification	Sample Depth Interval (feet bgs)	Stratigraphic Unit
BP-01	BP-01D	33	Hollow Stem Auger	BP-01-120106-6.8-7	6.8 - 7	Fill
				BP-01-120106-10.6-10.8	10.6 - 10.8	Native Surface
				BP-01-120106-16.5-17.5	16.5 - 17.5	Silt Deposits
				BP-01-120106-21-22	21 - 22	Top of Alluvium
				BP-01-120106-27.5-28.5	27.5 - 28.5	Alluvium
BP-02	BP-02D	33	Hollow Stem Auger	BP-02-120105-3-4	3 - 4	Fill
				BP-02-120105-11.3-11.5	11.3 - 11.5	Native Surface
				BP-02-120105-15-16	15 - 16	Silt Deposits
				BP-02-120105-23-24	23 - 24	Top of Alluvium
				BP-02-120105-27.5-28.5	27.5 - 28.5	Alluvium
BP-03	BP-03D	32	Hollow Stem Auger	BP-03-120104-6.7-6.9	6.7 - 6.9	Fill
				BP-03-120104-10.1-10.3	10.1 - 10.3	Native Surface
				BP-03-120104-14-15	14 - 15	Silt Deposits
				BP-03-120104-20-21	20 - 21	Top of Alluvium
				BP-03-120105-26-27	26 - 27	Alluvium
BP-04	BP-04D	33	Hollow Stem Auger	BP-04-120104-6.5-7	6.5 - 7	Fill
				BP-04-120104-10-10.2	10 - 10.2	Native Surface
				BP-04-120104-14-15	14 - 15	Silt Deposits
				BP-04-120104-21.5-22.5	21.5 - 22.5	Top of Alluvium
				BP-04-120104-27-28	27 - 28	Alluvium
	BP-04D2	101.5	Hollow Stem Auger	BP-04D2-35-36.5	35 - 36.5	Alluvium
				BP-04D2-50-51.5	50 - 51.5	Alluvium
				BP-04D2-60-61.25	60 - 61.25	Alluvium
				BP-04D2-65-66	65 - 66	Silt Deposits
				BP-04D2-80.5-81.5	80.5 - 81.5	Alluvium and Silt Deposits
				BP-04D2-100-101.5	100 - 101.5	Alluvium and Silt Deposits
BP-05	BP-05D	34	Hollow Stem Auger	BP-05-120103-2.5-3	2.5 - 3	Fill
				BP-05-120103-10.7-10.9	10.7 - 10.9	Native Surface
				BP-05-120103-14-15	14 - 15	Silt Deposits
				BP-05-120103-22-22.5	22 - 22.5	Top of Alluvium
				BP-05-120103-30-31	30 - 31	Alluvium
	BP-05D2	72	Hollow Stem Auger	BP05D2-40-41	40 - 41	Alluvium
				BP05D2-50-51	50 - 51	Silt Deposits
				BP05D2-62-62.5	62 - 62.5	Silt Deposits
				BP05D2-65-66	65 - 66	Silt Deposits
				BP05D2-70.5-71	70.5 - 71	Alluvium
BP-06	BP-06D	35	Hollow Stem Auger	BP-06-111230-5.5-6	5.5 - 6	Fill
				BP-06-111230-10.2-10.4	10.2 - 10.4	Native Surface
				BP-06-111230-12-13	12 - 13	Silt Deposits
				BP-06-111230-23-24	23 - 24	Top of Alluvium
				BP-06-111230-29.5-30	29.5 - 30	Alluvium
BP-07	BP-07D	36.5	Hollow Stem Auger	BP-07-111229-5-6	5 - 6	Fill
				BP-07-111229-12.6-12.8	12.6 - 12.8	Native Surface
				BP-07-111229-15.5-16.5	15.5 - 16.5	Silt Deposits
				BP-07-111229-24.5-25.5	24.5 - 25.5	Top of Alluvium
				BP-07-111229-30.5-31.5	30.5 - 31.5	Alluvium
	BP-07D2	81.5	Hollow Stem Auger	BP07D2-35-35.5	35 - 35.5	Alluvium
				BP07D2-40-41	40 - 41	Alluvium
				BP07D2-60-61	60 - 61	Silt Deposits
				BP07D2-75.5-76.5	75.5 - 76.5	Alluvium and Silt Deposits
				BP07D2-81-81.5	81 - 81.5	Alluvium and Silt Deposits
BP-08	BP-08D	33	Hollow Stem Auger	BP-08-111229-6-6.2	6 - 6.2	Fill
				BP-08-111229-10.2-10.4	10.2 - 10.4	Native Surface
				BP-08-111229-12-13	12 - 13	Silt Deposits
				BP-08-111229-20-21	20 - 21	Top of Alluvium
				BP-08-111229-24.5-25.5	24.5 - 25.5	Alluvium
BP-09	BP-09D	33	Hollow Stem Auger	BP-09-111228-8-9	8 - 9	Fill
				BP-09-111228-15.2-15.4	15.2 - 15.4	Native Surface
				BP-09-111228-17-18	17 - 18	Silt Deposits
				BP-09-111228-19-20	19 - 20	Top of Alluvium
				BP-09-111228-27-28	27 - 28	Alluvium
BP-10	BP-10D	30	Hollow Stem Auger	BP-10-111227-1.5-2	1.5 - 2	Fill
				BP-10-111227-10.3-10.5	10.3 - 10.5	Native Surface
				BP-10-111227-11.5-11.7	11.5 - 11.7	Silt Deposits
				BP-10-111227-17.5-18	17.5 - 18	Top of Alluvium
				BP-10-111227-21.5-22.5	21.5 - 22.5	Alluvium
LLMW-01	LLMW-01D	38	Hollow Stem Auger	LLMW01-3-4	3 - 4	Fill
				LLMW01-25-25.2	25 - 25.2	Native Surface
				LLMW01-26-26.5	26 - 26.5	Silt Deposits
				LLMW01-32.5-33.5	32.5 - 33.5	Alluvium
LLMW-02	LLMW-02D	32	Hollow Stem Auger	LLMW02-6-7	6 - 7	Fill
				LLMW02-17.4-17.6	17.4 - 17.6	Native Surface
				LLMW02-20-21	20 - 21	Silt Deposits
				LLMW02-27-28	27 - 28	Alluvium
LLMW-03	LLMW-03D	31	Hollow Stem Auger	LLMW03-9-10	9 - 10	Fill
				LLMW03-10.5-10.6	10.5 - 10.6	Native Surface
				LLMW03-13.5-14.5	13.5 - 14.5	Silt Deposits
				LLMW03-28-29	28 - 29	Alluvium

Investigation Location	Soil Boring/Core Identification	Total Depth (feet bgs)	Drilling Method	Sample Identification	Sample Depth Interval (feet bgs)	Stratigraphic Unit
LLMW-04	LLMW-04D	33	Hollow Stem Auger	LLMW04-2-3	2 - 3	Fill
				LLMW04-14.3-14.5	14.3 - 14.5	Native Surface
				LLMW04-18-19	18 - 19	Silt Deposits
				LLMW04-30-31	30 - 31	Alluvium
LLMW-05	LLMW-05D	25	Hollow Stem Auger	LLMW05-6-7	6 - 7	Fill
				LLMW05-10-10.2	10 - 10.2	Native Surface
				LLMW05-12-13	13-Dec	Silt Deposits
				LLMW05-20-21	20 - 21	Alluvium
LLMW-06	LLMW-06D	28.5	Hollow Stem Auger	LLMW06-6.5-7.5	6.5 - 7.5	Fill
				LLMW06-8-8.2	8 - 8.2	Native Surface
				LLMW06-11-12	12-Nov	Silt Deposits
				LLMW06-23-24	23 - 24	Alluvium
LLMW-07	LLMW-07D	25	Hollow Stem Auger	LLMW07-3-4	3 - 4	Fill
				LLMW07-10-10.2	10 - 10.2	Native Surface
				LLMW07-10.5-11	10.5 - 11	Silt Deposits
				LLMW07-18-19	18 - 19	Alluvium
LLMW-08	LLMW-08D	25.5	Hollow Stem Auger	LLMW08-3-4	3 - 4	Fill
				LLMW08-12-13	12 - 13	Native Surface
				LLMW08-20-21	20 - 21	Alluvium
LLMW-09	LLMW-09D	27	Hollow Stem Auger	LLMW09-4.5-5.5	4.5 - 5.5	Fill
				LLMW09-8.3-8.5	8.3 - 8.5	Native Surface
				LLMW09-10.5-11	10.5 - 11	Silt Deposits
				LLMW09-18-19	18 - 19	Alluvium
LLMW-10	LLMW-10D	31.5	Hollow Stem Auger	LLMW10-6-7	6 - 7	Fill
				LLMW10-7.5-7.7	7.5 - 7.7	Native Surface
				LLMW10-12-13	12 - 13	Silt Deposits
				LLMW10-27-28	27 - 28	Alluvium
LLMW-11	LLMW-11D	22.5	Hollow Stem Auger	LLMW11-5-6	5 - 6	Fill
				LLMW11-10.5-10.7	10.5 - 10.7	Native Surface
				LLMW11-11-11.5	11 - 11.5	Silt Deposits
				LLMW11-19.5-20.5	19.5 - 20.5	Alluvium
LLMW-12	LLMW-12D	27.5	Hollow Stem Auger	LLMW12-5-5.5	5 - 5.5	Fill
				LLMW12-8.5-8.7	8.5 - 8.7	Native Surface
				LLMW12-10-10.5	10 - 10.5	Silt Deposits
				LLMW12-21-22	21 - 22	Alluvium
LLMW-13	LLMW-13D	37	Hollow Stem Auger	LLMW13-10.5-11.5	10.5 - 11.5	Fill
				LLMW13-18.7-19	18.7 - 19	Native Surface
				LLMW13-23-24	23 - 24	Silt Deposits
				LLMW13-32-33	32 - 33	Alluvium
LLMW-14	LLMW-14D	31	Hollow Stem Auger	LLMW14-5.5-6	5.5 - 6	Fill
				LLMW14-7-7.2	7 - 7.2	Native Surface
				LLMW14-13.5-14.5	13.5 - 14.5	Silt Deposits
				LLMW14-29-30	29 - 30	Alluvium
LLMW-15	LLMW-15D	34	Hollow Stem Auger	LLMW15-2-3	2 - 3	Fill
				LLMW15-11.5-11.7	11.5 - 11.7	Native Surface
				LLMW15-14-15	14 - 15	Silt Deposits
				LLMW15-30.5-31.5	30.5 - 31.5	Alluvium
LLMW-16	LLMW-16D	34	Hollow Stem Auger	LLMW16-13-13.5	13 - 13.5	Fill
				LLMW16-13.5-13.7	13.5 - 13.7	Native Surface
				LLMW16-15-16	15 - 16	Silt Deposits
				LLMW16-29.5-30.5	29.5 - 30.5	Alluvium
LLMW-17	LLMW-17D	25.5	Hollow Stem Auger	LLMW17-5-6	5 - 6	Fill
				LLMW17-12-12.2	12 - 12.2	Native Surface
				LLMW17-12.5-13	12.5 - 13	Silt Deposits
				LLMW17-21-22	21 - 22	Alluvium
LLMW-18	LLMW-18D	30	Hollow Stem Auger	LLMW18-6-7	6 - 7	Fill
				LLMW18-8.5-8.7	8.5 - 8.7	Native Surface
				LLMW18-11-12	11 - 12	Silt Deposits
				LLMW18-21-22	21 - 22	Alluvium
LLMW-19	LLMW-19D	27	Hollow Stem Auger	LLMW19-3-4	3 - 4	Fill
				LLMW19-7.8-8	7.8 - 8	Native Surface
				LLMW19-9-10	10-Sep	Silt Deposits
				LLMW19-25-26	25 - 26	Alluvium
LLMW-20	LLMW-20D	21	Hollow Stem Auger	LLMW20-4.5-5.5	4.5 - 5.5	Fill
				LLMW20-7.2-7.4	7.2 - 7.4	Native Surface
				LLMW20-9-9.5	9 - 9.5	Silt Deposits
				LLMW20-13.5-14.5	13.5 - 14.5	Alluvium
LLMW-21	LLMW-21D	33	Hollow Stem Auger	LLMW21-6-7	6 - 7	Fill
				LLMW21-7.7-7.9[1]	7.7 - 7.9	Native Surface
				LLMW21-12-13	12 - 13	Silt Deposits
				LLMW21-15-16	15 - 16	Silt Deposits
				LLMW21-24-25	24 - 25	Alluvium
LLMW-22	LLMW-22D	27	Hollow Stem Auger	LLMW22-3-4	3 - 4	Fill
				LLMW22-8-8.2	8 - 8.2	Native Surface
				LLMW22-10.5-11.5	10.5 - 11.5	Silt Deposits
				LLMW22-20-21	20 - 21	Alluvium
LLMW-23	LLMW-23D	40	Hollow Stem Auger	LLMW23-17-18	17 - 18	Fill
				LLMW23-20-21	20 - 21	Fill
				LLMW23-22.9-23.1	22.9 - 23.1	Native Surface
				LLMW23-26-26.5	26 - 26.5	Silt Deposits
				LLMW23-35-36	35 - 36	Alluvium
LLMW-24	LLMW-24D	56.5	Hollow Stem Auger	LLMW24-1.3-1.5	1.3 - 1.5	Native Surface
				LLMW24-6-6.5	6 - 6.5	Till
				LLMW24-30-31	30 - 31	Outwash
				LLMW24-45-46	45 - 46	Outwash

Table 3-1. Summary of Supplemental Soil Investigation Locations and Sampling

Investigation Location	Soil Boring/Core Identification	Total Depth (feet bgs)	Drilling Method	Sample Identification	Sample Depth Interval (feet bgs)	Stratigraphic Unit
LLMW-25	LLMW-25D	65	Hollow Stem Auger	LLMW25-3-4	3 - 4	Fill
				LLMW25-8-8.2	8 - 8.2	Native Surface
				LLMW25-10.5-11	10.5 - 11	Till
				LLMW25-55-56	55 - 56	Outwash
LLMW-27	LLMW-27D	61.5	Hollow Stem Auger	LLMW27-3.5-4.5	3.5 - 4.5	Fill
				LLMW27-4.5-5.5	4.5 - 5.5	Native Surface
				LLMW27-8-9	8 - 9	Weathered Till
				LLMW27-15.5-16	15.5 - 16	Weathered Till
				LLMW27-25-26	25 - 26	Till
				LLMW27-30-31	30 - 31	Outwash
				LLMW27-37-37.5	37 - 37.5	Outwash
				LLMW27-40-41	40 - 41	Outwash
				LLMW27-50-51	50 - 51	Outwash
				LLMW27-60-61	60 - 61	Outwash
LLMW-29	LLMW-29D	61.5	Hollow Stem Auger	LLMW29-6-7	6 - 7	Fill
				LLMW29-12.5-13.5	12.5 - 13.5	Native Surface
				LLMW29-20-21	20 - 21	Till
				LLMW29-30-31	30 - 31	Outwash
				LLMW29-55-56	55 - 56	Outwash
LLMW-31	LLMW-31D	64	Hollow Stem Auger	LLMW31-3-4	3 - 4	Fill
				LLMW31-9.1-9.3	9.1 - 9.3	Native Surface
				LLMW31-25-25.5	25 - 25.5	Till
				LLMW31-45-46	45 - 46	Outwash
				LLMW31-55-56	55 - 56	Outwash
LLMW-33	LLMW-33D	45.5	Hollow Stem Auger	LLMW33-3-4	3 - 4	Fill
				LLMW33-4.5-4.7	4.5 - 4.7	Native Surface
				LLMW33-10.5-11.5	10.5 - 11.5	Weathered Till
				LLMW33-39-40	39 - 40	Outwash
LLMW-34	LLMW-34D	75	Hollow Stem Auger	LLMW34-4.5-5.5	4.5 - 5.5	Fill
				LLMW34-6-6.2	6 - 6.2	Native Surface
				LLMW34-11.5-11.7	11.5 - 11.7	Weathered Till
				LLMW34-70-70.5	70 - 70.5	Outwash
LLMW-35	LLMW-35D	92	Sonic	LLMW35-4-5	4 - 5	Fill
				LLMW35-5.5-6	5.5 - 6	Native Surface
				LLMW35-12-14	12 - 14	Till
				LLMW35-50-51	50 - 51	Till
				LLMW35-70-71	70 - 71	Till
				LLMW35-90-92	90 - 92	Outwash
LLMW-36	LLMW-36D	90	Sonic	LLMW36-7-8	7 - 8	Fill
				LLMW36-9-9.2	9 - 9.2	Native Surface
				LLMW36-16-16.2	16 - 16.2	Silt Deposits
				LLMW36-29-30	29 - 30	Alluvium
				LLMW36-59-60	50 - 60	Alluvium
				LLMW36-89-90	89 - 90	Silt Deposits
LLSB-01	LLSB-01	20	Direct Push	LLSB01-6-7	6 - 7	Fill
				LLSB01-10.8-11	10.8 - 11	Native Surface
				LLSB01-13-14	13 - 14	Silt Deposits
				LLSB01-19-20	19 - 20	Alluvium
LLSB-02	LLSB-02	20	Direct Push	LLSB02-3-4	3 - 4	Fill
				LLSB02-10-10.2	10 - 10.2	Native Surface
				LLSB02-10.6-10.8	10.6 - 10.8	Silt Deposits
				LLSB02-12-13	12 - 13	Silt Deposits
				LLSB02-15-16	15 - 16	Alluvium
LLSB-03	LLSB-03	20	Direct Push	LLSB03-3-4	3 - 4	Fill
				LLSB03-11-11.2	11 - 11.2	Native Surface
				LLSB03-13-14	13 - 14	Silt Deposits
				LLSB03-19-20	19 - 20	Alluvium
LLS-01	LLS-01	1	Hand Tools	LLS-01-0-1	0 - 1	Native Surface
LLS-02	LLS-02	1	Hand Tools	LLS02-0-1	0 - 1	Native Surface
LLS-03	LLS-03	1	Hand Tools	LLS-03-0-1	0 - 1	Native Surface
LLS-04	LLS-04	1	Hand Tools	LLS-04-0-1	0 - 1	Native Surface
LLS-05	LLS-05	1	Hand Tools	LLS-05-0-0.5	0 - 0.5	Native Surface
				LLS-05-0.8-1	0.8 - 1	Native Surface
LLS-06	LLS-06	1	Hand Tools	LLS06-0-1	0 - 1	Native Surface
LLS-07	LLS-07	1	Hand Tools	LLS07-0-1	0 - 1	Native Surface
LLS-08	LLS-08	1	Hand Tools	LLS-08-0.5-1	0.5 - 1	Native Surface

Notes

bgs = below ground surface

"BP" indicates "Benson Property location". Sample identifications for these locations have the following format; location designation, then date (yy/mm/dd) followed by the sample depth interval in feet bgs.

"LLMW" indicates "Lowland monitoring well location". Sample identifications for these locations have the following format; location designation followed by the sample depth interval in feet bgs.

"LLSB" indicates "Lowland soil boring location". Sample identifications for these locations have the following format; location designation followed by the sample depth interval in feet bgs.

"LLS" indicates "Lowland steep slope soil sample location". Sample identifications for these locations have the following format; location designation followed by the sample depth interval in feet bgs.

[1] Sample LLMW21-7.7-7.9 was mislabeled in the field and reported as LLMW21-7.7-9. The correct sample ID (LLMW21-7.7-7.9) is displayed in this table.

Table 3-2

Summary of Supplemental Groundwater Investigation Locations, Sampling and Hydrogeological Testing

Everett Lowland

Everett, Washington

Investigation Location	Monitoring Well Identification	Well Screen Depth (feet bgs)	Groundwater Aquifer	Groundwater Sampling Event						"Snapshot" Groundwater Level Monitoring[1]	Tidal Study[2]	Hydraulic Conductivity Testing[3]
				Winter 2012	Summer 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013			
BP-01	BP-01S	3-9.2	Shallow	X	--	X	X	X	X	--	--	--
	BP-01D	22-32	Deep	X	--	X	X	X	X	--	--	--
BP-02	BP-02S	3-8.7	Shallow	X	--	X	X	X	X	Q2,Q3,Q4	--	--
	BP-02D	22-32	Deep	X	--	X	X	X	X	Q2,Q3,Q4	--	--
BP-03	BP-03S	3-8.7	Shallow	X	--	X	X	X	X	Q2,Q3,Q4	--	--
	BP-03D	21-31	Deep	X	--	X	X	X	X	Q2,Q3,Q4	--	--
BP-04	BP-04S	3-8.2	Shallow	X	--	X	X	X	X	Q2,Q3,Q4	--	--
	BP-04D	21-31	Deep	X	--	X	X	X	X	Q2,Q3,Q4	--	--
	BP-04D2	60-65	Deep	X	--	X	X	X	X	Q3,Q4	--	--
BP-05	BP-05S	3-9.2	Shallow	X	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	X
	BP-05D	23-33	Deep	X	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	X
	BP-05D2	67-72	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
BP-06	BP-06S	3-8.7	Shallow	X	--	X	X	X	X	--	--	--
	BP-06D	24-34	Deep	X	--	X	X	X	X	--	--	--
BP-07	BP-07S	3-11.7	Shallow	X	--	X	X	X	X	Q3,Q4	--	--
	BP-07D	25.5-35.5	Deep	X	--	X	X	X	X	Q3,Q4	--	--
	BP-07D2	70-80	Deep	--	--	--	--	X	X	Q3,Q4	--	--
BP-08	BP-08S	3-8.7	Shallow	X	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	X
	BP-08D	21-31	Deep	X	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	X
BP-09	BP-09S	4-13.7	Shallow	X	--	X	X	X	X	--	--	--
	BP-09D	19-29	Deep	X	--	X	X	X	X	--	--	--
BP-10	BP-10S	3-8.7	Shallow	X	--	X	X	X	X	--	--	--
	BP-10D	19-29	Deep	X	--	X	X	X	X	--	--	--
LLMW-01	LLMW-01D	27.5-37.5	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-02	LLMW-02D	22-32	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-03	LLMW-03S	3.5-8.5	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
	LLMW-03D	21-31	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
LLMW-04	LLMW-04S	4-14	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-04D	22-32	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-05	LLMW-05S	4-9	Shallow	--	--	X	X	X	X	Q2,Q3,Q4	--	--
	LLMW-05D	15-25	Deep	--	--	X	X	X	X	Q2,Q3,Q4	--	--
LLMW-06	LLMW-06S	4-7	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	--
	LLMW-06D	18-28	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	--
LLMW-07	LLMW-07S	4-9	Shallow	--	--	X	X	X	X	Q2,Q3,Q4	--	--
	LLMW-07D	15-25	Deep	--	--	X	X	X	X	Q2,Q3,Q4	--	--
LLMW-08	LLMW-08S	5-10	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-08D	15-25	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-09	LLMW-09S	3.5-6	Shallow	--	--	X	X	X	X	--	--	--
	LLMW-09D	17-27	Deep	--	--	X	X	X	X	--	--	--
LLMW-10	LLMW-10S	4-6.5	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-10D	21-31	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-11	LLMW-11S	3.5-9.5	Shallow	--	--	X	X	dry	dry	Q2,Q3,Q4	Q1, Q4	X
	LLMW-11D	12-22	Deep	--	--	X	X	X	X	Q2,Q3,Q4	Q1, Q4	X
LLMW-12	LLMW-12S	3-7	Shallow	--	--	X	X	X	X	Q2,Q3,Q4	Q1, Q4	X
	LLMW-12D	17-27	Deep	--	--	X	X	X	X	Q2,Q3,Q4	Q1, Q4	X
LLMW-13	LLMW-13S	8-18	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	--
	LLMW-13D	25-35	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	Q1, Q4	--
LLMW-14	LLMW-14S	3.5-6	Shallow	--	--	X	X	X	X	Q2,Q3,Q4	--	--
	LLMW-14D	20-30	Deep	--	--	X	X	X	X	Q2,Q3,Q4	--	--
LLMW-15	LLMW-15S	3.5-9.5	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-15D	24-34	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-16	LLMW-16S	4-12	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
	LLMW-16D	24-34	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
LLMW-17	LLMW-17S	4-11	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-17D	15-25	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-18	LLMW-18S	3.5-7.5	Shallow	--	--	X	X	X	X	--	--	--
	LLMW-18D	20-30	Deep	--	--	X	X	X	X	--	--	--
LLMW-19	LLMW-19D	17-27	Deep	--	--	X	X	X	X	--	--	--
LLMW-20	LLMW-20D	11-21	Deep	--	--	X	X	X	X	--	--	--
LLMW-21	LLMW-21S	3.5-7	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
	LLMW-21D	23-33	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--

Table 3-2. Summary of Supplemental Groundwater Investigation Locations, Sampling and Hydrogeological Testing

Investigation Location	Monitoring Well Identification	Well Screen Depth (feet bgs)	Groundwater Aquifer	Groundwater Sampling Event: Winter 2012	Summer 2012	Q1 2013	Q2 2013	Q3 2013	Q4 2013	"Snapshot" Groundwater Level Monitoring[1]	Tidal Study[2]	Hydraulic Conductivity Testing[3]
LLMW-22	LLMW-22S	3.5-7	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
	LLMW-22D	17-27	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
LLMW-23	LLMW-23S	14-24	Shallow	--	--	X	X	X	X	--	--	--
	LLMW-23D	30-40	Deep	--	--	X	X	X	X	--	--	--
LLMW-24	LLMW-24D	43.5-53.5	Deep	--	--	X	X	X	X	--	--	--
LLMW-25	LLMW-25D	55-65	Deep	--	--	X	X	X	X	--	--	--
LLMW-27	LLMW-27S	31-36	Shallow	--	--	dry	dry	dry	dry	--	--	--
	LLMW-27D	50-60	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	X
LLMW-29	LLMW-29S	5-15	Shallow	--	--	dry	dry	dry	dry	--	--	--
	LLMW-29D	50-60	Deep	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
LLMW-31	LLMW-31D	54-64	Deep	--	--	X	X	X	X	--	--	--
LLMW-33	LLMW-33S	3.5-10.5	Shallow	--	--	X	X	dry	dry	--	--	--
	LLMW-33D	35-45	Deep	--	--	X	X	X	X	--	--	--
LLMW-34	LLMW-34S	4-12	Shallow	--	--	X	X	X	X	--	--	--
	LLMW-34D	63.5-73.5	Deep	--	--	X	X	X	X	--	--	--
LLMW-35	LLMW-35D	81.5-91.5	Deep	--	--	--	--	X	X	Q3,Q4	Q4	--
LLMW-36	LLMW-36D	20-30	Deep	--	--	--	--	X	X	Q3,Q4	Q4	--
EV-6	EV-6A	44.5-54.5	Shallow	--	--	X	X	X	X	--	--	--
	EV-6B	62.5-67.5	Deep	--	--	X	X	X	X	--	--	--
EV-7	EV-7B	24-29	Deep	--	--	--	--	X	X	Q3,Q4	Q4	--
EV-13	EV-13	4-10	Shallow	--	--	dry	dry	dry	dry	--	--	--
EV-19	EV-19B	~52-57	Deep	--	--	X	X	X	X	--	--	--
EV-20	EV-20B	50-55	Deep	--	X	X	X	X	X	--	Q4	--
EV-22	EV-22A	15-20	Shallow	--	X	X	X	X	X	Q1,Q2,Q3,Q4	--	X
	EV-22B	30-35	Deep	--	X	X	X	X	X	Q1,Q2,Q3,Q4	--	X
MW-1202R	MW-1202R	3-10	Shallow	--	--	X	X	X	X	--	--	--
MW-1203R	MW-1203R	6-12	Shallow	--	--	X	X	X	X	Q1,Q2,Q3,Q4	--	--
MW-1301R	MW-1301R	3-10	Shallow	--	--	X	X	X	X	--	--	--
MW-1501R	MW-1501R	3-10	Shallow	--	--	X	X	X	X	--	--	--
MW-1701	MW-1701	2-8	Shallow	--	--	X	X	X	X	Q1,Q2,Q4	--	--
PZ-1B	PZ-1B	~2.5-7.5	Shallow	--	--	X	X	X	X	--	--	--
PZ-2B	PZ-2B	~3.5-8.5	Shallow	--	--	X	X	X	X	--	--	--
PZ-3B	PZ-3B	~2-7	Shallow	--	--	X	X	X	X	--	--	--
UNK	UNK	~8-18	Shallow	--	--	X	X	X	X	--	--	--

Notes

bgs = below ground surface

X = Indicates the activity was performed at the specified location

X = Indicates the well was also sampled for conventionals

X = (shaded) Indicates the well was also sampled for arsenic speciation

-- = Indicates the activity was not performed at the specified location

Q1 = Quarterly monitoring performed in January/February 2013

Q2 = Quarterly monitoring performed in April/May 2013

Q3 = Quarterly monitoring performed in August/September 2013

Q4 = Quarterly monitoring performed in November 2013

[1] The values Q1,Q2, etc... indicate the groundwater sampling events during which snapshot groundwater level measuremnts were performed at the identified monitoring well locations in 2013.

[2] Tidal studies were performed in January and November 2013. The tidal study performed in November 2013 included monitoring wells LLMW-35D and LLMW-36D, which were installed in August 2013, along with preexisting wells EV-7B and EV-20B.

[3] Hydraulic conductivity testing included drawdown and/or slug testing. Slug testing was performed at all of the indicated moonitoring well locations. Slug testig was supplemented with drawdown testing at BP-05S, -05D, -05D2, LLMW-11S, -11D, and LLMW-16D.

Table 3-3

Surface Water, Stormwater, Seep and Sediment Investigation Locations and Sample Collection Method

Everett Lowland

Everett, Washington

Sample Location Type	Water Investigation Location Identification	Water Sample Collection Method	Sediment Investigation Location Identification	Sediment Sample Collection Method
Surface Water Pond	LLSW-01	Peristaltic Pump	LLSD-01	Hand Auger
	LLSW-02	Peristaltic Pump	LLSD-02	Hand Auger
	LLSW-04	Peristaltic Pump	LLSD-04	Hand Auger
	LLSW-05	Peristaltic Pump	LLSD-05	Hand Auger
Stormwater Basin	LLSW-03	Peristaltic Pump	LLSD-03	Hand Auger
	LLSW-06	Peristaltic Pump	LLSD-06	Cookie Cutter
	LLSW-07	Peristaltic Pump	LLSD-07	Hand Auger
Stormwater Outfall	LLO-02	Grab	LLSD-13	Cookie Cutter
	LLO-03	Grab	LLSD-15	Hand Auger
	LLO-04	Grab	LLSD-16	Van Veen
	LLO-05	Grab	LLSD-18	Van Veen
	LLO-06	Grab	LLSD-20	Van Veen
	LLO-07[2]	Peristaltic Pump	LLSD-19	Cookie Cutter
Shoreline Seep	LLSP-03	Peristaltic Pump	LLSD-11	Cookie Cutter
	LLSP-05	Peristaltic Pump	LLSD-14	Cookie Cutter
	LLSP-06S	Peristaltic Pump	LLSD-17S[1]	Cookie Cutter
	LLSP-08	Peristaltic Pump	LLSD-21	Van Veen

Notes:

[1] The S designation indicates that the seep and sediment samples were collected from a seep location observed higher up on the shoreline above an exposed silt layer observed outcropping on the riverbank.

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

Table 3-4

Summary of Focused Source Area Investigation Locations and Sampling

Everett Smelter

Everett, Washington

Investigation Location	Total Depth (feet bgs)	Sample Identification	Sample Depth Interval (feet bgs)	Stratigraphic Unit
LLSB-04	10	LLSB-04-3.2-3.7	3.2-3.7	Fill
		LLSB-04-5-6	5-6	Fill
		LLSB-04-8-9	8-9	Weathered Till
LLSB-05	10	LLSB-05-4-4.5	4-4.5	Fill
		LLSB-05-5.5-6	5.5-6	Fill
		LLSB-05-9-9.5	9-9.5	Weathered Till
LLSB-06	10	LLSB-06-3-3.5	3-3.5	Fill
		LLSB-06-6-6.5	6-6.5	Fill and Weathered Till
LLSB-07	15	LLSB-07-3.5-4	3.5-4	Fill
		LLSB-07-5.4-5.9	5.4-5.9	Fill
		LLSB-07-8.5-9	8.5-9	Weathered Till
LLSB-08	10	LLSB-08-6-6.5	6-6.5	Weathered Till
LLSB-09	10	LLSB-09-3-3.5	3-3.5	Fill
		LLSB-09-4.5-5	4.5-5	Fill
		LLSB-09-7-7.5	7-7.5	Weathered Till
LLSB-10	10	LLSB-10-3-3.5	3-3.5	Fill
		LLSB-10-4.5-5	4.5-5	Fill
		LLSB-10-7-7.5	7-7.5	Weathered Till
LLSB-11	10	LLSB-11-3.5-4	3.5-4	Fill
		LLSB-11-6-6.5	6-6.5	Fill
LLSB-12	10	LLSB-12-2-2.5	2-2.5	Fill
		LLSB-12-3-3.5	3-3.5	Fill
		LLSB-12-6.5-7	6.5-7	Fill
LLSB-13	10	LLSB-13-4-4.5	4-4.5	Fill
		LLSB-13-6-6.5	6-6.5	Fill
LLSB-14	10	LLSB-17-3-3.5	3-3.5	Fill
		LLSB-20-4.5-5	4.5-5	Fill
		LLSB-24-6.5-7	6.5-7	Fill
LLSB-15	10	LLSB-15-2-2.5	2-2.5	Fill
		LLSB-15-3.5-4	3.5-4	Fill
		LLSB-15-5-5.5	5-5.5	Weathered Till
		LLSB-15-6.5-7	6.5-7	Weathered Till
LLSB-16	12	LLSB-16-2.5-3	2.5-3	Fill
		LLSB-16-5.5-6	5.5-6	Fill
		LLSB-16-8-8.5	8-8.5	Weathered Till
LLSB-17	15	LLSB-17-3.5-4	3.5-4	Fill
		LLSB-17-14-14.5	14-14.5	Fill
LLSB-18	20	LLSB-18-4.5-5	4.5-5	Fill
		LLSB-18-13-13.5	13-13.5	Fill
		LLSB-18-14-14.5	14-14.5	Fill
LLSB-19	10	LLSB-19-1.5-2	1.5-2	Fill
		LLSB-19-4.5-5	4.5-5	Fill
		LLSB-19-6.5-7	6.5-7	Fill
LLSB-20	10	LLSB-20-2.5-3.5	2.5-3.5	Fill
		LLSB-20-4.5-5	4.5-5	Fill
LLSB-21	15	LLSB-21-2-2.5	2-2.5	Fill
		LLSB-21-7-7.5	7-7.5	Fill
		LLSB-21-8.5-9	8.5-9	Fill
LLSB-22/22a[1]	15	LLSB-22-3-3.5	3-3.5	Fill
		LLSB-22-4.5-5	4.5-5	Fill
		LLSB-22a2-8-8.5	8-8.5	Fill
LLSB-23	15	LLSB-23-4.5-5	4.5-5	Fill
		LLSB-23-8.5-9	8.5-9	Fill
		LLSB-23-11-11.5	11-11.5	Fill
LLSB-24	15	LLSB-24-3.5-4	3.5-4	Fill
		LLSB-24-7-7.5	7-7.5	Fill
		LLSB-24-10-10.5	10-10.5	Weathered Till
LLSB-25	15	LLSB-25-3.5-4	3.5-4	Fill
		LLSB-25-7.5-8	7.5-8	Fill
		LLSB-25-10-10.5	10-10.5	Fill
LLSB-26	10	LLSB-26-1.8-2.3	1.8-2.3	Fill
		LLSB-26-2.8-3.2	2.8-3.2	Fill
		LLSB-26-5.2-5.4	5.2-5.4	Fill
LLSB-27	10	LLSB-27-1.3-3.3	1.3-3.3	Fill
		LLSB-27-3.8-4.5	3.8-4.5	Fill
		LLSB-27-5-5.4	5-5.4	Fill
		LLSB-27-5.8-7.2	5.8-7.2	Fill and Weathered Till

Table 3-4. Summary of Focused Source Area Investigation Locations and Sampling

Investigation Location	Total Depth (feet bgs)	Sample Identification	Sample Depth Interval (feet bgs)	Stratigraphic Unit
LLSB-28	10	LLSB-28-2.2-2.7	2.2-2.7	Fill
		LLSB-28-2.8-7.2	2.8-7.2	Fill and Weathered Till
LLSB-29	10	LLSB-29-1.8-2.7	1.8-2.7	Fill
		LLSB-29-3.5-3.8	3.5-3.8	Fill
		LLSB-29-5.2-5.5	5.2-5.5	Fill
		LLSB-29-5.8-6.2	5.8-6.2	Fill
		LLSB-29-6.3-7.7	6.3-7.7	Fill and Weathered Till
LLSB-30	10	LLSB-30-2.8-4.7	2.8-4.7	Fill
LLSB-31	10	LLSB-31-2.9-3.2	2.9-3.2	Fill
		LLSB-31-3.3-3.7	3.3-3.7	Fill
		LLSB-31-6.8-8.2	6.8-8.2	Weathered Till
LLSB-32	10	LLSB-32-2.3-2.8	2.3-2.8	Fill
		LLSB-32-4.8-5.3	4.8-5.3	Fill
LLSB-33	10	LLSB-33-3.3-3.7	3.3-3.7	Fill
		LLSB-33-3.8-4.3	3.8-4.3	Fill
		LLSB-33-4.3-5.2	4.3-5.2	Fill
LLSB-34	17.5	LLSB-34-3.8-4.2	3.8-4.2	Fill
		LLSB-34-4.9-5.2	4.9-5.2	Fill
		LLSB-34-5.3-5.7	5.3-5.7	Fill
		LLSB-34-5.8-6.3	5.8-6.3	Fill
LLSB-35	17	LLSB-35-7.3-7.7	7.3-7.7	Fill
		LLSB-35-7.8-8.3	7.8-8.3	Fill
		LLSB-35-8.3-8.7	8.3-8.7	Fill
LLSB-36	15	LLSB-36-7.3-7.7	7.3-7.7	Fill
		LLSB-36-8-8.7	8-8.7	Fill
		LLSB-36-11.8-12.3	11.8-12.3	Fill
		LLSB-36-12.4-15	12.4-15	Till
LLSB-37/37a[1]	15	LLSB-37-12.2-12.7	12.2-12.7	Till
		LLSB-37-12.8-15	12.8-15	Till
		LLSB-37a2-8.3-9.7	8.3-9.7	Fill
LLSB-38	15	LLSB-38-8.7-9.7	8.7-9.7	Fill
LLSB-39	17.5	LLSB-39-12.3-12.7	12.3-12.7	Fill
		LLSB-39-12.8-13.2	12.8-13.2	Fill
		LLSB-39-13.3-15.2	13.3-15.2	Fill
		LLSB-39-15.8-17	15.8-17	Fill and Weathered Till
LLSB-40	21	LLSB-40-14.8-15.7	14.8-15.7	Weathered Till
LLSB-41	15	LLSB-41-8.3-8.7	8.3-8.7	Fill
		LLSB-41-11.3-12.2	11.3-12.2	Fill
LLSB-42	14	LLSB-42-9.3-9.6	9.3-9.6	Fill
		LLSB-42-9.6-10	9.6-10	Fill
		LLSB-42-12.2-12.6	12.2-12.6	Weathered Till
LLSB-43	15	LLSB-43-3.8-6.2	3.8-6.2	Fill
		LLSB-43-7.5-7.8	7.5-7.8	Fill
		LLSB-43-7.8-8.7	7.8-8.7	Fill
		LLSB-43-9.3-11.6	9.3-11.6	Weathered Till
LLSB-44	15	LLSB-44-3.3-4.2	3.3-4.2	Fill
		LLSB-44-4.8-5.2	4.8-5.2	Fill
		LLSB-44-5.8-7.7	5.8-7.7	Fill
		LLSB-44-8.7-9.2	8.7-9.2	Fill
		LLSB-44-9.3-10.7	9.3-10.7	Fill
LLSB-45	15	LLSB-45-6.3-6.7	6.3-6.7	Fill
		LLSB-45-6.8-8.2	6.8-8.2	Fill
		LLSB-45-9.8-10.2	9.8-10.2	Fill
		LLSB-45-10.3-11.2	10.3-11.2	Fill
LLSB-46	17.5	LLSB-46-9.8-10.2	9.8-10.2	Fill
		LLSB-46-12.3-13.2	12.3-13.2	Fill
		LLSB-46-13.3-13.7	13.3-13.7	Fill
		LLSB-46-14.8-17	14.8-17	Weathered Till
LLSB-47	19	LLSB-47-12.3-12.7	12.3-12.7	Fill
		LLSB-47-12.8-13.7	12.8-13.7	Fill
		LLSB-47-13.8-14.2	13.8-14.2	Fill
		LLSB-47-14.3-15.2	14.3-15.2	Fill
		LLSB-47-15.3-15.7	15.3-15.7	Fill
		LLSB-47-15.8-16.3	15.8-16.3	Fill and Weathered Till
		LLSB-47-16.8-18.2	16.8-18.2	Weathered Till

Notes:

[1] A second boring was drilled approximately 1 foot east of the original boring due to poor recovery in the original boring.

bgs = below ground surface

"LLSB" indicates "Lowland soil boring location". Sample identifications for these locations have the following format; location designation followed by the sample depth interval in feet bgs.

Table 4-1

Geologic and Hydrogeologic Units of the Everett Smelter Site

Everett Lowland

Everett, Washington

Upland Area			Lowland Area		
Geologic Unit	**Description**	**Hydrogeologic Unit**	**Geologic Unit**	**Description**	**Hydrogeologic Unit**
Fill / Weathered Till	Clay to boulder sized, typically 0 to 5 feet thick	Shallow Aquifer (perched, seasonal)	Fill / Slag	Silt to gravel size, typically 5 to 50 feet thick	Shallow Aquifer
Till	Clay to boulder sized, typically 3 to 60 feet thick	Aquitard (not water-bearing)	Silt / Channel Deposits	Organics and silt; silty sand channel deposits, typically 5 to 10 feet thick	Confining Layer (with leaky channel deposits)
Outwash	Sand and gravel, up to 300 feet thick	Deep Aquifer (unconfined)	Alluvium	Fine to coarse sand with silt layers, greater than 100 feet thick	Deep Aquifer (confined/leaky-confined)

Table 4-2

Well Construction Details

Everett Lowland

Everett, Washington

Monitoring Well Identification	Well Screen Depth (Feet bgs)		Top of Casing Elevation (Feet NAVD 88)	Well Screen Elevation (Feet NAVD 88)		Screened Geologic Unit	Screened Hydrogeologic Unit
	Top	Bottom		Top	Bottom		
BP-01S	3	9.2	17.77	14.77	8.57	Lowland Fill	Lowland Shallow Aquifer
BP-01D	22	32	17.97	-4.03	-14.03	Lowland Alluvium	Lowland Deep Aquifer
BP-02S	3	8.7	18.85	15.85	10.15	Lowland Fill	Lowland Shallow Aquifer
BP-02D	22	32	18.88	-3.12	-13.12	Lowland Alluvium	Lowland Deep Aquifer
BP-03S	3	8.7	18.26	15.26	9.56	Lowland Fill	Lowland Shallow Aquifer
BP-03D	21	31	18.37	-2.63	-12.63	Lowland Alluvium	Lowland Deep Aquifer
BP-04S	3	8.2	18.36	15.36	10.16	Lowland Fill	Lowland Shallow Aquifer
BP-04D	21	31	18.32	-2.68	-12.68	Lowland Alluvium	Lowland Deep Aquifer
BP-04D2	60	65	18.54	-41.46	-46.46	Lowland Alluvium	Lowland Deep Aquifer
BP-05S	3	9.2	18.56	15.56	9.36	Lowland Fill	Lowland Shallow Aquifer
BP-05D	23	33	18.65	-4.35	-14.35	Lowland Alluvium	Lowland Deep Aquifer
BP-05D2	67	72	19.26	-47.74	-52.74	Lowland Alluvium	Lowland Deep Aquifer
BP-06S	3	8.7	18.43	15.43	9.73	Lowland Fill	Lowland Shallow Aquifer
BP-06D	24	34	18.39	-5.61	-15.61	Lowland Alluvium	Lowland Deep Aquifer
BP-07S	3	11.7	18.41	15.41	6.71	Lowland Fill	Lowland Shallow Aquifer
BP-07D	25.5	35.5	18.40	-7.1	-17.1	Lowland Alluvium	Lowland Deep Aquifer
BP-07D2	70	80	18.58	-51.42	-61.42	Lowland Alluvium	Lowland Deep Aquifer
BP-08S	3	8.7	18.73	15.73	10.03	Lowland Fill	Lowland Shallow Aquifer
BP-08D	21	31	18.59	-2.41	-12.41	Lowland Alluvium	Lowland Deep Aquifer
BP-09S	4	13.7	18.91	14.91	5.21	Lowland Fill	Lowland Shallow Aquifer
BP-09D	19	29	19.03	0.03	-9.97	Lowland Alluvium	Lowland Deep Aquifer
BP-10S	3	8.7	18.82	15.82	10.12	Lowland Fill	Lowland Shallow Aquifer
BP-10D	19	29	18.86	-0.14	-10.14	Lowland Alluvium	Lowland Deep Aquifer
LLMW-01D	27.5	37.5	15.74	-11.76	-21.76	Lowland Alluvium	Lowland Deep Aquifer
LLMW-02D	22	32	15.15	-6.85	-16.85	Lowland Alluvium	Lowland Deep Aquifer
LLMW-03S	3.5	8.5	17.45	13.95	8.95	Lowland Fill	Lowland Shallow Aquifer
LLMW-03D	21	31	17.45	-3.55	-13.55	Lowland Alluvium	Lowland Deep Aquifer
LLMW-04S	4	14	21.91	17.91	7.91	Lowland Fill	Lowland Shallow Aquifer
LLMW-04D	22	32	21.98	-0.02	-10.02	Lowland Alluvium	Lowland Deep Aquifer
LLMW-05S	4	9	14.05	10.05	5.05	Lowland Fill	Lowland Shallow Aquifer
LLMW-05D	15	25	13.92	-1.08	-11.08	Lowland Alluvium	Lowland Deep Aquifer
LLMW-06S	4	7	12.49	8.49	5.49	Lowland Fill	Lowland Shallow Aquifer
LLMW-06D	18	28	12.29	-5.71	-15.71	Lowland Alluvium	Lowland Deep Aquifer
LLMW-07S	4	9	13.82	9.82	4.82	Lowland Fill	Lowland Shallow Aquifer
LLMW-07D	15	25	13.81	-1.19	-11.19	Lowland Alluvium	Lowland Deep Aquifer
LLMW-08S	5	10	16.21	11.21	6.21	Lowland Fill	Lowland Shallow Aquifer
LLMW-08D	15	25	16.26	1.26	-8.74	Lowland Alluvium	Lowland Deep Aquifer
LLMW-09S	3.5	6	12.57	9.07	6.57	Lowland Fill	Lowland Shallow Aquifer
LLMW-09D	17	27	12.79	-4.21	-14.21	Lowland Alluvium	Lowland Deep Aquifer
LLMW-10S	4	6.5	15.91	11.91	9.41	Lowland Fill	Lowland Shallow Aquifer
LLMW-10D	21	31	15.97	-5.03	-15.03	Lowland Alluvium	Lowland Deep Aquifer
LLMW-11S	3.5	9.5	19.76	16.26	10.26	Lowland Fill	Lowland Shallow Aquifer
LLMW-11D	12	22	19.71	7.71	-2.29	Lowland Alluvium	Lowland Deep Aquifer
LLMW-12S	3	7	15.61	12.61	8.61	Lowland Fill	Lowland Shallow Aquifer
LLMW-12D	17	27	15.71	-1.29	-11.29	Lowland Alluvium	Lowland Deep Aquifer
LLMW-13S	8	18	21.49	13.49	3.49	Lowland Fill	Lowland Shallow Aquifer
LLMW-13D	25	35	21.24	-3.76	-13.76	Lowland Alluvium	Lowland Deep Aquifer
LLMW-14S	3.5	6	14.74	11.24	8.74	Lowland Fill	Lowland Shallow Aquifer
LLMW-14D	20	30	14.80	-5.2	-15.2	Lowland Alluvium	Lowland Deep Aquifer

Table 4-2. Well Construction Details

Monitoring Well Identification	Well Screen Depth (Feet bgs)		Top of Casing Elevation (Feet NAVD 88)	Well Screen Elevation (Feet NAVD 88)		Screened Geologic Unit	Screened Hydrogeologic Unit
	Top	Bottom		Top	Bottom		
LLMW-15S	3.5	9.5	15.94	12.44	6.44	Lowland Fill	Lowland Shallow Aquifer
LLMW-15D	24	34	16.07	-7.93	-17.93	Lowland Alluvium	Lowland Deep Aquifer
LLMW-16S	4	12	20.02	16.02	8.02	Lowland Fill	Lowland Shallow Aquifer
LLMW-16D	24	34	20.14	-3.86	-13.86	Lowland Alluvium	Lowland Deep Aquifer
LLMW-17S	4	11	18.27	14.27	7.27	Lowland Fill	Lowland Shallow Aquifer
LLMW-17D	15	25	18.29	3.29	-6.71	Lowland Alluvium	Lowland Deep Aquifer
LLMW-18S	3.5	7.5	15.70	12.2	8.2	Lowland Fill	Lowland Shallow Aquifer
LLMW-18D	20	30	15.91	-4.09	-14.09	Lowland Alluvium	Lowland Deep Aquifer
LLMW-19D	17	27	14.22	-2.78	-12.78	Lowland Alluvium	Lowland Deep Aquifer
LLMW-20D	11	21	14.92	3.92	-6.08	Lowland Alluvium	Lowland Deep Aquifer
LLMW-21S	3.5	7	16.04	12.54	9.04	Lowland Fill	Lowland Shallow Aquifer
LLMW-21D	23	33	16.03	-6.97	-16.97	Lowland Alluvium	Lowland Deep Aquifer
LLMW-22S	3.5	7	12.87	9.37	5.87	Lowland Fill	Lowland Shallow Aquifer
LLMW-22D	17	27	12.80	-4.2	-14.2	Lowland Alluvium	Lowland Deep Aquifer
LLMW-23S	14	24	25.54	11.54	1.54	Lowland Fill	Lowland Shallow Aquifer
LLMW-23D	30	40	25.30	-4.7	-14.7	Lowland Alluvium	Lowland Deep Aquifer
LLMW-24D	43.5	53.5	54.28	10.78	0.78	Upland Outwash	Upland Deep Aquifer
LLMW-25D	55	65	61.76	6.76	-3.24	Upland Outwash	Upland Deep Aquifer
LLMW-27S	31	36	61.46	30.46	25.46	Upland Outwash	Upland Deep Aquifer
LLMW-27D	50	60	61.71	11.71	1.71	Upland Outwash	Upland Deep Aquifer
LLMW-29S	5	15	55.66	50.66	40.66	Upland Fill	Upland Shallow Aquifer
LLMW-29D	50	60	55.62	5.62	-4.38	Upland Outwash	Upland Deep Aquifer
LLMW-31D	54	64	58.41	4.41	-5.59	Upland Outwash	Upland Deep Aquifer
LLMW-33S	3.5	10.5	37.42	33.92	26.92	Upland Fill	Upland Shallow Aquifer
LLMW-33D	35	45	37.24	2.24	-7.76	Upland Outwash	Upland Deep Aquifer
LLMW-34S	4	12	52.71	48.71	40.71	Upland Fill	Upland Shallow Aquifer
LLMW-34D	63.5	73.5	53.03	-10.47	-20.47	Upland Outwash	Upland Deep Aquifer
LLMW-35D	81.5	91.5	90.98	9.48	-0.52	Upland Outwash	Upland Deep Aquifer
LLMW-36D	20	30	21.04	1.04	-8.96	Lowland Alluvium	Lowland Deep Aquifer
EV-6A	44.5	54.5	60.96	16.46	6.46	Upland Fill	Upland Shallow Aquifer
EV-6B	62.5	67.5	60.91	-1.59	-6.59	Lowland Channel Deposits	Lowland Confining Layer[1]
EV-7B	24	29	14.87	-9.13	-14.13	Lowland Alluvium	Lowland Deep Aquifer
EV-13	4	10	Not surveyed	58[2]	52[2]	Upland Fill	Upland Shallow Aquifer
EV-19B	52	57	61.46	9.46	4.46	Upland Outwash	Upland Deep Aquifer
EV-20B	50	55	64.28	14.28	9.28	Upland Outwash	Upland Deep Aquifer
EV-22A	15	20	28.59	13.59	8.59	Lowland Fill	Lowland Shallow Aquifer
EV-22B	30	35	29.02	-0.98	-5.98	Lowland Alluvium	Lowland Deep Aquifer
MW-1202R	3	10	12.08	9.08	2.08	Lowland Fill	Lowland Shallow Aquifer
MW-1203R	6	12	15.7	9.7	3.7	Lowland Fill	Lowland Shallow Aquifer
MW-1301R	3	10	14.44	11.44	4.44	Lowland Fill	Lowland Shallow Aquifer
MW-1501R	3	10	11.94	8.94	1.94	Lowland Fill	Lowland Shallow Aquifer
MW-1701	2	8	Not surveyed	13[2]	7[2]	Lowland Fill	Lowland Shallow Aquifer
PZ-1B	Unknown[3]	7.5[3]	11.34	Unknown[3]	3.81	Lowland Fill	Lowland Shallow Aquifer
PZ-2B	Unknown[3]	8.5[3]	12.02	Unknown[3]	3.49	Lowland Fill	Lowland Shallow Aquifer
PZ-3B	Unknown[3]	7[3]	11.23	Unknown[3]	-61.77	Lowland Fill	Lowland Shallow Aquifer
UNK	Unknown[4]	18[3]	20.05	Unknown[4]	-162.95	Lowland Fill	Lowland Shallow Aquifer

Notes:

[1] Well EV-6B is screened in what Hydrometrics has described as channel deposits. These deposits consist of silty sands that replace the silt confining layer that is found elsewhere throughout the Lowlands at the same approximate elevation. The geologic unit that is the silt layer coincides with the hydrogeologic unit called the Lowland confining layer in Table 4-1.

[2] The well was not surveyed. The approximate elevations have been estimated based on nearby surveyed features. Therefore, the well screen elevations should be considered approximate (i.e., to within approximately 1 foot of the indicated value).

[3] The monitoring location is a piezometer constructed by others. The screened interval is not known. The bottom of the piezometer, as measured in the field, is reported as the bottom of the well screen depth.

[4] Little is known about the origin, construction or purpose of this "unkown" well. The bottom of the well, as measured in the field, is reported as the bottom of the well screen depth.

Table 4-3

Groundwater Level Measurements - 2013 Snapshot Events

Everett Lowland

Everett, Washington

SHALLOW AQUIFER MONITORING WELLS

Location Designation	Northing (Y)[1]	Easting (X)[1]	TOC Elevation[2] (ft)	Q1 Snapshot		Q2 Snapshot		Q3 Snapshot		Q4 Snapshot	
				DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)
MW-1203R	373910.15	1307960.38	15.7	8.51	7.19	9.67	6.03	10.02	5.68	9.79	5.91
EV-22A	372106.2793	1308333.578	28.59	13.43	15.16	14.2	14.39	15.76	12.83	15.18	13.41
BP-02S	371826.4767	1308735.183	18.85	--	--	5.46	13.39	6.92	11.93	4.42	14.43
BP-03S	371659.4186	1308766.223	18.26	--	--	4.29	13.97	4.61	13.65	3.35	14.91
BP-04S	371545.1199	1308782.617	18.36	--	--	4.24	14.12	4.91	13.45	4.1	14.26
BP-05S	371481.4942	1308791.423	18.56	3.75	14.81	4.31	14.25	4.36	14.20	3.58	14.98
BP-07S	371337.2871	1308811.404	18.41	--	--	--	--	3.67	14.74	3.23	15.18
BP-08S	371143.3462	1308839.017	18.73	3.31	15.42	3.5	15.23	3.50	15.23	3.32	15.41
LLMW-03S	372968.3797	1308356.380	17.45	5.67	11.78	6.05	11.40	7.31	10.14	6.89	10.56
LLMW-04S	372644.1374	1308250.391	21.91	7.75	14.16	8.54	13.37	9.04	12.87	8.09	13.82
LLMW-05S	372938.0230	1309084.803	14.05	--	--	5.59	8.46	6.50	7.55	6.41	7.64
LLMW-06S	372477.6634	1309132.426	12.49	3.86	8.63	4.73	7.76	6.39	6.10	6.09	6.40
LLMW-07S	372578.1202	1309467.272	13.82	--	--	5.77	8.05	5.71	8.11	6.12	7.70
LLMW-08S	372213.2542	1309788.249	16.21	9.57	6.64	10.56	5.65	10.8	5.41	9.92	6.29
LLMW-10S	371722.2934	1309357.791	15.91	7.64	8.27	7.85	8.06	8.28	7.63	7.96	7.95
LLMW-11S	371825.3634	1310349.586	19.76	--	--	12.43	7.33	DRY	--	DRY	--
LLMW-12S	371520.0860	1309412.663	15.61	--	--	7.31	8.30	8.30	7.31	7.52	8.09
LLMW-13S	371682.6131	1309796.930	21.49	11.86	9.63	12.72	8.77	13.27	8.22	13.34	8.15
LLMW-14S	371373.4769	1309447.067	14.74	--	--	6.56	8.18	7.52	7.22	6.78	7.96
LLMW-15S	371051.1506	1309535.419	15.94	7.28	8.66	7.67	8.27	8.35	7.59	7.76	8.18
LLMW-16S	371159.2967	1310164.452	20.02	10.82	9.20	11.69	8.33	12.41	7.61	12.49	7.53
LLMW-17S	371320.3207	1310602.283	18.27	11.85	6.42	12.24	6.03	12.94	5.33	12.57	5.70
LLMW-21S	370010.9467	1309885.453	16.04	7.39	8.65	7.67	8.37	7.90	8.14	7.29	8.75
LLMW-22S	369173.0090	1310445.634	12.87	4.63	8.24	4.96	7.91	5.35	7.52	4.91	7.96
LLMW-27S	371254.5214	1308467.368	61.46	--	--	--	--	DRY	--	--	--
LLMW-29S	370978.8889	1308556.936	55.66	--	--	--	--	DRY	--	--	--
MW-1701[4]	--	--	--	--	--	--	--	--	--	4.12	--

DEEP AQUIFER MONITORING WELLS

Location Designation	Northing (Y)[1]	Easting (X)[1]	TOC Elevation[2] (ft)	Q1 Snapshot		Q2 Snapshot		Q3 Snapshot		Q4 Snapshot	
				DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)	DTW TOC (ft)	GW Elevation[2] (ft)
EV-7B	371490.8311	1308696.544	14.87	--	--	--	--	6.86	8.01	6.55	8.32
EV-22B	372111.4369	1308337.155	29.02	19.99	9.03	19.51	9.51	19.51	9.51	19.53	9.49
BP-02D	372886.6753	1307921.185	18.88	--	--	11.13	7.75	11.49	7.39	11.15	7.73
BP-03D	371655.4975	1308766.43	18.37	--	--	10.48	7.89	10.91	7.46	10.69	7.68
BP-04D	371541.1801	1308782.814	18.33	--	--	10.36	7.97	10.82	7.51	10.58	7.75
BP-04D2[3]	371552.1957	1308789.925	18.54	--	--	--	--	10.17	8.37	10.01	8.53
BP-05D	371477.267	1308791.557	18.65	10.23	8.42	10.68	7.97	11.12	7.53	10.87	7.78
BP-05D2[3]	371472.412	1308791.713	19.26	--	--	--	--	7.33	11.93	7.42	11.84
BP-07D	371332.8036	1308812.098	18.402	--	--	--	--	10.93	7.47	10.71	7.69
BP-07D2[3]	371340.7835	1308814.767	18.58	--	--	--	--	7.80	10.78	7.91	10.67
BP-08D	371139.579	1308839.538	18.59	10.71	7.88	11	7.59	11.60	6.99	11.34	7.25
LLMW-01D	373911.1708	1307952.929	15.74	8.03	7.71	12.41	3.33	12.78	2.96	8.63	7.11
LLMW-02D	372887.009	1307921.39	15.15	7.18	7.97	6.24	8.91	8.88	6.27	7.97	7.18
LLMW-03D	372965.5718	1308351.511	17.45	9.42	8.03	12.15	5.30	12.06	5.39	10.14	7.31
LLMW-04D	372642.8382	1308246.252	21.98	13.88	8.10	16.12	5.86	15.28	6.70	14.42	7.56
LLMW-05D	372933.914	1309087.930	13.92	--	--	11.42	2.50	11.97	1.95	5.57	8.35
LLMW-06D	372472.7325	1309133.872	12.29	4.92	7.37	7.35	4.94	7.59	4.70	4.94	7.35
LLMW-07D	372580.662	1309464.938	13.81	--	--	10.96	2.85	11.40	2.41	5.54	8.27
LLMW-08D	372209.3701	1309788.569	16.26	9.02	7.24	12.29	3.97	12.72	3.54	8.39	7.87
LLMW-10D	371725.4255	1309359.407	15.97	8.34	7.63	10.73	5.24	10.73	5.24	9.06	6.91
LLMW-11D	371821.896	1310350.780	19.71	--	--	17.45	2.26	18.13	1.58	11.68	8.03
LLMW-12D	371523.015	1309414.262	15.71	--	--	10.42	5.29	10.43	5.28	8.87	6.84
LLMW-13D	371682.4624	1309793.149	21.24	13.94	7.30	16.82	4.42	17.19	4.05	14.17	7.07
LLMW-14D	371375.602	1309449.147	14.80	--	--	9.48	5.32	9.50	5.30	8.12	6.68
LLMW-15D	371053.2175	1309536.612	16.07	8.68	7.39	10.57	5.50	10.3	5.77	9.56	6.51
LLMW-16D	371158.166	1310160.437	20.14	13.15	6.99	15.98	4.16	16.63	3.51	12.86	7.28
LLMW-17D	371317.6575	1310603.072	18.29	11.01	7.28	15.73	2.56	16.43	1.86	10.41	7.88
LLMW-21D	370011.1759	1309881.28	16.03	8.87	7.16	10.62	5.41	10.35	5.68	9.83	6.20
LLMW-22D	369167.8357	1310446.091	12.80	5.47	7.33	10.24	2.56	8.51	4.29	6.12	6.68
LLMW-27D	371259.2652	1308465.435	61.71	47.48	14.23	47.41	14.30	47.94	13.77	48.23	13.48
LLMW-29D	370982.4647	1308556.215	55.62	41.31	14.31	41.23	14.39	41.79	13.83	42.12	13.50
LLMW-35D	371239.0453	1308164.388	90.98	--	--	--	--	77.07	13.91	77.42	13.56
LLMW-36D	371372.9356	1308601.392	21.04	--	--	--	--	8.27	12.77	8.41	12.63

Notes:

Q1 Snapshot = Quarterly monitoring performed in January/February 2013

Q2 Snapshot = Quarterly monitoring performed in April/May 2013

Q3 Snapshot = Quarterly monitoring performed in August/September 2013

Q4 Snapshot = Quarterly monitoring performed in November 2013

[1] Northing (Y) and Easting (X) are in Washington State Plane North Coordinate System, 83/91 grid values.

[2] Vertical datum is NAVD 88, US survey feet.

[3] The deeper, deep wells (i.e., designated D2) are not used in groundwater gradient contouring.

[4] Well MW-1701 was not surveyed during previous work by Floyd Snyder because it was thought to have been destroyed at the time of survey. Therefore, the depth to water recorded for this well was not coverted to water level elevation.

DTW TOC = Depth to water below top of PVC well casing.

-- = The water level in the well was not measured during the identified monitoring event and therefore, the groundwater elevation could not be calculated.

DRY = The well was dry and therefore, the groundwater elevation could not be calculated.

GW = Groundwater

Table 4-4

Observed Tidal Effects on Groundwater in the Deep Aquifer

Everett Lowland
Everett, Washington

Monitoring Well Identification	Distance from Shoreline (ft) [1]	Tidal Study 1 [2]			Tidal Study 2 [3]		
		Mean Groundwater Elevation (ft NAVD 88)	Time Lag (hours)	Stage Ratio (%)	Mean Groundwater Elevation (ft NAVD 88)	Time Lag (hours)	Stage Ratio (%)
LLMW11D	49	5.9	0.6	77	5.3	0.6	69
LLMW06D	361	6.5	1.4	55	6.2	1.4	51
LLMW13D	604	6.2	1.7	54	5.8	1.7	50
LLMW12D	1,013	6.6	2.6	44	6.0	2.4	39
BP05D	1,483	7.7	3.4	29	7.3	3.4	25
EV-7B	1,550	--	--	--	7.9	3.4	22
BP08D	1,699	8.4	4.1	30	6.8	3.8	25
LLMW-36D [4]	1,700	--	--	--	12.5	3.4	4
EV-20B [5]	1,653	--	--	--	13.6	NO	NO
LLMW-35D [4, 5]	2,130	--	--	--	13.7	NO	NO

Notes:

[1] Distance is from the well to the nearest shoreline area.

[2] The first tidal study completed as part of the supplemental investigation was performed between February 5 and February 15, 2013.

[3] The second tidal study completed as part of the supplemental investigation was performed between November 4 and November 8, 2013.

[4] Monitoring well not installed until August 2013.

[5] Monitoring well installed in deep aquifer in the Upland Area. There was no discernable tidal effect observed on water levels in this aquifer.

NO = Tidal effects not observed at this location.

-- = Location not monitored as part of first tidal study.

% = percent

Table 4-5

Vertical Hydraulic Gradients For Snapshot Groundwater Monitoring Events

Everett Smelter - Lowland Area

Everett, Washington

Monitoring Well Identification	Q1 Snapshot			Q2 Snapshot			Q3 Snapshot			Q4 Snapshot		
	DTW TOC (ft) [1]	Groundwater Elevation (ft) [2]	VHG (ft/ft)	DTW TOC (ft) [1]	Groundwater Elevation (ft) [2]	VHG (ft/ft)	DTW TOC (ft) [1]	Groundwater Elevation (ft) [2]	VHG (ft/ft)	DTW TOC (ft) [1]	Groundwater Elevation (ft) [2]	VHG (ft/ft)
Shallow and Deep (Upper Alluvium)												
MW-1203R	8.51	7.19	-0.022	9.67	6.03	0.115	10.02	5.68	0.115	9.79	5.91	-0.051
LLMW-01D	8.03	7.71		12.41	3.33		12.78	2.96		8.63	7.11	
EV-22A	13.43	15.16	0.409	14.2	14.39	0.326	15.76	12.83	0.222	15.18	13.41	0.262
EV-22B	19.99	9.03		19.51	9.51		19.51	9.51		19.53	9.49	
BP-02S	NM	NM	NM	5.46	13.39	0.266	6.92	11.93	0.214	4.42	14.43	0.316
BP-02D	NM	NM		11.13	7.75		11.49	7.39		11.15	7.73	
BP-03S	NM	NM	NM	4.29	13.97	0.303	4.61	13.65	0.309	3.35	14.91	0.360
BP-03D	NM	NM		10.48	7.89		10.91	7.46		10.69	7.68	
BP-04S	NM	NM	NM	4.24	14.12	0.303	4.91	13.45	0.293	4.1	14.26	0.321
BP-04D	NM	NM		10.36	7.97		10.82	7.51		10.58	7.75	
BP-05S	3.75	14.81	0.293	4.31	14.25	0.288	4.36	14.20	0.305	3.58	14.98	0.330
BP-05D	10.23	8.42		10.68	7.97		11.12	7.53		10.87	7.78	
BP-07S	NM	NM	NM	NM	NM	NM	3.67	14.74	0.313	3.23	15.18	0.323
BP-07D	NM	NM		NM	NM		10.93	7.47		10.71	7.69	
BP-08S	3.31	15.42	0.371	3.5	15.23	0.376	3.5	15.23	0.405	3.32	15.41	0.401
BP-08D	10.71	7.88		11.00	7.59		11.60	6.99		11.34	7.25	
LLMW-03S	5.67	11.78	0.187	6.05	11.40	0.304	7.31	10.14	0.237	6.89	10.56	0.162
LLMW-03D	9.42	8.03		12.15	5.30		12.06	5.39		10.14	7.31	
LLMW-04S	7.75	14.16	0.342	8.54	13.37	0.424	9.04	12.87	0.348	8.09	13.82	0.353
LLMW-04D	13.88	8.10		16.12	5.86		15.28	6.70		14.42	7.56	
LLMW-05S	NM	NM	NM	5.59	8.46	0.441	6.5	7.55	0.414	6.41	7.64	-0.052
LLMW-05D	NM	NM		11.42	2.50		11.97	1.95		5.57	8.35	
LLMW-06S	3.86	8.63	0.072	4.73	7.76	0.161	6.39	6.10	0.080	6.09	6.40	-0.054
LLMW-06D	4.92	7.37		7.35	4.94		7.59	4.70		4.94	7.35	
LLMW-07S	NM	NM	NM	5.77	8.05	0.386	5.71	8.11	0.423	6.12	7.70	-0.042
LLMW-07D	NM	NM		10.96	2.85		11.40	2.41		5.54	8.27	
LLMW-08S	9.57	6.64	-0.049	10.56	5.65	0.137	10.8	5.41	0.153	9.92	6.29	-0.129
LLMW-08D	9.02	7.24		12.29	3.97		12.72	3.54		8.39	7.87	
LLMW-10S	7.64	8.27	0.031	7.85	8.06	0.136	8.28	7.63	0.115	7.96	7.95	0.050
LLMW-10D	8.34	7.63		10.73	5.24		10.73	5.24		9.06	6.91	
LLMW-11S	NM	NM	NM	12.43	7.33	Perched	DRY	DRY	--	DRY	DRY	--
LLMW-11D	NM	NM		17.45	2.26		18.13	1.58		11.68	8.03	
LLMW-12S	NM	NM	NM	7.31	8.30	0.175	8.3	7.31	0.118	7.52	8.09	0.073
LLMW-12D	NM	NM		10.42	5.29		10.43	5.28		8.87	6.84	
LLMW-13S	11.86	9.63	0.138	12.72	8.77	0.257	13.27	8.22	0.246	13.34	8.15	0.064
LLMW-13D	13.94	7.30		16.82	4.42		17.19	4.05		14.17	7.07	
LLMW-14S	NM	NM	NM	6.56	8.18	0.141	7.52	7.22	0.095	6.78	7.96	0.063
LLMW-14D	NM	NM		9.48	5.32		9.50	5.30		8.12	6.68	
LLMW-15S	7.28	8.66	0.056	7.67	8.27	0.123	8.35	7.59	0.081	7.76	8.18	0.074
LLMW-15D	8.68	7.39		10.57	5.50		10.30	5.77		9.56	6.51	
LLMW-16S	10.82	9.20	0.105	11.69	8.33	0.198	12.41	7.61	0.195	12.49	7.53	0.012
LLMW-16D	13.15	6.99		15.98	4.16		16.63	3.51		12.86	7.28	
LLMW-17S	11.85	6.42	-0.068	12.24	6.03	0.277	12.94	5.33	Perched	12.57	5.70	-0.174
LLMW-17D	11.01	7.28		15.73	2.56		16.43	1.86		10.41	7.88	
LLMW-21S	7.39	8.65	0.065	7.67	8.37	0.128	7.9	8.14	0.107	7.29	8.75	0.111
LLMW-21D	8.87	7.16		10.62	5.41		10.35	5.68		9.83	6.20	
LLMW-22S	4.63	8.24	0.055	4.96	7.91	0.319	5.35	7.52	0.193	4.91	7.96	0.077
LLMW-22D	5.47	7.33		10.24	2.56		8.51	4.29		6.12	6.68	
Deep and Deep (Upper and Lower Alluvium)												
BP-04D	NM	NM	NM	NM	NM	NM	10.82	7.51	-0.02345	10.58	7.75	-0.02127
BP-04D2	NM	NM	NM	NM	NM	NM	10.17	8.37		10.01	8.53	
BP-05D	NM	NM	NM	NM	NM	NM	11.12	7.53	-0.10757	10.87	7.78	-0.09925
BP-05D2	NM	NM	NM	NM	NM	NM	7.33	11.93		7.42	11.84	
BP-07D	NM	NM	NM	NM	NM	NM	10.93	7.47	-0.07501	10.71	7.69	-0.06753
BP-07D2	NM	NM	NM	NM	NM	NM	7.8	10.78		7.91	10.67	

Notes:

Q1 Snapshot = Quarterly monitoring performed in January/February 2013

Q2 Snapshot = Quarterly monitoring performed in April/May 2013

Q3 Snapshot = Quarterly monitoring performed in August/September 2013

Q4 Snapshot = Quarterly monitoring performed in November 2013

VHG = Vertical Hydraulic Gradient

[1] DTW TOC = Depth to water below top of PVC casing

[2] Vertical datum is NAVD 88, US survey feet.

DRY = The well was dry and therefore, the groundwater elevation could not be calculated.

- = The VHG could not be calculated because the well installed in the shallow aquifer was dry.

PERCHED = water level in lower well was below the bottom of the silt aquitard creating an unsaturated zone between shallow and deep well screens. Therefore, the VHG could not be calculated.

NM = Not Monitored

Table 4-6

Estimated Hydraulic Conductivity by Aquifer

Everett Smelter - Lowlands Area
Everett, Washington

Wells Screened in the Lowland Area Shallow Aquifer		
Monitoring Well Identification	**Hydraulic Conductivity (K, ft/day)**	**Hydraulic Test**
BP-05S	1.97	Slug Test
BP-08S	1.78	Slug Test
EV-22A	1.55	Slug Test
LLMW-03S	28.14	Slug Test
LLMW-11S	85.57	Slug Test
LLMW-12S	196.92	Slug Test
LLMW-16S	8.18	Slug Test, Drawdown Test
LLMW-22S	254.28	Slug Test
Mean	72.30	--
Standard Deviation	99.86	--
Wells Screened in the Lowland Area Deep Aquifer		
Monitoring Well Identification	**Hydraulic Conductivity (K, ft/day)**	**Hydraulic Test**
BP-05D	27.71	Slug Test, Drawdown Test
BP-05D2	2.11	Slug Test, Drawdown Test
BP-08D	11.65	Slug Test
EV-22B	0.01	Slug Test
LLMW-03D	111.56	Slug Test
LLMW-11D	24.77	Slug Test, Drawdown test
LLMW-12D	173.07	Slug Test
LLMW-16D	91.42	Slug Test, Drawdown Test
LLMW-22D	245.28	Slug Test
Standard Deviation	86.54	--
Mean	76.40	--
Bulk Aquifer	23	Tidal study 1
Bulk Aquifer	29	Tidal study2
Wells Screened in the Upland Area Deep Aquifer		
Monitoring Well Identification	**Hydraulic Conductivity (K, ft/day)**	**Hydraulic Test**
LLMW-27D	2.74	Slug Test

Notes:

[1] Where both slug and drawdown tests were performed, the identified hydraulic conductivity result is from the drawdown test. Hydraulic conductivities were calculated for slug tests using Bouwer and Rice (1976) or Butler and Garnett (2000). Hydraulic conductivity values for drawdown tests were calculated from Cooper-Jacob (1946) and Theis Recovery (1935) methods by converting average T values calculated from pumping and recovery phases to K values using assumed aquifer thickness of 35 feet.

K = Hydraulic conductivity

ft/day = feet per day

Table 4-7

Average Horizontal Groundwater Velocities Between Selected Wells

Everett Lowland

Everett, Washington

Well Pair Used for Velocity Calculation		General Soil Type[1]	Effective Porosity by Soil Type (n_e)[2]	Hydraulic Conductivity (K)[3] (ft/day)	Groundwater Gradient (i)[4]		Average Horizontal Groundwater Velocity[5,6] (ft/day)	
Upgradient Well	Downgradient Well				Tidal Study 1[7]	Tidal Study 2[8]	Tidal Study 1[7]	Tidal Study 2[8]
Lowland Area Shallow Aquifer								
BP-05S	LLMW-12S	Silty Sand	0.30	99.45	0.0098	0.011	3.23	3.68
LLMW-12S	LLMW-11S	Silty Sand	0.30	141.25	0.00055	DRY	0.26	DRY
Lowland Area Deep Aquifer								
Slug and Drawdown Test Values								
LLMW-36D	BP-05D	Fine to Coarse Sand	0.32	27.71	--	0.024	--	2.05
BP-05D	LLMW-12D	Silty Sand	0.30	100.39	0.0018	0.0020	0.59	0.69
LLMW-12D	LLMW-11D	Fine to Coarse Sand	0.32	98.92	0.00053	0.00065	0.17	0.20
Tidal Study "Bulk" Values								
BP-05D	LLMW-11D	Fine to Coarse Sand	0.32	26.00	0.0011	0.0013	0.08	0.11
Upland Area Deep Aquifer[9, 10]								
LLMW-35D	LLMW-36D	Fine to Medium Sand	0.32	2.74	--	0.0052	--	0.04

Notes:

[1] Soil type based on visual classification during well installation.

[2] Average effective porosity (n_e) values by soil type from Argonne National Laboratory Environmental Science Division website, U.S. Department of Energy.

[3] Where both slug and drawdown tests were performed on a single well, the result presented is from the drawdown test. The average hydraulic conductivity was used if both wells used for gradient calculation were hydraulically tested (i.e., drawdown and/or slug tested).

[4] Hydraulic gradients (i) are calculated from mean groundwater elevations observed during each tidal study between the two wells noted.

[5] Horizontal groundwater velocity calculation: $v = K/n_e*i$

[6] Horizontal groundwater velocities are based on literature values for effective porosity by soil type and hydraulic gradients are calculated from a limited set of data points. Groundwater velocities should therefore be considered estimates.

[7] The first tidal study completed as part of the supplemental investigation was performed between February 5 and February 15, 2013.

[8] The second tidal study completed as part of the supplemental investigation was performed between November 4 and November 8, 2013.

[9] Hydraulic conductivity value from slug testing of well LLMW-27D was used in the velocity calculation for the Upland Area.

[10] Velocity for the Upland Area was calculated using LLMW-36D as the end point. LLMW-36D is completed at the edge of the Upland and Lowland deep aquifer contact and the value is considered representative of groundwater moving from the Upland deep aquifer to the Lowland deep aquifer.

DRY = LLMW-11S was dry and therefore, the groundwater gradient and velocity could not be calculated.

-- = Well not used for tidal study. Therefore the average groundwater elevation, gradient and velocity could not be calculated.

Table 5-1

Preliminary Soil Cleanup Levels - Human Health

Everett Smelter Site - Lowland Area
Everett, Washington

Analyte	CAS No.	Lowland Area Industrial Land Use MTCA Method C Cleanup Level (Standard Formula Values[1])		Area Adjacent to Non-Industrial Land Use Trespasser Cleanup Level (Adult - 48 days/year[2])		Public Access Areas Site Visitor Cleanup Level (Child - 48 days/year[3])		Background Concentration[4]	Preliminary Soil Cleanup Levels		
		Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen	Carcinogen	Non-Carcinogen		Lowland Area Industrial Land Use (except where noted[5])	Area Adjacent to Non-Industrial Land Use[6]	Public Access Areas[7]
Metals (mg/kg)											
Antimony	7440-36-0	NE	1,400	NE	2,100	NE	220	NE	1,400	1,400	220
Arsenic	7440-38-2	88	1,100	9	1,500	4.6	160	20[8]	88	20	20
Barium	7440-39-3	NE	700,000	NE	> 1E+6	NE	110,000	NE	700,000	700,000	110,000
Cadmium	7440-43-9	NE	3,500	NE	5,200	NE	550	1	3,500	3,500	550
Chromium	16065-83-1	NE	> 1E+6	NE	> 1E+6	NE	820,000	48	> 1E+6	> 1E+6	820,000
Copper	7440-50-8	NE	140,000	NE	210,000	NE	22,000	36	140,000	140,000	22,000
Lead	7439-92-1	NE	1,000	NE	250[9]	NE	250[9]	24	1,000	250[9]	250[9]
Mercury	7439-97-6	NE	1,100	NE	1,500	NE	160	0.07	1,100	1,100	160
Nickel	7440-020-0	NE	70,000	NE	100,000	NE	11,000	48	70,000	70,000	11,000
Selenium	7782-49-2	NE	18,000	NE	26,000	NE	2,700	NE	18,000	18,000	2,700
Silver	7440-22-4	NE	18,000	NE	26,000	NE	2,700	NE	18,000	18,000	2,700
Thallium	7440-28-0	NE	35	NE	52	NE	5.5	NE	35	35	5.5
Zinc	7440-66-6	NE	> 1E+6	NE	> 1E+6	NE	160,000	85	> 1E+6	> 1E+6	160,000

Notes:

1 Values from CLARC database accessed from Ecology Website February 2013 (https://fortress.wa.gov/ecy/clarc/CLARCOverview.aspx).

2 The Trespasser exposure scenario evaluates adult exposure to soil based on a modified residential exposure scenario assuming an exposure frequency of 48 days/year (see Table 9 for exposure parameter values).

3 The Site Visitor exposure scenario evaluates child exposure to soil based on a modified residential exposure scenario assuming an exposure frequency of 48 days/year (see Table 9 for exposure parameter values).

4 Metals background values (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. See footnote 8.

5 Lower of MTCA Method C cleanup levels, except if the background concentration is higher, is identified as the preliminary cleanup level for Lowland Area based on industrial land use except where there is an additional, location-specific, current and future exposure scenarios as identified.

6 The lower of MTCA Method C and Trespasser Cleanup Level, except if the background concentration is higher, is identified as a location-specific preliminary cleanup level in the Lowland Area in areas adjacent to non-industrial land use.

7 The lower of MTCA Method C and Site Visitor Cleanup Level, except if the background concentration is higher, is identified as a location-specific preliminary cleanup level in the Lowland Area in public access areas.

8 Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

9 MTCA Method A residential soil cleanup level.

MTCA = Washington State Model Toxics Control Act

mg/kg = Milligrams per kilogram

NE = A criteria is not currently established for this analyte

Table 5-2

Preliminary Soil Cleanup Levels - Terrestrial Ecological Receptors

Everett Smelter Site - Lowland Area

Everett, Washington

Analyte	CAS No.	Site-Specific Terrestrial Ecological Evaluation Cleanup Levels (Table 749-3)			Background Concentration [1]	Preliminary Soil Cleanup Levels	
		Plants	Soil Biota	Wildlife		**Lowland Area Industrial Land Use (except where noted)[2]**	**Forest Area[3]**
Metals (mg/kg)							
Antimony	7440-36-0	NE	NE	NE	NE	NE	NE
Arsenic (V)	17428-41-0	10	60	132	20[4]	132	20
Barium	7440-39-3	500	NE	102	NE	102	102
Cadmium	7440-43-9	4	20	14	1	14	4
Chromium	16065-83-1	42	42	67	48	67	48
Copper	7440-50-8	100	50	217	36	217	50
Lead	7439-92-1	50	500	118	24	118	50
Mercury	7439-97-6	0.3	0.1	5.5	0.07	5.5	0.1
Nickel	7440-020-0	30	200	980	48	980	48
Selenium	7782-49-2	1	70	0.3	NE	0.3	0.3
Silver	7440-22-4	2	NE	NE	NE	NE	2
Thallium	7440-28-0	1	NE	NE	NE	NE	1
Zinc	7440-66-6	86	200	360	85	360	86

Notes:

[1] Metals background values (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. See footnote 4.

[2] Wildlife Indicator Soil Concentration, except if the background concentration is higher, is identified as the preliminary clenaup level for soil in the Lowland Area based on industrial land use except where urban forest is present in Lowland Area.

[3] Lower of the Plant, Soil Biota and Wildlife Indicator Soil Concentration, except if the background concentration is higher, is identified as the preliminary cleanup level for soil in the urban forest area located in the Lowland Area.

[4] Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

MTCA = Washington State Model Toxics Control Act

mg/kg = Milligrams per kilogram

NE = A criteria is not currently established for this analyte

Table 5-3

Preliminary Groundwater Cleanup Levels - Protection of Surface Water in Lowland Area

Everett Smelter Site - Lowland Area
Everett, Washington

Analyte	CAS No.	State Surface Water Quality Criteria[1]		National Toxics Rule[2]		Clean Water Act[3]		Groundwater Cleanup Level Before Adjustment for Background	Background Concentration[4]	Preliminary Groundwater Cleanup Levels[5,6,7]
		Fresh Water		Fresh Water Protection of Aquatic Life		Fresh Water Protection of Aquatic Life				
		Acute	Chronic	Acute	Chronic	Acute	Chronic			
Metals (µg/l)										
Antimony	7440-36-0	NE	NE	NE	NE	NE	NE	NE	NE	NE
Arsenic	7440-38-2	360	190	360	190	340	150	150	5[8]	150
Cadmium	7440-43-9	3.3	0.95	3.3	0.95	1.8	0.23	0.23	NE	0.23
Lead	7439-92-1	58	2.2	58	2.2	58	2.2	2.2	NE	2.2
Mercury	7439-97-6	2.1	0.012	2.1	0.012	1.4	0.77	0.012	NE	0.02[9]
Thallium	7440-28-0	NE	NE	NE	NE	NE	NE	NE	NE	NE

Notes:

[1] Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A-240).

[2] 40 CFR Part 131 (National Toxics Rule).

[3] National Recommended Water Quality Criteria (Clean Water Act Section 304a; on-line table accessed January 2014).

[4] Background concentration for Washington State.

[5] The preliminary cleanup levels for groundwater discharging to water features (i.e., pond, wetland, etc.) in the Lowland Area are based on protection of fresh water aquatic life.

[6] The lowest of State Surface Water Quality Criteria, National Toxics Rule criteria, and Clean Water Act criteria, except if the background groundwater concentration or PQL are higher. The background groundwater concentration is used where the background groundwater concentration or PQL are higher than the fresh water quality criteria.

[7] The cleanup levels listed for each metal apply to the dissolved fraction with the exception of mercury. The cleanup level for mercury applies to the total mercury concentration.

[8] The background groundwater concentration for arsenic as established in the MTCA Method A Table 720-1 (WAC 173-340-900).

[9] The laboratory PQL for mercury is used for the groundwater cleanup level.

MTCA = Washington State Model Toxics Control Act

µg/l = Micrograms per liter

NE = A criteria is not currently established for this analyte

Table 5-4

Preliminary Groundwater Cleanup Levels - Protection of Surface Water in Snohomish River

Everett Smelter Site - Lowland Area
Everett, Washington

Analyte	CAS No.	State Surface Water Quality Criteria[1] Marine Water: Acute	State Surface Water Quality Criteria[1] Marine Water: Chronic	National Toxics Rule[2] Marine Water Protection of Aquatic Life: Acute	National Toxics Rule[2] Marine Water Protection of Aquatic Life: Chronic	National Toxics Rule[2] AWQC for Protection of Human Health (Organisms Only)	Clean Water Act[3] Marine Water Protection of Aquatic Life: Acute	Clean Water Act[3] Marine Water Protection of Aquatic Life: Chronic	Clean Water Act[3] AWQC for Protection of Human Health	MTCA Method B Surface Water Cleanup Level[4] (Standard Formula Value): Carcinogen	MTCA Method B Surface Water Cleanup Level[4] (Standard Formula Value): Non-Carcinogen	Protection of Sediment (SQO values in Table 5-6)[11]	Groundwater Cleanup Level Before Adjustment for Background	Background Concentration[5]	Preliminary Groundwater Cleanup Levels[6,7,8]
Metals (µg/l)															
Antimony	7440-36-0	NE	NE	NE	NE	4,300	NE	NE	640	NE	1, 000[10]	NE	640	NE	640
Arsenic	7440-38-2	69	36	69	36	0.14	69	36	0.14	0.098[10]	18[10]	2,000	0.14	5[9]	5
Cadmium	7440-43-9	42	9.3	42	9.3	NE	40	8.8	NE	NE	41[10]	760	8.8	NE	8.8
Lead	7439-92-1	210	8.1	210	8.1	NE	210	8.1	NE	NE	NE	45	8.1	NE	8.1
Mercury	7439-97-6	1.8	0.025	1.8	0.025	0.15	1.8	0.94	NE	NE	NE	7.9	0.025	NE	0.025
Thallium	7440-28-0	NE	NE	NE	NE	6.3	NE	NE	0.47	NE	0.22	NE	0.22	NE	0.22

Notes:

[1] Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A-240).

[2] 40 CFR Part 131 (National Toxics Rule).

[3] National Recommended Water Quality Criteria (Clean Water Act Section 304a; on-line table accessed January 2014).

[4] Model Toxics Control Act (MTCA) Method B criteria for surface water (WAC 173-340-730).

[5] Background concentration for Washington State.

[6] The preliminary cleanup levels for groundwater discharging to the Snohomish River in the Lowland Area are based on protection of marine surface water.

[7] The lowest of State Surface Water Quality Criteria, National Toxics Rule criteria, and Clean Water Act criteria, except if the background groundwater concentration or PQL are higher. The background groundwater concentration is used where the background groundwater concentration or PQL are higher than the marine water quality criteria.

[8] The preliminary cleanup level listed for each metal applies to the dissolved fraction with the exception of mercury. The cleanup level for mercury applies to the total fraction.

[9] Background for arsenic as established in the MTCA A Table 720-1 (WAC 173-340-900).

[10] Value not considered in selecting cleanup level because available Federal and/or State criteria are sufficiently protective.

[11] Calculated assuming equilibrium partioning: Cw (µg/L; porewater) = Sediment Quality Objective (mg/kg, SQO, Chapter 173-204 WAC)/Kd (L/kg) * Conversion Factor (1,000 µg/mg).

MTCA = Washington State Model Toxics Control Act

µg/l = Micrograms per liter

NE = No criteria is currently established for this analyte

Table 5-5

Preliminary Sediment Cleanup Levels - Lowland Area

Everett Smelter Site - Lowland Area
Everett, Washington

Analyte	Protection of Benthic Organisms[1]		Background Concentration[2]	Preliminary Sediment Cleanup Levels	
	Freshwater				
	Sediment Cleanup Objective (SCO)	Cleanup Screening Level (CSL)		Preliminary Sediment Cleanup Objectives (SCO)[4]	Preliminary Cleanup Screening Levels (CSL)[4]
Metals (mg/kg - DW)					
Antimony	NE	NE	NE	NE	NE
Arsenic	14	120	20[3]	20	120
Cadmium	2.1	5.4	1	2.1	5.4
Lead	360	>1,300	24	360	>1,300
Mercury	0.66	0.8	0.07	0.66	0.8
Thallium	NE	NE	NE	NE	NE

Notes:

[1] Sediment Management Standards (Chapter 173-204 WAC).

[2] Metals background values (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. See footnote 3.

[3] Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

[4] The SQO or CSL concentration, except if the background concentrations is higher. The background concentration is used where the background concentration is higher than the SQO or CSL concentration.

MTCA = Washington State Model Toxics Control Act

mg/kg - DW = milligram per kilogram, dry weight

NE = A criteria is not currently established for this analyte

Table 5-6

Preliminary Sediment Cleanup Objectives - Snohomish River

Everett Smelter Site - Lowland Area

Everett, Washington

Analyte	Protection of Benthic Organisms[1]	Protection of Human Health[2] (Risk = 1 x 10^{-6}; HQ = 1)				Protection of Ecological Receptors[2]	Lowest Risk-Based Level	Background Concentration[8]	Preliminary Sediment Cleanup Objectives (SCO)[9]
	Marine	Direct Contact			Bioaccumulation	Bioaccumulation			
	Sediment Cleanup Objective (SCO)	Beach Play Scenario[3]	Clamming Scenario[4]	Net Fishing Scenario[5]	Subsistence Fishers[6]	Aquatic & Aquatic-Dependent Ecological Receptors[7]			
Metals (mg/kg - DW)									
Antimony	NE	260	190	690	NA	NA	190	NE	190
Arsenic	57	5.3	0.78	2.9	0.00028	0.59	0.00028	20[10]	20
Cadmium	5.1	640	470	1,700	0.47	0.056	0.056	1	1
Lead	450	250	250	250	NC	1.3	1.3	24	24
Mercury	0.41	190	140	520	0.15	0.0074	0.0074	0.07	0.07
Thallium	NE	6.4	4.7	17	NA	NA	4.7	NE	4.7

Notes:

[1] Sediment Management Standards (Chapter 173-204 WAC).

[2] Direct contact and bioaccumulation preliminary SCOs calculated following Ecology's Sediment Cleanup Users Manual (SCUM II; Ecology, 2012).

[3] The Beach Play exposure scenario evaluates child exposure to sediment and assumes an exposure frequency of 41 days/year.

[4] The Clamming exposure scenario evaluates tribal adult exposure to sediment and assumes an exposure frequency of 120 days/year.

[5] The Net Fishing exposure scenario evaluates tribal adult exposure to sediment and assumes an exposure frequency of 119 days/year.

[6] The Subsistence Fisher exposure scenario evaluates tribal exposure to sediment through ingestion of crab, clams, mussels, bottom fish and pelagic exposed to site sediment and is based on a total consumption rate of 97.5 grams/day.

[7] Bioaccumulation for aquatic and aquatic-dependent ecological receptors based on acceptable tissue concentrations from Ecology (2012) and Oregon Department of Environmental Quality (ODEQ, 2007) guidance.

[8] Metals background values (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. See footnote 8. Soil background concentrations are used as the sediment on the shoreline is actually Lowland Area soil.

[9] The lowest of the risk-based values, except if the background groundwater concentration is are higher. The background concentration is used where the background concentration is higher than the lowest risk-based value.

[10] Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

MTCA = Washington State Model Toxics Control Act

mg/kg - DW = milligram per kilogram, dry weight

NE = A criteria is not currently established for this analyte

Table 5-7

Preliminary Sediment Cleanup Screening Levels - Snohomish River

Everett Smelter Site - Lowland Area

Everett, Washington

Analyte	Protection of Benthic Organisms[1]	Protection of Human Health[2] (Risk = 1 x 10^{-5}; HQ = 1)				Protection of Ecological Receptors[2]	Lowest Risk--Based Level	Background Concentration[8]	Preliminary Cleanup Screening Level (CSL)[9]
	Marine	Direct Contact			Bioaccumulation	Bioaccumulation			
	Cleanup Screening Level (CSL)	Beach Play Scenario[3]	Clamming Scenario[4]	Net Fishing Scenario[5]	Subsistence Fishers[6]	Aquatic & Aquatic-Dependent Ecological Receptors[7]			
Metals (mg/kg - DW)									
Antimony	NE	260	190	690	NA	NA	190	NE	190
Arsenic	93	53	7.8	29	0.0028	3.0	0.0028	20[10]	20
Cadmium	6.7	640	470	1,700	0.47	0.056	0.056	1	1
Lead	530	250	250	250	NC	6.2	6.2	24	24
Mercury	0.59	190	140	520	0.15	0.011	0.011	0.07	0.07
Thallium	NE	6.4	4.7	17	NA	NA	4.7	NE	4.7

Notes:

[1] Sediment Management Standards (Chapter 173-204 WAC).

[2] Direct contact and bioaccumulation preliminary CSLs calculated following Ecology's Sediment Cleanup Users Manual (SCUM II; Ecology, 2012).

[3] The Beach Play exposure scenario evaluates child exposure to sediment and assumes an exposure frequency of 41 days/year.

[4] The Clamming exposure scenario evaluates tribal adult exposure to sediment and assumes an exposure frequency of 120 days/year.

[5] The Net Fishing exposure scenario evaluates tribal adult exposure to sediment and assumes an exposure frequency of 119 days/year.

[6] The Subsistence Fisher exposure scenario evaluates tribal exposure to sediment through ingestion of crab, clams, mussels, bottom fish and pelagic exposed to site sediment and is based on a total consumption rate of 97.5 grams/day.

[7] Bioaccumulation for aquatic and aquatic-dependent ecological receptors based on acceptable tissue concentrations from Ecology (2012) and Oregon Department of Environmental Quality (ODEQ, 2007) guidance.

[8] Metals background values (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. See footnote 8. Soil background concentrations are used as the sediment on the shoreline is actually Lowland Area soil.

[9] The lowest of the risk-based values, except if the background groundwater concentration is are higher. The background concentration is used where the background concentration is higher than the lowest risk-based value.

[10] Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

MTCA = Washington State Model Toxics Control Act

mg/kg - DW = milligram per kilogram, dry weight

NE = A criteria is not currently established for this analyte

Table 5-8

Parameters Used to Derive Preliminary Sediment Cleanup Levels for Ecological Receptors[1]

Everett Smelter Site - Lowland Area
Everett, Washington

Analyte	Acceptable Tissue Level[2] (mg/kg ww)		Bioaccumulation Factor[3] (gram tissue ww/ gram sediment dw)	Preliminary Sediment Cleanup Level (mg/kg dw)	
	Sediment Cleanup Objective	Cleanup Screening Level		Sediment Cleanup Objective	Cleanup Screening Level
Arsenic	2.7	14	4.6	0.59	3.0
Cadmium	0.15	0.15	2.7	0.056	0.056
Lead	2.0	9.9	1.6	1.3	6.2
Mercury	0.02	0.03	2.7	0.0074	0.011

Note:

[1] The preliminary sediment cleanup levels shown are used in Tables 5-6 and 5-7 for protection of ecological receptors.

[2] Acceptable tissue levels from Ecology's SCUM II guidance (Ecology, 2012), Sediment Evaluation Framework (RSET, 2009), and Oregon Department of Environmental Quality (ODEQ, 2007).

[3] Arsenic, cadmium and mercury bioaccumulation factors (BAFs) were derived for bivalves, crustacean and fish for Port Angeles Harbor (NewFields, 2013). The lead BAF used is the recommended sediment-to-benthic bioconcentration factor for lead from draft EPA guidance (EPA, 1999).

mg/kg = milligram per kilogram

ww = wet weight

dw = dry weight

TABLE 5-9

Parameters Used to Derive Site Visitor and Trespasser Preliminary Soil Cleanup Levels Based on Ingestion and Dermal Contact[1]

Everett Smelter - Lowland Area
Everett, Washington

CHEMICAL-SPECIFIC PARAMETERS[2]

Analytes	Oral Slope Factor	Oral Reference Dose	Dermal Absorption Fraction	Gastrointestinal Absorption Factor	Dermal Slope Factor	Dermal Reference Dose
	kg-day/mg	mg/kg-day	unitless	unitless	kg-day/mg	mg/kg-day
Antimony	--	4.0E-04	0.01	0.2	--	8.0E-05
Arsenic	1.5E+00	3.0E-04	0.01	0.2	7.5E+00	6.0E-05
Cadmium	--	1.0E-03	0.01	0.2	--	2.0E-04
Lead	--	--	0.01	0.2	--	--
Mercury	--	3.0E-04	0.01	0.2	--	6.0E-05
Thallium	--	1.0E-05	0.01	0.2	--	2.0E-06

EXPOSURE PARAMETERS

Parameter	Units	Site Visitor (Child)[3]		Trespasser (Adult)[4]	
		Carcinogen	Noncarcinogen	Carcinogen	Noncarcinogen
Cancer Risk/Hazard Quotient	unitless	1E-06	1E+00	1E-06	1E+00
Body Weight (BW)	kg	16	16	70	70
Averaging Time (AT)	days	27375	2190	27375	10950
Exposure Frequency (EF)[3]	days/year	48	48	48	48
Exposure Duration (ED)	years	6	6	30	30
Soil Ingestion Rate (SIR)	mg/day	200	200	100	100
GI Abs (other analytes) (AB1)	unitless	1	1	1	1
Dermal Surface Area (SA)	cm2	2200	2200	3160	3160
Soil to Skin Adherence Factor (AF)	mg/cm2-day	0.2	0.2	0.02	0.02

PRELIMINARY SOIL CLEANUP LEVELS[5]

Analytes	Site Visitor		Trespasser	
	Carcinogen mg/kg	Noncarcinogen mg/kg	Carcinogen mg/kg	Noncarcinogen mg/kg
Antimony	--	219	--	2,064
Arsenic	4.57	164	9	1,548
Cadmium	--	548	--	5,160
Lead	--	--	--	--
Mercury	--	164	--	1,548
Thallium	--	5	--	52

Notes:

[1] The preliminary soil cleanup levels shown are used in Table 5-1.

[2] Oral cancer potency factor and oral reference dose values from Ecology's on-line CLARC database, accessed February 2014. Remaining values are default Modified Method B values.

[3] Default Modified Method B exposure parameter values except exposure frequency. Site visitor exposure scenario assumes an exposure frequency of 48 days per year or 4 days per month on average.

[4] Exposure parameter values from Ecology's draft SCUM II guidance (Ecology 2012) for subsistence clam digging adult, except exposure frequency, exposure duration and soil to skin adherence factor. Trespasser exposure scenario assumes an exposure frequency of 48 days per year or 4 days per month on average. Exposure duration for trespasser is 30 years, based on typical residential exposure. Soil to skin adherence factor is 0.02, from SCUM II for subsistence net fishing adult and is based on geometric mean value for an adult groundskeeper. This set of exposure parameter values were selected to provide an estimate of exposure to a site trespasser.

[5] Calculated using Equations 9-7 and 9-8 from Ecology's draft SCUM II guidance (Ecology 2012), which are consistent with the modified Method B soil cleanup level equations (Equations 740-4 and 740-5).

mg/kg = milligram per kilogram

-- = not available or applicable

TABLE 5-10

Parameters Used to Derive Preliminary Sediment Clean Up Levels Based On Ingestion and Dermal Contact[1]

Everett Smelter - Lowland Area
Everett, Washington

CHEMICAL-SPECIFIC PARAMETERS[2]

Analytes	Oral Slope Factor kg-day/mg	Oral Reference Dose mg/kg-day	Dermal Absorption Fraction unitless	Gastrointestinal Absorption Factor unitless	Dermal Slope Factor kg-day/mg	Dermal Reference Dose mg/kg-day
Antimony	--	4.0E-04	0.01	0.2	--	0.00008
Arsenic	1.5E+00	3.0E-04	0.01	0.2	7.5	0.00006
Cadmium	--	1.0E-03	0.01	0.2	--	0.0002
Lead	--	--	0.01	0.2	--	--
Mercury	--	3.0E-04	0.01	0.2	--	0.00006
Thallium	--	1.0E-05	0.01	0.2	--	0.000002

EXPOSURE PARAMETERS[3]

Parameter	Units	Beach Play Child		Subsistence Clam Digging Adult		Subsistence Net Fishing Adult	
		Carcinogen	Noncarcinogen	Carcinogen	Noncarcinogen	Carcinogen	Noncarcinogen
Cancer Risk/Hazard Quotient	unitless	1E-06	1E+00	1E-06	1E+00	1E-06	1E+00
Body Weight	kg	16	16	70	70	70	70
Averaging Time	days	27375	2190	27375	10950	27375	10950
Exposure Frequency	days/year	41	41	120	120	119	119
Exposure Duration	years	6	6	70	70	70	70
Ingestion Rate	mg/day	200	200	100	100	50	50
Gastrointestinal Absorption Fraction - for dioxins/furans	unitless	0.6	0.6	0.6	0.6	0.6	0.6
Gastrointestinal Absorption Fraction - for other	unitless	1	1	1	1	1	1
Dermal Surface Area	cm2	2200	2200	3160	3160	3160	3160
Sediment to Skin Adherence Factor	mg/cm2-day	0.2	0.2	0.6	0.6	0.02	0.02

PRELIMINARY SEDIMENT CLEAN UP LEVELS[4]

Analytes	Beach Play Child		Subsistence Clam Digging Adult		Subsistence Net Fishing Adult	
	Carcinogen mg/kg	Noncarcinogen mg/kg	Carcinogen mg/kg	Noncarcinogen mg/kg	Carcinogen mg/kg	Noncarcinogen mg/kg
Antimony	--	2.6E+02	--	1.9E+02	--	6.9E+02
Arsenic	5.3E+00	1.9E+02	7.8E-01	1.4E+02	2.9E+00	5.2E+02
Cadmium	--	6.4E+02	--	4.7E+02	--	1.7E+03
Lead	--	--	--	--	--	--
Mercury	--	1.9E+02	--	1.4E+02	--	5.2E+02
Thallium	--	6.4E+00	--	4.7E+00	--	1.7E+01

Notes:

[1] The preliminary sediment cleanup levels shown are used in Tables 5-6 and 5-7.

[2] Oral cancer potency factor and oral reference dose values from Ecology's on-line CLARC database, accessed February 2014. Remaining values are default Modified Method B values.

[3] Values from Ecology's SCUM II guidance (Ecology 2012), Table 9-2.

[4] Calculated using Equations 9-4 and 9-6 from Ecology's draft SCUM II guidance (Ecology 2012).

mg/kg = milligram per kilogram

-- = not available or applicable

TABLE 5-11

Parameters Used to Derive Preliminary Sediment Clean Up Levels Based on Consumption of Fish/Shellfish[1]

Everett Smelter - Lowland Area
Everett, Washington

CHEMICAL-SPECIFIC PARAMETERS[2]

Analytes	Oral Slope Factor	Oral Reference Dose	BAF (crab)[3]	BAF (clam/mussel)[3]	BAF (fish)[3]
	kg-day/mg	mg/kg-day	grams/grams	grams/grams	grams/grams
Arsenic	1.5E+00	3.0E-04	4.60E+00	6.00E-01	2.40E-01
Cadmium	--	1.0E-03	2.70E+00	1.50E+00	2.80E-02
Mercury	--	3.0E-04	2.70E+00	8.70E-01	1.60E+00

EXPOSURE PARAMETERS[4]

Parameter	Units	Subsistence Fisher	
		Carcinogen	Noncarcinogen
Cancer Risk/Hazard Quotient	unitless	1E-06	1E+00
Body Weight	kg	70	70
Averaging Time	days	27375	27375
Crab Consumption Rate	grams/day	31.1	31.1
Clam and Mussel Consumption Rate	grams/day	50.8	50.8
Fish Consumption Rate	grams/day	15.6	15.6
Crab Diet Fraction	proportion	1	1
Clam and Mussel Diet Fraction	proportion	1	1
Fish Diet Fraction	proportion	1	1
Exposure Frequency	days/year	365	365
Exposure Duration	years	70	70
Crab Site Use Factor	proportion	1	1
Clam and Mussel Site Use Factor	proportion	1	1
Fish Site Use Factor	proportion	1	1

PRELIMINARY SEDIMENT CLEAN UP LEVELS[5]

Analytes	Units	Subsistence Fisher	
		Carcinogen	Noncarcinogen
Arsenic	mg/kg	2.8E-04	1.3E-01
Cadmium	mg/kg	--	4.7E-01
Mercury	mg/kg	--	1.5E-01

Notes:

[1] The preliminary sediment cleanup levels shown are used in Tables 5-6 and 5-7.

[2] Oral cancer potency factor and oral reference dose values from Ecology's on-line CLARC database, accessed February 2014.

[3] BAFs were derived for bivalves, crustacean and fish for Port Angeles Harbor (NewFields, 2013).

[4] Values from Ecology's draft SCUM II guidance (Ecology 2012), Table 9-2, except for consumption rates (see text for discussion of consumption rates).

[5] Calculated using Equations 9-4 and 9-6 from Ecology's draft SCUM II guidance (Ecology, 2012).

BAF = Bioaccumulation Factor. In kilograms tissue (wet weight)/ kilograms sediment (dry weight).

µg/kg = microgram per kilogram

ng/kg = nanogram per kilogram

mg/kg = milligram per kilogram

-- = not available or applicable

Table 5-12

Selection of Indicator Hazardous Substances for Soil

Everett Lowland
Everett, Washington

Site Media	Analyte	Number of Samples	Number of Detections	Percent Detected	Maximum Detected Concentration (mg/kg)	Non-Detections Greater Than Preliminary Cleanup Levels	Detections Greater Than Preliminary Cleanup Levels	Exceedance Frequency[1]	Maximum Exceedance Factor (EF)	Meets Initial Selection Criteria?	Is the Analyte an IHS in Other Site Media? Shallow Aquifer / Deep Aquifer Groundwater?	Is the Analyte an IHS in Other Site Media? Surface Water in the Lowland Area?	Is the Analyte an IHS in Other Site Media? Sediment in the Lowland Area?	Is the Analyte an IHS in Other Site Media? Sediment on the Snohomish River Shoreline?	Soil IHS After Evaluation of Other Considerations?	Other Considerations Evaluated to Make Soil IHS Determination
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations					
Shallow Soil (Fill, Native Surface, Silt and Till)	Antimony	123	4	3%	110	0	0	0%	NA	No	No	No	No	No	No	None
	Arsenic	718	628	87%	7,940	0	252	35%	134	Yes	Yes	Yes	Yes	Yes	Yes	High exceedance frequency and EF. Additionally, arsenic is an IHS for shallow groundwater in the fill stratigraphic unit, surface water and sediment in the Lowland Area and seep and sediment on the Snohomish River.
	Barium	14	14	100%	8,340	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Cadmium	597	226	38%	92	0	4	1%	6.6	Yes	No	No	No	No	No	Low exceedance frequency in all Site media. Additionally, cadmium is present in soil at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and lead) are present in soil at concentrations greater than PCULs.
	Chromium	317	311	98%	949	0	91	29%	7.5	Yes	NA	NA	NA	NA	No	Background concentrations of chromium in soil at the Site are greater than the PCUL.
	Copper	381	381	100%	1,970	0	27	7%	9.1	Yes	NA	NA	NA	NA	No	Low exceedance frequency. Additionally, copper is present in soil at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and lead) are present in soil at concentrations greater than PCULs.
	Lead	692	608	88%	24,230	0	144	21%	183	Yes	No	No	No	No	Yes	High exceedance frequency and EF. Additionally, lead was detected at concentrations greater than the PCULs in fill over a substantial portion of the Benson Subarea.
	Mercury	162	110	68%	1.44	0	0	0%	NA	No	Yes	Yes	Yes	Yes	Yes	Mercury is selected as an IHS for fill, native surface soil, silt and till as mercury is an IHS for shallow groundwater in the fill stratigraphic unit, surface water and sediment in the Lowland Area and seeps and sediment in the Snohomish River shoreline.
	Nickel	19	18	95%	119	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Selenium	14	3	21%	32	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Silver	14	3	21%	94	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Thallium	123	1	0.8%	1.5	0	1	0.8%	1.5	No	No	No	No	No	No	None
	Zinc	383	383	100%	79,380	0	45	12%	158	Yes	NA	NA	NA	NA	No	Zinc is present in soil at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and/or lead) are present in soil at concentrations greater than PCULs.
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations					
Deeper Soil (Alluvium and Outwash)	Antimony	85	0	0%	NA	0	0	0%	NA	No	No	No	No	No	No	None
	Arsenic	122	102	84%	396	0	3	4%	4.5	Yes	Yes	Yes	Yes	Yes	Yes	Arsenic is selected as an IHS for alluvium and outwash as arsenic is an IHS for deep groundwater in the alluvium and outwash stratigraphic units and seeps on the Snohomish River shoreline.
	Cadmium	120	56	47%	1	0	0	0%	NA	No	No	No	No	No	No	None
	Chromium	22	22	100%	284	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Copper	24	24	100%	55	0	0	0%	NA	No	NA	NA	NA	NA	No	None
	Lead	122	68	56%	324	0	0	0%	NA	No	No	No	No	No	No	None
	Mercury	85	25	29%	0.29	0	0	0%	NA	No	No[2]	Yes	Yes	Yes	No	None
	Thallium	85	2	2.4%	0.4	0	0	0%	NA	No	No	No	No	No	No	None
	Zinc	24	24	100%	115	0	0	0%	NA	No	NA	NA	NA	NA	No	None

Notes:

The IHSs for surface and near-surface soil (fill, native surface soil, silt and till) are evaluated separately from the IHSs for deeper soil (alluvium and outwash). Samples evaluated include those collected during previous investigations (see Section 2) and supplemental investigations (see Section 3). This table does not include evaluation of field or laboratory duplicate results.

[1] The Exceedance Frequency is the percent of detections of the contaminant greater than the preliminary cleanup levels (PCUL).

[2] Not an IHS in deep aquifer groundwater.

NA = Not applicable. Data for the analyte not available for the identified Site media.

Table 5-13

Selection of Indicator Hazardous Substances for Groundwater

Everett Lowland

Everett, Washington

Site Media	Analyte	Number of Samples	Number of Detections	Percent Detected	Maximum Detected Concentration (µg/L)	Non-Detections Greater Than Preliminary Cleanup Levels	Detections Greater Than Preliminary Cleanup Levels	Exceedance Frequency [1]	Maximum Exceedance Factor (EF)	Meets Initial Selection Criteria?	Is the Analyte an IHS in Other Site Media? Fill, Native Surface, Silt and Till / Alluvium and Outwash Soil?	Surface Water in the Lowland Area?	Sediment in the Lowland Area?	Sediment on the Snohomish River Shoreline?	Groundwater IHS After Evaluation of Other Considerations?	Other Considerations Evaluated to Make Groundwater IHS Determination
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations					
Shallow Aquifer Groundwater	Antimony	84	51	61%	15.6	0	0	0%	NA	No	No	No	No	No	No	None
	Arsenic	163	163	100%	2,070	0	45	28%	38	Yes	Yes	Yes	Yes	Yes	Yes	High exceedance frequency and EF. Additionally, arsenic is an IHS for the fill stratigraphic unit where shallow groundwater is present, surface water and sediment in the Lowland Area and seeps and sediment on the Snohomish River shoreline.
	Cadmium	84	12	14%	27.1	0	2	2%	118	Yes	No	No	No	No	No	Low exceedance frequency in all Site media. Only present in shallow groundwater at concentrations greater than PCULs at one out of 44 shallow monitoring well locations. Additionally, cadmium is present in shallow groundwater at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and/or lead) are present in shallow groundwater at concentrations greater than PCULs.
	Lead	163	69	42%	103	0	14	9%	31	Yes	Yes	No	No	No	Yes	Lead is selected as an IHS for shallow groundwater as lead is an IHS for fill, native surface soil, silt and till.
	Mercury	84	14	17%	0.229	0	13	15%	12	Yes	Yes[2]	Yes	Yes	Yes	Yes	Moderate exceedance frequency and EF. Additionally, mercury is an IHS for surface water and sediment in the Lowland Area and seeps and sediment on the Snohomish River shoreline.
	Thallium	84	2	2%	0.4	0	0	0%	NA	No	No	No	No	No	No	None
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations					
Deep Aquifer Groundwater	Antimony	105	42	40%	1.3	0	0	0%	NA	No	No	No	No	No	No	None
	Arsenic	190	180	95%	18,600	0	85	45%	3,720	Yes	Yes	Yes	Yes	Yes	Yes	High exceedance frequency and EF. Arsenic is an IHS for the alluvium and outwash stratigraphic units where deep groundwater is present and for seeps and sediment on the Snohomish River shoreline.
	Cadmium	105	12	11%	2.2	0	0	0%	NA	No	No	No	No	No	No	None
	Lead	190	26	14%	3	0	0	0%	NA	No	No	No	No	No	No	None
	Mercury	105	5	5%	0.05	0	2	2%	2.07	Yes	No[2]	Yes	Yes	Yes	No	Low detection and exceedance frequency and EF in deep aquifer groundwater.
	Thallium	105	0	0%	NA	1	0	0%	NA	No	No	No	No	No	No	None

Notes:

The IHSs for shallow and deep aquifer groundwater are evaluated separately. Samples evaluated include those collected during Q1 through Q4 2013, as described in Section 3. This table does not include evaluation of field or laboratory duplicate results.

[1] The Exceedance Frequency is the percent of detections of the contaminant greater than the preliminary cleanup levels (PCUL).

[2] Not an IHS in the alluvium and outwash stratigraphic units.

Table 5-14

Selection of Indicator Hazardous Substances for Surface Water

Everett Lowland
Everett, Washington

Site Media	Analyte	Number of Samples	Number of Detections	Percent Detected	Maximum Detected Concentration (µg/L)	Non-Detections Greater Than Preliminary Cleanup Levels	Detections Greater Than Preliminary Cleanup Levels	Exceedance Frequency[1]	Maximum Exceedance Factor (EF)	Meets Initial Selection Criteria?	Is the Analyte an IHS in Other Site Media? Fill, Native Surface, Silt and Till / Alluvium and Outwash Soil?	Shallow Aquifer / Deep Aquifer Groundwater?	Sediment in the Lowland Area?	Sediment on Snohomish River Shoreline?	Surface Water IHS After Evaluation of Other Considerations?	Other Considerations Evaluated to Make Surface Water IHS Determination
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations					
Surface Water	Antimony	8	8	100%	9.1	0	0	0%	NA	No	No	No	No	No	No	None
Surface Water	Arsenic	12	12	100%	486	0	3	25%	3.3	Yes	Yes	Yes	Yes	Yes	Yes	High exceedance frequency. Additionally, arsenic is an IHS for fill, native surface soil, silt and till; shallow groundwater and sediment in the Lowland Area.
Surface Water	Cadmium	8	0	0%	NA	0	0	0%	NA	No	No	No	No	No	No	None
Surface Water	Lead	12	10	83%	2	0	1	8%	1.1	No	Yes[2]	No	No	No	No	Low exceedance frequency in all site media other than fill in the Benson Subarea.
Surface Water	Mercury	8	3	37.5%	0.0413	0	3	37.5%	2.1	Yes	Yes	Yes	Yes	Yes	Yes	High exceedance frequency. Additionally, mercury is an IHS for the fill, native surface soil, silt and till; shallow groundwater and sediment in the Lowland Area.
Surface Water	Thallium	8	0	0%	NA	0	0	0%	NA	No	No	No	No	No	No	None

Notes:

Samples evaluated include surface water samples collected in the Lowland Area during Q2 through Q4 (locations LLSW-01, LLSW-02, LLSW-04, and LLSW-05). This table does not include evaluation of field or laboratory duplicate results.

[1] The Exceedance Frequency is the percent of detections of the contaminant greater than the preliminary cleanup levels (PCUL).

[2] Not an IHS in the alluvium and outwash stratigraphic units and deep aquifer groundwater.

Table 5-15

Selection of Indicator Hazardous Substances for Sediment

Everett Lowland
Everett, Washington

Site Media	Analyte	Number of Samples	Number of Detections	Percent Detected	Maximum Detected Concentration (mg/kg)	Non-Detections Greater Than Preliminary Cleanup Levels	Detections Greater Than Preliminary Cleanup Levels	Exceedance Frequency[1]	Maximum Exceedance Factor (EF)	Meets Initial Selection Criteria?	Is the Analyte an IHS in Other Site Media? Fill, Native Surface, Silt and Till / Alluvium and Outwash Soil?	Is the Analyte an IHS in Other Site Media? Shallow Aquifer / Deep Aquifer Groundwater?	Is the Analyte an IHS in Other Site Media? Surface Water in the Lowland Area?	Sediment IHS After Evaluation of Other Considerations?	Other Considerations Evaluated to Make Sediment IHS Determination
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations				
Sediment in the Lowland Area	Antimony	7	0	0%	NA	0	0	0%	NA	No	No	No	No	No	None
	Arsenic	7	7	100%	219	0	2	29%	11	Yes	Yes	Yes	Yes	Yes	High exceedance frequency and EF. Additionally, arsenic is an IHS for fill, native surface soil, silt and till; shallow groundwater and surface water in the Lowland Area.
	Cadmium	7	7	100%	2.7	0	1	14%	1.3	Yes	No	No	No	No	Low exceedance frequency in all Site media. Additionally, cadmium is present in sediment in the Lowland Area at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and mercury) are present in sediment at concentrations greater than PCULs.
	Lead	7	7	100%	532	0	1	14%	1.5	Yes	Yes	No	No	No	Lead is present in sediment in the Lowland Area at concentrations greater than PCULs where analytes selected as IHSs (i.e., arsenic and mercury) are present in sediment at concentrations greater than PCULs.
	Mercury	7	5	71%	0.15	0	1	14%	2.1	Yes	Yes[2]	Yes[2]	Yes	Yes	Moderate exceedance frequency. Additionally, mercury is an IHS for the fill, native surface soil, silt and till; shallow groundwater and surface water in the Lowland Area.
	Thallium	7	0	0%	NA	0	0	0%	NA	No	No	No	No	No	None
Initial IHS Selection Criteria								≥10%	>2 x PCUL		Other IHS Considerations				
Sediment on Snohomish River Shoreline	Antimony	11	0	0%	NA	0	0	0%	NA	No	No	No	No	No	None
	Arsenic	11	11	100%	837	0	3	27%	42	Yes	Yes	Yes	Yes	Yes	High exceedance frequency and EF. Additionally, arsenic is an IHS for soil; shallow and deep groundwater; surface water in the Lowland Area and seeps on the Snohomish River shoreline.
	Cadmium	11	10	91%	1.1	0	1	9.1%	1.1	No	No	No	No	No	None
	Lead	11	10	91%	22	0	0	0%	NA	No	Yes	No	No	No	None
	Mercury	11	9	82%	0.16	0	5	45%	2.3	Yes	Yes[2]	Yes[2]	Yes	Yes	High exceedance frequency. Additionally, mercury is an IHS for fill, native surface soil, silt and till; shallow and deep groundwater, and seeps on the Snohomish River Shoreline.
	Thallium	11	0	0%	NA	0	0	0%	NA	No	No	No	No	No	None

Notes:

The IHSs for sediment in the Lowland Area are evaluated separately from the IHSs for sediment on the Snohomish River shoreline. Samples utilized in the evaluation include Lowland Area sediment locations LLSD-01 through LLSD-07 and shoreline sediment locations LLSD-11 and LLSD-13 through LLSD-21. The parent and duplicate sample results at one location (LLSD-11) were different, resulting in a preliminary cleanup level exceedance for mercury in the duplicate sample but not the parent sample. In this case, the field duplicate from LLSD-11 is included in the evaluation.

[1] The Exceedance Frequency is the percent of detections of the contaminant greater than the preliminary cleanup levels (PCUL).

[2] Not an IHS in the alluvium and outwash stratigraphic units and deep aquifer groundwater.

Table 5-16

Summary of Indicator Hazardous Substances for Site Media

Everett Lowland

Everett, Washington

Analyte	Site Media						
	Fill, Native Surface, Silt and Till Soil	Alluvium and Outwash Soil	Shallow Aquifer Groundwater	Deep Aquifer Groundwater	Surface Water in the Lowland Area	Sediment in the Lowland Area	Sediment on the Snohomish River Shoreline
Antimony	No	No	No	No	No	No	No
Arsenic	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Barium	No	NA	NA	NA	NA	NA	NA
Cadmium	No	No	No	No	No	No	No
Chromium	No	No	NA	NA	NA	NA	NA
Copper	No	No	NA	NA	NA	NA	NA
Lead	Yes	No	Yes	No	No	No	No
Mercury	Yes	No	Yes	No	Yes	Yes	Yes
Nickel	No	NA	NA	NA	NA	NA	NA
Selenium	No	NA	NA	NA	NA	NA	NA
Silver	No	NA	NA	NA	NA	NA	NA
Thallium	No	No	No	No	No	No	No
Zinc	No	NA	NA	NA	NA	NA	NA

Notes:

NA = Not applicable. Data for the analyte not available for the identified Site media.

Orange shading indicates analyte selected as indicator hazardous substance for identified media.

Table 6-1

Detection Frequency Summary for Soil

Everett Lowland

Everett, Washington

Stratigraphic Units	Analyte	Number of Samples	Number of Detections	Percent Detected	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	Mean Detected Concentration (mg/kg)	Median Detected Concentration (mg/kg)	Non-Detections Greater Than Preliminary Cleanup Level	Detections Greater Than Preliminary Cleanup Level	Percent of Detections Greater Than Preliminary Cleanup Level
Shallow Soil (Fill/Native Surface Soil/Silt/Till)	Antimony	135	4	3%	0.2	110	32.73	10.15	0	0	0%
	Arsenic	742	651	88%	0.7	7940	147.65	24.7	0	184	28%
	Barium	14	3	21%	412	8340	3465.67	1645	0	0	0%
	Cadmium	625	243	39%	0.1	92	3.32	1	0	4	2%
	Chromium	321	315	98%	8	949	109.21	106	0	93	30%
	Copper	386	386	100%	3	1970	192.01	44.5	0	27	7%
	Lead	716	636	89%	1.7	24230	1148.54	45	0	140	22%
	Mercury	174	120	69%	0.02	1.4	0.16	0.09	0	0	0
	Nickel	19	18	95%	19	119	48.83	35	0	0	0
	Selenium	14	3	21%	19	32	25.33	25	0	0	0
	Silver	14	3	21%	50	94	77	87	0	0	0
	Thallium	135	1	1%	1.5	1.5	1.50	1.5	0	1	1
	Zinc	387	387	100%	3.0	79380	3155	83	0	45	12%
Deeper Soil (Alluvium/ Outwash)	Antimony	85	0	0%	NA	NA	NA	NA	0	0	0
	Arsenic	122	102	83.6%	1.2	396	17.9	6.2	0	3	3.5%
	Cadmium	120	56	46.7%	0.1	1	0.4	0.3	0	0	0
	Chromium	22	22	100%	43	284	95.8	79	0	0	0
	Copper	24	24	100%	17	55	25.6	23.5	0	0	0
	Lead	122	68	55.7%	1.5	324	12.8	4	0	0	0
	Mercury	85	25	29.4%	0.02	0.29	0.05	0.04	0	0	0
	Thallium	85	2	2.4%	0.2	0.4	0.3	0.3	0	0	0
	Zinc	24	24	100%	28	115	50.04	40.5	0	0	0

Notes:

mg/kg = milligrams per kilogram

NA = Not applicable as antimony was not detected in alluvium.

Table 6-2

Metals Results for Shallow Soil - Benson Subarea

Everett Lowland

Everett, Washington

						Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Applicable PCULs													
1B	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	112	--	10 U	133	248	1,527	--	--	--	--	--	4,063
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	109	--	10 U	113	235	1,404	--	--	--	--	--	3,391
1M	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	262	--	10 U	133	100	407	--	--	--	--	--	456
1T	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	92	--	10 U	107	77	408	--	--	--	--	--	400
2B	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	100	--	10 U	97	84	343	--	--	--	--	--	693
2M	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	47	--	10 U	134	63	208	--	--	--	--	--	384
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	342	--	10 U	161	123	450	--	--	--	--	--	480
2T	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	34	--	10 U	150	44	117	--	--	--	--	--	168
3B	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	220	--	10 U	113	1,359	2,302	--	--	--	--	--	8,001
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	184	--	10 U	114	601	1,703	--	--	--	--	--	4,698
3M	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	107	--	10 U	133	72	373	--	--	--	--	--	510
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	88	--	10 U	122	80	257	--	--	--	--	--	400
3T	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	30	--	10 U	135	45	196	--	--	--	--	--	172
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	15	--	10 U	133	30	71	--	--	--	--	--	64
	Benson	8/28/1998	2	3	Lowland Fill	HHI, EI	--	10 U	--	10 U	98	32	45	--	--	--	--	--	55
4B	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	168	--	10 U	114	265	1,294	--	--	--	--	--	2,385
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	154	--	10 U	140	171	1,114	--	--	--	--	--	1,377
4M	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	446	--	10 U	113	96	153	--	--	--	--	--	196
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	266	--	2.9	99	51	79	--	--	--	--	--	82
4T	Benson	8/28/1998	0	1	Lowland Fill	HHT, HHI, EI	--	12	--	10 U	111	38	90	--	--	--	--	--	114
	Benson	8/28/1998	1	2	Lowland Fill	HHI, EI	--	16	--	10 U	130	33	52	--	--	--	--	--	86
AB-3	Benson	10/1/1990	2.5	4	Lowland Fill	HHI, EI	--	28	--	1 U	26	25	21	0.10	42	--	--	--	61
	Benson	10/1/1990	7.5	8.5	Lowland Fill	HHI	--	259	--	1 U	19	1,000	10,827	0.1 U	119	--	--	--	6,970
	Benson	10/1/1990	12.5	14	Lowland Silt	HHI	--	49	--	1 U	46	71	316	0.10	37	--	--	--	470
AB-5	Benson	10/1/1990	2.4	4	Lowland Fill	HHI, EI	--	1,400	--	1 U	121	1,650	3,110	0.1 U	50	--	--	--	16,900
	Benson	10/1/1990	5	6	Lowland Fill	HHI, EI	--	188	--	1 U	27	836	8,390	0.1 U	93	--	--	--	8,970
	Benson	10/1/1990	7.5	8.5	Lowland Fill	HHI	--	264	--	1 U	39	74	365	0.20	35	--	--	--	571
	Benson	10/1/1990	10	12	Lowland NS	HHI	--	298	--	1 U	36	53	206	0.20	35	--	--	--	454
BP-01D	Benson	1/6/2012	6.8	7	Lowland Fill	HHI	6 U	21.7 J	--	0.7	--	--	506	0.33 J	--	--	--	0.2 U	--
	Benson	1/6/2012	10.6	11	Lowland NS	HHI	10 U	63 J	--	0.6	--	--	27	0.11 J	--	--	--	0.4 U	--
	Benson	1/6/2012	16.5	18	Lowland Silt	HHI	7 U	11.5 J	--	0.6	--	--	8	0.05 J	--	--	--	0.3 U	--
BP-02D	Benson	1/5/2012	3	4	Lowland Fill	HHI, EI	6 U	4.4 J	--	0.3	--	--	16	0.05	--	--	--	0.2 U	--
	Benson	1/5/2012	3	4	Lowland Fill	HHI, EI	6 U	5.4 J	--	0.3	--	--	21	0.06	--	--	--	0.2 U	--
	Benson	1/5/2012	11.3	12	Lowland NS	HHI	9 U	320 J	--	2.5	--	--	126	0.28	--	--	--	0.3 U	--
	Benson	1/5/2012	15	16	Lowland Silt	HHI	8 U	11.3 J	--	0.4	--	--	7	0.07	--	--	--	0.3 U	--
BP-03D	Benson	1/4/2012	6.7	6.9	Lowland NS [w/Slag]	HHI	10 U	875 J	--	6.9	--	--	2,260	1.28	--	--	--	0.4 U	--
	Benson	1/4/2012	10.1	10	Lowland Silt	HHI	10 U	56.3 J	--	0.8	--	--	29	0.08	--	--	--	0.4 U	--
BP-04D	Benson	1/4/2012	6.5	7	Lowland Fill [Slag]	HHI	60 U	368 J	--	7	--	--	8,520	0.08	--	--	--	0.2 U	--
	Benson	1/4/2012	10	10	Lowland NS	HHI	10 U	721 J	--	8.4	--	--	985	0.71	--	--	--	0.5 U	--
	Benson	1/4/2012	14	15	Lowland Silt	HHI	9 U	13.1 J	--	0.5	--	--	14	0.14	--	--	--	0.3 U	--
BP-05D	Benson	1/3/2012	2.5	3	Lowland Fill [w/Slag]	HHI, EI	110	507 J	--	4	--	--	6,950	0.03 U	--	--	--	0.3 U	--
	Benson	1/3/2012	10.7	11	Lowland NS	HHI	9 U	362 J	--	5.7	--	--	239 J	0.20	--	--	--	0.3 U	--
	Benson	1/3/2012	10.7	11	Lowland NS	HHI	9 U	505 J	--	6.6	--	--	1,020 J	0.26	--	--	--	0.4 U	--
	Benson	1/3/2012	14	15	Lowland Silt	HHI	8 U	10.9 J	--	0.3	--	--	9	0.11	--	--	--	0.3 U	--

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
BP-06D	Benson	12/30/2011	5.5	6	Lowland Fill [w/Slag]	HHI, EI	7 U	45	--	1.3	--	--	283	0.13	--	--	--	0.3 U	--
	Benson	12/30/2011	10.2	10	Lowland NS	HHI	9 U	29	--	0.7	--	--	21	0.08	--	--	--	0.3 U	--
	Benson	12/30/2011	12	13	Lowland Silt	HHI	10 U	20	--	0.4	--	--	9	0.06	--	--	--	0.4 U	--
BP-07D	Benson	12/29/2011	5	6	Lowland Fill	HHI, EI	20 U	56.4 J	--	1.9	--	--	727	0.27 J	--	--	--	0.3 U	--
	Benson	12/29/2011	12.6	13	Lowland NS	HHI	7 U	14	--	0.4	--	--	32	0.06	--	--	--	0.3 U	--
	Benson	12/29/2011	15.5	17	Lowland Silt	HHI	9 U	15	--	0.4	--	--	8	0.08	--	--	--	0.3 U	--
BP-08D	Benson	12/29/2011	6	6.2	Lowland Fill	HHI	6 U	9	--	0.9	--	--	44	0.37	--	--	--	0.2 U	--
	Benson	12/29/2011	10.2	10	Lowland NS	HHI	10 U	150	--	4.4	--	--	376	0.30	--	--	--	0.4 U	--
	Benson	12/29/2011	12	13	Lowland Silt	HHI	9 U	23	--	0.3 U	--	--	7	0.07	--	--	--	0.3 U	--
BP-09D	Benson	12/28/2011	8	9	Lowland Fill	HHI	6 U	28	--	0.3	--	--	17	1.44 J	--	--	--	0.2 U	--
	Benson	12/28/2011	8	9	Lowland Fill	HHI	6 U	17	--	0.4	--	--	15	0.86 J	--	--	--	0.2 U	--
	Benson	12/28/2011	15.2	15	Lowland NS	HHI	7 U	51	--	2.1	--	--	98	0.12	--	--	--	0.3 U	--
	Benson	12/28/2011	17	18	Lowland Silt	HHI	6 U	12	--	0.3	--	--	4	0.11	--	--	--	0.3 U	--
BP-10D	Benson	12/27/2011	1.5	2	Lowland Fill	HHI, EI	6 U	55	--	0.6	--	--	56	0.12	--	--	--	0.3 U	--
	Benson	12/27/2011	10.3	11	Lowland NS	HHI	9 U	61	--	1.6	--	--	98	0.14	--	--	--	0.4 U	--
	Benson	12/27/2011	11.5	12	Lowland Silt	HHI	10 U	30	--	0.5 U	--	--	31	0.15	--	--	--	0.5 U	--
EV-4B	Benson	1/20/1993	0	1	Upland Fill	HHI	--	16 J	--	1	--	--	12	--	--	--	--	--	--
	Benson	1/20/1993	1.5	3	Upland Fill	HHI	--	7 J	--	1	--	--	11	--	--	--	--	--	--
	Benson	1/20/1993	4.5	6	Upland Fill	HHI	--	3 J	--	1	--	--	4	--	--	--	--	--	--
	Benson	1/20/1993	9	11	Upland Fill	HHI	--	21	--	1 U	--	--	8	--	--	--	--	--	--
	Benson	1/20/1993	15	17	Upland Fill [w/Slag]	HHI	--	138 J	--	2	--	--	140	--	--	--	--	--	--
	Benson	1/20/1993	24	26	Upland Fill	HHI	--	5 J	--	1	--	--	7	--	--	--	--	--	--
EV-5	Benson	1/26/1993	0	1	Lowland Fill	HHT, HHI, EI	--	20 J	--	7	--	--	1,300 J	--	--	--	--	--	--
	Benson	2/1/1993	1.5	3	Lowland Fill	HHI, EI	--	7	--	1 U	--	--	53 J	--	--	--	--	--	--
	Benson	2/1/1993	4.5	6	Lowland Fill	HHI, EI	--	19	--	1 U	--	--	23 J	--	--	--	--	--	--
	Benson	2/1/1993	9	11	Lowland Silt	HHI	--	131	--	1	--	--	66 J	--	--	--	--	--	--
	Benson	1/27/1993	13.5	15	Lowland Silt	HHI	--	19	--	2	--	--	11	--	--	--	--	--	--
EV-6A	Benson	8/17/1993	0	1.5	Lowland Fill	HHI	--	5 U	--	1 U	--	--	5.4	--	--	--	--	--	--
	Benson	8/17/1993	2	3.5	Lowland Fill	HHI	--	17	--	1 U	--	--	40	--	--	--	--	--	--
	Benson	8/17/1993	5	5	Lowland Fill	HHI	--	18	--	1 U	--	--	70	--	--	--	--	--	--
	Benson	8/17/1993	10	12	Lowland Fill	HHI	--	37	--	1.2	--	--	64	--	--	--	--	--	--
	Benson	8/17/1993	15	17	Lowland Fill	HHI	--	87	--	4.3	--	--	359	--	--	--	--	--	--
	Benson	8/17/1993	25	27	Lowland Fill	HHI	--	138	--	1 U	--	--	131	--	--	--	--	--	--
	Benson	8/17/1993	30	32	Lowland Fill [Slag]	HHI	--	423	--	7.3	--	--	24,010	--	--	--	--	--	--
	Benson	8/17/1993	45	47	Lowland Fill [Slag]	HHI	--	484	--	4.3	--	--	24,230	--	--	--	--	--	--
	Benson	8/17/1993	50	52	Lowland Fill	HHI	--	418	--	17	--	--	12	--	--	--	--	--	--
EV-6B	Benson	8/24/1993	54	56	Lowland Fill [Slag]	HHI	--	350	--	5.2	--	--	12,140 J	--	--	--	--	--	--
	Benson	8/25/1993	60	62	Lowland Silt	HHI	--	27	--	1 U	--	--	378	--	--	--	--	--	--
	Benson	8/25/1993	67.5	68	Lowland Silt	HHI	--	7.5	--	1 U	--	--	29 J	--	--	--	--	--	--
	Benson	8/25/1993	68	69	Lowland Silt	HHI	--	5 U	--	1 U	--	--	12 J	--	--	--	--	--	--
EV-7A	Benson	8/16/1993	0	1.5	Lowland Fill	HHT, HHI, EI	--	100	--	1.6	--	--	1,875	--	--	--	--	--	--
	Benson	8/16/1993	2	3.5	Lowland Fill	HHI, EI	--	359	--	3	--	--	8,708	--	--	--	--	--	--
	Benson	8/16/1993	4	5.5	Lowland Fill	HHI, EI	--	428	--	3	--	--	11,000	--	--	--	--	--	--
	Benson	8/16/1993	10	12	Lowland Fill [Slag]	HHI	--	385	--	13	--	--	14,440	--	--	--	--	--	--
	Benson	8/16/1993	14	16	Lowland NS	HHI	--	24	--	1 U	--	--	65	--	--	--	--	--	--
EV-7B	Benson	8/20/1993	17	19	Lowland NS	HHI	--	79	--	1 U	--	--	1,941	--	--	--	--	--	--
EV-8A	Benson	8/16/1993	0	1.5	Lowland Fill	HHT, HHI, EI	--	21	--	13	--	--	457	--	--	--	--	--	--
	Benson	8/16/1993	2	3.5	Lowland Fill [Slag]	HHI, EI	--	338	--	1 U	--	--	3,048	--	--	--	--	--	--
	Benson	8/16/1993	4	5.5	Lowland Fill [Slag]	HHI, EI	--	207	--	5.4	--	--	15,630	--	--	--	--	--	--
	Benson	8/16/1993	10	12	Lowland NS	HHI	--	169	--	1.2	--	--	1,584	--	--	--	--	--	--
EV-8B	Benson	8/18/1993	15	17	Lowland Silt	HHI	--	34	--	1 U	--	--	48	--	--	--	--	--	--

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
EV-9A	Benson	8/16/1993	0	1.5	Lowland Fill	HHI	--	46	--	1 U	--	--	605	--	--	--	--	--	--
	Benson	8/16/1993	2	3.5	Lowland Fill	HHI	--	34	--	1 U	--	--	60	--	--	--	--	--	--
	Benson	8/16/1993	4	5.5	Lowland Fill [Slag]	HHI	--	540	--	1 U	--	--	2,979	--	--	--	--	--	--
	Benson	8/16/1993	8	9.5	Lowland Fill [Slag]	HHI	--	1,344	--	1 U	--	--	4,415	--	--	--	--	--	--
	Benson	8/16/1993	14	16	Lowland Fill	HHI	--	1,394	--	1 U	--	--	4,643	--	--	--	--	--	--
	Benson	8/16/1993	16	18	Lowland NS	HHI	--	119	--	1 U	--	--	337	--	--	--	--	--	--
EV-9B	Benson	8/23/1993	18	20	Lowland Silt	HHI	--	13	--	1 U	--	--	7	--	--	--	--	--	--
EV-15A/B	Benson	9/29/1998	0	0.5	Lowland Fill	HHI	--	29	--	10 U	121	75	171	--	--	--	--	--	453
	Benson	9/29/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	114	45	10 U	--	--	--	--	--	52
	Benson	9/29/1998	10	12	Lowland NS	HHI	--	31	--	10 U	137	57	10 U	--	--	--	--	--	90
EV-16A	Benson	9/29/1998	0	0.5	Lowland Fill	HHI	--	13	--	10 U	158	46	52	--	--	--	--	--	92
	Benson	9/29/1998	2	3.5	Lowland Fill	HHI	--	11	--	10 U	137	71	17	--	--	--	--	--	60
	Benson	9/29/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	141	37	10 U	--	--	--	--	--	60
	Benson	9/29/1998	10	12	Lowland Fill	HHI	--	782	--	10 U	143	58	149	--	--	--	--	--	135
EV-17B	Benson	9/23/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	163	--	10 U	110	140	735	--	--	--	--	--	1,899
	Benson	9/23/1998	2	3.5	Lowland Fill [w/Slag]	HHI, EI	--	516	--	10 U	104	664	5,638	--	--	--	--	--	18,395
	Benson	9/23/1998	5	6.5	Lowland Fill [Slag]	HHI, EI	--	523	--	10 U	86	1188	8,078	--	--	--	--	--	30,256
	Benson	9/23/1998	10	12	Lowland Silt	HHI	--	79	--	10 U	116	45	428	--	--	--	--	--	1,116
	Benson	9/23/1998	15	17	Lowland Silt	HHI	--	24	--	10 U	117	27	63	--	--	--	--	--	181
EV-20B	Benson	9/28/1998	0	0.5	Upland Fill	HHT, HHI, EI	--	80	--	10 U	130	61	290	--	--	--	--	--	247
	Benson	9/28/1998	5	6.5	Upland Fill	HHI, EI	--	25	--	10 U	131	35	75	--	--	--	--	--	343
	Benson	9/28/1998	10	12	Upland Fill	HHI	--	33	--	10 U	106	33	132	--	--	--	--	--	109
	Benson	9/28/1998	15	17	Upland Fill	HHI	--	2,570	--	10 U	126	409	282	--	--	--	--	--	86
	Benson	9/28/1998	20	22	Upland Fill	HHI	--	598	--	10 U	118	40	10 U	--	--	--	--	--	42
EV-23A/B	Benson	9/30/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	25	--	10 U	144	105	199	--	--	--	--	--	669
	Benson	9/30/1998	2	3.5	Lowland Fill	HHI, EI	--	41	--	10 U	139	143	358	--	--	--	--	--	463
	Benson	9/30/1998	5	6.5	Lowland Fill	HHI, EI	--	98	--	10 U	143	110	199	--	--	--	--	--	269
	Benson	9/30/1998	10	12	Lowland Silt	HHI	--	28	--	10 U	145	55	12	--	--	--	--	--	90
HA-4	Benson	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	30	--	--	--	--	925	--	--	--	--	--	--
	Benson	4/8/1998	0.5	1	Lowland Fill	HHI, EI	--	20	--	--	--	--	338	--	--	--	--	--	--
	Benson	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	59	--	--	--	--	--	--
	Benson	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
HA-8	Benson	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	20	--	--	--	--	755	--	--	--	--	--	--
	Benson	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	18 U	--	--	--	--	20 U	--	--	--	--	--	--
	Benson	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	190	--	--	--	--	--	--
	Benson	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
HA-12	Benson	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	21	--	--	--	--	1,086	--	--	--	--	--	--
	Benson	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	181	--	--	--	--	--	--
	Benson	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	215	--	--	--	--	7,186	--	--	--	--	--	--
	Benson	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	13	--	--	--	--	--	--
HA-16	Benson	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	19	--	--	--	--	641	--	--	--	--	--	--
	Benson	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	32	--	--	--	--	625	--	--	--	--	--	--
	Benson	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	30	--	--	--	--	--	--
	Benson	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	19	--	--	--	--	15	--	--	--	--	--	--
HP-01	Benson	8/23/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	8	--	2	--	47	97	--	--	--	--	--	177
	Benson	8/23/1995	5	7	Lowland Silt	HHI, EI	--	6	--	1	--	31	23	--	--	--	--	--	67
	Benson	8/23/1995	10	12	Lowland NS	HHI	--	61	--	1	--	54	18	--	--	--	--	--	90
HP-02	Benson	8/24/1995	0.25	0.5	Lowland Fill	HHT, HHI, EI	--	59	--	4	--	396	794	--	--	--	--	--	3,654
	Benson	8/24/1995	1.5	3	Lowland Fill [Slag]	HHI, EI	--	426	--	6	--	1,044	14,280	--	--	--	--	--	17,070
	Benson	8/24/1995	5	6.5	Lowland Fill [Slag]	HHI, EI	--	382	--	7	--	1,121	14,130	--	--	--	--	--	18,150
	Benson	8/24/1995	10	12	Lowland Fill [Slag]	HHI	--	353	--	5	--	1,114	12,180	--	--	--	--	--	15,520
	Benson	8/24/1995	15	17	Lowland Silt	HHI	--	39	--	1 U	--	47	60	--	--	--	--	--	142

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
HP-05	Benson	8/25/1995	0.25	0.5	Lowland Fill	HHI	--	101	--	1	--	210	1,175	--	--	--	--	--	3,187
	Benson	8/25/1995	0.5	2.5	Lowland Fill	HHI	--	85	--	2	--	159	824	--	--	--	--	--	2,180
	Benson	8/25/1995	5	6.5	Lowland Fill	HHI	--	9	--	1 U	--	28	14	--	--	--	--	--	77
	Benson	8/25/1995	10	12	Lowland NS	HHI	--	4,194	--	16	--	149	968	--	--	--	--	--	385
	Benson	8/25/1995	15	17	Lowland Silt	HHI	--	43	--	1	--	52	9	--	--	--	--	--	80
	Benson	8/25/1995	20	21	Lowland Silt	HHI	--	14	--	1	--	53	8	--	--	--	--	--	77
HP-12	Benson	9/1/1995	0	0.2	Lowland Fill	HHI	--	4	--	1 U	--	16	8	--	--	--	--	--	39
	Benson	9/1/1995	2	3.5	Lowland Fill	HHI	--	3	--	1 U	--	14	2	--	--	--	--	--	33
	Benson	9/1/1995	5	6.5	Lowland Fill	HHI	--	3	--	1 U	--	19	3	--	--	--	--	--	40
	Benson	9/1/1995	10	12	Lowland Fill	HHI	--	8	--	1 U	--	21	3	--	--	--	--	--	44
	Benson	9/1/1995	15	17	Lowland Fill	HHI	--	3	--	1 U	--	17	3	--	--	--	--	--	48
HP-17	Benson	12/8/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	419	--	1 U	112	170	1,160	--	--	--	--	--	3,330
	Benson	12/8/1995	2	3.5	Lowland Fill [Slag]	HHI, EI	--	217	--	4	159	1,760	11,440	--	--	--	--	--	36,100
	Benson	12/8/1995	5	6.5	Lowland Fill [Slag]	HHI, EI	--	151	--	5	175	1,310	10,120	--	--	--	--	--	27,060
	Benson	12/8/1995	10	12	Lowland Fill [Slag]	HHI	--	165	--	5	143	1,200	11,380	--	--	--	--	--	21,560
	Benson	12/8/1995	15	17	Lowland Silt	HHI	--	19	--	1 U	94	64	106	--	--	--	--	--	277
HP-18	Benson	12/11/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	320	--	1 U	116	49	405	--	--	--	--	--	421
	Benson	12/11/1995	2	3.5	Lowland Fill [Slag]	HHI, EI	--	534	--	1 U	63	134	1,020	--	--	--	--	--	2,000
	Benson	12/11/1995	5	6.5	Lowland Fill [Slag]	HHI, EI	--	226	--	6	235	916	9,510	--	--	--	--	--	9,820
	Benson	12/11/1995	10	12	Lowland NS	HHI	--	110	--	3	66	280	2,550	--	--	--	--	--	2,490
	Benson	12/11/1995	15	17	Lowland Silt	HHI	--	32	--	1 U	65	68	306	--	--	--	--	--	327
HP-19	Benson	12/12/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	56	--	23	139	1,120	1,690	--	--	--	--	--	5,310
	Benson	12/12/1995	2	3.5	Lowland Fill [w/Slag]	HHI, EI	--	199	--	1	92	1,460	6,330	--	--	--	--	--	35,840
	Benson	12/12/1995	5	6.5	Lowland Fill	HHI, EI	--	255	--	2	126	552	5,220	--	--	--	--	--	16,080
	Benson	12/12/1995	10	12	Lowland NS	HHI	--	55	--	1 U	87	58	196	--	--	--	--	--	665
	Benson	12/12/1995	15	17	Lowland Silt	HHI	--	22	--	1 U	101	36	19	--	--	--	--	--	140
HP-20	Benson	12/13/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	28	--	1	268	75	246	--	--	--	--	--	626
	Benson	12/13/1995	2	3.5	Lowland Fill	HHI, EI	--	10	--	2	257	37	147	--	--	--	--	--	251
	Benson	12/13/1995	5	6.5	Lowland Fill [Slag]	HHI, EI	--	124	--	1 U	161	1,470	5,420	--	--	--	--	--	35,700
	Benson	12/13/1995	10	12	Lowland Fill [w/Slag]	HHI	--	2,075	--	5	185	471	2,140	--	--	--	--	--	10,910
	Benson	12/13/1995	15	17	Lowland Silt	HHI	--	42	--	1 U	107	43	53	--	--	--	--	--	237
HP-21	Benson	12/14/1995	0	0.5	Lowland Fill	HHT, HHI, EI	--	410	--	4	502	1,350	12,470	--	--	--	--	--	33,600
	Benson	12/14/1995	2	3.5	Lowland Fill [Slag]	HHI, EI	--	268	--	1	95	1,030	11,040	--	--	--	--	--	15,350
	Benson	12/14/1995	5	6.5	Lowland Fill [Slag]	HHI, EI	--	311	--	1	92	1,298	8,181	--	--	--	--	--	16,670
	Benson	12/14/1995	10	12	Lowland Fill [Slag]	HHI	--	188	--	2	186	1,392	7,142	--	--	--	--	--	17,510
	Benson	12/14/1995	15	17	Lowland Fill [Slag]	HHI	--	200	--	1	164	1,523	9,121	--	--	--	--	--	22,620
	Benson	12/14/1995	20	22	Lowland Silt	HHI	--	20	--	1 U	75	93	503	--	--	--	--	--	887
HP-24	Benson	1/8/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	36	--	2	296	135	400	--	--	--	--	--	1,064
	Benson	1/8/1996	2	3.5	Lowland Fill	HHI, EI	--	18	--	1 U	146	37	12	--	--	--	--	--	58
	Benson	1/8/1996	5	6.5	Lowland Fill [Slag]	HHI, EI	--	1,175	--	1	138	1,970	4,900	--	--	--	--	--	25,660
	Benson	1/8/1996	10	12	Lowland Fill [Slag]	HHI	--	1,124	--	1	154	1,960	5,530	--	--	--	--	--	27,580
	Benson	1/8/1996	15	17	Lowland Silt	HHI	--	33	--	1 U	78	63	79	--	--	--	--	--	405
HP-26	Benson	1/10/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	59	--	1	187	134	1,090	--	--	--	--	--	2,730
	Benson	1/10/1996	2	3.5	Lowland Fill [Slag]	HHI, EI	--	355	--	4	102	1,880	21,580	--	--	--	--	--	56,800
	Benson	1/10/1996	5	6.5	Lowland Fill [Slag]	HHI, EI	--	345	--	4	102	1,350	18,430	--	--	--	--	--	56,220
	Benson	1/10/1996	10	12	Lowland Fill [Slag]	HHI	--	399	--	4	103	1,920	15,950	--	--	--	--	--	53,020
	Benson	1/10/1996	15	17	Lowland Silt	HHI	--	366	--	4	106	1,660	15,340	--	--	--	--	--	49,980
	Benson	1/10/1996	20	22	Lowland Silt	HHI	--	349	--	4	87	1,600	15,520	--	--	--	--	--	49,580

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
LB-1	Benson	2/23/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	30	--	1 U	--	--	167	--	--	--	--	--	--
	Benson	2/23/1996	2	3.5	Lowland Fill [Slag]	HHI, EI	--	297	--	5	--	--	11,020	--	--	--	--	--	--
	Benson	2/23/1996	5	6.5	Lowland Fill [w/Slag]	HHI, EI	--	2,207	--	24	--	--	5,371	--	--	--	--	--	--
	Benson	2/23/1996	10	12	Lowland Fill [w/Slag]	HHI	--	369	--	5	--	--	8,037	--	--	--	--	--	--
LB-2	Benson	2/26/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	53	--	1	--	--	1,057	--	--	--	--	--	--
	Benson	2/26/1996	5	6.5	Lowland Fill	HHI, EI	--	3,645	--	7	--	--	1,720	--	--	--	--	--	--
	Benson	2/26/1996	10	12	Lowland Silt	HHI	--	30	--	1 U	--	--	13	--	--	--	--	--	--
LB-3	Benson	2/27/1996	0	0.5	Lowland Fill	HHI	--	39	--	1 U	--	--	733	--	--	--	--	--	--
	Benson	2/27/1996	2	3.5	Lowland Fill	HHI	--	8	--	1 U	--	--	13	--	--	--	--	--	--
	Benson	2/27/1996	5	6.5	Lowland Fill	HHI	--	5	--	1 U	--	--	11	--	--	--	--	--	--
	Benson	2/27/1996	10	12	Lowland Fill	HHI	--	1,901	--	11	--	--	519	--	--	--	--	--	--
LB-4	Benson	2/27/1996	0	0.5	Lowland Fill [w/Slag]	HHI	--	51	--	1	--	--	786	--	--	--	--	--	--
	Benson	2/27/1996	2	3.5	Lowland Fill	HHI	--	7	--	1 U	--	--	83	--	--	--	--	--	--
	Benson	2/27/1996	5	6.5	Lowland Fill	HHI	--	465	--	4	--	--	369	--	--	--	--	--	--
	Benson	2/27/1996	10	12	Lowland Fill	HHI	--	38	--	1 U	--	--	113	--	--	--	--	--	--
LB-5	Benson	2/27/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	42	--	1 U	--	--	524	--	--	--	--	--	--
	Benson	2/27/1996	2	3.5	Lowland Fill	HHI, EI	--	46	--	6	--	--	743	--	--	--	--	--	--
	Benson	2/27/1996	5	6.5	Lowland Fill	HHI, EI	--	35	--	10	--	--	1,091	--	--	--	--	--	--
	Benson	2/27/1996	10	12	Lowland Fill	HHI	--	32	--	1 U	--	--	111	--	--	--	--	--	--
LB-6	Benson	2/27/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	22	--	1 U	--	--	281	--	--	--	--	--	--
	Benson	2/27/1996	2	3.5	Lowland Fill [Slag]	HHI, EI	--	326	--	4	--	--	7,550	--	--	--	--	--	--
	Benson	2/27/1996	5	6.5	Lowland Fill [Slag]	HHI, EI	--	235	--	3	--	--	16,640	--	--	--	--	--	--
	Benson	2/27/1996	10	12	Lowland Fill [Slag]	HHI	--	205	--	1 U	--	--	8,371	--	--	--	--	--	--
	Benson	2/27/1996	15	17	Lowland NS	HHI	--	155	--	1	--	--	4,864	--	--	--	--	--	--
LB-7	Benson	2/28/1996	0	0.5	Lowland Fill [w/Slag]	HHT, HHI, EI	--	104	--	92	--	--	3,083	--	--	--	--	--	--
	Benson	2/28/1996	2	3.5	Lowland Fill [w/Slag]	HHI, EI	--	24	--	13	--	--	683	--	--	--	--	--	--
	Benson	2/28/1996	5	6.5	Lowland Fill [Slag]	HHI, EI	--	393	--	5	--	--	9,418	--	--	--	--	--	--
	Benson	2/28/1996	10	12	Lowland NS	HHI	--	41	--	1 U	--	--	250	--	--	--	--	--	--
LB-8	Benson	2/29/1996	0	0.5	Lowland Fill [w/Slag]	HHT, HHI, EI	--	292	--	6	--	--	4,376	--	--	--	--	--	--
	Benson	2/29/1996	2	3.5	Lowland Fill [Slag]	HHI, EI	--	124	--	1	--	--	4,504	--	--	--	--	--	--
LB-9	Benson	2/29/1996	0	0.5	Lowland Fill [w/Slag]	HHT, HHI, EI	--	97	--	8	--	--	1,268	--	--	--	--	--	--
	Benson	2/29/1996	2	3.5	Lowland Fill [w/Slag]	HHI, EI	--	65	--	4	--	--	1,338	--	--	--	--	--	--
	Benson	2/29/1996	5	6.5	Lowland NS	HHI, EI	--	61	--	1 U	--	--	78	--	--	--	--	--	--
LB-10	Benson	2/29/1996	0	0.5	Lowland Fill	HHT, HHI, EI	--	42	--	33	--	--	5,304	--	--	--	--	--	--
	Benson	2/29/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	--	--	54	--	--	--	--	--	--
	Benson	2/29/1996	5	6.5	Lowland Fill	HHI, EI	--	3	--	1 U	--	--	36	--	--	--	--	--	--
LB-11	Benson	8/25/1998	0	0.5	Lowland Fill	HHI	--	61	--	10 U	88 J	85	529 J	--	--	--	--	--	1,279 J
	Benson	8/25/1998	0.5	2	Lowland Fill	HHI	--	26	--	10 U	106 J	71 J	120 J	--	--	--	--	--	322 J
	Benson	8/25/1998	2	3.5	Lowland Fill	HHI	--	31	--	10 U	159 J	35 J	56 J	--	--	--	--	--	72 J
	Benson	8/25/1998	5	6.5	Lowland Fill	HHI	--	5,966	--	34	125 J	292 J	2,065 J	--	--	--	--	--	710 J
	Benson	8/25/1998	10	12	Lowland Silt	HHI	--	37	--	10 U	229 J	64 J	114 J	--	--	--	--	--	311 J
LB-12	Benson	8/26/1998	0	0.5	Lowland Fill	HHI	--	37	--	10 U	137	107	401	--	--	--	--	--	679
	Benson	8/26/1998	0.5	2	Lowland Fill	HHI	--	27	--	10 U	138	36	89	--	--	--	--	--	192
	Benson	8/26/1998	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	143	32	16	--	--	--	--	--	39
	Benson	8/26/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	151	29	19	--	--	--	--	--	46
	Benson	8/26/1998	10	12	Lowland Silt	HHI	--	12	--	10 U	164	30	15	--	--	--	--	--	57
LB-13	Benson	8/26/1998	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	134	55	74	--	--	--	--	--	145
	Benson	8/26/1998	0.5	2	Lowland Fill	HHI	--	18	--	10 U	131	30	22	--	--	--	--	--	41
	Benson	8/26/1998	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	148	33	10 U	--	--	--	--	--	19
	Benson	8/26/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	145	33	10 U	--	--	--	--	--	33
	Benson	8/26/1998	10	12	Lowland Silt	HHI	--	20	--	10 U	152	37	10 U	--	--	--	--	--	35

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Applicable PCULs	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
LB-14	Benson	8/26/1998	0	0.5	Lowland Fill	HHI	--	16	--	10 U	156	36	31	--	--	--	--	--	148
	Benson	8/26/1998	0.5	2	Lowland Fill	HHI	--	10 U	--	10 U	123	37	14	--	--	--	--	--	46
	Benson	8/26/1998	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	160	26	10 U	--	--	--	--	--	24
	Benson	8/26/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	129	24	10 U	--	--	--	--	--	45
	Benson	8/26/1998	10	12	Lowland Silt	HHI	--	10 U	--	10 U	159	27	10 U	--	--	--	--	--	46
LB-15	Benson	8/26/1998	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	139	31	33	--	--	--	--	--	83
	Benson	8/26/1998	0.5	2	Lowland Fill	HHI	--	10 U	--	10 U	121	37	10 U	--	--	--	--	--	53
	Benson	8/26/1998	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	128	33	14	--	--	--	--	--	42
	Benson	8/26/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	171	33	12	--	--	--	--	--	44
	Benson	8/26/1998	10	12	Lowland NS	HHI	--	1,071	--	10 U	127	61	119	--	--	--	--	--	155
LB-16	Benson	8/27/1998	0	2	Lowland Fill	HHT, HHI, EI	--	550	--	--	--	--	--	--	--	--	--	--	--
	Benson	8/27/1998	5	7	Lowland Fill	HHI, EI	--	320	--	--	--	--	--	--	--	--	--	--	--
LB-17	Benson	8/27/1998	0	2	Lowland Fill	HHT, HHI, EI	--	360	--	--	--	--	--	--	--	--	--	--	--
	Benson	8/27/1998	5	7	Lowland Fill	HHI, EI	--	360	--	--	--	--	--	--	--	--	--	--	--
LB-18	Benson	8/27/1998	0	2	Lowland Fill	HHT, HHI, EI	--	220	--	--	--	--	--	--	--	--	--	--	--
	Benson	8/27/1998	5	7	Lowland Fill	HHI, EI	--	340	--	--	--	--	--	--	--	--	--	--	--
LB-19	Benson	9/29/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	49 J	--	10 U	110	116	471	--	--	--	--	--	1,044
	Benson	9/29/1998	2	3.5	Lowland Fill	HHI, EI	--	34 J	--	10 U	126	24	33	--	--	--	--	--	82
	Benson	9/29/1998	4	5.5	Lowland Fill	HHI, EI	--	12 J	--	10 U	134	33	25	--	--	--	--	--	62
	Benson	9/29/1998	6	7.5	Lowland Fill	HHI	--	121 J	--	10 U	133	33	37	--	--	--	--	--	71
	Benson	9/29/1998	8	9.5	Lowland NS	HHI	--	2,458 J	--	16	122	245	1,614	--	--	--	--	--	571
	Benson	9/29/1998	10	12	Lowland NS	HHI	--	1,712 J	--	15	136	140	868	--	--	--	--	--	376
LB-20	Benson	9/29/1998	0	0.5	Lowland Fill	HHI	--	76 J	--	10 U	100	166	928	--	--	--	--	--	1,728
	Benson	9/29/1998	2	3.5	Lowland Fill	HHI	--	19	--	10 U	154	31	11	--	--	--	--	--	63
	Benson	9/29/1998	4	5.5	Lowland Fill	HHI	--	10 UJ	--	10 U	144	30	10 U	--	--	--	--	--	31
	Benson	9/29/1998	6	7.5	Lowland Fill	HHI	--	968	--	10 U	158	116	411	--	--	--	--	--	434
	Benson	9/29/1998	8	9.5	Lowland Fill	HHI	--	205	--	10 U	150	45	87	--	--	--	--	--	96
	Benson	9/29/1998	10	12	Lowland Silt	HHI	--	26	--	10 U	139	72	12	--	--	--	--	--	84
LB-21	Benson	5/11/1999	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	144	31	11	--	--	--	--	--	51
	Benson	5/11/1999	0.5	2	Lowland Fill	HHI	--	10 U	--	10 U	137	21	10 U	--	--	--	--	--	33
	Benson	5/11/1999	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	150	28	10 U	--	--	--	--	--	36
	Benson	5/11/1999	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	174	27	10 U	--	--	--	--	--	40
	Benson	5/11/1999	10	12	Lowland Silt	HHI	--	10 U	--	10 U	158	31	10 U	--	--	--	--	--	55
	Benson	5/11/1999	11.5	14	Lowland Silt	HHI	--	10 U	--	10 U	111	26	10 U	--	--	--	--	--	32
	Benson	5/11/1999	13.5	16	Lowland Silt	HHI	--	10 U	--	10 U	123	22	10 U	--	--	--	--	--	48
LB-22	Benson	5/11/1999	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	159	23	10 U	--	--	--	--	--	52
	Benson	5/11/1999	0.5	2	Lowland Fill	HHI	--	10 U	--	10 U	149	21	10 U	--	--	--	--	--	41
	Benson	5/11/1999	2	3.5	Lowland Fill	HHI	--	10 U	--	10 U	163	33	10 U	--	--	--	--	--	39
	Benson	5/11/1999	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	164	31	10 U	--	--	--	--	--	54
	Benson	5/11/1999	10	12	Lowland Silt	HHI	--	10 U	--	10 U	159	27	10 U	--	--	--	--	--	37
	Benson	5/11/1999	11.5	14	Lowland Silt	HHI	--	10 U	--	10 U	170	26	10 U	--	--	--	--	--	43
	Benson	5/11/1999	13.5	16	Lowland Silt	HHI	--	10 U	--	10 U	135	22	10 U	--	--	--	--	--	37
LB-23	Benson	5/11/1999	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	10 U	152	38	18	--	--	--	--	--	55
	Benson	5/11/1999	0.5	2	Lowland Fill	HHT, HHI, EI	--	10 U	--	10 U	124	31	13	--	--	--	--	--	39
	Benson	5/11/1999	2	3.5	Lowland Fill	HHI, EI	--	94	--	10 U	131	48	136	--	--	--	--	--	197
	Benson	5/11/1999	5	6.5	Lowland Fill	HHI, EI	--	73	--	10 U	128	45	158	--	--	--	--	--	285
	Benson	5/11/1999	10	12	Lowland Fill	HHI	--	93	--	10 U	159	45	112	--	--	--	--	--	345
	Benson	5/11/1999	11.5	14	Lowland NS	HHI	--	112	--	10 U	152	72	242	--	--	--	--	--	1,823
	Benson	5/11/1999	13.5	16	Lowland Silt	HHI	--	10 U	--	10 U	162	28	10 U	--	--	--	--	--	45
LLMW-31D	Benson	1/23/2013	3	4	Upland Fill	HHI, EI	5 U	58.8	--	0.8	--	--	271	0.13	--	--	--	0.2 U	--
	Benson	1/23/2013	9.1	9.3	Upland Till	HHI	5 U	12.7	--	0.4	--	--	34	0.07	--	--	--	0.2 U	--
	Benson	1/23/2013	25	25	Upland Till	HHI	5 U	4.3	--	0.4	--	--	3	0.02 U	--	--	--	0.2 U	--

Table 6-2. Metals Results for Shallow Soil - Benson Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
LLMW-36D	Benson	8/9/2013	7	8	Lowland Fill [w/Slag]	HHI	1.3	224	--	2.6	--	--	11,500	0.24	--	--	--	0.2 U	--
	Benson	8/9/2013	9	9.2	Lowland NS	HHI	0.6	351	--	6.9	--	--	3,130	0.21	--	--	--	0.2 U	--
	Benson	8/9/2013	16	16	Lowland Silt	HHI	0.2 U	12.3	--	0.1 U	--	--	5.4	0.02	--	--	--	0.2 U	--
PC-18A	Benson	10/1/1990	0	0	Lowland Fill	HHT, HHI, EI	--	12	--	28	--	--	1,120	--	--	--	--	--	--
SB-4	Benson	4/16/1996	4.5	5	Lowland Fill	HHI	--	43	--	10 U	--	90	118	--	--	--	--	--	81
	Benson	4/16/1996	9.5	10	Lowland Fill	HHI	--	39	--	10 U	--	46	44	--	--	--	--	--	93
	Benson	4/16/1996	14.5	15	Lowland Fill	HHI	--	17	--	10 U	--	116	40	--	--	--	--	--	132
	Benson	4/16/1996	19.5	20	Lowland Fill	HHI	--	66	--	10 U	--	95	649	--	--	--	--	--	289
	Benson	4/16/1996	24.5	25	Lowland Fill	HHI	--	10 U	--	10 U	--	31	19	--	--	--	--	--	41
	Benson	4/16/1996	29.5	30	Lowland Fill	HHI	--	698	--	10 U	--	80	165	--	--	--	--	--	175
	Benson	4/16/1996	34.5	35	Lowland Fill	HHI	--	34	--	10 U	--	21	28	--	--	--	--	--	42
	Benson	4/16/1996	39.5	40	Lowland Fill	HHI	--	10 U	--	10 U	--	37	10 U	--	--	--	--	--	35
	Benson	4/16/1996	44.5	45	Lowland Fill	HHI	--	83	--	10 U	--	88	338	--	--	--	--	--	375
	Benson	4/16/1996	51.5	52	Lowland Silt	HHI	--	10 U	--	10 U	--	56	27	--	--	--	--	--	581
	Benson	4/16/1996	55	56	Lowland Silt	HHI	--	42	--	10 U	--	138	225	--	--	--	--	--	429
SB-5	Benson	4/16/1996	8	8.5	Lowland Fill	HHI	--	15	--	10 U	--	34	24	--	--	--	--	--	57
	Benson	4/16/1996	13	14	Lowland Fill	HHI	--	287	--	10 U	--	180	274	--	--	--	--	--	152
	Benson	4/16/1996	18	19	Lowland Fill	HHI	--	33	--	10 U	--	42	26	--	--	--	--	--	54
	Benson	4/16/1996	23	24	Lowland Fill	HHI	--	138	--	10 U	--	127	306	--	--	--	--	--	155
SB-6	Benson	4/16/1996	8	8.5	Lowland Fill	HHI	--	10 U	--	10 U	--	25	10 U	--	--	--	--	--	44
	Benson	4/16/1996	13	14	Lowland Fill	HHI	--	46	--	10 U	--	38	80	--	--	--	--	--	103
	Benson	4/16/1996	18	19	Lowland Fill	HHI	--	27	--	10 U	--	45	47	--	--	--	--	--	56
SB-7	Benson	4/16/1996	6	6.5	Lowland Fill	HHI	--	29	--	10 U	--	43	48	--	--	--	--	--	69
	Benson	4/16/1996	9.5	10	Lowland Fill	HHI	--	10 U	--	10 U	--	28	10 U	--	--	--	--	--	27
	Benson	4/16/1996	14.5	15	Lowland Fill	HHI	--	10 U	--	10 U	--	32	18	--	--	--	--	--	42
SB-8	Benson	4/16/1996	4.5	5	Lowland Fill	HHI, EI	--	10 U	--	10 U	--	40	22	--	--	--	--	--	51
	Benson	4/16/1996	9.5	10	Lowland Fill	HHI	--	34	--	10 U	--	62	56	--	--	--	--	--	77
	Benson	4/16/1996	16	17	Lowland Fill	HHI	--	34	--	10 U	--	53	45	--	--	--	--	--	61
	Benson	4/16/1996	21	22	Lowland Fill	HHI	--	147	--	10 U	--	114	143	--	--	--	--	--	110
SL-1	Benson	2/5/1993	8	14	Lowland Fill	HHI	--	163	--	2	--	--	113	--	--	--	--	--	--
	Benson	2/5/1993	27	27	Lowland Fill [Slag]	HHI	--	432	1,645	3	145	1,011	14,790	--	--	32	87	--	31,870
SL-3	Benson	2/4/1993	12	15	Lowland Fill	HHI	--	270	--	2	--	--	486	--	--	--	--	--	--
	Benson	2/5/1993	55	60	Lowland Fill [Slag]	HHI	--	410	8,340	1	99	1,701	8,501	--	--	25	94	--	67,410
SL-4	Benson	2/4/1993	18	20	Lowland Fill	HHI	--	92	--	5	--	--	371	--	--	--	--	--	--
	Benson	2/4/1993	28	34	Lowland Fill [Slag]	HHI	--	787	412	7	44	1,767	18,800	--	--	19	50	--	79,380
SS1	Benson	2/12/1991	0	0.2	Upland Fill	HHI	--	55.3	--	6.5 U	--	--	267	--	--	--	--	--	--
SS2	Benson	2/12/1991	0	0.5	Lowland Fill	HHI	--	56.3	--	7.5 U	--	--	268	--	--	--	--	--	--
SS3	Benson	2/12/1991	0	0.5	Lowland Fill	HHI	--	7.2	--	0.98	--	--	82.4	--	--	--	--	--	--
WP-1	Benson	10/1/1990	5	6	Lowland Fill	HHI	--	115	--	1	56	1,240	4,850	0.10 U	25	--	--	--	34,900
	Benson	10/1/1990	5	6	Lowland Fill	HHI	--	134	--	--	--	--	--	--	--	--	--	--	--
	Benson	10/1/1990	6	6.5	Lowland Fill	HHI	--	7,940	--	22	33	264	818	0.1 U	34	--	--	--	4,270

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-3

Metals Results for Shallow Soil - Marine View Drive Right-of-Way

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
B-5	MVD	9/7/1995	0	2	Upland Fill	HHI, EI	--	18	--	1 U	--	37	27	--	--	--	--	--	64
	MVD	9/7/1995	2	3	Upland Till	HHI, EI	--	3	--	1 U	--	12	2	--	--	--	--	--	26
	MVD	9/7/1995	5	5.5	Upland Till	HHI, EI	--	4	--	1 U	--	16	3	--	--	--	--	--	31
	MVD	9/7/1995	10	10.75	Upland Till	HHI	--	5	--	1 U	--	20	3	--	--	--	--	--	41
	MVD	9/7/1995	15	16	Upland Till	HHI	--	3	--	1 U	--	16	2	--	--	--	--	--	35
B-6	MVD	9/7/1995	0	0.16	Upland Fill	HHI, EI	--	25	--	1 U	--	40	66	--	--	--	--	--	74
	MVD	9/7/1995	2	3.5	Upland Fill	HHI, EI	--	3	--	1 U	--	16	3	--	--	--	--	--	32
	MVD	9/7/1995	5	5.5	Upland Fill	HHI, EI	--	4	--	1 U	--	14	4	--	--	--	--	--	31
	MVD	9/7/1995	10	11	Upland Till	HHI	--	2	--	1 U	--	12	2	--	--	--	--	--	28
	MVD	9/7/1995	15	15.5	Upland Till	HHI	--	4	--	1 U	--	14	7	--	--	--	--	--	30
BH-6	MVD	5/28/2004	2	3	Upland Fill	HHI	--	680	--	17	--	--	260	--	--	--	--	--	--
	MVD	5/28/2004	3	4	Upland Fill [w/Slag]	HHI	--	100	--	4	--	--	100	--	--	--	--	--	--
	MVD	5/28/2004	4	5	Upland Fill	HHI	--	3.9 U	--	0.48 U	--	--	3.9 U	--	--	--	--	--	--
BH-7	MVD	5/28/2004	1	2	Upland Fill	HHI	--	58	--	2.5	--	--	180	--	--	--	--	--	--
	MVD	5/28/2004	3	4	Upland Fill	HHI	--	81	--	4	--	--	240	--	--	--	--	--	--
	MVD	5/28/2004	5	6	Upland Fill	HHI	--	4.3 U	--	0.53 U	--	--	12	--	--	--	--	--	--
EV-3-S	MVD	1/22/1993	1	2.5	Upland Fill	HHI	--	288	--	2	--	--	66	--	--	--	--	--	--
	MVD	1/22/1993	1	2.5	Upland Fill	HHI	--	166	--	1	--	--	13	--	--	--	--	--	--
	MVD	1/22/1993	4	5.5	Upland Fill	HHI	--	248 J	--	1	--	--	44 J	--	--	--	--	--	--
	MVD	1/22/1993	8.5	10	Upland Fill	HHI	--	212 J	--	1 U	--	--	4 J	--	--	--	--	--	--
	MVD	1/22/1993	10	11.5	Upland Fill	HHI	--	34 J	--	1	--	--	4 J	--	--	--	--	--	--
	MVD	1/22/1993	14.5	16.9	Upland Fill	HHI	--	83 J	--	1	--	--	7 J	--	--	--	--	--	--
	MVD	1/22/1993	24	25.5	Upland Till	HHI	--	66 J	--	1 U	--	--	4 J	--	--	--	--	--	--
EV-10	MVD	2/22/1996	0	0.5	Upland Fill	HHI	--	55	--	1 U	--	--	3	--	--	--	--	--	--
	MVD	2/22/1996	2	2.8	Upland Fill	HHI	--	1,660	--	7	--	--	132	--	--	--	--	--	--
	MVD	2/22/1996	2.8	3.5	Upland Fill	HHI	--	7,660	--	30	--	--	144	--	--	--	--	--	--
	MVD	2/22/1996	5	5.5	Upland Fill	HHI	--	773	--	4	--	--	4	--	--	--	--	--	--
	MVD	2/22/1996	10	10.5	Upland Fill	HHI	--	1,728	--	7	--	--	16	--	--	--	--	--	--
	MVD	2/22/1996	10.5	11	Upland Fill	HHI	--	280	--	1 U	--	--	3	--	--	--	--	--	--
EV-11	MVD	2/21/1996	0	0.5	Upland Fill	HHI	--	37	--	1 U	--	--	25	--	--	--	--	--	--
	MVD	2/21/1996	2	3.5	Upland Fill	HHI	--	77	--	1 U	--	--	43	--	--	--	--	--	--
	MVD	2/21/1996	5	6.5	Upland Fill	HHI	--	2,439	--	9	--	--	6	--	--	--	--	--	--
	MVD	2/21/1996	10	11.5	Upland Fill	HHI	--	748	--	1 U	--	--	3	--	--	--	--	--	--
	MVD	2/21/1996	12.5	13.5	Upland Till	HHI	--	364	--	1 U	--	--	3	--	--	--	--	--	--

Table 6-3. Metals Results for Shallow Soil - Marine View Drive Right-of-Way

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
EV-12	MVD	2/23/1996	0	0.5	Upland Fill	HHI	--	49	--	1 U	--	--	20	--	--	--	--	--	--
	MVD	2/23/1996	2	3.5	Upland Fill	HHI	--	56	--	1 U	--	--	29	--	--	--	--	--	--
	MVD	2/23/1996	5	6.5	Upland Fill	HHI	--	776	--	3	--	--	6	--	--	--	--	--	--
	MVD	2/23/1996	10.5	11.5	Upland Till	HHI	--	187	--	1 U	--	--	40	--	--	--	--	--	--
	MVD	2/23/1996	12.5	13.5	Upland Till	HHI	--	60	--	1 U	--	--	6	--	--	--	--	--	--
EV-13	MVD	2/22/1996	0	0.5	Upland Fill	HHI	--	487	--	7	--	--	121	--	--	--	--	--	--
	MVD	2/22/1996	2	3.5	Upland Fill	HHI	--	11,810	--	86	--	--	141	--	--	--	--	--	--
	MVD	2/22/1996	5	5.5	Upland Fill	HHI	--	2,785	--	10	--	--	80	--	--	--	--	--	--
	MVD	2/22/1996	5.5	6.5	Upland Fill	HHI	--	1,831	--	6	--	--	5	--	--	--	--	--	--
	MVD	2/22/1996	10	11.5	Upland Fill	HHI	--	2,259	--	16	--	--	72	--	--	--	--	--	--
EV-14	MVD	2/23/1996	0	0.5	Upland Fill	HHI	--	53	--	3	--	--	164	--	--	--	--	--	--
	MVD	2/23/1996	2	3.5	Upland Fill	HHI	--	24	--	6	--	--	35	--	--	--	--	--	--
	MVD	2/23/1996	5	6.5	Upland Fill	HHI	--	4	--	27	--	--	7	--	--	--	--	--	--
	MVD	2/23/1996	10	11.5	Upland Till	HHI	--	20	--	7	--	--	46	--	--	--	--	--	--
EV-18B	MVD	9/24/1998	1	1.25	Upland Fill	HHI	--	10 UJ	--	10 U	111	28	27 J	--	--	--	--	--	41
	MVD	9/24/1998	2	3.5	Upland Fill	HHI	--	--	--	10 U	131	25	77 J	--	--	--	--	--	112
	MVD	9/24/1998	5	6.5	Upland Fill	HHI	--	133 J	--	10 U	118	157	720 J	--	--	--	--	--	948
	MVD	9/24/1998	10	11.5	Upland Fill	HHI	--	912 J	--	24	118	224	1,789 J	--	--	--	--	--	689
	MVD	9/24/1998	15	16.5	Upland Fill	HHI	--	588 J	--	10 U	147	16	21 J	--	--	--	--	--	36
	MVD	9/24/1998	20	21.5	Upland Fill	HHI	--	10 UJ	--	10 U	142	28	11 J	--	--	--	--	--	22
	MVD	9/24/1998	25	26.5	Upland Fill	HHI	--	10 UJ	--	10 U	195	31	10 UJ	--	--	--	--	--	62
LLMW-24D	MVD	12/20/2012	1.3	1.5	Upland Fill	HHI, EI	6 U	14.6 J	--	1.1	--	--	69	0.07	--	--	--	0.2 U	--
	MVD	12/20/2012	6	6.5	Upland Till	HHI	6 U	3.2 J	--	0.5	--	--	4	0.04	--	--	--	0.2 U	--
LLMW-25D	MVD	12/19/2012	3	4	Upland Fill	HHI, EI	5 U	2.7	--	0.6	--	--	5	0.04	--	--	--	0.2 U	--
	MVD	12/19/2012	8	8.2	Upland Fill	HHI	5 U	2.1	--	0.3	--	--	2 U	0.02 U	--	--	--	0.2 U	--
	MVD	12/19/2012	10.5	11	Upland Till	HHI	5 U	2	--	0.3	--	--	2	0.03 U	--	--	--	0.2 U	--
LLMW-27D	MVD	1/9/2013	3.5	4.5	Upland Fill	HHI	6 U	1,330	--	0.2 U	--	--	2 U	0.08	--	--	--	0.2 U	--
	MVD	1/9/2013	4.5	5.5	Upland Fill	HHI	5 U	274	--	0.7	--	--	2 U	0.02 U	--	--	--	0.2 U	--
	MVD	1/9/2013	8	9	Upland Till	HHI	6 U	84.2	--	0.8	--	--	2 U	0.02 U	--	--	--	0.2 U	--
	MVD	1/9/2013	15.5	16	Upland Till	HHI	6 U	2.4	--	0.3	--	--	2 U	0.02 U	--	--	--	0.2 U	--
	MVD	1/9/2013	25	26	Upland Till	HHI	5 U	3.1	--	0.4	--	--	2	0.02 U	--	--	--	0.2 U	--
LLMW-29D	MVD	1/8/2013	6	7	Upland Fill	HHI	10 U	6.9	--	0.5 U	--	--	5 U	0.05	--	--	--	0.2 U	--
	MVD	1/8/2013	12.5	13.5	Upland Till	HHI	5 U	85.7	--	0.4	--	--	2	0.02	--	--	--	0.2 U	--
	MVD	1/8/2013	20	21	Upland Till	HHI	5 U	52.6	--	0.3	--	--	2	0.02	--	--	--	0.2 U	--
LLMW-33D	MVD	1/3/2013	3	4	Upland Fill	HHI	6 U	121	--	1	--	--	301	0.81	--	--	--	0.2 U	--
	MVD	1/3/2013	4.5	4.7	Upland Fill	HHI	6 U	10.9	--	0.5	--	--	18	0.17	--	--	--	0.2 U	--
	MVD	1/3/2013	10.5	11.5	Upland Till	HHI	6 U	2.6	--	0.3	--	--	2 U	0.03 U	--	--	--	0.2 U	--
LLMW-34D	MVD	12/18/2012	4.5	5.5	Upland Fill	HHI	6 U	5.7 J	--	0.4	--	--	7	0.05	--	--	--	0.2 U	--
	MVD	12/18/2012	6	6.2	Upland Fill	HHI	6 U	4.6 J	--	0.3	--	--	6	0.06	--	--	--	0.2 U	--
	MVD	12/18/2012	11.5	11.7	Upland Fill	HHI	6 U	2.7 J	--	0.3	--	--	2 U	0.02 U	--	--	--	0.2 U	--

Table 6-3. Metals Results for Shallow Soil - Marine View Drive Right-of-Way

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
SA-24	MVD	4/1/1998	0	1	Upland Fill	HHI	--	18	--	--	--	--	20	--	--	--	--	--	--
	MVD	4/1/1998	1	2	Upland Till	HHI	--	10	--	--	--	--	10	--	--	--	--	--	--
	MVD	4/1/1998	2	3	Upland Till	HHI	--	36	--	--	--	--	63	--	--	--	--	--	--
	MVD	4/1/1998	3	4	Upland Till	HHI	--	10	--	--	--	--	10	--	--	--	--	--	--
	MVD	4/1/1998	4	5	Upland Till	HHI	--	10	--	--	--	--	17	--	--	--	--	--	--
SAI-SS1	MVD	1998	0	0.17	Upland Fill	HHI	--	18	--	--	--	--	35	--	--	--	--	--	--
SAIC-S44	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	341	--	2.4	--	--	209	--	--	--	--	--	--
SAIC-S51	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	49.3	--	0.5 U	--	--	261	--	--	--	--	--	--
SAIC-S54	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	34.8	--	0.5 U	--	--	242	--	--	--	--	--	--
SAIC-S60	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	23.3	--	1.7	--	--	666	--	--	--	--	--	--
SAIC-S61	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	80	--	3.2	--	--	4,540	--	--	--	--	--	--
SAIC-S69	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	66.7	--	1.2	--	--	248	--	--	--	--	--	--
	MVD	5/1/1991	0.5	0.5	Upland Fill	HHI	--	121	--	3.4	--	--	3,940	--	--	--	--	--	--
	MVD	5/1/1991	1	1	Upland Fill	HHI	--	40.7	--	4.8	--	--	330	--	--	--	--	--	--
	MVD	5/1/1991	2	2	Upland Fill	HHI	--	3.5	--	0.89	--	--	12.7	--	--	--	--	--	--
	MVD	5/1/1991	3	3	Upland Fill	HHI	--	4.4	--	1.7	--	--	5 U	--	--	--	--	--	--
SAIC-S70	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	51.2	--	0.82	--	--	217	--	--	--	--	--	--
SAIC-S71	MVD	5/1/1991	0	0.17	Upland Fill	HHI	--	333	--	1.9	--	--	630	--	--	--	--	--	--
SAIC-S81	MVD	5/1/1991	0	0.17	Upland Fill	HHI, EI	--	53.9	--	1.8	--	--	67.1	--	--	--	--	--	--
SAIC-S82	MVD	5/1/1991	0	0.17	Upland Fill	HHI, EI	--	54.9	--	0.82	--	--	89.4	--	--	--	--	--	--
SP-20	MVD	5/28/2004	1	2	Upland Fill	HHI	--	230	--	3.9	--	--	400	--	--	--	--	--	--
	MVD	5/28/2004	2	3	Upland Fill	HHI	--	130	--	2.6	--	--	900	--	--	--	--	--	--
	MVD	5/28/2004	3	4	Upland Fill	HHI	--	150	--	--	--	--	130	--	--	--	--	--	--
	MVD	5/28/2004	4	5	Upland Fill	HHI	--	100	--	--	--	--	41	--	--	--	--	--	--
	MVD	5/28/2004	5	6	Upland Fill	HHI	--	110	--	--	--	--	490	--	--	--	--	--	--
SP-21	MVD	5/28/2004	1	2	Upland Fill	HHI	--	200	--	3.7	--	--	200	--	--	--	--	--	--
	MVD	5/28/2004	2	3	Upland Fill	HHI	--	1,400	--	21	--	--	870	--	--	--	--	--	--
	MVD	5/28/2004	3	4	Upland Fill	HHI	--	12	--	0.58 U	--	--	5.3	--	--	--	--	--	--
	MVD	5/28/2004	4	5	Upland Fill	HHI	--	18	--	--	--	--	4.3 U	--	--	--	--	--	--
	MVD	5/28/2004	5	6	Upland Till	HHI	--	4 U	--	0.5 U	--	--	4 U	--	--	--	--	--	--
SP-22	MVD	5/27/2004	0	1	Uplant Fill	HHI	--	24	--	0.64	--	--	21	--	--	--	--	--	--
	MVD	5/27/2004	1	2	Uplant Fill	HHI	--	150	--	7.2	--	--	120	--	--	--	--	--	--
	MVD	5/27/2004	2	3	Uplant Fill	HHI	--	230	--	--	--	--	270	--	--	--	--	--	--
	MVD	5/27/2004	3	4	Uplant Fill	HHI	--	1,600	--	--	--	--	530	--	--	--	--	--	--
	MVD	5/27/2004	5	6	Uplant Fill	HHI	--	59	--	--	--	--	31	--	--	--	--	--	--
	MVD	5/27/2004	8	10	Uplant Fill	HHI	--	300	--	--	--	--	200	--	--	--	--	--	--
SP-23	MVD	5/27/2004	1	2	Upland Fill	HHI	--	51	--	0.88	--	--	9.9	--	--	--	--	--	--
	MVD	5/27/2004	2	3	Upland Fill	HHI	--	500	--	8.4	--	--	87	--	--	--	--	--	--
	MVD	5/27/2004	3	4	Upland Till	HHI	--	1,300	--	18	--	--	18	--	--	--	--	--	--
	MVD	5/27/2004	4	5	Upland Fill	HHI	--	880	--	14	--	--	57	--	--	--	--	--	--
	MVD	5/27/2004	5	6	Upland Till	HHI	--	850	--	--	--	--	4.8 U	--	--	--	--	--	--
	MVD	5/27/2004	8	10	Upland Till	HHI	--	360	--	--	--	--	--	--	--	--	--	--	--

Table 6-3. Metals Results for Shallow Soil - Marine View Drive Right-of-Way

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
SP-24	MVD	5/27/2004	1	2	Upland Fill	HHI	--	330	--	9	--	--	410	--	--	--	--	--	--
	MVD	5/27/2004	3	4	Upland Fill	HHI	--	170	--	7	--	--	370	--	--	--	--	--	--
	MVD	5/27/2004	5	6	Upland Fill	HHI	--	26	--	0.55 U	--	--	120	--	--	--	--	--	--
	MVD	5/27/2004	8	10	Upland Fill	HHI	--	260	--	6.3	--	--	460	--	--	--	--	--	--
	MVD	5/27/2004	10	12	Upland Fill	HHI	--	100	--	2.3	--	--	82	--	--	--	--	--	--
SP-25	MVD	5/27/2004	1	2	Upland Fill	HHI	--	99	--	5.1	--	--	230	--	--	--	--	--	--
	MVD	5/27/2004	3	4	Upland Fill	HHI	--	10	--	0.59 U	--	--	31	--	--	--	--	--	--
	MVD	5/27/2004	5	6	Upland Fill	HHI	--	22	--	0.59 U	--	--	41	--	--	--	--	--	--
	MVD	5/27/2004	8	10	Upland Fill	HHI	--	800	--	22	--	--	450	--	--	--	--	--	--
	MVD	5/27/2004	10	12	Upland Fill	HHI	--	400	--	16	--	--	712	--	--	--	--	--	--
SP-26	MVD	5/27/2004	1	2	Upland Fill	HHI	--	300	--	5.5	--	--	540	--	--	--	--	--	--
	MVD	5/27/2004	2	3	Upland Fill	HHI	--	230	--	4	--	--	4.1 U	--	--	--	--	--	--
	MVD	5/27/2004	3	4	Upland Till	HHI	--	1,200	--	--	--	--	4.8 U	--	--	--	--	--	--
	MVD	5/27/2004	4	5	Upland Till	HHI	--	880	--	--	--	--	4.7 U	--	--	--	--	--	--
	MVD	5/27/2004	5	6	Upland Till	HHI	--	440	--	--	--	--	4.7 U	--	--	--	--	--	--
T-1	MVD	May 1991	0*	0.5*	Upland Fill	HHI, EI	--	1.4	--	0.5 U	--	--	5 U	--	--	--	--	--	--
	MVD	May 1991	0.5*	3*	Upland Fill	HHI, EI	--	3.5	--	0.5 U	--	--	8.4	--	--	--	--	--	--
	MVD	May 1991	3*	4*	Upland Fill	HHI, EI	--	6.2	--	0.5 U	--	--	181	--	--	--	--	--	--
TB-1	MVD	4/1/1998	0	0.5	Upland Fill	HHI	--	18 U	--	--	--	--	20 U	--	--	--	--	--	--
	MVD	4/1/1998	2	3.5	Upland Fill	HHI	--	46	--	--	--	--	27 J	--	--	--	--	--	--
	MVD	4/1/1998	5	6.5	Upland Fill	HHI	--	48	--	--	--	--	417	--	--	--	--	--	--
	MVD	4/1/1998	10	11.5	Upland Fill	HHI	--	695	--	--	--	--	63 J	--	--	--	--	--	--
	MVD	4/1/1998	15	16.5	Upland Till	HHI	--	455	--	--	--	--	13 J	--	--	--	--	--	--
	MVD	4/1/1998	20	21.5	Upland Till	HHI	--	197	--	--	--	--	12 J	--	--	--	--	--	--
	MVD	4/1/1998	25	26.5	Upland Till	HHI	--	201	--	--	--	--	10 U	--	--	--	--	--	--
	MVD	4/1/1998	30	31.5	Upland Till	HHI	--	120	--	--	--	--	10 U	--	--	--	--	--	--
TB-2	MVD	3/31/1998	0	0.5	Upland Fill	HHI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
	MVD	3/31/1998	2	3.5	Upland Fill	HHI	--	115	--	--	--	--	297	--	--	--	--	--	--
	MVD	3/31/1998	5	6.5	Upland Fill	HHI	--	28	--	--	--	--	222	--	--	--	--	--	--
	MVD	3/31/1998	10	11.5	Upland Fill	HHI	--	47	--	--	--	--	52	--	--	--	--	--	--
	MVD	3/31/1998	15	16.5	Upland Till	HHI	--	502	--	--	--	--	10 U	--	--	--	--	--	--
	MVD	3/31/1998	20	21.5	Upland Till	HHI	--	15	--	--	--	--	10 U	--	--	--	--	--	--
	MVD	3/31/1998	30	31.5	Upland Till	HHI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-4

Metals Results for Shallow Soil - BNSF Property

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
AB-4	BNSF	10/1/1990	2.5	4	Lowland Fill	HHI	--	180	--	1 U	66	1,370	--	0.1 U	22	--	--	--	38,700
	BNSF	10/1/1990	5	6.5	Lowland Fill	HHI	--	167	--	1 U	78	1,340	5,480	0.1 U	19	--	--	--	40,100
	BNSF	10/1/1990	7.5	8	Lowland Fill	HHI	--	42	--	1 U	39	45	107	0.1 U	35	--	--	--	494
	BNSF	10/1/1990	8	9	Lowland Fill	HHI	--	105	--	1 U	1 U	6	11	0.1 U	3 U	--	--	--	27
	BNSF	10/1/1990	10	12	Lowland NS	HHI	--	97	--	1 U	35	31	20	0.1 U	33	--	--	--	49
AB-6	BNSF	10/1/1990	2.5	4	Lowland Fill	HHI	--	120	--	2	33	1,030	8,535	0.10	71	--	--	--	30,400
	BNSF	10/1/1990	5	6	Lowland Fill	HHI	--	238	--	2	60	638	5,560	0.1 U	83	--	--	--	7,500
	BNSF	10/1/1990	7.5	9	Lowland Fill	HHI	--	335	--	3	53	634	5,960	0.10	82	--	--	--	5,750
	BNSF	10/1/1990	12.5	14	Lowland Silt	HHI	--	12	--	1 U	34	57	402	0.10	33	--	--	--	497
HP-06	BNSF	8/25/1995	0.25	0.5	Lowland Fill	HHI	--	6	--	2	--	18	5	--	--	--	--	--	44
	BNSF	8/25/1995	5	6.5	Lowland Fill	HHI	--	5	--	1 U	--	18	3	--	--	--	--	--	43
	BNSF	8/25/1995	15	17	Lowland Silt	HHI	--	4	--	1 U	--	17	4	--	--	--	--	--	47
	BNSF	8/25/1995	17.5	19	Lowland Silt	HHI	--	4	--	1 U	--	17	3	--	--	--	--	--	43
HP-07	BNSF	8/29/1995	0	0.2	Lowland Fill	HHI	--	19	--	1	--	77	86	--	--	--	--	--	147
	BNSF	8/29/1995	2	3.5	Lowland Fill	HHI	--	5	--	1 U	--	18	5	--	--	--	--	--	44
	BNSF	8/29/1995	5	6.5	Lowland Fill	HHI	--	4	--	1 U	--	23	4	--	--	--	--	--	46
	BNSF	8/29/1995	10	12	Lowland Fill	HHI	--	5	--	1 U	--	19	4	--	--	--	--	--	43
	BNSF	8/29/1995	15	16	Lowland Silt	HHI	--	5	--	1 U	--	21	4	--	--	--	--	--	45
HP-08	BNSF	8/31/1995	0	0.2	Lowland Fill	HHI	--	29	--	1	--	87	112	--	--	--	--	--	194
	BNSF	8/31/1995	2	3.5	Lowland Fill	HHI	--	7	--	1 U	--	19	4	--	--	--	--	--	42
	BNSF	8/31/1995	5	6.5	Lowland Fill	HHI	--	12	--	1 U	--	17	4	--	--	--	--	--	40
	BNSF	8/31/1995	10	12	Lowland Silt	HHI	--	20	--	1 U	--	51	8	--	--	--	--	--	69
	BNSF	8/31/1995	15	17	Lowland Silt	HHI	--	47	--	1 U	--	44	8	--	--	--	--	--	73
HP-09	BNSF	8/31/1995	0	0.2	Lowland Fill	HHI	--	7	--	1 U	--	16	7	--	--	--	--	--	47
	BNSF	8/31/1995	2	3.5	Lowland Fill	HHI	--	5	--	1 U	--	16	3	--	--	--	--	--	40
	BNSF	8/31/1995	5	6.5	Lowland Fill	HHI	--	9	--	1 U	--	19	5	--	--	--	--	--	41
	BNSF	8/31/1995	10	12	Lowland Silt	HHI	--	36	--	1 U	--	44	7	--	--	--	--	--	73
HP-10	BNSF	8/30/1995	0	0.2	Lowland Fill	HHI	--	6	--	1 U	--	18	14	--	--	--	--	--	44
	BNSF	8/30/1995	2	3.5	Lowland Fill	HHI	--	6	--	1 U	--	21	5	--	--	--	--	--	48
	BNSF	8/30/1995	5	6.5	Lowland Fill	HHI	--	10	--	1 U	--	16	4	--	--	--	--	--	44
	BNSF	8/30/1995	10	12	Lowland Fill	HHI	--	14	--	1 U	--	16	3	--	--	--	--	--	45
	BNSF	8/30/1995	15	17	Lowland Silt	HHI	--	20	--	1 U	--	35	8	--	--	--	--	--	61

Table 6-4. Metals Results for Shallow Soil - BNSF Property

Location Identification	General Location	Sample Date	(feet bgs) Start	End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
HP-11	BNSF	8/29/1995	0	0.2	Lowland Fill	HHI	--	7	--	1 U	--	23	33	--	--	--	--	--	58
	BNSF	8/29/1995	2	3.5	Lowland Fill	HHI	--	5	--	1 U	--	18	4	--	--	--	--	--	43
	BNSF	8/29/1995	5	6.5	Lowland Fill	HHI	--	31	--	1 U	--	51	14	--	--	--	--	--	76
	BNSF	8/29/1995	10	12	Lowland Silt	HHI	--	14	--	1 U	--	44	8	--	--	--	--	--	68
HP-13	BNSF	8/31/1995	0	0.2	Lowland Fill	HHI	--	31	--	1 U	--	124	33	--	--	--	--	--	86
	BNSF	8/31/1995	2	3.5	Lowland Fill	HHI	--	26	--	1 U	--	18	4	--	--	--	--	--	47
	BNSF	8/31/1995	5	6.5	Lowland Fill	HHI	--	40	--	1 U	--	21	43	--	--	--	--	--	47
	BNSF	8/31/1995	10	12	Lowland Fill	HHI	--	8	--	1 U	--	16	3	--	--	--	--	--	38
	BNSF	8/31/1995	12	14	Lowland Silt	HHI	--	20	--	1 U	--	36	8	--	--	--	--	--	61
HP-14	BNSF	9/1/1995	0	0.2	Lowland Fill	HHI	--	53	--	2	--	157	184	--	--	--	--	--	536
	BNSF	9/1/1995	2	3.5	Lowland Fill	HHI	--	29	--	3	--	666	268	--	--	--	--	--	527
	BNSF	9/1/1995	5	6.5	Lowland Fill	HHI	--	10	--	1 U	--	18	4	--	--	--	--	--	83
	BNSF	9/1/1995	10	12	Lowland Fill	HHI	--	110	--	1 U	--	65	29	--	--	--	--	--	95
	BNSF	9/1/1995	15	17	Lowland Silt	HHI	--	37	--	1 U	--	42	7	--	--	--	--	--	64
HP-15	BNSF	12/5/1995	0	0.5	Lowland Fill	HHI	--	57	--	2	370	170	253	--	--	--	--	--	437
	BNSF	12/5/1995	2	3.5	Lowland Fill	HHI	--	9	--	1 U	226	18	3 U	--	--	--	--	--	52
	BNSF	12/5/1995	5	6	Lowland Fill	HHI	--	12	--	1 U	161	39	29	--	--	--	--	--	63
	BNSF	12/5/1995	10	12	Lowland Silt	HHI	--	9	--	1 U	84	43	3	--	--	--	--	--	75
HP-16	BNSF	12/7/1995	0	0.5	Lowland Fill	HHI	--	31	--	1	331	170	144	--	--	--	--	--	247
	BNSF	12/7/1995	2	3.5	Lowland Fill	HHI	--	8	--	1 U	156	18	4	--	--	--	--	--	59
	BNSF	12/7/1995	5	6.5	Lowland Fill	HHI	--	24	--	1 U	203	82	261	--	--	--	--	--	132
	BNSF	12/7/1995	10	12	Lowland Silt	HHI	--	18	--	1 U	87	48	14	--	--	--	--	--	77
	BNSF	12/7/1995	15	17	Lowland Silt	HHI	--	14	--	1 U	98	46	8	--	--	--	--	--	74
HP-25	BNSF	1/9/1996	0	0.5	Lowland Fill	HHI	--	42	--	1	347	116	173	--	--	--	--	--	284
	BNSF	1/9/1996	2	3.5	Lowland Fill	HHI	--	15	--	1 U	122	18	3 U	--	--	--	--	--	48
	BNSF	1/9/1996	5	6.5	Lowland Fill	HHI	--	16	--	1 U	98	29	17	--	--	--	--	--	90
	BNSF	1/9/1996	10	12	Lowland Fill	HHI	--	32	--	1 U	84	40	8	--	--	--	--	--	79
HP-27	BNSF	1/11/1996	0	0.5	Lowland Fill	HHI	--	153	--	1 U	183	50	75	--	--	--	--	--	186
	BNSF	1/11/1996	2	3.5	Lowland Fill	HHI	--	9	--	1 U	68	17	3	--	--	--	--	--	48
	BNSF	1/11/1996	5	6.5	Lowland Fill	HHI	--	9	--	1 U	96	17	5	--	--	--	--	--	50
	BNSF	1/11/1996	10	12	Lowland Fill	HHI	--	10	--	1 U	96	18	6	--	--	--	--	--	55
	BNSF	1/11/1996	15	17	Lowland Silt	HHI	--	15	--	1 U	67	42	6	--	--	--	--	--	73
HP-28	BNSF	1/11/1996	0	0.5	Lowland Fill	HHI	--	28	--	1	199	91	168	--	--	--	--	--	252
	BNSF	1/11/1996	2	3.5	Lowland Fill	HHI	--	18	--	1 U	202	59	116	--	--	--	--	--	258
	BNSF	1/11/1996	5	6.5	Lowland Fill	HHI	--	15	--	1 U	185	29	91	--	--	--	--	--	283
	BNSF	1/11/1996	10	12	Lowland Fill	HHI	--	8	--	1 U	48	22	14	--	--	--	--	--	101
	BNSF	1/11/1996	15	17	Lowland Silt	HHI	--	16	--	1 U	95	28	3 U	--	--	--	--	--	68
HP-42	BNSF	1/25/1996	0	0.5	Lowland Fill	HHI	--	5	--	1 U	52	18	9	--	--	--	--	--	48
	BNSF	1/25/1996	2	3.5	Lowland Fill	HHI	--	3	--	1 U	70	19	3 U	--	--	--	--	--	43
	BNSF	1/25/1996	5	6.5	Lowland Fill	HHI	--	6	--	1 U	59	18	3 U	--	--	--	--	--	43
	BNSF	1/25/1996	10	12	Lowland Fill	HHI	--	13	--	1 U	74	45	3 U	--	--	--	--	--	84

Table 6-4. Metals Results for Shallow Soil - BNSF Property

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
MW-1	BNSF	2/3/1993	0	1	Lowland Fill	HHI	--	32	--	2	--	--	118	--	--	--	--	--	--
	BNSF	2/3/1993	1.5	3	Lowland Fill	HHI	--	10	--	1	--	--	3	--	--	--	--	--	--
	BNSF	2/3/1993	4.5	6	Lowland Fill	HHI	--	3	--	1 U	--	--	4 J	--	--	--	--	--	--
	BNSF	2/3/1993	9	11	Lowland Silt	HHI	--	6	--	1 U	--	--	3 J	--	--	--	--	--	--
	BNSF	2/3/1993	13.5	15	Lowland Silt	HHI	--	3	--	1 U	--	--	3 J	--	--	--	--	--	--
	BNSF	2/3/1993	19.5	21	Lowland Silt	HHI	--	5	--	1 U	--	--	3 J	--	--	--	--	--	--
MW-2	BNSF	4/13/1993	0	0.5	Lowland Fill	HHI	--	23	--	1	--	--	120 J	--	--	--	--	--	--
	BNSF	4/13/1993	1	2.5	Lowland Fill	HHI	--	22	--	3	--	--	330 J	--	--	--	--	--	--
	BNSF	4/13/1993	4	5.5	Lowland Fill	HHI	--	64	--	6	--	--	470 J	--	--	--	--	--	--
	BNSF	4/13/1993	8.5	10	Lowland Fill	HHI	--	74	--	2	--	--	490 J	--	--	--	--	--	76
MW-3	BNSF	4/12/1993	0	0.2	Lowland Fill	HHI	--	13	--	1 U	--	--	20	--	--	--	--	--	--
	BNSF	4/12/1993	1	2.5	Lowland Fill	HHI	--	5.3	--	1 U	--	--	3.4	--	--	--	--	--	--
	BNSF	4/12/1993	4	5.5	Lowland Fill	HHI	--	4.5	--	1 U	--	--	4.1	--	--	--	--	--	--
	BNSF	4/12/1993	8.5	9	Lowland Fill	HHI	--	10	--	1 U	--	--	10	--	--	--	--	--	--
	BNSF	4/12/1993	9	9.5	Lowland Silt	HHI	--	25 J	--	1	--	--	15	--	--	--	--	--	--
	BNSF	4/12/1993	10	12	Lowland Silt	HHI	--	21 J	--	1 U	--	--	10	--	--	--	--	--	--
MW-4B	POE	4/12/1993	0	0.2	Lowland Fill	HHI	--	36 J	--	1	--	--	180	--	--	--	--	--	--
	POE	4/12/1993	1	2.5	Lowland Fill	HHI	--	7.3 J	--	1 U	--	--	10	--	--	--	--	--	--
	POE	4/12/1993	4	5.5	Lowland Fill	HHI	--	5.9 J	--	1 U	--	--	5.2	--	--	--	--	--	--
	POE	4/12/1993	8.5	10	Lowland Silt	HHI	--	25 J	--	1 U	--	--	10	--	--	--	--	--	--
	POE	4/13/1993	15	17	Lowland Silt	HHI	--	15	--	1 U	--	--	10 J	--	--	--	--	--	--
MW-5	BNSF	4/13/1993	0	0.5	Lowland Fill	HHI	--	5.3	--	1	--	--	10 J	--	--	--	--	--	--
	BNSF	4/13/1993	1	2.5	Lowland Fill	HHI	--	6.9	--	1 U	--	--	4.4 J	--	--	--	--	--	--
	BNSF	4/13/1993	4	5.5	Lowland Fill	HHI	--	6.7	--	1 U	--	--	5 J	--	--	--	--	--	--
	BNSF	4/13/1993	8.5	10	Lowland Silt	HHI	--	18	--	1 U	--	--	10 J	--	--	--	--	--	--
RR-1	BNSF	10/1/1990	0	0	Lowland Fill	HHI	--	26	--	1 U	59	1,970	12	0.1 U	31	--	--	--	178

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-5

Metals Results for Shallow Soil - Pacific Highway Right-of-Way

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
HA-2	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	11	--	--	--	--	1,003	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	11	--	--	--	--	539	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	21	--	--	--	--	331	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	52	--	--	--	--	219	--	--	--	--	--	--
HA-3	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	16 J	--	--	--	--	686 J	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	16 J	--	--	--	--	1,049 J	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	296 J	--	--	--	--	323 J	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	389 J	--	--	--	--	758 J	--	--	--	--	--	--
HA-6	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	11	--	--	--	--	738	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	10 U	--	--	--	--	160	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	10 U	--	--	--	--	13	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	10 U	--	--	--	--	166	--	--	--	--	--	--
HA-7	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	15	--	--	--	--	295	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	15	--	--	--	--	276	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	21	--	--	--	--	351	--	--	--	--	--	--
HA-10	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	22	--	--	--	--	793	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	10 U	--	--	--	--	174	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	10 U	--	--	--	--	80	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	349	--	--	--	--	1,039	--	--	--	--	--	--
HA-11	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	10 U	--	--	--	--	852	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	25	--	--	--	--	688	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	10 U	--	--	--	--	27	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	31	--	--	--	--	210	--	--	--	--	--	--
HA-14	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	12	--	--	--	--	663	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	20	--	--	--	--	62	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	45	--	--	--	--	40	--	--	--	--	--	--
HA-15	WSDOT	4/9/1998	0	0.5	Lowland Fill	HHI	--	17	--	--	--	--	780	--	--	--	--	--	--
	WSDOT	4/9/1998	0.5	1	Lowland Fill	HHI	--	32	--	--	--	--	1,439	--	--	--	--	--	--
	WSDOT	4/9/1998	2	2.5	Lowland Fill	HHI	--	12	--	--	--	--	56	--	--	--	--	--	--
	WSDOT	4/9/1998	4	4.5	Lowland Fill	HHI	--	10 U	--	--	--	--	1,236	--	--	--	--	--	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-6

Metals Results for Shallow Soil - Port of Everett Riverside Business Park Subarea

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
A3-05	POE	12/1/1994	1	2.9	Lowland Fill	HHI	--	20	--	--	--	--	--	--	--	--	--	--	--
A10-05	POE	12/1/1994	0.7	1.3	Lowland Fill	HHI, EI	--	13.3	--	--	--	--	--	--	--	--	--	--	--
EV-21A/B	POE	2/8/1999	0	0.5	Lowland Fill	HHT, EI	--	16	--	5 U	86	42	50	--	--	--	--	--	145
	POE	2/8/1999	0.5	2	Lowland Fill	HHT, EI	--	11	--	5 U	139	32	32	--	--	--	--	--	94
	POE	2/8/1999	2	3.5	Lowland Fill	HHT, EI	--	5	--	5 U	88	30	5	--	--	--	--	--	39
	POE	2/8/1999	5	6.5	Lowland Fill	HHT, EI	--	5	--	5 U	76	31	43	--	--	--	--	--	37
	POE	2/8/1999	8	9.5	Lowland Fill	HHI	--	18	--	5 U	141	65	15	--	--	--	--	--	87
	POE	2/8/1999	10	11.5	Lowland Silt	HHI	--	14	--	5 U	120	62	17	--	--	--	--	--	90
	POE	2/8/1999	15	16.5	Lowland Silt	HHI	--	5	--	5 U	136	33	5	--	--	--	--	--	73
GP-1	POE	5/10/2005	1	10	Lowland Fill	HHI, EI	--	31	--	0.2 U	28.8	24.3	36	--	--	--	--	--	87.5
GP-2	POE	5/10/2005	1	10	Lowland Fill	HHI	--	26	--	0.2 U	29.3	23.2	12	--	--	--	--	--	54.9
GP-3	POE	5/10/2005	2	9	Lowland Fill	HHI	--	10	--	0.2 U	29	63.7	44	--	--	--	--	--	83.5
GP-4	POE	5/11/2005	2	6	Lowland Fill	HHI	--	40	--	0.2 U	30.5	28.5	52	--	--	--	--	--	79
GP-5	POE	5/11/2005	4	6	Lowland Fill	HHI, EI	--	6	--	0.2 U	28.2	20.1	5	--	--	--	--	--	41.9
GP-6	POE	5/11/2005	2	6	Lowland Fill	HHI, EI	--	17	--	0.3 U	25.1	45.4	48	--	--	--	--	--	86.7
GP-7	POE	5/10/2005	4	12	Lowland Fill	HHI, EI	--	7	--	0.2 U	31.2	42.8	37	--	--	--	--	--	114
GP-8	POE	5/10/2005	6	11	Lowland Fill	HHI, EI	--	6 U	--	0.2 U	21	16.5	4	--	--	--	--	--	39.3
GP-9	POE	5/11/2005	5	8	Lowland Fill	HHI, EI	--	22	--	0.2 U	28.6	24.8	5	--	--	--	--	--	44.3
GP-10	POE	5/11/2005	5	8	Lowland Fill	HHI, EI	--	16	--	0.2 U	25.3	23.1	10	--	--	--	--	--	43.9
GP-11	POE	5/11/2005	4	7	Lowland Fill	HHI, EI	--	51	--	0.2 U	27.8	21.1	22	--	--	--	--	--	48.6
HC-11	POE	8/10/1992	2	2	Lowland Fill	HHI, EI	--	24.7	--	--	--	--	--	--	--	--	--	--	--
HC-24	POE	5/29/1990	2.5	4	Lowland Fill	HHI, EI	--	17	--	--	--	--	--	--	--	--	--	--	--
	POE	5/29/1990	7.5	9	Lowland Silt	HHI	--	10.2	--	--	--	--	--	--	--	--	--	--	--
HC-25	POE	5/29/1990	2.5	4	Lowland Fill	HHI	--	4.8	--	--	--	--	--	--	--	--	--	--	--
	POE	5/29/1990	6.5	8	Lowland Silt	HHI	--	11.7	--	--	--	--	--	--	--	--	--	--	--
HC-26	POE	5/29/1990	2.5	4	Lowland Fill	HHI, EI	--	16.1	--	--	--	--	--	--	--	--	--	--	--
	POE	5/29/1990	6.5	8	Lowland Silt	HHI	--	8.9	--	--	--	--	--	--	--	--	--	--	--
HP-30	POE	1/18/1996	0	0.5	Lowland Fill	HHI, EI	--	4	--	1 U	69	39	76	--	--	--	--	--	399
	POE	1/18/1996	2	3.5	Lowland Fill	HHI, EI	--	31	--	1 U	68	25	38	--	--	--	--	--	146
	POE	1/18/1996	5	6.5	Lowland Fill	HHI, EI	--	14	--	1 U	72	50	8	--	--	--	--	--	76
	POE	1/18/1996	8	9.5	Lowland Silt	HHI	--	15	--	1 U	76	44	7	--	--	--	--	--	83
HP-31	POE	1/19/1996	0	0.5	Lowland Fill	HHI, EI	--	5	--	1 U	68	22	3 U	--	--	--	--	--	72
	POE	1/19/1996	2	3.5	Lowland Fill	HHI, EI	--	9	--	1 U	102	55	45	--	--	--	--	--	151
	POE	1/19/1996	5	6.5	Lowland Fill	HHI, EI	--	10	--	1 U	55	128	48	--	--	--	--	--	282
	POE	1/19/1996	8	9.5	Lowland Silt	HHI	--	17	--	1 U	72	49	4	--	--	--	--	--	82
HP-32	POE	1/19/1996	0	0.5	Lowland Fill	HHI, EI	--	5	--	1 U	68	23	4	--	--	--	--	--	50
	POE	1/19/1996	2	3.5	Lowland Fill	HHI, EI	--	5	--	1 U	57	22	4	--	--	--	--	--	53
	POE	1/19/1996	5	6.5	Lowland Silt	HHI, EI	--	17	--	1 U	75	47	6	--	--	--	--	--	72
HP-33	POE	1/20/1996	0	0.5	Lowland Fill	HHI	--	42	--	1 U	63	30	12	--	--	--	--	--	70
	POE	1/20/1996	2	3.5	Lowland Fill	HHI	--	52	--	1 U	103	93	4	--	--	--	--	--	82
	POE	1/20/1996	8	9.5	Lowland NS	HHI	--	50	--	1 U	67	57	49	--	--	--	--	--	87
HP-34	POE	1/20/1996	0	0.5	Lowland Fill	HHI, EI	--	18	--	1 U	99	71	88	--	--	--	--	--	278
	POE	1/20/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	66	24	5	--	--	--	--	--	66
	POE	1/20/1996	5	6.5	Lowland Fill	HHI, EI	--	9	--	1 U	127	35	25	--	--	--	--	--	95
	POE	1/20/1996	8	9.5	Lowland Silt	HHI	--	12	--	1 U	75	48	3	--	--	--	--	--	85
HP-35	POE	1/21/1996	0	0.5	Lowland Fill	HHI, EI	--	198	--	5	98	259	224	--	--	--	--	--	190
	POE	1/21/1996	2	3.5	Lowland Fill	HHI, EI	--	81	--	2	56	92	155	--	--	--	--	--	112
	POE	1/21/1996	8	9.5	Lowland Silt	HHI	--	11	--	1 U	79	46	7	--	--	--	--	--	68
HP-36	POE	1/22/1996	0	0.5	Lowland Fill	HHI, EI	--	7	--	1 U	110	109	102	--	--	--	--	--	147
	POE	1/22/1996	12	13.5	Lowland Silt	HHI	--	9	--	1 U	75	33	10	--	--	--	--	--	55

Table 6-6. Metals Results for Shallow Soil - Port of Everett Riverside Business Park Subarea

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
HP-37	POE	1/22/1996	0	0.5	Lowland Fill	HHI, EI	--	8	--	1 U	109	33	10	--	--	--	--	--	92
	POE	1/22/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	77	26	13	--	--	--	--	--	95
	POE	1/22/1996	5	6.5	Lowland Silt	HHI, EI	--	18	--	1 U	71	50	5	--	--	--	--	--	83
HP-38	POE	1/23/1996	0	0.5	Lowland Fill	HHI, EI	--	6	--	1 U	70	21	3 U	--	--	--	--	--	46
	POE	1/23/1996	2	3.5	Lowland Fill	HHI, EI	--	8	--	1 U	69	19	3 U	--	--	--	--	--	46
	POE	1/23/1996	5	6.5	Lowland Silt	HHI, EI	--	13	--	1 U	108	26	3 U	--	--	--	--	--	58
HP-39	POE	1/23/1996	2	3.5	Lowland Fill	HHI, EI	--	41	--	1 U	60	20	4	--	--	--	--	--	45
	POE	1/23/1996	5	6.5	Lowland Silt	HHI, EI	--	13	--	1 U	62	46	4	--	--	--	--	--	72
HP-40	POE	1/24/1996	0	0.5	Lowland Fill	HHI, EI	--	3	--	1 U	139	33	16	--	--	--	--	--	61
	POE	1/24/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	73	18	3 U	--	--	--	--	--	42
	POE	1/24/1996	5	6.5	Lowland Fill	HHI, EI	--	7	--	1 U	49	18	3 U	--	--	--	--	--	44
HP-41	POE	1/24/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	62	18	3 U	--	--	--	--	--	43
	POE	1/24/1996	5	6.5	Lowland Fill	HHI, EI	--	6	--	1 U	54	17	3 U	--	--	--	--	--	41
	POE	1/24/1996	9	10.5	Lowland Silt	HHI, EI	--	8	--	1 U	59	19	3	--	--	--	--	--	42
HP-43	POE	1/25/1996	2	3.5	Lowland Fill	HHI, EI	--	6	--	1 U	60	21	3 U	--	--	--	--	--	55
	POE	1/25/1996	5	6.5	Lowland Fill	HHI, EI	--	5	--	1 U	46	18	3 U	--	--	--	--	--	49
HP-46	POE	2/9/1999	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	149	33	30	--	--	--	--	--	85
	POE	2/9/1999	0.5	2	Lowland Fill	HHI	--	531	--	10 U	118	167	458	--	--	--	--	--	1,119
	POE	2/9/1999	2	3.5	Lowland Fill	HHI	--	210	--	10 U	74	40	38	--	--	--	--	--	54
	POE	2/9/1999	5	6.5	Lowland NS	HHI	--	99	--	10 U	147	83	64	--	--	--	--	--	107
	POE	2/9/1999	10	11.5	Lowland Silt	HHI	--	16	--	10 U	124	48	10 U	--	--	--	--	--	86
HP-47	POE	2/9/1999	0	0.5	Lowland Fill	HHI	--	10 U	--	10 U	154	29	10 U	--	--	--	--	--	35
	POE	2/9/1999	0.5	2	Lowland Fill	HHI	--	299	--	10 U	81	1,059	5,619	--	--	--	--	--	23,874
	POE	2/9/1999	2	3.5	Lowland Fill	HHI	--	25	--	10 U	51	25	18	--	--	--	--	--	58
	POE	2/9/1999	5	6.5	Lowland Silt	HHI	--	24	--	10 U	133	50	18	--	--	--	--	--	78
HP-48	POE	2/10/1999	0	0.5	Lowland Fill	HHI, EI	--	59	--	10 U	111	124	294	--	--	--	--	--	1,064
	POE	2/10/1999	0.5	2	Lowland Fill	HHI, EI	--	175	--	10 U	51	120	40	--	--	--	--	--	194
	POE	2/10/1999	2	3.5	Lowland Fill	HHI, EI	--	22	--	10 U	50	20	10 U	--	--	--	--	--	40
	POE	2/10/1999	5	6.5	Lowland Silt	HHI, EI	--	22	--	10 U	137	65	10 U	--	--	--	--	--	88
	POE	2/10/1999	10	11.5	Lowland Silt	HHI, EI	--	10	--	10 U	130	49	10 U	--	--	--	--	--	59
LLMW-05D	POE	12/10/2012	6	7	Lowland Fill	HHI	6 U	9.8	--	0.3	--	--	4	0.02 U	--	--	--	0.2 U	--
	POE	12/10/2012	10	10.2	Lowland NS	HHI	8 U	49.8	--	0.8	--	--	53	0.10	--	--	--	0.3 U	--
	POE	12/10/2012	12	13	Lowland Silt	HHI	7 U	9.8	--	0.5	--	--	6	0.06	--	--	--	0.3 U	--
	POE	12/10/2012	12	13	Lowland Silt	HHI	7 U	9.8	--	0.5	--	--	5	0.06	--	--	--	0.3 U	--
LLMW-06D	POE	12/27/2012	6.5	7.5	Lowland Fill	HHI	6 U	59.5	--	0.3	--	--	3	0.02 U	--	--	--	0.2 U	--
	POE	12/27/2012	8	8.2	Lowland NS	HHI	9 U	28	--	0.8	--	--	15	0.08	--	--	--	0.3 U	--
	POE	12/27/2012	11	12	Lowland Silt	HHI	7 U	13.7	--	0.6	--	--	6	0.09	--	--	--	0.3 U	--
LLMW-07D	POE	12/7/2012	3	4	Lowland Fill	HHI	6 U	5.7	--	0.5	--	--	16	0.02 U	--	--	--	0.2 U	--
	POE	12/7/2012	10	10.2	Lowland NS	HHI	8 U	12.9	--	0.3	--	--	4	0.05	--	--	--	0.3 U	--
	POE	12/7/2012	10.5	11	Lowland Silt	HHI	7 U	13.5	--	0.4	--	--	5	0.06	--	--	--	0.3 U	--
LLMW-08D	POE	12/10/2012	3	4	Lowland Fill	HHI, EI	10 U	26.8	--	0.8	--	--	81	0.06	--	--	--	0.2 U	--
	POE	12/10/2012	12	13	Lowland NS	HHI	20 U	29.2	--	1.1	--	--	386	0.07	--	--	--	0.3 U	--
LLMW-09D	POE	12/6/2012	4.5	5.5	Lowland Fill	HHI, EI	6 U	15.1	--	0.3	--	--	4	0.02 U	--	--	--	0.2 U	--
	POE	12/6/2012	8.3	8.5	Lowland NS	HHI	10 U	103	--	1.7	--	--	169	0.26	--	--	--	0.4 U	--
	POE	12/6/2012	10.5	11	Lowland Silt	HHI	8 U	16.5	--	0.5	--	--	8	0.08	--	--	--	0.3 U	--
LLMW-10D	POE	12/11/2012	6	7	Lowland Fill	HHI	6 U	2.8	--	0.3	--	--	3	0.03 U	--	--	--	0.2 U	--
	POE	12/11/2012	7.5	7.7	Lowland NS	HHI	7 U	22.3	--	2.5	--	--	37	0.10	--	--	--	0.3 U	--
	POE	12/11/2012	12	13	Lowland Silt	HHI	8 U	15.4	--	0.6	--	--	8	0.09	--	--	--	0.3 U	--
LLMW-11D	POE	12/13/2012	5	6	Lowland Fill	HHI, EI	10 U	26	--	0.6 U	--	--	15	0.05	--	--	--	0.2 U	--
	POE	12/13/2012	10.5	10.7	Lowland NS	HHI	7 U	13.9	--	0.4	--	--	12	0.05	--	--	--	0.3 U	--
	POE	12/13/2012	11	11.5	Lowland Silt	HHI	6 U	10.8	--	0.5	--	--	6	0.06	--	--	--	0.3 U	--
LLMW-12D	POE	12/12/2012	5	5.5	Lowland Fill	HHI, EI	6 U	3.8	--	0.3	--	--	3	0.02 U	--	--	--	0.2 U	--
	POE	12/12/2012	8.5	8.7	Lowland NS	HHI	8 U	32.1	--	0.8	--	--	12	0.07	--	--	--	0.3 U	--
	POE	12/12/2012	10	10.5	Lowland Silt	HHI	8 U	12.6	--	0.5	--	--	8	0.09	--	--	--	0.3 U	--

Table 6-6. Metals Results for Shallow Soil - Port of Everett Riverside Business Park Subarea

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
LLMW-13D	POE	12/17/2012	10.5	11.5	Lowland Fill	HHI	7 U	47.2	--	0.3	--	--	49	0.03 U	--	--	--	0.3 U	--
	POE	12/17/2012	18.7	19	Lowland NS	HHI	7 U	15.7	--	0.5	--	--	12	0.09	--	--	--	0.3 U	--
	POE	12/17/2012	23	24	Lowland Silt	HHI	6 U	6.7	--	0.4	--	--	5	0.02 U	--	--	--	0.2 U	--
LLMW-14D	POE	12/12/2012	5.5	6	Lowland Fill	HHI, EI	6 U	8.4	--	0.4	--	--	16	0.03	--	--	--	0.2 U	--
	POE	12/12/2012	7	7.2	Lowland NS	HHI	10 U	203	--	4.5	--	--	395	0.23	--	--	--	0.4 U	--
	POE	12/12/2012	13.5	14.5	Lowland Silt	HHI	7 U	12.9	--	0.6	--	--	7	0.07	--	--	--	0.3 U	--
LLMW-15D	POE	12/13/2012	2	3	Lowland Fill	HHI, EI	6 U	2.6	--	0.3	--	--	4	0.02	--	--	--	0.2 U	--
	POE	12/13/2012	2	3	Lowland Fill	HHI, EI	6 U	2.5	--	0.3	--	--	3	0.03 U	--	--	--	0.2 U	--
	POE	12/13/2012	11.5	11.7	Lowland NS	HHI	10 U	63.8	--	1.5	--	--	105	0.20	--	--	--	0.4 U	--
	POE	12/13/2012	14	15	Lowland Silt	HHI	8 U	12.9	--	0.6	--	--	7	0.10	--	--	--	0.3 U	--
LLMW-16D	POE	12/14/2012	13	13.5	Lowland Fill	HHI	6 U	15	--	0.3	--	--	6	0.03	--	--	--	0.2 U	--
	POE	12/14/2012	13.5	13.7	Lowland NS	HHI	7 U	21	--	0.5	--	--	8	0.06	--	--	--	0.3 U	--
	POE	12/14/2012	15	16	Lowland Silt	HHI	7 U	10.5	--	0.5	--	--	6	0.07	--	--	--	0.3 U	--
LLMW-17D	POE	12/12/2012	5	6	Lowland Fill	HHI, EI	19	43.7	--	0.4	--	--	47	0.04	--	--	--	0.2 U	--
	POE	12/12/2012	12	12.2	Lowland NS	HHI	6 U	10.8	--	0.4	--	--	5	0.05	--	--	--	0.3 U	--
	POE	12/12/2012	12.5	13	Lowland Silt	HHI	6 U	12.2	--	0.4	--	--	5	0.05	--	--	--	0.3 U	--
LLMW-18D	POE	12/13/2012	6	7	Lowland Fill	HHI	6 U	3.9	--	0.2	--	--	3	0.03 U	--	--	--	0.2 U	--
	POE	12/13/2012	8.5	8.7	Lowland NS	HHI	10 U	313	--	3.1	--	--	212	0.54	--	--	--	0.4 U	--
	POE	12/13/2012	11	12	Lowland Silt	HHI	9 U	18.8	--	0.5	--	--	9	0.08	--	--	--	0.4 U	--
LLMW-19D	POE	12/6/2012	3	4	Lowland Fill	HHI, EI	6 U	142	--	0.4	--	--	86	0.04	--	--	--	0.2 U	--
	POE	12/6/2012	7.8	8	Lowland NS	HHI	8 U	31.2	--	0.5	--	--	131	0.09	--	--	--	0.3 U	--
	POE	12/6/2012	9	10	Lowland Silt	HHI	8 U	19.8	--	0.5	--	--	13	0.08	--	--	--	0.3 U	--
LLMW-20D	POE	12/12/2012	4.5	5.5	Lowland Fill	HHI, EI	5 U	30.2	--	0.3	--	--	12	0.03	--	--	--	0.2 U	--
	POE	12/12/2012	7.2	7.4	Lowland NS	HHI	7 U	64.6	--	0.5	--	--	9	0.06	--	--	--	0.3 U	--
	POE	12/12/2012	9	9.5	Lowland Silt	HHI	6 U	19.4	--	0.4	--	--	5	0.03	--	--	--	0.2 U	--
LLMW-21D	POE	12/20/2012	6	7	Lowland Fill	HHI	6 U	15.4	--	0.3	--	--	5	0.02 U	--	--	--	0.2 U	--
	POE	12/20/2012	7.7	7.9**	Lowland NS	HHI	10 U	121	--	2	--	--	96	0.22	--	--	--	0.4 U	--
	POE	12/20/2012	12	13	Lowland Silt	HHI	8 U	21.3	--	0.6	--	--	9	0.07	--	--	--	0.3 U	--
	POE	12/20/2012	15	16	Lowland Silt	HHI	10 U	17	--	0.6	--	--	10	0.07	--	--	--	0.4 U	--
LLMW-22D	POE	12/5/2012	3	4	Lowland Fill	HHI, EI	6 U	6.1	--	0.2 U	--	--	2 U	0.02 U	--	--	--	0.2 U	--
	POE	12/5/2012	8	8.2	Lowland NS	HHI	9 U	24.6	--	0.4	--	--	8	0.10	--	--	--	0.3 U	--
	POE	12/5/2012	10.5	11.5	Lowland Fill	HHI	8 U	16.9	--	0.4	--	--	9	0.09	--	--	--	0.3 U	--
LLMW-23D	POE	12/4/2012	17	18	Lowland Fill	HHI	6 U	5.6	--	0.2 U	--	--	4	0.02 U	--	--	--	0.2 U	--
	POE	12/4/2012	20	21	Lowland Fill	HHI	6 U	5.7	--	0.2 U	--	--	5	0.03 U	--	--	--	0.2 U	--
	POE	12/4/2012	22.9	23.1	Lowland NS	HHI	7 U	11.2	--	0.3	--	--	7	0.04	--	--	--	0.3 U	--
MW-11D2	POE	7/15/1992	10.5	10.5	Lowland NS	HHI	--	49.2 J	--	--	--	--	--	--	--	--	--	--	--
MW-34	POE	7/29/1992	3	3	Lowland Fill	HHI, EI	--	15.5	--	--	--	--	2.4	--	--	--	--	--	--
MW-107D	POE	2/4/1999	0	0.5	Lowland Fill	HHI, EI	--	10 U	--	10 U	65	25	14	--	--	--	--	--	49
	POE	2/4/1999	0.5	2	Lowland Fill	HHI, EI	--	207	--	10 U	130	219	742	--	--	--	--	--	796
	POE	2/4/1999	2	3.5	Lowland Fill	HHI, EI	--	14	--	10 U	53	28	10 U	--	--	--	--	--	21
	POE	2/4/1999	5	6.5	Lowland Fill	HHI, EI	--	14	--	10 U	70	27	21	--	--	--	--	--	78
	POE	2/4/1999	10	11.5	Lowland Silt	HHI	--	15	--	10 U	127	53	10	--	--	--	--	--	92
MW-109D	POE	2/3/1999	0	0.5	Lowland Fill	HHI, EI	--	13	--	10 U	91 J	54	51	--	--	--	--	--	74
	POE	2/3/1999	0.5	2	Lowland Fill	HHI, EI	--	15	--	10 U	69 J	72	243	--	--	--	--	--	100
	POE	2/3/1999	2	3.5	Lowland Fill	HHI, EI	--	10 U	--	10 U	71 J	29	16	--	--	--	--	--	44
	POE	2/3/1999	5	6.5	Lowland Fill	HHI, EI	--	14	--	10 U	59 J	37	24	--	--	--	--	--	44
	POE	2/3/1999	10	11.5	Lowland Silt	HHI	--	17	--	10 U	138 J	48	12	--	--	--	--	--	89
TP-20	POE	10/18/1993	1	1	Lowland Fill	HHI, EI	--	101	--	--	--	--	--	--	--	--	--	--	--
	POE	10/18/1993	3	3	Lowland Fill	HHI, EI	--	12.3	--	--	--	--	--	--	--	--	--	--	--

Table 6-6. Metals Results for Shallow Soil - Port of Everett Riverside Business Park Subarea

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
TP-23	POE	10/18/1993	1	1	Lowland Fill	HHI, EI	--	40.5	--	--	--	--	--	--	--	--	--	--	--
	POE	10/18/1993	3	3	Lowland Fill	HHI, EI	--	25.4	--	--	--	--	--	--	--	--	--	--	--
TP-25	POE	10/18/1993	1	1	Lowland Fill	HHI, EI	--	37.2	--	--	--	--	--	--	--	--	--	--	--
	POE	10/18/1993	3	3	Lowland Fill	HHI, EI	--	38.1	--	--	--	--	--	--	--	--	--	--	--
TP-28	POE	10/18/1993	2	2	Lowland Fill	HHI	--	63.6	--	--	--	--	--	--	--	--	--	--	--
TP-29	POE	10/18/1993	2	2	Lowland Fill	HHI	--	59.9	--	--	--	--	--	--	--	--	--	--	--
TP-30	POE	10/18/1993	2	2	Lowland Fill	HHI	--	954	--	--	--	--	--	--	--	--	--	--	--
TP-31	POE	10/18/1993	2	2	Lowland Fill	HHI	--	62.7	--	--	--	--	--	--	--	--	--	--	--
TP-SE-8	POE	5/17/1996	6.5	6.5	Lowland Fill	HHI	--	2.9	--	--	8	8	10 U	--	--	--	--	--	3
	POE	5/17/1996	13	13	Lowland Silt	HHI	--	14	--	--	75	53	10 U	--	--	--	--	--	85
TP-SE-9	POE	5/17/1996	10	10	Lowland Fill	HHI	--	0.9	--	--	9	3	10	--	--	--	--	--	3
	POE	5/17/1996	12.5	12.5	Lowland Fill	HHI	--	5.3	--	--	41	24	10 U	--	--	--	--	--	40
TP-SE-10	POE	5/17/1996	11.5	11.5	Lowland Fill	HHI	--	4.6	--	--	27	20	10	--	--	--	--	--	48
TP-SE-10	POE	5/17/1996	15	15	Lowland Silt	HHI	--	27	--	--	69	64	10 U	--	--	--	--	--	58
TP-SE-11	POE	5/17/1996	12	12	Lowland Fill	HHI	--	0.7 U	--	--	23	64	70	--	--	--	--	--	620
	POE	5/17/1996	14	14	Lowland Silt	HHI	--	0.7	--	--	72	42	10 U	--	--	--	--	--	79
TP-SE-12	POE	5/17/1996	11.5	11.5	Lowland Fill	HHI	--	14	--	--	23	9	10	--	--	--	--	--	16
	POE	5/17/1996	14	14	Lowland Fill	HHI	--	5.1	--	--	22	16	10	--	--	--	--	--	42
	POE	5/17/1996	16	16	Lowland Silt	HHI	--	29	--	--	59	52	10	--	--	--	--	--	68
TP-SE-13	POE	5/17/1996	13.5	13.5	Lowland Silt	HHI	--	19	--	--	70	64	10 U	--	--	--	--	--	72
TP-SE-14	POE	5/17/1996	9.5	9.5	Lowland Fill	HHI	--	100	--	--	141	390	310	--	--	--	--	--	915
	POE	5/17/1996	11	11	Lowland Silt	HHI	--	19	--	--	67	60	10 U	--	--	--	--	--	85
TP-SE-15	POE	5/17/1996	9	9	Lowland Silt	HHI	--	21	--	--	75	55	10 U	--	--	--	--	--	88
TP-SE-16	POE	5/17/1996	3	3	Lowland Fill	HHI, EI	--	5.9	--	--	28	20	10 U	--	--	--	--	--	47
	POE	5/17/1996	6	6	Lowland Silt	HHI, EI	--	22	--	--	72	50	10 U	--	--	--	--	--	77

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-7

Metals Results for Shallow Soil - Snohomish PUD Subarea

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	(feet bgs) Start	(feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
EV-22A/B	PUD	9/22/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	10 U	115	25	11	--	--	--	--	--	47
	PUD	9/22/1998	2	3.5	Lowland Fill	HHI, EI	--	10 U	--	10 U	132	30	15	--	--	--	--	--	40
	PUD	9/22/1998	5	6.5	Lowland Fill	HHI, EI	--	10 U	--	10 U	115	18	10 U	--	--	--	--	--	40
	PUD	9/22/1998	10	12	Lowland Fill	HHI	--	10 U	--	10 U	59	32	12	--	--	--	--	--	35
	PUD	9/22/1998	15	17	Lowland Fill	HHI	--	10 U	--	10 U	65	27	10 U	--	--	--	--	--	38
	PUD	9/22/1998	20	22	Lowland Silt	HHI	--	300	--	10 U	118	138	1,108	--	--	--	--	--	459
HA-5	PUD	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	14	--	--	--	--	--	--
	PUD	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
	PUD	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
	PUD	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
HA-9	PUD	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	21	--	--	--	--	--	--
	PUD	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	21	--	--	--	--	--	--
	PUD	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	23	--	--	--	--	--	--
	PUD	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
HA-13	PUD	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	25	--	--	--	--	--	--
	PUD	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	10 U	--	--	--	--	26	--	--	--	--	--	--
	PUD	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
	PUD	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	12	--	--	--	--	--	--
LLMW-04D	PUD	12/28/2012	2	3	Lowland Fill	HHI, EI	5 U	7.3	--	0.5	--	--	11	0.05	--	--	--	0.2 U	--
	PUD	12/28/2012	2	3	Lowland Fill	HHI, EI	5 U	6.7	--	0.5	--	--	10	0.05	--	--	--	0.2 U	--
	PUD	12/28/2012	14.3	15	Lowland NS	HHI	7 U	24.9	--	0.6	--	--	11	0.08	--	--	--	0.3 U	--
	PUD	12/28/2012	18	19	Lowland Silt	HHI	8 U	15.7	--	0.7	--	--	6	0.09	--	--	--	0.3 U	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-8

Metals Results for Shallow Soil - Shadow / Blunt Family Subarea

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Start (feet bgs)	End (feet bgs)	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
GRAB-1-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	24	48	1 U	38	--	59	0.1 U	--	0.4 U	1 U	--	--
GRAB-2-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	61	57	1 U	27	--	34	0.1 U	--	0.4 U	1 U	--	--
GRAB-3-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	219	53	1 U	23	--	12	0.1 U	--	0.4 U	1 U	--	--
GRAB-4-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	111	34	1 U	45	--	65	0.1 U	--	0.4 U	1 U	--	--
GRAB-5-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	21	41	1 U	30	--	1,000	1.4	--	0.4 U	1 U	--	--
GRAB-6-1292	Shadow/Blunt	12/2/1992	0.17	0.5	Lowland Fill	HHI	--	22	48	1 U	39	--	48	0.8	--	0.4 U	1 U	--	--
LLSB-01	Shadow/Blunt	1/7/2013	6	7	Lowland Fill	HHI	8 U	11.3	--	0.5	--	--	26 J	0.06	--	--	--	0.3 U	--
	Shadow/Blunt	1/7/2013	10.8	11	Lowland NS	HHI	9 U	13.4	--	1.2	--	--	50 J	0.40	--	--	--	0.4 U	--
	Shadow/Blunt	1/7/2013	13	14	Lowland Silt	HHI	8 U	14.9	--	0.6	--	--	12 J	0.15	--	--	--	0.3 U	--
LLSB-02	Shadow/Blunt	1/7/2013	3	4	Lowland Fill	HHI	5 U	9.8	--	0.4	--	--	37	0.02	--	--	--	0.2 U	--
	Shadow/Blunt	1/7/2013	10	10	Lowland NS	HHI	9 U	36.4	--	1	--	--	133	0.10	--	--	--	0.3 U	--
	Shadow/Blunt	1/7/2013	10.6	11	Lowland Silt	HHI	8 U	14.7	--	0.6	--	--	7	0.07	--	--	--	0.3 U	--
	Shadow/Blunt	1/7/2013	12	13	Lowland Silt	HHI	7 U	15	--	0.7	--	--	7	0.09	--	--	--	0.3 U	--
LLSB-03	Shadow/Blunt	1/7/2013	3	4	Lowland Fill	HHI	5 U	6.9	--	0.3	--	--	3	0.02 U	--	--	--	0.2 U	--
	Shadow/Blunt	1/7/2013	3	4	Lowland Fill	HHI	5 U	5.4	--	0.3	--	--	3 J	0.02 U	--	--	--	0.2 U	--
	Shadow/Blunt	1/7/2013	11	11	Lowland NS	HHI	8 U	31.1	--	0.7	--	--	14	0.12	--	--	--	0.3 U	--
	Shadow/Blunt	1/7/2013	13	14	Lowland Silt	HHI	7 U	18.3	--	0.6	--	--	7	0.07	--	--	--	0.3 U	--
LLMW-01D	Shadow/Blunt	1/2/2013	3	4	Lowland Fill	HHI	5 U	5.6	--	0.2	--	--	2	0.02 U	--	--	--	0.2 U	--
	Shadow/Blunt	1/2/2013	25	25	Lowland NS	HHI	8 U	16.4	--	0.6	--	--	14	0.18	--	--	--	0.3 U	--
	Shadow/Blunt	1/2/2013	26	27	Lowland Silt	HHI	8 U	13.3	--	0.6	--	--	12	0.16	--	--	--	0.3 U	--
LLMW-02D	Shadow/Blunt	12/21/2012	6	7	Lowland Fill	HHI	6 U	5.3	--	0.3	--	--	3	0.02 U	--	--	--	0.2 U	--
	Shadow/Blunt	12/21/2012	17.4	18	Lowland NS	HHI	8 U	64.6	--	1.9	--	--	50	0.21	--	--	--	0.3 U	--
	Shadow/Blunt	12/21/2012	20	21	Lowland Silt	HHI	6 U	7.5	--	0.3	--	--	3	0.03 U	--	--	--	0.2 U	--
LLMW-03D	Shadow/Blunt	12/26/2012	9	10	Lowland Fill	HHI	6 U	6.4	--	0.3	--	--	5	0.02 U	--	--	--	0.2 U	--
	Shadow/Blunt	12/26/2012	10.5	11	Lowland NS	HHI	8 U	20.9	--	0.6	--	--	21	0.09 J	--	--	--	0.3 U	--
	Shadow/Blunt	12/26/2012	13.5	15	Lowland Silt	HHI	8 U	12.6	--	0.7	--	--	7	0.09 J	--	--	--	0.3 U	--
SB-1101	Shadow/Blunt	6/11/1993	3	4.5	Lowland Fill	HHI, EI	--	38	--	--	416	--	659	0.1 U	--	--	--	--	--
SB-1104	Shadow/Blunt	6/23/1993	0.5	1	Lowland Fill	HHI	--	9.5	--	--	949	--	96	0.1 U	--	--	--	--	--
SB-1202	Shadow/Blunt	6/11/1993	1.5	3	Lowland Fill	HHI, EI	--	6.3	--	--	21	--	--	--	--	--	--	--	--
SB-1304	Shadow/Blunt	6/8/1993	3	4.5	Lowland Fill	HHI	--	25	--	--	24	--	6	0.1 U	--	--	--	--	--
SB-1305	Shadow/Blunt	6/8/1993	3	4.5	Lowland Fill	HHI	--	6.4	--	--	25	--	2.8	0.1 U	--	--	--	--	--
TP-1202	Shadow/Blunt	5/27/1993	2	10	Lowland Fill	HHI, EI	--	4	--	--	24	--	9	0.1 U	--	--	--	--	--
TP-1207	Shadow/Blunt	5/27/1993	6	11	Lowland Fill	HHI	--	3.9	--	--	44	--	10	0.1 U	--	--	--	--	--
TP-1401	Shadow/Blunt	5/26/1993	3.5	8	Lowland Fill	HHI, EI	--	3.5	--	--	18	--	32	0.1 U	--	--	--	--	--
TP-1402	Shadow/Blunt	5/26/1993	7	9.5	Lowland Fill	HHI	--	3	--	--	17	--	72	0.1 U	--	--	--	--	--
TP-1404	Shadow/Blunt	5/26/1993	6	10	Lowland Fill	HHI	--	2.8	--	--	25	--	16	0.1 U	--	--	--	--	--
TP-1701	Shadow/Blunt	5/26/1993	1	6.5	Lowland Fill	HHI	--	--	--	--	--	--	5.5	--	--	--	--	--	--
TP-1702	Shadow/Blunt	5/26/1993	0.5	4.5	Lowland Fill	HHI	--	--	--	--	--	--	4.3	--	--	--	--	--	--
TP-92-26	Shadow/Blunt	9/2/1992	1.5	2	Lowland Fill	HHI	--	0.1 U	0.7	0.01 U	0.01 U	--	0.05 U	0.001 U	--	0.2 U	0.01 U	--	--
TP-92-27	Shadow/Blunt	9/2/1992	1.5	2	Lowland Fill	HHI	--	0.1 U	0.5	0.01 U	0.01 U	--	0.05 U	0.001 U	--	0.2 U	0.01 U	--	--
TP-92-28	Shadow/Blunt	9/2/1992	1.5	2	Lowland Fill	HHI	--	0.1 U	0.8	0.01 U	0.01 U	--	0.05 U	0.001 U	--	0.2 U	0.01 U	--	--
TP-92-29	Shadow/Blunt	9/2/1992	1.5	2	Lowland Fill	HHI	--	0.1 U	0.8	0.01 U	0.01 U	--	0.05 U	0.001 U	--	0.2 U	0.01 U	--	--
TP-92-30	Shadow/Blunt	9/2/1992	1.5	2	Lowland Fill	HHI	--	0.1 U	0.6	0.01 U	0.01 U	--	0.05 U	0.001 U	--	0.2 U	0.01 U	--	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

mg/kg = miligrams per kilogram

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

J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-9

Metals Results forShallow Soil - Slope Subarea

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	(feet bgs) Start	End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Barium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]													
						Human Health Industrial (HHI):	1,400	88	700,000	3,500	>1E+6	140,000	1,000	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Trespasser (HHT):	1,400	20	700,000	3,500	>1E+6	140,000	250	1,100	70,000	18,000	18,000	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	110,000	550	820,000	22,000	250	160	77,000	2,700	2,700	5.5	160,000
						Ecological Industrial (EI):	NE	132	102	14	67	217	118	5.5	980	0.3	NE	NE	360
						Ecological Forest Area (EFA):	NE	20	102	4	48	50	50	0.1	48	0.3	2	1	86
						Applicable PCULs													
HA-1	Slope	4/8/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	91	--	--	--	--	1,221	--	--	--	--	--	--
	Slope	4/8/1998	0.5	1	Lowland Fill	HHT, HHI, EI	--	159	--	--	--	--	3,582	--	--	--	--	--	--
	Slope	4/8/1998	2	2.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	11	--	--	--	--	--	--
	Slope	4/8/1998	4	4.5	Lowland Fill	HHI, EI	--	10 U	--	--	--	--	10 U	--	--	--	--	--	--
HP-45	Slope	9/23/1998	0	0.5	Lowland Fill	HHT, HHI, EI	--	10 U	--	10 U	112	30	17	--	--	--	--	--	44
	Slope	9/23/1998	2	3.5	Lowland Fill	HHI, EI	--	3.9	--	10 U	77	25	7.2	--	--	--	--	--	50
	Slope	9/23/1998	5	6.5	Lowland Fill	HHI	--	10 U	--	10 U	108	27	10	--	--	--	--	--	39
	Slope	9/23/1998	10	12	Lowland NS	HHI, EI	--	23	--	10 U	102	55	232	--	--	--	--	--	322
	Slope	9/23/1998	15	17	Lowland Silt	HHI	--	13	--	10 U	80	27	14	--	--	--	--	--	96
LLS-01	Slope	5/24/2013	0	1	Lowland NS	HHT, HHI, EI	5 U	6.5	--	0.2	--	--	5	0.02	--	--	--	0.2 U	--
LLS-02	Slope	5/24/2013	0	1	Lowland NS	HHT, HHI, EI	8 U	5.9	--	0.5	--	--	30	0.07	--	--	--	0.3 U	--
LLS-03	Slope	9/4/2013	0	1	Lowland NS	HHT, HHI, EI	0.2 U	9.8	--	0.3	--	--	15.1	0.06	--	--	--	0.2 U	--
LLS-04	Slope	9/4/2013	0	1	Lowland NS	HHT, HHI, EI	0.2 U	6.8	--	0.2	--	--	15.4	0.04	--	--	--	0.2 U	--
LLS-05	Slope	5/24/2013	0	0.5	Lowland NS	HHT, HHI, EFA	6 U	16.2	--	0.5	--	--	25	0.07	--	--	--	0.2 U	--
	Slope	5/24/2013	0.8	1	Lowland NS	HHT, HHI, EFA	6 U	27.1	--	0.5	--	--	18	0.07	--	--	--	1.5	--
LLS-06	Slope	5/24/2013	0	1	Lowland NS	HHT, HHI, EI	6 U	29.5	--	0.9	--	--	74	0.08	--	--	--	0.2 U	--
LLS-07	Slope	5/24/2013	0	1	Lowland NS	HHT, HHI, EI	6 U	82.2	--	1.9	--	--	194	0.16	--	--	--	0.2 U	--
LLS08	Slope	5/24/2013	0.5	1	Lowland NS	HHT, HHI, EI	6 U	30	--	1.1	--	--	113	0.23	--	--	--	0.2 U	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

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J = The result is an estimate

NA = Not applicable

NE = Not Established

PCULs = Preliminary Cleanup Levels

HHI = Human Health Industrial

HHT = Human Health Trespasser

HHV = Human Health Site Visitor

EI = Ecological Industrial

EFA = Ecological Forest Area

Table 6-10

Metals Results for Shallow Soil - Focused Source Area Investigation[1]

Everett Smelter

Everett, Washington

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-04	1.5	Fill	HHI	12.4	<5.6
	2	Fill/brick	HHI	45.3	40.3
	2.5	Fill/brick	HHI	454	269
	3	Fill	HHI	310	12.3
	3.5	Fill	HHI	4,399	1,033
	4	Fill	HHI	231	131
	4.5	Fill	HHI	206	100
	4.9	Fill	HHI	392	238
	5.1	Fill	HHI	447	757
	5.5	Fill	HHI	1,874	<5.3
	6	Fill	HHI	1,431	<4.9
	6.5	Fill	HHI	1,832	<14
	7	Fill	HHI	1,718	<5
	7.5	Weathered till	HHI	1,212	<5.1
	8	Weathered till	HHI	1,567	<5.9
	8.5	Weathered till	HHI	1,068	<5.2
	9	Weathered till	HHI	791	<20
	9.5	Weathered till	HHI	1,034	<4.8
	10	Weathered till	HHI	1,039	<5
LLSB-05	1.5	Fill	HHI	7.6	<4.9
	2	Fill	HHI	10.7	24.4
	2.5	Fill	HHI	400	350
	3	Fill	HHI	655	308
	3.5	Fill/brick	HHI	1,488	369
	4	Fill/brick	HHI	568	518
	4.5	Fill	HHI	616	371
	5	Fill	HHI	301	117
	5.5	Fill	HHI	2,064	<4.9
	6	Fill	HHI	3,846	5.7
	6.5	Fill	HHI	2,145	6.1
	7	Fill	HHI	2,587	<5.1
	7.5	Weathered till	HHI	1,343	<4.7
	8	Weathered till	HHI	1,762	<4.9
	8.5	Weathered till	HHI	954	5.3
	9	Weathered till	HHI	1,077	<4.8
	9.5	Weathered till	HHI	1,201	<4.7
	10	Weathered till	HHI	940	<4.7
LLSB-06	2	Fill	HHI	8.4	23.7
	2.5	Fill	HHI	172	110
	3	Fill/brick	HHI	716	500
	3.5	Fill/brick	HHI	775	643
	4	Fill/brick	HHI	719	662
	4.5	Fill/brick	HHI	595	319
	5	Fill	HHI	65	58
	5.5	Fill	HHI	722	<4.8
	6	Weathered till	HHI	2,598	6.1
	6.5	Weathered till	HHI	2,346	<6
	7	Weathered till	HHI	1,783	<5.5
	7.5	Weathered till	HHI	2,066	<5.1
	8	Weathered till	HHI	2,116	<57
	8.5	Weathered till	HHI	1,152	<5.2
	9	Weathered till	HHI	2,314	<5
	9.5	Weathered till	HHI	2,050	<5.2
	10	Weathered till	HHI	2,511	<4.8
LLSB-07	2	Fill	HHI	17.9	<4.0
	2.5	Fill	HHI	245	270
	3	Fill/brick and mortar	HHI	2,487	1,239
	3.5	Fill/brick and mortar	HHI	745	7
	4.1	Fill/brick and mortar	HHI	3,888	1,080
	4.2	Fill/brick and mortar	HHI	223	13.5
	4.4	Fill/brick and mortar	HHI	7,408	561
	5	Fill/brick and mortar	HHI	15,700	784
	5.1	Fill/brick and mortar	HHI	310	51
	5.4	Fill/brick and mortar	HHI	35,100	1,574
	6	Fill/brick and mortar	HHI	22,000	468
	6.5	Fill	HHI	5,264	8.7
	7	Weathered till	HHI	3,764	<5.1
	7.5	Weathered till	HHI	3,594	7.3
	8	Weathered till	HHI	2,616	<5
	8.5	Weathered till	HHI	3,344	<4.5
	9	Weathered till	HHI	2,874	6.1
	10	Weathered till	HHI	1,588	5.5
	11	Weathered till	HHI	526	<4.9
	12	Weathered till	HHI	474	<4.9
	13	Weathered till	HHI	467	<4.5
	14	Weathered till	HHI	340	<5
	15	Weathered till	HHI	339	<4.6

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-08	2	Fill	HHI	72	51
	2.5	Fill/brick	HHI	26.5	43
	3	Fill	HHI	1,281	953
	3.4	Fill	HHI	1,005	289
	3.8	Fill	HHI	3,209	893
	4.3	Fill/brick	HHI	1,664	575
	4.6	Fill	HHI	1,552	700
	6	Fill	HHI	539	<4.7
	6.5	Fill	HHI	1,343	<4.7
	7	Weathered till	HHI	222	<4.8
	7.5	Weathered till	HHI	260	<4.4
	8	Weathered till	HHI	259	6.2
	8.5	Weathered till	HHI	186	<4.4
	9	Weathered till	HHI	194	<5.0
	9.5	Weathered till	HHI	219	<4.8
LLSB-09	1.7	Fill	HHI	25.8	<4.7
	2.3	Fill	HHI	22.2	47
	3	Fill	HHI	577	418
	3.5	Fill/brick	HHI	424	274
	3.8	Fill/debris	HHI	1,297	552
	4.2	Fill/debris	HHI	23,000	15,100
	4.4	Fill/debris	HHI	3.12	1,004
	4.6	Fill	HHI	6,971	1,916
	5.2	Fill	HHI	16,100	8,358
	5.5	Fill	HHI	7,774	884
	6.1	Fill	HHI	1,264	<4.6
	7	Weathered till	HHI	814	76
	7.5	Weathered till	HHI	695	<5.9
	8	Weathered till	HHI	617	<4.6
	9	Weathered till	HHI	379	<5.1
	10	Weathered till	HHI	426	<4.6
LLSB-10	3.2	Fill	HHI	54.7	5.3
	3.5	Fill/brick	HHI	291	135
	4	Fill/brick	HHI	1,889	907
	4.5	Fill/brick	HHI	11,200	4,727
	5	Fill/brick	HHI	2,868	48
	6	Fill/brick	HHI	761	5.6
	6.5	Fill	HHI	760	<4.6
	7	Fill	HHI	484	<4.8
	7.5	Fill	HHI	715	<4.7
	8	Weathered till	HHI	542	<4.7
	8.5	Weathered till	HHI	463	<4.6
	9	Weathered till	HHI	297	<5.2
	9.5	Weathered till	HHI	238	<6
LLSB-11	2.5	Fill	HHI	33.8	22.8
	3	Fill	HHI	659	297
	3.5	Fill/brick	HHI	219	56
	4	Fill/brick	HHI	3,581	1,002
	4.5	Fill	HHI	1,377	250
	4.8	Fill	HHI	1,282	31
	5.5	Fill	HHI	731	<5.5
	6	Fill	HHI	418	7.6
	6.5	Weathered till	HHI	282	<4.8
	7	Weathered till	HHI	267	<5.2
	7.5	Weathered till	HHI	323	<3.2
	8	Weathered till	HHI	543	5.7
	8.5	Weathered till	HHI	507	<4.8
	9	Weathered till	HHI	393	<5
	9.5	Weathered till	HHI	656	<4.8
	10	Weathered till	HHI	784	<4.8
LLSB-12	2	Fill/brick/debris	HHI	312	129
	2.5	Fill/brick/debris	HHI	704	694
	3	Fill/brick/debris	HHI	20,000	1,494
	3.5	Fill/brick/debris	HHI	1,331	<5.3
	4	Fill	HHI	401	6.9
	4.5	Fill	HHI	1,107	<4.3
	5.2	Fill	HHI	326	7.6
	5.5	Fill	HHI	270	<4.7
	6	Fill	HHI	274	<4.8
	6.5	Fill	HHI	259	<4.9
	7.5	Weathered till	HHI	271	<4.9
	8.5	Weathered till	HHI	406	<4.5
	9	Weathered till	HHI	188	<4.5
	9.5	Weathered till	HHI	158	<4.7

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-13	2.5	Fill	HHI	1,464	766
	3	Fill/brick and mortar	HHI	1,781	530
	3.5	Fill/brick and mortar	HHI	1,343	250
	4	Fill/brick and mortar	HHI	12,700	376
	4.5	Fill	HHI	5,186	6.4
	4.7	Fill	HHI	28,700	319
	5	Fill/brick	HHI	3,408	363
	5.5	Fill/brick	HHI	245	42
	6	Fill/brick	HHI	5,246	71
	6.5	Fill/brick	HHI	3,435	<5.2
	7	Weathered till	HHI	1,981	<5.2
	8	Weathered till	HHI	1,818	<5.5
	9	Weathered till	HHI	535	<4.3
	10	Weathered till	HHI	339	<4.6
LLSB-14	2	Fill	HHI	284	45
	2.5	Fill/brick and mortar	HHI	1,360	162
	2.8	Fill/debris	HHI	2	435
	3.1	Fill/debris	HHI	10,500	2,313
	3.4	Fill/debris	HHI	19,300	434
	4	Fill	HHI	4,306	45
	4.5	Fill	HHI	2,500	<5.6
	5	Fill	HHI	1,079	<5.1
	5.5	Fill	HHI	3,075	<5.5
	6	Fill	HHI	1,011	<4.8
	6.5	Fill	HHI	1,439	<4.9
	7	Fill	HHI	1,503	3.6
	8	Weathered till	HHI	633	5.3
	9	Weathered till	HHI	351	<4.6
LLSB-15	1.8	Fill	HHI	90	<4.8
	2	Fill/brick	HHI	1,072	164
	2.5	Fill/brick	HHI	45	7.4
	3.1	Fill/brick	HHI	51.6	<4.8
	3.6	Fill/brick	HHI	4,769	<5.5
	4.1	Fill/brick	HHI	3,110	<4.9
	4.5	Fill/brick	HHI	3,606	<5.7
	5.1	Weathered till	HHI	7,555	<6
	5.5	Weathered till	HHI	2,818	<4.9
	6	Weathered till	HHI	2,410	<5.6
	6.5	Weathered till	HHI	2,363	<5.5
	7	Weathered till	HHI	2,464	<5.1
	8	Weathered till	HHI	2,357	6.2
	9	Weathered till	HHI	886	<4.7
LLSB-16	1.5	Fill	HHI	32	55
	2	Fill	HHI	22	<4.9
	2.5	Fill	HHI	22,100	471
	3	Fill	HHI	3,486	<5
	3.5	Fill	HHI	4,087	6.1
	4	Fill	HHI	3,065	6.4
	4.5	Fill	HHI	2,751	<5
	5	Fill	HHI	1,543	<5.4
	5.5	Fill	HHI	975	5.9
	6	Fill	HHI	1,575	6.9
	6.5	Fill	HHI	980	<5.6
	7	Fill	HHI	1,907	<5
	7.5	Weathered till	HHI	878	<5.6
	8	Weathered till	HHI	802	<6
	9	Weathered till	HHI	504	6.1
	10	Weathered till	HHI	316	4.5
	10.5	Weathered till	HHI	217	5.1
	11	Weathered till	HHI	227	<4.7
	12.5	Weathered till	HHI	232	<4.9
LLSB-17	2.5	Fill	HHI	38.8	8.9
	3	Fill	HHI	23.2	<4.9
	3.5	Fill	HHI	57.5	9.8
	4	Fill	HHI	14.4	7
	4.5	Fill	HHI	4.4	<4.8
	4.9	Fill	HHI	1.5	4.6
	6.3	Fill	HHI	12.5	<4.4
	7	Fill	HHI	5.5	3
	8	Fill	HHI	8.2	<4.3
	9	Fill	HHI	7.4	<4.4
	10	Fill	HHI	1,191	14.9

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-18	2.5	Fill	HHI	42.5	<4.8
	3	Fill	HHI	200	16.2
	3.5	Fill	HHI	68	<6
	4	Fill	HHI	160	34
	4.5	Fill	HHI	386	22.7
	8	Fill	HHI	1,922	94
	8.5	Fill	HHI	464	36
	9	Fill	HHI	187	<4.8
	10	Fill	HHI	683	58
	13	Fill	HHI	214	7.6
	13.5	Fill	HHI	429	23.6
	14	Fill	HHI	1,004	109
	14.2	Fill	HHI	992	14.3
	19	Fill	HHI	128	<4.6
	19.8	Fill	HHI	105	<4.7
LLSB-19	1.5	Fill	HHI	131	15
	2	Fill	HHI	187	12
	2.6	Fill	HHI	6	7.3
	3	Fill	HHI	<3.4	<4.8
	3.5	Fill	HHI	556	<4.6
	4	Fill	HHI	862	<4.7
	4.5	Fill	HHI	1,608	<4.7
	5.3	Fill	HHI	640	<4.8
	6	Fill	HHI	1,418	<6
	6.5	Fill	HHI	1,407	<4.9
	7	Weathered till	HHI	1,310	<4.8
	7.5	Weathered till	HHI	698	<4.9
	8	Weathered till	HHI	616	<3
	8.5	Weathered till	HHI	426	4.7
	9	Weathered till	HHI	714	<5
	9.5	Weathered till	HHI	593	<4.9
LLSB-20	2	Fill/brick	HHI	121	12
	2.5	Fill/brick	HHI	237	13.6
	3	Fill	HHI	<3.5	7.1
	3.5	Fill	HHI	<8.7	7
	4	Fill	HHI	856	5.8
	4.5	Fill	HHI	1,287	6.3
	4.8	Fill	HHI	1,063	6.4
	5.1	Fill	HHI	399	5.4
	5.5	Fill	HHI	354	5.2
	6	Fill	HHI	422	5.1
	6.5	Fill	HHI	242	<4.8
	7	Weathered till	HHI	326	<4.9
	7.5	Weathered till	HHI	818	<4.9
	8	Weathered till	HHI	884	<4.9
	8.5	Weathered till	HHI	539	<5.2
	9	Weathered till	HHI	355	<4.8
	9.5	Weathered till	HHI	596	<4.9
	10	Weathered till	HHI	270	<5.1
LLSB-21	2	Fill	HHI	41	54
	2.5	Fill	HHI	330	727
	3	Fill	HHI	82	129
	3.5	Fill/brick	HHI	184	113
	4	Fill/brick	HHI	204	139
	4.5	Fill/brick	HHI	1,580	865
	4.8	Fill/brick	HHI	234	103
	6.5	Fill/brick	HHI	497	194
	7	Fill/brick	HHI	5,325	2,706
	7.8	Fill	HHI	3,002	117
	8.2	Fill	HHI	2,529	57
	8.5	Fill	HHI	1,787	88
	9	Weathered till	HHI	559	<4.9
	9.5	Weathered till	HHI	345	<22
	10.3	Weathered till	HHI	670	<4.7
	11	Weathered till	HHI	364	<4.3
	12	Weathered till	HHI	471	<5.4
	13	Weathered till	HHI	327	11.9
	14	Weathered till	HHI	183	<5
	14.8	Weathered till	HHI	97	6.6
LLSB-22	2	Fill	HHI	79	92
	2.5	Fill	HHI	24.1	5.8
	3	Fill	HHI	71	200
	3.5	Fill	HHI	116	12.9
	4	Fill/brick	HHI	1,105	724
	4.5	Fill/brick	HHI	1,171	341
	10	Fill	HHI	3,226	1,000
	10.5	Fill	HHI	89	6.2
	11	Fill	HHI	170	<5.4
	11.5	Fill	HHI	261	<5.2
	12	Weathered till	HHI	157	<4.8
	12.5	Weathered till	HHI	158	<4.6
	13	Weathered till	HHI	185	<4.8
	14	Weathered till	HHI	213	<4.5
	15	Weathered till	HHI	359	<4.7

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-22a[2]	3.5	Fill	HHI	94	27.6
	4	Fill/debris	HHI	2,102	977
	4.5	Fill/debris	HHI	3,085	1,229
	5.5	Fill/debris	HHI	2,943	819
	6	Fill/debris	HHI	2,930	1,000
	6.5	Fill/brick and mortar	HHI	5,344	1,141
	7	Fill/brick and mortar	HHI	1,524	1,334
	7.5	Fill/brick and mortar	HHI	2,626	1,023
	8	Fill	HHI	3,146	<5.3
	8.5	Fill	HHI	1,073	5.3
	9	Fill	HHI	731	<4.6
	9.5	Fill	HHI	519	<5.1
LLSB-23	1.7	Fill	HHI	35.7	18.3
	2	Fill	HHI	95	115
	2.6	Fill	HHI	53	190
	3	Fill	HHI	133	422
	3.3	Fill	HHI	37	295
	3.5	Fill	HHI	171	27.1
	4	Fill/brick/debris	HHI	2,310	665
	4.5	Fill/brick/debris	HHI	4,793	921
	6.5	Fill/brick/debris	HHI	5,718	1,030
	7	Fill/brick/debris	HHI	4,568	979
	7.5	Fill	HHI	3,647	545
	8	Fill	HHI	2,418	17.4
	8.5	Fill	HHI	418	9.3
	8.9	Fill	HHI	13,757	81
	9.5	Fill	HHI	5,224	<5.4
	10.3	Fill	HHI	3,390	<5.3
	11	Fill	HHI	6,920	8.3
	11.5	Fill	HHI	3,880	<5.1
	12	Weathered till	HHI	5,429	<5.3
	12.5	Weathered till	HHI	2,700	7
	13	Weathered till	HHI	1,199	<4.7
	13.5	Weathered till	HHI	1,205	<5
	14	Weathered till	HHI	529	<5.2
	14.8	Weathered till	HHI	668	<4.8
LLSB-24	2	Fill	HHI	28	50
	2.5	Fill	HHI	51	143
	3	Fill/brick/debris	HHI	63	170
	3.5	Fill/brick/debris	HHI	169	287
	4	Fill/brick/debris	HHI	298	469
	4.5	Fill/brick/debris	HHI	120	2,016
	5.9	Fill/debris	HHI	74	128
	6.5	Fill/debris	HHI	48	14.4
	7	Fill/debris	HHI	2,220	325
	7.5	Fill	HHI	791	645
	8	Fill	HHI	964	441
	8.5	Fill	HHI	146	13.3
	9	Weathered till	HHI	200	358
	9.5	Weathered till	HHI	655	23.2
	10	Weathered till	HHI	2,012	<7
	10.5	Weathered till	HHI	1,921	<5
	11	Weathered till	HHI	2,308	<5.3
	11.5	Weathered till	HHI	2,330	5.1
	12	Weathered till	HHI	2,553	<5.1
	12.5	Weathered till	HHI	2,506	6.6
	13	Weathered till	HHI	3,309	<5.1
	13.6	Weathered till	HHI	1,763	<5.3
	14	Weathered till	HHI	1,592	<5
	14.8	Weathered till	HHI	894	<5.1
LLSB-25	1.6	Fill	HHI	21.6	16.6
	2	Fill	HHI	41.2	37
	2.5	Fill	HHI	262	220
	3	Fill	HHI	31.8	42
	3.5	Fill	HHI	86	198
	4	Fill	HHI	396	284
	4.5	Fill	HHI	753	246
	4.9	Fill	HHI	1,096	36
	5.9	Fill	HHI	102	24
	6.5	Fill	HHI	2,227	1,294
	7	Fill	HHI	933	278
	7.5	Fill/debris	HHI	4,373	6,447
	8	Fill	HHI	64.4	12.4
	8.5	Fill	HHI	7	<4.8
	9	Fill	HHI	14.8	<5.6
	9.5	Fill	HHI	5.6	<4.8
	10.2	Fill	HHI	655	<4.8
	11	Weathered till	HHI	832	<4.9
	11.5	Weathered till	HHI	356	<5.8
	12	Weathered till	HHI	319	<4.7
	12.5	Weathered till	HHI	661	5.9
	13	Weathered till	HHI	635	<4.7
	14	Weathered till	HHI	123	5.9
	14.8	Weathered till	HHI	203	<5.1

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-26	1	Fill	HHI	103	11.3
LLSB-26	1.5	Fill	HHI	180	34
LLSB-26	2	Fill/brick and mortar	HHI	2,987	752
LLSB-26	2.5	Fill/brick and mortar	HHI	1,714	655
LLSB-26	3	Fill/debris	HHI	5,301	1,318
LLSB-26	5.2	Fill	HHI	2,300	572
LLSB-26	5.5	Fill	HHI	267	<4
LLSB-26	6	Fill	HHI	237	<3
LLSB-26	6.5	Fill	HHI	159	<3
LLSB-26	7	Weathered till	HHI	175	<3
LLSB-26	7.5	Weathered till	HHI	121	<2
LLSB-26	8	Weathered till	HHI	118	<3
LLSB-26	8.5	Weathered till	HHI	112	<11
LLSB-26	9	Weathered till	HHI	77	<2
LLSB-26	9.5	Weathered till	HHI	84	<2
LLSB-26	10	Weathered till	HHI	78	<2
LLSB-27	1	Fill	HHI	172	40
LLSB-27	1.5	Fill	HHI	597	328
LLSB-27	2	Fill/brick	HHI	1,072	1,165
LLSB-27	2.5	Fill/brick	HHI	973	544
LLSB-27	3	Fill/brick	HHI	1,823	1,823
LLSB-27	3.5	Fill	HHI	2,062	3,417
LLSB-27	4	Fill	HHI	15,579	5,622
LLSB-27	4.3	Fill	HHI	13,239	9,871
LLSB-27	5.2	Fill	HHI	5,749	563
LLSB-27	5.5	Fill	HHI	3,844	1,604
LLSB-27	6	Fill	HHI	1,273	10.7
LLSB-27	6.5	Weathered till	HHI	1,051	11.7
LLSB-27	7	Weathered till	HHI	533	<5
LLSB-27	7.5	Weathered till	HHI	457	<5
LLSB-27	8	Weathered till	HHI	327	<4
LLSB-27	8.5	Weathered till	HHI	301	8
LLSB-27	9	Weathered till	HHI	280	<4
LLSB-27	9.5	Weathered till	HHI	285	12.1
LLSB-27	10	Weathered till	HHI	161	<3
LLSB-28	1	Fill	HHI	64.9	<1.9
LLSB-28	1.5	Fill	HHI	26	126
LLSB-28	2	Fill	HHI	14.6	18.7
LLSB-28	2.5	Fill	HHI	2,823	<18
LLSB-28	3	Fill	HHI	1,801	10
LLSB-28	3.5	Fill	HHI	735	<6
LLSB-28	4.1	Fill	HHI	660	<7
LLSB-28	4.5	Fill	HHI	1,304	<26
LLSB-28	5	Fill	HHI	1,058	<9
LLSB-28	5.5	Weathered till	HHI	1,725	7.3
LLSB-28	6	Weathered till	HHI	816	7.1
LLSB-28	6.5	Weathered till	HHI	664	<6
LLSB-28	7	Weathered till	HHI	636	<6
LLSB-28	7.5	Weathered till	HHI	389	5.1
LLSB-28	8	Weathered till	HHI	317	<4
LLSB-28	8.5	Weathered till	HHI	423	6.1
LLSB-28	9	Weathered till	HHI	260	<4
LLSB-28	9.5	Weathered till	HHI	125	<2
LLSB-28	10	Weathered till	HHI	88	<2
LLSB-29	1	Fill	HHI	23.1	<1.4
LLSB-29	1.5	Fill	HHI	70	41
LLSB-29	2	Fill/brick	HHI	1,595	1,349
LLSB-29	2.5	Fill/brick	HHI	550	833
LLSB-29	3	Fill/brick	HHI	77	8.4
LLSB-29	3.5	Fill/brick	HHI	124	35
LLSB-29	3.7	Fill/brick	HHI	5,963	4,849
LLSB-29	5.4	Fill/brick	HHI	11,946	10,492
LLSB-29	6	Fill	HHI	2,276	308
LLSB-29	6.5	Fill	HHI	1,460	22
LLSB-29	7	Weathered till	HHI	741	<6
LLSB-29	7.5	Weathered till	HHI	577	<5
LLSB-29	8	Weathered till	HHI	467	<5
LLSB-29	8.5	Weathered till	HHI	767	16.3
LLSB-29	9	Weathered till	HHI	639	<6
LLSB-29	9.5	Weathered till	HHI	435	<5

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-30	1	Fill	HHI	74.7	<1.9
	1.5	Fill	HHI	52	35
	2	Fill	HHI	8.1	11.4
	2.5	Fill	HHI	619	<6
	3	Fill	HHI	1,040	<10
	3.5	Fill	HHI	827	<7
	4	Fill	HHI	993	<9
	4.5	Fill	HHI	589	<6
	5	Fill	HHI	326	5.1
	5.5	Fill	HHI	445	5.9
	6	Fill	HHI	184	<3
	6.5	Fill	HHI	302	<4
	7	Weathered till	HHI	159	<3
	7.5	Weathered till	HHI	37.1	<1.6
	8	Weathered till	HHI	35.7	<1.8
	8.5	Weathered till	HHI	89	4.7
	9	Weathered till	HHI	144	<3
	9.5	Weathered till	HHI	273	<4
	10	Weathered till	HHI	163	<3
LLSB-31	1.5	Fill	HHI	488	586
	2	Fill	HHI	195	440
	2.5	Fill	HHI	211	374
	3.1	Fill/brick	HHI	578	900
	3.5	Fill/brick	HHI	19,709	15,442
	5.1	Fill	HHI	1163	37
	5.4	Fill/brick	HHI	40.7	13.7
	6	Fill/brick	HHI	887	<72
	6.5	Fill	HHI	176	<3
	7	Fill	HHI	507	12
	7.5	Weathered till	HHI	589	6.9
	8	Weathered till	HHI	510	<55
	8.5	Weathered till	HHI	367	5
	9	Weathered till	HHI	108	<2
	9.5	Weathered till	HHI	6.1	<1.3
	10	Weathered till	HHI	<3.6	5.9
LLSB-32	1	Fill	HHI	86	20.7
	1.5	Fill	HHI	92	26.7
	2	Fill	HHI	6.2	<1.2
	2.5	Fill	HHI	1,307	<11
	3	Fill	HHI	334	8.1
	3.5	Fill	HHI	319	<4
	4	Fill	HHI	98	<2
	4.5	Fill	HHI	465	7
	4.8	Fill	HHI	251	5.5
	5.5	Weathered till	HHI	690	<6
	6	Weathered till	HHI	239	<3
	6.5	Weathered till	HHI	226	<3
	7	Weathered till	HHI	62.1	<1.9
	7.5	Weathered till	HHI	48.4	<2
	8	Weathered till	HHI	43.8	<1.6
	8.5	Weathered till	HHI	19.2	<1.4
	9	Weathered till	HHI	5.1	<1.2
	9.5	Weathered till	HHI	4.9	<1.2
	10	Weathered till	HHI	344	<13
LLSB-33	2	Fill/brick	HHI	137	52
	2.5	Fill/brick	HHI	248	149
	3	Fill/brick	HHI	493	469
	3.5	Fill/brick	HHI	1,224	3,888
	4	Fill/brick	HHI	19,404	15,533
	4.5	Fill/debris	HHI	1,752	603
	5	Fill/debris	HHI	643	326
	6	Fill/brick and mortar	HHI	341	637
	6.5	Fill/brick and mortar	HHI	213	14.8
	7	Fill	HHI	91	<2
	7.5	Weathered till	HHI	116	5.6
	8	Weathered till	HHI	54	5.7
	8.5	Weathered till	HHI	9.4	6.8
	9	Weathered till	HHI	6.2	6.4
	9.5	Weathered till	HHI	3.9	5.2
	10	Weathered till	HHI	<29	<29

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-34	2	Fill	HHI	120	26.5
LLSB-34	2.5	Fill	HHI	194	30
LLSB-34	3	Fill	HHI	206	108
LLSB-34	3.5	Fill	HHI	123	135
LLSB-34	4	Fill	HHI	2,575	852
LLSB-34	4.5	Fill	HHI	679	424
LLSB-34	5	Fill	HHI	1,304	1,349
LLSB-34	5.5	Fill	HHI	2,319	408
LLSB-34	6	Fill	HHI	1,299	246
LLSB-34	6.5	Weathered till	HHI	144	43
LLSB-34	7	Weathered till	HHI	288	7.2
LLSB-34	11	Weathered till	HHI	179	9
LLSB-34	11.5	Weathered till	HHI	47.1	19.8
LLSB-34	11.8	Weathered till	HHI	468	475
LLSB-34	12.3	Weathered till	HHI	82.3	<2
LLSB-34	13	Weathered till	HHI	119	<2
LLSB-34	14	Weathered till	HHI	6.2	5.7
LLSB-34	14.9	Weathered till	HHI	27.7	<1.4
LLSB-35	1.5	Fill/debris	HHI	16.9	17.6
LLSB-35	2	Fill/debris	HHI	42	98
LLSB-35	2.5	Fill/debris	HHI	192	145
LLSB-35	3	Fill	HHI	271	20
LLSB-35	3.5	Fill	HHI	97	5.8
LLSB-35	4	Fill	HHI	5.9	<1.2
LLSB-35	4.5	Fill	HHI	8.5	5.7
LLSB-35	5	Fill	HHI	12.1	49
LLSB-35	7.1	Fill	HHI	4,031	466
LLSB-35	7.5	Fill/brick	HHI	6,643	906
LLSB-35	8	Fill/brick	HHI	2,829	997
LLSB-35	8.5	Fill	HHI	1,440	18.9
LLSB-35	9	Fill	HHI	426	<5
LLSB-35	9.5	Fill	HHI	8.3	<1.4
LLSB-35	10	Fill	HHI	131	6.6
LLSB-35	10.5	Fill	HHI	686	<6
LLSB-35	11	Fill	HHI	338	5
LLSB-35	11.5	Fill	HHI	287	<4
LLSB-35	12	Fill	HHI	190	<3
LLSB-35	15	Weathered till	HHI	165.72	<10.58
LLSB-35	15.5	Weathered till	HHI	180.44	<10.08
LLSB-35	16	Weathered till	HHI	140.99	<9.63
LLSB-35	16.5	Weathered till	HHI	61.53	<7.93
LLSB-35	17	Weathered till	HHI	45.81	<7.39
LLSB-36	2	Fill	HHI	107.29	344
LLSB-36	2.5	Fill	HHI	65.55	104
LLSB-36	3	Fill	HHI	<20.22	<20.22
LLSB-36	3.5	Fill	HHI	<19.33	<19.33
LLSB-36	4	Fill	HHI	<18.58	<18.58
LLSB-36	4.5	Fill	HHI	<22.59	<22.59
LLSB-36	5	Fill	HHI	93.51	944
LLSB-36	5.5	Fill	HHI	<22.45	45.0
LLSB-36	6	Fill	HHI	<21.22	<21.22
LLSB-36	6.5	Fill	HHI	<25.67	51.7
LLSB-36	7	Fill	HHI	59.26	<8.3
LLSB-36	7.5	Fill	HHI	1,176.93	503
LLSB-36	8.2	Fill/brick	HHI	4,670.44	1,121
LLSB-36	8.5	Fill	HHI	4,763.31	936
LLSB-36	9	Fill	HHI	1,053.6	<23.09
LLSB-36	9.4	Fill	HHI	1,060.33	<23.54
LLSB-36	10	Fill	HHI	3,397.96	<49.32
LLSB-36	10.5	Fill	HHI	2,622.95	<40.83
LLSB-36	11	Fill	HHI	4,029.23	<55.24
LLSB-36	11.5	Fill	HHI	3,096.83	<54.78
LLSB-36	12	Weathered till	HHI	1,421.16	<28.03
LLSB-36	12.5	Weathered till	HHI	2,893.12	<44.78
LLSB-36	13	Weathered till	HHI	2,336.21	<41.93
LLSB-36	13.5	Weathered till	HHI	959.83	<21.1
LLSB-36	14	Weathered till	HHI	655.23	<17.46
LLSB-36	14.5	Weathered till	HHI	530.63	<16.03
LLSB-36	15	Weathered till	HHI	642.41	<16.92
LLSB-37	2	Fill	HHI	<25.47	124.57
LLSB-37	2.5	Fill	HHI	<48.51	722
LLSB-37	3	Fill	HHI	46.99	90.2
LLSB-37	3.5	Fill	HHI	<20.37	<20.37
LLSB-37	4	Fill	HHI	<20.84	31.6
LLSB-37	4.5	Fill	HHI	<20.25	<20.25
LLSB-37	5	Fill	HHI	24.35	<6.76
LLSB-37	7	Fill	HHI	<25.06	<25.06
LLSB-37	7.5	Fill	HHI	<26.69	<26.69
LLSB-37	8	Fill	HHI	<22.78	64.9
LLSB-37	8.5	Fill	HHI	<20.28	<20.28
LLSB-37	9	Fill	HHI	<38.87	365
LLSB-37	11.5	Fill	HHI	26.26	<7.06
LLSB-37	12	Fill	HHI	26.55	<7.06
LLSB-37	12.5	Weathered till	HHI	2,895.13	<45.85
LLSB-37	13	Weathered till	HHI	790.5	<19.79
LLSB-37	13.5	Weathered till	HHI	681.96	<17.94
LLSB-37	14	Weathered till	HHI	620.38	<17.7
LLSB-37	14.5	Weathered till	HHI	851.34	<20.95
LLSB-37	15	Weathered till	HHI	506.57	<15.64

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-37a[2]	2	Fill	HHI	<19.16	<19.16
	3	Fill	HHI	60.09	101.74
	4	Fill	HHI	<18.87	<18.87
	5	Fill	HHI	<24.78	65.4
	5.5	Fill	HHI	<22.3	30.1
	6	Fill	HHI	<22.89	<22.89
	6.5	Fill	HHI	<20.15	<20.15
	7	Fill	HHI	<19.87	<19.87
	7.5	Fill	HHI	35.5	<6.9
	8	Fill	HHI	<20.1	<20.1
	8.5	Fill	HHI	151.37	408
	9	Fill	HHI	788.31	65.3
	9.5	Fill	HHI	656.27	<17.88
	10	Fill	HHI	39.75	<6.97
LLSB-38	2	Fill	HHI	<22.92	30.8
	2.5	Fill	HHI	<20.55	<20.55
	3	Fill	HHI	32.57	84.7
	3.5	Fill	HHI	<19.08	<19.08
	4	Fill	HHI	<18.82	<18.82
	4.5	Fill	HHI	<18.5	<18.5
	5	Fill	HHI	82.99	166
	5.5	Fill	HHI	<20.38	<20.38
	6	Fill	HHI	42.57	298
	6.5	Fill	HHI	<18.11	<18.11
	7	Fill	HHI	<19.36	<19.36
	7.5	Fill	HHI	<18.02	<18.02
	8	Fill	HHI	<22.8	59.5
	8.5	Fill/brick	HHI	495.89	490
	9	Fill	HHI	1,751.5	2,653
	9.5	Fill	HHI	1,088.05	106
	10	Fill	HHI	157.45	<8.82
	10.5	Fill	HHI	413.74	<13.37
	11	Weathered till	HHI	303.16	<12.23
	11.5	Weathered till	HHI	228.78	<11.12
	12	Weathered till	HHI	203.41	<10.15
	12.5	Weathered till	HHI	409.51	<13.44
	13	Weathered till	HHI	333.93	<12.66
	13.5	Weathered till	HHI	411.63	<13.4
	14	Weathered till	HHI	<18.29	<18.29
	14.5	Weathered till	HHI	27.77	38.5
LLSB-39	2	Fill	HHI	<18.5	<18.5
	2.5	Fill	HHI	<20.76	<20.76
	3	Fill	HHI	37.37	79.0
	3.5	Fill	HHI	<17.42	<17.42
	4	Fill	HHI	<18.97	<18.97
	4.5	Fill	HHI	<18.32	<18.32
	5	Fill/debris	HHI	<16.99	<16.99
	6	Fill	HHI	<16.93	<16.93
	6.5	Fill	HHI	29.31	56.2
	7	Fill	HHI	<17.1	<17.1
	7.5	Fill	HHI	<30.03	173
	8	Fill	HHI	39.94	71.7
	8.5	Fill	HHI	22.72	<6.87
	9	Fill	HHI	104.12	374
	9.5	Fill	HHI	86.67	137
	11	Fill	HHI	<18.11	<18.11
	11.5	Fill	HHI	904.44	233
	12	Fill	HHI	362.83	259
	12.5	Fill	HHI	851.69	484
	13	Fill/brick	HHI	2,755.55	888
	13.5	Fill/brick	HHI	1,904.75	641
	14	Fill	HHI	858.21	<21.88
	15	Fill	HHI	1,416.76	63.9
	15.5	Fill	HHI	133.92	30.3
	16	Weathered till	HHI	1,627.77	<28.81
	16.5	Weathered till	HHI	1,670.19	<30.01
	17	Weathered till	HHI	907.14	<20.09
	17.5	Weathered till	HHI	870.95	<19.1

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-40	1.5	Fill	HHI	<19.38	<19.38
	2	Fill	HHI	<19.03	<19.03
	2.5	Fill/debris	HHI	<21.05	<21.05
	3	Fill	HHI	32.61	<7.11
	3.5	Fill	HHI	<18.37	<18.37
	4	Fill	HHI	<18.59	<18.59
	4.5	Fill	HHI	<18.62	<18.62
	5	Fill	HHI	<17.84	<17.84
	6.4	Fill	HHI	<18.49	<18.49
	6.7	Fill	HHI	<19.47	<19.47
	7.5	Fill/slag	HHI	34.38	60.4
	8	Fill	HHI	<49.21	629
	8.5	Fill	HHI	<18.54	<18.54
	9	Fill	HHI	<34.41	177
	10.5	Fill	HHI	104.5	292
	11	Fill	HHI	39.04	117
	11.5	Fill	HHI	113.63	<9
	12	Fill	HHI	<22.6	<22.6
	12.5	Fill	HHI	<20.51	<20.51
	13	Fill	HHI	138.72	<9.2
	13.5	Fill	HHI	<17.19	<17.19
	14	Fill	HHI	836.94	<18.88
	14.5	Fill	HHI	103.88	<8.81
	15	Weathered till	HHI	<40.78	238.5
	15.5	Weathered till	HHI	<19.08	<19.08
	16.5	Weathered till	HHI	79.53	<10.37
	17	Weathered till	HHI	166.32	<9.04
	17.5	Weathered till	HHI	173.39	<9.53
	18	Weathered till	HHI	113.09	<9.05
	18.5	Weathered till	HHI	163.36	<9.47
	19	Weathered till	HHI	147.28	<9.48
	19.5	Weathered till	HHI	97.26	<8.54
	20	Weathered till	HHI	43.27	<9.06
	20.5	Weathered till	HHI	<19.82	<19.82
	21	Weathered till	HHI	<18.87	<18.87
LLSB-41	2.5	Fill	HHI	25.85	<6.74
	3	Fill/brick	HHI	58.51	<7.72
	3.5	Fill	HHI	<19.16	<19.16
	4	Fill	HHI	<22.02	45
	4.5	Fill	HHI	<18.73	<18.73
	5	Fill	HHI	<19.84	<19.84
	5.5	Fill	HHI	<23.46	61.8
	6	Fill	HHI	77.29	85.7
	6.5	Fill	HHI	51.02	<7.58
	7	Fill	HHI	21.81	<6.46
	7.5	Fill	HHI	55.21	<8.11
	8	Fill	HHI	70.66	<7.66
	8.5	Fill/brick	HHI	2,857.89	1,344
	9	Fill	HHI	304.32	<13.23
	9.5	Fill	HHI	<18.87	<18.87
	10	Fill	HHI	<21.07	<21.07
	11	Fill/slag	HHI	127.86	<9.11
	11.5	Fill	HHI	1,940.74	<34.99
	12	Fill	HHI	836.04	<19.32
	12.5	Fill	HHI	80.28	<8.17
	13	Weathered till	HHI	<20.35	<20.35
	13.5	Weathered till	HHI	262.13	<12.37
	14	Weathered till	HHI	327.47	<12.01
	14.5	Weathered till	HHI	400.34	<13.78

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-42	1.5	Fill	HHI	<18.72	<18.72
	2	Fill	HHI	72.73	136
	2.5	Fill	HHI	60.72	<7.58
	3	Fill	HHI	39.81	<7.08
	3.5	Fill	HHI	<18.12	<18.12
	4	Fill	HHI	<19.75	<19.75
	4.5	Fill	HHI	142.14	1,779
	6	Fill/slag	HHI	<59.8	1,048
	6.5	Fill/slag	HHI	184.24	534
	7	Fill/slag	HHI	287.41	195
	7.5	Fill	HHI	82.33	<7.7
	8	Fill	HHI	<18.16	<18.16
	8.5	Fill	HHI	33.56	<7.38
	9	Fill/brick	HHI	457.2	136
	9.5	Fill/brick	HHI	1,681.62	2,678
	10	Fill/brick	HHI	5,556.54	7,504
	11	Weathered till	HHI	31.32	166
	11.5	Weathered till	HHI	128.59	<9.04
	12	Weathered till	HHI	319.63	<12.65
	12.5	Weathered till	HHI	546.29	<17.56
	13	Weathered till	HHI	582.98	<16.75
	13.5	Weathered till	HHI	304.57	<12.48
LLSB-43	1.5	Fill	HHI	140.6	64.0
	2	Fill	HHI	<18.37	<18.37
	2.5	Fill	HHI	124.72	62.5
	3	Fill/brick and mortar	HHI	908.44	1637
	3.5	Fill/brick and mortar	HHI	378.85	166
	4	Fill	HHI	1,855.05	742
	4.4	Fill	HHI	1,613.72	170
	4.7	Fill	HHI	1,045.54	154
	5	Fill/brick and mortar	HHI	1,134.15	962
	6	Fill/brick and mortar	HHI	1,285.22	1,059
	6.5	Fill/brick and mortar	HHI	1,828.56	946
	7	Fill/brick and mortar	HHI	360.1	322
	7.5	Fill/brick and mortar	HHI	724.01	597
	7.7	Fill	HHI	3,400.45	2,136
	8	Fill	HHI	2,251.98	<38.16
	8.5	Fill	HHI	2,841.26	<41.08
	9	Fill	HHI	1,554.91	<28.7
	9.5	Weathered till	HHI	1,007.94	<20.58
	10	Weathered till	HHI	858.98	<20.81
	11	Weathered till	HHI	772.99	<18.21
	11.5	Weathered till	HHI	760.84	<17.71
	12	Weathered till	HHI	443.25	<15.05
	12.5	Weathered till	HHI	396.16	<13.76
	13	Weathered till	HHI	545.12	<15.5
	13.5	Weathered till	HHI	399.84	<13.42
	14	Weathered till	HHI	437.16	<13.64
	14.5	Weathered till	HHI	447.36	<14.22
LLSB-44	1.5	Fill	HHI	64.34	251
	2	Fill	HHI	210.87	127
	2.5	Fill	HHI	80.34	<7.78
	3	Fill	HHI	155.7	<9.77
	3.5	Fill	HHI	2,667.46	1,369
	4	Fill	HHI	2,065.62	623
	4.5	Fill/brick	HHI	598.2	<16.49
	5	Fill/brick	HHI	14,215.54	336
	6	Fill/brick and mortar	HHI	1,132.08	803
	6.5	Fill/brick and mortar	HHI	538.57	416
	7	Fill/brick and mortar	HHI	1,679.51	222
	7.5	Fill/debris	HHI	1,535.87	<26.99
	7.8	Fill	HHI	166.19	<9.25
	8.5	Fill	HHI	41.71	<7.44
	9	Fill	HHI	2,632.66	<39.62
	9.5	Fill	HHI	624.29	<18.2
	10	Weathered till	HHI	577.04	<16.18
	10.2	Weathered till	HHI	466.82	34.32
	10.5	Weathered till	HHI	584.61	<16.61
	11	Weathered till	HHI	333.25	<12.55
	11.5	Weathered till	HHI	632.81	<17.08
	12	Weathered till	HHI	168.38	<10.71
	12.5	Weathered till	HHI	356.37	<14.63
	13	Weathered till	HHI	351.04	<13.29
	13.5	Weathered till	HHI	276.57	<12.68
	14	Weathered till	HHI	487.74	<16.45
	14.5	Weathered till	HHI	371.71	<14.1
	14.8	Weathered till	HHI	336.12	<15.53

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-45	1.5	Fill/brick	HHI	280.79	345
	2	Fill	HHI	282.71	458
	2.5	Fill	HHI	43.65	<7.29
	3	Fill	HHI	30.33	<6.87
	3.5	Fill	HHI	<18.62	<18.62
	4	Fill	HHI	113.12	<8.94
	4.5	Fill	HHI	198.85	426
	5	Fill	HHI	273.53	<11.57
	6	Fill	HHI	265.46	<12.18
	6.5	Fill/brick	HHI	1,602.65	838
	7	Fill/brick	HHI	2,461.11	1,020
	7.5	Fill	HHI	2,236.48	1,078
	8	Fill/debris	HHI	2,589.74	296
	8.5	Fill/debris	HHI	470.4	<12.08
	9	Fill	HHI	887.83	<21.53
	9.5	Fill	HHI	388.38	<12.74
	10	Fill	HHI	4,037.58	<53.37
	10.5	Fill	HHI	563.79	<15.85
	11	Weathered till	HHI	681.45	<17.15
	11.5	Weathered till	HHI	311.73	<12.12
	12	Weathered till	HHI	170.21	<9.98
	12.5	Weathered till	HHI	138.7	<9.76
	13	Weathered till	HHI	112.26	<8.7
	13.5	Weathered till	HHI	154.24	<10.09
	14	Weathered till	HHI	58.77	<7.8
	14.5	Weathered till	HHI	36.84	<6.98
	15	Weathered till	HHI	42.43	<7.01
LLSB-46	2	Fill	HHI	<21.16	<21.16
	2.5	Fill	HHI	45.57	65.1
	3	Fill	HHI	21.2	<6.46
	3.5	Fill	HHI	41.34	<7.22
	4	Fill	HHI	<20.05	<20.05
	4.5	Fill	HHI	<18.88	<18.88
	5	Fill	HHI	<18.88	<18.88
	5.5	Fill	HHI	<21.17	<21.17
	6	Fill	HHI	<19.54	<19.54
	6.5	Fill	HHI	<18.43	<18.43
	7	Fill	HHI	102.99	708
	7.5	Fill	HHI	86.37	442
	8	Fill	HHI	34.38	179
	8.5	Fill	HHI	49.28	<7.81
	9	Fill/brick	HHI	70.43	373
	9.5	Fill/brick	HHI	58.84	182
	10	Fill	HHI	1,368.53	179
	11.5	Fill	HHI	<24.6	80
	12	Fill	HHI	201.27	105
	12.5	Fill	HHI	804.81	420
	13	Fill	HHI	648.75	682
	13.5	Fill	HHI	2,106.53	727
	14	Fill	HHI	304.77	<11.82
	14.5	Fill	HHI	<20.68	<20.68
	15	Weathered till	HHI	938.52	111
	16.5	Weathered till	HHI	335.94	<12.6
	17.5	Weathered till	HHI	743.49	<21.74
	17.7	Weathered till	HHI	903.75	<19.46

Table 6-10. Metals Results for Shallow Soil - Focused Source Area Investigation

Location Identification	Depth (feet bgs)	Stratigraphic Unit/Material Type	Analyte	Arsenic	Lead
			Unit	mg/kg	mg/kg
			Preliminary Cleanup Level (PCUL)		
			Human Health Industrial (HHI) [2]	88	1,000
LLSB-47	1.5	Fill	HHI	<18.15	<18.15
	2	Fill	HHI	<21.05	<21.05
	2.5	Fill	HHI	<17.78	<17.78
	3	Fill	HHI	**20.77**	<6.82
	3.5	Fill	HHI	**30.88**	**165**
	4	Fill	HHI	<18.48	<18.48
	4.5	Fill	HHI	**18.54**	<5.99
	5	Fill	HHI	<16.85	<16.85
	6	Fill	HHI	<18.12	<18.12
	6.5	Fill	HHI	<18.5	<18.5
	7	Fill	HHI	<18.34	<18.34
	7.5	Fill	HHI	<21.48	<21.48
	8	Fill	HHI	**23.19**	**52.6**
	8.5	Fill	HHI	**77.73**	**338**
	9	Fill	HHI	**27.86**	<7.04
	9.5	Fill	HHI	<18.25	<18.25
	10	Fill	HHI	<23.58	**77.0**
	11	Fill	HHI	<24.5	**76.1**
	11.5	Fill	HHI	**46.68**	**169**
	12	Fill/brick	HHI	**171.23**	**926**
	12.5	Fill	HHI	**2,936.58**	**414**
	13	Fill	HHI	**1,527.74**	<28.89
	13.5	Fill	HHI	**992.06**	<21.14
	14	Fill	HHI	**4,425.7**	<66
	14.5	Fill	HHI	**2,404.3**	<39.2
	15	Fill	HHI	**2,894.22**	<42.13
	15.5	Fill	HHI	**1,111.7**	<22.74
	16	Weathered till	HHI	**2,177.08**	<35.77
	16.5	Weathered till	HHI	**3,174.05**	<45.39
	17	Weathered till	HHI	**1,842.47**	<33.95
	17.5	Weathered till	HHI	**1,476.81**	<29.41
	18	Weathered till	HHI	**814.61**	<18.2
	18.5	Weathered till	HHI	**488.98**	<15.36
	19	Weathered till	HHI	**359.08**	<14.04

Notes:

[1] Presented in this table are x-ray fluorescence (XRF) measurements of arsenic and lead performed on soil as part of the focused source area investigation. The focused source area investigation was performed March 26 though 28 and April through May 1, 2014.

[2] The applicable preliminary cleanup level (PCUL) is Human Health Industrial (HHI) as the soil is beneath pavement in the Marine View Drive right-of way.

XRF = X-ray fluorescence. The XRF instrument was operated by Ecology during drilling activities. A Delta Dynamic DP-4000 was used on soil from LLSB-04 through LLSB-35. An Alpha X-Ray Analyzer XT-440 was used on soil from LLSB-36 through LLSB-47.

bgs = below ground surface

Bold font indicates the analyte was detected

Gray-shaded cells indicate the highest arsenic or lead concentrations measured in the boring

< = The analyte was not detected at the identified reporting limit

Table 6-11

Metals for Deeper Soil - Lowland Area

Everett Lowland

Everett, Washington

Location Identification	General Location	Sample Date	Depth (feet bgs) Start	Depth (feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]									
						Human Health Industrial (HHI):	1,400	88	3,500	>1E+6	140,000	1,000	1,100	35	>1E+6
						Human Health Trespasser (HHT):	14,000	20	3,500	>1E+6	140,000	250	1,100	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	550	820,000	22,000	250	160	5.5	160,000
						Ecological Industrial (EI):	NE	132	14	67	217	118	5.5	NE	360
						Ecological Forest Area (EFA):	NE	20	4	48	50	50	0.1	1	86
						Applicable PCUL									
BP-01D	Benson	1/6/2012	21	22	Lowland Alluvium	HHI	6 U	3.3 J	0.2 U	--	--	3	0.02 U	0.2 U	--
	Benson	1/6/2012	27.5	28.5	Lowland Alluvium	HHI	6 U	5.1 J	0.2 U	--	--	2 U	0.03 U	0.2 U	--
BP-02D	Benson	1/5/2012	23	24	Lowland Alluvium	HHI	6 U	5.4 J	0.2 U	--	--	4	0.02 U	0.2 U	--
	Benson	1/5/2012	27.5	28.5	Lowland Alluvium	HHI	7 U	11.3 J	0.4	--	--	3	0.03 U	0.3 U	--
BP-03D	Benson	1/4/2012	14	15	Lowland Alluvium	HHI	9 U	14.7 J	0.4 U	--	--	10	0.05	0.4 U	--
	Benson	1/4/2012	20	21	Lowland Alluvium	HHI	7 U	6.4 J	0.3 U	--	--	4	0.03	0.3 U	--
	Benson	1/5/2012	26	27	Lowland Alluvium	HHI	6 U	1.2 J	0.3 U	--	--	3 U	0.02 U	0.2 U	--
BP-04D	Benson	1/4/2012	21.5	22.5	Lowland Alluvium	HHI	7 U	5.1 J	0.3 U	--	--	4	0.02 U	0.3 U	--
	Benson	1/4/2012	27	28	Lowland Alluvium	HHI	6 U	14.7 J	0.2 U	--	--	3	0.02 U	0.2 U	--
BP-04D2	Benson	8/13/2013	35	36.5	Lowland Alluvium	HHI	0.2 U	41.2	0.5	--	--	324	0.02 U	0.2 U	--
	Benson	8/13/2013	50	51.5	Lowland Alluvium	HHI	0.2 U	6	0.1 U	--	--	50.6	0.05	0.2 U	--
	Benson	8/13/2013	60	61.25	Lowland Alluvium	HHI	0.2 U	3.6	0.1 U	--	--	1.5	0.02 U	0.2 U	--
	Benson	8/13/2013	65	66	Lowland Alluvium	HHI	0.2 U	3.2	0.1 U	--	--	1.9	0.03	0.2 U	--
	Benson	8/13/2013	80.5	81.5	Lowland Alluvium	HHI	0.2 U	5	0.2	--	--	15.5 J	0.02	0.2 U	--
	Benson	8/13/2013	100	101.5	Lowland Alluvium	HHI	0.2 U	2.6	0.1 U	--	--	3.1	0.03 U	0.2 U	--
	Benson	8/13/2013	80.5	81.5	Lowland Alluvium	HHI	0.2 U	5.5	0.2	--	--	3.9 J	0.03	0.2 U	--
BP-05D	Benson	1/3/2012	22	22.5	Lowland Alluvium	HHI	6 U	41.1 J	0.2 U	--	--	2	0.02 U	0.2 U	--
	Benson	1/3/2012	30	31	Lowland Alluvium	HHI	6 U	396 J	0.2 U	--	--	2	0.03 U	0.2 U	--
BP-05D2	Benson	1/8/2013	40	41	Lowland Alluvium	HHI	6 U	10.7	0.3	--	--	6	0.03 U	0.2 U	--
	Benson	1/8/2013	50	51	Lowland Alluvium	HHI	6 U	8.2	0.5	--	--	4	0.03	0.2 U	--
	Benson	1/8/2013	62	62.5	Lowland Alluvium	HHI	7 U	11.9	0.7	--	--	5	0.04	0.3 U	--
	Benson	1/8/2013	65	66	Lowland Alluvium	HHI	6 U	12.3	0.6	--	--	3	0.03 U	0.3 U	--
	Benson	1/8/2013	70.5	71	Lowland Alluvium	HHI	6 U	6.4	0.3	--	--	2 U	0.02 U	0.2 U	--
BP-06D	Benson	12/30/2011	23	24	Lowland Alluvium	HHI	6 U	7	0.3 U	--	--	4	0.04	0.3 U	--
	Benson	12/30/2011	29.5	30	Lowland Alluvium	HHI	6 U	84	0.2 U	--	--	2 U	0.03 U	0.2 U	--
	Benson	12/30/2011	29.5	30	Lowland Alluvium	HHI	6 U	116	0.2 U	--	--	2 U	0.02 U	0.2 U	--
BP-07D	Benson	12/29/2011	24.5	25.5	Lowland Alluvium	HHI	6 U	8	0.3	--	--	5	0.04	0.3 U	--
	Benson	12/29/2011	30.5	31.5	Lowland Alluvium	HHI	6 U	6 U	0.2 U	--	--	2 U	0.03 U	0.2 U	--
BP-07D2	Benson	8/12/2013	35	35.5	Lowland Alluvium	HHI	0.2 U	30.3 J	0.4	--	--	59 J	0.29 J	0.2 U	--
	Benson	8/12/2013	40	41	Lowland Alluvium	HHI	0.2 U	36.4 J	0.2	--	--	27.9 J	0.04 J	0.2 U	--
	Benson	8/12/2013	60	61	Lowland Alluvium	HHI	0.2 U	8.5 J	0.2	--	--	5 J	0.02 U	0.2 U	--
	Benson	8/12/2013	75.5	76.5	Lowland Alluvium	HHI	0.3 U	15.1 J	0.2	--	--	6.8 J	0.05 J	0.3 U	--
	Benson	8/12/2013	81	81.5	Lowland Alluvium	HHI	0.2 U	6.5 J	0.2	--	--	4.4 J	0.03 U	0.2 U	--
BP-08D	Benson	12/29/2011	20	21	Lowland Alluvium	HHI	6 U	6	0.3 U	--	--	4	0.07	0.3 U	--
	Benson	12/29/2011	24.5	25.5	Lowland Alluvium	HHI	6 U	7	0.2 U	--	--	2 U	0.03 U	0.2 U	--
BP-09D	Benson	12/28/2011	19	20	Lowland Alluvium	HHI	6 U	10	0.2	--	--	4	0.04	0.2 U	--
	Benson	12/28/2011	27	28	Lowland Alluvium	HHI	6 U	6	0.2 U	--	--	2 U	0.04	0.2 U	--
BP-10D	Benson	12/27/2011	17.5	18	Lowland Alluvium	HHI	7 U	7 U	0.3	--	--	3 U	0.03 U	0.3 U	--
	Benson	12/27/2011	21.5	22.5	Lowland Alluvium	HHI	5 U	5 U	0.2 U	--	--	2	0.02	0.2 U	--
	Benson	12/27/2011	21.5	22.5	Lowland Alluvium	HHI	5 U	5 U	0.2 U	--	--	2 U	0.03	0.2 U	--
EV-3-S	MVD	1/22/1993	34	35.5	Upland Outwash	HHI	--	14 J	1 U	--	--	6 J	--	--	--
	MVD	1/22/1993	44	45.5	Upland Outwash	HHI	--	5 J	1 U	--	--	3 J	--	--	--
	MVD	1/22/1993	49	50.5	Upland Outwash	HHI	--	3 J	1 U	--	--	6	--	--	--
EV-4B	Benson	1/20/1993	39	40.5	Upland Outwash	HHI	--	4 J	1	--	--	4	--	--	--
	Benson	1/20/1993	55.5	57.5	Upland Outwash	HHI	--	5 J	1	--	--	1 U	--	--	--
EV-5	Benson	2/1/1993	25	26.5	Lowland Alluvium	HHI	--	8	1 U	--	--	6 J	--	--	--
EV-7B	Benson	8/20/1993	28	29.5	Lowland Alluvium	HHI	--	30	1 U	--	--	5 U	--	--	--
EV-8B	Benson	8/19/1993	22	23.5	Lowland Alluvium	HHI	--	14	1 U	--	--	5 U	--	--	--
EV-9B	Benson	8/23/1993	23	24.5	Lowland Alluvium	HHI	--	9.5	1 U	--	--	5 U	--	--	--
	Benson	8/23/1993	28	29.5	Lowland Alluvium	HHI	--	14	1 U	--	--	6	--	--	--
EV-17B	Benson	9/23/1998	20	21.5	Lowland Alluvium	HHI	--	10 U	10 U	81	22	49	--	--	115
	Benson	9/23/1998	25	26.5	Lowland Alluvium	HHI	--	18	10 U	72	23	23	--	--	73
EV-18B	MVD	9/24/1998	30	31.5	Upland Outwash	HHI	--	10 UJ	10 U	113	25	10 UJ	--	--	40
	MVD	9/24/1998	35	36.5	Upland Outwash	HHI	--	10 UJ	10 U	115	24	13 J	--	--	36
	MVD	9/24/1998	40	41.5	Upland Outwash	HHI	--	10 UJ	10 U	115	20	10 UJ	--	--	39
	MVD	9/24/1998	45	46.5	Upland Outwash	HHI	--	10 UJ	10 U	132	29	10 UJ	--	--	38
EV-21A/B	POE	2/8/1999	20	21.5	Lowland Alluvium	HHI	--	20	5 U	66	32	5	--	--	32
EV-22A/B	PUD	9/22/1998	25	26.5	Lowland Alluvium	HHI	--	10 U	10 U	132	55	10 U	--	--	71
	PUD	9/22/1998	30	31.5	Lowland Alluvium	HHI	--	10 U	10 U	284	23	10	--	--	114
HP-04	Benson	8/24/1995	22	24	Lowland Alluvium	HHI	--	34	1 U	--	47	7	--	--	73
HP-06	BNSF	8/25/1995	20	21.5	Lowland Alluvium	HHI	--	5	1 U	--	20	4	--	--	44
HP-41	POE	1/24/1996	12	13.5	Lowland Alluvium	HHI	--	5	1 U	77	19	3 U	--	--	42
HP-43	POE	1/25/1996	10	11.5	Lowland Alluvium	HHI	--	3	1 U	101	18	3 U	--	--	45
HP-45	PUD	9/23/1998	20	21.5	Lowland Alluvium	HHI	--	10 U	10 U	97	23	10	--	--	35
	PUD	9/23/1998	25	26.5	Lowland Alluvium	HHI	--	10 U	10 U	125	27	10 U	--	--	41
HP-46	POE	2/9/1999	15	16.5	Lowland Alluvium	HHI	--	10 U	10 U	58	25	10 U	--	--	32
	POE	2/9/1999	20	21.5	Lowland Alluvium	HHI	--	10 U	10 U	66	25	10 U	--	--	35
HP-47	POE	2/10/1999	15	16.5	Lowland Alluvium	HHI	--	6.7	1 U	43	18	5.3	--	--	78
	POE	2/10/1999	20	21.5	Lowland Alluvium	HHI	--	10 U	10 U	73	17	11	--	--	40
HP-48	POE	2/10/1999	15	16.5	Lowland Alluvium	HHI	--	15	10 U	101	32	10 U	--	--	42
LLMW-01D	Shadow	1/2/2013	32.5	33.5	Lowland Alluvium	HHI	6 U	2.7	0.2 U	--	--	2 U	0.03 U	0.2 U	--
LLMW-02D	Shadow	12/21/2012	27	28	Lowland Alluvium	HHI	6 U	5.3	0.3	--	--	3	0.02 U	0.2 U	--
LLMW-03D	Shadow	12/26/2012	28	29	Lowland Alluvium	HHI	6 U	3.2	0.3	--	--	2 U	0.03 U	0.2 U	--
LLMW-04D	PUD	12/28/2012	30	31	Lowland Alluvium	HHI	5 U	4.4	0.3	--	--	2 U	0.02 U	0.2 U	--
LLMW-05D	POE	12/10/2012	20	21	Lowland Alluvium	HHI	6 U	4.4	0.3	--	--	3	0.03 U	0.2 U	--
LLMW-06D	POE	12/27/2012	23	24	Lowland Alluvium	HHI	6 U	5.3	0.3	--	--	2 U	0.03	0.3 U	--
LLMW-07D	POE	12/7/2012	18	19	Lowland Alluvium	HHI	6 U	2.6	0.2 U	--	--	2 U	0.02 U	0.2 U	--
LLMW-08D	POE	12/10/2012	20	21	Lowland Alluvium	HHI	6 U	5.4	0.3	--	--	4	0.02 U	0.2 U	--
LLMW-09D	POE	12/6/2012	18	19	Lowland Alluvium	HHI	6 U	5.9	0.2 U	--	--	2 U	0.02 U	0.2 U	--
LLMW-10D	POE	12/11/2012	27	28	Lowland Alluvium	HHI	6 U	3.4	0.2	--	--	2 U	0.03 U	0.2 U	--
LLMW-11D	POE	12/13/2012	19.5	20.5	Lowland Alluvium	HHI	6 U	28.9	0.3	--	--	3	0.03 U	0.3 U	--
LLMW-12D	POE	12/12/2012	21	22	Lowland Alluvium	HHI	6 U	9.4	0.3	--	--	3	0.02 U	0.2 U	--
LLMW-13D	POE	12/17/2012	32	33	Lowland Alluvium	HHI	6 U	4.2	0.3	--	--	3	0.02 U	0.2 U	--
LLMW-14D	POE	12/12/2012	29	30	Lowland Alluvium	HHI	6 U	2.8	0.3	--	--	2 U	0.03 U	0.2 U	--
LLMW-15D	POE	12/13/2012	30.5	31.5	Lowland Alluvium	HHI	6 U	5.1	0.2	--	--	2 U	0.03 U	0.2 U	--
LLMW-16D	POE	12/14/2012	29.5	30.5	Lowland Alluvium	HHI	5 U	4	0.3	--	--	3	0.02 U	0.2 U	--
LLMW-17D	POE	12/12/2012	21	22	Lowland Alluvium	HHI	6 U	3.7	0.3	--	--	2	0.03 U	0.2 U	--
LLMW-18D	POE	12/13/2012	21	22	Lowland Alluvium	HHI	6 U	3.4	0.3 U	--	--	3 U	0.03 U	0.3 U	--

Table 6-11. Metals for Deeper Soil - Lowland Area

Location Identification	General Location	Sample Date	Depth (feet bgs) Start	Depth (feet bgs) End	Stratigraphic Unit	Analyte	Antimony	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Thallium	Zinc
						Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
						Preliminary Cleanup LeveLs (PCULs) [1]									
						Human Health Industrial (HHI):	1,400	88	3,500	>1E+6	140,000	1,000	1,100	35	>1E+6
						Human Health Trespasser (HHT):	14,000	20	3,500	>1E+6	140,000	250	1,100	35	>1E+6
						Human Health Site Visitor (HHV):	220	20	550	820,000	22,000	250	160	5.5	160,000
						Ecological Industrial (EI):	NE	132	14	67	217	118	5.5	NE	360
						Ecological Forest Area (EFA):	NE	20	4	48	50	50	0.1	1	86
						Applicable PCUL									
LLMW-19D	POE	12/6/2012	25	26	Lowland Alluvium	HHI	6 U	**2.7**	0.2 U	--	--	2 U	0.03 U	0.2 U	--
LLMW-20D	POE	12/12/2012	13.5	14.5	Lowland Alluvium	HHI	6 U	**22.9**	**0.3**	--	--	**19**	0.03 U	0.3 U	--
LLMW-21D	POE	12/20/2012	24	25	Lowland Alluvium	HHI	6 U	**5.1**	**0.3**	--	--	3 U	0.02 U	0.2 U	--
LLMW-22D	POE	12/5/2012	20	21	Lowland Alluvium	HHI	6 U	**2.6**	**0.2**	--	--	2 U	0.03 U	0.2 U	--
LLMW-23D	POE	12/5/2012	26	26.5	Lowland Alluvium	HHI	8 U	**16.3**	**0.4**	--	--	**6**	**0.10**	0.3 U	--
	POE	12/5/2012	35	36	Lowland Alluvium	HHI	6 U	**2.3**	0.2 U	--	--	2 U	0.02 U	0.2 U	--
LLMW-24D	MVD	12/20/2012	30	31	Upland Outwash	HHI	5 U	**2.1 J**	**0.4**	--	--	**2**	0.03 U	0.2 U	--
	MVD	12/21/2012	45	46	Upland Outwash	HHI	5 U	**2.5 J**	**0.3**	--	--	2 U	**0.02**	0.2 U	--
LLMW-25D	MVD	12/19/2012	55	56	Upland Outwash	HHI	6 U	**2.2**	**0.3**	--	--	2 U	0.03 U	**0.2**	--
LLMW-27D	MVD	1/9/2013	30	31	Upland Outwash	HHI	5 U	**2.3**	**0.4**	--	--	2 U	0.02 U	0.2 U	--
	MVD	1/9/2013	37	37.5	Upland Outwash	HHI	6 U	**58.7**	**0.7**	--	--	**19**	**0.08**	0.2 U	--
	MVD	1/9/2013	40	41	Upland Outwash	HHI	5 U	**2.3**	**0.3**	--	--	2 U	0.02 U	0.2 U	--
	MVD	1/9/2013	50	51	Upland Outwash	HHI	6 U	**28.8**	**0.4**	--	--	2 U	0.03 U	0.2 U	--
	MVD	1/9/2013	60	61	Upland Outwash	HHI	5 U	**38.9**	**0.3**	--	--	2 U	0.03 U	0.2 U	--
LLMW-29D	MVD	1/8/2013	30	31	Upland Outwash	HHI	5 U	**30.1**	**0.3**	--	--	2 U	0.02 U	0.2 U	--
	MVD	1/8/2013	55	56	Upland Outwash	HHI	6 U	**6.7**	**0.3**	--	--	2 U	0.03 U	0.2 U	--
LLMW-31D	Benson	1/23/2013	45	46	Upland Outwash	HHI	5 U	**2.2**	**0.4**	--	--	**3**	**0.03**	0.2 U	--
	Benson	1/23/2013	55	56	Upland Outwash	HHI	6 U	**2.1**	**0.4**	--	--	2 U	0.02 U	0.2 U	--
LLMW-33D	MVD	1/7/2013	39	40	Upland Outwash	HHI	6 U	**1.7**	**0.3**	--	--	2 U	0.02 U	0.2 U	--
LLMW-34D	MVD	12/19/2012	70	70.5	Upland Outwash	HHI	5 U	**2.2 J**	**0.4**	--	--	2 U	0.02 U	0.2 U	--
LLMW35D	Upland	8/8/2013	90	92	Upland Outwash	HHI	0.2 U	**2.2**	**0.1**	--	--	**2.3**	0.03 U	0.2 U	--
LLMW36D	Benson	8/9/2013	29	30	Lowland Alluvium	HHI	0.2 U	**133**	0.1 U	--	--	**2.4**	0.03 U	0.2 U	--
	Benson	8/9/2013	59	60	Lowland Alluvium	HHI	0.2 U	**23.8**	0.1 U	--	--	**1.8**	0.03 U	0.2 U	--
	Benson	8/9/2013	89	90	Lowland Alluvium	HHI	0.3 U	**10.2**	**0.4**	--	--	**14**	**0.06**	**0.4**	--
LLSB-01	Shadow	1/7/2013	19	20	Lowland Alluvium	HHI	6 U	**3.9**	**0.3**	--	--	**3 J**	0.03 U	0.2 U	--
LLSB-02	Shadow	1/7/2013	15	16	Lowland Alluvium	HHI	6 U	**9.4**	**0.4**	--	--	**4**	**0.04**	0.2 U	--
LLSB-03	Shadow	1/7/2013	19	20	Lowland Alluvium	HHI	6 U	**6.9**	**0.3**	--	--	**3**	0.03 U	0.2 U	--
MW-107D	POE	2/4/1999	15	16.5	Lowland Alluvium	HHI	--	10 U	10 U	**60**	**27**	**10**	--	--	**37**
	POE	2/4/1999	20	21.5	Lowland Alluvium	HHI	--	**13**	10 U	**66**	**24**	10 U	--	--	**42**
MW-109D	POE	2/3/1999	15	16.5	Lowland Alluvium	HHI	--	10 U	10 U	**74 J**	**22**	10 U	--	--	**28**
	POE	2/3/1999	20	21.5	Lowland Alluvium	HHI	--	10 U	10 U	**56 J**	**18**	10 U	--	--	**29**
MW-4B	POE	4/13/1993	20	21.5	Lowland Alluvium	HHI	--	**29**	1 U	--	--	**5**	--	--	--
TB-1	MVD	4/1/1998	35	36.5	Upland Outwash	HHI	--	**76**	--	--	--	10 U	--	--	--
TB-2	MVD	3/31/1998	35	36.5	Upland Outwash	HHI	--	10 U	--	--	--	10 U	--	--	--

Notes:

[1] Preliminary cleanup levels for soil are described in Section 5 of the SRI report.

Benson = Benson Subarea

MVD = On or adjacent to Marine View Drive

POE = Port of Everett Riverside Business Park

PUD = PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

BNSF = BNSF Subarea

Upland = Upland area

PCULs = Preliminary Cleanup Levels

mg/kg = milligrams per kilogram

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result exceeds the applicable screening level

Table 6-12

Total Organic Carbon Results for Soil - Lowland Area

Everett Lowland

Everett, Washington

Location Identification	Sample Identification	Analyte	Total Organic Carbon	Total Solids
		Units	Percent	Percent
		Stratigraphic Unit		
LLMW-05	LLMW05-6-7	Lowland Fill	0.247	84.2
LLMW-06	LLMW06-6.5-7.5	Lowland Fill	0.368	87.8
LLMW-10	LLMW10-6-7	Lowland Fill	0.296	83
LLMW-13	LLMW13-10.5-11.5	Lowland Fill	28.2	65.7
LLMW-14	LLMW14-5.5-6	Lowland Fill	3.36	82.8
LLMW-17	LLMW17-5-6	Lowland Fill	11.6	88
LLMW-18	LLMW18-6-7	Lowland Fill	0.433	83.2
LLMW-20	LLMW20-4.5-5.5	Lowland Fill	3.42	88.6
LLMW-03	LLMW03-5-5.2	Lowland NS	2.93	67.3
LLMW-04	LLMW04-30-31	Lowland Alluvium	0.264	88.3
LLMW-07	LLMW07-18-19	Lowland Alluvium	0.222	82.2
LLMW-08	LLMW08-20-21	Lowland Alluvium	0.741	82.6
LLMW-11	LLMW11-19.5-20.5	Lowland Alluvium	3.06	84.6
LLMW-12	LLMW12-21-22	Lowland Alluvium	0.765	83.8
LLMW-16	LLMW16-29.5-30.5	Lowland Alluvium	0.549	87.5
LLMW-18	LLMW18-21-22	Lowland Alluvium	1.29	78.30
LLMW-27	LLMW27-50-51	Upland Outwash	0.129	79.8
LLMW-29	LLMW29-55-56	Upland Outwash	0.538	78.9

Notes:

Lowland NS = Lowland Native Surface Soil

Table 6-13

Detection Frequency Summary - Groundwater

Everett Lowland

Everett, Washington

Aquifer	Sample Type [1]	Analyte	Number of Samples	Number of Detections	Percent Detected	Minimum Detected Concentration (µg/L)	Maximum Detected Concentration (µg/L)	Mean Detected Concentration (µg/L)	Median Detected Concentration (µg/L)	Non-Detections Greater than Cleanup Level	Detections Greater than Cleanup Level	Percent Greater than Cleanup Level
Shallow	Total	Antimony	84	50	60%	0.2	15.6	1.8	0.55	NA	NA	NA
		Arsenic	163	163	100%	0.5	365 [2]	72.1 [2]	18.3 [2]	NA	NA	NA
		Cadmium	84	38	45%	0.1	27.4	2.1	0.3	NA	NA	NA
		Lead	163	124	76%	0.1	396	13.2	0.70	NA	NA	NA
		Mercury	84	14	17%	0.021	0.23	0.051	0.037	0	13	15%
		Thallium	84	3	4%	0.3	0.3	0.3	0.3	NA	NA	NA
	Dissolved	Antimony	84	51	61%	0.2	15.6	1.6	0.5	0	0	0%
		Arsenic	163	163	100%	0.3	316 [2]	53.1 [2]	18.8 [2]	0	45	28%
		Cadmium	84	12	14%	0.1	27.1	3.9	0.2	0	2	2%
		Lead	163	69	42%	0.1	103	7.7	0.7	0	14	9%
		Mercury	84	5	6%	0.020	0.065	0.039	0.034	NA	NA	NA
		Thallium	84	2	2%	0.30	0.4	0.35	0.35	0	0	0%
Deep	Total	Antimony	105	47	45%	0.20	1.3	0.44	0.40	NA	NA	NA
		Arsenic	190	187	98%	0.20	18,900	1,108	3.40	NA	NA	NA
		Cadmium	105	44	42%	0.10	2.4	0.50	0.30	NA	NA	NA
		Lead	190	141	74%	0.10	8.80	0.70	0.30	NA	NA	NA
		Mercury	105	5	5%	0.020	0.052	0.021	0.020	0	2	2%
		Thallium	105	0	0%	ND	ND	ND	ND	NA	NA	NA
	Dissolved	Antimony	105	42	40%	0.20	1.6	0.45	0.40	0	0	0%
		Arsenic	190	180	95%	0.20	18,600	1,166	4.50	0	86	45%
		Cadmium	105	12	11%	0.10	2.20	0.42	0.30	0	0	NA
		Lead	190	26	14%	0.10	3.00	0.41	0.20	0	0	0%
		Mercury	105	2	2%	0.026	0.037	0.032	0.032	NA	NA	NA
		Thallium	105	0	0%	ND	ND	ND	ND	1	0	1%

Notes:

This table does not include field or laboratory duplicate analyses.

[1] Groundwater samples were collected for total and dissolved metals analysis. Dissolved samples were prepared by filtering the samples in the field using a disposable 0.45 micrometer filter.

[2] Total and dissolved arsenic results from LLMW-16S are excluded from the maximum, mean and median concentrations presented in the table. Total and dissolved arsenic concentrations in LLMW-16S during monitoring in January/February (Q1) and April/May (Q2) were 1,700 µg/L and 2,110 µg/L. The arsenic concentrations detected in groundwater at LLMW-16s were not typical of conditions in shallow groundwater and therefore, were not included in the maximum, mean and median values.

NA = Not applicable. Cleanup levels are based on the total fraction for mercury, and the dissolved fraction for all other metals.

ND = Not detected

µg/L = Microgram per liter

Table 6-14

Total/Dissolved Metals for Shallow Groundwater in Q1 (January/February 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Antimony Total	Antimony Dissolved	Arsenic Total	Arsenic Dissolved	Cadmium Total	Cadmium Dissolved	Lead Total	Lead Dissolved	Mercury Total	Mercury Dissolved	Thallium Total	Thallium Dissolved
		Unit	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
BP-01S	Benson	Lowland Area	0.7	0.2 U	88.4 J	83.8 J	0.2	0.1 U	11.9 J	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-01S-DUP	Benson	Lowland Area	0.7	0.2 U	90.9 J	84.8 J	0.2	0.1 U	12.1 J	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-02S	Benson	Lowland Area	0.4	0.2 U	132	94.5	0.1	0.1 U	10.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-03S	Benson	Lowland Area	0.2 U	0.4	34.4	36.8	0.1 U	0.2	0.2	9.6	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-04S	Benson	Lowland Area	3.8	3.3	30.5	24.3	0.6	0.2	35.5	2.2	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-05S	Benson	Lowland Area	1.3	1.1	29.9	26.2	7.9	0.1 U	1.4	0.3	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-06S	Benson	Lowland Area	0.2 U	0.2 U	59	52.3	0.3	0.1 U	1.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-07S	Benson	Lowland Area	0.3	0.2	274	277	0.1 U	0.1 U	0.8	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-08S	Benson	Lowland Area	0.2 U	0.2 U	71.7	57.5	0.1 U	0.1 U	0.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-09S	Benson	Lowland Area	1.1	0.5	279	164	5.6	0.1 U	0.9	0.1 U	0.0394	0.0200 U	0.2 U	0.2 U
BP-10S	Benson	Lowland Area	0.4	0.4	115	94.8	0.2	0.1 U	0.5	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-6A	Benson	Lowland Area	15.6	14.9	136	28.4	27.4	27.1	291	67.8	0.0404	0.0200 U	0.3	0.3
EV-13	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
EV-22A	PUD	Lowland Area	0.6	0.6	11.9	11.8	0.1	0.1 U	6.5	5.2	0.0366	0.0200 U	0.2 U	0.2 U
LLMW-03S	Shadow	Lowland Area	0.2 U	0.2 U	2.4	1.8	0.2	0.1 U	1.5	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-04S	PUD	Lowland Area	0.5 U	0.2	9.1	8.3	0.2 U	0.1 U	1.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-05S	POE	Snohomish River	0.2	0.2	8	8.4	0.1 U	0.1 U	0.2	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-06S	POE	Lowland Area	0.4	0.3	13.7	12.4	0.2	0.1 U	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-07S	POE	Snohomish River	1.5	1.3	17.2	15.6	0.6	0.1	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-08S	POE	Snohomish River	1.2	0.9	206	192	0.4	0.3	43.4	30.5	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-09S	POE	Lowland Area	0.3	0.3	61.5	59	2.2	0.1 U	0.6	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-10S	POE	Lowland Area	0.5	0.5	4.5	4.4	0.3	0.1 U	0.7	0.1	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-11S	POE	Snohomish River	0.2	0.2	1.1	1.1	0.2	0.1 U	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-12S	POE	Lowland Area	0.2 U	0.2 U	20	16.6	5.5	0.1 U	0.2	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-13S	POE	Lowland Area	0.2 U	0.2 U	27.1	25.5	0.1 U	0.1 U	0.4	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-14S	POE	Lowland Area	1.2	1.3	2.8	2.7	0.3	0.1	2.3	2.3	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-15S	POE	Lowland Area	0.5 U	0.2 U	4.5	4.6	0.2 U	0.1 U	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-16S	POE	Lowland Area	0.2 U	0.2 U	1,700	1,700	0.1	0.1 U	0.8	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-17S	POE	Snohomish River	1.8	1.9	2.8	2.6	0.2 U	0.1 U	0.2	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-18S	POE	Lowland Area	0.4	0.4	4.7	4.9	0.2	0.2	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-21S	POE	Lowland Area	0.4	0.4	31.1	28.9	0.1 U	0.1 U	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-22S	POE	Snohomish River	5 U	2 U	8	6	3	1 U	3	1 U	0.0351	0.0200 U	5 U	2 U
LLMW-23S	POE	Snohomish River	0.2 U	0.2 U	15.4	15	0.1 U	0.1 U	1.8	0.7	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-27S	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
LLMW-29S	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
LLMW-33S	MVD	Lowland Area	0.4	0.4	3.1	0.3	0.4	0.1 U	3.5	0.1 U	0.0328	0.0200 U	0.2 U	0.2 U
LLMW-34S	MVD	Lowland Area	0.2 U	0.2 U	0.5	0.5	0.2	0.1 U	0.2	0.1 U	0.0275	0.0222	0.2 U	0.2 U
MW-1202R	Shadow	Snohomish River	1.2	1.2	3	2.9	0.1 U	0.1 U	0.2	0.1	0.0238	0.0200 U	0.2 U	0.2 U
MW-1203R	Shadow	Snohomish River	0.2 U	0.2 U	1.2	1.2	0.1	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
MW-1301R	Shadow	Snohomish River	1	1	1.5	1.5	0.1 U	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
MW-1501R	Shadow	Snohomish River	2.9	2.9	1.8	1.7	0.1 U	0.1 U	1	0.7	0.0200 U	0.0200 U	0.2 U	0.2 U
MW-1701	Shadow	Lowland Area	0.2 U	0.2 U	2.8	2.2	0.2	0.1 U	0.2	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
PZ-1B	POE	Lowland Area	0.2	0.2	122	131	0.1	0.1 U	0.3	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
PZ-2B	POE	Snohomish River	0.4	0.4	21	22.9	0.4	0.1	0.3	0.2	0.0200 U	0.0200 U	0.2 U	0.2 U
PZ-3B	POE	Snohomish River	1.2	1.2	6.6	5.8	0.1 U	0.1 U	0.8	0.1	0.0200 U	0.0200 U	0.2 U	0.2 U
UNK	Shadow	Lowland Area	11.6	7	86.9	71.6	0.2	0.1 U	4.2	3.1	0.0599	0.044	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

2 Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

3 PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in shallow wells located inland from the Snohomish River shoreline must be protective of surface water within the Lowland Area and therefore, meet the Lowland Area PCUL. Groundwater concentrations in shallow wells located adjacent to the Snohomish River must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

-- = The well was dry and therefore, no sample could be obtained for analysis

DUP = Field duplicate sample

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-15

Total/Dissolved Metals for Shallow Groundwater in Q2 (April/May 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
BP-01S	Benson	Lowland Area	**0.3**	0.2 U	**94**	**91.8**	0.1 U	**0.2**	**5.6**	**0.2**	0.02 U	0.02 U	0.2 U	0.2 U
BP-02S	Benson	Lowland Area	0.2 U	0.2 U	**104**	**101**	0.1 U	0.1 U	**1.8**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-03S	Benson	Lowland Area	0.2 U	0.2 U	**46.4**	**44.4**	0.1 U	0.1 U	**1.3**	**0.3**	0.02 U	0.02 U	0.2 U	0.2 U
BP-04S	Benson	Lowland Area	**4.2**	**4.1**	**55.4**	**47.8**	**0.3**	**0.2**	**41.1**	**2**	0.02 U	0.02 U	0.2 U	0.2 U
BP-05S	Benson	Lowland Area	**0.6**	**0.6**	**37.8**	**35.2**	0.1 U	0.1 U	**1.3**	**0.8**	0.02 U	0.02 U	0.2 U	0.2 U
BP-06S	Benson	Lowland Area	0.2 U	0.2 U	**50.7**	**54**	0.1 U	0.1 U	**1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-07S	Benson	Lowland Area	**0.3**	**0.3**	**326**	**316**	0.1 U	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-08S	Benson	Lowland Area	0.2 U	0.2 U	**85.2**	**80.7**	**0.6**	0.1 U	**0.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-09S	Benson	Lowland Area	**0.5**	**0.4**	**164**	**160**	**0.1**	0.1 U	**0.4**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-10S	Benson	Lowland Area	**0.4**	**0.3**	**123**	**116**	0.1 U	0.1 U	**1.4**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
EV-6A	Benson	Lowland Area	**15.4**	**15.6**	**210**	**195**	**17.7**	**17.9**	**51.4**	**38.7**	**0.0478**	**0.0343**	**0.3**	**0.4**
EV-13	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
EV-22A	PUD	Lowland Area	**0.6**	**0.6**	**10.2**	**10.2**	**0.3**	0.1 U	**6.1**	**4.6**	**0.0213**	0.02 U	0.2 U	0.2 U
LLMW-03S	Shadow	Lowland Area	0.2 U	0.2 U	**1.4**	**1.3**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-04S	PUD	Lowland Area	0.2 U	0.2 U	**7.2**	**7.2**	0.1 U	0.1 U	**0.4**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-05S	POE	Snohomish River	0.2 U	**0.2**	**9.5**	**8.3**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-06S	POE	Lowland Area	**0.3**	**0.3**	**9.1**	**10.1**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-07S	POE	Snohomish River	**0.2**	**0.3**	**24.5**	**24.4**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-08S	POE	Snohomish River	**0.3**	**0.2**	**142**	**140**	0.1 U	0.1 U	**7**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-09S	POE	Lowland Area	**0.3**	**0.3**	**62**	**60.2**	0.1 U	0.1 U	**0.4**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-10S	POE	Lowland Area	**0.2**	**0.2**	**6.3**	**7.1**	0.1 U	0.1 U	**0.4**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-11S	POE	Snohomish River	0.2 U	0.2 U	**1.2**	**1.5 J**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-12S	POE	Lowland Area	0.2 U	0.2 U	**36.8**	**32.6**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-13S	POE	Lowland Area	0.2 U	0.2 U	**22.6**	**22.8**	**0.4**	0.1 U	**0.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-14S	POE	Lowland Area	**0.7**	**0.7**	**8.2**	**8.1**	0.1 U	**0.1**	**0.6**	**0.3**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-15S	POE	Lowland Area	0.2 U	0.2 U	**4**	**3.8**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-16S	POE	Lowland Area	0.2 U	0.2 U	**2,110**	**2,070**	0.1 U	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-17S	POE	Snohomish River	**1.6**	**1.6**	**3.8**	**3.6**	**0.3**	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-18S	POE	Lowland Area	0.2 U	0.2 U	**6**	**6.8**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-21S	POE	Lowland Area	**0.3**	**0.3**	**35.4**	**33.9**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-22S	POE	Snohomish River	**0.4**	**0.5**	**3**	**3**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-23S	POE	Snohomish River	0.2 U	0.2 U	**9.8**	**10**	**0.1**	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-27S	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
LLMW-29S	MVD	Lowland Area	--	--	--	--	--	--	--	--	--	--	--	--
LLMW-33S	MVD	Lowland Area	**0.3**	**0.2**	**24.4**	**0.3**	**4.3**	0.1 U	**28.1**	0.1 U	**0.229**	0.02 U	**0.3**	0.2 U
LLMW-34S	MVD	Lowland Area	0.2 U	0.2 U	**0.8**	**0.7**	0.1 U	0.1 U	**0.2**	0.1 U	**0.0321**	0.02 U	0.2 U	0.2 U
MW-1202R	Shadow	Snohomish River	0.2 U	0.2 U	**1.5**	**1.4**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
MW-1203R	Shadow	Snohomish River	0.2 U	0.2 U	**0.8**	**0.7**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
MW-1301R	Shadow	Snohomish River	**1**	**1**	**0.9**	**0.9**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
MW-1501R	Shadow	Snohomish River	**2.2**	**1.9**	**1.7**	**1.2**	0.1 U	0.1 U	**2**	**0.7**	0.02 U	0.02 U	0.2 U	0.2 U
MW-1701	Shadow	Lowland Area	0.2 U	0.2 U	**2.9**	**2.5**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
PZ-1B	POE	Lowland Area	0.2 U	**0.2**	**176**	**163**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
PZ-2B	POE	Snohomish River	0.2 U	0.2 U	**17.9**	**18.8**	**0.2**	0.1 U	**0.2**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
PZ-3B	POE	Snohomish River	**3.3**	**3.6**	**29.7**	**31**	0.1 U	0.1 U	**1.9**	**1.7**	**0.0712**	**0.0652**	0.2 U	0.2 U
UNK	Shadow	Lowland Area	**5.4**	**3.5**	**84.8 J**	**78.9 J**	**0.1**	0.1 U	**3.7**	**3.2**	**0.0401**	**0.0285**	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

2 Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

3 PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in shallow wells located inland from the Snohomish River shoreline must be protective of surface water within the Lowland Area and therefore, meet the Lowland Area PCUL. Groundwater concentrations in shallow wells located adjacent to the Snohomish River must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

-- = The well was dry and therefore no sample could be obtained for analysis

"DUP" = Field duplicate sample

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-16

Total/Dissolved Metals for Shallow Groundwater in Q3 (August/September 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Arsenic Total (µg/L)	Arsenic Dissolved (µg/L)	Lead Total (µg/L)	Lead Dissolved (µg/L)
Preliminary Cleanup Levels (PCULs)		Lowland Area [2]	NA[4]	150	NA[4]	2.2
		Snohomish River [3]	NA[4]	5	NA[4]	8.1
BP-01S	Benson	Lowland Area	208	116	287	0.1 U
BP-02S	Benson	Lowland Area	130	133	4.8	0.1 U
BP-03S	Benson	Lowland Area	67.2	69.5	1.4	0.1 U
BP-04S	Benson	Lowland Area	116	113	9.1	1.9
BP-05S	Benson	Lowland Area	69.4	69.5	1.4	0.1 U
BP-06S	Benson	Lowland Area	76.8	77	3.1	0.1 U
BP-07S	Benson	Lowland Area	365	127	1	0.1 U
BP-08S	Benson	Lowland Area	118	110	5.9	0.1 U
BP-09S	Benson	Lowland Area	283	276	0.3	0.1 U
BP-10S	Benson	Lowland Area	204	201	1.2	0.1 U
EV-6A	Benson	Lowland Area	314	208	70.9	24.9
EV-13	MVD	Lowland Area	--	--	--	--
EV-22A	PUD	Lowland Area	7.5	7.1	4	3.5
LLMW-03S	Shadow	Lowland Area	2.3	2.4	0.1 U	0.1 U
LLMW-04S	PUD	Lowland Area	4.4	4.3	0.2	0.1
LLMW-05S	POE	Snohomish River	18.2	17.7	0.1 U	0.1 U
LLMW-06S	POE	Lowland Area	6.1	6.4	0.1 U	0.1 U
LLMW-07S	POE	Snohomish River	46	44	2 U	2 U
LLMW-08S	POE	Snohomish River	206	187	104	0.2 U
LLMW-09S	POE	Lowland Area	23.8	24.8	0.1 U	0.1 U
LLMW-10S	POE	Lowland Area	31.5	30.1	25.6	0.3
LLMW-11S	POE	Snohomish River	--	--	--	--
LLMW-12S	POE	Lowland Area	62.5	61.1	0.1 U	0.2
LLMW-13S	POE	Lowland Area	25.8	26.8	0.2	0.1 U
LLMW-14S	POE	Lowland Area	22.5	20.8	0.7	0.3
LLMW-15S	POE	Lowland Area	8.6	6.3	0.3	0.1 U
LLMW-16S	POE	Lowland Area	497	386	54.7	0.1 U
LLMW-17S	POE	Snohomish River	3.7	2.4	0.4	0.1 U
LLMW-18S	POE	Lowland Area	20	19	0.1 U	0.1 U
LLMW-21S	POE	Lowland Area	90.2	91.3	0.1 U	0.1 U
LLMW-22S	POE	Snohomish River	5	6	0.1 U	0.2
LLMW-23S	POE	Snohomish River	7.1	6.6	0.3	0.1 U
LLMW-27S	MVD	Lowland Area	--	--	--	--
LLMW-29S	MVD	Lowland Area	--	--	--	--
LLMW-33S	MVD	Lowland Area	--	--	--	--
LLMW-34S	MVD	Lowland Area	1.5	0.6	2.4	0.1 U
MW-1202R	Shadow	Snohomish River	0.7	0.7	0.1 U	0.1 U
MW-1203R	Shadow	Snohomish River	1.1	0.9	0.3	0.1 U
MW-1301R	Shadow	Snohomish River	5.7	5.6	0.1	0.1 U
MW-1501R	Shadow	Snohomish River	7	10	0.5 U	0.5 U
MW-1701	Shadow	Lowland Area	4.4	4.3	0.1 U	0.1 U
PZ-1B	POE	Lowland Area	161	166	0.2	0.1 U
PZ-2B	POE	Snohomish River	95	108	0.1	0.1 U
PZ-3B	POE	Snohomish River	11	10.5	0.2	0.2
UNK	Shadow	Lowland Area	69.3	81.6	4.1	3.8

Sample Type [1]: Total / Dissolved.

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

2 Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

3 PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in shallow wells located inland from the Snohomish River shoreline must be protective of surface water within the Lowland Area and therefore, meet the Lowland Area PCUL. Groundwater concentrations in shallow wells located adjacent to the Snohomish River must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

-- = The well was dry and therefore no sample could be obtained for analysis

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-17

Total/Dissolved Metals for Shallow Groundwater in Q4 (October/November 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Arsenic Total	Arsenic Dissolved	Lead Total	Lead Dissolved
		Analyte	Arsenic		Lead	
		Unit	µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)					
		Lowland Area [2]	NA[4]	150	NA[4]	2.2
		Snohomish River [3]	NA[4]	5	NA[4]	8.1
BP-01S	Benson	Lowland Area	110	110	14.1	0.2
BP-02S	Benson	Lowland Area	122	114	2.6	0.1 U
BP-03S	Benson	Lowland Area	42.6	42.4	1.2	0.1
BP-04S	Benson	Lowland Area	49.7	44.1	14.2	1.4
BP-05S	Benson	Lowland Area	53.7	51.5	0.6	0.1 U
BP-06S	Benson	Lowland Area	61.1	54.0	2.6	0.1 U
BP-07S	Benson	Lowland Area	243	227	0.3	0.1 U
BP-08S	Benson	Lowland Area	105	101	2.6	0.1 U
BP-09S	Benson	Lowland Area	499	289	4.9	0.1 U
BP-10S	Benson	Lowland Area	171	160	0.7	0.1 U
EV-6A	Benson	Lowland Area	176	33.5	396	103
EV-13	MVD	Lowland Area	--	--	--	--
EV-22A	PUD	Lowland Area	6.0 J	3.1 J	3.0 J	0.1 UJ
LLMW-03S	Shadow	Lowland Area	2.0	2.0	0.1 U	0.1 U
LLMW-04S	PUD	Lowland Area	8.0	8.2	0.1 U	0.1 U
LLMW-05S	POE	Snohomish River	210	11.7	0.6	0.1 U
LLMW-06S	POE	Lowland Area	4.7	4.5	0.1 U	0.1 U
LLMW-07S	POE	Snohomish River	13	17	1 U	1 U
LLMW-08S	POE	Snohomish River	136	136	5.4	0.1 U
LLMW-09S	POE	Lowland Area	14.2	14.4	0.1	0.1 U
LLMW-10S	POE	Lowland Area	8.4	7.4	0.1	0.1 U
LLMW-11S	POE	Snohomish River	--	--	--	--
LLMW-12S	POE	Lowland Area	43.5	41.6	0.1 U	0.1 U
LLMW-13S	POE	Lowland Area	24.1	23.7	0.1 U	0.1 U
LLMW-14S	POE	Lowland Area	18.3 J	17.1 J	0.4 J	0.1 UJ
LLMW-15S	POE	Lowland Area	9.2	9.3	0.1	0.1 U
LLMW-16S	POE	Lowland Area	238	216	0.6	0.1 U
LLMW-17S	POE	Snohomish River	2.6	2.5	0.1 U	0.1 U
LLMW-18S	POE	Lowland Area	12.2	11.9	0.1 U	0.1 U
LLMW-21S	POE	Lowland Area	98.6	92.7	0.1 U	0.1 U
LLMW-22S	POE	Snohomish River	7	7	1 U	1 U
LLMW-23S	POE	Snohomish River	5.5	5.3	0.2	0.1 UJ
LLMW-27S	MVD	Lowland Area	--	--	--	--
LLMW-29S	MVD	Lowland Area	--	--	--	--
LLMW-33S	MVD	Lowland Area	--	--	--	--
LLMW-34S	MVD	Lowland Area	0.7	0.7	0.2	0.1 U
MW-1202R	Shadow	Snohomish River	1.1	1.2	0.1 U	0.1 U
MW-1203R	Shadow	Snohomish River	0.7	0.8	0.1 U	0.1 U
MW-1301R	Shadow	Snohomish River	3.6	3.8	0.1	0.1 U
MW-1501R	Shadow	Snohomish River	5	6	1 U	1 U
MW-1701	Shadow	Lowland Area	4.9	4.2	0.4	0.1 U
PZ-1B	POE	Lowland Area	129	128	0.2	0.1 U
PZ-2B	POE	Snohomish River	6.0	3.0	0.2	0.1 U
PZ-3B	POE	Snohomish River	7.5	7.1	0.7	0.6
UNK	Shadow	Lowland Area	163	158	11.2	8.8

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in shallow wells located inland from the Snohomish River shoreline must be protective of surface water within the Lowland Area and therefore, meet the Lowland Area PCUL. Groundwater concentrations in shallow wells located adjacent to the Snohomish River must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

-- = The well was dry and therefore no sample could be obtained for analysis.

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-18

Dissolved Arsenic for Shallow Groundwater - All Quarters

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Arsenic			
		Analyte	Arsenic			
		Unit	µg/L			
		Sample Type [1]	Dissolved	Dissolved	Dissolved	Dissolved
	Preliminary Cleanup Levels (PCULs)					
		Lowland Area [2]	150	150	150	150
		Snohomish River [3]	5	5	5	5
		Quarter	Q1[4]	Q2[4]	Q3[4]	Q4[4]
BP-01S	Benson	Lowland Area	83.8 J	91.8	116	110
BP-02S	Benson	Lowland Area	94.5	101	133	114
BP-03S	Benson	Lowland Area	36.8	44.4	69.5	42.4
BP-04S	Benson	Lowland Area	24.3	47.8	113	44.1
BP-05S	Benson	Lowland Area	26.2	35.2	69.5	51.5
BP-06S	Benson	Lowland Area	52.3	54	77	54.0
BP-07S	Benson	Lowland Area	277	316	127	227
BP-08S	Benson	Lowland Area	57.5	80.7	110	101
BP-09S	Benson	Lowland Area	164	160	276	289
BP-10S	Benson	Lowland Area	94.8	116	201	160
EV-6A	Benson	Lowland Area	28.4	195	208	33.5
EV-13	MVD	Lowland Area	Dry	Dry	Dry	Dry
EV-22A	PUD	Lowland Area	11.8	10.2	7.1	3.1 J
LLMW-03S	Shadow	Lowland Area	1.8	1.3	2.4	2.0
LLMW-04S	PUD	Lowland Area	8.3	7.2	4.3	8.2
LLMW-05S	POE	Snohomish River	8.4	8.3	17.7	11.7
LLMW-06S	POE	Lowland Area	12.4	10.1	6.4	4.5
LLMW-07S	POE	Snohomish River	15.6	24.4	44	17
LLMW-08S	POE	Lowland Area	192	140	187	136
LLMW-09S	POE	Lowland Area	59	60.2	24.8	14.4
LLMW-10S	POE	Lowland Area	4.4	7.1	30.1	7.4
LLMW-11S	POE	Snohomish River	1.1	1.5 J	Dry	Dry
LLMW-12S	POE	Lowland Area	16.6	32.6	61.1	41.6
LLMW-13S	POE	Lowland Area	25.5	22.8	26.8	23.7
LLMW-14S	POE	Lowland Area	2.7	8.1	20.8	17.1 J
LLMW-15S	POE	Lowland Area	4.6	3.8	6.3	9.3
LLMW-16S	POE	Lowland Area	1,700	2,070	386	216
LLMW-17S	POE	Snohomish River	2.6	3.6	2.4	2.5
LLMW-18S	POE	Lowland Area	4.9	6.8	19	11.9
LLMW-21S	POE	Lowland Area	28.9	33.9	91.3	92.7
LLMW-22S	POE	Snohomish River	6	3	6	7
LLMW-23S	POE	Snohomish River	15	10	6.6	5.3
LLMW-27S	MVD	Lowland Area	Dry	Dry	Dry	Dry
LLMW-29S	MVD	Lowland Area	Dry	Dry	Dry	Dry
LLMW-33S	MVD	Lowland Area	0.3	0.3	Dry	Dry
LLMW-34S	MVD	Lowland Area	0.5	0.7	0.6	0.7
MW-1202R	Shadow	Snohomish River	2.9	1.4	0.7	1.2
MW-1203R	Shadow	Snohomish River	1.2	0.7	0.9	0.8
MW-1301R	Shadow	Snohomish River	1.5	0.9	5.6	3.8
MW-1501R	Shadow	Snohomish River	1.7	1.2	10	6
MW-1701	Shadow	Lowland Area	2.2	2.5	4.3	4.2
PZ-1B	POE	Lowland Area	131	163	166	128
PZ-2B	POE	Snohomish River	22.9	18.8	108	3
PZ-3B	POE	Snohomish River	5.8	31	10.5	7.1
UNK	Shadow	Lowland Area	71.6	78.9 J	81.6	158

Notes:

This table does not include field duplicate data.

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] Q1 was completed in January/February 2013, Q2 was completed in April/May 2013, Q3 was completed in August/September 2013 and Q4 was completed in October/November 2013.

[5] Groundwater concentrations in shallow wells located inland from the Snohomish River shoreline must be protective of surface water within the Lowland Area and therefore, meet the Lowland Area PCUL. Groundwater concentrations in shallow wells located adjacent to the Snohomish River must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-19

Total/Dissolved Metals for Deep Groundwater in Q1 (January/February 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
BP-01D	Benson	Snohomish River	0.2 U	0.2 U	**0.5 J**	**0.3**	**0.5**	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-02D	Benson	Snohomish River	0.2 U	0.2 U	**1**	**0.3**	**0.1**	0.1 U	**0.5**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-03D	Benson	Snohomish River	0.2 U	0.2 U	**0.9**	**0.3**	**0.7**	0.1 U	**0.6**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-04D	Benson	Snohomish River	0.2 U	0.2 U	**3,740**	**3,620**	**0.5**	0.1 U	**3.8**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-05D	Benson	Snohomish River	**0.6**	**0.5**	**16,400**	**14,800**	**0.3**	0.1 U	**0.6**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-05D-DUP	Benson	Snohomish River	**0.6**	**0.6**	**16,500**	**16,100**	**0.2**	**0.2**	**0.8**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-05D2	Benson	Snohomish River	**0.7**	**0.6**	**25.3**	**25.6**	**0.6**	0.1 U	**1.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-06D	Benson	Snohomish River	**0.4**	**0.4**	**1,820**	**1,780**	**0.2**	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-07D	Benson	Snohomish River	**0.4**	**0.4**	**4,940**	**5,020**	0.1 U	0.1 U	**0.3**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-08D	Benson	Snohomish River	0.2 U	0.2 U	**0.9**	**0.8**	0.1 U	0.1 U	**0.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-09D	Benson	Snohomish River	0.2 U	0.2 U	**23**	**22.4**	**0.7**	0.1 U	**0.5**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-10D	Benson	Snohomish River	**0.3**	**0.3**	**8.1**	**8.3**	**0.1**	0.1 U	**0.7**	**0.1**	**0.0239**	0.0200 U	0.2 U	0.2 U
EV-6B	Benson	Snohomish River	**0.4**	**0.3**	**10.2**	**12.6**	0.1 U	0.1 U	**1.2**	**0.1**	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-19B	Benson	Snohomish River	**0.2**	**0.2**	**4,050**	**3,970**	**0.3**	**0.1**	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-20B	Benson	Snohomish River	**0.7**	**0.3**	**13,900**	**14,000**	**0.1**	0.1 U	**0.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-22B	PUD	Snohomish River	**0.6**	**0.4**	**3.4**	**3.3**	0.2 U	0.1 U	**0.6**	0.1 U	**0.0518**	**0.0371**	0.2 U	0.2 U
LLMW-01D	Shadow	Snohomish River	**0.3**	**0.2**	**24.5**	**23.8**	0.1 U	0.1 U	**2.1**	**0.1**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-02D	Shadow	Snohomish River	0.2 U	0.2 U	**2.6**	**2.4**	0.1 U	0.1 U	**0.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-03D	Shadow	Snohomish River	0.2 U	0.2 U	**1.1**	**0.6**	0.1 U	0.1 U	**0.6**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-04D	PUD	Snohomish River	**0.3**	**0.3**	**35**	**31.1**	0.1 U	0.1 U	**1.2**	**0.6**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-05D	POE	Snohomish River	0.2 U	0.2 U	**1.4**	**1.7**	0.1 U	0.1 U	**0.3**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-06D	POE	Snohomish River	0.2 U	0.2 U	**7**	**5.5**	0.1 U	0.1 U	**1**	**0.3**	**0.0232**	0.0200 U	0.2 U	0.2 U
LLMW-07D	POE	Snohomish River	0.2 U	0.5 U	**6.9**	**5.9**	0.1 U	0.2 U	**1.5**	0.2 U	0.0200 U	0.0200 U	0.2 U	0.5 U
LLMW-08D	POE	Snohomish River	0.2 U	0.2 U	**2**	**2**	0.1 U	0.1 U	**0.1**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-09D	POE	Snohomish River	0.2 U	0.2 U	**1.7**	**0.9**	**2**	0.1 U	**0.9**	**0.3**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-10D	POE	Snohomish River	0.2 U	0.2 U	**3**	**2.4**	0.1 U	0.1 U	**1.7**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-11D	POE	Snohomish River	0.2 U	0.2 U	**1.7**	**1.7**	**0.5**	0.1 U	**0.3**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-12D	POE	Snohomish River	0.2 U	0.2 U	**1,880**	**1,980**	**0.4**	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-13D	POE	Snohomish River	0.2 U	0.2 U	**25.4**	**22.4**	0.1 U	0.1 U	**0.6**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-14D	POE	Snohomish River	0.2 U	0.2 U	**274**	**313**	**0.4**	0.1 U	**0.6**	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-15D	POE	Snohomish River	0.5 U	0.2 U	**0.9**	**0.5**	0.2 U	0.1 U	**0.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-16D	POE	Snohomish River	**0.2**	0.2 U	**1.8**	0.5 U	0.1 U	0.1 U	**1.2**	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-17D	POE	Snohomish River	0.5 U	0.2 U	**15.8**	**14.9**	0.2 U	0.1 U	**0.5**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-18D	POE	Snohomish River	0.2 U	0.2 U	**1.4**	**0.7**	0.1 U	0.1 U	**0.5**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-19D	POE	Snohomish River	0.5 U	0.2 U	**8.7**	**4.9**	**1.8**	0.1 U	**0.9**	**0.1**	0.0200 U	0.0200 U	0.5 U	0.2 U
LLMW-20D	POE	Snohomish River	**1**	**0.9**	**9.2**	**8.7**	0.2 U	**0.3 J**	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-20D-DUP	POE	Snohomish River	**1**	**0.9**	**11**	**8.6**	0.5 U	0.1 UJ	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-21D	POE	Snohomish River	0.2 U	0.2 U	**1.3**	**0.5**	**0.2**	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-22D	POE	Snohomish River	0.2 U	0.2 U	**0.7**	**0.4**	0.1 U	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-23D	POE	Snohomish River	0.2 U	0.2 U	**1.4**	**0.8**	0.1 U	0.1 U	**0.5**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-24D	MVD	Snohomish River	**0.4**	**0.4**	**2.6 J**	**0.8**	**0.2**	**0.4 J**	**2.1 J**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-24D-DUP	MVD	Snohomish River	**0.4**	**0.4**	**1.6 J**	**1.1**	**0.3**	**0.2 J**	**0.9 J**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-25D	MVD	Snohomish River	**0.5**	**0.5**	**1.5**	**0.9**	**0.3**	**0.7**	**0.9**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-27D	MVD	Snohomish River	**0.5**	**0.6**	**941**	**814**	**0.2**	**0.1**	**1**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-29D	MVD	Snohomish River	**0.4**	**0.4**	**7.1**	**4.5**	**0.2**	0.1 U	**0.9**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-31D	MVD	Snohomish River	**0.3**	**0.4**	**0.8**	**0.7**	**2.4**	**2.2**	**0.8**	**0.7**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-33D	MVD	Snohomish River	0.2 U	0.2 U	**1.4**	**1.3**	**0.8**	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-34D	MVD	Snohomish River	**0.9**	**1**	**3.1**	**2.2**	0.1 U	0.1 U	**0.4**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in deep wells must be protective of surface water within the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

"DUP" = Field duplicate sample

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-20

Total/Dissolved Metals for Shallow Deep Groundwater in Q2 (April/May 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL [5]	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Preliminary Cleanup Levels (PCULs)														
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
BP-01D	Benson	Snohomish River	0.2 U	0.2 U	**0.2**	**0.2**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-02D	Benson	Snohomish River	0.2 U	0.2 U	**0.6**	**0.6**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-03D	Benson	Snohomish River	0.2 U	0.2 U	**0.2**	**0.2**	0.1 U	0.1 U	**0.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-04D	Benson	Snohomish River	0.2 U	0.2 U	**3,470**	**3,820**	0.1 U	0.1 U	**0.4**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-05D2	Benson	Snohomish River	**0.6**	**0.6**	**15,500**	**17,100**	0.1 U	0.1 U	**0.2**	**0.2**	0.02 U	0.02 U	0.2 U	0.2 U
BP-05D2-DUP	Benson	Snohomish River	**0.6**	**0.6**	**15,400**	**17,200**	0.1 U	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-05D2	Benson	Snohomish River	**0.7**	**0.3**	**9.3**	**5.4**	**0.2**	0.1 U	**1.9**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-06D	Benson	Snohomish River	**0.4**	**0.4**	**1,820**	**1,850**	0.1 U	0.1 U	**0.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BO-07D	Benson	Snohomish River	**0.5**	**0.4**	**5,140**	**4,150**	0.1 U	0.1 U	**0.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-08D	Benson	Snohomish River	0.2 U	0.2 U	**0.5**	**1.1**	**1**	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-09D	Benson	Snohomish River	**0.2**	0.2 U	**27**	**26.1**	**0.2**	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
BP-10D	Benson	Snohomish River	**0.2**	**0.2**	**8**	**7.7**	**0.2**	0.1 U	**0.7**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
EV-6B	Benson	Snohomish River	**1.2**	**1.6**	**20.4**	**16.9**	0.1 U	0.1 U	**1.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
EV-19B	Benson	Snohomish River	**0.3**	**0.3**	**3,950**	**3,720**	**0.2**	**0.3**	**2.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
EV-20B	Benson	Snohomish River	**0.2**	**0.2**	**14,300**	**14,300**	0.1 U	0.1 U	**1.7**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
EV-22B	PUD	Snohomish River	**0.2**	0.2 U	**1.3**	**1.4**	0.2 U	**0.1**	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-01D	Shadow	Snohomish River	0.2 U	0.2 U	**22**	**21.2**	0.1 U	0.1 U	**0.1**	**0.3**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-02D	Shadow	Snohomish River	0.2 U	0.2 U	**1.5**	**1.5**	**0.2**	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-03D	Shadow	Snohomish River	0.2 U	0.2 U	**0.4**	**0.3**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-04D	PUD	Snohomish River	0.2 U	0.2 U	**4.7**	**5.0**	0.1 U	0.1 U	**0.2**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-05D	POE	Snohomish River	0.2 U	0.2 U	**1.7**	**1.2**	**0.5**	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-06D	POE	Snohomish River	0.2 U	0.2 U	**2.8**	**2**	**0.3**	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-07D	POE	Snohomish River	0.2 U	0.2 U	**9**	**9.9**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-08D	POE	Snohomish River	0.2 U	0.2 U	**3.7**	**3.8**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-09D	POE	Snohomish River	0.2 U	0.2 U	**1.2**	**0.9**	0.1 U	0.1 U	**0.4**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-10D	POE	Snohomish River	0.2 U	0.2 U	**2.6**	**3.2**	0.1 U	0.1 U	**0.2**	**0.2**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-11D	POE	Snohomish River	**0.2**	**0.3**	**1.4**	**1.2 J**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-12D	POE	Snohomish River	0.2 U	0.2 U	**2,020**	**2,040**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-12D-DUP	POE	Snohomish River	**0.2**	0.2 U	**2,030**	**2,040**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-13D	POE	Snohomish River	0.2 U	0.2 U	**68**	**79.8**	**0.1**	0.1 U	**0.3**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-13D-DUP	POE	Snohomish River	0.2 U	0.2 U	**73.6**	**85.3**	0.1 U	0.1 U	**0.3**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-14D	POE	Snohomish River	0.2 U	0.2 U	**234**	**246**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-14D-DUP	POE	Snohomish River	0.2 U	0.2 U	**293**	**228**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-15D	POE	Snohomish River	0.2 U	0.2 U	**0.5**	**0.5**	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-16D	POE	Snohomish River	0.2 U	0.2 U	**1**	**0.5**	**0.2**	0.1 U	**0.3**	**0.2**	0.025	0.02 U	0.2 U	0.2 U
LLMW-17D	POE	Snohomish River	0.2 U	0.2 U	**6.8**	**6.4**	**0.4**	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-18D	POE	Snohomish River	0.2 U	0.2 U	**0.8**	0.5 U	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-19D	POE	Snohomish River	**0.2**	0.2 U	**17.9**	**16.2**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-20D	POE	Snohomish River	**1.3**	**1.4**	**20.7**	**20.7**	0.1 U	0.1 U	**0.7**	**0.6**	**0.0277**	**0.0262**	0.2 U	0.2 U
LLMW-21D	POE	Snohomish River	0.2 U	0.2 U	**0.7**	**0.3**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-22D	POE	Snohomish River	0.2 U	0.2 U	**0.5 U**	0.5 U	**0.3**	0.1 U	0.1 U	0.1 U	**0.0229**	0.02 U	0.2 U	0.2 U
LLMW-23D	POE	Snohomish River	0.2 U	0.2 U	**0.5 U**	0.5 U	0.1 U	0.1 U	0.1 U	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-24D	MVD	Snohomish River	**0.3**	**0.3**	**1**	**0.8**	**0.3**	**0.3**	**0.5**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-25D	MVD	Snohomish River	**0.5**	**0.5**	**1.6**	**1.5**	**0.4**	**0.3**	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-27D	MVD	Snohomish River	**0.3**	**0.3**	**4,380**	**4,460**	**0.1**	0.1 U	**1.1**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-27D-DUP	MVD	Snohomish River	**0.4**	**0.3**	**4,340**	**4,380**	**0.1**	0.1 U	**1.3**	**0.1**	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-29D	MVD	Snohomish River	**0.2**	**0.2**	**8.4**	**6.5**	**0.2**	0.1 U	**0.7**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-31D	MVD	Snohomish River	**0.2**	**0.2**	**0.9**	**0.8**	**0.1**	**0.1**	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-33D	MVD	Snohomish River	**0.2**	**0.2**	**1.3**	**1.2**	0.1 U	0.1 U	**0.2**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLMW-34D	MVD	Snohomish River	**1.2**	**0.9**	**1.6**	**1.5**	**0.2**	0.1 U	**5.6**	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in deep wells must be protective of surface water within the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

µg/L = Microgram per liter

NE = Not established

"DUP" = Field duplicate sample.

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-21

Total/Dissolved Data for Metals Groundwater in Q3 (August/September 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification		Analyte	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
	General Area	Applicable PCUL [5]												
BP-01D	Benson	Snohomish River	--	--	0.2	0.2 U	--	--	0.1 U	0.1 U	--	--	--	--
BP-02D	Benson	Snohomish River	--	--	0.2	0.2 U	--	--	0.1 U	0.1 U	--	--	--	--
BP-03D	Benson	Snohomish River	--	--	0.2	0.2 U	--	--	0.1	0.1 U	--	--	--	--
BP-04D	Benson	Snohomish River	--	--	3,940	4,060	--	--	0.1	0.1 U	--	--	--	--
BP-04D2	Benson	Snohomish River	0.2 U	0.2 U	0.4	0.4	0.1 U	0.1 U	0.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-05D	Benson	Snohomish River	--	--	17,500	17,300	--	--	1.3	0.1 U	--	--	--	--
BP-05D	Benson	Snohomish River	--	--	18,100	17,500	--	--	1.4	0.1 U	--	--	--	--
BP-05D2	Benson	Snohomish River	--	--	4.1	3.7	--	--	0.2	0.1 U	--	--	--	--
BP-06D	Benson	Snohomish River	--	--	1,810	1,810	--	--	0.2	0.1 U	--	--	--	--
BP-07D	Benson	Snohomish River	--	--	6,530	6,610	--	--	0.1 U	0.1 U	--	--	--	--
BP-07D	Benson	Snohomish River	0.2 U	0.2 U	49.2	47.1	0.1 U	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
BP-08D	Benson	Snohomish River	--	--	0.8	0.8	--	--	0.1 U	0.1 U	--	--	--	--
BP-09D	Benson	Snohomish River	--	--	25.5	25.3	--	--	0.1	0.1 U	--	--	--	--
BP-10D	Benson	Snohomish River	--	--	6.1	6	--	--	0.3	0.1 U	--	--	--	--
EV-6B	Benson	Snohomish River	0.2 U	0.2 U	12.1	6.8	0.1 U	0.1 U	0.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-7B	Benson	Snohomish River	0.5	0.5	2,790	2,680	0.2	0.1	0.2	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
EV-19B	Benson	Snohomish River	--	--	3,090	3,560	--	--	0.5	0.2 U	--	--	--	--
EV-20B	Benson	Snohomish River	--	--	13,000	13,200	--	--	0.4	0.2 U	--	--	--	--
EV-22B	PUD	Snohomish River	--	--	7	5.1	--	--	3.6	0.3	--	--	--	--
LLMW-01D	Shadow	Snohomish River	--	--	26.9	28.1	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-02D	Shadow	Snohomish River	--	--	1.4	1.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-03D	Shadow	Snohomish River	--	--	0.4	0.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-04D	PUD	Snohomish River	--	--	1.7	1.5	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-05D	POE	Snohomish River	--	--	1	1	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-06D	POE	Snohomish River	--	--	1.4	1.5	--	--	0.1	0.1 U	--	--	--	--
LLMW-07D	POE	Snohomish River	--	--	5.6	5.0	--	--	0.2	0.1 U	--	--	--	--
LLMW-08D	POE	Snohomish River	--	--	1.2	1.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-09D	POE	Snohomish River	--	--	0.8	0.7	--	--	0.2	0.1 U	--	--	--	--
LLMW-10D	POE	Snohomish River	--	--	3.2	2.3	--	--	1.2	0.1 U	--	--	--	--
LLMW-11D	POE	Snohomish River	--	--	7.8	8.1	--	--	0.2	0.1 U	--	--	--	--
LLMW-12D	POE	Snohomish River	--	--	1,870	2,120	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-12D-DUP	POE	Snohomish River	--	--	1,860	2,050	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-13D	POE	Snohomish River	--	--	73	82.7	--	--	0.3	0.1 U	--	--	--	--
LLMW-13D-DUP	POE	Snohomish River	--	--	66.6	81.2	--	--	0.3	0.1 U	--	--	--	--
LLMW-14D	POE	Snohomish River	--	--	98.2	107	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-14D-DUP	POE	Snohomish River	--	--	131	103	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-15D	POE	Snohomish River	--	--	0.6	0.5	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-16D	POE	Snohomish River	--	--	1.3	0.9	--	--	0.5	0.2	--	--	--	--
LLMW-17D	POE	Snohomish River	--	--	13	11.3	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-18D	POE	Snohomish River	--	--	0.8	0.6	--	--	0.2	0.1 U	--	--	--	--
LLMW-19D	POE	Snohomish River	--	--	40.3	25.9	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-20D	POE	Snohomish River	--	--	36.9	34.2	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-21D	POE	Snohomish River	--	--	0.4	0.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-22D	POE	Snohomish River	--	--	0.8	0.7	--	--	0.1	0.1 U	--	--	--	--
LLMW-23D	POE	Snohomish River	--	--	1.2	1	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-24D	MVD	Snohomish River	--	--	0.9	0.8	--	--	0.1	0.1 U	--	--	--	--
LLMW-25D	MVD	Snohomish River	--	--	1.5	1.4	--	--	0.5	0.1 U	--	--	--	--
LLMW-27D	MVD	Snohomish River	--	--	4,610	4,360	--	--	0.2	0.1 U	--	--	--	--
LLMW-27D-DUP	MVD	Snohomish River	--	--	4,540	4,410	--	--	0.2	0.1 U	--	--	--	--
LLMW-29D	MVD	Snohomish River	--	--	6.8	5.8	--	--	0.6	0.1 U	--	--	--	--
LLMW-31D	MVD	Snohomish River	--	--	1.4	1	--	--	0.5	0.1 U	--	--	--	--
LLMW-33D	MVD	Snohomish River	--	--	1.3	1.2	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-34D	MVD	Snohomish River	--	--	1.6	1.6	--	--	0.3	0.1 U	--	--	--	--
LLMW-35D	Upland	Snohomish River	0.4	--	2	2	0.1 U	0.1 U	0.1	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLMW-36D	Benson	Snohomish River	0.3	--	10.6	10.4	0.1 U	0.1 U	3.2	3	0.0200 U	0.0200 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in deep wells must be protective of surface water within the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

Upland = Upland Area

µg/L = Microgram per liter

NE = Not established

-- = Metals sampling was reduced to arsenic and lead only at most wells in Q3 and Q4

"DUP" = Field duplicate sample

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-22

Total/Dissolved Metals for Deep Groundwater in Q4 (October/November 2013)

Everett Lowland

Everett, Washington

Monitoring Well Identification		Analyte	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
	General Area	Applicable PCUL [5]												
BP-01D	Benson	Snohomish River	--	--	0.3	0.4	--	--	0.1 U	0.1 U	--	--	--	--
BP-02D	Benson	Snohomish River	--	--	0.4	0.2 U	--	--	0.2	0.1 U	--	--	--	--
BP-03D	Benson	Snohomish River	--	--	0.2 U	0.2 U	--	--	0.1	0.1 U	--	--	--	--
BP-04D	Benson	Snohomish River	--	--	3,650	3,880	--	--	0.2 U	0.1 U	--	--	--	--
BP-04D2	Benson	Snohomish River	0.2 U	0.2 U	0.4	0.3	0.1 U	0.1 U	0.2	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
BP-05D	Benson	Snohomish River	--	--	18,900	18,600	--	--	0.4 J	0.1 U	--	--	--	--
BP-05D	Benson	Snohomish River	--	--	18,500	18,500	--	--	0.2 J	0.1 U	--	--	--	--
BP-05D2	Benson	Snohomish River	--	--	3.4	3.5	--	--	0.3	0.1 U	--	--	--	--
BP-06D	Benson	Snohomish River	--	--	1,740	1,750	--	--	0.4	0.1 U	--	--	--	--
BP-07D	Benson	Snohomish River	--	--	5,670	5,620	--	--	0.2	0.1 U	--	--	--	--
BP-07D2	Benson	Snohomish River	0.2 U	0.2 U	33.2	32.9	0.1 U	0.1 U	0.3	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
BP-08D	Benson	Snohomish River	--	--	0.6	0.7	--	--	0.1	0.1 U	--	--	--	--
BP-09D	Benson	Snohomish River	--	--	24.0	24.2	--	--	0.2	0.1 U	--	--	--	--
BP-10D	Benson	Snohomish River	--	--	5.7	5.8	--	--	0.2	0.1 U	--	--	--	--
EV-6B	Benson	Snohomish River	0.4	0.2 U	15.9	13.9	0.1 U	0.1 U	0.8 J	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
EV-7B	Benson	Snohomish River	0.4	0.4	2,980	2,840	0.1 U	0.1 U	0.3	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
EV-19B	Benson	Snohomish River	--	--	3,090	3,080	--	--	8.8	0.1	--	--	--	--
EV-20B	Benson	Snohomish River	--	--	13,000	12,800	--	--	0.1	0.1 U	--	--	--	--
EV-22B	PUD	Snohomish River	--	--	1.7 J	1.7 J	--	--	0.9 J	0.1 UJ	--	--	--	--
LLMW-01D	Shadow	Snohomish River	--	--	28.9	29.6	--	--	0.1	0.1 U	--	--	--	--
LLMW-02D	Shadow	Snohomish River	--	--	1.5	1.5	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-03D	Shadow	Snohomish River	--	--	0.3	0.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-04D	PUD	Snohomish River	--	--	9.5	9.0	--	--	0.2	0.1 U	--	--	--	--
LLMW-05D	POE	Snohomish River	0.2 U	0.2 U	1.1	0.9	2.1	0.1 U	0.2	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
LLMW-06D	POE	Snohomish River	0.2 U	0.2 U	1.4	1.3	1.0	0.1 U	0.1	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
LLMW-07D	POE	Snohomish River	--	--	7.0	4.5	--	--	0.2	0.1 U	--	--	--	--
LLMW-08D	POE	Snohomish River	--	--	1.9	1.5	--	--	0.2 U	0.1 U	--	--	--	--
LLMW-09D	POE	Snohomish River	--	--	1.0	0.7	--	--	0.3	0.1 U	--	--	--	--
LLMW-10D	POE	Snohomish River	--	--	2.7	2.7	--	--	0.3	0.1 U	--	--	--	--
LLMW-11D	POE	Snohomish River	--	--	8.2	8.4	--	--	0.1	0.1	--	--	--	--
LLMW-12D	POE	Snohomish River	--	--	1,580	1,670	--	--	0.1	0.1 U	--	--	--	--
LLMW-12D	POE	Snohomish River	--	--	1,610	1,590	--	--	0.1	0.1 U	--	--	--	--
LLMW-13D	POE	Snohomish River	--	--	53.7	62.9	--	--	0.2	0.1	--	--	--	--
LLMW-13D	POE	Snohomish River	--	--	67.5	71.3	--	--	0.2	0.1 U	--	--	--	--
LLMW-14D	POE	Snohomish River	--	--	158 J	179 J	--	--	1.8 J	0.1 UJ	--	--	--	--
LLMW-14D	POE	Snohomish River	--	--	128 J	174 J	--	--	0.1 UJ	0.1 UJ	--	--	--	--
LLMW-15D	POE	Snohomish River	--	--	0.5	0.5	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-16D	POE	Snohomish River	--	--	1.0	0.6	--	--	0.3	0.1 U	--	--	--	--
LLMW-17D	POE	Snohomish River	--	--	13.0	8.9	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-18D	POE	Snohomish River	--	--	0.7	0.6	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-19D	POE	Snohomish River	--	--	35.3	31.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-20D	POE	Snohomish River	--	--	36	14.9	--	--	0.6	0.4	--	--	--	--
LLMW-21D	POE	Snohomish River	--	--	0.5	0.4	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-22D	POE	Snohomish River	--	--	0.8	1 U	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-23D	POE	Snohomish River	--	--	0.8	0.7	--	--	0.1	0.1 U	--	--	--	--
LLMW-24D	MVD	Snohomish River	--	--	0.7	0.7	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-25D	MVD	Snohomish River	--	--	1.6	1.5	--	--	0.1 U	0.1 U	--	--	--	--
LLMW-27D	MVD	Snohomish River	0.2	0.2	4,480	4,460	0.1 U	0.1 U	0.6	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
LLMW-27D	MVD	Snohomish River	0.2	0.2	4,440	4,460	0.1 U	0.1 U	0.6	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
LLMW-29D	MVD	Snohomish River	--	--	5.7	5.1	--	--	0.2	0.1 U	--	--	--	--
LLMW-31D	MVD	Snohomish River	--	--	1.3	1.1	--	--	0.1	0.1 U	--	--	--	--
LLMW-33D	MVD	Snohomish River	--	--	1.1	1.1	--	--	0.1	0.1 U	--	--	--	--
LLMW-34D	MVD	Snohomish River	--	--	4.0	1.5	--	--	5.9	0.1 U	--	--	--	--
LLMW-35D	Upland	Snohomish River	0.2	0.2	3.4	3.4	0.1 U	0.1 U	0.1 U	0.1 U	0.020 U	0.020 U	0.2 U	0.2 U
LLMW-36D	Benson	Snohomish River	0.3	0.3	127	115	0.1 U	0.1 U	4.4	2.3	0.020 U	0.020 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Groundwater concentrations in deep wells must be protective of surface water within the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

Upland = Upland Area

NE = Not established

µg/L = Microgram per liter

-- = Metals sampling was reduced to arsenic and lead only at most wells in Q3 and Q4

"DUP" = Field duplicate sample

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

J = The result is an estimate

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-23

Dissolved Arsenic for Deep Groundwater - All Quarters

Everett Lowland

Everett, Washington

Monitoring Well Identification	General Area	Applicable PCUL[5]	Arsenic			
		Analyte	Arsenic			
		Unit	µg/L			
		Sample Type[1]	Dissolved	Dissolved	Dissolved	Dissolved
	Preliminary Cleanup Levels (PCULs)					
		Lowland Area[2]	150	150	150	150
		Snohomish River[3]	5	5	5	5
		Quarter	Q1[4]	Q2[4]	Q3[4]	Q4[4]
BP-01D	Benson	Snohomish River	0.3	0.2	0.2 U	0.4
BP-02D	Benson	Snohomish River	0.3	0.6	0.2 U	0.2 U
BP-03D	Benson	Snohomish River	0.3	0.2	0.2 U	0.2 U
BP-04D	Benson	Snohomish River	3,620	3,820	4,060	3,880
BP-04D2	Benson	Snohomish River	NA	NA	0.4	0.3
BP-05D	Benson	Snohomish River	14,800	17,100	17,300	18,600
BP-05D2	Benson	Snohomish River	25.6	5.4	3.7	3.5
BP-06D	Benson	Snohomish River	1,780	1,850	1,810	1,750
BP-07D	Benson	Snohomish River	5,020	4,150	6,610	5,620
BP-07D2	Benson	Snohomish River	NA	NA	47.1	32.9
BP-08D	Benson	Snohomish River	0.8	1.1	0.8	0.7
BP-09D	Benson	Snohomish River	22.4	26.1	25.3	24.2
BP-10D	Benson	Snohomish River	8.3	7.7	6	5.8
EV-6B	Benson	Snohomish River	12.6	16.9	6.8	13.9
EV-7B	Benson	Snohomish River	NA	NA	2,680	2,840
EV-19B	Benson	Snohomish River	3,970	3,720	3,560	3,080
EV-20B	Benson	Snohomish River	14,000	14,300	13,200	12,800
EV-22B	PUD	Snohomish River	3.3	1.4	5.1	1.7 J
LLMW-01D	Shadow	Snohomish River	23.8	21.2	28.1	29.6
LLMW-02D	Shadow	Snohomish River	2.4	1.5	1.4	1.5
LLMW-03D	Shadow	Snohomish River	0.6	0.3	0.4	0.4
LLMW-04D	PUD	Snohomish River	31.1	5.0	1.5	9
LLMW-05D	POE	Snohomish River	1.7	1.2	1	0.9
LLMW-06D	POE	Snohomish River	5.5	2	1.5	1.3
LLMW-07D	POE	Snohomish River	5.9	9.9	5.0	4.5
LLMW-08D	POE	Snohomish River	2	3.8	1.4	1.5
LLMW-09D	POE	Snohomish River	0.9	0.9	0.7	0.7
LLMW-10D	POE	Snohomish River	2.4	3.2	2.3	2.7
LLMW-11D	POE	Snohomish River	1.7	1.2 J	8.1	8.4
LLMW-12D	POE	Snohomish River	1,980	2,040	2,120	1,670
LLMW-13D	POE	Snohomish River	22.4	79.8	82.7	62.9
LLMW-14D	POE	Snohomish River	313	246	107	179
LLMW-15D	POE	Snohomish River	0.5	0.5	0.5	0.5
LLMW-16D	POE	Snohomish River	0.5 U	0.5	0.9	0.6
LLMW-17D	POE	Snohomish River	14.9	6.4	11.3	8.9
LLMW-18D	POE	Snohomish River	0.7	0.5 U	0.6	0.6
LLMW-19D	POE	Snohomish River	4.9	16.2	25.9	31.4
LLMW-20D	POE	Snohomish River	8.7	20.7	34.2	14.9
LLMW-21D	POE	Snohomish River	0.5	0.3	0.4	0.4
LLMW-22D	POE	Snohomish River	0.4	0.5 U	0.7	1 U
LLMW-23D	POE	Snohomish River	0.8	0.5 U	1	0.7
LLMW-24D	MVD	Snohomish River	0.8	0.8	0.8	0.7
LLMW-25D	MVD	Snohomish River	0.9	1.5	1.4	1.5
LLMW-27D	MVD	Snohomish River	814	4,460	4,360	4,460
LLMW-29D	MVD	Snohomish River	4.5	6.5	5.8	5.1
LLMW-31D	MVD	Snohomish River	0.7	0.8	1	1.1
LLMW-33D	MVD	Snohomish River	1.3	1.2	1.2	1.1
LLMW-34D	MVD	Snohomish River	2.2	1.5	1.6	1.5
LLMW-35D	Upland	Snohomish River	NA	NA	2	3.4
LLMW-36D	Benson	Snohomish River	NA	NA	10.4	115

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] Q1 was completed in January/February 2013, Q2 was completed in April/May 2013, Q3 was completed in August/September 2013 and Q4 was completed in October/November 2013.

[5] Groundwater concentrations in deep wells must be protective of surface water within the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

Benson = Benson Subarea

MVD = Marine View Drive right-of-way

POE = Port of Everett Riverside Business Park Subarea

PUD = Snohomish County PUD Subarea

Shadow = Shadow Development / Blunt Family Subarea

Upland = Upland Area

µg/L = Microgram per liter

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

J = The result is an estimate

NA = Not applicable because the well either was not discovered or not installed until a later quarter

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-24

Arsenic Speciation for Shallow Groundwater, Surface Water and Deep Groundwater

Everett Lowland
Everett, Washington

Quarter[1]	Q2					Q3					Q4				
Analyte	Arsenate	Arsenite	MMA	DMA	Arsenate Ratio	Arsenate	Arsenite	MMA	DMA	Arsenate Ratio	Arsenate	Arsenite	MMA	DMA	Arsenate Ratio
Sample Type[2]	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Unit	µg/L	µg/L	µg/L	µg/L	Percent	µg/L	µg/L	µg/L	µg/L	Percent	µg/L	µg/L	µg/L	µg/L	Percent
Sample Identification															
Shallow Monitoring Well															
BP-01S	**1.42**	**7.43**	0.069 U	0.041 U	16%	**102**	**42.5**	1.6 U	0.95 U	71%	--	--	--	--	--
BP-04S	**21.2**	**26.8**	0.12 U	0.093 U	44%	**26.3**	**93.4**	1.6 U	0.95 U	22%	**20.2**	**30.0**	5.1 U	5.2 U	40%
BP-05S	**8.39**	**26.4**	0.062 U	0.046 U	24%	**4.3 J**	**61.5**	1.6 U	0.95 U	7%	**4.37 J**	**47.0**	5.1 U	5.2 U	9%
BP-07S	**23.8**	**114**	0.5 U	0.37 U	17%	**6.3**	**86.2**	1.6 U	0.95 U	7%	**14.8**	**109**	5.1 U	5.2 U	12%
EV-6A	**11.4**	**49.4**	0.14 U	0.081 U	19%	**44.7**	**170**	0.77 U	0.96 U	21%	**35.6**	**2.69 J**	5.1 U	5.2 U	93%
LLMW-04S	**1.24**	**2.88**	0.13 U	**0.154 J**	30%	--	--	--	--	--	--	--	--	--	--
LLMW-05S	**1.94**	**3.48**	0.069 U	0.041 U	36%	**2.9 J**	**18.5**	0.77 U	0.96 U	14%	--	--	--	--	--
LLMW-06S	**1.06**	**2.42**	0.13 U	0.093 U	30%	**5.1**	**4.92 J**	1.6 U	0.95 U	51%	--	--	--	--	--
LLMW-08S	**42.3**	**75.6**	0.12 U	0.093 U	36%	**39.9**	**115**	0.77 U	0.96 U	26%	--	--	--	--	--
LLMW-11S	**1.29**	**0.454 J**	0.12 U	0.093 U	74%	--	--	--	--	--	--	--	--	--	--
LLMW-12S	**11**	**16.3**	0.069 U	0.041 U	40%	**21**	**69.1**	1.6 U	0.95 U	23%	**8.15**	**38.6**	5.1 U	5.2 U	17%
LLMW-13S	**0.79**	**2.6**	0.13 U	0.093 U	23%	**30.2**	**5.55**	1.6 U	0.95 U	84%	**26.0**	**0.82 J**	5.1 U	5.2 U	97%
LLMW-16S	**746**	**1,280**	0.51 U	3.7 U	37%	**75.2**	**223**	1.6 U	0.95 U	25%					
Surface Water															
LLSW-01	**0.65**	**0.66**	**0.13 J**	**1.31**	50%	--	--	--	--	--	--	--	--	--	--
LLSW02	**1.1**	**0.95**	0.13 U	**0.279 J**	54%	--	--	--	--	--	--	--	--	--	--
LLSW-04	**356**	**111**	2.5 U	1.9 U	76%	**28.2**	**10.9**	0.77 U	0.96 U	72%	--	--	--	--	--
LLSW-05[3]	**59.6**	**1.87**	0.25 U	**0.38 J**	97%	**4.6 J**	**2.10 J**	0.77 U	0.96 U	69%	--	--	--	--	--
	60.1	**1.38**	0.25 U	**0.47 J**	98%	--	--	--	--	--	--	--	--	--	--
Deep Monitoring Well															
BP-01D	**0.283 J**	0.081 U	0.069 U	0.041 U	100%	2.9 U	0.80 U	1.6 U	0.95 U	--	--	--	--	--	--
BP-04D	**537**	**3,000**	2.5 U	1.9 U	15%	**80**	**3,800**	6.2 U	3.8 U	2%	**131**	**3,520**	102 U	105 U	4%
BP-05D[4]	**14,800**	**288**	25 U	19 U	98%	**18,100**	**733**	**99 J**	38 U	96%	**15,600**	**164 J**	203 U	210 U	99%
	15,200	**268**	25 U	19 U	98%	**17,500**	**667**	**84 J**	38 U	96%	**15,900**	**154 J**	203 U	210 U	99%
BP-05D2	**6.89**	**3.08**	0.062 U	0.046 U	69%	1.0 U	**4.18 J**	0.77 U	0.96 U	0%	--	--	--	--	--
BP-07D	**3,630**	**362**	**17.4 J**	1.9 U	91%	**4,860**	**643**	**28.1**	3.8 U	88%	**4,940**	**743**	20 U	21 U	87%
EV6B	**3.05**	**1.21**	0.069 U	0.041 U	72%	1.0 U	**0.57 J**	0.77 U	0.96 U	0%	**2.07 J**	**3.78 J**	5.1 U	5.2 U	35%
EV-7B	--	--	--	--	--	**2,850**	**3.9 J**	3.1 U	3.8 U	100%	**3,060**	**5.3 J**	20 U	21 U	100%
EV-19B	**3,840**	3.2 U	**15.6 J**	1.6 U	100%	**3,270**	1.4 U	3.1 U	3.8 U	100%	**2,960**	20 U	20 U	21 U	100%
EV-20B	**15,800**	32 U	**77 J**	16 U	100%	**14,440**	1.4 U	3.1 U	3.8 U	100%	**13,100**	40 U	41 U	42 U	100%
LLMW-04D	**1.03**	**1.44**	**0.23 J**	0.093 U	42%	--	--	--	--	--	--	--	--	--	--
LLMW-05D	**2.53**	**0.368 J**	0.069 U	0.041 U	87%	1.0 U	**1.18 J**	0.77 U	0.96 U	0%	--	--	--	--	--
LLMW-06D	**0.58**	**1**	0.13 U	0.093 U	37%	2.9 U	**1.12 J**	1.6 U	0.95 U	0%	--	--	--	--	--
LLMW-08D	**1.05**	**0.774**	0.062 U	0.046 U	58%	1.0 U	**1.01 J**	0.77 U	0.96 U	0%	--	--	--	--	--
LLMW-11D	**1.16**	**0.257 J**	0.062 U	0.046 U	82%	**4.4 J**	**6.13**	1.6 U	0.95 U	42%	**3.56 J**	**4.23 J**	5.1 U	5.2 U	46%
LLMW-12D[4]	**445**	**1,170**	2.8 U	1.6 U	28%	**46.5**	**1,660**	6.2 U	3.8 U	3%	**78.8**	**1,430**	20 U	21 U	5%
	476	**1,230**	2.8 U	1.6 U	28%	**55**	**1,730**	6.2 U	3.8 U	3%	**68.5**	**1,410**	20 U	21 U	5%
LLMW-13D[4]	**46.2**	**103**	0.51 U	0.37 U	31%	**14.8**	**81.3**	1.6 U	0.95 U	15%	**12.9 J**	**47.6**	5.1 U	5.2 U	21%
	42	**103**	0.37 U	0.51 U	29%	**17.7**	**81.2**	1.6 U	0.95 U	18%	**31.3 J**	**47.9**	5.1 U	5.2 U	40%
LLMW-16D	**0.22 J**	0.13 U	0.13 U	0.093 U	100%	2.9 U	0.80 U	1.6 U	0.95 U	--	--	--	--	--	--
LLMW-25D	--	--	--	--	--	1.0 U	0.35 U	0.77 U	0.96 U	--	--	--	--	--	--
LLMW-27D[4]	**4,440**	3.2 U	**20.6**	1.6 U	100%	**4,640**	1.4 U	3.1 U	3.8 U	100%	**4,160**	200 U	203 U	210 U	100%
	4,400	3.2 U	**27.3**	1.6 U	100%	**4,770**	1.4 U	3.1 U	3.8 U	100%	**4,090**	200 U	203 U	210 U	100%
LLMW-35D	--	--	--	--	--	1.0 U	**1.22 J**	0.77 U	0.96 U	0%	**1.71 J**	**2.20 J**	5.1 U	5.2 U	44%
LLMW-36D	--	--	--	--	--	**5.5**	**2.91 J**	0.77 U	0.96 U	65%	**17.1**	**91.7**	5.1 U	5.2 U	16%

Notes:

[1] Q1 was completed in January/February 2013, Q2 was completed in April/May 2013, Q3 was completed in August/September 2013 and Q4 was completed in October/November 2013.

[2] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[3] Includes duplicate sample collected in Q2.

[4] Includes duplicate samples collected in Q2, Q3 and Q4.

-- = Arsenic speciation was not performed

MMA = Monomethylarsonic acid

DMA = Dimethylarsenic acid

µg/L = micrograms per liter

U = The analyte was not detected at a concentration greater than the identified reporting limit

J = The analyte was detected and the detected concentration is considered an estimate

DUP = Field Duplicate Sample

Bold font type indicates analyte was detected

Table 6-25

Water Quality Parameters for Groundwater and Surface Water in Q1 (January 2013)

Everett Lowland

Everett, Washington

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Total Iron[1] (mg/L)	Ferrous Iron[2] (mg/L)	Turbidity (NTU)	Depth to Water[3] (Feet)
Shallow Monitoring Wells									
BP-01S	5.98	102	7.46	0.49	-111	5	1.2	11	4.20
BP-02S	6.7	52.3	8.32	0.39	-151	5.5	0.5	25	4.30
BP-03S	6.76	40.4	7.95	0.61	-143	5.5	2	3.4	3.30
BP-04S	7.1	32.1	5.99	1.17	-56	0	0	15	3.64
BP-05S	7.5	31	7.99	0.53	-171	0.5	0	6	3.61
BP-06S	6.41	51	7.4	0.8	-140	7	1	5.1	3.53
BP-07S	6.76	134	9.2	0.7	-258	3	2	8.7	3.22
BP-08S	6.41	166	6.8	0.7	-147	7	2	6.3	3.20
BP-09S	6.3	80.1	8.43	0.64	-135	5.5	1	69	3.13
BP-10S	6.26	72	6.6	0.5	-133	7	2	7.6	2.61
EV-6A	5.99	34.4	10	1.99	170	0	0	1.2	46.29
EV-13	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
EV-22A	6.3	147	9.85	0.54	0.104	5	2.5	4.4	13.07
LLMW-03S	5.1	26.5	9.61	0.71	-40	5.1	1.5	24	5.34
LLMW-04S	6.37	162	9.65	0.59	-136	5.6	2	25	7.42
LLMW-05S	5.1	99	10.99	1.21	-34	6.8	1.3	3.1	4.78
LLMW-06S	6.07	70	7.8	0.6	-76	7	2	7.2	3.23
LLMW-07S	6.06	187	8.5	1.73	-3	0.5	0.2	0.95	8.75
LLMW-08S	6.3	370	10.11	0.8	-111	5.8	1.4	35	6.02
LLMW-09S	6.18	36	7.7	0.3	-64	7	1	8.3	3.48
LLMW-10S	6.44	69	8.2	0.8	-54	5	1	4.3	7.25
LLMW-11S	5.67	58	9.3	1.1	59	0.5	0.5	8.7	11.41
LLMW-12S	6.29	35	8.5	0.6	-13	6.5	3	10.3	6.60
LLMW-13S	6.2	120	10.5	0.5	-134	7	4	7.2	11.86
LLMW-14S	6.44	4	6.3	0.8	42	0.5	0	7.7	5.32
LLMW-15S	6.54	52	9.4	0.8	-243	7	1.5	1.4	6.46
LLMW-16S	6.57	109	10.14	0.65	-149	4.5	2.4	16	10.10
LLMW-17S	6.65	41	8.8	1.7	-32	0	0	5.4	11.36
LLMW-18S	6.26	43	8.3	1.1	-89	4	1.5	8.2	6.78
LLMW-21S	6.37	34	9.6	1	-5	0.5	0.5	8.3	6.62
LLMW-22S	6.17	720	9	1.4	-64	4	2.6	4.6	4.26
LLMW-23S	5.26	78.8	13.57	0.95	-92	5.2	1.5	11	10.21
LLMW-27S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-29S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-33S	5.58	30.7	9.81	7	171	0.7	0	OR	8.38
LLMW-34S	5.43	34.3	11.03	1.1	155	0	0	8.4	6.72
MW-1202R	6.3	217	9.53	0.91	-48	0.7	0.6	2.5	5.91
MW-1203R	5.79	122	9.96	0.78	-11	2	0.6	UR	8.62
MW-1301R	6.06	79	8.56	0.41	-14	0.5	0	UR	5.48
MW-1501R	6.24	344	7.29	1.79	10	1.5	0.5	5	3.24
MW-1701	6.41	68.7	9.48	0.4	-124	7	1.5	7	2.22
PZ-1B	6.09	76	8.2	0.5	-95	7	2.5	7.3	2.13
PZ-2B	6.28	33	5.9	0.5	44	0.5	0	5.2	2.63
PZ-3B	6.26	273	6.4	0.6	96	0	0	3.2	3.63
UNK	8.05	74	9.6	1.6	-250	2.5	0	10.3	8.86
Deep Monitoring Wells									
BP-01D	6.1	56.5	10.17	0.8	-70	0	0	16.8	6.79
BP-02D	6.14	45.6	10.62	0.52	-14	0	0	19	11.68
BP-03D	6.32	49.8	9.8	0.87	-104	0.5	0	6.5	10.44
BP-04D	6.3	59.9	16.65	0.82	-59	0.5	0.1	49	10.70
BP-05D	6	39.5	11.35	1.98	53	0	0	18	10.18
BP-05D2	6.92	30.1	10.5	0.94	-46	0	0	13	6.80
BP-06D	6.23	47	10.7	0.6	-54	1	0.5	6.3	10.93
BP-07D	6.43	49	11	0.7	-156	0.5	0.5	5.5	10.55
BP-08D	6.46	171	10	0.6	-68	1.5	0.5	8.6	10.97
BP-09D	6.18	87.7	9.84	0.66	-101	6.25	1	19	10.84
BP-10D	6.23	122	10.3	0.4	-95	7	4	12.9	9.19
EV-6B	7.76	61	10.92	0.48	-345	NR	NR	33	50.95
EV-19B	6.12	53	12.5	6.5	63	0.5	0	5	47.30
EV-20B	6.22	29	12.2	9.6	52	4	0	5.3	50.01
EV-22B	6.57	411	9.16	0.63	-119	4.7	1.5	10.5	19.61
LLMW-01D	5.72	59.8	12.13	0.87	-101	4.5	2.4	95	6.72
LLMW-02D	5.5	118	12.5	0.6	-94	5.1	1.75	14.8	7.16
LLMW-03D	5.34	55.8	11.96	0.72	-57	0.6	0.6	15	7.96
LLMW-04D	6.82	229	11	0.58	-174	0.5	0	19	12.65
LLMW-05D	5.59	129	11.92	0.49	-72	5.8	1.7	9.1	6.03
LLMW-06D	6.71	640	11.5	1.5	-77	1.5	0.5	12.3	4.68
LLMW-07D	5.94	133	10.1	1.35	-88	5	2.6	45	4.05
LLMW-08D	6.56	520	11.6	0.82	-147	6	2	6	7.70
LLMW-09D	6.5	55	14.18	0.5	-52	1.5	1	10.8	5.14
LLMW-10D	6.58	41	11.4	0.6	-101	6	1	8.9	8.94
LLMW-11D	5.97	65	10.6	7	-27	4.5	1	8.3	11.15
LLMW-12D	6.51	44	11.6	1	-89	1.5	0.5	5.6	9.82

Table 6-25. Water Quality Parameters for Groundwater and Surface Water in Q1 (January 2013)

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Total Iron[1] (mg/L)	Ferrous Iron[2] (mg/L)	Turbidity (NTU)	Depth to Water[3] (Feet)
Shallow Monitoring Wells									
LLMW-13D	6.43	80	11.1	0.4	-94	3	2.5	25.6	13.63
LLMW14D	6.57	53	11.3	1.3	-262	0.5	0.5	5.4	7.71
LLMW-15D	6.49	85	11.2	1.1	-333	0	0	6.1	8.32
LLMW-16D	6.48	127	11.63	0.53	-84	1.3	0	79	13.73
LLMW-17D	6.72	40	10.3	0.7	-187	2.5	1.5	33.2	11.10
LLMW-18D	6.48	123	10.7	0.6	-347	0.5	0	23.4	8.06
LLMW-19D	5.85	61.8	11.35	0.76	-107	1.4	1	30	7.03
LLMW-20D	5.5	381	7.03	0.84	1.09	0.2	0.2	UR	8.23
LLMW-21D	6.57	79	11.8	0.8	-320	0.2	0.2	12.2	8.12
LLMW-22D	6.31	138	12	1	-48	0.6	0.6	4.7	5.89
LLMW-23D	5.71	204	12.81	0.47	-110	1.8	1.5	33	18.16
LLMW-24D	6.15	31.4	10.49	0.69	65	0.05	0	71	44.28
LLMW-25D	5.77	32.5	11	3.49	88	0	0	43	51.72
LLMW-27D	6.36	41	12.3	3.4	61	0.5	0	9.5	47.51
LLMW-29D	6.38	32.9	9.55	2.85	29	0	0	59	41.36
LLMW-31D	6.59	50	12.8	1.9	39	0.5	0	2	44.00
LLMW-33D	5.94	29.1	10.9	2.04	151	1	0	3.2	26.32
LLMW-34D	8.04	33	10.23	0.7	-125	0	0	11	31.25

Notes:

[1] Total iron measured without field filtration

[2] Dissolved iron measured without field filtration

[3] Depth to water measured in feet below top of casing at time of sampling.

OR = Over-reading: The value was higher than the highest reading on the instrument

UR = Under-reading: The value was lower than the lowest point on the instrument calibration curve

NR = Not recorded

NA = Not applicable

mS/m - Siemens per meter

NTU = Nephelometric turbidity units

mg/L = milligrams per liter

mV = Millivolts

Table 6-26

Water Quality Parameters for Groundwater and Surface Water in Q2 (April/May 2013)

Everett Lowland

Everett, Washington

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Total Iron[1] (mg/L)	Ferrous Iron[2] (mg/L)	Turbidity (NTU)	Depth to Water[3] (Feet)
Shallow Monitoring Wells									
BP-01S	5.91	67.9	10.96	5.62	-99.6	5	3.5	7.61	5.03
BP-02S	6.92	39.8	10.95	0.17	-141.8	9	5	5.35	4.95
BP-03S	6.97	26.6	12.56	0.43	-93.9	5	2	3.84	4.07
BP-04S	7.48	25.2	11.56	0.63	-24.7	0.5	0	2.99	3.94
BP-05S	7.72	25.8	11.82	0.27	-139.9	3	1	1.65	3.71
BP-06S	6.49	34.5	12.76	0.13	-95.2	8	1.5	4.31	3.91
BP-07S	6.92	154	11.3	2.1	-265	2	0.5	3.53	3.37
BP-08S	6.42	155	10.7	1.9	-172	9	1	4.54	3.37
BP-09S	6.56	78	11.2	2.2	-172	10	3	3.06	3.21
BP-10S	6.23	75	10.8	2.6	-130	13	3	4.27	3.01
EV-6A	6.45	39	14.36	2.48	-1.2	1.5	0.5	24.1	46.73
EV-13	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
EV-22A	6.44	147	10.86	2.07	-84.5	12	1.5	30.2	14.17
LLMW-03S	--[5]	37.7	10.04	0.4	-119	7.5	5	1.24	5.41
LLMW-04S	6.75	115.7	10.4	0.11	-136.2	3.5	3.5	7.97	8.34
LLMW-05S	5.98	26.9	12.94	2.29	4.3	3	2.5	1.97	5.59
LLMW-06S	6.28	41.8	11.11	0.48	-119.6	4.5	2	2.77	4.28
LLMW-07S	6.74	76.8	11.12	0.85	-21.1	0.5	0	2.83	5.59
LLMW-08S	7.91	171.3	10.15	0.43	-122.5	3	1.5	3.47	10.11
LLMW-09S	6.41	48	11.2	1.3	-99	6	1	3.37	4.06
LLMW-10S	6.46	47.6	11.29	0.3	-63.5	5.5	1.5	2.59	7.76
LLMW-11S	5.84	27	10.47	3.03	40.6	4	1.5	1.51	12.20
LLMW-12S	6.47	23.5	10.8	0.35	-63.9	3.5	3	1.35	7.16
LLMW-13S	6.48	143	10.8	1.5	-150	11	4	2.74	12.48
LLMW-14S	6.74	19	12.36	7.68	22.7	2	1.5	4.29	6.30
LLMW-15S	6.49	30.5	11.44	0.46	-57.9	5	1.5	2.84	7.34
LLMW-16S	6.56	136	10.4	1.5	-174	7	5.5	4.63	11.38
LLMW-17S	6.57	43	10.4	6.6	67	0	0	2.78	11.93
LLMW-18S	5.88	31	11.1	2	-24	13	4	1.54	7.16
LLMW-21S	6.17	19.7	11.3	0.85	-100.2	2	1.5	0.98	7.25
LLMW-22S	6.22	257	11.4	3	-126	4.5	0.5	2.15	4.60
LLMW-23S	6.1	89	12.41	0.16	-79.1	5.5	1.5	5.2	11.47
LLMW-27S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-29S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-33S	5.78	24	NR	4.4	97	0	0	61.8	9.30
LLMW-34S	5.94	33	12.2	2.3	134	1.5	0	29.2	7.18
MW-1202R	6.13	119	12.33	2.29	-98	--[6]	--[6]	1.7	7.01
MW-1203R	6.1	104	12.24	2.89	48	--[6]	--[6]	UR	9.57
MW-1301R	6.52	67.5	10.69	2.75	88	--[6]	--[6]	UR	6.90
MW-1501R	6.25	146	11.49	2.34	-71	--[6]	--[6]	4.1	3.80
MW-1701	6.96	58	11.2	1.3	-168	6.5	5	4.3	2.84
PZ-1B	6.1	68	11.3	1.8	-132	13	3	1.44	2.40
PZ-2B	6.19	36	10.3	1.8	26	0	0	0.81	2.82
PZ-3B	6.59	40	10.6	3	27	1.5	0	2.71	4.46
UNK	9.22	68	10.7	1.2	-265	0	0	4.55	9.31
Deep Monitoring Wells									
BP-01D	6.45	30.6	12.42	1.25	-80.7	0.5	0.5	0.74	10.11
BP-02D	6.28	36.4	12.29	0.31	-24.4	0	0	3.45	11.62
BP-03D	6.58	33.4	12.66	0.37	-100.8	0.5	0	2.77	11.95
BP-04D	6.56	34.5	11.52	0.36	-76.2	0.5	0.5	2.21	10.73
BP-05D	6.33	32.3	12.22	0.77	-29.6	0	0	4.79	11.49
BP-05D2	7.34	23.8	12.58	0.35	-104.2	1	1	4.21	7.01
BP-06D	6.34	37.5	13.88	0.24	-11.8	1	0.5	3.77	11.33
BP-07D	6.38	42	12.8	2.2	-116	0.5	0.5	4.68	11.61
BP-08D	6.46	162	12.1	1.9	-62	1.5	0.5	3.61	11.46
BP-09D	6.37	83	11.9	2.1	-129	11	1.5	4.88	12.17
BP-10D	6.21	117	12.4	2.1	-93	>14 [4]	2.5	4.98	9.73
EV-6B	7.9	50	14.08	0.68	-358.9	0	0	7.05	50.99
EV-19B	6.47	49	13	6.5	109	1.5	0	2.92	47.14
EV-20B	6.23	28	12.9	7.7	111	0.5	0	2.79	49.85
EV-22B	6.63	330	11.96	0.36	-61	3.5	2	32	19.58
LLMW-01D	6.83	39.8	13.42	2.45	-113.5	3.5	3	2.45	10.23
LLMW-02D	6.61	94	14	1.3	-156	>14 [2]	5.5	3.79	9.91
LLMW-03D	6.8	64.8	10.49	0.8	-164	0	0	0.87	11.84
LLMW-04D	6.98	51.4	12.25	0.39	-197.7	0.5	0.5	4.78	16.84
LLMW-05D	6.55	78	12.7	2.1	-113	4.5	1.5	1.12	10.30
LLMW-06D	7.1	79.3	10.59	1	-161	3.5	2	6.95	5.99
LLMW-07D	6.76	54.5	12.4	2.38	-120.6	5.5	4.5	25	9.57
LLMW-08D	6.82	225.1	10.61	0.36	-110	6.5	1	1.05	12.91
LLMW-09D	6.43	57	12.3	2	-41	0.5	0.5	5.62	7.38
LLMW-10D	6.65	29.2	12.45	0.29	-62.9	3.5	2.5	5.39	10.08

Table 6-26. Water Quality Parameters for Groundwater and Surface Water in Q2 (April/May 2013)

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Total Iron[1] (mg/L)	Ferrous Iron[2] (mg/L)	Turbidity (NTU)	Depth to Water[3] (Feet)
LLMW-11D	6.38	37.7	10.86	0.64	21.3	1	0.5	4.28	13.78
LLMW-12D	6.48	41.2	12.39	0.17	-47.2	3	1	4.64	10.73
LLMW-13D	6.63	56	11.6	1.5	-121	3	1.5	4.97	15.66
LLMW14D	6.57	43.1	12.64	0.35	-187.2	0	0	4.67	11.12
LLMW-15D	6.84	68	12.87	0.68	-284.4	0	0	1.29	10.95
LLMW-16D	6.47	121	12.5	1.4	-80	1	0.5	4.58	16.27
LLMW-17D	6.41	41	10.5	2	-103	3.5	1	1.37	15.82
LLMW-18D	6.52	135	13.1	1.7	-354	0.5	0.5	3.82	11.24
LLMW-19D	6.39	41.1	12.08	0.21	-181.7	3	2	6.32	8.79
LLMW-20D	6.18	61	10.4	1.9	46	0.5	0	UR	12.28
LLMW-21D	6.52	60.4	12.99	0.23	-307.8	1	0.5	5.01	12.56
LLMW-22D	6.32	172	13.3	1.9	-112	11	0.5	2.36	6.83
LLMW-23D	6.41	204	13.51	1.31	-193.5	1	1	2.72	20.40
LLMW-24D	6.47	27	13.8	1.6	69	0	0	16.6	44.45
LLMW-25D	6.18	32	13.1	4.4	91	0	0	8.5	51.91
LLMW-27D	6.41	36	13.3	5.9	110	NR	NR	22.2	47.36
LLMW-29D	6.74	33	13.6	3.6	104	9	0	47.2	41.11
LLMW-31D	6.4	59	13.6	2.8	117	0.5	0	9.54	43.79
LLMW-33D	6.38	30	13	3.3	124	0.5	NR	4.42	26.9
LLMW-34D	7.37	32	13.7	2.1	-125	2.5	0	4.18	31.8

Notes:

[1] Total iron measured without field filtration

[2] Dissolved iron measured without field filtration

[3] Depth to water measured in feet below top of casing at time of sampling.

[4] The maximum scale for the iron test kit is 7 mg/L. Values listed as >14 mg/L were above the scale after one dilution was performed (equal parts sample and distilled water).

[5] The pH meter was not operating correctly. No pH measurement was recorded for this well during Q2. Note however the pH ranged between 5.1 and 6.59 during Q1, Q3 and Q4. The pH meter was replaced with an operating and calibrated pH meter after sampling this well.

[6] Samples collected by Floyd Snyder; GeoEngineers collected sample split and copied down parameters. Floyd Snyder did not measure total or ferrous iron.

UR = Under-reading: The value was lower than the lowest point on the instrument calibration curve

NR = Not recorded

mS/m - Siemens per meter

NTU = Nephelometric turbidity units

mg/L = milligrams per liter

mV = Millivolts

-- The investigation activity was not performed at the identified location.

Table 6-27

Water Quality Parameters for Groundwater and Surface Water in Q3 (August/September 2013)

Everett Lowland

Everett, Washington

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Ferrous Iron[1] (mg/L)	Turbidity (NTU)	Salinity (Parts per thousand)	TDS (g/l)	Depth to Water[2] (Feet)
Shallow Monitoring Wells										
BP-01S	6.16	90	17.4	3.9	-112	3.5	96.6	0	0.6	5.7
BP-02S	7.32	21.6	16.5	0.12	-201.4	1	2.24	0.12	0.168	6.39
BP-03S	7.14	43.3	19.1	0.05	-146.6	2	0.9	0.24	0.318	5.44
BP-04S	7.05	96.3	20.8	2.6	-129	0	1.17	0	0.65	5.44
BP-05S	8.46	35.1	19.6	0.05	-261	0	2.15	0.19	254.8	5.54
BP-06S	6.36	53.9	19.5	3.4	-123	1	22.8	0	0.34	5.45
BP-07S	7.03	129	17.2	0.04	-288.7	1.5	1.39	0.77	0.982	4.98
BP-08S	7.77	16.2	17.3	1.18	-148	1	3.98	0.1	1.1	4.84
BP-09S	7.91	9	14.2	1.13	-171	1.5	2.15	0	0.6	4.82
BP-10S	7.42	9.7	17	1.14	-146	1	3.15	0	0.6	5.19
EV-6A	6.46	45.4	14.7	1.03	41.4	0	19.3	0.28	0.367	48.16
EV-13	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
EV-22A	6.62	147	12.4	0.22	-163.4	1	9.52	0.84	1.079	15.75
LLMW-03S	6.33	58.5	17.1	3.2	-68	1.5	3.2	0	0.36	7.60
LLMW-04S	7.12	154	14.5	0.24	-200.1	1.5	7.39	0.98	1.248	9.73
LLMW-05S	6.22	16.2	19.1	0.16	-22.8	1.5	3.29	0.09	0.119	6.48
LLMW-06S	6.48	65	19.7	0.11	-86.1	1	0.35	0.35	0.468	6.44
LLMW-07S	5.94	33.8	18.2	0.08	-4.6	2.5	1.59	0.19	0.254	6.47
LLMW-08S	8.46	44.1	16.2	0.87	-198	0.5	4.5	0.2	2.8	10.33
LLMW-09S	6.7	49.9	19.5	0.11	-94.9	1	1.09	0.27	0.361	5.63
LLMW-10S	6.51	75	18.6	3.9	-79	1	111.3	0	0.48	8.18
LLMW-11S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-12S	6.58	17.4	17.3	0.16	-98.5	1.5	0.56	0.09	0.126	8.02
LLMW-13S	6.28	113	15.3	3.8	-121	3.5	3.54	0.1	0.7	13.16
LLMW-14S	–[3]	68.8	17.8	0.87	-114	0.5	4.32	0	0.44	6.92
LLMW-15S	–[3]	89.1	17.4	0.83	-145	1.5	3.98	0	0.57	7.88
LLMW-16S	6.12	90	17.6	3.3	-76	1.5	508.3	0	0.57	12.37
LLMW-17S	6.39	38	15.7	8.8	102	0	3.15	0	0.25	12.79
LLMW-18S	7.77	13.2	18.3	0.97	-90	2	1.35	0.1	0.8	7.57
LLMW-21S	6.69	40.4	18.4	0.3	-218.2	2	4.38	0.22	0.301	7.37
LLMW-22S	6.43	9.04	18.8	0.28	-226	1	2.9	5.81	6.656	5.25
LLMW-23S	6.45	31.7	14.5	0.16	-113.4	1.5	3.57	0.19	0.259	14.69
LLMW-27S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-29S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-33S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-34S	5.96	34	15.9	3	184	0	43.4	0	0.21	10.26
MW-1202R	8.27	32.8	15.8	0.73	-123	0.5	4.3	0.2	2.1	6.70
MW-1203R	6.46	27.6	16.6	0.16	-26.3	2	4.1	UR	0.213	9.97
MW-1301R	8.01	9.5	16.9	0.87	-98	0.5	3.2	UR	0.6	8.3
MW-1501R	7.44	2.79	17.6	1.17	-103	NR	4.57	1.7	17	4.16
MW-1701	6.92	74	16.8	0.03	-143.1	1.5	3.56	0.43	0.572	4.54
PZ-1B	7.78	9.1	19	0.98	-100	1.5	1.56	0	0.6	3.36
PZ-2B	7.36	73.8	17	1.1	-22	0	1.21	0	0.47	3.98
PZ-3B	5.96	382	19.7	3.38	108.9	0	22.4	2.25	2.74	4.75
UNK	11.53	63.3	15.6	0.98	-328	0	8.41	0	0.41	10.56
Deep Monitoring Wells										
BP-01D	6.53	45.6	13.2	4.8	-31	0	2.24	0	0.29	12.85
BP-02D	6.55	40.9	13.1	0.15	-26.9	0.5	2.13	0.26	0.343	13.51
BP-03D	6.93	15.8	12.8	0.08	-71.9	0	2.68	0.09	0.128	12.92
BP-04D	6.33	53.1	13.9	3.3	-35	0.5	4.71	0	0.34	12.24
BP-04D2	7.61	21.3	13.1	0.06	-141.9	0.5	6.06	0.13	0.179	10.77
BP-05D	6.67	34.1	13.6	0.48	-51.8	0	1	0.21	284.06	12.97
BP-05D2	7.62	13.1	13.8	0.11	-154.3	0.5	4.3	0.08	0.108	7.42
BP-06D	6.12	54.2	13.4	3.6	-3	0.5	4.82	0	0.35	12.85
BP-07D	6.63	33.4	13.5	0.11	-61.5	0	1.93	0.1	0.135	12.00
BP-07D2	7.51	23.6	13.7	0.1	-148.4	1	5.53	0.14	0.196	6.75
BP-08D	7.88	17.1	13.3	1.08	-52	0.5	3.12	0.1	1.1	12.05
BP-09D	7.25	9.3	13.2	1.03	-129	1.5	3.98	0	0.6	13.24
BP-10D	7.62	12.1	12.6	1.18	-102	1	3.45	0.1	0.8	10.61
EV-6B	8.03	51	14.8	0.54	-367.4	0	2.69	0.31	0.409	51.14
EV-7B	6.62	27.2	11.9	0.65	-34.4	0	3.45	0.17	0.235	7.17
EV-19B	6.62	38.6	15.3	4.19	87	0	3.47	0.23	0.3087	45.75
EV-20B	6.27	13.7	14.7	5	134.3	0	4.8	0.08	0.111	50.49
EV-22B	6.71	361	14.1	1.41	-92.4	1	24.5	2.45	2.954	19.62
LLMW-01D	7.12	17.9	13.2	0.17	143.6	1.5	0.77	0.11	0.149	10.77
LLMW-02D	6.85	81	13.2	0.06	-126.5	1.5	1.02	0.53	0.689	9.57
LLMW-03D	6.56	90	13.1	3.6	-44	0	2.1	0.2	0.3	11.64
LLMW-04D	7.11	40.5	12.7	0.31	-192.5	0	5.75	0.26	0.347	17.24
LLMW-05D	6.61	18.9	15.9	0.13	-102.4	2	2.65	0.11	0.149	11.98
LLMW-06D	6.77	37.2	13.2	0.11	-79.8	1	3.06	0.23	0.312	6.83
LLMW-07D	6.83	26.6	14	0.13	-95.7	1.5	5.06	0.16	0.219	9.72
LLMW-08D	8.02	28.8	13.4	0.73	-192	1.5	3.98	0.1	1.8	12.23

Table 6-27. Water Quality Parameters for Groundwater and Surface Water in Q3 (August/September 2013)

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Ferrous Iron[1] (mg/L)	Turbidity (NTU)	Salinity (Parts per thousand)	TDS (g/l)	Depth to Water[2] (Feet)
LLMW-09D	6.76	52	13.7	0.14	-35.1	0.5	3.88	0.32	0.429	9.12
LLMW-10D	6.55	44.1	13	3.4	-75	1	12.6	0	0.29	8.78
LLMW-11D	6.69	38.1	12.8	0.11	-99.9	2	2.25	0.24	0.323	15.92
LLMW-12D	6.73	38.2	12.8	0.21	102.6	0.5	1.59	0.24	0.324	9.76
LLMW-13D	6.54	54.6	12.6	4.8	-98	1	4.82	0	0.35	14.81
LLMW14D	--[3]	9.7	13.2	0.86	-187	0	3.72	0	0.6	8.20
LLMW-15D	--[3]	15.6	13.7	0.76	-345	0	3.71	0.1	1	9.85
LLMW-16D	6.45	95	14.1	3.5	-35	0.5	3.21	0	0.6	14.32
LLMW-17D	6.36	53	12.8	3.5	-107	1.5	1.85	UR	0.35	14.16
LLMW-18D	11.22	20.3	14.1	0.87	-354	0.5	2.54	0.1	1.3	11.86
LLMW-19D	6.85	52	13.7	0.11	-197.8	1.5	3.71	0.32	0.429	7.57
LLMW-20D	5.95	204	18.5	0.35	44.9	2	12.6	3.6	4.264	8.39
LLMW-21D	9.72	62	13.4	0.08	-310.4	0.5	4.59	0.39	0.52	9.82
LLMW-22D	6.69	219	14.1	0.15	-75.2	1	4.59	1.44	1.788	6.70
LLMW-23D	6.66	29.7	13.8	0.21	-97	1.5	4.32	0.18	0.245	20.77
LLMW-24D	6.2	68.6	13.2	0.76	91	0	3.7	0	0.44	44.48
LLMW-25D	6.16	61.6	13.5	0.99	87	0	3.9	0	0.39	51.9
LLMW-27D	6.5	15.4	19.6	3.89	102.3	0	7.73	0.09	0.125	47.94
LLMW-29D	6.81	28.4	15.8	1.95	66.8	0	45.8	0.17	0.224	41.73
LLMW-31D	6.45	44.3	16.2	0.15	116.5	0	39.4	0.27	0.362	44.55
LLMW-33D	6.46	25.7	15	1.18	99.6	0	2.32	0.15	0.206	28.39
LLMW-34D	7.82	29	14.8	3.9	-118	0	5.08	0	0.3	33.85
LLMW-35D	8.9	68.2	15.8	0.67	-159	0	1.75	0	0.43	77.05
LLMW-36D	6.31	23.6	12.1	0.08	91.2	0	2.44	0.15	0.204	8.23

Notes:

[1] Ferrous iron measurements were performed in the field on the dissolved groundwater fraction (i.e., after filtration through 0.45 um filters).

[2] Depth to water measured in feet below top of casing at time of sampling.

[5] The pH meter was not operating correctly. No pH measurement was recorded for this well during Q3. The pH meter was replaced with an operating and calibrated pH meter after sampling wells on this day.

mS/m - Siemens per meter

NTU = Nephelometric turbidity units

UR = Under-reading: The value was lower than the lowest point on the instrument calibration curve

TDS = Total dissolved solids

mg/L = milligrams per liter

g/L = grams per liter

mV = Millivolts

-- The investigation activity was not performed at the identified location.

NR = Not recorded (inadvertently not recorded on field form due to field error)

NA = Not applicable

Table 6-28

Water Quality Parameters for Groundwater and Surface Water in Q4 (October/November 2013)

Everett Lowland

Everett, Washington

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Ferrous Iron[1] (mg/L)	Turbidity (NTU)	Salinity (Parts per thousand)	TDS (g/l)	Depth to Water[2] (Feet)
Shallow Monitoring Wells										
BP-01S	6.67	80	13.8	0.66	-84.3	1.5	14.1	0.5	0.658	5.49
BP-02S	7.25	46.6	14.1	0.52	261.4	1	11.3	0.29	0.382	5.90
BP-03S	7.33	40	13.4	0.53	-108.9	1.5	4.11	0.25	0.334	4.77
BP-04S	7.72	42.3	13.4	0.34	-70.5	0.5	2.59	0.26	0.353	4.72
BP-05S	8.15	41.3	13.8	0.4	-179.1	1.5	3.96	0.26	0.342	4.70
BP-06S	6.63	56	12.5	0.36	-170.1	2	3.86	0.36	0.481	3.76
BP-07S	6.97	145	13.6	0.22	-216.6	1.5	UR	0.95	1.209	3.29
BP-08S	6.68	114	12.4	0.44	-68.7	3	5.32	0.76	0.982	3.28
BP-09S	6.9	69	13	0.29	-96.5	1.5	3.12	0.45	0.585	3.26
BP-10S	6.62	71	12.9	0.32	-58.9	3	4.17	0.45	0.592	3.18
EV-13	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
EV-22A	6.66	119	12	0.47	-58.6	1	4.83	0.8	1.034	15.07
EV-6A	6.38	147	14.4	1.8	145.4	0	4.51	0.45	0.598	46.53
LLMW-03S	6.59	22.8	15.3	0.42	-56.2	1.5	2.03	0.13	0.182	7.21
LLMW-04S	6.85	148	13.4	0.42	-187.6	2.5	1.11	0.97	1.229	7.84
LLMW-05S	6.34	27.4	15.9	0.48	-4.7	1.5	3.62	0.16	0.215	6.36
LLMW-06S	6.54	45.9	15	0.3	-40	3	2.18	0.28	0.368	5.96
LLMW-07S	6.02	2158	13.4	0.41	70.4	1.5	0.61	16.92	17.856	5.73
LLMW-08S	6.53	328	13.3	0.5	-58.8	4	5.06	2.23	2.6	9.94
LLMW-09S	6.33	111	14	0.43	-107	1	4.85	0.71	0.917	5.00
LLMW-10S	6.67	97	13	0.33	-99.4	3	0.9	0.63	0.819	7.62
LLMW-11S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-12S	6.41	46.9	13.5	0.34	-46.1	1.5	0.54	0.29	0.391	7.19
LLMW-13S	6.75	89	14.4	0.25	-79.4	1.5	4.08	0.56	0.728	12.92
LLMW-14S	6.49	31.6	14.2	0.56	-13.7	1	5.36	0.19	0.259	6.67
LLMW-15S	6.69	61	14.5	0.36	-117.3	2.5	4.12	0.38	0.5	7.62
LLMW-16S	6.58	78	14.6	0.45	-49.5	2.5	3.17	0.48	0.63	12.31
LLMW-17S	6.49	41.3	13.8	6.63	63.5	0	0.87	0.26	0.342	12.65
LLMW-18S	6.44	54	12.5	0.48	197.8	2	3.72	0.35	0.455	7.02
LLMW-21S	6.65	36.8	13.8	0.54	14	2	4.15	0.23	0.309	6.90
LLMW-22S	6.17	2075	13.7	0.38	-70	2	1.6	16.22	17.177	4.88
LLMW-23S	6.6	160	14.1	0.81	-74.7	1.5	3.25	1.04	1.313	15.09
LLMW-27S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-29S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-33S	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
LLMW-34S	6.19	25.1	14.6	0.32	42.6	0	3.72	0.15	0.203	9.03
MW-1202R	6.35	280	14.6	0.43	-152.1	1	3.27	1.84	2.262	6.08
MW-1203R	6.63	71	15.1	0.51	-113.8	1	2.03	UR	0.565	9.84
MW-1301R	6.97	47.6	14.7	1.08	-17.2	0	2.16	UR	0.383	7.96
MW-1501R	6.4	1409	14.7	0.48	-15.3	1.5	3.62	10.42	11.336	3.46
MW-1701	6.75	83	14.9	0.44	-97.1	2	3.73	0.51	0.669	4.37
PZ-1B	6.23	82	13.2	0.34	-143.3	1.5	2.79	0.53	0.689	2.6
PZ-2B	6.14	56	12	0.37	50.7	0	1.86	0.36	0.481	2.84
PZ-3B	6.21	197	11.7	4.45	108.6	0	1.79	1.38	1.716	3.6
UNK	10.45	53	14.3	0.21	-255.4	0	3.98	0.33	0.435	10.55
Deep Monitoring Wells										
BP-01D	6.94	41.3	11.9	0.24	-26.1	0.5	1.44	0.27	0.358	11.19
BP-02D	6.58	41.6	12	0.76	51.6	0	3.65	0.27	0.359	12.59
BP-03D	7.01	28.4	11.7	0.35	-24	0	1.04	0.18	0.248	11.71
BP-04D	6.8	34.5	11.9	0.45	19.8	1	2.65	0.22	0.399	10.84
BP-04D2	7.57	28.7	12.2	0.45	-150.3	0.5	4.65	0.18	0.246	10.82
BP-05D	6.71	32.1	12.2	0.53	77.8	0	4.55	0.2	0.276	11.43
BP-05D2	7.52	33.2	12.6	0.43	-137.6	0.5	4.14	0.21	0.283	7.38
BP-06D	6.27	49.6	12.3	0.32	-95.6	0.5	4.19	0.32	0.425	11.83
BP-07D	6.39	47.5	12.1	0.35	-121.9	0	3.49	0.31	0.409	10.51
BP-07D2	7.38	32.3	12.2	0.32	-161	1	5.05	0.21	0.277	6.91
BP-08D	6.76	121	12	0.4	30.5	0.5	4.86	0.82	1.046	11.87
BP-09D	6.64	70	12.4	0.35	-51.9	2	3.87	0.45	0.598	12.80
BP-10D	6.54	85	12	0.48	-17.3	3	4.36	0.56	0.735	10.38
EV-6B	7.93	71	13.7	0.29	-343.9	0	4.5	0.45	0.592	51.09
EV-7B	6.42	39	11.5	1.04	58.3	0	3.35	0.26	0.341	7.00
EV-19B	6.47	52	13.6	5.19	69.4	0	1.35	0.33	0.436	48.00
EV-20B	6.09	40.6	14.2	6.08	105.5	0	2.51	0.25	0.332	50.70
EV-22B	6.77	308	11.2	0.44	-34	3	4.29	2.24	2.724	19.48
LLMW-01D	6.98	38	12.7	0.3	-113.2	1.5	2.16	0.24	0.324	8.73
LLMW-02D	6.84	85	13.3	0.54	-91.6	1	3.15	0.54	0.708	9.63
LLMW-03D	6.7	49	12.3	0.37	-58.2	0	1.32	0.32	0.421	9.92
LLMW-04D	7.33	100	12.1	0.42	-256.1	0	1.89	0.67	0.865	14.23
LLMW-05D	6.6	58	14.1	0.26	-43.5	1	2.89	0.36	0.481	8.31
LLMW-06D	6.8	34.9	12.4	0.27	-24.1	1.5	3.72	0.22	0.3	5.81
LLMW-07D	6.69	286	13.2	1.65	-23.2	1.5	11.3	1.96	2.398	7.29
LLMW-08D	6.88	475	12.9	0.35	-96.2	2	1.69	3.38	4.011	7.87
LLMW-09D	6.61	76	13	0.31	-91.2	1	4.76	0.49	0.637	5.00
LLMW-10D	6.8	42.9	12	0.23	-80.7	2.5	4.3	0.28	0.371	8.16

Table 6-28. Water Quality Parameters for Groundwater and Surface Water in Q4 (October/November 2013)

Location Identification	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Ferrous Iron[1] (mg/L)	Turbidity (NTU)	Salinity (Parts per thousand)	TDS (g/l)	Depth to Water[2] (Feet)
LLMW-11D	6.75	42.1	13.1	0.61	-15.3	0.5	1.96	0.27	0.355	11.62
LLMW-12D	6.69	63	11.8	0.22	-118.1	1	4.77	0.42	0.546	8.48
LLMW-13D	6.85	40.8	12.1	0.64	-27.2	2	3.21	0.26	0.354	13.13
LLMW14D	6.68	54	12.4	0.24	-31.9	0	2.32	0.35	0.468	7.08
LLMW-15D	6.74	99	12.6	0.32	-312.3	0	2.38	0.65	0.845	8.46
LLMW-16D	6.71	71	12.9	0.33	13.3	1	4.27	0.46	0.598	12.67
LLMW-17D	6.55	51	13	0.32	-65.4	3.5	16.4	UR	0.429	12.32
LLMW-18D	6.88	82	11.8	0.43	-299	0	4.07	0.54	0.708	8.57
LLMW-19D	6.57	66	12.9	0.89	-50.6	2	4.67	0.42	0.559	7.57
LLMW-20D	6.11	204	13.3	0.46	116.6	0	4.92	3.49	4.128	10.22
LLMW-21D	6.84	60	12	0.28	-97.6	0	3.28	0.39	0.514	8.37
LLMW-22D	6.53	293	12.9	0.39	18.6	0.5	4.21	0.02	2.47	5.72
LLMW-23D	6.47	211	12.7	0.37	-14.9	0.5	5.83	1.43	1.788	16.82
LLMW-24D	6.63	23.5	12.3	0.54	74.3	0	1.32	0.15	0.203	44.37
LLMW-25D	6.41	24.2	12.7	3.31	82.5	0	1.26	0.15	0.206	51.79
LLMW-27D	6.44	26.8	13.5	4.57	45.4	0	25.4	0.17	0.223	48.14
LLMW-29D	6.72	40	13.8	2	56.6	0	9.9	0.25	0.332	42.10
LLMW-31D	6.28	660	13.6	0.32	74.7	0	4.89	0.42	0.553	44.83
LLMW-33D	6.46	23.7	12.7	1.42	41.2	0	2.73	0.15	0.201	28.45
LLMW-34D	8.22	24	12.2	0.53	-108	0	4.12	0.15	0.206	33.79
LLMW-35D	7.86	28.9	12.7	0.32	-98.9	0	2.17	0.18	0.246	77.33
LLMW-36D	6.21	34.9	11.2	0.33	76	0	2.01	0.23	0.308	8.51

Notes:

[1] Ferrous iron measurements were performed in the field on the dissolved groundwater fraction (i.e., after filtration through disposable 0.45 um filters).

[2] Depth to water measured in feet below top of casing at time of sampling.

mS/m - Millisiemens per meter

NTU = Nephelometric turbidity units

UR = Under-reading: The value was lower than the lowest point on the instrument calibration curve

TDS = Total dissolved solids

mg/L = Milligrams per liter

g/L = Grams per liter

mV = Millivolts

NR = Not recorded (the parameter was inadvertently not recorded on field form due to field error)

NA = Not applicable

Table 6-29

Conventionals Data for Shallow Groundwater, Surface Water, and Deep Groundwater in Q3 (August/September 2013)

Everett Lowland

Everett, Washington

	Analyte	Alkalinity	Bicarbonate	Carbonate	Hydroxide	TOC	DOC	Nitrate	Nitrite	Phosphorus	Sulfate	Chloride	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Sample Type [1]	Dissolved	Dissolved	Dissolved	Dissolved	Total	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Location Identification	Sample Identification																	
Shallow Wells																		
BP-01S	BP-01S-130821-W	493	493	1.0 U	1.0 U	20.2	17.4	0.1 U	0.1 U	0.1 U	0.3	12.5	119	72.9	28.1	1.76	7.56	20.5
BP-04S	BP-04S-130819-W	216	216	1.0 U	1.0 U	5.47	5.53	0.1 U	0.1 U	0.1 U	60.9	5.8	70	0.66	9.44	1.35	6.83	28.7
BP-05S	BP-05S-130819-W	180	180	1.0 U	1.0 U	6.09	6.3	0.1 U	0.1 U	0.1	17.5	5.2	41.3	0.91	5.8	0.211	5.73	31
BP-07S	BP-07S-130820-W	443	443	1.0 U	1.0 U	15.5	15.6	0.1 U	0.1 U	0.1 U	371	17.4	221	4.1	21.2	1.79	53.7	68
EV6A	EV6A-130828-W	199	199	1.0 U	1.0 U	7.54	7.56	0.1 U	0.1 U	0.1 U	72.4	4.5	66.7	4.29	10.1	2.07	12.5	9.23
LLMW-05S	LLMW-05S-130905-W	110	110	1.0 U	1.0 U	2.68	3.77	0.1 U	0.1 U	0.1 U	45.3	3.3	21.3	5.39	6.44	0.241	4.09	30.5
LLMW-06S	LLMW-06S-130826-W	368	368	1.0 U	1.0 U	5.74	5.82	0.1 U	0.1 U	0.1 U	8.9	5.9	63.1	9.04	17.2	0.685	20.5	64.8
LLMW-08S	LLMW-08S-130906-W	516	516	1.0 U	1.0 U	6.16	5.99	0.1 U	0.1 U	0.1 U	2.9	561	99.3	21.2	65.5	1.01	26.4	402
LLMW-12S	LLMW-12S-130826-W	179	179	1.0 U	1.0 U	6.09	6.22	0.1 U	0.1 U	0.1 UJ	6	8.1	43.3	15	7.65	0.414	5.58	18.8
LLMW-13S	LLMW-13S-130821-W	578	578	1.0 U	1.0 U	12.4	12.3	0.1 U	0.1 U	0.1 U	1.4	35.3	145	58	21.1	3.25	23.3	71
LLMW-16S	LLMW-16S-130823-W	465	465	1.0 U	1.0 U	8.5	9.01	0.1 U	0.1 U	0.1 U	0.4	18.3	95.7	94.2	66.4	3.56	19.1	51.5
Surface Water																		
LLSW-04	LLSW-04-130906-W	49.8	49.8	1.0 U	1.0 U	4.87	5.38	3.4	0.1 U	0.1 U	32.9	1.8	18.9	6.54	5.47	0.143	4.05	15.6
LLSW-05	LLSW-05-130906-W	16.5	16.5	1.0 U	1.0 U	2.85	2.87	0.1 U	0.1 U	0.1 U	9.8	0.5	9.46	0.28	0.69	0.071	1.23	1.08
Deep Wells																		
BP-01D	BP-01D-130821-W	185	185	1.0 U	1.0 U	1.7	1.76	0.1 U	0.1 U	0.1 U	19	16.5	21.4	0.18	24.5	0.198	5.87	31.4
BP-04D	BP-04D-130820-W	135	135	1.0 U	1.0 U	2.48	2.49	0.1 U	0.1 U	0.2	44.4	27.6	17.8	0.39	25.4	0.055	4.83	33.3
BP-05D	BP-05D-130819-W	140	140	1.0 U	1.0 U	2.02	1.9	2.2	0.1 U	0.4	37.9	14	26.8	1.25	29.9	0.03	3.26	19.5
BP-05D	DUP-01-130819-W	143	143	1.0 U	1.0 U	1.92	1.89	2.2	0.1 U	0.4	37.7	13.9	27.2	1.65	30.2	0.032	3.19	17.2
BP-05D2	BP-05D2-130904-W	128	128	1.0 U	1.0 U	1.50 U	1.50 U	0.1 U	0.1 U	0.1 U	19.1	7.1	25	0.77	16.9	0.088	3.07	9.84
BP-07D	BP-07D-130821-W	173	173	1.0 U	1.0 U	1.57	1.64	0.3	0.1 U	0.2	35.1	10.9	30.3	0.14	26.1	0.063	3.82	18.2
EV-19B	EV-19B-130903-W	153	153	1.0 U	1.0 U	1.78	1.86	1.3 J	0.1 UJ	0.2 J	31.4	33.1	33.9	0.05 U	28.9	0.002	3.84	14.8
EV-20B	EV-20B-130904-W	92.6	92.6	1.0 U	1.0 U	2.13	2.38	0.7	0.1 U	0.3	19.1	25.6	22.5	0.42	16.7	0.016	2.76	14
EV-6B	EV6B-130827-W	301	301	1.0 U	1.0 U	3.66	5.38	0.1 UJ	0.1 UJ	0.1 UJ	9.4	20.2	27.9	0.05 U	54.5	0.071	7.1	25.1
EV-7B	EV-7B-130909-W	91.8	91.8	1.0 U	1.0 U	1.63	1.9	1.1	0.1 U	0.1 U	61.7	13.4	31.4	0.05 U	17.3	0.051	3.33	11.7
LLMW-05D	LLMW-05D-130903-W	218	218	1.0 U	1.0 U	8.33	8.4	0.1 UJ	0.1 UJ	1.0 J	5	67.9	14	4.3	12.7	0.166	9.87	106
LLMW-06D	LLMW-06D-130826-W	200	200	1.0 U	1.0 U	3.59	3.56	0.1 U	0.1 U	0.2	2	31.4	11.1	2.37	24.4	0.146	11.8	54.9
LLMW-08D	LLMW-08D-130905-W	349	349	1.0 U	1.0 U	7.44	7.28	0.1 U	0.1 U	0.1 U	6.4	364	43.2	5.85	37.7	0.196	17.4	280
LLMW-11D	LLMW-11D-130820-W	204	204	1.0 U	1.0 U	9.5	8.87	0.1 U	0.1 U	0.1 U	2.5	24.6	12.3	11.7	12.5	0.535	10.2	64.9
LLMW-12D	LLMW-12D-130826-W	188	188	1.0 U	1.0 U	4.31	4.15	0.1 U	0.1 U	0.3 J	35.5	28.2	16.6	0.590 J	24.8	0.033 J	5.55	56.6
LLMW-12D	DUP-02-130826-W	182	182	1.0 U	1.0 U	3.97	4.24	0.1 U	0.1 U	0.3	35.9	27.8	17.3	1.44 J	26.2	0.077 J	5.91	61.3
LLMW-13D	LLMW-13D-130821-W	214	214	1.0 U	1.0 U	6.12	5.96	0.1 U	0.1 U	0.6 J	1.5	26.3	18.8	4.84	13.8	0.263	7.83	72.3
LLMW-13D	DUP-03-130821-W	214	214	1.0 U	1.0 U	6	6.12	0.1 U	0.1 U	0.4 J	1.6	26.7	19.2	4.87	14	0.284	7.97	73.2
LLMW-16D	LLMW-16D-130826-W	387	387	1.0 U	1.0 U	13	13.1	0.1 U	0.1 U	2	0.1 U	93.5	8.38	1.57	19.4	0.137	15.8	224
LLMW-25D	LLMW-25D-130905-W	97.7	97.7	1.0 U	1.0 U	1.50 U	1.50 U	1	0.1 U	0.1 U	52.6	4.4	18.7	0.36	16.6	0.066	3.36	18.9
LLMW-27D	LLMW-27D-130830-W	121	121	1.0 U	1.0 U	1.50 U	1.50 U	2.1	0.1 U	0.1 U	31.7	9.8	24.1	0.18	20.4	0.085	3.77	15.8
LLMW-27D	DUP-05-130830-W	121	121	1.0 U	1.0 U	1.50 U	1.50 U	2.1	0.1 U	0.1 U	31.8	9.8	23.9	0.19	20.2	0.083	3.72	15.6
LLMW-35D	LLMW-35D-130830-W	128	128	1.0 U	1.0 U	1.99	2.04	0.4 J	0.1 UJ	0.1 UJ	35.8	9.5	28.9	0.05 U	20.3	0.328	3.62	12.5
LLMW-36D	LLMW-36D-130906-W	112	112	1.0 U	1.0 U	5.61	5.67	0.1 U	0.1 U	0.1 U	39.4	5.7	19.5	0.06	19.8	0.157	1.59	14.8

Notes:

[1] All samples were filtered through disposable 0.45 um filters with the exception of samples analyzed for total organic carbon (TOC).

Alkalinity = Total alkalinity, reported as $CaCO_3$

Bicarbonate and carbonate reported as $CaCO_3$

TOC = Total Organic Carbon

DOC = Dissolved Organic Carbon

Nitrate and nitrite reported as Nitrate-N and Nitrite-N

Phosphorous reported as orthophosphate-P

J = The result is an estimate

Bold font indicates the analyte was detected in the sample

DUP = duplicate of the parent sample above

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

Table 6-30

Conventionals Data for Shallow Groundwater, Surface Water, and Deep Groundwater in Q4 (October/November 2013)

Everett Lowland

Everett, Washington

	Analyte	Alkalinity	Bicarbonate	Carbonate	Hydroxide	TOC	DOC	Nitrate	Nitrite	Phosphorus	Sulfate	Chloride	Calcium	Iron	Magnesium	Manganese	Potassium	Sodium
	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	Sample Type [1]	Dissolved	Dissolved	Dissolved	Dissolved	Total	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved	Dissolved
Location ID	Sample ID																	
Shallow Wells																		
BP-01S	BP-01S-131101-W	482	482	1.0 U	1.0 U	17.1	17.5	0.1 U	0.1 U	0.1 U	0.4	12.6	108	75.2 J	26.5	2.14	7.03	19.4
BP-04S	BP-04S-131031-W	187	187	1.0 U	1.0 U	4.88	5.01	0.1 U	0.1 U	0.1 U	92.5	7.3	66.6	0.69 J	10.2	1.16	5.66	30.1
BP-05S	BP-05S-131101-W	200	200	1.0 U	1.0 U	5.73	5.87	0.1 U	0.1 U	0.1 U	71	6.5	59	2.33 J	8.2	0.29	6.42	35.6
BP-07S	BP-07S-131113-W	514	514	1.0 U	1.0 U	15.9	16	0.2	0.1 U	0.1 U	176	18.3	172	3.49 J	19.2	1.74	44.8	60.1
EV-6A	EV-6A-131108-W	214	214	1.0 U	1.0 U	8.17	4.89	0.1 U	0.1 U	0.1 U	113	3.9	72.9	2.62	11.6	1.63	15.9	13.7
LLMW-05S	LLMW-05S-131106-W	109	109	1.0 U	1.0 U	2.66	2.19	0.1 U	0.1 U	0.2	41.6	7.2	27.9	81.4	8	0.24	3.75	26.8
LLMW-06S	LLMW-06S-131106-W	234	234	1.0 U	1.0 U	3.99	4.05	0.1 U	0.1 U	0.1 U	48.6	4.4	48.4	6.69	13.2	0.5	14.9	39.9
LLMW-08S	LLMW-08S-131107-W	466	466	1.0 U	1.0 U	5.88	5.96	0.1 U	0.1 U	0.1 U	1.7	672	85.7	13	63.4	0.8	24.2	412
LLMW-12S	LLMW-12S-131119-W	182	182	1.0 U	1.0 U	7.07	6.91	0.3	0.1 U	0.1 U	6.1	12.2	51.4	9.94	8.1	0.36	6.88	17.4
LLMW-13S	LLMW-13S-131114-W	514	514	1.0 U	1.0 U	11.8	11.8	0.1 U	0.1 U	0.1 U	1.1	34.1	117	50.7	17.2	2.94	21.4	79.2
LLMW-16S	LLMW-16S-131113-W	473	473	1.0 U	1.0 U	8.21	8.62	0.1 UJ	0.1 UJ	0.1 UJ	14.2	19.4	78	33.2	49	2.95	13.7	46.7
Surface Water																		
LLSW-04	LLSW-04-131119-W	140	140	1.0 U	1.0 U	7.15	7.17	0.2	0.1 U	0.1 UJ	30.9	9.2	40.7	2	9.9	0.27	5.68	16.7
LLSW-05	LLSW-05-131119-W	109	109	1.0 U	1.0 U	8.36	7.7	0.1	0.1 U	0.1 UJ	18.9	3.6	42.5	1.8	3.5	0.93	4.69	6.6
Deep Wells																		
BP-01D	BP-01D-131101-W	245	245	1.0 U	1.0 U	2.51	2.68	0.1 U	0.1 U	0.1 U	16.3	23.3	27.6	0.33 J	29.5	0.2	6.54	40.3
BP-04D	BP-04D-131031-W	136	136	1.0 U	1.0 U	2.07	2.26	0.1 U	0.1 U	0.4	46.8	30.6	17.6	0.61 J	25.4	0.04	4.88	33.1
BP-05D	BP-05D-131101-W	141	141	1.0 U	1.0 U	1.64	1.7	2.3	0.1 U	0.5	38.6	14.6	26.2	0.23 J	29.8	0.01	3.03	15.2
BP-05D	DUP-01-131101-W	145	145	1.0 U	1.0 U	1.64	1.71	2.3	0.1 U	0.5	38.7	14.8	26.4	0.22 J	30.1	0.01	3.05	15.6
BP-05D2	BP-05D2-131112-W	129	129	1.0 U	1.0 U	1.50 U	1.50 U	0.3	0.1 U	0.1 U	21	7.4	24.6	1.69 J	16.7	0.1	3.03	10.2
BP-07D	BP-07D-131113-W	170	170	1.0 U	1.0 U	1.63	1.72	0.4 J	0.1 UJ	0.2 J	39.8	12	31.1	0.81	27.4	0.06	3.77	19.2
EV-19B	EV-19B-131115-W	156	156	1.0 U	1.0 U	1.74	1.61	1.2	0.1 U	0.1	34.2	34.8	35.9	3.26	30.5	0.05	3.95	15.9
EV-20B	EV-20B-131115-W	102	102	1.0 U	1.0 U	2.04	2.03	0.7	0.1 U	0.3	22.6	30.8	26.1	0.17	19.4	0.01	2.82	14.7
EV-6B	EV-6B-131108-W	295	295	1.0 U	1.0 U	3.81	4.04	0.1 U	0.1 U	0.1 U	41.2	20	28.1	2.15	53.6	0.09	7.14	24.6
EV-7B	EV-7B-131114-W	94.1	94.1	1.0 U	1.0 U	1.64	1.73	1.1	0.1 U	0.1	67.8	14.8	30.7	0.15	18.4	0.02	3.3	12.1
LLMW-05D	LLMW-05D-131106-W	223	223	1.0 U	1.0 U	6.63	6.77	0.1 U	0.1 U	0.1 U	4.3	89.7	17.3	6.62	14	0.21	10.4	114
LLMW-06D	LLMW-06D-131106-W	194	194	1.0 U	1.0 U	3.4	3.58	0.1 U	0.1 U	0.5	2.6	32.1	10.1	2.19	23.6	0.12	11.5	51.7
LLMW-08D	LLMW-08D-131107-W	395	395	1.0 U	1.0 U	5.52	5.65	0.1 U	0.1 U	0.1 U	41.3	1260	95.2	14.7	85.6	0.32	29.8	621
LLMW-11D	LLMW-11D-131030-W	235	235	1.0 U	1.0 U	10.6	11	0.1 UJ	0.1 UJ	0.1 UJ	0.4	22.4	12.2	20.9 J	16.1	0.35	11.6	70.5
LLMW-12D	LLMW-12D-131119-W	223	223	1.0 U	1.0 U	6.41	6.84	0.1 U	0.1 U	0.3	27.3	38.1	18.2	1	27.4	0.02	7.19	72.8
LLMW-12D	DUP-02-131119-W	220	220	1.0 U	1.0 U	6.31	6.74	0.1 U	0.1 U	0.3	26.8	38.5	17.5	0.97	26.2	0.02	6.91	69.9
LLMW-13D	LLMW-13D-131114-W	227	227	1.0 U	1.0 U	5.75	6.13	0.1 U	0.1 U	0.3	0.4	32.1	21.7	6.93	14.6	0.36	8.32	74.9
LLMW-13D	DUP-03-131114-W	231	231	1.0 U	1.0 U	5.9	5.93	0.1	0.1 U	0.3	0.4	32.3	20.9	6.39	14.7	0.34	8.22	73.7
LLMW-16D	LLMW-16D-131113-W	347	347	1.0 U	1.0 U	12	12.4	0.2 J	0.1 UJ	2.3 J	0.1 U	82.1	7.1	1.49	15.8	0.1	12.9	180
LLMW-25D	LLMW-25D-131115-W	99.9	99.9	1.0 U	1.0 U	1.50 U	1.50 U	1.1	0.1 U	0.1 U	57.7	5.4	16.9	0.13	18	0.03	3.4	20.3
LLMW-27D	LLMW-27D-131101-W	118	118	1.0 U	1.0 U	1.50 U	1.50 U	2.3	0.1 U	0.1 U	35	9.4	24.4	3.23 J	20.5	0.11	3.99	15.8
LLMW-27D	DUP-05-131101-W	118	118	1.0 U	1.0 U	1.50 U	1.50 U	2.3	0.1 U	0.1 U	34.7	9.3	23.9	2.76 J	20.7	0.1	3.95	15.4
LLMW-35D	LLMW-35D-131108-W	144	144	1.0 U	1.0 U	1.50 U	1.50 U	0.5	0.1 U	0.1 U	40.4	9.6	28.8	0.42	21	0.52	3.49	11.9
LLMW-36D	LLMW-36D-131114-W	131	131	1.0 U	1.0 U	6.21	6.53	0.1	0.1 U	0.1 U	37.5	5.9	21.5	0.14	21.2	0.17	1.56	16.3

Notes:

[1] All samples were filtered through disposable 0.45 um filters with the exception of samples analyzed for total organic carbon (TOC).

Alkalinity = Total alkalinity, reported as $CaCO_3$

Bicarbonate and carbonate reported as $CaCO_3$

TOC = Total Organic Carbon

DOC = Dissolved Organic Carbon

Nitrate and nitrite reported as Nitrate-N and Nitrite-N

Phosphorous reported as orthophosphate-P

J = The result is an estimate

Bold font indicates the analyte was detected in the sample

DUP = duplicate of the parent sample above

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

Table 6-31

Total and Dissolved Metals for Surface Water and Stormwater Within the Lowland Area

Everett Lowland

Everett, Washington

		Analyte	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
		Preliminary Cleanup Levels (PCULs)												
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
Location Identification	Applicable PCUL [5]	Quarter [6]												
Surface Water														
LLSW-01	Lowland Area	Q1	0.5	0.6	4	2.5	0.1 U	0.1 U	0.6	0.1	0.02 U	0.02 U	0.2 U	0.2 U
		Q2	0.4	0.4	3.7	3.1	0.1 U	0.1 U	0.3	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLSW-02	Lowland Area	Q1	0.6	0.7	6.7	5	0.1 U	0.1 U	0.9	0.3	0.0217	0.02 U	0.2 U	0.2 U
		Q2	0.6	0.5	3.5	4.9	0.1 U	0.1 U	0.1 U	0.1	0.02 U	0.02 U	0.2 U	0.2 U
LLSW-04	Lowland Area	Q1	1.3	1.5	378	263	0.1 U	0.1 U	1.9	0.3	0.0234	0.02 U	0.2 U	0.2 U
		Q2	0.7	0.7	656	486	0.1 U	0.1 U	0.4	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
		Q3	–	–	41.6	36.2	–	–	5.4	0.3	–	–	–	–
		Q4	–	–	96.2	65.3	–	–	1.7	0.6	–	–	–	–
LLSW-05	Lowland Area	Q1	9.1	9.1	347	233	0.2	0.1 U	6.2	2.3	0.0413	0.0291	0.2 U	0.2 U
		Q2	2.6	2.3	197	64.1	0.1 U	0.1 U	6.3	0.4	0.02 U	0.02 U	0.2 U	0.2 U
		Q3	–	–	8.3	7.3	–	–	1.2	0.3	–	–	–	–
		Q4	–	–	94.9	60.9	–	–	2.3	0.8	–	–	–	–
Stormwater														
LLSW-03	Lowland Area[7]	Q1	0.2	0.3	1.2	0.7	0.1 U	0.1 U	0.4	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLSW-06	Lowland Area[7]	Q1	0.3	0.3	3.5	2.1	0.1 U	0.1 U	0.3	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U
LLSW-07	Lowland Area[7]	Q1	0.3	0.4	1.4	0.8	0.1 U	0.1 U	0.3	0.1 U	0.02 U	0.02 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using disposable 0.45 micrometer filters.

[2] Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed in Section 5 of the SRI report.

[3] PCUL for protection of surface water in the Snohomish River as discussed in Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Surface water concentrations in ponds and wetlands in the Lowland Area must meet the Lowland Area PCUL.

[6] Q1 was completed in January/February 2013, Q2 was completed in April/May 2013, Q3 was completed in August/September 2013 and Q4 was completed in October/November 2013.

[7] PCULs applied to stormwater samples to evaluate if stormwater is a source or transport pathway for contaminants in the Lowland Area.

PCUL = Preliminary cleanup level

"--" = Not analyzed

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

J = The result is an estimate

NA = Not applicable

NE = Not established

Bold text indicates the analyte was detected.

Shading indicates the result is greater than the PCUL

Table 6-32

Water Quality Parameters for Surface Water and Stormwater in the Lowland Area

Everett Lowland

Everett, Washington

Location Identification	Quarter	pH	Conductivity (mS/m)	Temperature (Celsius)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)	Total Iron [1] (mg/L)	Ferrous Iron [1] (mg/L)	Turbidity (NTU)
Surface Water									
LLSW-01	Q1	6.55	19.9	6.98	11.01	164	0	0	5.65
	Q2	7.65	24.5	16.04	10.01	--	--	--	--
LLSW-02	Q1	6.12	35.5	8.7	6.75	142	1	0	4.17
	Q2	6.71	76.7	11.45	4.56	--	--	--	--
LLSW-04	Q1	6.32	33.4	8.02	3.6	131	1	0	30.1
	Q2	6.82	65.3	15.47	8.41	--	--	--	--
	Q3	7.33	36.2	17.5	1.7	49	--	--	255
	Q4	7.3	21.2	8.8	6.88	2	--	--	17.3
LLSW-05	Q1	6.62	28.1	8.96	9.48	126	0.5	0	7.27
	Q2	6.81	62.7	12.68	5.12	--	--	--	--
	Q3	6.93	14.7	17.7	2.13	64	--	--	19.6
	Q4	7.26	17.6	8.8	4.59	31.5	--	--	23.4
Stormwater									
LLSW-03	Q1	5.59	10.4	7.44	8.13	162	0	0	2.49
LLSW-06	Q1	6.1	38.9	7.18	3.50	46	1	0	12.4
LLSW-07	Q1	6.29	26.4	7.45	14.24	128	0	0	27.1

Notes:

[1] Iron measurements were performed in the field on the dissolved groundwater fraction (i.e., after filtration through disposable 0.45 um filters).

mS/m - Millisiemens per meter

NTU = Nephelometric turbidity units

TDS = Total dissolved solids

mg/L = Milligrams per liter

g/L = Grams per liter

mV = Millivolts

-- The parameter was not measured at the identified location.

Table 6-33

Metals for Sediment and Stormwater Solids in the Lowland Area

Everett Smelter - Lowland Area

Everett, Washington

Location and Sample Identification		Antimony	Arsenic	Cadmium	Lead	Mercury	Thallium
	Analyte	Antimony	Arsenic	Cadmium	Lead	Mercury	Thallium
	Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Preliminary Cleanup Levels (PCULs)						
	Lowland Area [1]	NE	20	2.1	360	0.07	NE
	Snohomish River [2]	190	20	1	24	0.07	4.7
	Applicable PCUL [3]						
Sediment							
LLSD-01	Lowland Area	6 U	**6.3**	**0.5**	**10**	0.03 U	0.3 U
LLSD-02	Lowland Area	7 U	**14.3**	**0.6**	**86**	**0.05**	0.2 U
LLSD-04	Lowland Area	10 U	**219**	**0.9**	**31**	0.03 U	0.4 U
LLSD-05	Lowland Area	10 U	**157**	**2.7**	**532**	**0.15**	0.4 U
Stormwater Solids							
LLSD-03	Lowland Area[4]	9 U	**18.7**	**0.8**	**30**	**0.07**	0.4 U
LLSD-06	Lowland Area[4]	20 U	**105**	**1.8**	**78**	**0.1**	0.8 U
LLSD-07	Lowland Area[4]	10 U	**11.5**	**0.8**	**24**	**0.06**	0.5 U

Notes:

[1] Preliminary cleanup levels (PCULs) for sediment in ponds and wetlands in the Lowland Area as described in Section 5 of the SRI report.

[2] PCULs for sediment on the western shoreline of the Snohomish River in the Lowland Area as described in Section 5 of the SRI report.

[3] Sediment concentrations in ponds and wetlands in the Lowland Area must meet the Lowland Area PCUL.

[4] PCULs applied to stormwater solids to evaluate potential sources of contamination.

PCUL = Preliminary cleanup level

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

Bold text indicates the analyte was detected.

NE = Not established

NA = Not applicable

Shading indicates the result is greater than the preliminary cleanup level

Table 6-34

Metals for Seeps and Outfalls on the Snohomish River Shoreline

Everett Lowland

Everett, Washington

Location Identification	Sample Identification	Applicable PCUL [5]	Antimony		Arsenic		Cadmium		Lead		Mercury		Thallium	
		Unit	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Sample Type [1]	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
	Preliminary Cleanup Levels (PCULs)													
		Lowland Area [2]	NA[4]	NE	NA[4]	150	NA[4]	0.23	NA[4]	2.2	0.02	NA[4]	NA[4]	NE
		Snohomish River [3]	NA[4]	640	NA[4]	5	NA[4]	8.8	NA[4]	8.1	0.025	NA[4]	NA[4]	0.22
Seeps														
LLSP-03	LLSP03-130429	Snohomish River	0.2 U	**0.2**	**5.5**	**4.0**	0.1 U	0.1 U	**1.7**	**0.1**	0.0200 U	0.0200 U	0.2 U	0.2 U
	LLSP03-130429-DUP		0.2 U	0.2 U	**5.0**	**3.0**	0.1 U	0.1 U	**2.2**	**0.1**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLSP-05	LLSP05-130426	Snohomish River	**0.3**	**0.3**	**2.0**	**1.6**	0.1 U	0.1 U	**1.1**	**0.6**	**0.0278**	**0.0217**	0.2 U	0.2 U
LLSP-06S	LLSP06S-130429	Snohomish River	**0.5**	**0.6**	**4.9**	**6.7**	0.1 U	0.1 U	**1.4**	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLSP-08	LLSP08-130429	Snohomish River	**0.2**	**0.6**	**8.5**	**2.5**	**0.1**	0.1 U	**4.5**	0.1 U	**0.0344**	0.0200 U	0.2 U	0.2 U
Outfalls														
LLO-02	LL002-130429	Snohomish River[6]	**0.7**	**0.6**	**18.3**	**10.2**	0.1 U	0.1 U	**1.5**	**0.5**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-03	LL003-130426	Snohomish River[6]	**0.2**	**0.3**	**44.3**	**44.7**	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	Snohomish River[6]	0.2 U	0.2 U	**38.4**	**35.8**	0.1 U	0.1 U	**0.2**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-05	LL005-130429	Snohomish River[6]	0.2 U	0.2 U	**1.2**	**0.8**	0.1 U	0.1 U	**0.1**	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-06	LL006-130429	Snohomish River[6]	**0.3**	**0.4**	**43.7**	**39.9**	0.1 U	0.1 U	**0.4**	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
	LL006-130429-DUP		**0.4**	**0.4**	**43.9**	**40.5**	0.1 U	0.1 U	**0.5**	**0.2**	0.0200 U	0.0200 U	0.2 U	0.2 U
LLO-07	LL007-130429	Snohomish River[6]	0.2 U	**0.2**	**636**	**542**	0.1 U	0.1 U	0.1 U	0.1 U	0.0200 U	0.0200 U	0.2 U	0.2 U

Notes:

[1] Dissolved samples were prepared by filtering the samples in the field using a disposable 0.45 micrometer filter.

2 Preliminary cleanup level (PCUL) for protection of surface water in the Lowland Area as discussed Section 5 of the SRI report.

3 PCUL for protection of surface water in the Snohomish River as discussed Section 5 of the SRI report.

[4] PCULs are based on the dissolved fraction for antimony, arsenic, cadmium, lead and thallium and are based on the total fraction for mercury.

[5] Seep concentrations must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

[6] PCULs applied to outfall samples to evaluate if outfall water is a source or transport pathway for contaminants in the Lowland Area.

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

NA = Not Applicable

NE = Not established

GeoEngineers

Table 6-35

Water Quality Parameters for Seeps and Outfalls on the Snohomish River Shoreline

Everett Lowland

Everett, Washington

Location Designation	pH	Conductivity (mS/cm)	Temperature (C)	Dissolved Oxygen (mg/L)	Oxidization Reduction Potential (mV)
Seeps					
LLSP-03	6.95	466.2	14.75	3.33	-295.5
LLSP-05	6.88	38.2	12.74	6.33	-47.2
LLSP-06S	6.74	47.1	14.83	6.26	-37.1
LLSP-08	6.98	75.9	14.10	6.28	-89.2
Outfalls					
LLO-02	7.19	77.8	12.73	7.97	3.5
LLO-03	6.70	91.4	12.06	6.46	-50.5
LLO-04	6.45	46	10.63	5.86	-51.1
LLO-05	7.15	6.0	9.23	11.12	65.7
LLO-06	6.79	47.2	11.77	5.43	-40.0
LLO-07	6.36	60.4	11.57	6.35	-2.8

Notes:

mS/cm - millisiemens per centimeter

C = degrees Celsius

mg/L = milligrams per liter

mV = millivolts

Table 6-36

Metals for Sediment on the Snohomish River Shoreline

Everett Lowland
Everett, Washington

Location Identification	Sample Identification	Analyte	Antimony	Arsenic	Cadmium	Lead	Mercury	Thallium
		Unit	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
		Preliminary Cleanup Levels (PCULs)						
		Lowland Area [1]	NE	20	2.1	360	0.07	NE
		Snohomish River [2]	190	20	1	24	0.07	4.7
		Applicable PCUL [3]						
Co-located With Seeps								
LLSD-11	LLSD11-130429	Snohomish River	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-14	LLSD14-130426	Snohomish River	7 U	7.7	0.5	9	0.03 U	0.3 U
LLSD-17S	LLSD17S-130429	Snohomish River	6 U	10.3	1.1	3	0.03 U	0.2 U
LLSD-21	LLSD21-130426	Snohomish River	10 U	10.9	0.9	9	0.08	0.4 U
Co-located With Outfalls								
LLSD-13	LLSD13-130429	Snohomish River	10 U	32.0	0.7	22	0.10	0.4 U
LLSD-15	LLSD15-130426	Snohomish River	8 U	48.9	0.7	14	0.04	0.3 U
LLSD-16	LLSD16-130429	Snohomish River	8 U	10.1	0.7	8	0.08	0.3 U
LLSD-18	LLSD18-130429	Snohomish River	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	Snohomish River	20 U	837	0.9 U	9 U	0.16	0.4 U
LLSD-20	LLSD20-130429	Snohomish River	7 U	18.6	0.6	6	0.04	0.3 U

Notes:

[1] Preliminary cleanup levels (PCULs) for sediment in ponds and wetlands in the Lowland Area as described in Section 5 of the SRI report.

[2] PCULs for sediment on the western shoreline of the Snohomish River in the Lowland Area as described in Section 5 of the SRI report.

[3] Seep concentrations must be protective of surface water in the Snohomish River and therefore, meet the Snohomish River PCUL.

PCUL = Preliminary cleanup level

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

NE = Not established

Shading indicates the result is greater than the PCUL

Table 7-1

Summary of Arsenic Concentrations in Source Material and Leachate

Everett Lowland

Everett, Washington

Source / Sample Type	Location	Sample Location Identification / Depth (ft bgs)	Soil Arsenic Concentration (mg/kg)	SPLP Arsenic Concentration (µg/L)	Column Leaching Arsenic Concentration (µg/L)	Data Source
Arsenic Trioxide						
Pure Arsenic Trioxide	NA	NA	760,000[1]	20,500,000[2]	NT	CRC Handbook of Chemistry and Physics (Lide, 2005)
Residual Arsenic Trioxide	Fenced Area[3]	S-111 Composite[4] / 3	727,000	NT	NT	Remedial Investigation Everett Smelter Site (Hydrometrics, 1995)
Flue Dust						
Pure Flue Dust	NA	NA	25,000[5]	NT	NT	Smelter Area Investigation Report (ASARCO, 1998)
Residual Flue dust In Smelter Debris	Fenced Area[3]	TP-3 / 2-3	21,686	NT	NT	Smelter Area Investigation Report (ASARCO, 1998)
	Fenced Area[3]	TP-3 / 3-4	28,579	NT	NT	Smelter Area Investigation Report (ASARCO, 1998)
Slag						
Slag	Benson Subarea	SL-4 / 28-34	787	1,300	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-18 / 5-7	340	410	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	SL-1 / 27-31	432	100 U	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	SL-3 / 55-60	410	100 U	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-17 / 5-7	360	100 U	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-17 (crushed)[6] / 5-7	360	100 U	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
Contaminated Soil and Debris						
Residual Arsenic Trioxide In Smelter Debris	Fenced Area[3]	TP5 / 1-2	5,370	27,000	NT	Smelter Area Investigation Report (ASARCO, 1998)
	Fenced Area[3]	TP6A / 1-2	12,487	7,000	NT	Smelter Area Investigation Report (ASARCO, 1998)
Residual Flue dust In Smelter Debris	Fenced Area[3]	TP7 / 3-4	10,644	9,100	NT	Smelter Area Investigation Report (ASARCO, 1998)
	Fenced Area[3]	TP8 / 4-5	4,699	8,600	NT	Smelter Area Investigation Report (ASARCO, 1998)
	Marine View Drive ROW	LLSB-07 / 5.4-5.9	40,100	18,200	NT	Focused Source Area Investigation (GeoEngineers, 2014)
Contaminated Fill and Till	Focused Source Area	Comp-1[7]	1,190; 1,390[8]	8,960	14,600	Focused Source Area Investigation (GeoEngineers, 2014)
	Focused Source Area	Comp-2[9]	2,250; 2,450[8]	6,380	10,911	Focused Source Area Investigation (GeoEngineers, 2014)
	Focused Source Area	Comp-3[10]	3,730; 17,800[8]	10500	21700	Focused Source Area Investigation (GeoEngineers, 2014)
	Focused Source Area	LLSB-29 / 5.2-5.5	4,320	10,100	NT	Focused Source Area Investigation (GeoEngineers, 2014)
Contaminated Fill	Marine View Drive ROW	LLMW27 / 3.5-4.5	1,330	1,810	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Marine View Drive ROW	LLMW27 / 4.5-5.5	274	980	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Marine View Drive ROW	LLMW33 / 3-4	121	7.9	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Upland Area	LLMW35D / 4-5	294	1,600	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
Contaminated Fill with Slag	Benson Subarea	LB-16 / 0-2	550	1,400	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-16 / 5-7	320	270	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-17 / 0-2	360	110	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LB-18 / 0-2	220	360	NT	Comprehensive Lowland Area Remedial Investigation (ASARCO, 2000)
	Benson Subarea	LLMW36D / 7-8	223	129	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
Contaminated Till	Marine View Drive ROW	LLMW29 / 12.5-13.5	85.7	336	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Marine View Drive ROW	LLMW27 / 8-9	84.2	115	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Marine View Drive ROW	LLMW29 / 20-21	52.6	115	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
Contaminated Native Surface Soil	Benson Subarea	LLMW36D / 9-9.2	300	335	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Riverside Business Park	LLMW14 / 7-7.2	203	130	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)
	Riverside Business Park	LLMW15 / 11.5-11.7	63.8	106	NT	Supplemental Investigation of the Lowland Area (GeoEngineers, 2013)

Notes

[1] Arsenic concentration of pure arsenic trioxide

[2] Synthetic Precipitation Leaching Procedure (SPLP) was not performed on pure arsenic trioxide from the Everett Smelter. However, the solubility of arsenic trioxide at 25 degrees Celsius is reported to be 20,500,000 µg/L (Lide, 2005).

[3] Sample collected from Fenced Area prior to remediation. Remediation removed the arsenic trioxide and flue dust that was sampled.

[4] The report text and table do not match. The report has been interpreted to mean that sample S-111 Composite is a composite of boring location S-111 consisting of residual arsenic trioxide from a depth of approximately 3 feet bgs.

[5] The 1998 Smelter Area Investigation Report indicates, "Based on sampling data [flue dust contains] around 25,000 mg/Kg arsenic."

[6] The report indicates one sample (presumably a "split" of LB-17 / 5-7) was crushed and analyzed by SPLP.

[7] Sample Comp-1 is a composite of 15 samples the majority of which have XRF arsenic concentrations ranging from 563 to 1,471 mg/kg. The average of the XRF concentrations is 978 mg/kg. The samples include LLSB-06-3-3.5, LLSB-09-7-7.5, LLSB-10-7-7.5, LLSB-14-6.5-7, LLSB-16-5.5-6, LLSB-16-8-8.5, LLSB-27-1.3-3.3, LLSB-27-5.8-7.2, LLSB-29-6.3-7.7, LLSB-35-8.3-8.7, LLSB-42-12.2-12.6, LLSB-43-3.8-6.2, LLSB-43-9.3-11.6, LLSB-44-5.8-7.7, and LLSB-44-9.3-10.7.

[8] Because of the potential for heterogeneity in the composite samples, two samples were submitted from each composite sample for soil arsenic during the Focused Source Area Investigation.

[9] Sample Comp-2 is a composite of 29 samples the majority of which have XRF arsenic concentrations ranging from 1,388 to 3,200 mg/kg. The average of the XRF concentrations is 2,183 mg/kg. The samples include (LLSB-05-5.5-6, LLSB-06-6-6.5, LLSB-08-3.5-4, LLSB-11-3.5-4, LLSB-14-4.5-5, LLSB-15-6.5-7, LLSB-19-4.5-5, LLSB-22-8-8.5, LLSB-24-10-10.5, LLSB-25-7.5-8, LLSB-26-5.2-5.4, LLSB-28-2.2-2.7, LLSB-29-5.8-6.2, LLSB-33-4.3-5.2, LLSB-34-5.3-5.7, LLSB-35-7.8-8.3, LLSB-36-10.3-10.7, LLSB-38-8.7-9.7, LLSB-39-13.3-15.2, LLSB-41-11.3-12.2, LLSB-41-8.3-8.7, LLSB-42-9.3-9.6, LLSB-43-7.5-7.8, LLSB-43-7.8-8.7, LLSB-44-3.3-4.2, LLSB-44-8.7-9.2, LLSB-45-6.3-6.7, LLSB-46-13.3-13.7, and LLSB-47-15.8-16.3.

[10] Sample Comp-3 is a composite of 27 samples the majority of which have XRF arsenic concentrations ranging from 2,429 to 8,943 mg/kg. The average of the XRF concentrations is 4,991 mg/kg. The samples include LLSB-04-3.2-3.7, LLSB-09-4.5-5, LLSB-10-4.5-5, LLSB-13-4-4.5, LLSB-13-6-6.5, LLSB-15-3.5-4, LLSB-15-5-5.5, LLSB-21-7-7.5, LLSB-23-11-11.5, LLSB-23-4.5-5, LLSB-23-8.5-9, LLSB-26-1.8-2.3, LLSB-26-2.8-3.2, LLSB-27-3.8-4.5, LLSB-27-5-5.4, LLSB-28-2.8-7.7, LLSB-29-3.5-3.8, LLSB-35-7.3-7.7, LLSB-36-8.0-8.7, LLSB-37-12.2-12.7, LLSB-39-12.8-13.2, LLSB-42-9.6-10, LLSB-45-6.8-8.2, LLSB-45-9.8-10.2, LLSB-47-12.3-12.7, LLSB-47-13.8-14.2, and LLSB-47-14.3-15.2.

N
W
E
S

2,000 0 2,000

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.
3. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission.

Data Sources: ESRI Data & Maps

Projection: NAD 1983 UTM Zone 10N

Vicinity Map

Everett Smelter - Lowland Area

GeoEngineers

Figure 1-1

Path: \\seal\projects\0\0504068\GIS\MXDs\Report\Figure_1-1.mxd Map Revised: 18 November 2013 cgonzales

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_1-2.mxd Map Revised: 04 December 2013 cgonzales

Legend

- Everett Smelter Lowland Area
- Everett Smelter Upland Area
- Former Everett Smelter Facility Boundary

N W E S

700 0 700

Feet

Notes:
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Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Everett Smelter Site

Everett Smelter Site

GEOENGINEERS

Figure 1-2

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_2-1.mxd Map Revised: 04 December 2013 cgonzales

Legend

Lowland Area

N W E S

600 0 600

Feet

Notes:
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Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

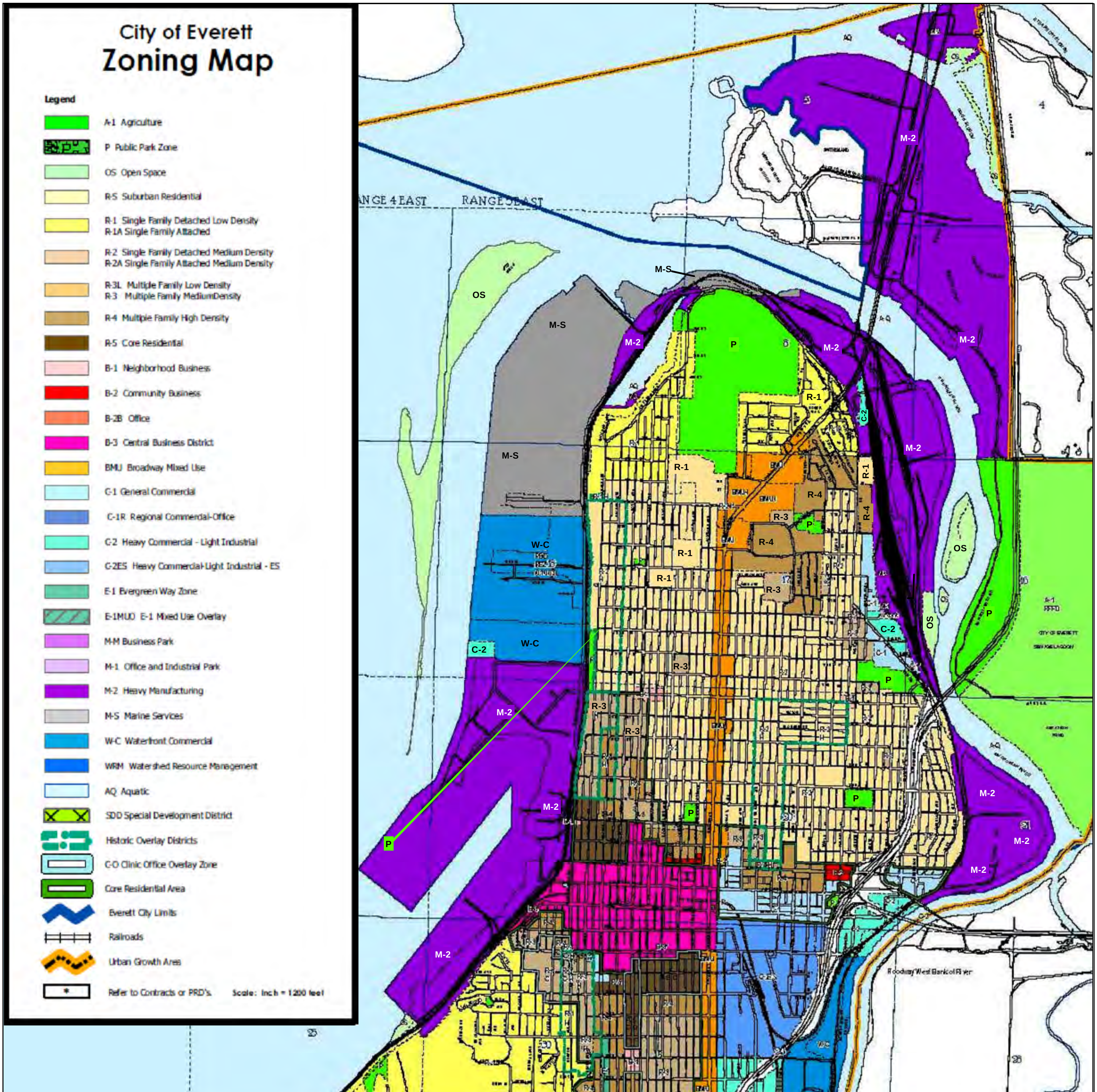
Lowland Area

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-1

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_2-2.mxd Map Revised: 04 December 2013 cgonzales



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: City of Everett, 2012

N
W E
S

3,000 0 3,000
Feet

City of Everett Zoning

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-2

Legend

Lowland Area

Snohomish County Parcel Boundary

BNSF ROW = Burlington Northern Santa Fe Railway Company Right of Way

N E S W

600 0 600

Feet

Lowland Area Property Ownership - 2013

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-3

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_2-5.mxd Map Revised: 30 January 2015 cgonzales

Legend

Lowland Area

Historical Smelter Facility Structure[1]

Approximate Extent of Slag (1913 Survey by Cutter & Tegtmeier, as shown in Hydrometrics, 1995)[2]

Approximate Extent of Slag (Estimate by Hydrometrics as Shown in ASARCO, 2000)[3]

N W E S

200 0 200

Feet

Notes:
1. Based on Sheet 1-3 of the September 1995 "Remedial Investigation Everett Smelter Site," Hydrometrics and figures 5-1 through 5-6 of the 1998 "Smelter Area Investigation Report," ASARCO.
2. Based on Sheet 1-2 of the September 1995 "Remedial Investigation Everett Smelter Site," Hydrometrics.
3. Based on Exhibit 4-1 in the January 2000 "Comprehensive Lowland Area Remedial Investigation Report for the Everett Smelter Site," ASARCO.
4. The locations of all features shown are approximate.
5. 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.

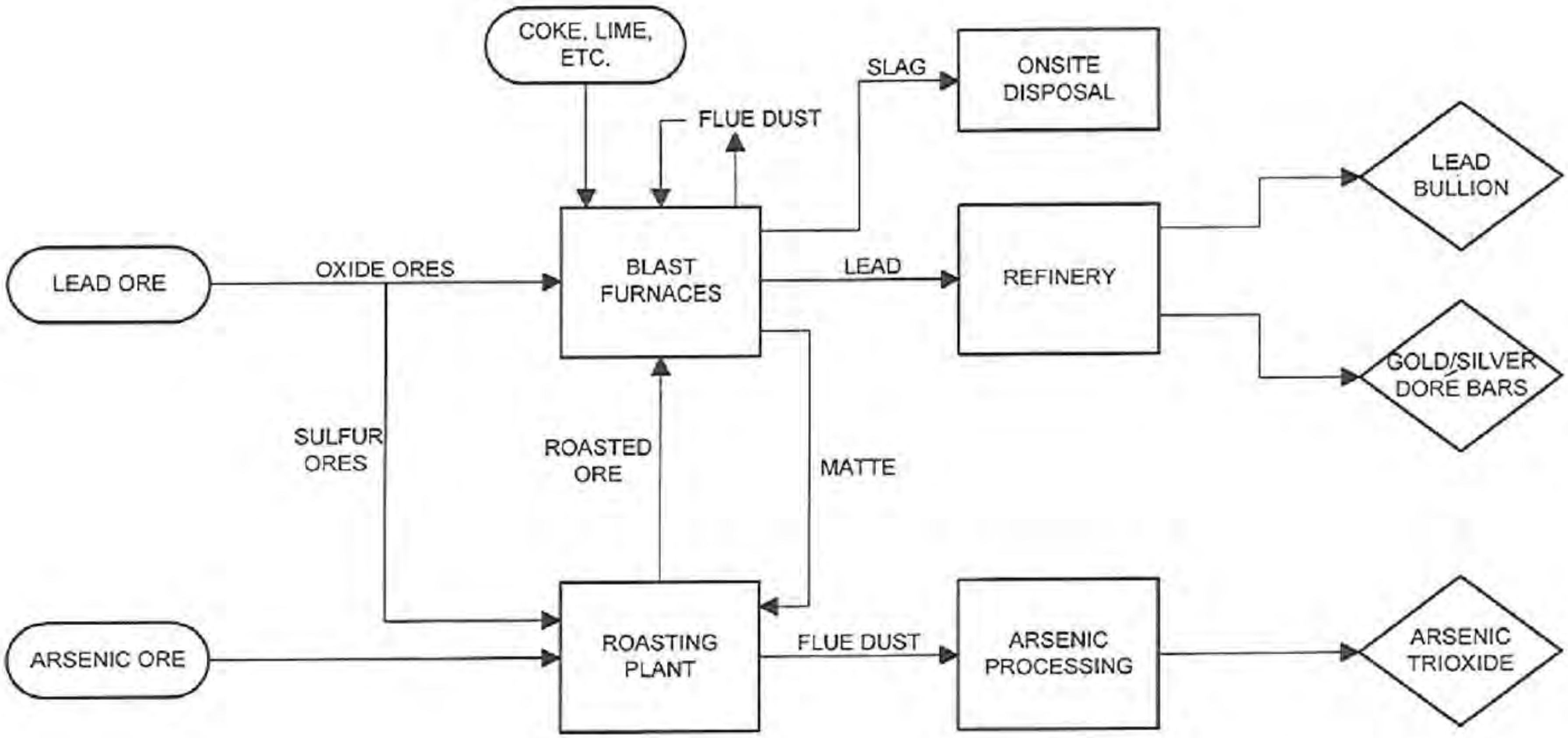
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology.

Historical Smelter Structures and Extent of Slag

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-5



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: McCulley, Frick & Gilman, Inc. 1998

Legend

◇ Products

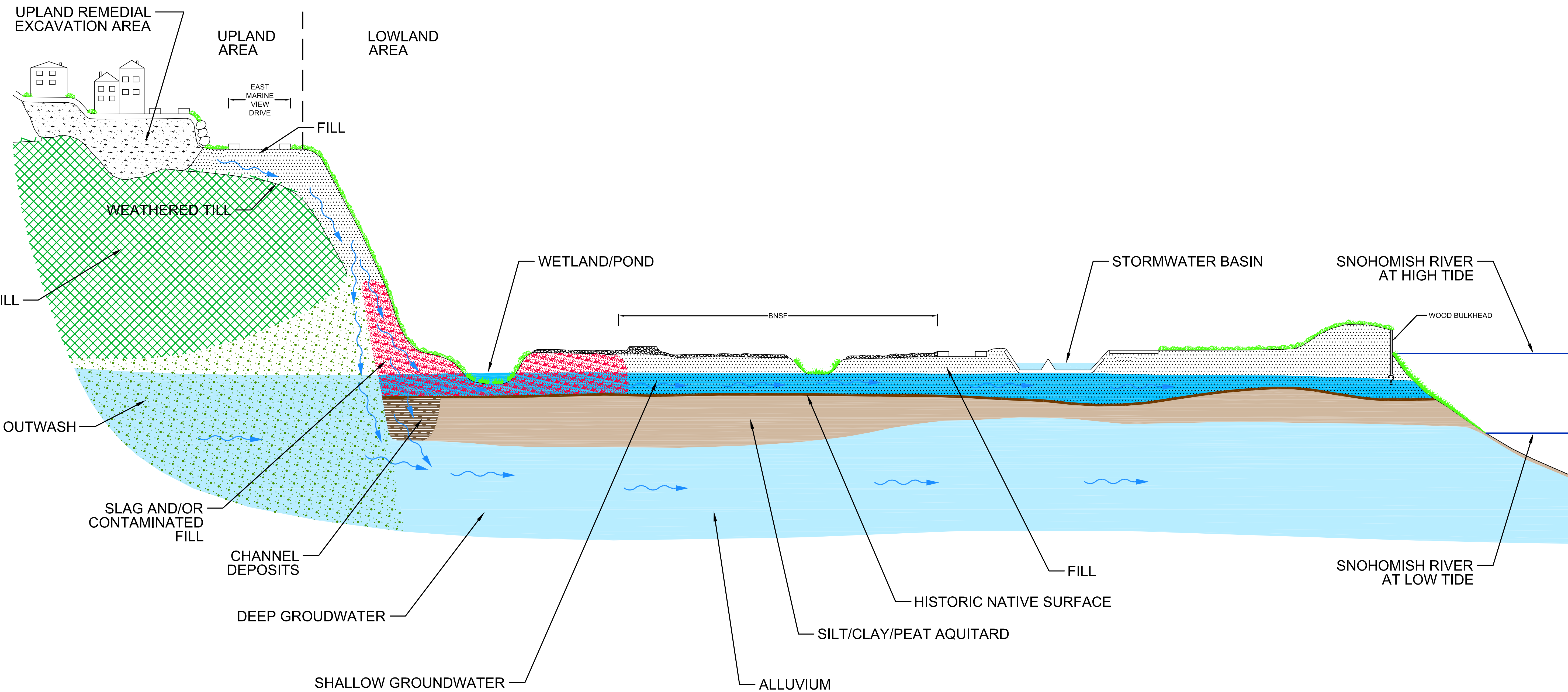
⬭ Raw Material

Generalized Process Schematic For Everett Smelter

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-6



GRAVEL
ROADS/SIDEWALKS
VEGETATION
SNOHOMISH RIVER LEVEL
GROUNDWATER FLOW PATH

NOT TO SCALE

Schematic Cross Section

Everett Smelter Site, Lowland Area
Everett, Washington

GEOENGINEERS

Figure 2-7

Notes:
1. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

SEAT:GRL : SCY

W:\Seattle\Projects\0\0504068\01\CAD\050406801_T400_CSM_F2-7.dwg\TAB:F2-7 modified on Jan 29, 2015 - 12:49pm

Legend

- Lowland Area
- Former Everett Smelter Facility Boundary
- Weyerhaeuser Mill E - (W-Mill E)
- Weyerhaeuser East - (W-East)
- Weyerhaeuser West - (W-West)
- Weyerhaeuser Demolition Landfill - (W-Landfill)

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Weyerhaeuser Sites

Everett Smelter - Lowland Area

GeoEngineers

Figure 2-8

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_2-9.mxd Map Revised: 23 September 2014 cgonzales

Legend

Lowland Area

Former Arsenic Trioxide Processing Area ("Fenced Area")

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Hydrometrics Comprehensive Lowland Area Remedial Investigation Report For the Everett Smelter Site, January 2000

N W E S

400 0 400

Feet

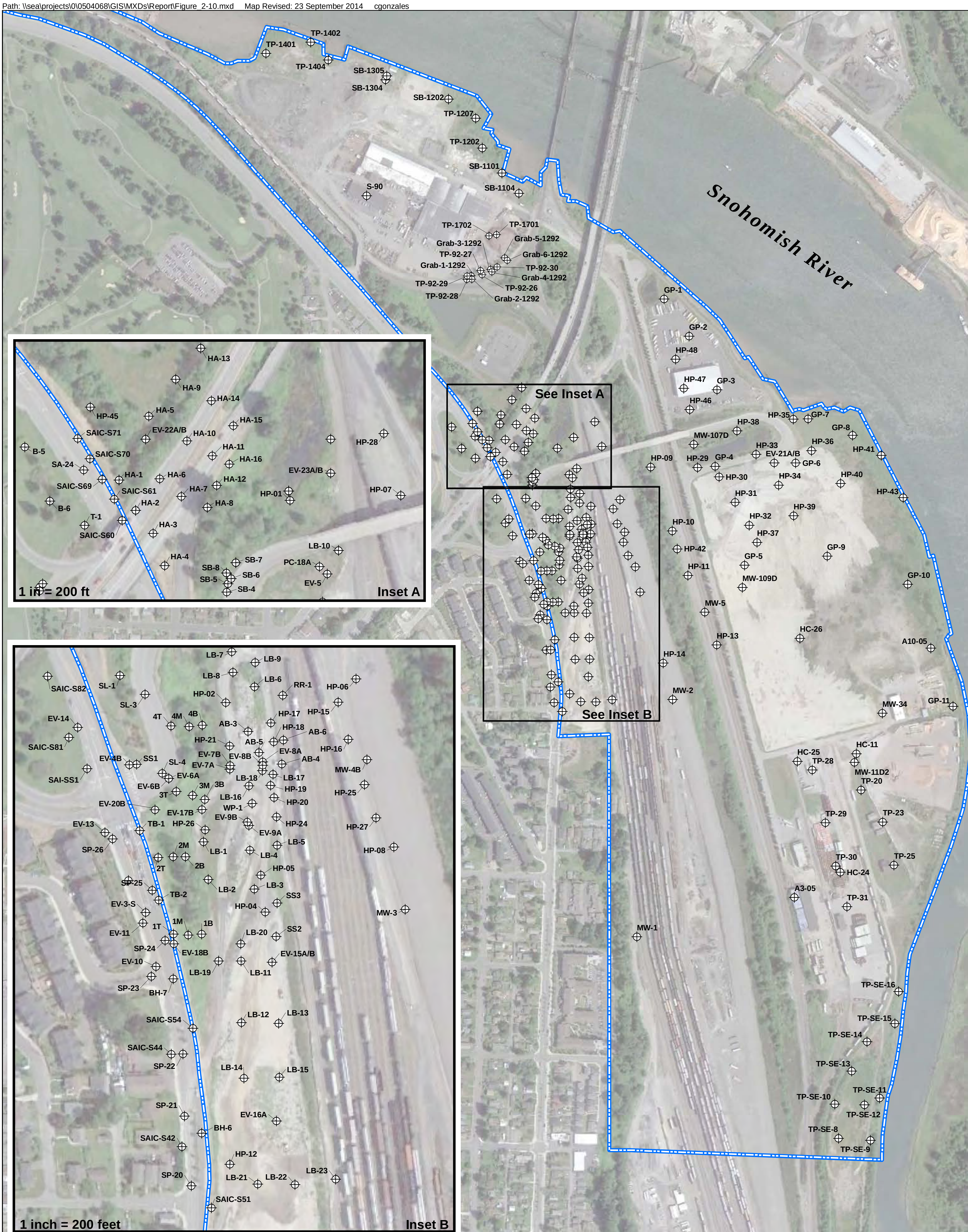
Former Arsenic Trioxide Processing Area - Uplands

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-9

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_2-10.mxd Map Revised: 23 September 2014 cgonzales



Legend

Lowland Area

EV-13 Previous Soil Investigation Location and Location Identification

N W E S

500 0 500

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.

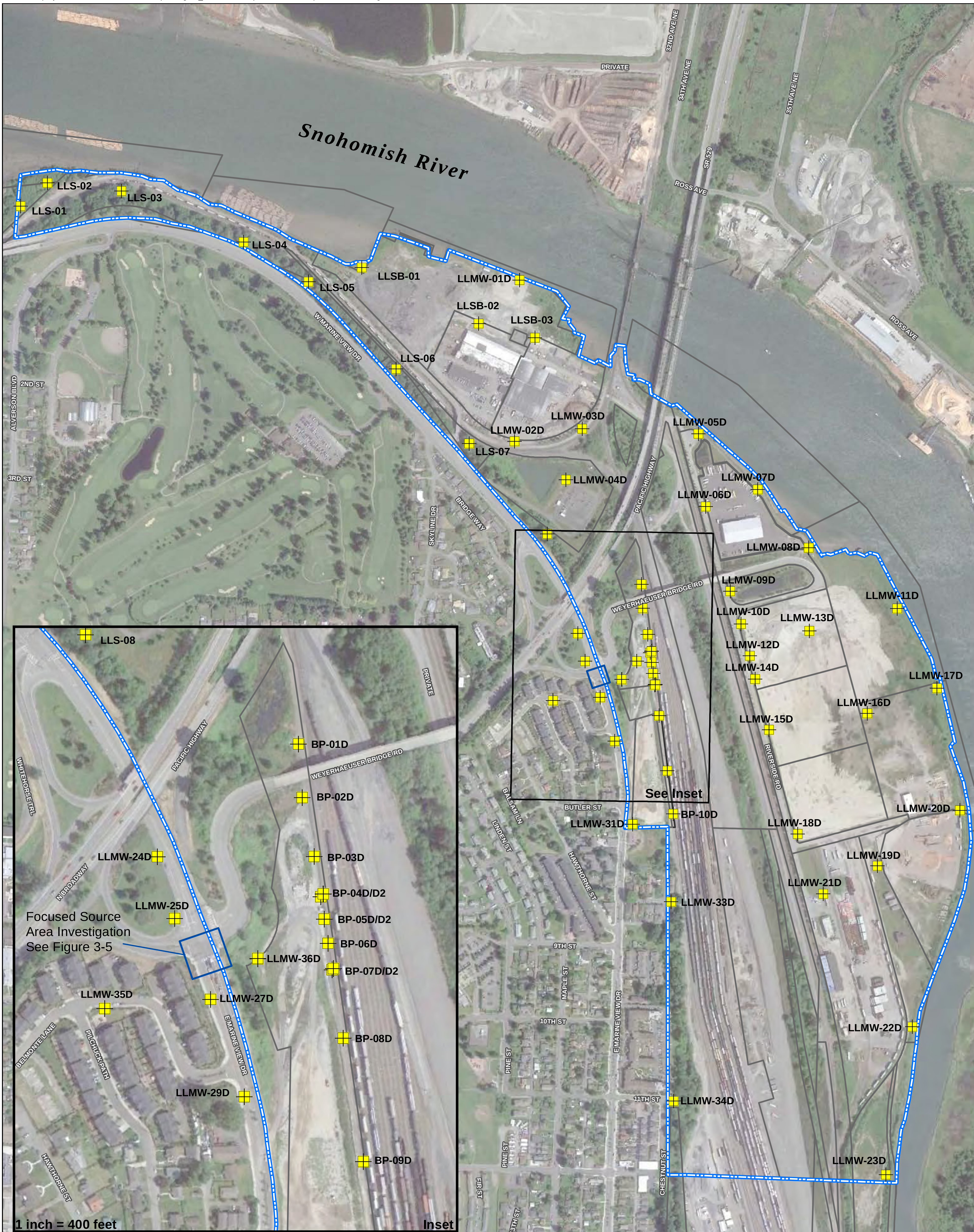
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

Previous Soil Investigation Locations

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 2-10



Legend

- Lowland Area
- Snohomish County Parcel Boundary
- BP-01D — Supplemental Soil Investigation Location and Location Identification

N / W / E / S

600 0 600

Feet

Lowland Area Supplemental Soil Investigation Locations

Everett Smelter - Lowland Area

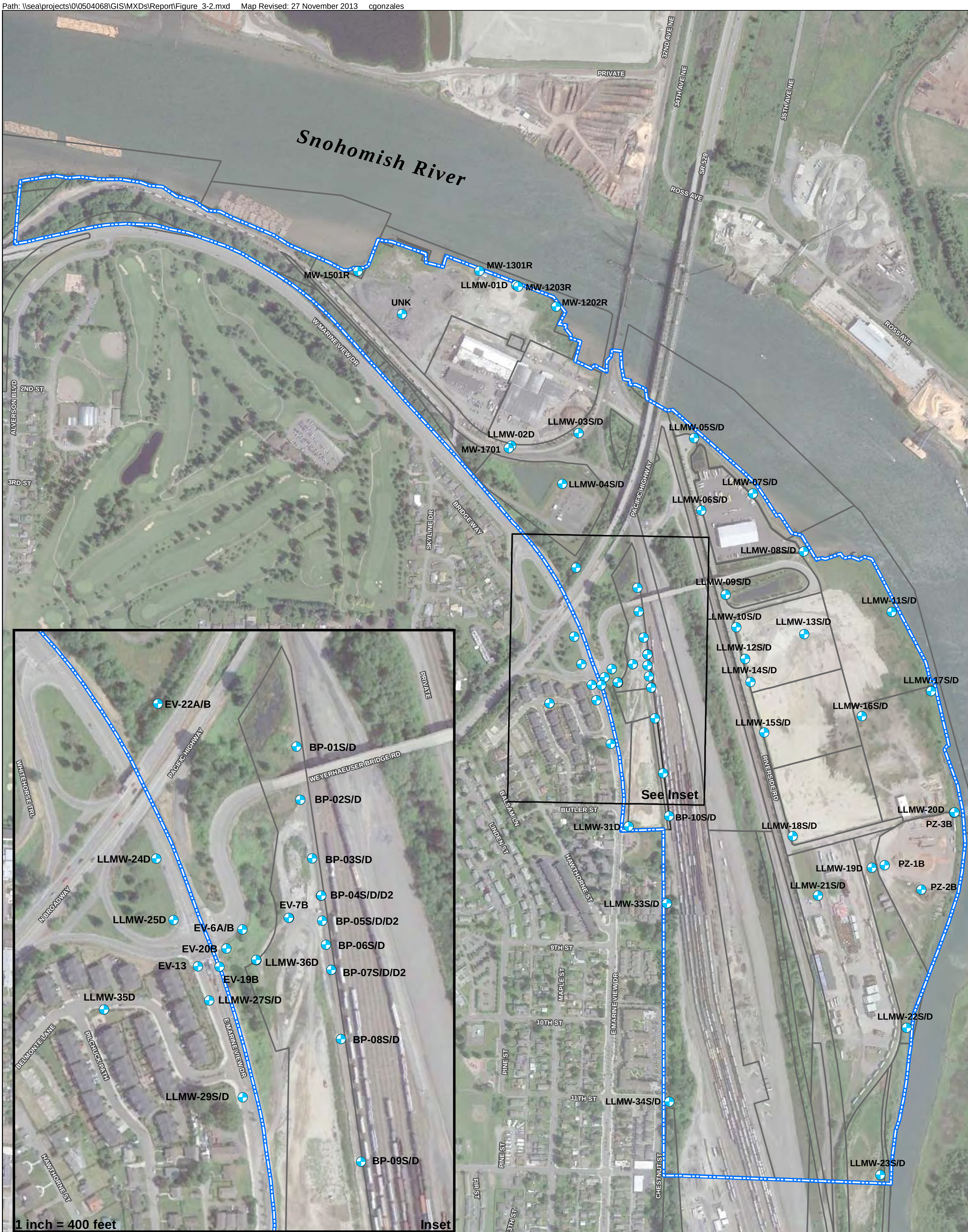
GEOENGINEERS

Figure 3-1

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_3-2.mxd Map Revised: 27 November 2013 cgonzales



Legend

Lowland Area

Snohomish County Parcel Boundary

BP-05S/D/D2 Supplemental Groundwater Investigation Locations and Location Identifications

Note: See Table 3-2 for monitoring well details.

N E S W

600 0 600

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Lowland Area Supplemental Groundwater Investigation Locations

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 3-2

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_3-3.mxd Map Revised: 27 November 2013 cgonzales

Legend

Lowland Area

LLSW-01/LLSD-01 Surface Water/Stormwater and Sediment Investigation Locations and Location Identifications

LLSP-03/LLSD-11 Seep and Sediment Investigation Locations and Location Identifications

LLO-02/LLSD-13 Stormwater Outfall and Sediment Investigation Locations and Locatoin Identifications

Notes: See Table 3-3 for water and sediment investigation location details.

N W E S

600 0 600

Feet

Notes:
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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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

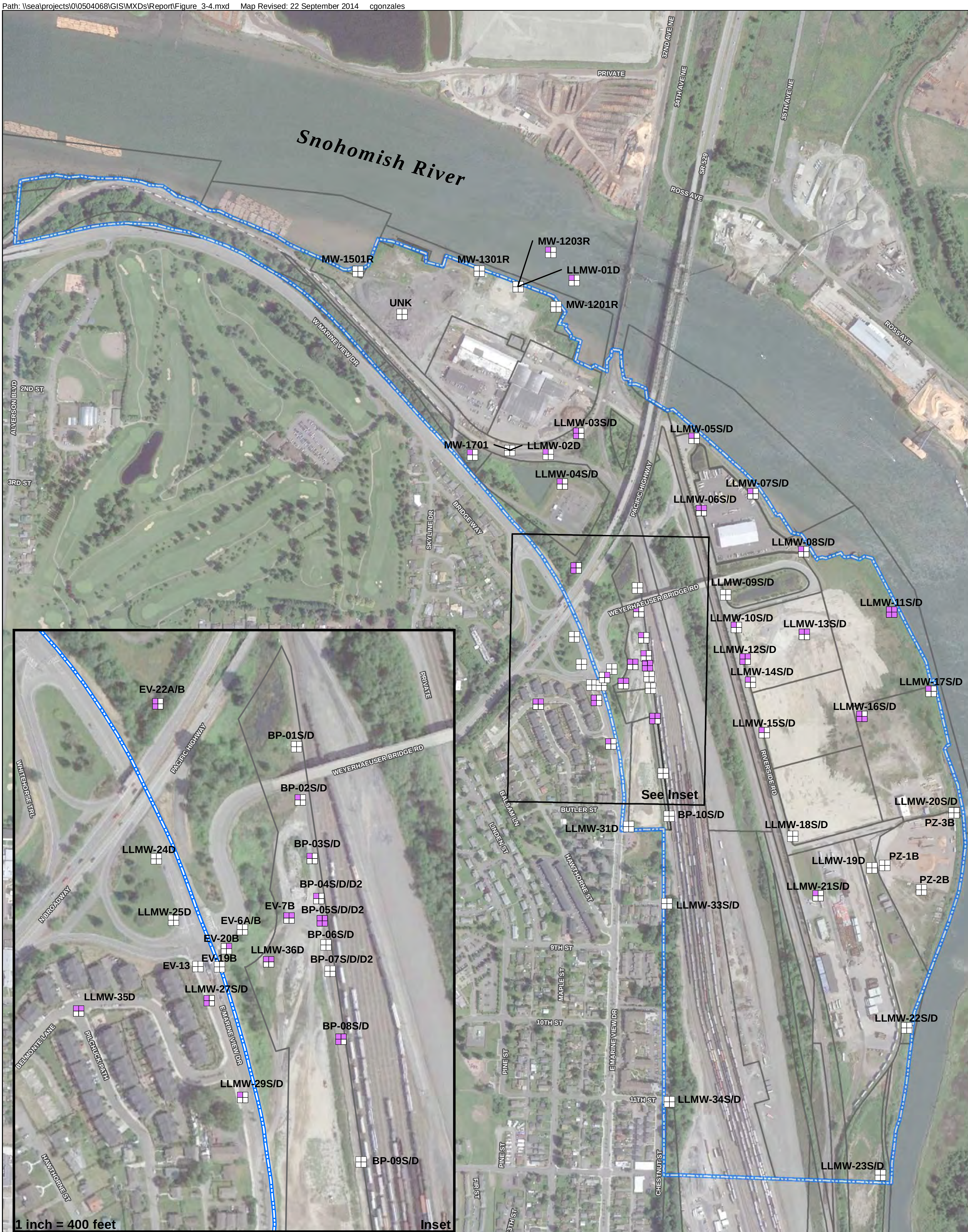
Lowland Area Supplemental Water and Sediment Investigation Locations

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 3-3

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_3-4.mxd   Map Revised: 22 September 2014   cgonzales



Legend

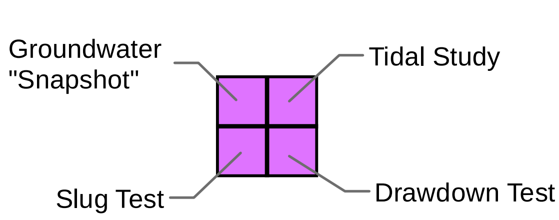
Lowland Area

Snohomish County Parcel Boundary

BP-01S/D Supplemental Groundwater Investigation Locations and Location Identifications

Purple Indicates Investigation Activity Performed

White Indicates No Investigation Activity Performed



N W E S

600 0 600

Feet

Notes:
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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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

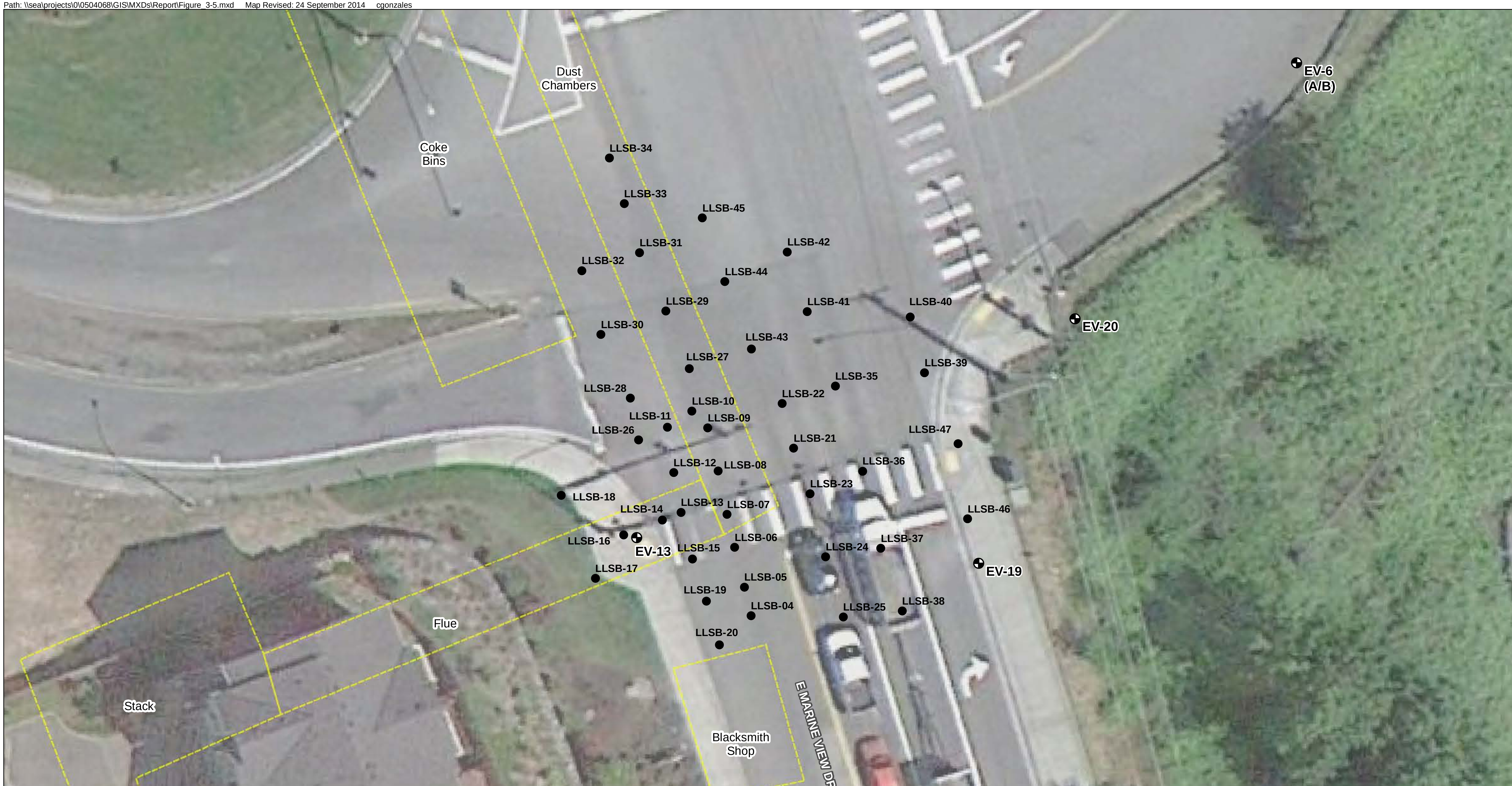
Lowland Area Supplemental Hydrogeological Investigation Activities

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 3-4

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_3-5.mxd Map Revised: 24 September 2014 cgonzales



Notes:
1. Aerial photo from 2012.
2. Based on Sheet 2-1 in the 1995 "Remedial Investigation, Everett Smelter Site," report prepared by Hydrometrics.
3. Geologic Cross Sections A-A' through C-C' were previously prepared in adjacent locations as part of the remedial investigation of the Lowland Area.
4. The locations of all features shown are approximate.
5. 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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology.

Legend

- Approximate Location of Former Everett Smelter Structures[2]
- LLSB-04 ● Investigation Location and Location Designation
- Existing Monitoring Well

N S E W

20 0 20

Feet

Focused Source Area Investigation Locations

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 3-5

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-1.mxd Map Revised: 20 December 2013 cgonzales

Legend

- Lowland Area
- 2 Foot Contour (NAVD 88)
- 10 Foot Contour (NAVD 88)

N W E S

600 0 600

Feet

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

Site Topography

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-1

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-2.mxd   Map Revised: 26 September 2014   cgonzales

Legend

- Lowland Area
- Wetland, Pond or Ditch
- Stormwater Basin
- Stormwater Pipe
- Under Drain
- Culvert
- LLO-02 — Outfall Location and Location Identification

N W E S

600 0 600
Feet

Notes:
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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 Sources: Aerial Photo: GoogleEarth Pro, 2013. Wetlands, Ponds, Ditches and Culverts: Hydrometrics, 2000. Stormwater Pipes: Port of Everett, 2001. Stormwater Outfalls: GeoEngineers Field Reconnaissance and PTI, 1994.

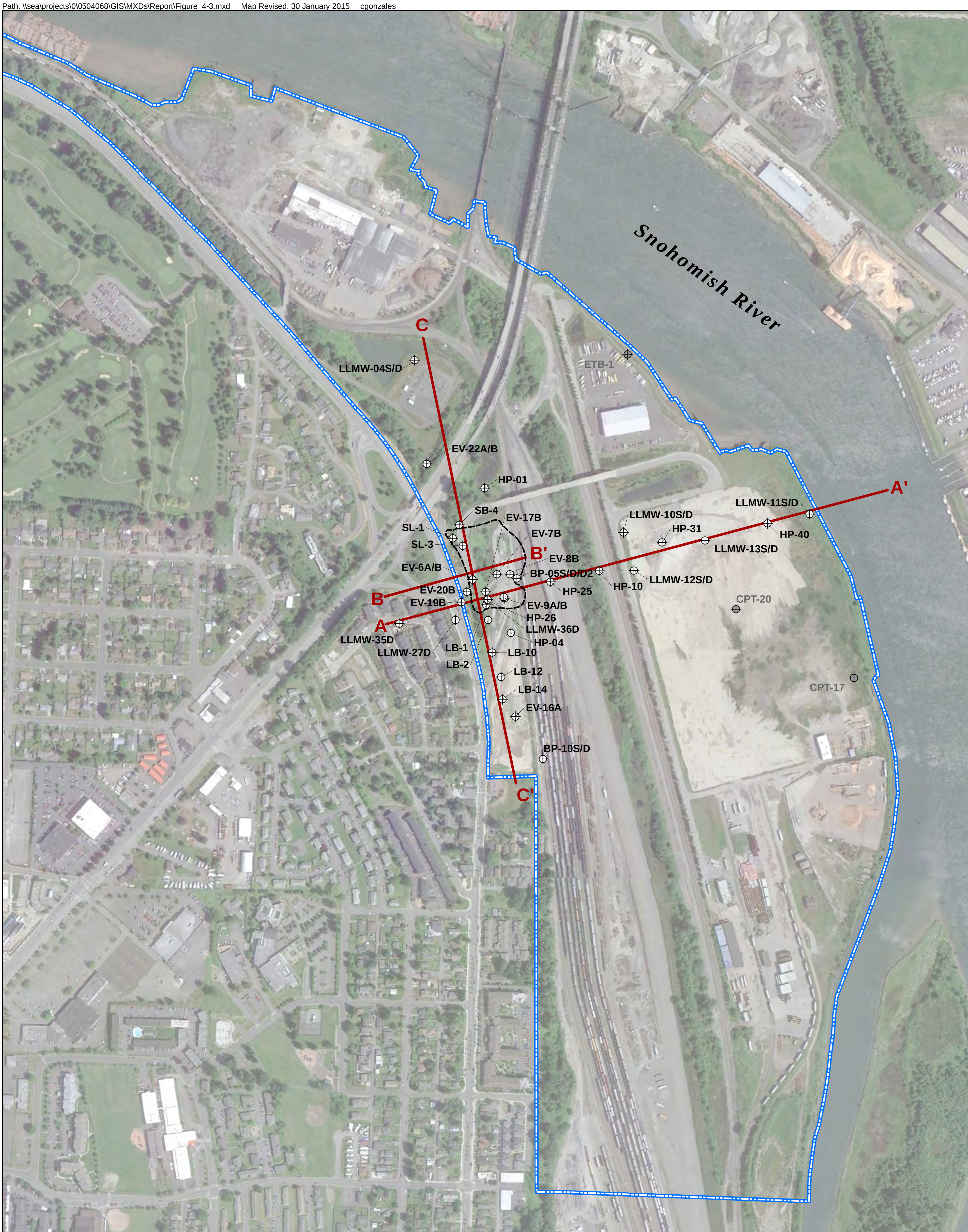
Lowland Area Surface Water and Stormwater Features

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-2

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-3.mxd Map Revised: 30 January 2015 cgonzales



Legend

Lowland Area

Approximate Extent of Slag (Estimate by Hydrometrics as Shown in ASARCO, 2000)[1]

Cross Sections and Identification

LLMW-05S Soil Investigation Location and Location Identification

CPT-17, CPT-20, EBT-1 Geotechnical Explorations By Others

N W E S

500 0 500

Feet

Notes:
1. Based on Exhibit 4-1 in the January 2000 "Comprehensive Lowland Area Remedial Investigation Report for the Everett Smelter Site," ASARCO
2. The locations of all features shown are approximate.
3. 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.

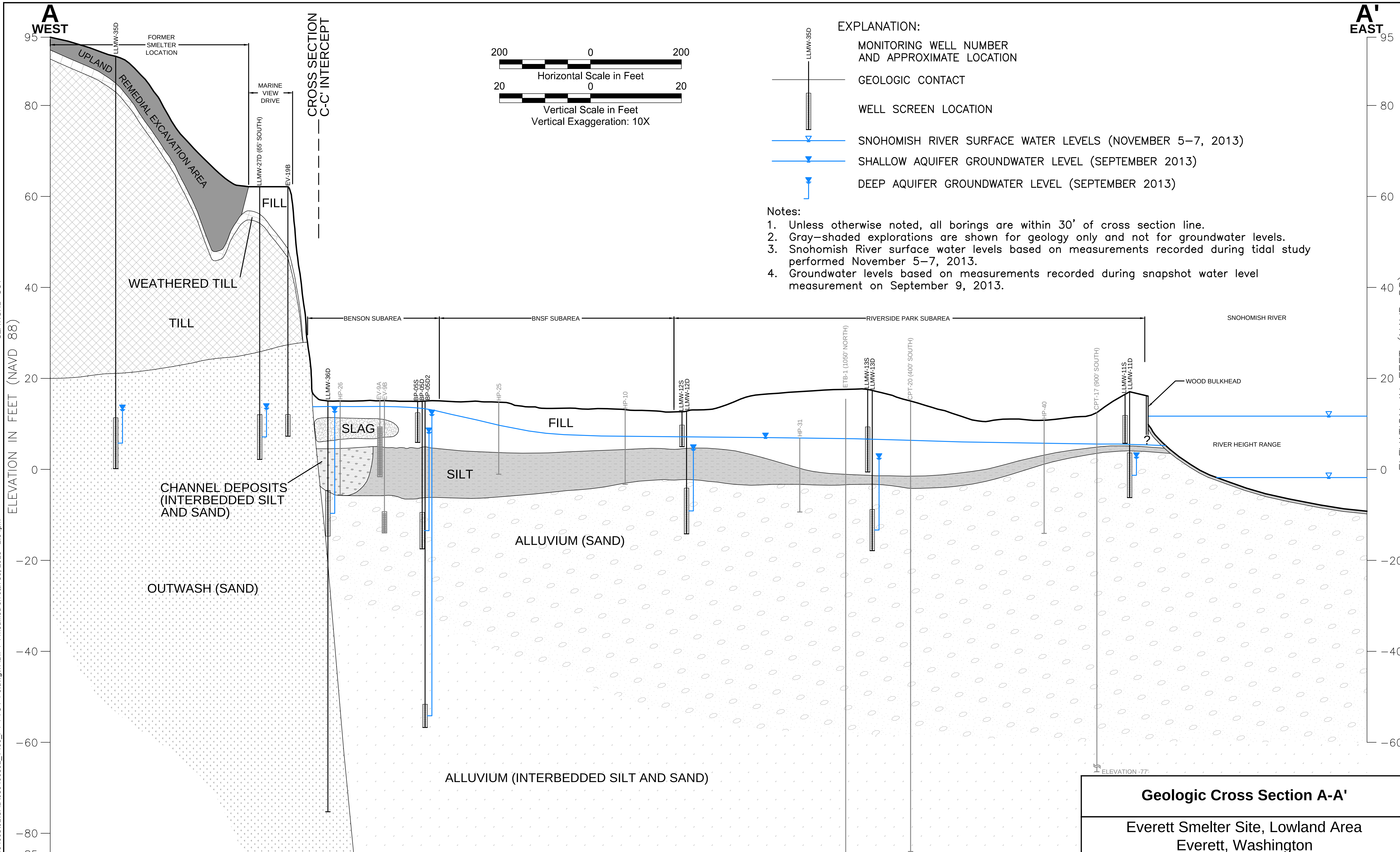
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology

Cross Section Location Map

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-3



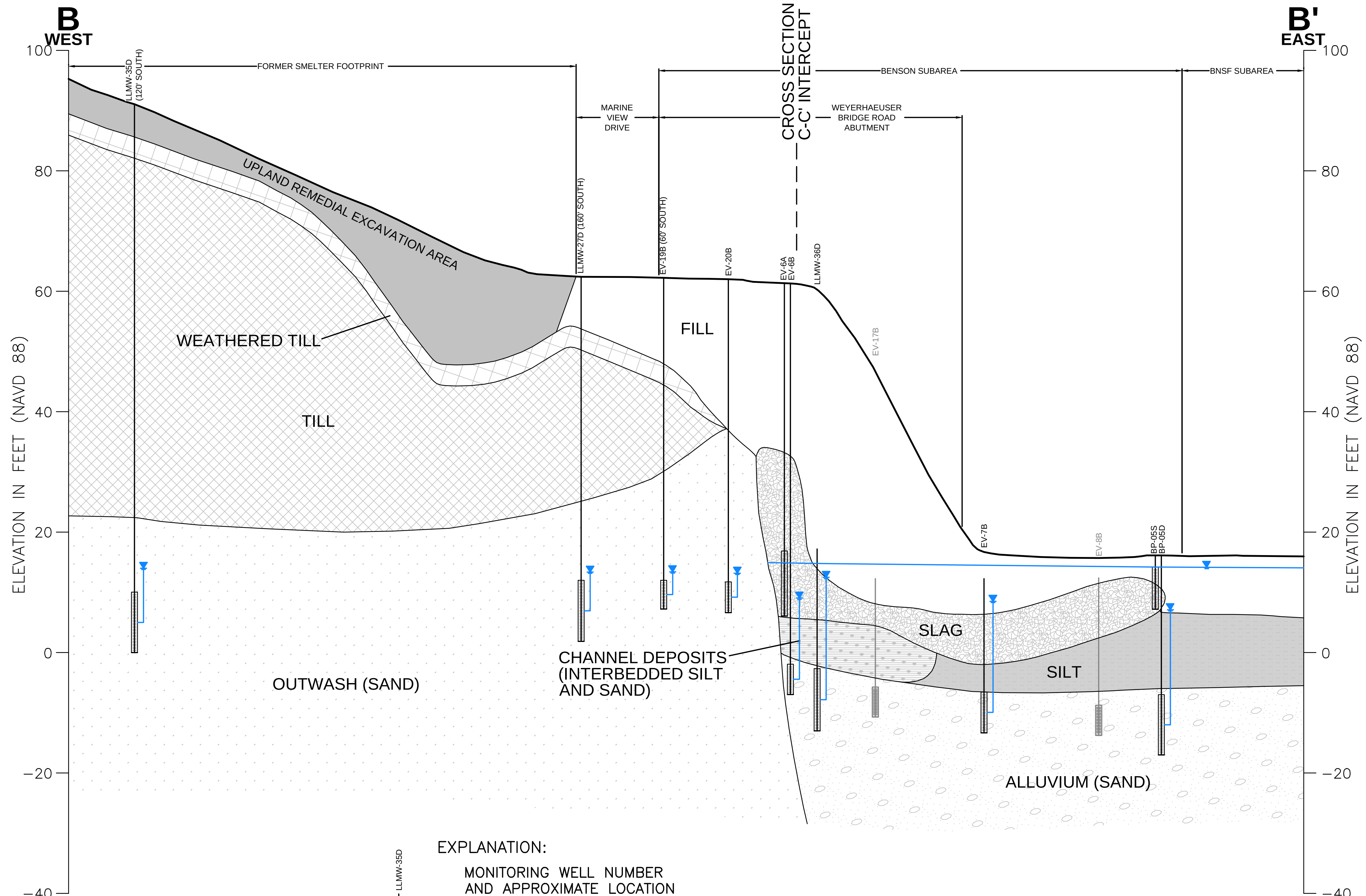
Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 4-3 for location of Cross Section.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Certain data were compiled from sources other than GeoEngineers. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Geologic Cross Section A-A'

Everett Smelter Site, Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-4



EXPLANATION:

LLMW-35D — MONITORING WELL NUMBER AND APPROXIMATE LOCATION

GEOLOGIC CONTACT

WELL SCREEN LOCATION

SHALLOW AQUIFER GROUNDWATER LEVEL (SEPTEMBER 2013)

DEEP AQUIFER GROUNDWATER LEVEL (SEPTEMBER 2013)

Notes:
1. Unless otherwise noted, all borings are within 30' of cross section line.
2. Gray-shaded explorations are shown for geology only and not for groundwater levels.
3. Groundwater levels based on measurements recorded during snapshot water level measurement on September 9, 2013.

80 0 80
Horizontal Scale in Feet

20 0 20
Vertical Scale in Feet
Vertical Exaggeration: 4X

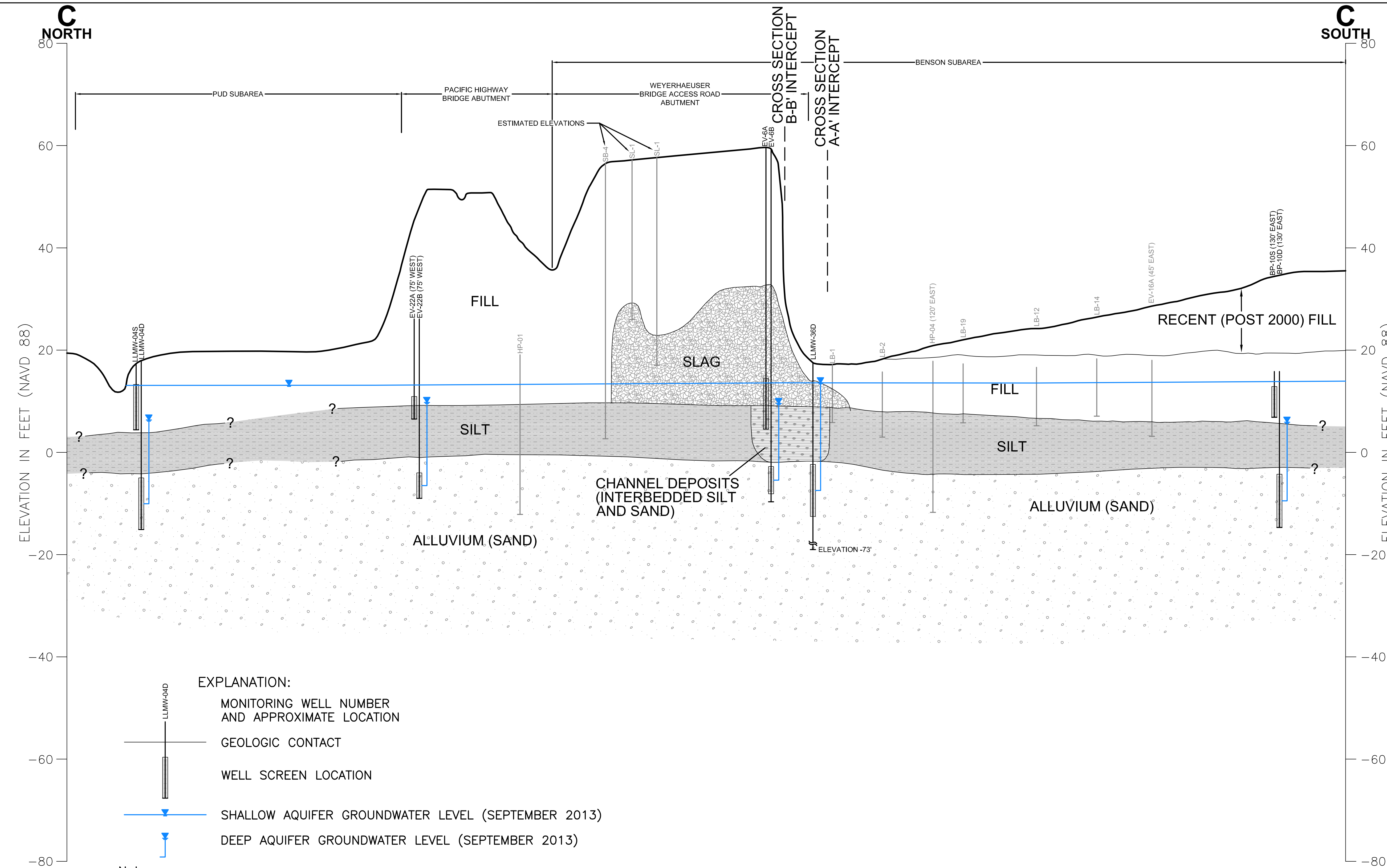
Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 4-3 for location of Cross Section.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Certain data were compiled from sources other than GeoEngineers. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

Geologic Cross Section B-B'

Everett Smelter Site, Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-5



Notes:
1. Unless otherwise noted, all borings are within 30' of cross section line.
2. Gray–shaded explorations are shown for geology only and not for groundwater levels.
3. Groundwater levels based on measurements recorded during snapshot water level measurement on September 9, 2013.

200 0 200
Horizontal Scale in Feet

20 0 20
Vertical Scale in Feet
Vertical Exaggeration: 10X

Geologic Cross Section C-C'

Everett Smelter Site, Lowland Area
Everett, Washington

GEOENGINEERS

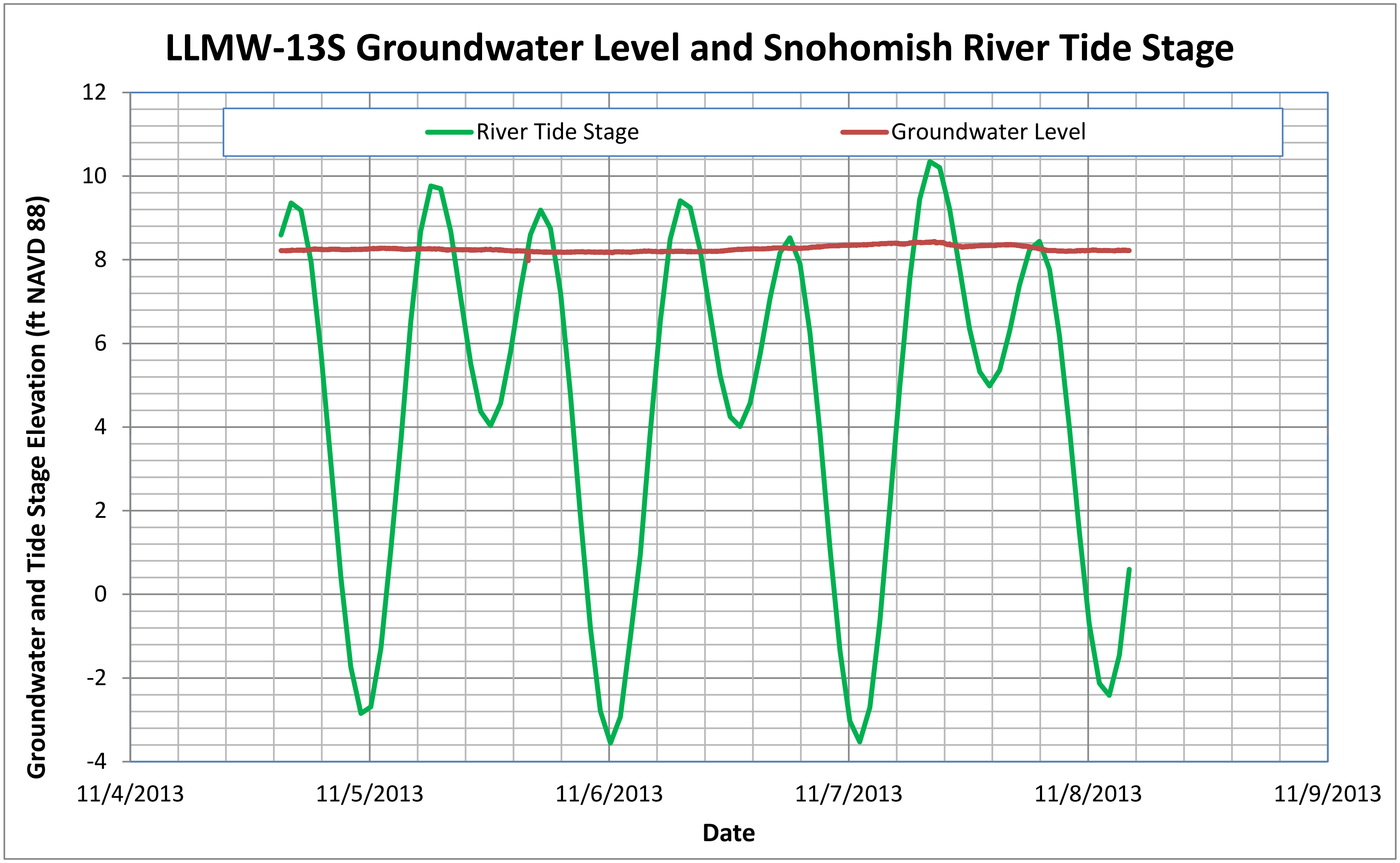
Figure 4-6

Notes:
1. The subsurface conditions shown are based on interpolation between widely spaced explorations and should be considered approximate; actual subsurface conditions may vary from those shown.
2. Refer to Figure 4-3 for location of Cross Section.
3. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. Certain data were compiled from sources other than GeoEngineers. The data sources do not guarantee these data are accurate or complete. There may have been updates to the data since the publication of this figure. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

SEAT:GRL : SCY

W:\Seattle\Projects\0\0504068\01\CAD\050406801_T400_F4-4 TO F4-6.dwg\TAB:F4-6 modified on Dec 19, 2013 - 3:08pm

0504-068-01



Notes:

1. LLMW-13S is located approximately 600 feet from the Snohomish River Shoreline.
2. No discernible tidal effect was observed on groundwater levels in LLMW-13S. The lack of discernible tidal effect shown is typical of other Lowland shallow aquifer wells measured during the tidal study.

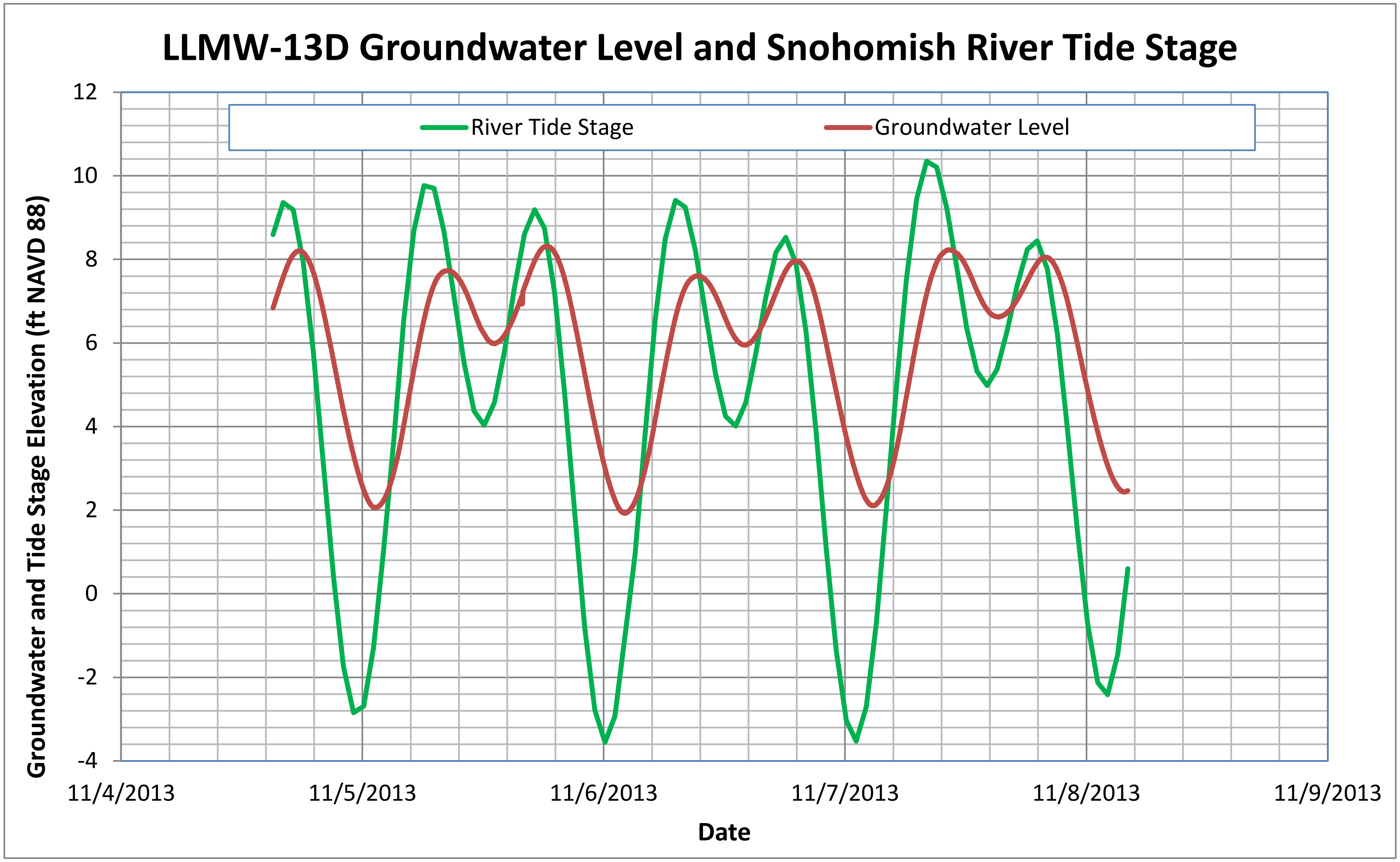
Reference: Drawing reference information.

Typical Tidal Response Observed in Lowland Shallow Aquifer

Everett Smelter Site – Lowland Area
Everett, Washington

GeoEngineers

Figure 4-7



Notes:

1. LLMW-13D is located approximately 600 feet from the Snohomish River Shoreline.
2. A tidal effect was observed on groundwater levels in LLMW-13D. The tidal effect shown is typical of other Lowland deep aquifer wells measured during the tidal study.

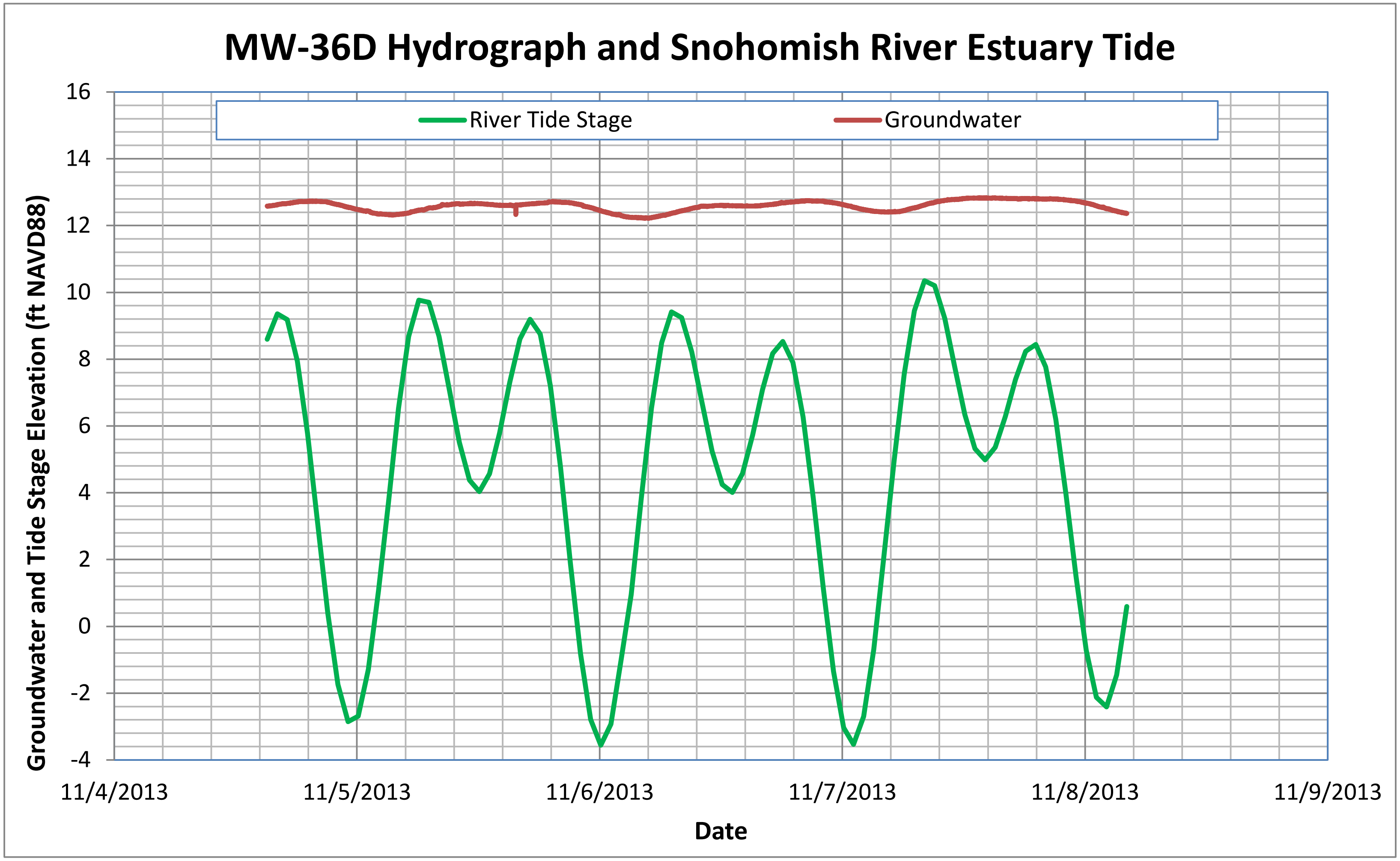
Reference: Drawing reference information.

Typical Tidal Response Observed in Lowland Area Deep Aquifer

Everett Smelter Site– Lowland Area
Everett, Washington

GeoEngineers

Figure 4-8



Notes:

1. LLMW-36D is located approximately 1,700feet from the Snohomish River Shoreline.
2. A tidal effect was observed on groundwater levels in LLMW-36D, which is the furthest well from the Snohomish River in which a tidal effect was observed.

Reference: Drawing reference information.

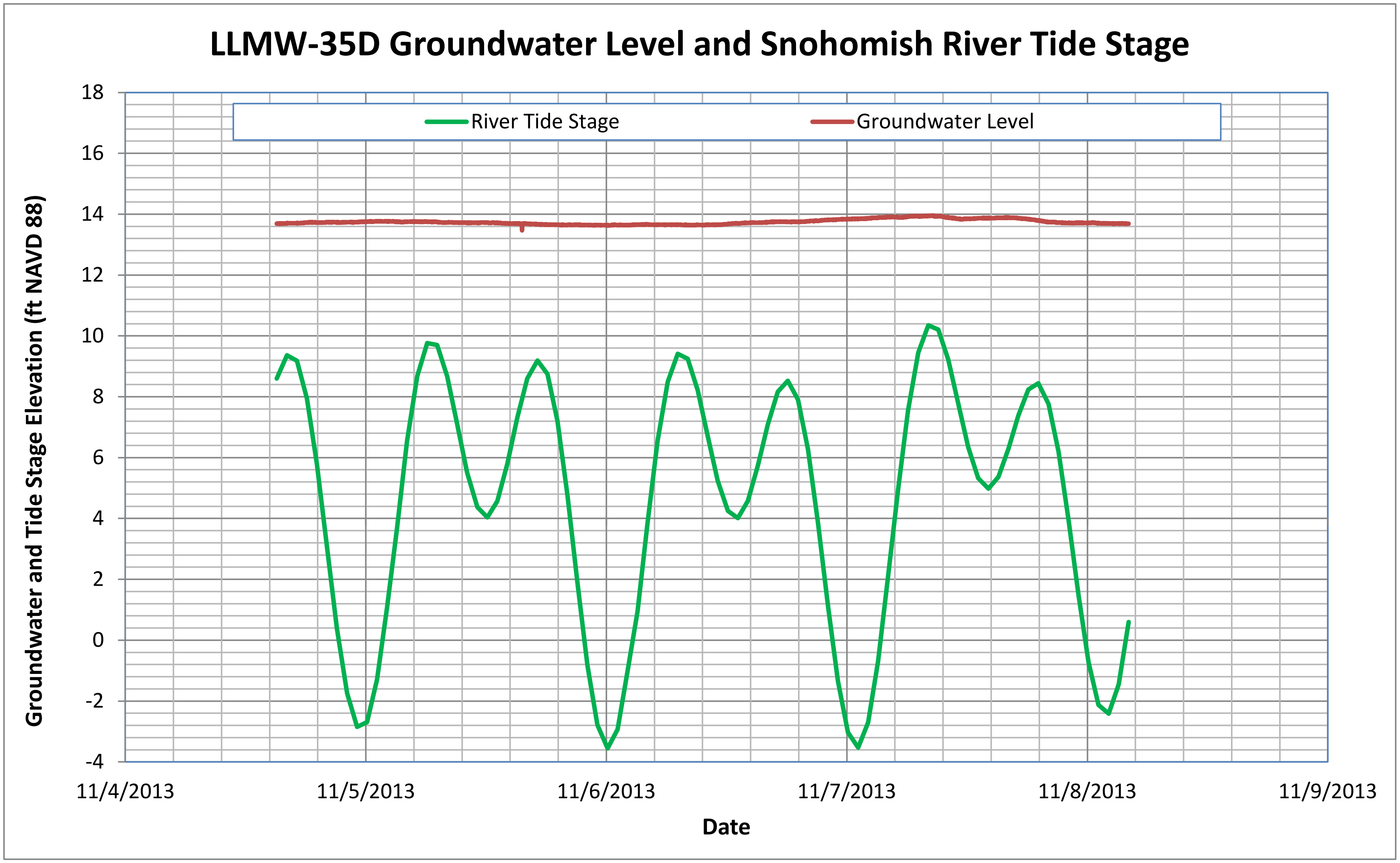
Tidal Response Observed in MW-36D

Everett Smelter Site– Lowland Area
Everett, Washington

GeoEngineers

Figure 4-9

0504-068-01



Notes:

1. LLMW-35D is located approximately 2,130 feet from the Snohomish River Shoreline.

   No discernible tidal effect was observed on groundwater levels in LLMW-35D. LLMW-35D was one of two upland deep aquifer wells measured during the tidal study; the second well was EV-20B, for which no discernible tidal effect was observed on groundwater levels.

Reference: Drawing reference information.

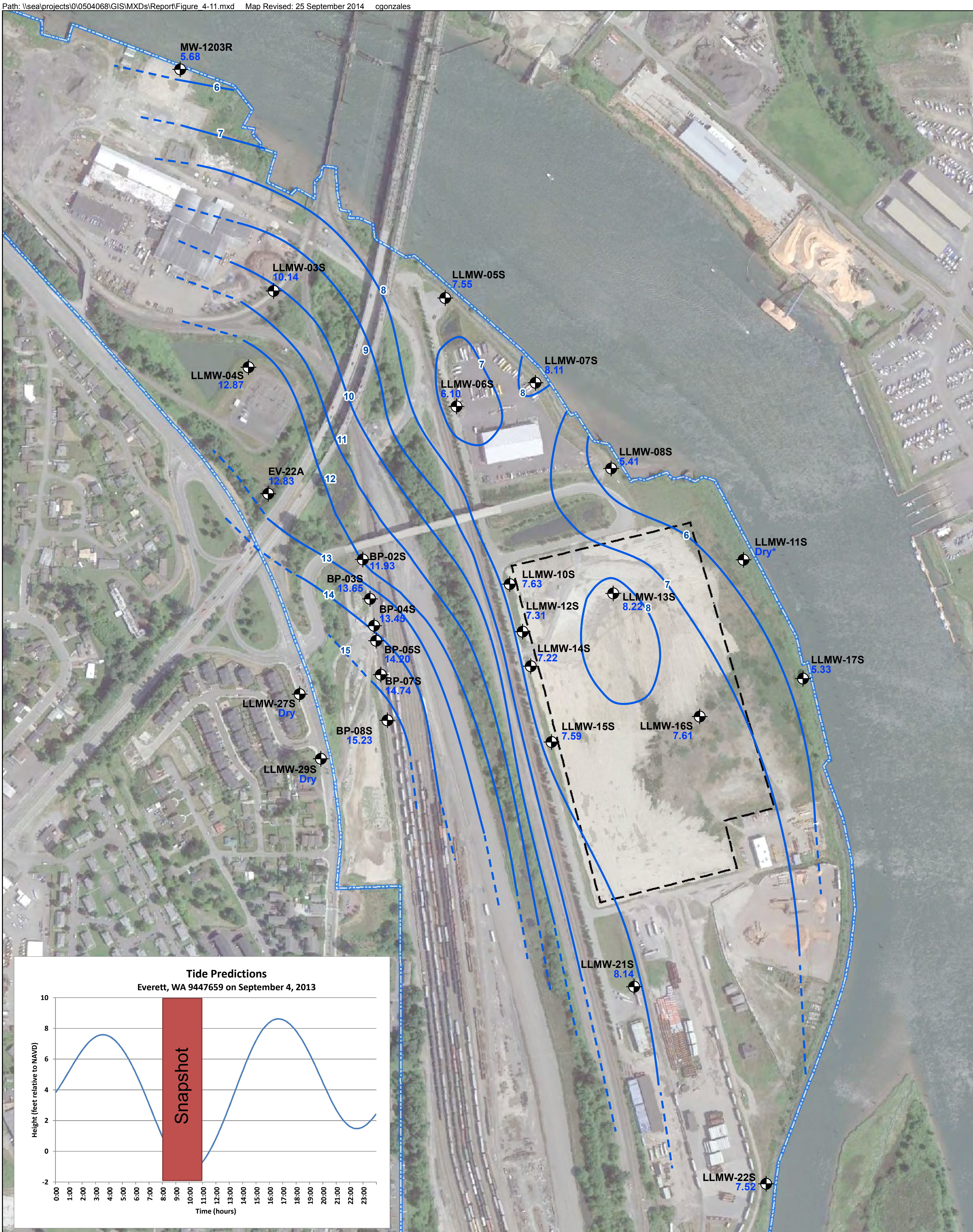
Tidal Response Observed in Upland Deep Aquifer

Everett Smelter Site – Lowland Area
Everett, Washington

GeoEngineers

Figure 4-10

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-11.mxd Map Revised: 25 September 2014 cgonzales



Legend

LLMW-10S 8.06 — Monitoring well designation and groundwater elevation (NAVD 88) on September 4, 2013.

Extent of Recent Filling (2011 to present)

Lowland Area

Estimated Groundwater Elevation Contour, ft (dashed where inferred)

1. The locations of all features shown are approximate.
2. Inset tidal prediction chart generated using National Oceanic and Atmospheric Administration (NOAA) tidal prediction data for September 4, 2013. http://tidesandcurrents.noaa.gov/
3. Red overlay box on tidal prediction chart represents the time period for groundwater measurements on September 4, 2013.
4. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document.

* NAVD 88 elevation of bottom of well screen is 10.26 feet.

Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

N W E S

400 0 400

Feet

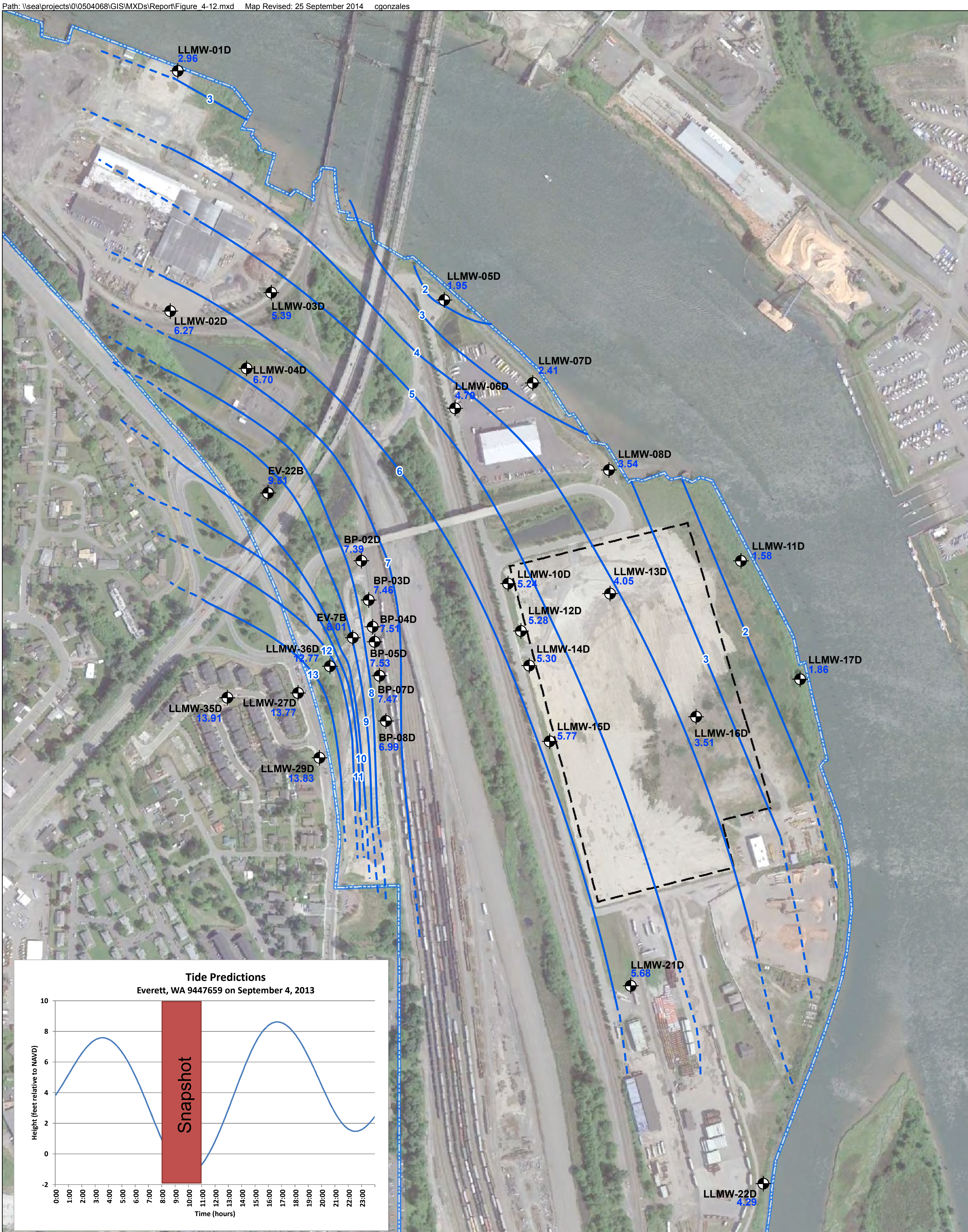
Snapshot Groundwater Elevations September 2013 – Shallow Aquifer

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-11

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-12.mxd Map Revised: 25 September 2014 cgonzales



Legend

- LLMW-10D 5.24 — Monitoring well designation and groundwater elevation (NAVD 88) on September 4, 2013.
- Extent of Recent Filling (2011 to present)
- Lowland Area
- Estimated Groundwater Elevation Contour, ft (dashed where inferred)

N W E S

400 0 400

Feet

Notes:
1. The locations of all features shown are approximate.
2. Inset tidal prediction chart generated using National Oceanic and Atmospheric Administration (NOAA) tidal prediction data for September 4, 2013. http://tidesandcurrents.noaa.gov/
3. Red overlay box on tidal prediction chart represents the time period for groundwater measurements on September 4, 2013.
4. 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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Snapshot Groundwater Elevations September 2013 – Deep Aquifer

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-12

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-13.mxd Map Revised: 25 September 2014 cgonzales

Legend

Lowland Area

Extent of Recent Filling (2011 to present)

MW12S 8.12 — Monitoring well designation and mean groundwater elevation in feet (NAVD 88) from 72-hour tidal study[3]

N, E, S, W

400 0 400

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.
3. Results from 72-hour tidal study performed on November 5-7, 2013.
* NAVD 88 elevation of bottom of well screen is 10.26 feet.

Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Mean Groundwater Elevations in Shallow Aquifer

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-13

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_4-14.mxd Map Revised: 25 September 2014 cgonzales

Legend

Lowland Area

Extent of Recent Filling (2011 to present)

MW12D 6.05 Monitoring well designation and mean groundwater elevation in feet (NAVD 88) from 72-hour tidal study[3]

N W E S

400 0 400

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.
3. Results from 72-hour tidal study performed on November 5-7, 2013.
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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

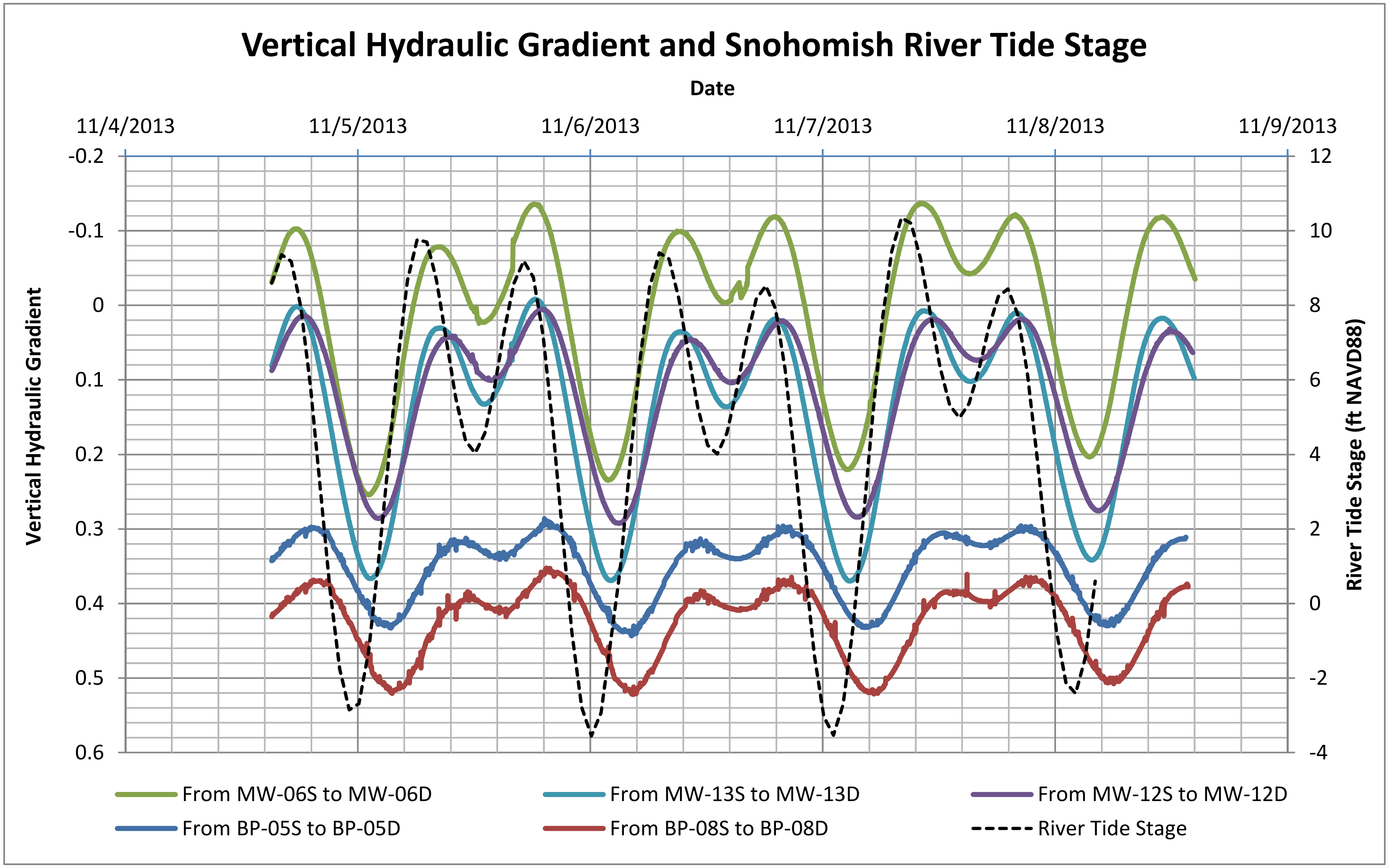
Mean Groundwater Elevations in Deep Aquifers

Everett Smelter Site - Lowland Area
Everett, Washington

GEOENGINEERS

Figure 4-14

0504-068-01



Notes:

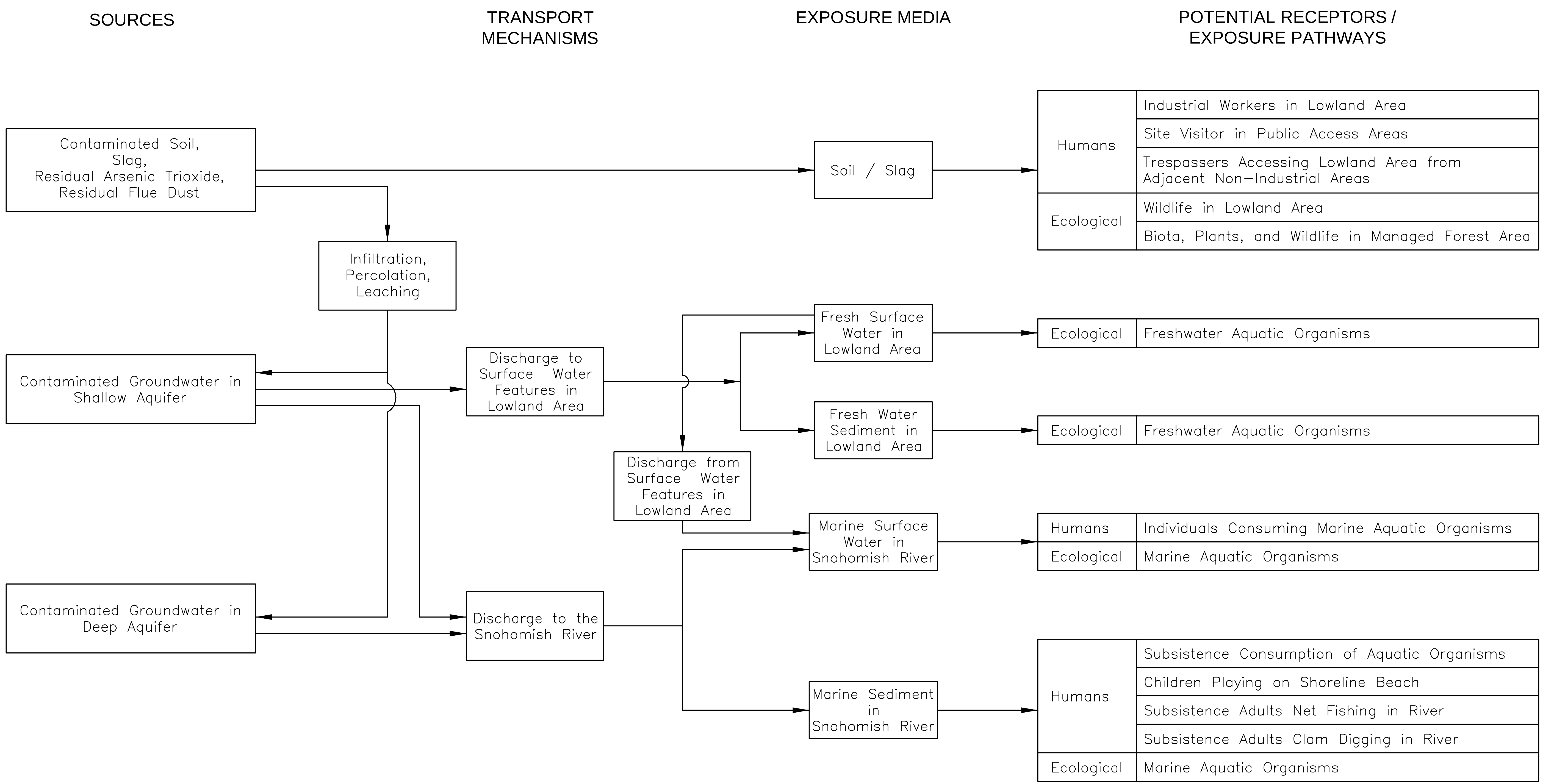
1. Vertical hydraulic gradient values that are positive indicate downward vertical gradient. Vertical hydraulic gradient values that are negative indicate an upward vertical hydraulic gradient.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached 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.

Vertical Hydraulic Gradients During Tidal Study

Everett Smelter – Lowland Area
Everett, Washington

GeoEngineers

Figure 4-15



Conceptual Site Exposure Model

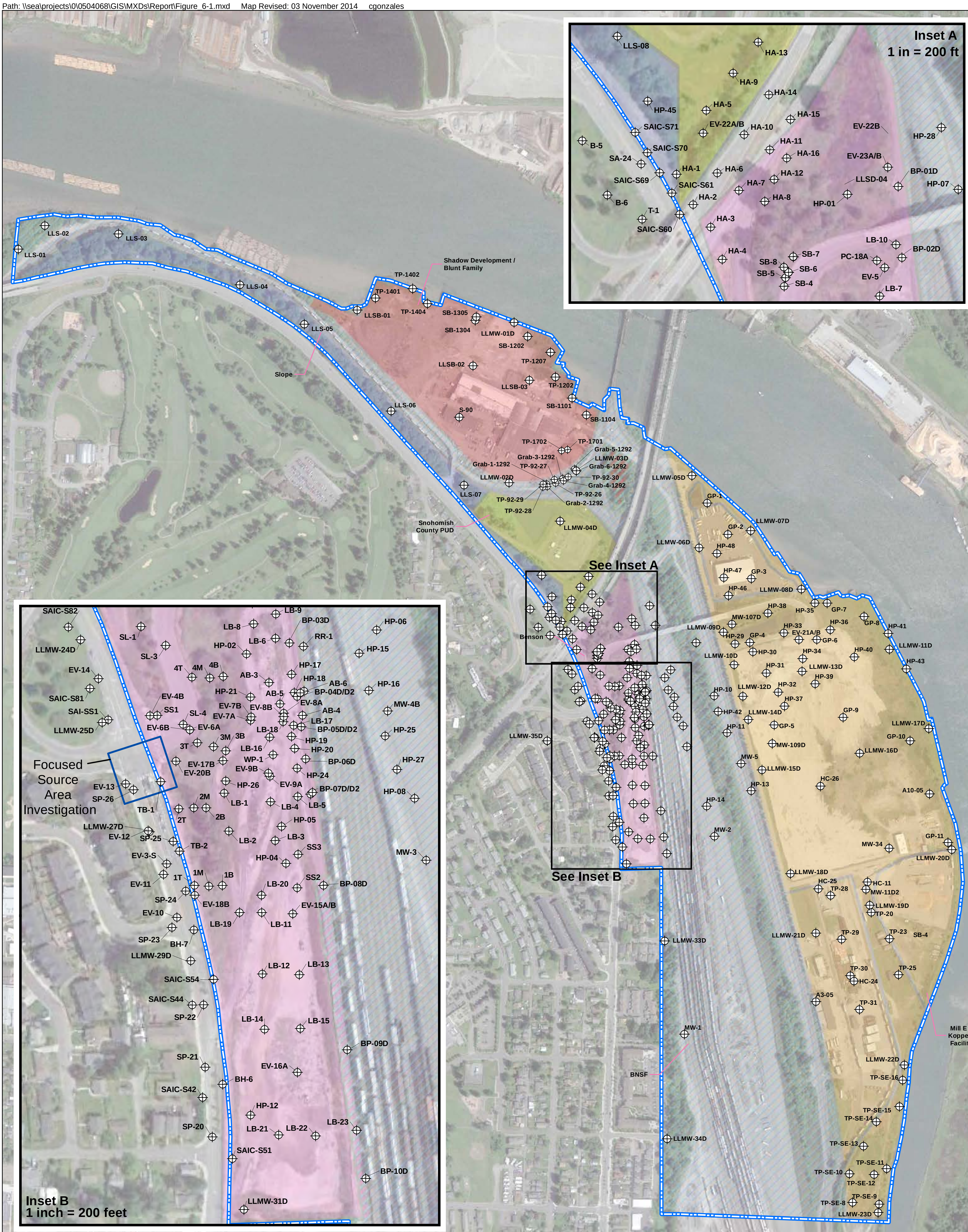
Everett Smelter Lowland Area
Everett, Washington

GEOENGINEERS

Figure 5-1

P:\0\0504068\01\CAD\050406801_Fig 5-1 CSEM.dwg\TAB:LANDSCAPE MODIFIED BY TMICHAUD ON MAR 11, 2014 - 12:08

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-1.mxd Map Revised: 03 November 2014 cgonzales



Legend

Lowland Area

EV-13 Soil Investigation Location and Location Identification

N W E S

600 0 600

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.

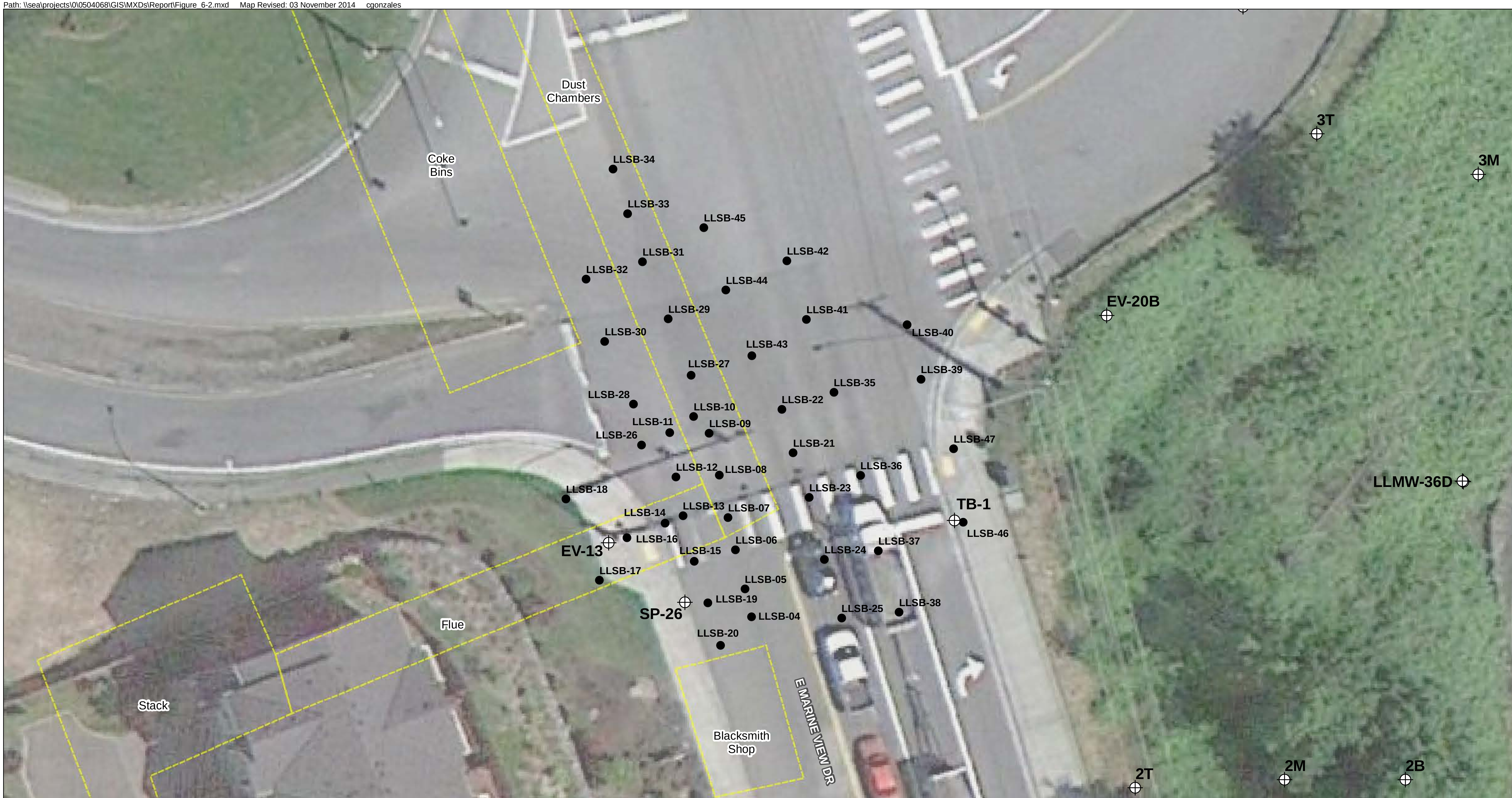
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

Soil Investigation Locations

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-1



Notes:
1. Aerial photo from 2012.
2. Based on Sheet 2-1 in the 1995 "Remedial Investigation, Everett Smelter Site," report prepared by Hydrometrics.
3. Geologic Cross Sections A-A' through C-C' were previously prepared in adjacent locations as part of the remedial investigation of the Lowland Area.
4. The locations of all features shown are approximate.
5. 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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology.

Legend

- (yellow dashed box) Approximate Location of Former Everett Smelter Structures[2]
- LLSB-04 ● Focused Source Area Investigation Location and Location Identification
- ⊕ Existing Investigation Location

N / W / E / S

20 0 20

Feet

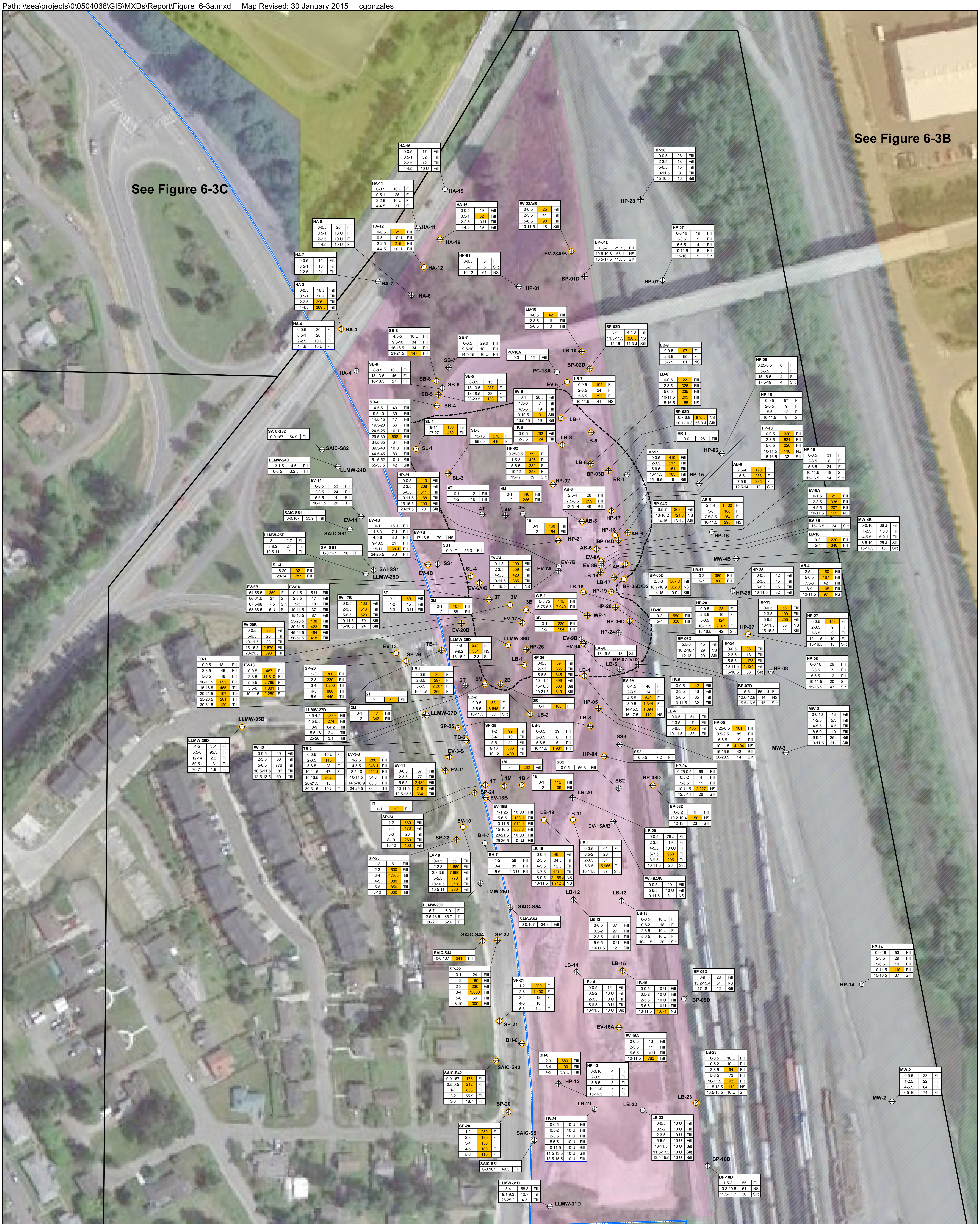
Focused Source Area Investigation Locations

Everett Smelter - Lowland Area

GeoEngineers

Figure 6-2

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-3a.mxd Map Revised: 30 January 2015 cgonzales



Legend

Lowland Area

BP-02D Soil Investigation Location and Location Identification

Soil Investigation Location with Arsenic Concentration Greater Than Preliminary Cleanup Levels

Approximate Extent of Slag (Estimated by Hydrometrics as Shown in ASARCO, 2000)

Arsenic Concentration in mg/kg

Location Identification

Soil Type
Fill
NS - Native Surface
Silt

BP-02D		
3-4	4.4 J	Fill
11.3-11.5	320 J	NS
15-16	11.3 J	Silt

Depth in Feet

Orange shading indicates arsenic concentration greater than preliminary cleanup levels

150 0 150

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

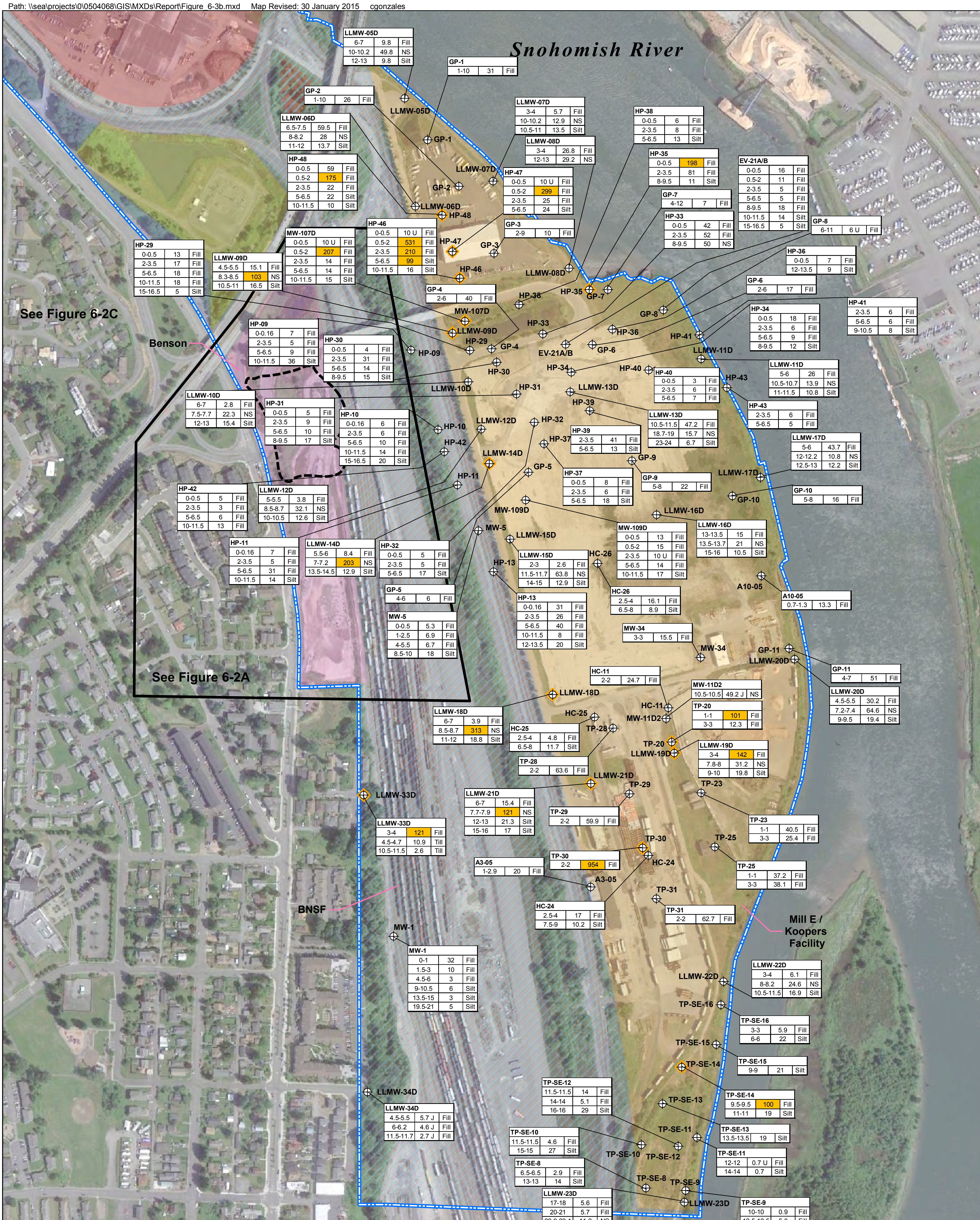
Arsenic Concentrations in Shallow Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-3A

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-3b.mxd Map Revised: 30 January 2015 cgonzales



Legend

- Lowland Area
- LLMW-09D ⊕ Soil Investigation Location and Location Identification
- Soil Investigation Location with Arsenic Concentration Greater Than Preliminary Cleanup Levels
- Approximate Extent of Slag (Estimated by Hydrometrics as Shown in ASARCO, 2000)

Arsenic Concentration in mg/kg

Location Identification

Depth in Feet

Soil Type
Fill
NS - Native Surface
Silt

LLMW-09D		
4.5-5.5	15.1	Fill
8.3-8.5	103	NS
10.5-11	16.5	Silt

Orange shading indicates arsenic concentration greater than preliminary cleanup levels

N E S W

400 0 400
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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

Arsenic Concentrations in Shallow Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-3B

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-3c.mxd Map Revised: 30 January 2015 cgonzales

Legend

- Lowland Area
- LLS-05 Soil Investigation Location and Location Identification
- Soil Investigation Location with Arsenic Concentration Greater Than Preliminary Cleanup Levels
- Approximate Extent of Slag (Estimated by Hydrometrics as Shown in ASARCO, 2000)

Arsenic Concentration in mg/kg

Location Identification

Depth in Feet

Soil Type
Fill
NS - Native Surface
Silt

LLS-05		
0-0.5	16.2	NS
0.8-1	27.1	NS

Orange shading indicates arsenic concentration greater than preliminary cleanup levels

350 0 350
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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

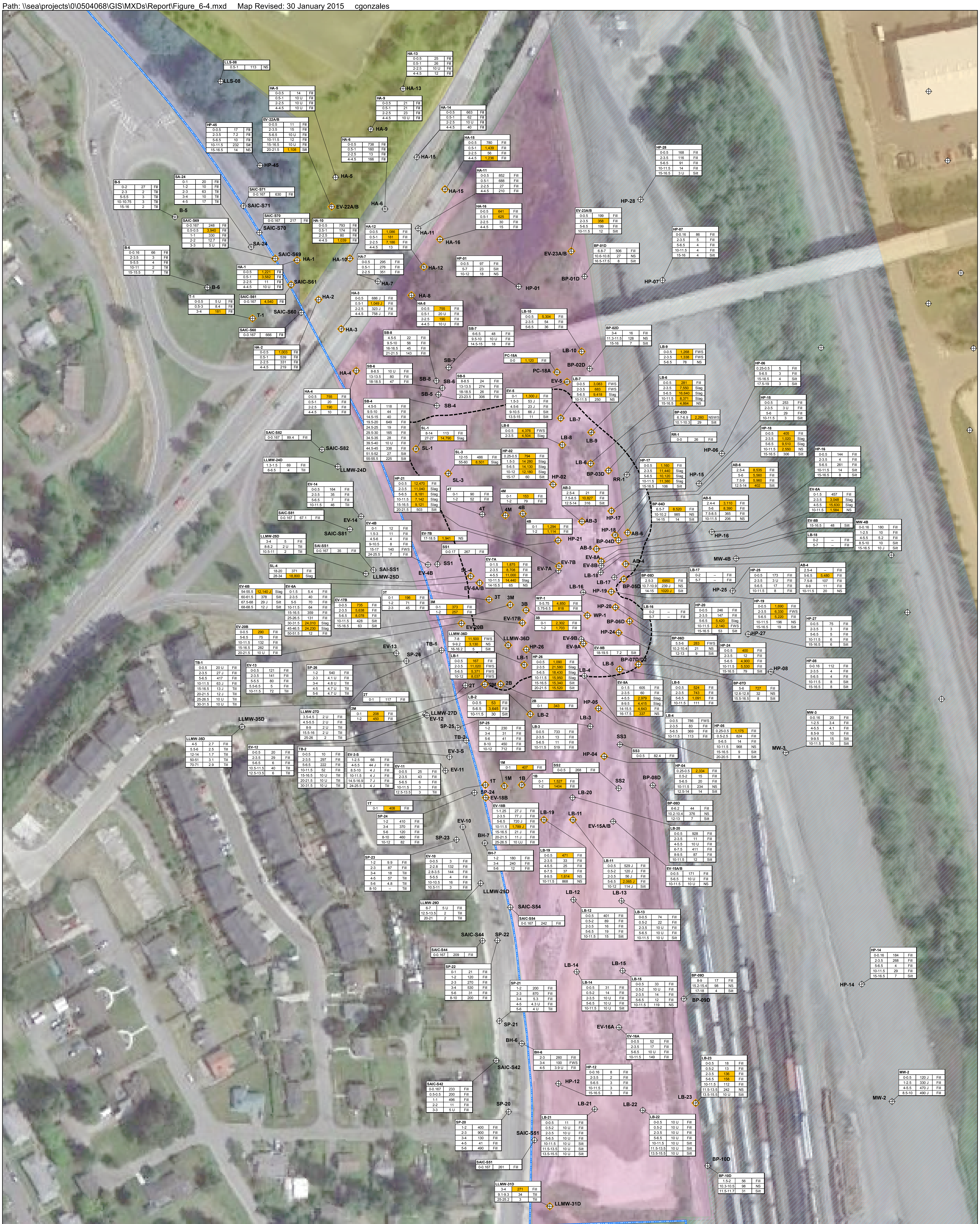
Arsenic Concentrations in Shallow Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-3C

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-4.mxd   Map Revised: 30 January 2015   cgonzales



Legend

Lowland Area

BP-02D — Soil Investigation Location and Location Identification

Soil Investigation Location with Lead Concentration Greater Than Preliminary Cleanup Levels

Approximate Extent of Slag (Estimated by Hydrometrics as Shown in ASARCO, 2000)

Lead Concentration in mg/kg

Location Identification

Depth in Feet

BP-02D		
3-4	4.4 J	Fill
11.3-11.5	320 J	NS
15-16	11.3 J	Silt

Orange Shading Indicates Lead Concentration Greater Than Preliminary Cleanup Levels

Soil Type
Fill
NS - Native Surface
Silt
Till
FWS - Fill With Slag
NSWS - Native Surface With Slag
SWS - Silt With Slag
TWS - Till With Slag

150 0 150
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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

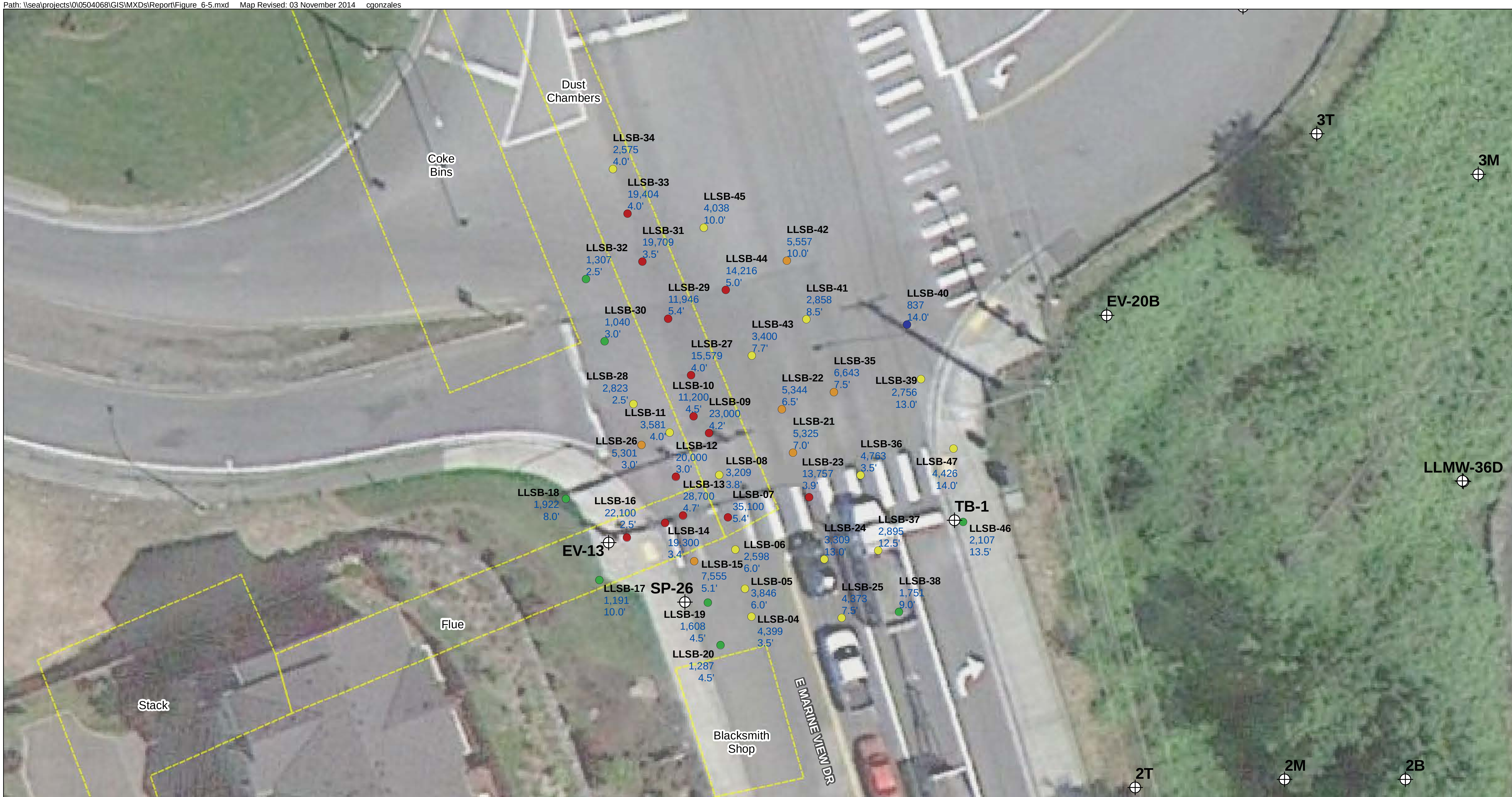
Lead Concentrations in Shallow Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-4

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-5.mxd Map Revised: 03 November 2014 cgonzales



Notes:
1. Aerial photo from 2012.
2. Based on Sheet 2-1 in the 1995 "Remedial Investigation, Everett Smelter Site," report prepared by Hydrometrics.
3. The locations of all features shown are approximate.
4. 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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology.

Legend

- LLSB-09 ← Investigation Location and Location Designation
- 23,000 ← Arsenic Concentration in mg/kg
- 4.2' ← Sample Depth in Feet Below Gound Surface (bgs)
- Approximate Location of Former Everett Smelter Structures[2]
- Existing Investigation Location

Maximum Arsenic Concentration Range (mg/kg)

- <1,000
- 1,001 - 2,500
- 2,501 - 5,000
- 5,001 - 10,000
- >10,000

N W E S

20 0 20

Feet

Maximum Arsenic Concentrations in Soil Focused Source Area Investigation

Everett Smelter - Lowland Area

GeoEngineers

Figure 6-5

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-6.mxd Map Revised: 31 October 2014 cgonzales

Notes:
1. Aerial photo from 2012.
2. Based on Sheet 2-1 in the 1995 "Remedial Investigation, Everett Smelter Site," report prepared by Hydrometrics.
3. The locations of all features shown are approximate.
4. 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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. City of Everett GIS. Washington State Department of Ecology.

Legend

- LLSB-09 ⟵ Investigation Location and Location Designation
- 23,000 ⟵ Arsenic Concentration in mg/kg
- 4.2' ⟵ Sample Depth in Feet Below Gound Surface (bgs)
- Approximate Location of Former Everett Smelter Structures[2]
- Existing Investigation Location

Maximum Lead Concentration Range (mg/kg)

- <250
- 251 - 1,000
- 1,001 - 2,500
- 2,501 - 10,000
- >10,000

N W E S

20 0 20
Feet

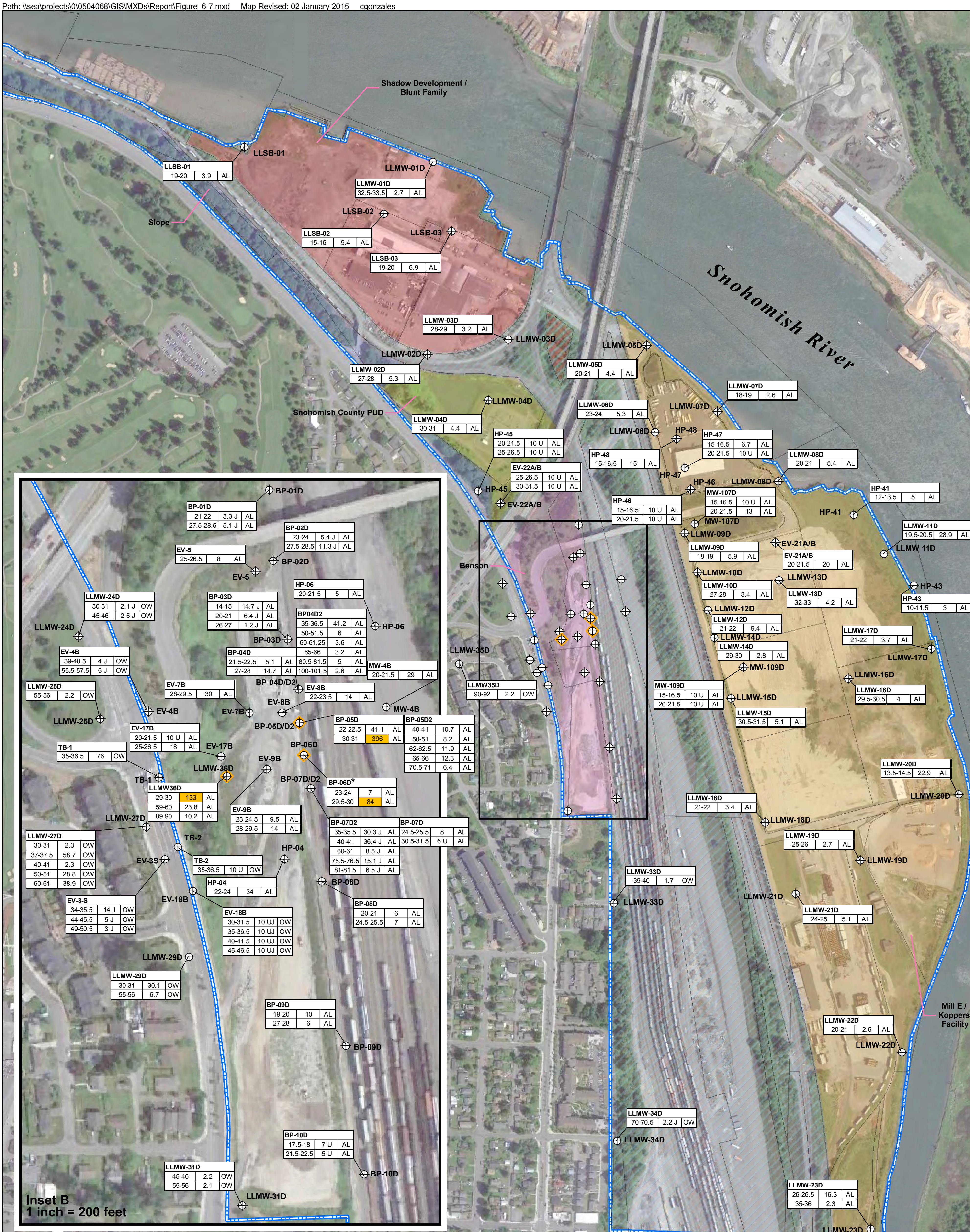
Maximum Lead Concentrations in Soil Focused Source Area Investigation

Everett Smelter - Lowland Area

GeoEngineers

Figure 6-6

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-7.mxd Map Revised: 02 January 2015 cgonzales



Legend

Lowland Area

BP-05D Soil Investigation Location and Location Identification

Soil Investigation Location with Arsenic Concentration Greater Than Preliminary Cleanup Levels

* The duplicate of sample collected from a depth of 29.5 to 30 feet had an arsenic concentration of 116 mg/kg which is greater than the preliminary cleanup level.

Arsenic Concentration in mg/kg

Location Identification

Depth in Feet

Soil Type
AL - Alluvium
OW - Outwash

BP-05D		
22-22.5	41.1	AL
30-31	396	AL

Orange shading indicates arsenic concentration greater than preliminary cleanup level

N S E W

600 0 600
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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

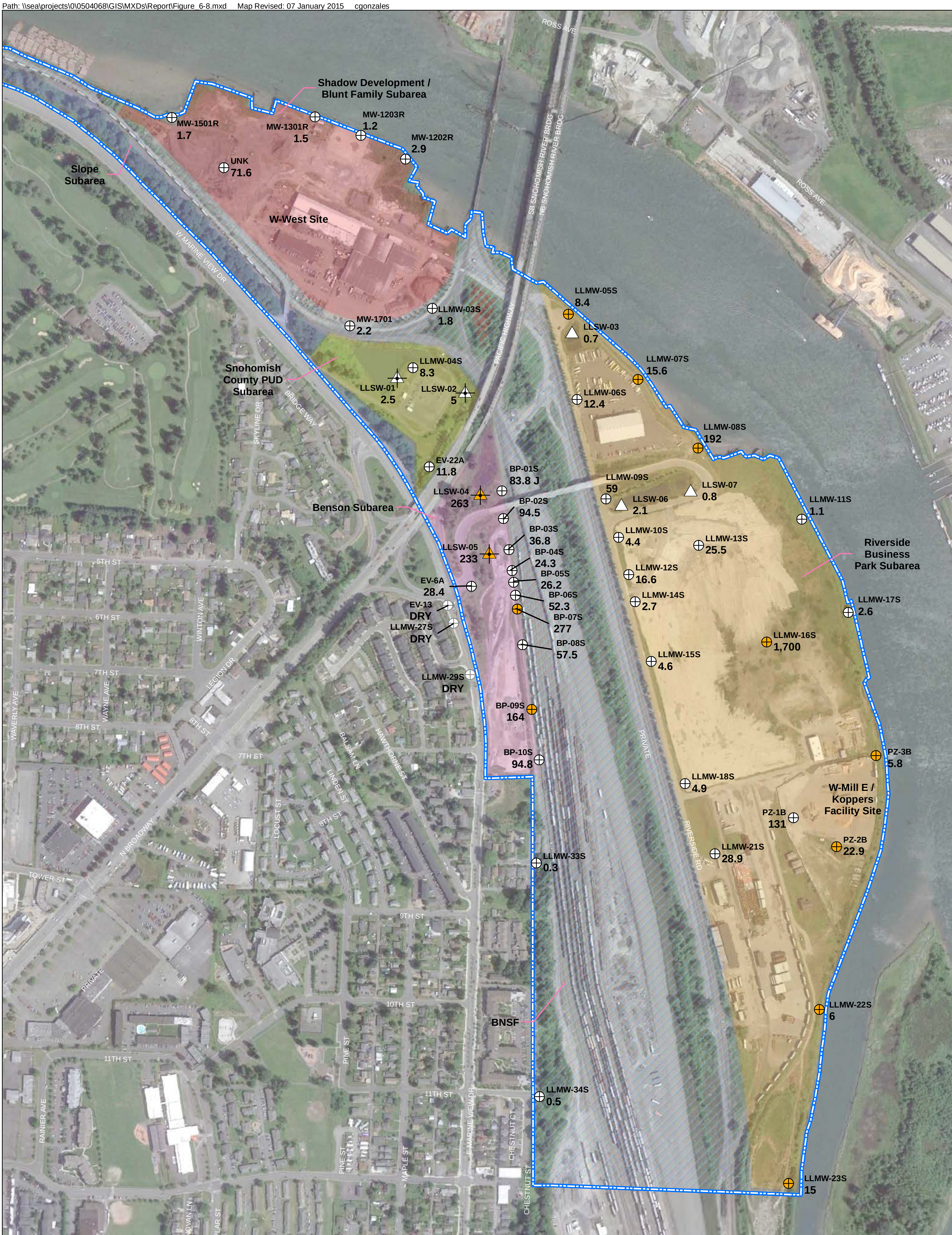
Arsenic Concentrations in Deeper Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-7

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-8.mxd Map Revised: 07 January 2015 cgonzales



Legend

Lowland Area

LLMW-03S

- Monitoring Well Location and Location Identification
- Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels
- Surface Water Sample Location and Location Identification
- Surface Water Sample Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels
- Stormwater Sample Location and Location Identification

LLMW-03S
1.8

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

Notes:
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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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

N W E S

500 0 500
Feet

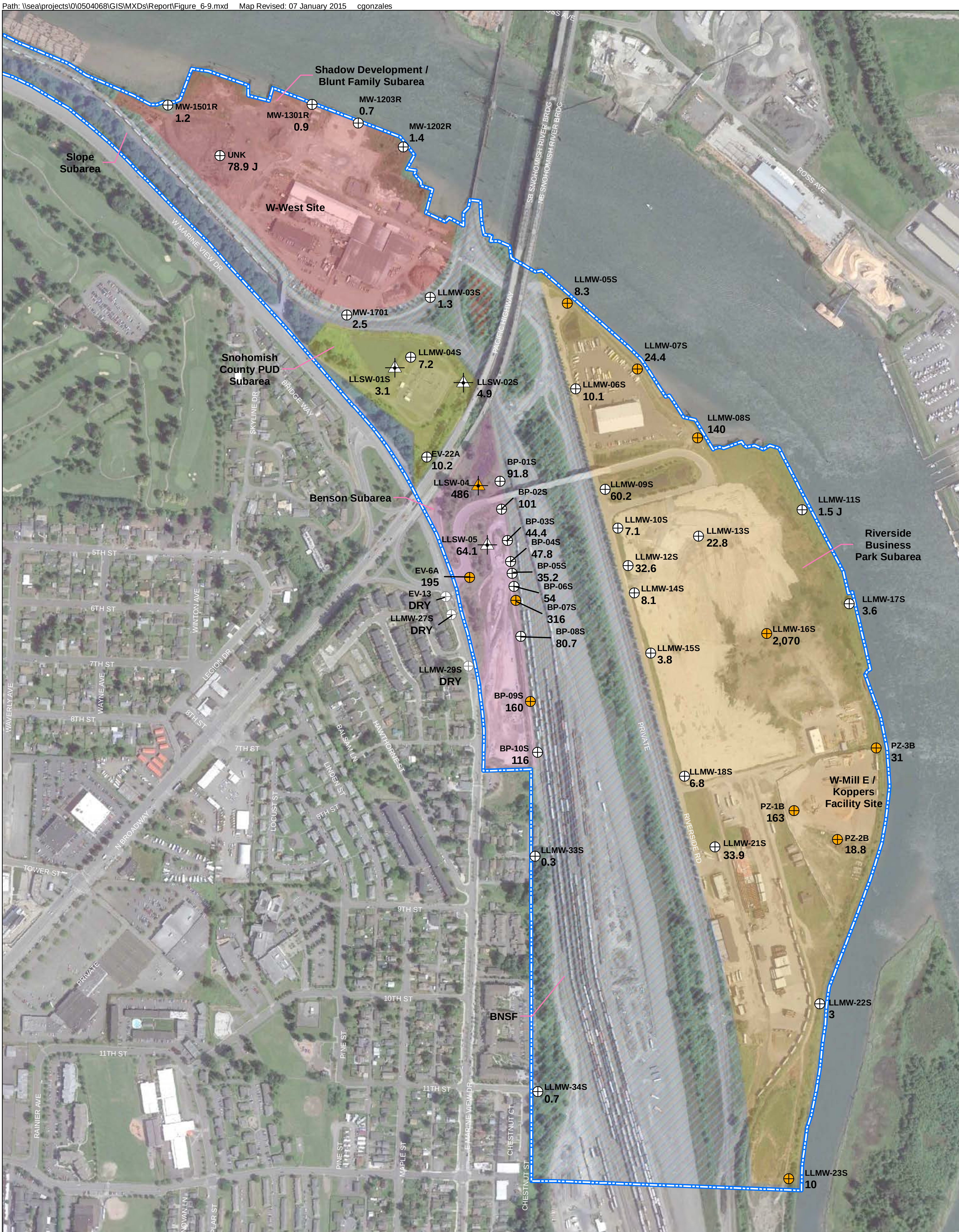
Dissolved Arsenic Concentrations in Shallow Aquifer Groundwater, Surface Water and Stormwater January/February, 2013 (Q1)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-8

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-9.mxd Map Revised: 07 January 2015 cgonzales



Legend

Lowland Area

LLMW-03S

- Monitoring Well Location and Location Identification
- Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels
- Surface Water Sample Location and Location Identification
- Surface Water Sample Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03S
1.3

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N W E S

500 0 500

Feet

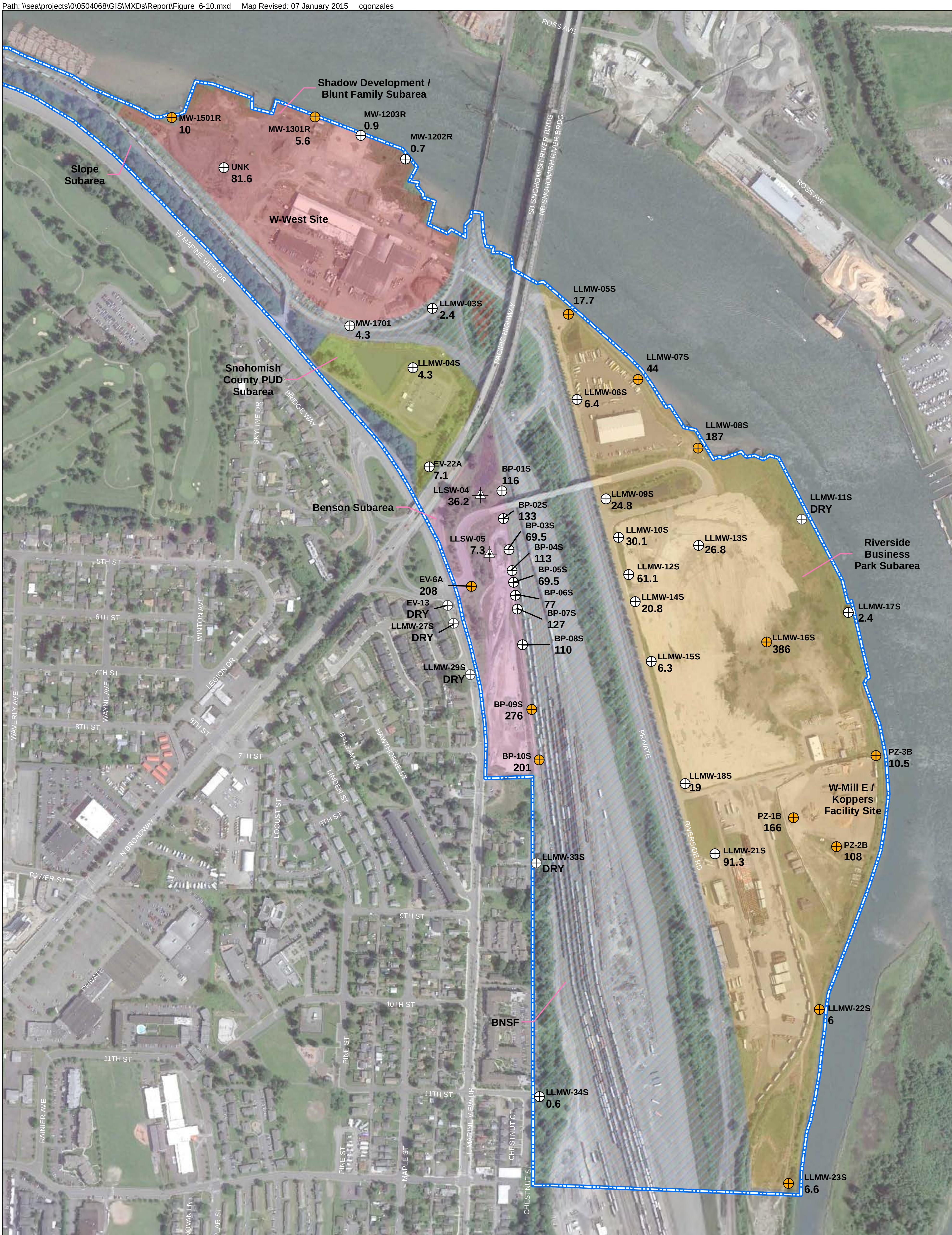
Dissolved Arsenic Concentrations in Shallow Aquifer Groundwater and Surface Water April/May 2013 (Q2)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-9

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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.



Legend

Lowland Area

LLMW-03S

Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

Surface Water Sample Location and Location Identification

Surface Water Sample Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03S
2.4

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N / S / E / W

500 0 500

Feet

Notes:
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Data Source: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

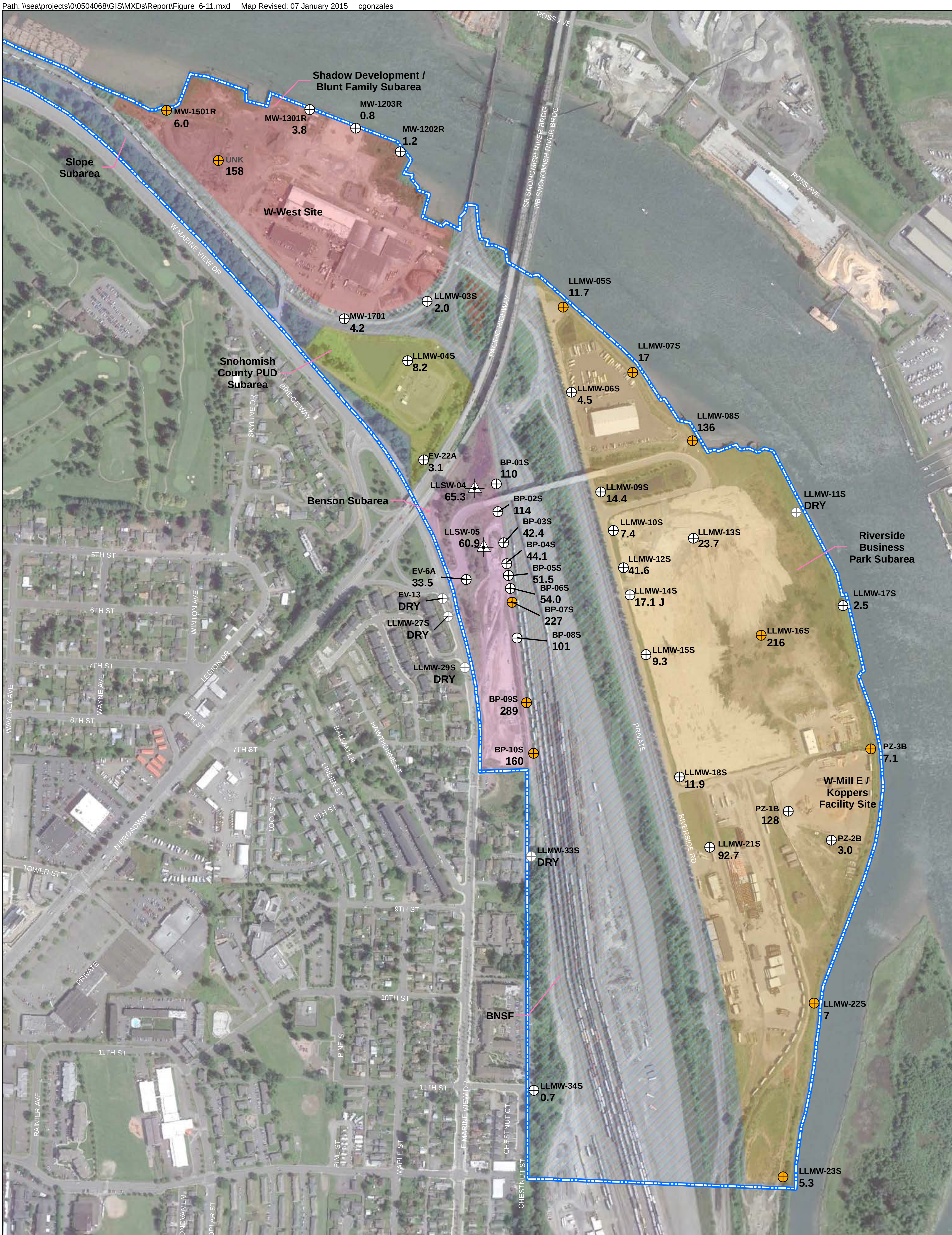
Dissolved Arsenic Concentrations in Shallow Aquifer Groundwater and Surface Water August/September 2013 (Q3)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-10

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-11.mxd Map Revised: 07 January 2015 cgonzales



Legend

Lowland Area

LLMW-03S

Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

Surface Water Sample Location and Location Identification

Surface Water Sample Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03S
2.0

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N E S W

500 0 500

Feet

Notes:
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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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

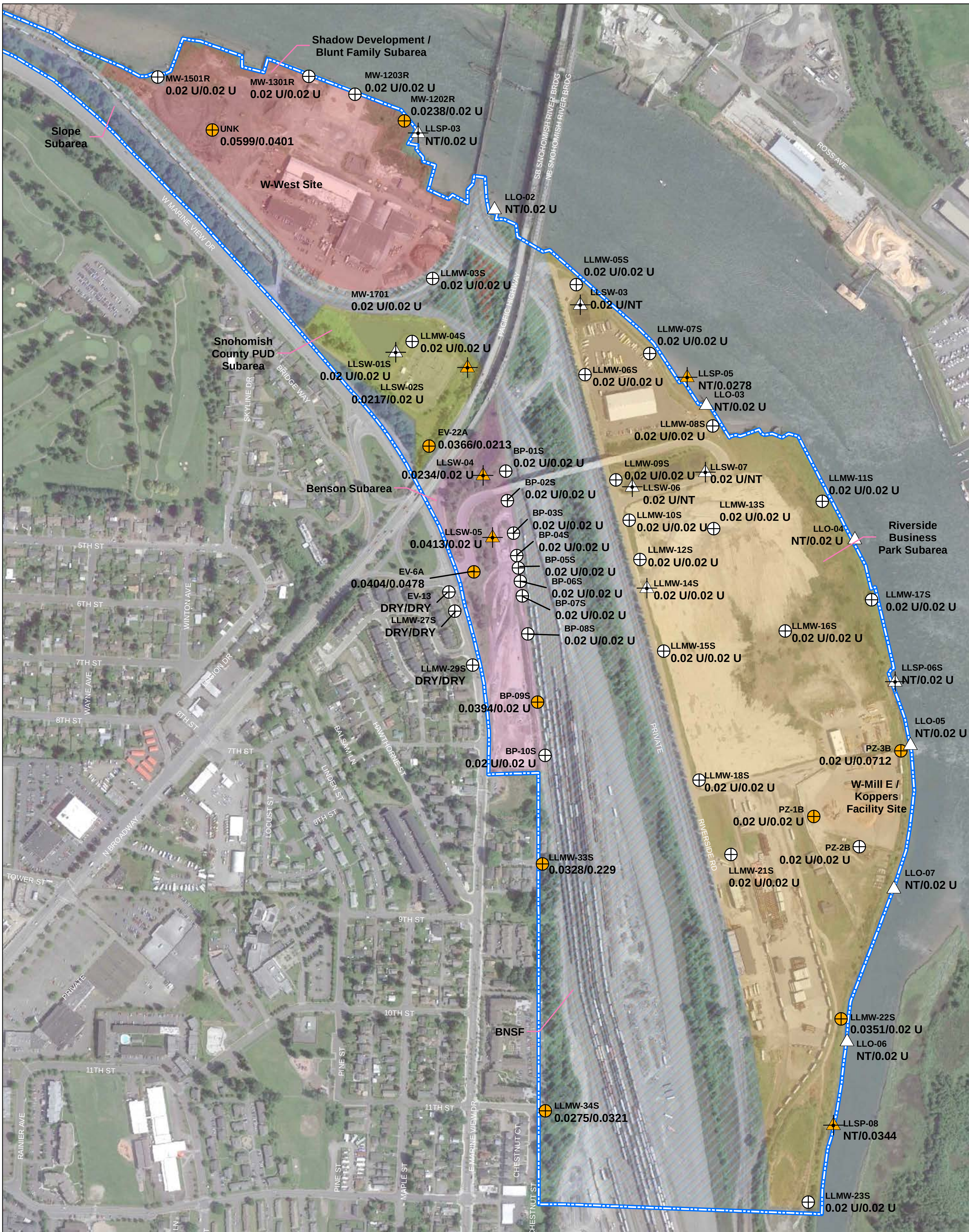
Dissolved Arsenic Concentrations in Shallow Aquifer Groundwater and Surface Water October/November 2013 (Q4)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-11

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-12.mxd Map Revised: 07 January 2015 cgonzales



Legend

Lowland Area

LLMW-03S

Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Mercury Concentration Greater Than Preliminary Cleanup Levels During Either Q1 or Q2

Surface Water or Seep Sample Location and Location Identification

Surface Water or Seep Sample Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels During Either Q1 or Q2

Outfall Location and Location Identification.

LLMW-03S
0.02 U / 0.02 U
Q1 Q2

Total Mercury Concentration in ug/L
U= Mercury Was Not Detected at Identifed at Detection Limit
DRY = Well Was Dry and Therefore, No Sample Could Be Obtaineed
NT = Not Tested

N E S W

500 0 500
Feet

Notes:
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Data Source: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

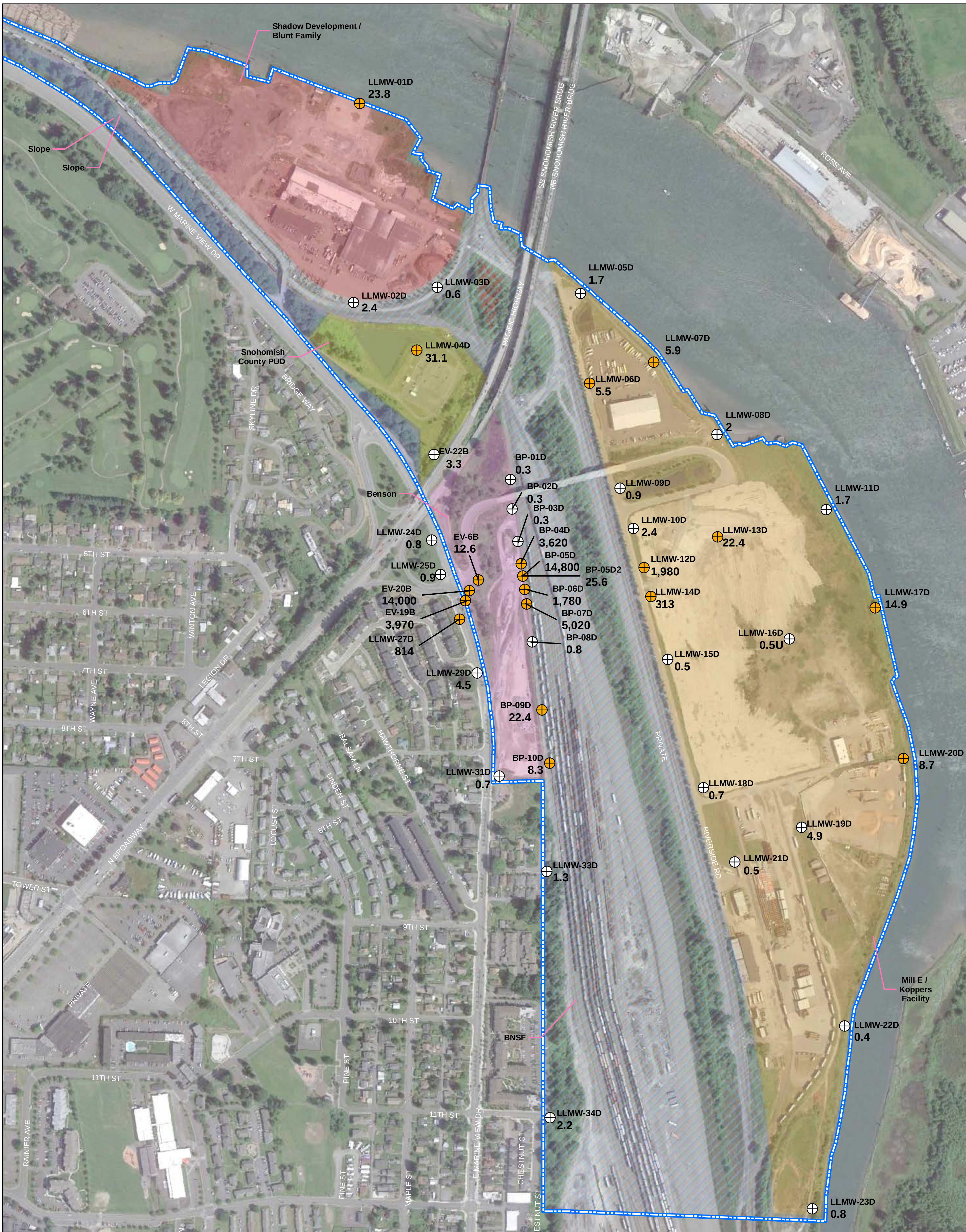
Total Mercury Concentrations in Shallow Aquifer Groundwater, Surface Water, Stormwater, Seeps and Outfalls (Q1,Q2)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-12

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-13.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

LLMW-03D
⊕ Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

⊕ LLMW-03D
0.6

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N E S W

500 0 500

Feet

Notes:
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Data Source: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

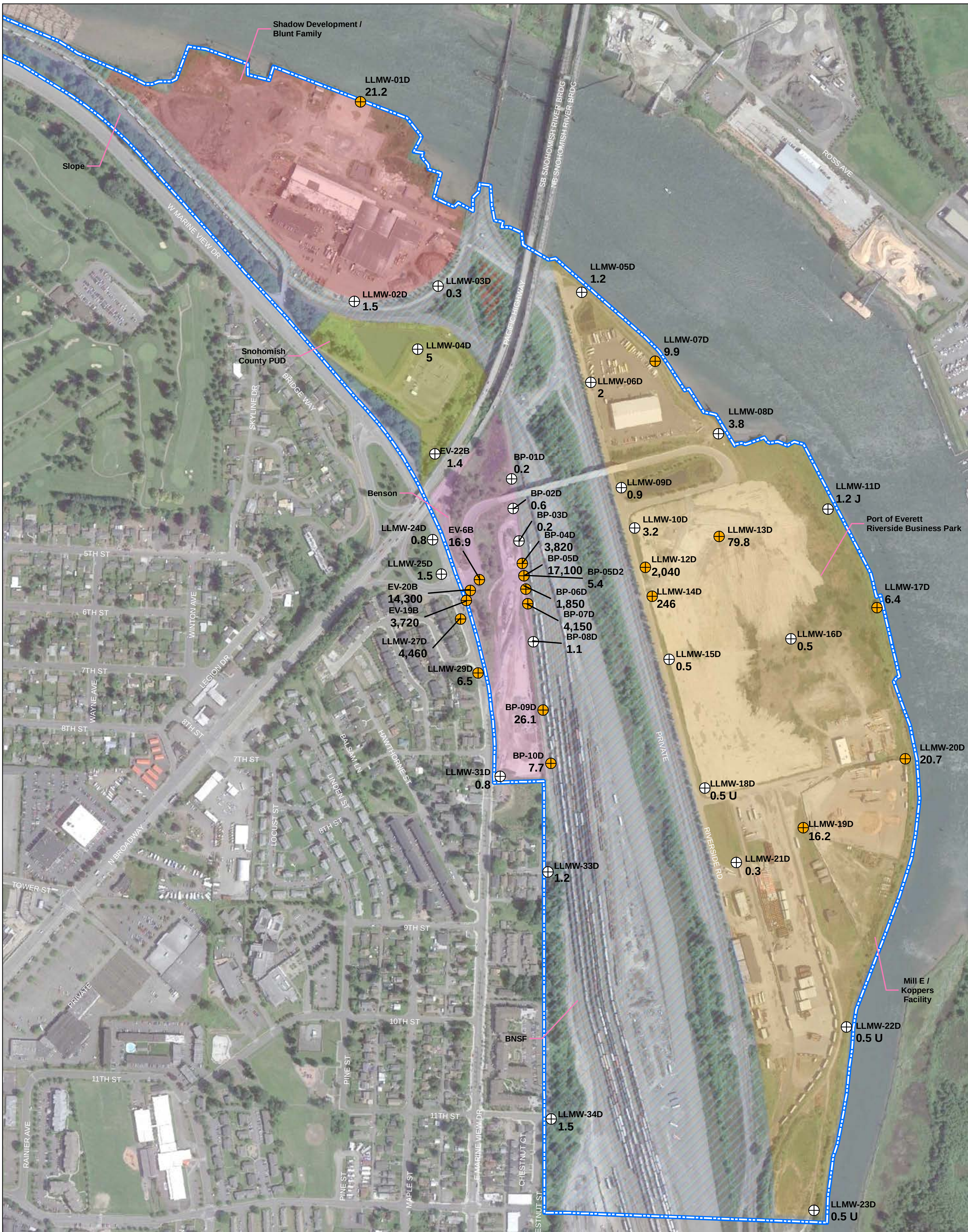
Dissolved Arsenic Concentrations in Deep Groundwater January/February, 2013 (Q1)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-13

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-14.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

LLMW-03D

⊕ Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03D
0.3

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N / E / S / W

500 0 500

Feet

Dissolved Arsenic Concentrations in Deep Groundwater April/May 2013 (Q2)

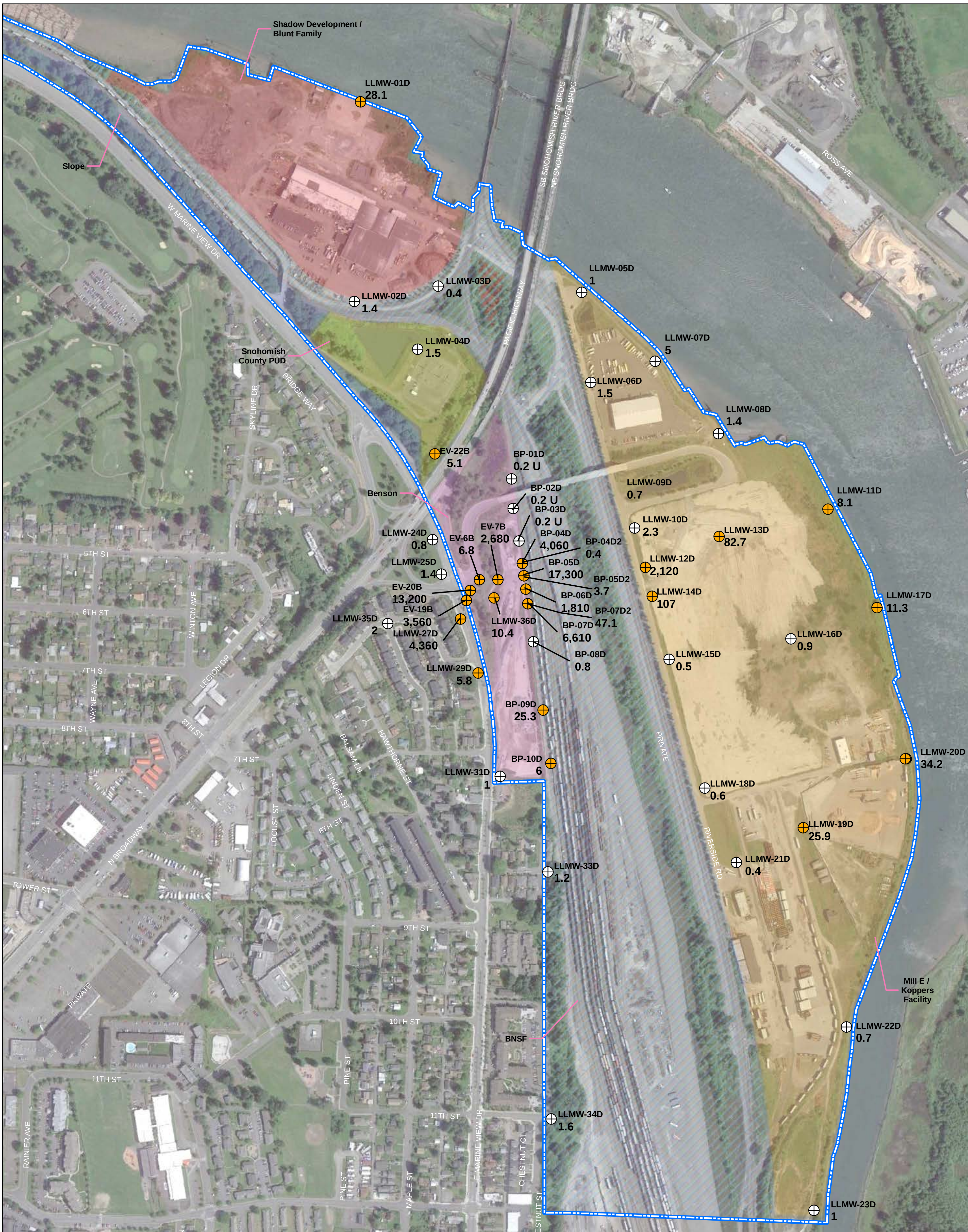
Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-14

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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-15.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

LLMW-03D Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03D
0.4

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

N E S W

500 0 500
Feet

Notes:
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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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

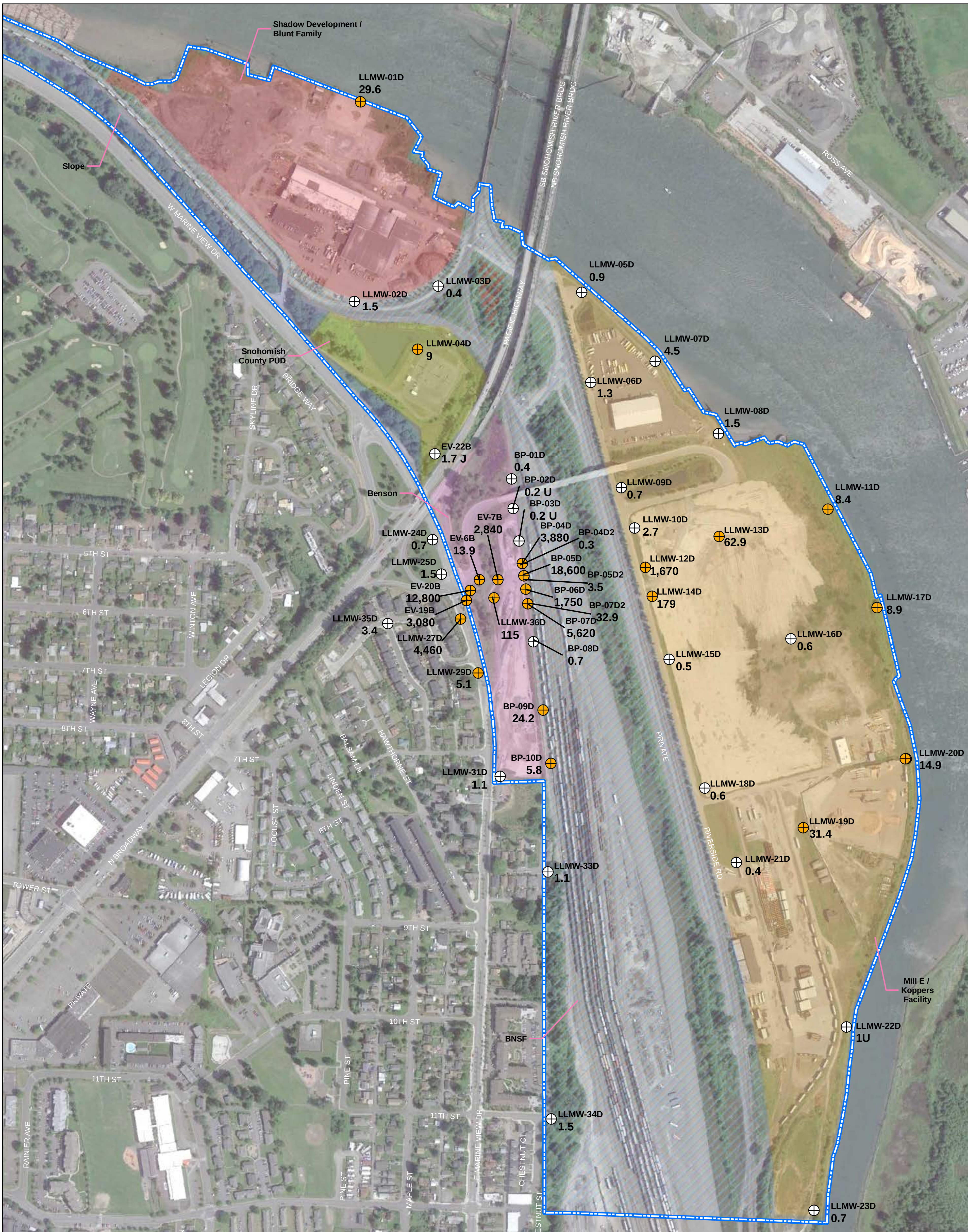
Dissolved Arsenic Concentrations in Deep Aquifer Groundwater August/September 2013 (Q3)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-15

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-16.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

LLMW-03D

Monitoring Well Location and Location Identification

Monitoring Well Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Levels

LLMW-03D
0.4

Dissolved Arsenic Concentration in ug/L
U= Arsenic Was Not Detected at Identifed at Detection Limit
J = Result Is An Estimate
DRY = Well Was Dry and Therefore, No Sample Could Be Obtained

500 0 500
Feet

Dissolved Arsenic Concentrations in Deep Aquifer Groundwater October/November 2013 (Q4)

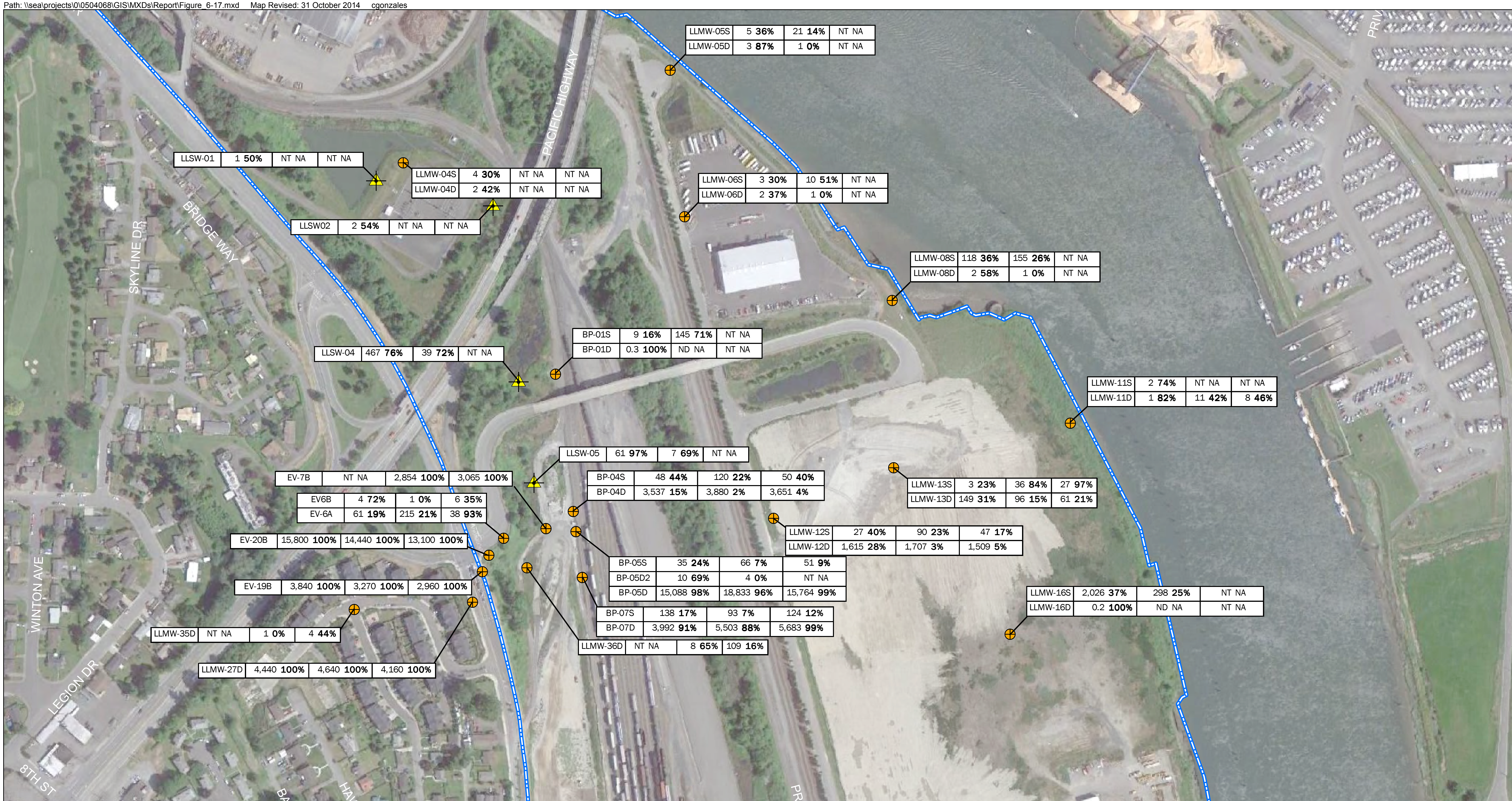
Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-16

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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-17.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

	Q2	Q3	Q4
BP-01D	0.3 100%	ND	NT

- Well or Surface Water Sample Location ID
- Total Dissolved Arsenic (Sum of Arsenate and Arsenite (ug/L))
- Percent Arsenate (i.e., Arsenate Divided by Sum of Arsenate and Arsenite)
- Neither Arsenate Nor Arsenite Detected
- Not Tested

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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

N W E S

300 0 300

Feet

Dissolved Arsenic Speciation in Surface Water, Shallow Groundwater, and Deep Groundwater

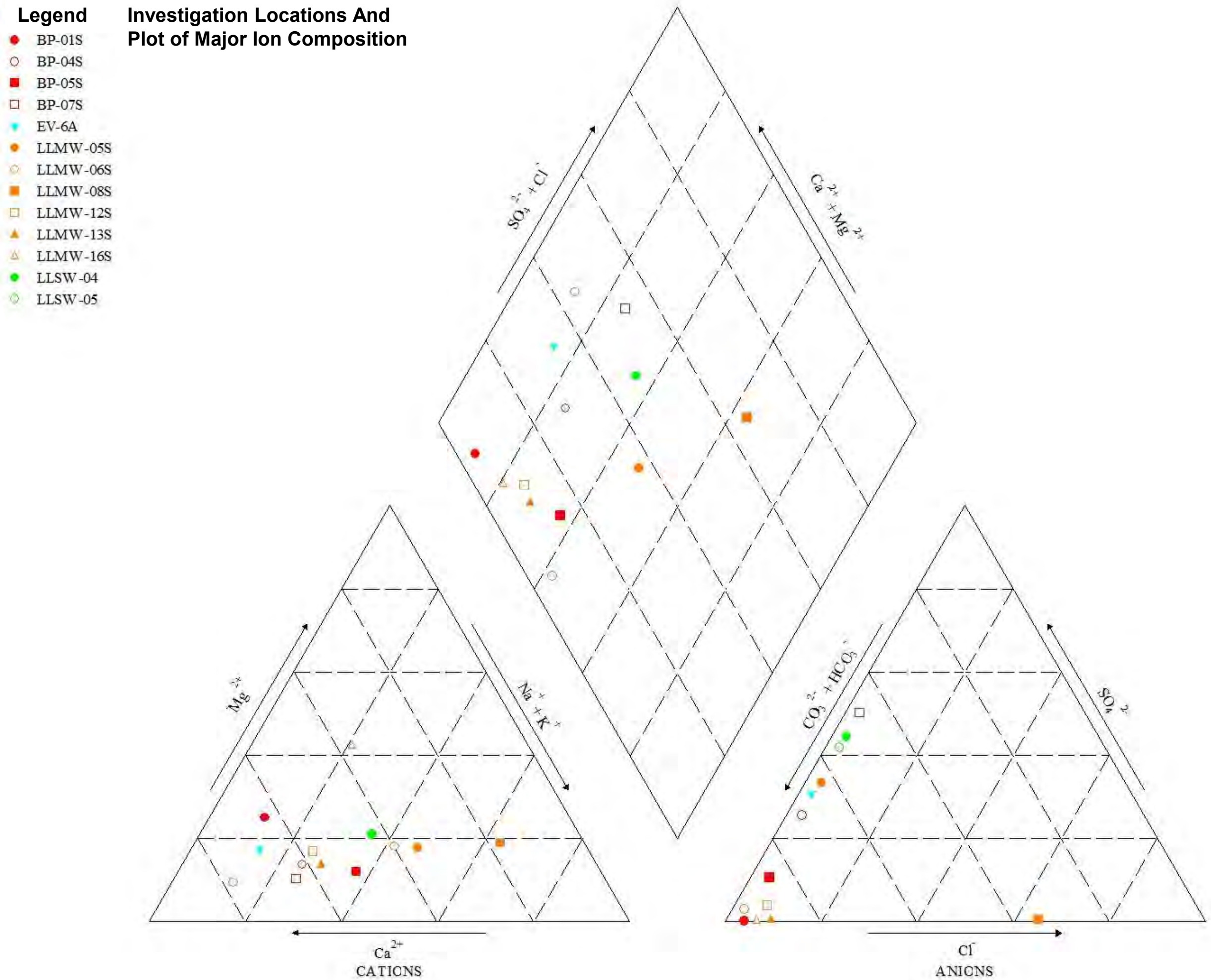
Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-17

Legend

Investigation Locations And Plot of Major Ion Composition



Notes:

1. Dashed lines indicate 20 percent increments of normalized ion percentages.
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.

Major Ion Composition in Shallow Aquifer Groundwater and Surface Water August/September 2013 (Q3)

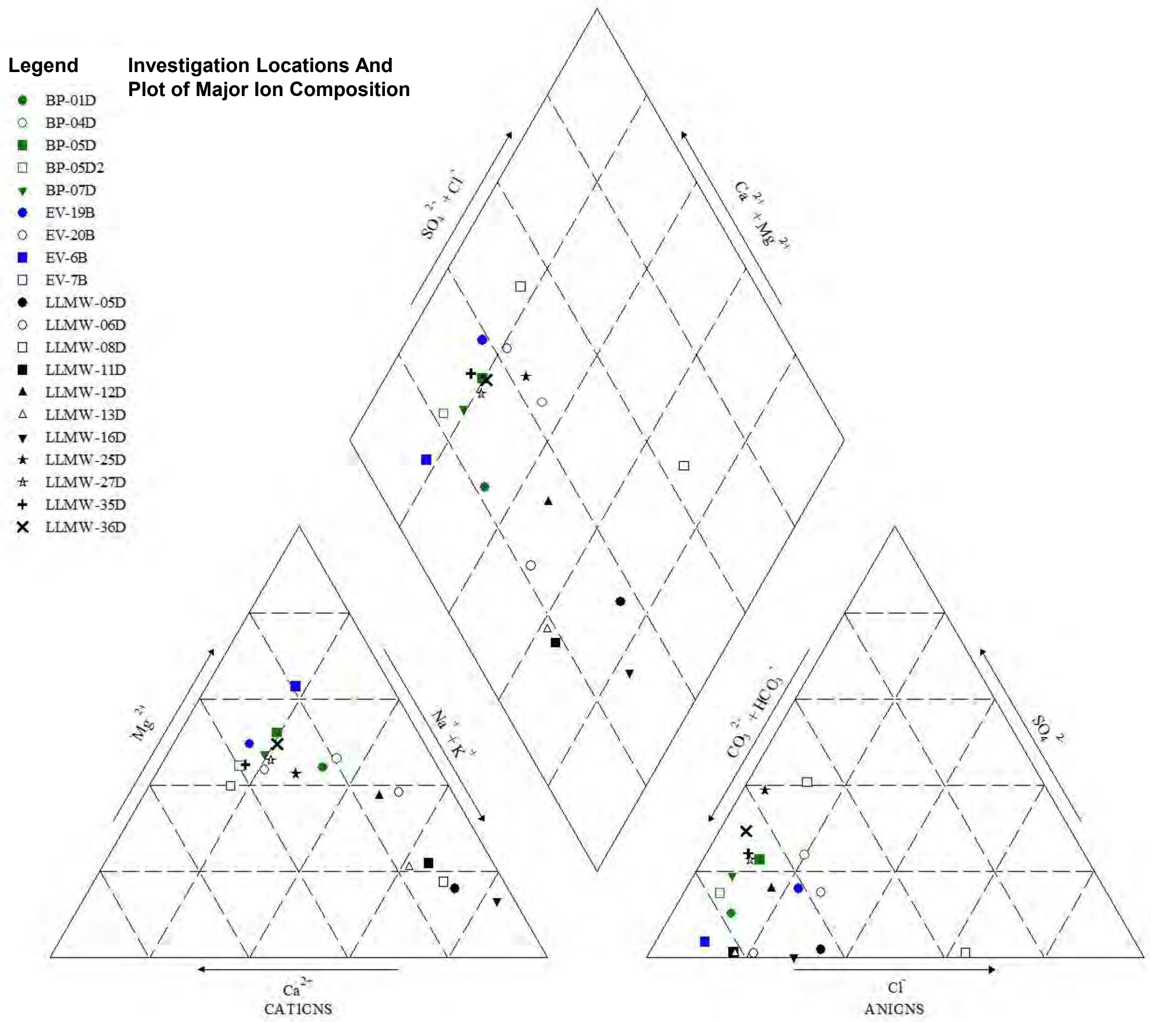
Everett Smelter Lowland Area
Everett, Washington

GEOENGINEERS

Figure 6-18

Legend

Investigation Locations And Plot of Major Ion Composition



Notes:

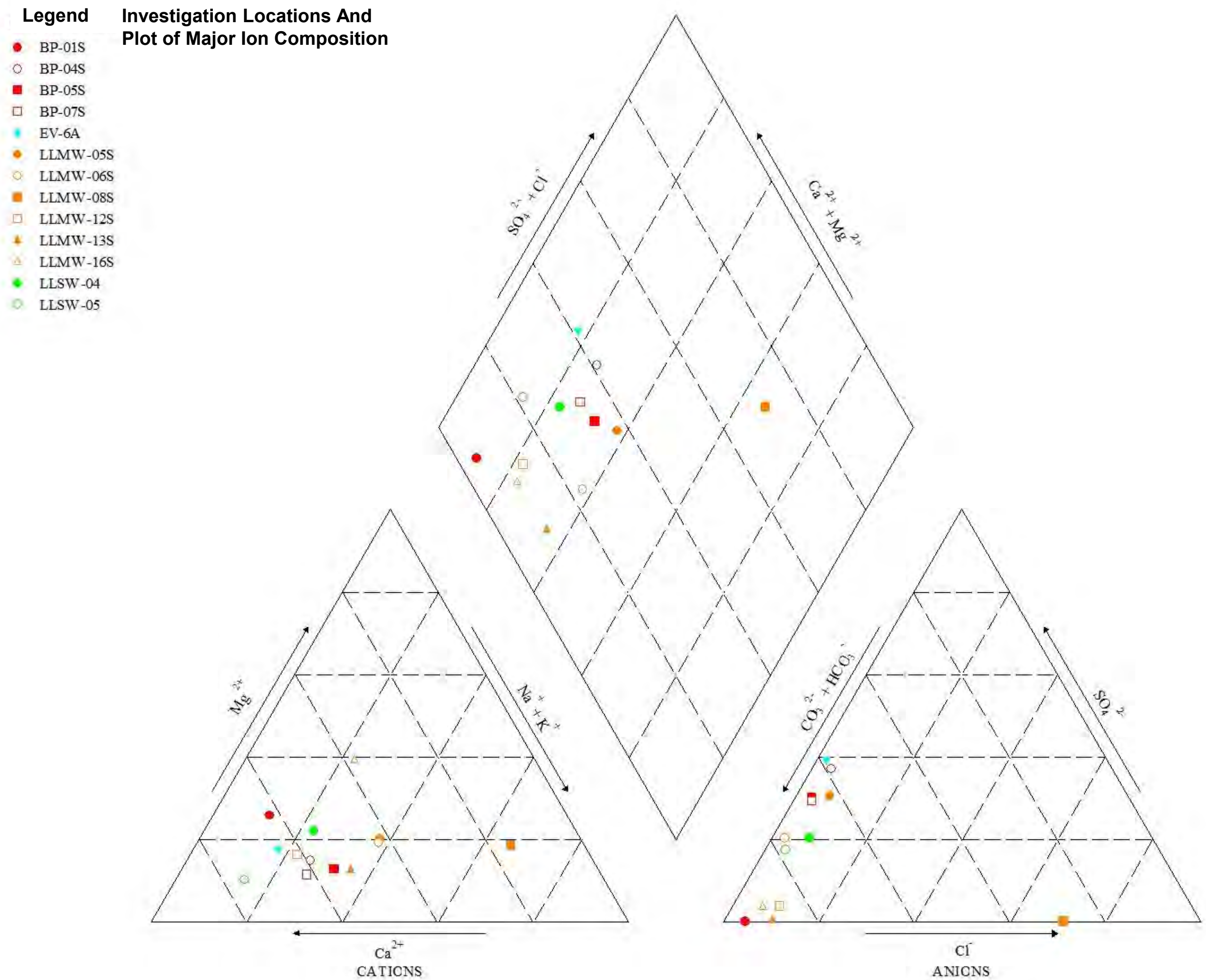
1. Dashed lines indicate 20 percent increments of normalized ion percentages.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Major Ion Composition in Deep Aquifer Groundwater August/September 2013 (Q3)

Everett Smelter Lowland Area
Everett, Washington

GEOENGINEERS

Figure 6-19



Notes:

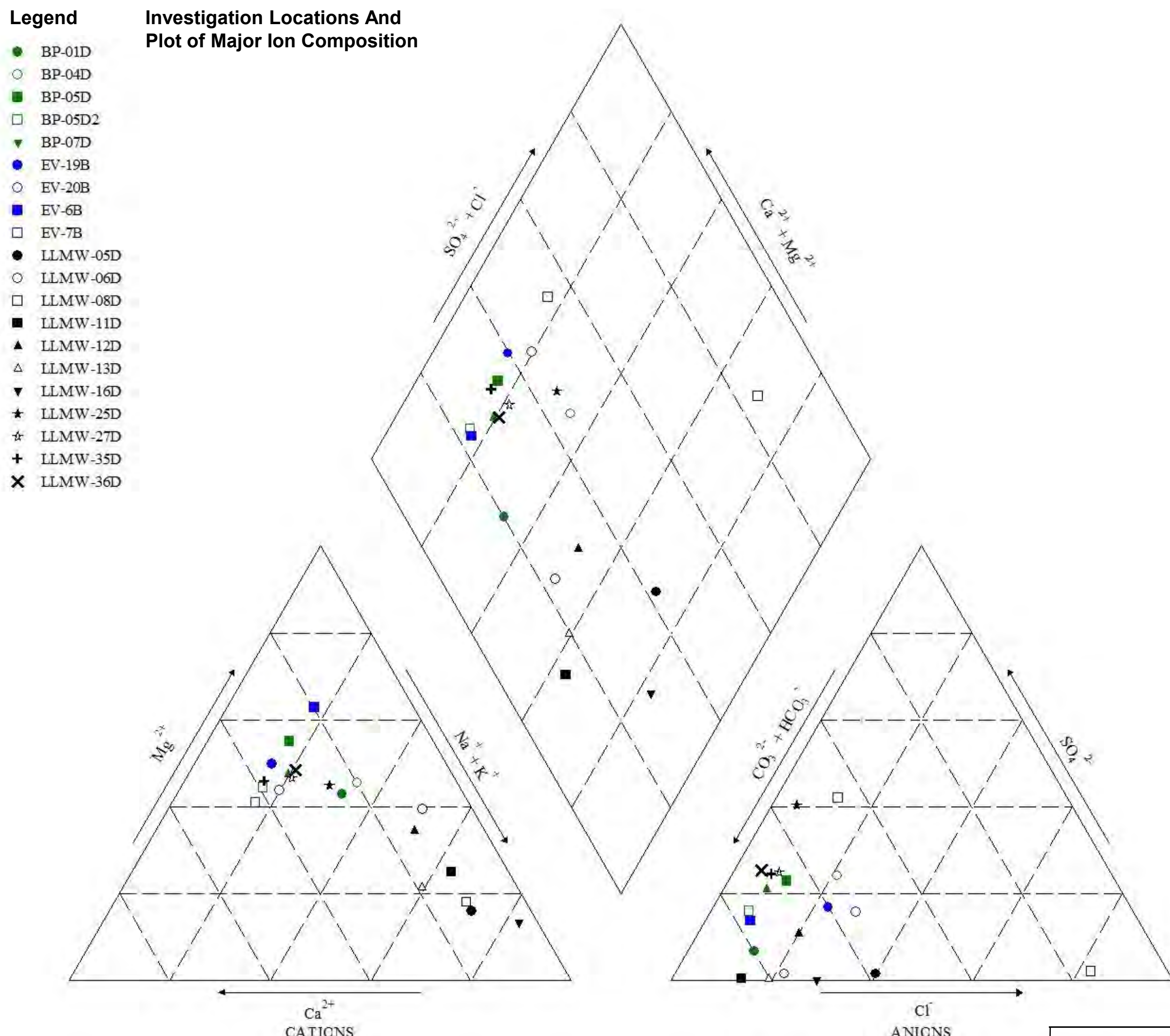
1. Dashed lines indicate 20 percent increments of normalized ion percentages.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Major Ion Composition in Shallow Aquifer Groundwater and Surface Water October/November 2013 (Q4)

Everett Smelter Lowland Area
Everett, Washington

GEOENGINEERS

Figure 6-20



Notes:

1. Dashed lines indicate 20 percent increments of normalized ion percentages.
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.

Major Ion Composition in Deep Aquifer Groundwater
October/November 2013 (Q4)

Everett Smelter Lowland Area
Everett, Washington

GEOENGINEERS

Figure 6-21

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-22.mxd Map Revised: 07 January 2015 cgonzales

Legend

Lowland Area

LLSD-01 Sediment Location and Location Identification

LLSD-13 Sediment Location and Location Identification With Arsenic Concentration Greater Than Preliminary Cleanup Level

LLSD-03 Stormwater Solids Location and Location Identification

LLSD-06 Stormwater Solids Location and Location Identification with Arsenic Concentration Greater Than Preliminary Cleanup Level

LLSD-01
9.3
Arsenic Concentration in mg/kg

N S E W

600 0 600
Feet

Notes:
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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.

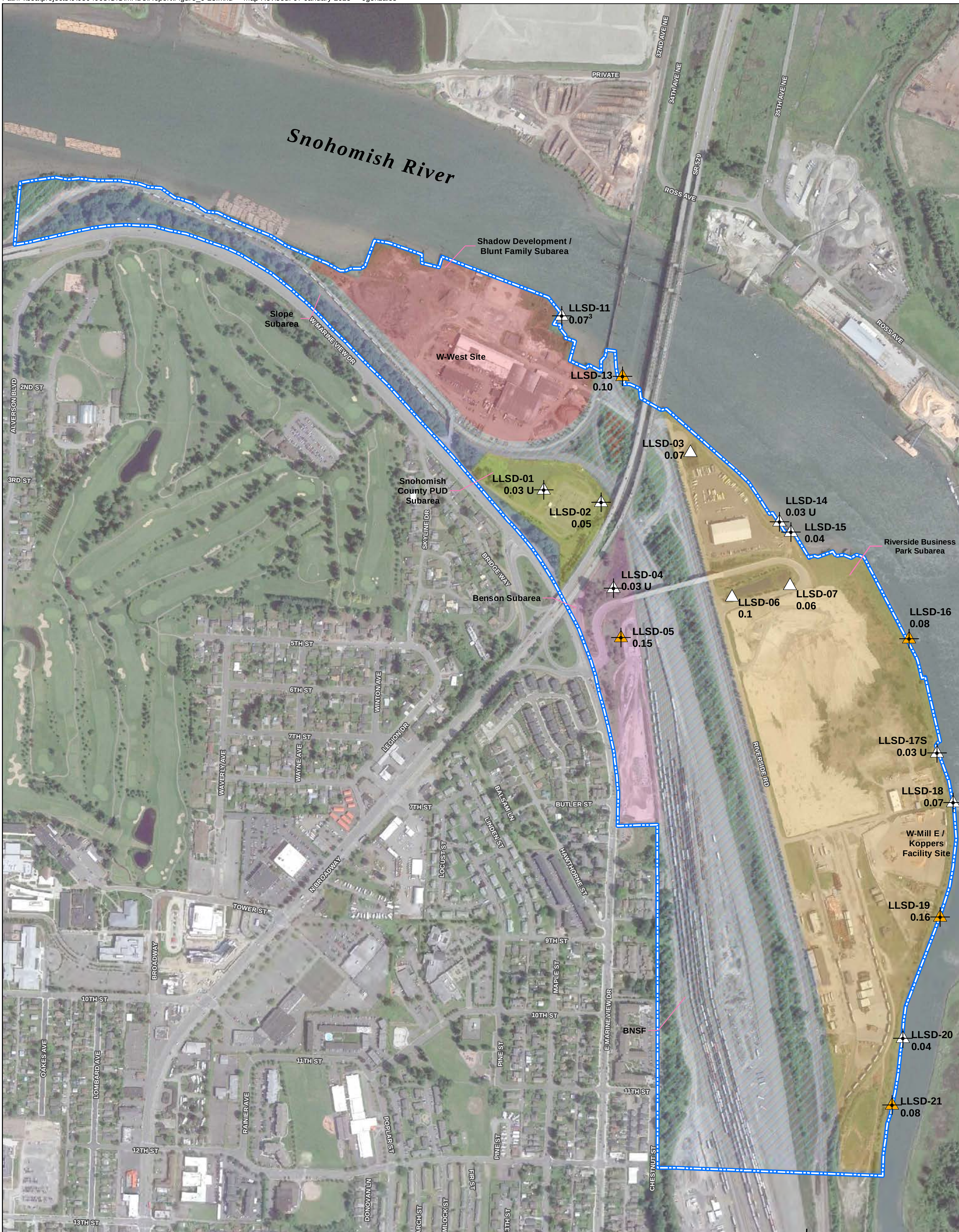
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Arsenic Concentrations in Sediment And Stormwater Solids

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-22



Legend

Lowland Area

LLSD-01 Sediment Location and Location Identification

LLSD-13 Sediment Location and Location Identification With Mercury Concentration Greater Than Preliminary Cleanup Level

LLSD-03 Stormwater Solids Location and Location Identification

LLSD-13
0.10

Mercury Concentration in mg/kg
U = Mercury Not Detected At The Identified Detection Limit

N W E S

600 0 600
Feet

Notes:
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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.
3. The duplicate sample result was 0.08 mg/kg. See report text.
Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

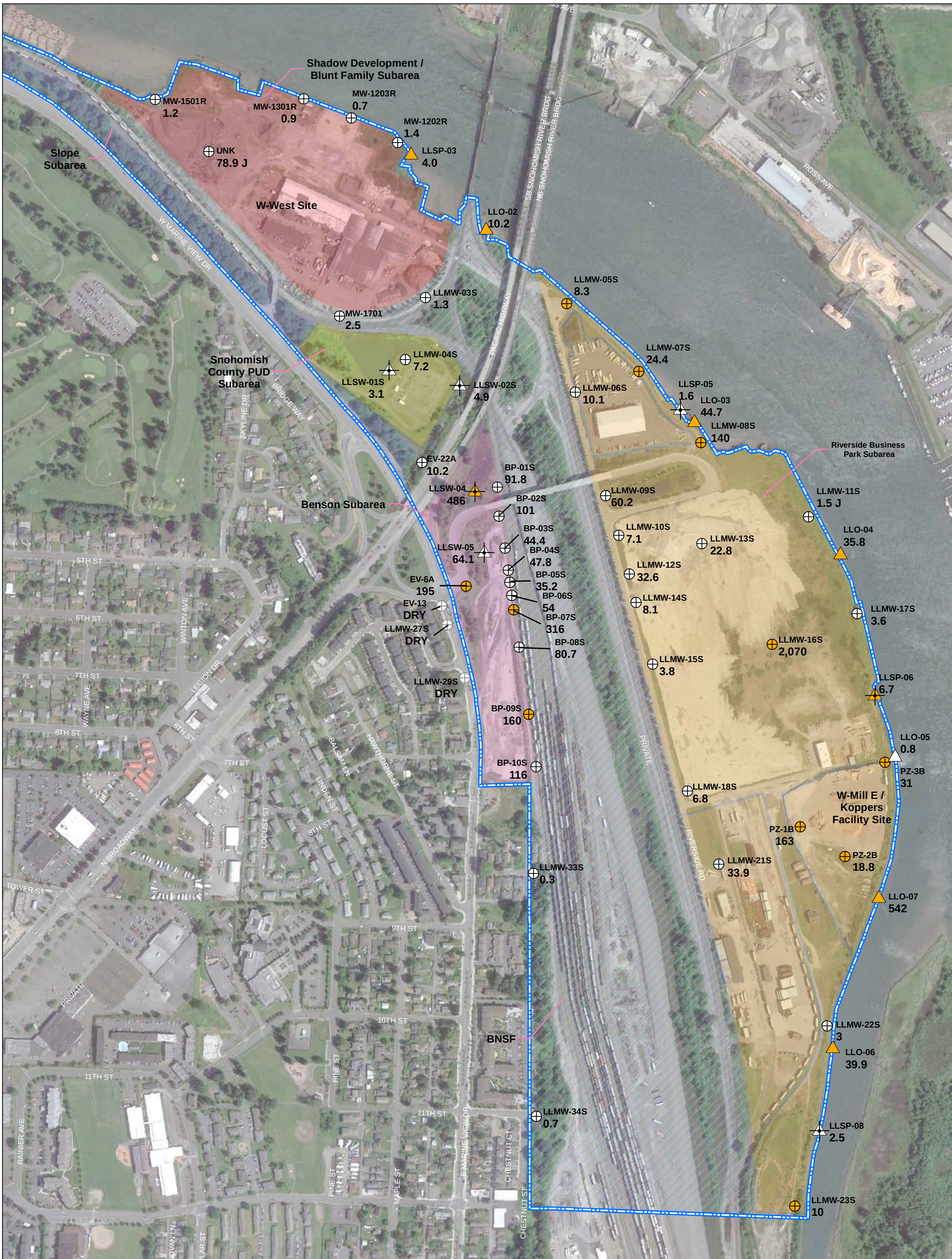
Mercury Concentrations in Sediment And Stormwater Solids

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-23

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-24.mxd Map Revised: 07 January 2015 cgonzales



Legend

Lowland Area

April/May 2013 (Q2) dissolved arsenic concentrations in shallow aquifer groundwater, surface water and stormwater are shown along with the Q2 Seep and outfall data on this figure. See Figure 6-14 for the legend information concerning shallow aquifer groundwater, surface water and stormwater.

- LLSP-03 — Seep Location and Location Identification
- LLSP-06 — Seep Location With Arsenic Concentration Greater Than Preliminary Cleanup Level
- LLO-05 — Outfall Location and Location Identification
- LLO-02 — Outfall Location and Location Identification With Arsenic Greater Than Preliminary Cleanup Level

LLSP-03
4.0
Dissolved Arsenic Concentration in ug/L

500 0 500
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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.

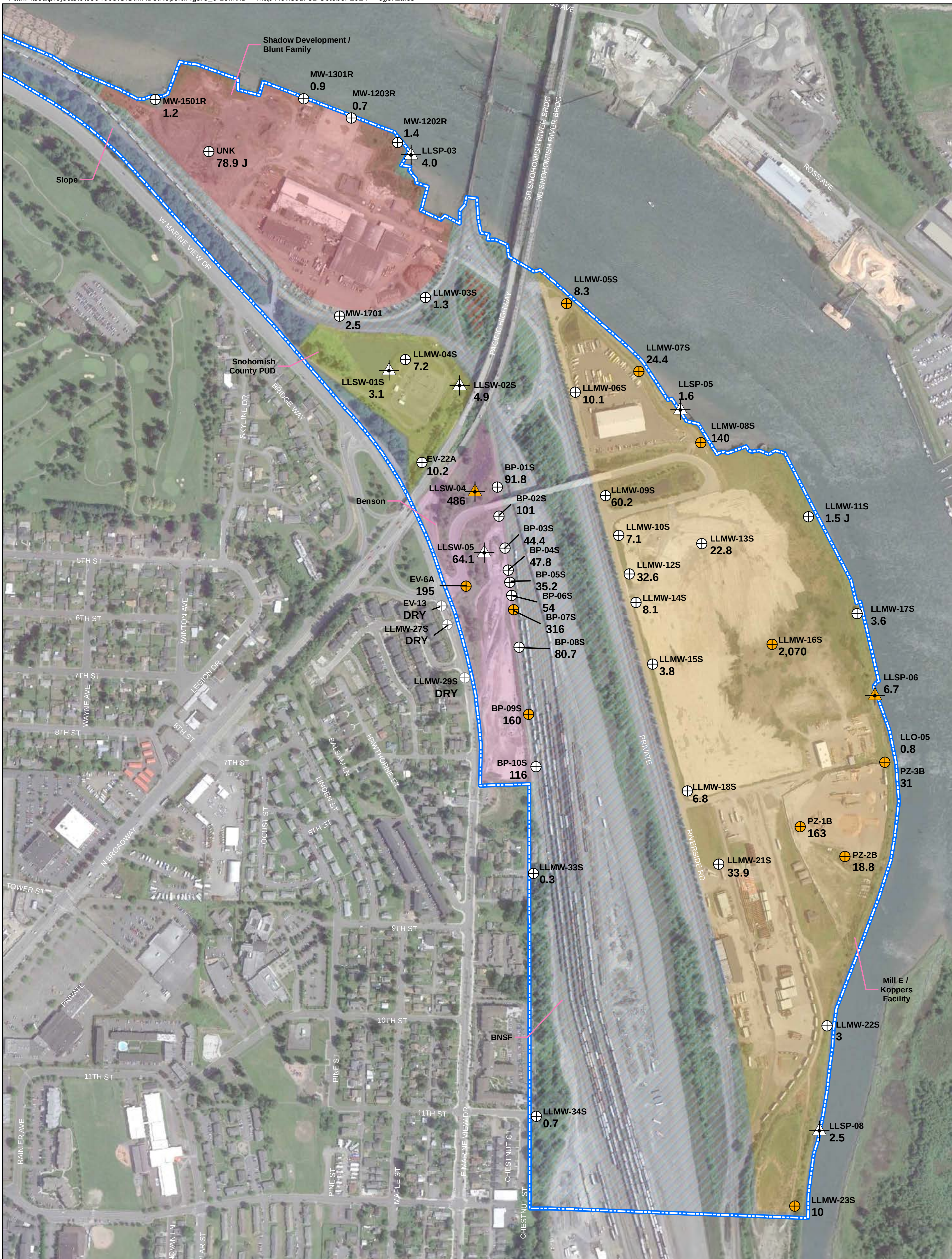
Dissolved Arsenic Concentrations in Seeps and Outfalls April/May 2013 (Q2)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-24

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_6-25.mxd Map Revised: 31 October 2014 cgonzales



Legend

Lowland Area

April/May 2013 (Q2) dissolved arsenic concentrations in deep aquifer groundwater and stormwater are shown along with the Q2 Seep and outfall data on this figure. See Figure 6-19 for the legend information concerning deep aquifer groundwater.

Seep Location

Seep Location. With Arsenic Concentration Greater Than Preliminary Cleanup Level

LLSP-03
4.0

Dissolved Arsenic Concentration in ug/L

N W E S

500 0 500

Feet

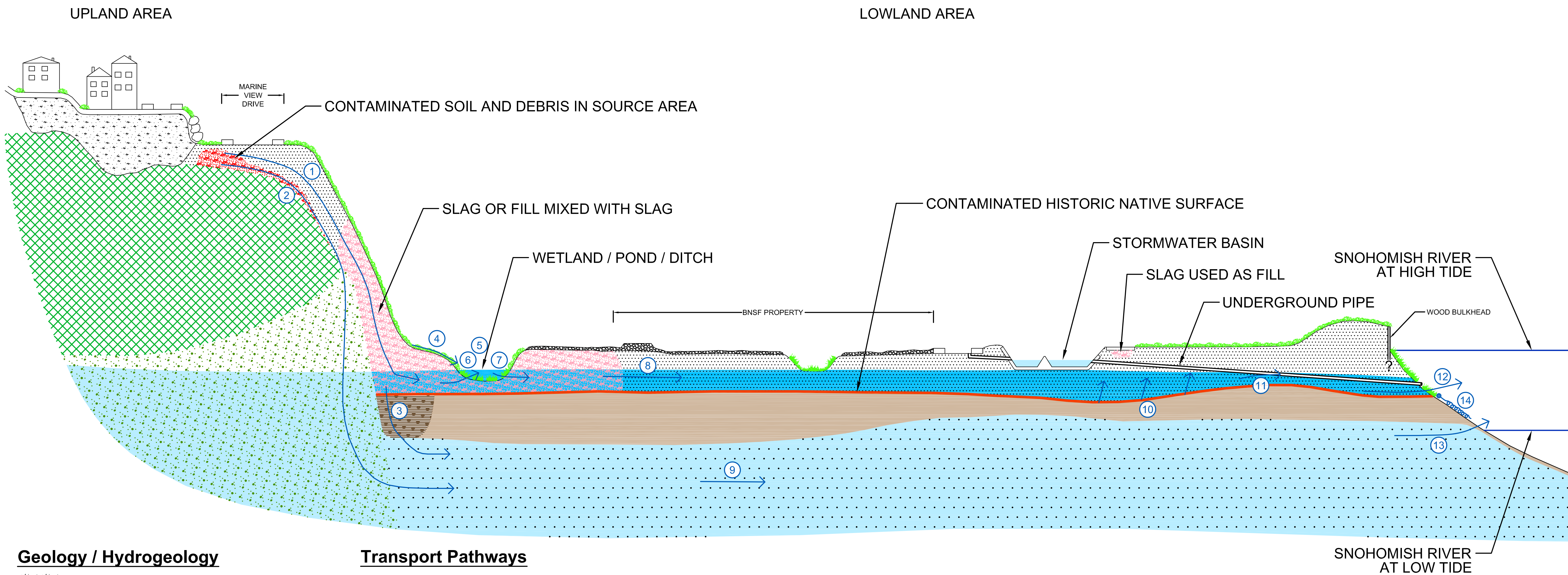
Dissolved Arsenic Concentrations in Seeps April/May 2013 (Q2)

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 6-25

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: Aerial Image from Microsoft, 2010. Snohomish County GIS, 2012.



Geology / Hydrogeology

- UPLAND REMEDIAL EXCAVATION AREA
- TILL
- OUTWASH
- FILL
- SILT AQUITARD
- ALLUVIUM
- CHANNEL DEPOSITS
- SHALLOW GROUNDWATER
- DEEP GROUNDWATER

Surface Features

- GRAVEL
- ROADS/SIDEWALKS
- VEGETATION

Transport Pathways

1. Transport from contaminated soil and debris in transient groundwater flow followed by lateral and downward migration to groundwater in the shallow aquifer
2. Transport from contaminated soil and debris in transient groundwater flow followed by lateral and downward migration to groundwater in the deep aquifer
3. Transport in shallow groundwater through channel deposits to deep groundwater
4. Transport in surface runoff to surface water in the Lowland Area
5. Transport in surface water through ditches and culverts and discharge through an outfall to the Snohomish River shoreline
6. Transport in shallow groundwater discharging to sediment and/or surface water in the Lowland Area
7. Transport in surface water through sediment to shallow groundwater in the Lowland Area
8. Transport from slag or fill mixed with slag in shallow groundwater toward the Snohomish River
9. Transport in deep groundwater toward the Snohomish River
10. Transport from historic native surface soil in shallow groundwater toward the Snohomish River
11. Infiltration of contaminated shallow groundwater into underground pipes and discharge to the Snohomish River shoreline
12. Discharge of shallow groundwater through sediment at seeps on the Snohomish River shoreline
13. Discharge of deep groundwater to Snohomish River through sediment at seeps on the Snohomish River shoreline
14. Transport of contaminated soil / sediment by erosion

NOT TO SCALE

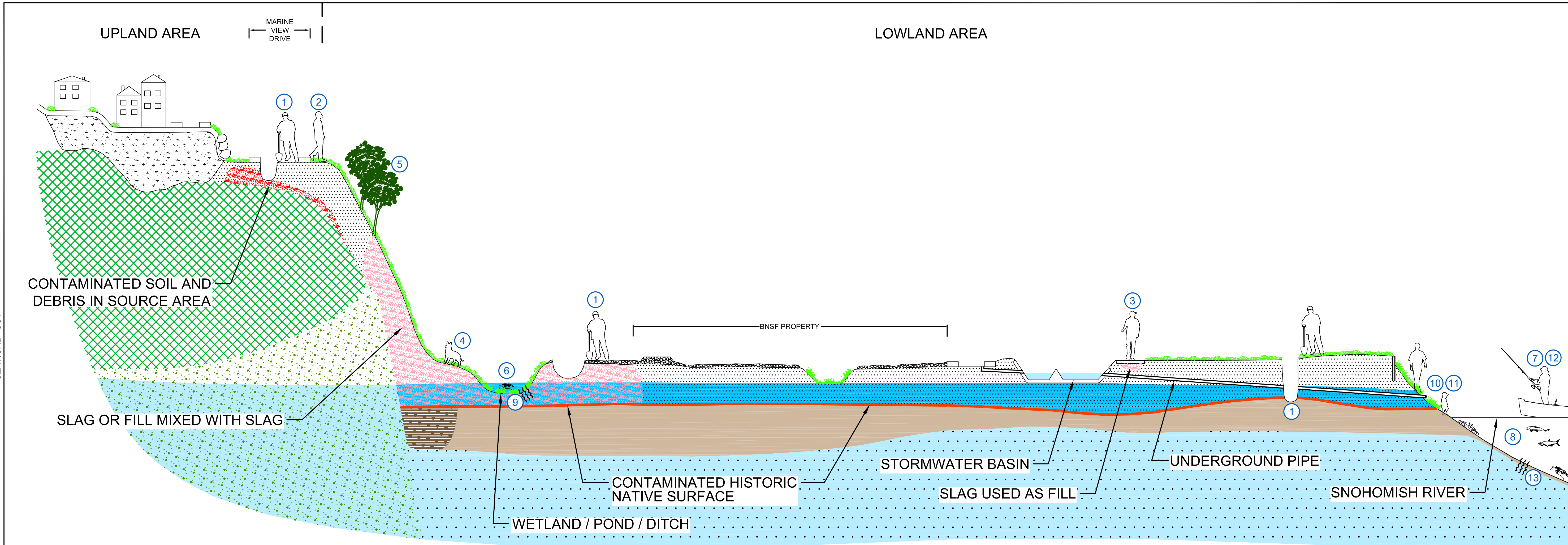
Conceptual Site Model
Transport Pathways

Everett Smelter Site, Lowland Area
Everett, Washington

GEOENGINEERS

Figure 8-1

Notes:
1. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.



Geology / Hydrogeology

- UPLAND REMEDIAL EXCAVATION AREA
- TILL
- OUTWASH
- FILL
- SILT AQUITARD
- ALLUVIUM
- CHANNEL DEPOSITS
- SHALLOW GROUNDWATER
- DEEP GROUNDWATER

Surface Features

- GRAVEL
- ROADS/SIDEWALKS
- VEGETATION

Exposure Pathways

Contaminated Soil / Slag

1. Industrial worker contact with contaminated soil and/or slag resulting from smelter operations
2. Potential trespasser contact with contaminated soil resulting from smelter operations in the portion of the Lowland Area adjacent to the Marine View Drive ROW
3. Site Visitor contact with contaminated soil resulting from smelter operations at current and future public access areas
4. Wildlife exposure to contaminated soil from smelter operations in Lowland Area
5. Biota, plants and wildlife exposure to contaminated soil from smelter operations within the urban forest habitat in American Legion Park

Groundwater and Surface Water

6. Freshwater aquatic organism exposure to contaminants in surface water and shallow groundwater discharging to surface water in ponds and wetlands in the Lowland Area
7. Individual consumption of aquatic organisms exposed to contaminants in shallow and deep groundwater discharging to surface water in the Snohomish River adjacent to the Lowland Area
8. Marine aquatic organism exposure to contaminants in shallow and deep groundwater discharging to surface water in the Snohomish River adjacent to the Lowland Area

Sediment

9. Freshwater benthic organism exposure to contaminants in sediment in ponds and wetlands in the Lowland Area
10. Subsistence consumption of aquatic organisms exposed to contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area
11. Children playing on beach coming in contact with contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area
12. Subsistence fishing and clamming and contact with contaminants in sediment on the Snohomish River shoreline
13. Marine benthic organism exposure to contaminants in sediment on the Snohomish River shoreline adjacent to the Lowland Area

NOT TO SCALE

Conceptual Site Model
Exposure Pathways and Receptors

Everett Smelter Site, Lowland Area
Everett, Washington

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Figure 8-2

Notes:
1. This figure is for informational purposes only. It is intended to assist in the identification of features discussed in a related document. This figure is a copy of a master document. The master hard copy is stored by GeoEngineers, Inc. and will serve as the official document of record.

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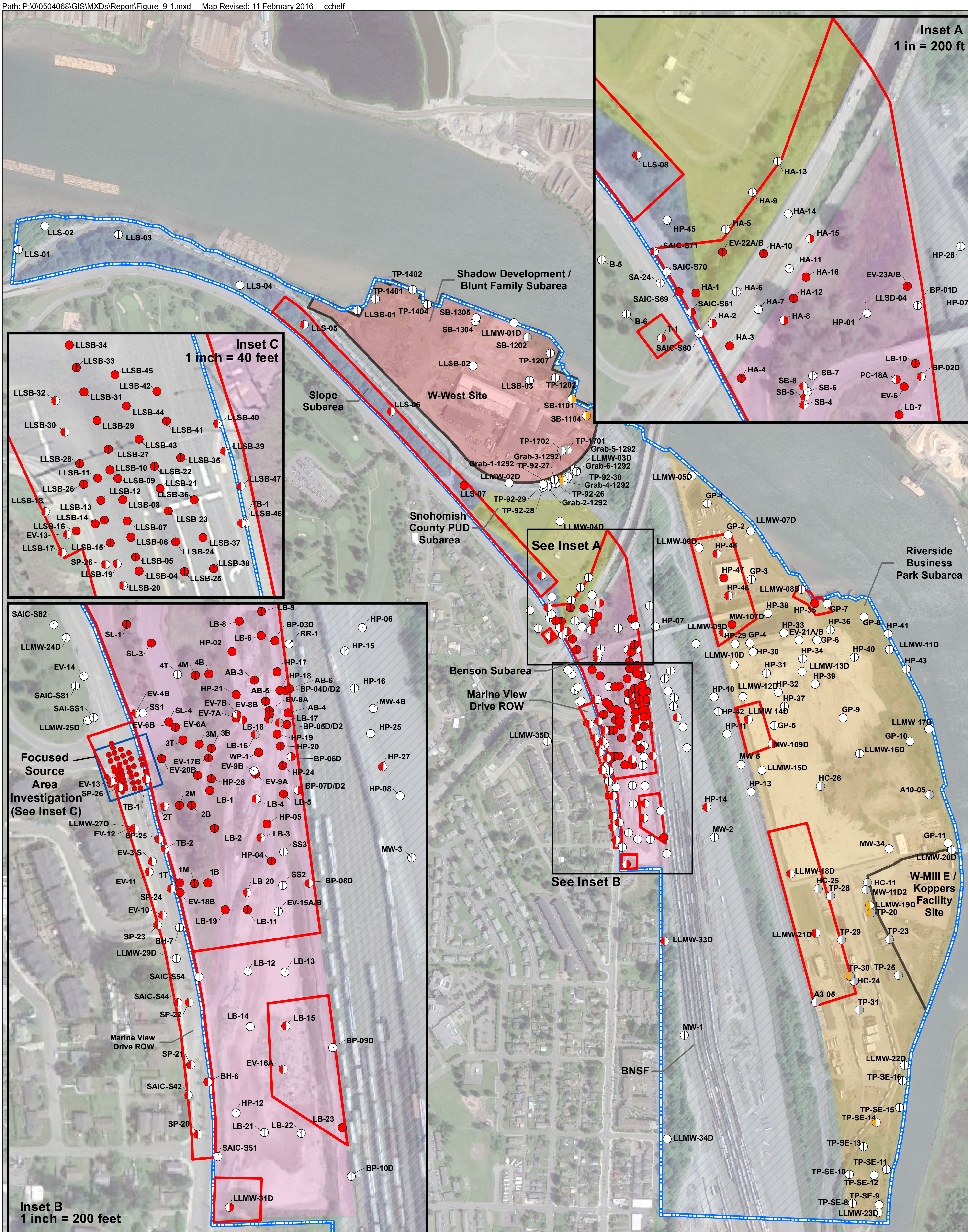


Legend

Results for Arsenic Analysis on Soil Samples from the Investigation Location — Results for Lead Analysis on Soil Samples from the Investigation Location

- The Contaminant Concentration was Greater Than the Preliminary Cleanup Levels (PCULs) in at Least One Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- The Contaminant Concentration was Greater Than PCULs in at Least One Sample from the Investigation Location and the Contamination Was Not Identified to be the Result of Smelter Operations
- Contaminant Concentration Was Less than the PCULs
- Sample Was Not Analyzed for the Identified Contaminant
- Area Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

N W E S

600 0 600

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

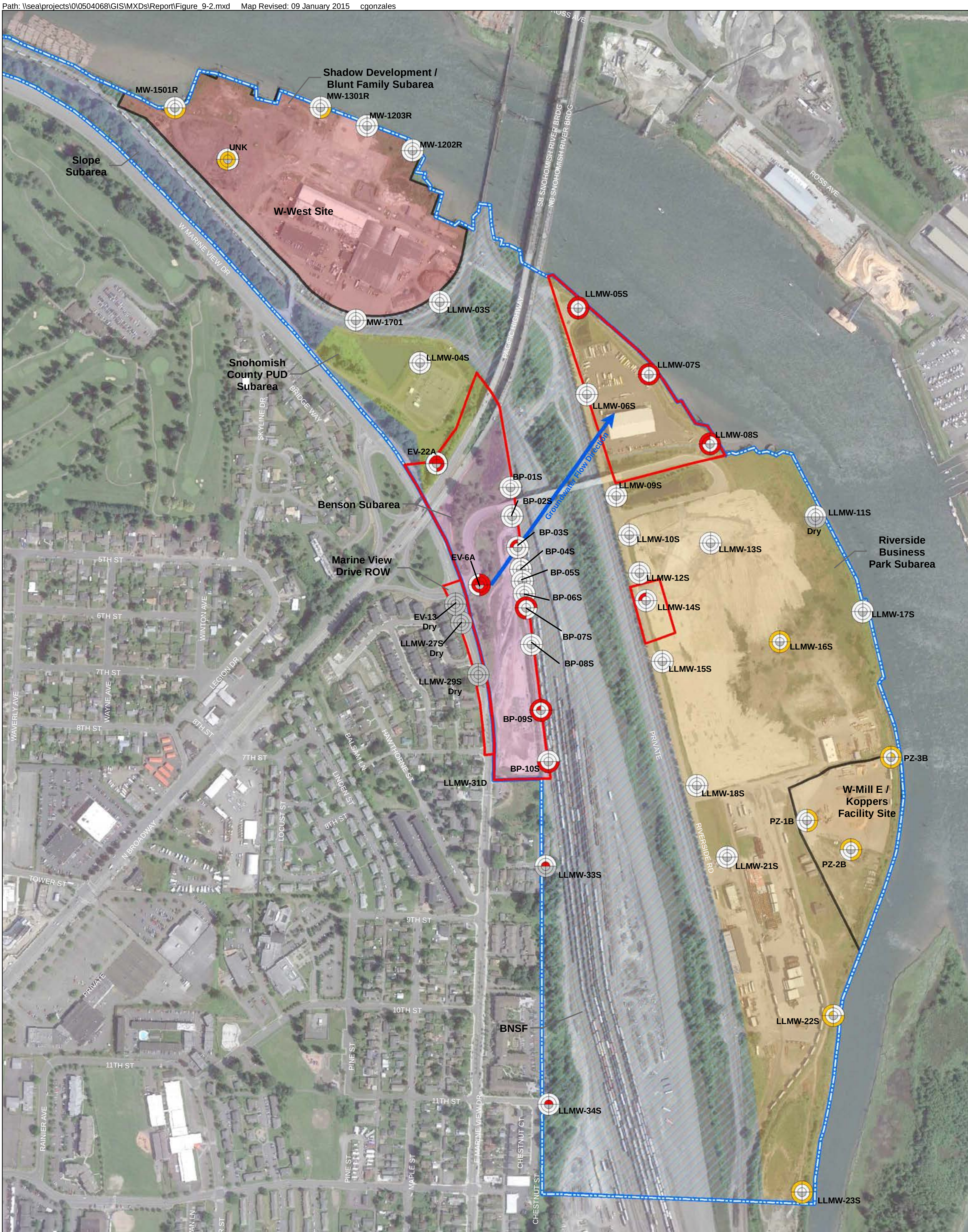
Summary of Arsenic and Lead Exceedances in Soil

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 9-1

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_9-2.mxd Map Revised: 09 January 2015 cgonzales



Legend

Q1 Q2 Arsenic Mercury Lead Q4 Q3

- (red) The Contaminant Concentration was Greater Than the Preliminary Cleanup Levels (PCULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- (orange) The Contaminant Concentration was Greater Than PCULs in Sample from the Investigation Location and the Contamination Was Not Identified to be the Result of Smelter Operations
- (white) Contaminant Concentration Was Less than the PCULs
- (gray) Sample Was Not Analyzed for the Identified Contaminant
- (red outline) Area Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

N W E S

500 0 500

Feet

Summary of Arsenic, Lead, and Mercury Exceedances in Shallow Groundwater

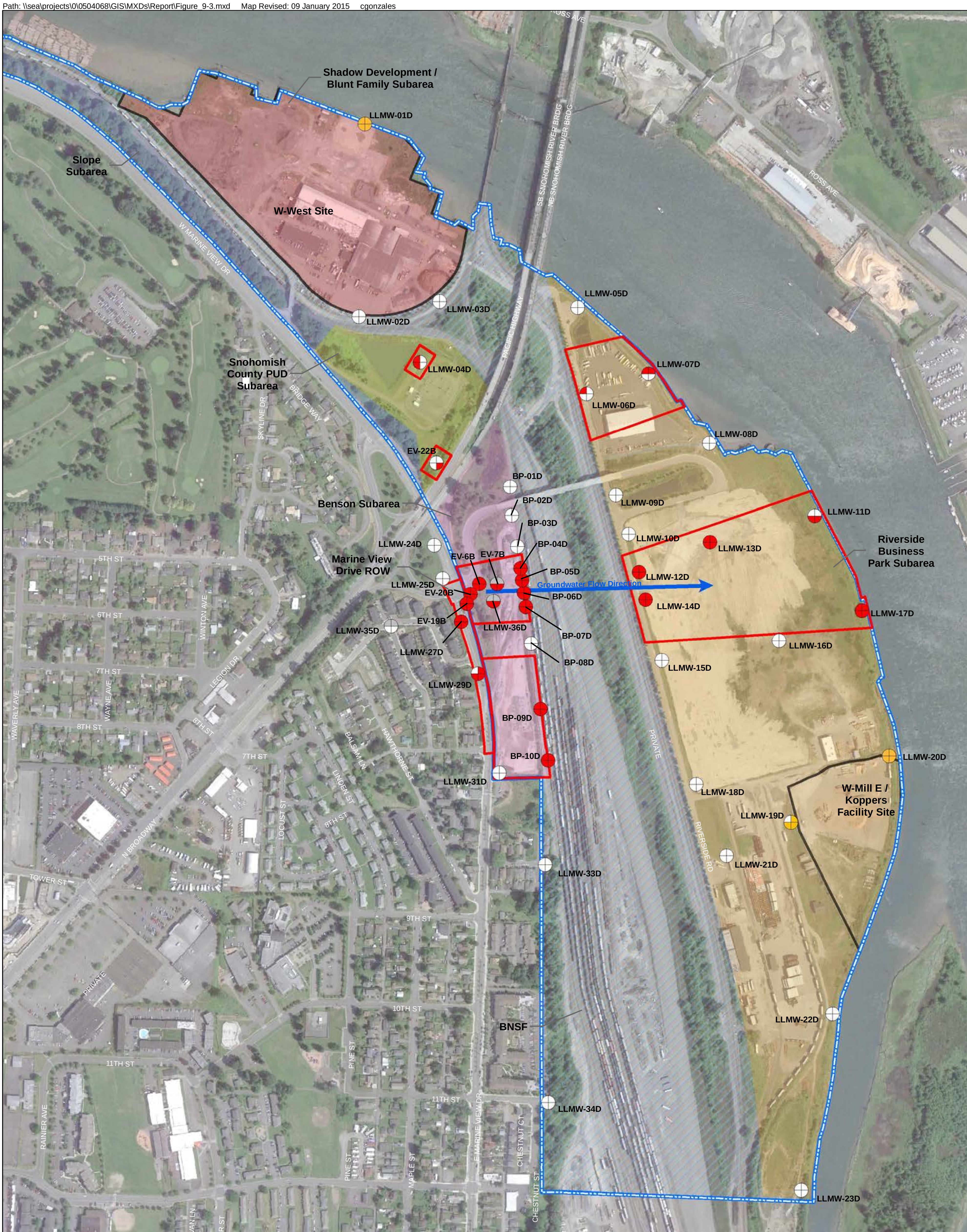
Everett Smelter - Lowland Area

GeoEngineers

Figure 9-2

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_9-3.mxd Map Revised: 09 January 2015 cgonzales



Legend

Arsenic (Q1, Q2, Q3, Q4)

- The Contaminant Concentration was Greater Than the Preliminary Cleanup Levels (PCULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- The Contaminant Concentration was Greater Than PCULs in Sample from the Investigation Location and the Contamination Was Not Identified to be the Result of Smelter Operations
- Contaminant Concentration Was Less than the PCULs
- Sample Was Not Analyzed for the Identified Contaminant
- Area Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

N W E S

500 0 500

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

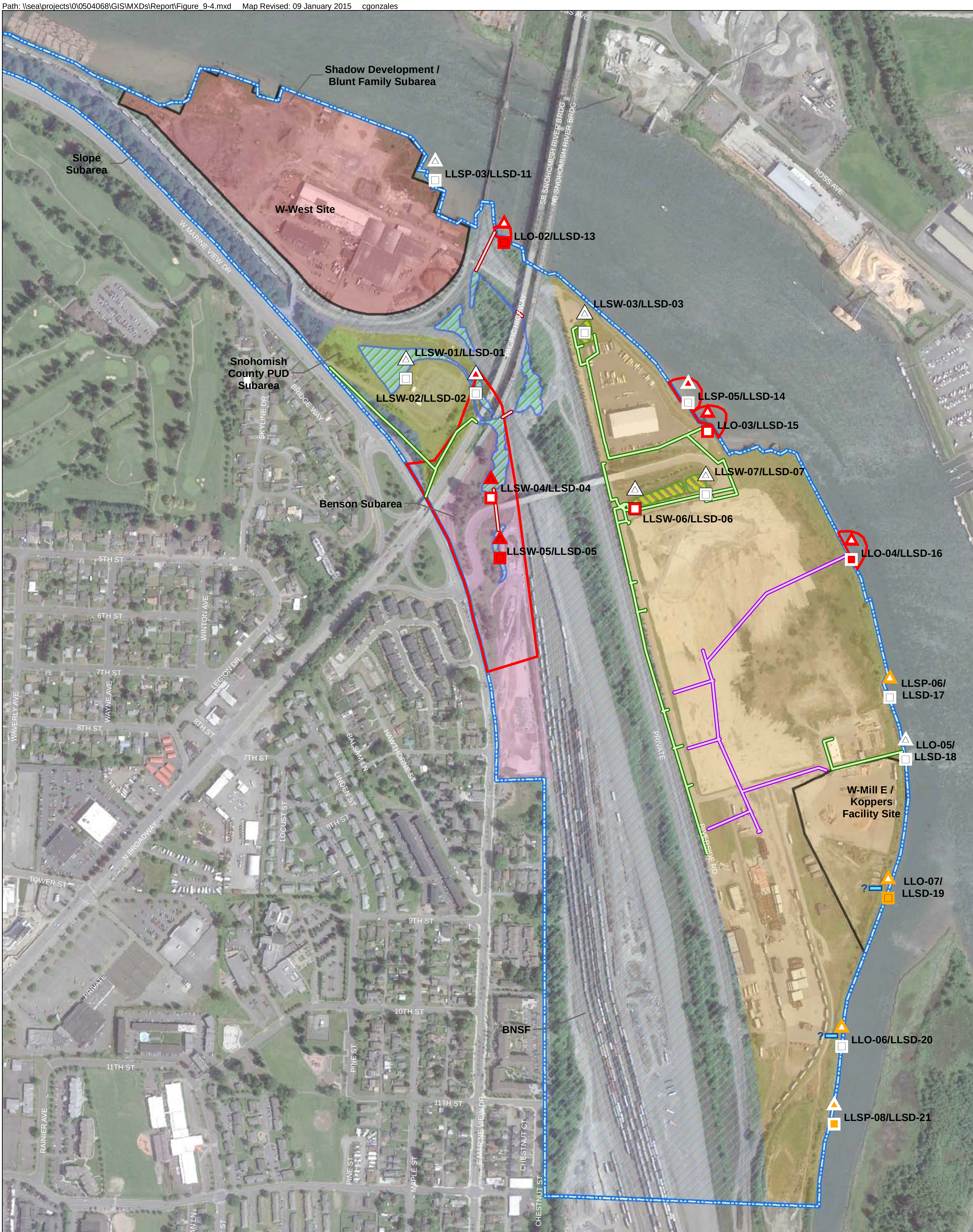
Summary of Arsenic Exceedances in Deep Groundwater

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 9-3

Path: \\sea\projects\0\0504068\GIS\MXDs\Report\Figure_9-4.mxd Map Revised: 09 January 2015 cgonzales



Legend

Arsenic / Mercury — Surface Water, Stormwater, Seep, and Outfall Water

Arsenic / Mercury — Sediment

- The Contaminant Concentration was Greater Than the Preliminary Cleanup Levels (PCULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- The Contaminant Concentration was Greater Than PCULs in Sample from the Investigation Location and the Contamination Was Not Identified to be the Result of Smelter Operations
- Contaminant Concentration Was Less than the PCULs
- Area Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study
- Stormwater Pipe
- Culvert
- Wetland, Pond or Ditch
- Under Drain
- ? Unknown Source
- Stormwater Basin

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

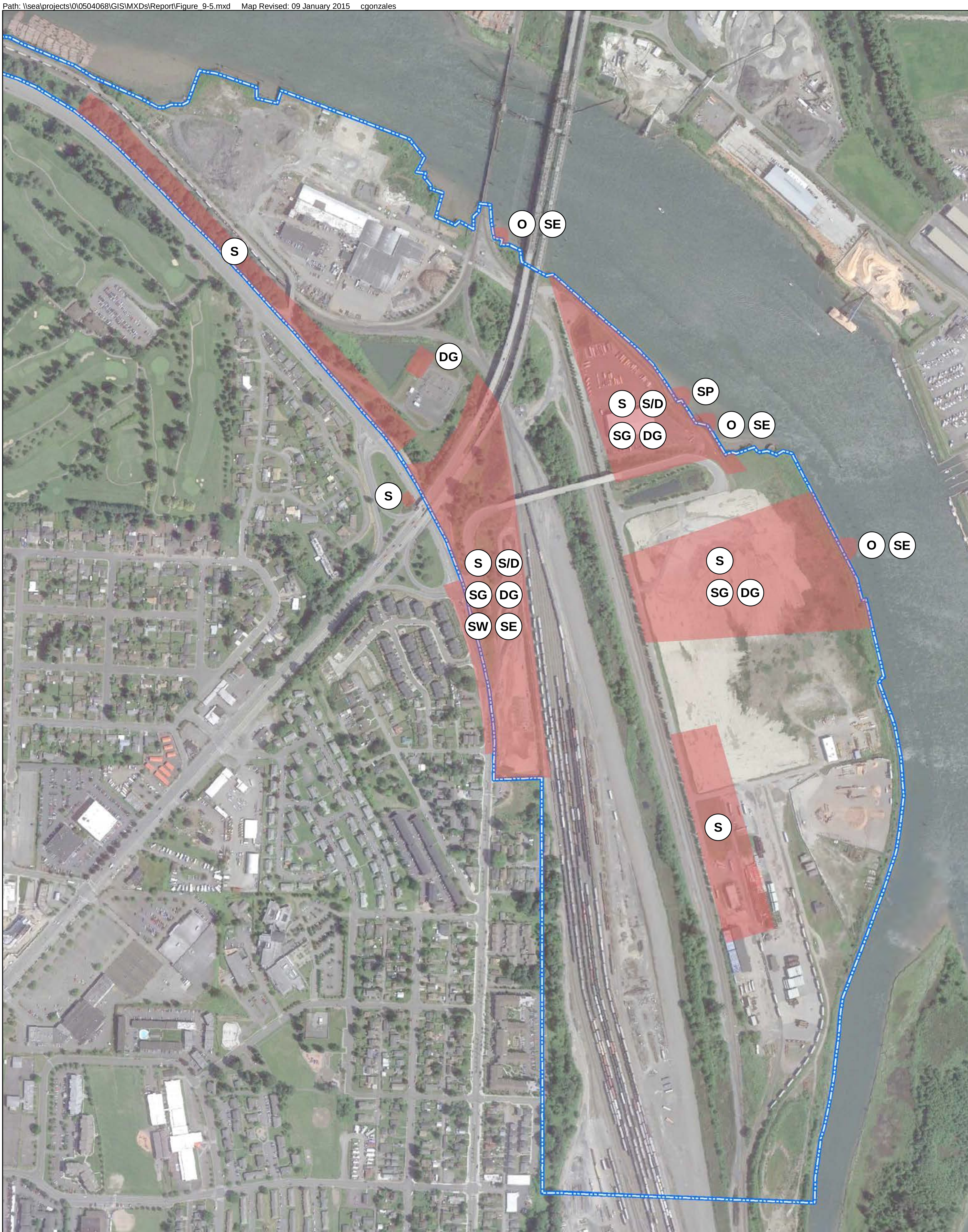
500 0 500
Feet

Summary of Arsenic and Mercury Exceedances in Surface Water, Seeps, Outfalls and Sediment

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 9-4



Legend

Lowland Area

Area Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

Media Requiring Evaluation of Remedial Alternatives As Part of the Feasibility Study

S	Soil	SW	Surface Water
S/D	Slag or Debris	SP	Seep Water
SG	Shallow Groundwater	O	Outfall Water
DG	Deep Groundwater	SE	Sediment

N W E S

500 0 500

Feet

Areas Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

Everett Smelter - Lowland Area

GEOENGINEERS

Figure 9-5

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: GoogleEarth Pro, 2013. Snohomish County GIS, 2012. Washington State Department of Ecology

APPENDIX A
Supplemental Remedial Investigation Technical Memorandums

Annotated Table of Contents for Appendix A for the Everett Smelter Lowland Area Supplemental Remedial Investigation

The following is an annotated table of contents for technical memorandums prepared as part of the supplemental remedial investigation (SRI) of the Everett Smelter Lowland Area. The following summary identifies the investigation activities described in each memorandum that were used in the SRI. Each memorandum prepared as part of the SRI includes the laboratory analytical data report(s) for samples collected as part of the identified investigation activities and the results of a data quality review of analytical results.

May 7, 2012 - Groundwater Monitoring Technical Memorandum, Lowland Area – Benson Property

This technical memorandum summarizes investigation activities at the Everett Smelter Lowland Area Benson Subarea performed in December 2011 and January 2012. Investigation activities included the following:

- Installation of 20 groundwater monitoring well pairs (10 "shallow" wells and 10 "deep" wells) along the east side of the Benson Subarea (BP-01 S/D through BP-10 S/D).
- Soil sample collection from each deep well boring completed during the monitoring well installation.
- Soil sample analysis for metals.
- Monitoring well development.

July 25, 2012 - Groundwater Monitoring Technical Memorandum, Lowland Area – Benson Property

This technical memorandum summarizes investigation activities at the Everett Smelter Lowland Area Benson Subarea on June 4 and 11, 2012. Investigation activities included the following:

- Development of three existing groundwater monitoring wells (EV-20B, EV-22A and EV-22B).

May 15, 2013 - Monitoring Well Installation Technical Memorandum, Lowland Area

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in December 2012 and January 2013. Investigation activities included the following:

- Installation of 54 groundwater monitoring wells (23 "shallow" wells, 30 "deep" wells and one "deeper deep" well) throughout the Lowland Area including:
    - Forty-six monitoring wells were installed in shallow/deep well pairs at twenty three locations.
    - Seven wells were installed as deep wells, either adjacent to existing shallow wells or where shallow groundwater was not encountered.
    - One deeper, deep well (BP-05D2) was installed adjacent to an existing shallow/deep well pair (BP-05S/D) on the Benson Property.
- Installation of three soil borings.
- Soil sample collection during the monitoring well and soil boring installation.

- Soil sample analysis for metals.
- Monitoring well development.

June 25, 2013 - Snohomish River Sediment, Seep and Outfall Sampling Technical Memorandum, Lowland Area

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area on April 26, 29 and 30, 2013. Investigation activities included the following:

- Collection of seep and outfall water and sediment samples from 10 locations on the Snohomish River shoreline in the Lowland Area.
- Analysis of the water and sediment samples for metals.

July 16, 2013 - Lowland Area Groundwater, Surface Water and Sediment Technical Memorandum (Quarter 1)

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in January through March 2013. Investigation activities included the following:

- Collection of groundwater samples from 87 monitoring wells.
- Groundwater sample analysis for metals.
- Collection of surface water and sediment samples from four locations in the Lowland Area.
- Surface water and sediment sample analysis for metals.
- Hydraulic conductivity testing.
- Tidal study.

June 27, 2013 - Lowland Area Surface Soil Sample Collection Technical Memorandum

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area on May 24, 2013. Investigation activities included the following:

- Collection of six surface soil samples at the base of the slope adjacent to East Marine View Drive.
- Surface soil sample analyses for metals.

June 28, 2013 - Lowland Area Groundwater and Surface Water Technical Memorandum (Quarter 2)

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in April and May 2013. Investigation activities included the following:

- Collection of groundwater sample from 87 monitoring wells.
- Groundwater sample analysis for metals and arsenic speciation.
- Collection of surface water samples from four locations in the Lowland Area.

- Surface Water sample analysis for metals and arsenic speciation.

October 18, 2013 - August 2013 Monitoring Well Installation Memorandum

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in August 2013. Investigation activities included the following:

- Installation of four groundwater monitoring wells [two "deep" wells (LLMW-35D and LLMW-36D) and two "deeper deep" wells (BP-04D2 and BP-07D2)].
- Soil sample collection during monitoring well installation.
- Soil sample analysis for metals.

October 31, 2013 - August/September 2013 Groundwater Sampling Memorandum **(Quarter 3)**

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in August and September 2013. Investigation activities included the following:

- Monitoring well development.
- Collection of groundwater samples from 91 monitoring wells.
- Collection of surface water samples from two locations in the Lowland Area.
- Groundwater and surface water sample analysis for metals, arsenic speciation and conventionals.

January 15, 2014 – October/November 2013 Groundwater Sampling Memorandum (Quarter 4)

This memorandum summarizes investigation activities completed at the Everett Smelter Lowland Area in October through November 2013. Investigation activities included the following:

- Collection of groundwater samples from 91 monitoring wells.
- Collection of surface water samples from two locations in the Lowland Area.
- Groundwater and surface water sample analysis for metals, arsenic speciation and conventionals.
- Tidal study.

November 17, 2014 - 2014 Focused Source Area Investigation Results

This technical memorandum summarizes investigation activities at the Everett Smelter Lowland Area Benson Subarea performed in March and April 2014. Investigation activities included the following:

- Installation of 44 soil borings in the Marine View Drive Right-of-Way (LLSB-04 through LLSB-47).
- Soil sample collection from each boring.
- Soil sample analysis for metals.

- Synthetic Precipitation Leaching Procedure (SPLP) testing for arsenic.
- Column leaching tests for arsenic.
- Permeameter testing.

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APPENDIX B
Exploration Logs

APPENDIX C

Historical Sampling Results: Sediment, and Outfall Water and Outfall Sediment Sampling

APPENDIX D
Report Limitations and Guidelines for Use

APPENDIX D
REPORT LIMITATIONS AND GUIDELINES FOR USE[2]

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 contract (Contract No.: C1100145AA) and scope and limitations of associated project proposals. 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 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

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

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.