Final Cleanup Action Plan

Everett Smelter Site, Lowland Area
Everett, Washington

for
Washington State Department of Ecology

November 10, 2016

GeoEngineers
Earth Science + Technology

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ACRONYMS AND ABBREVIATIONS

APPS	Aquatic Protection Permitting System
ARARs	applicable or relevant and appropriate requirement
ASARCO	American Smelting and Refining Company
BA	biological assessment
bgs	below ground surface
bml	below mudline
BMPs	best management practices
BNSF	BNSF Railway
BO	biological opinion
CAOs	cleanup action objectives
CAP	Cleanup Action Plan
City	City of Everett
cm	centimeter
Corps	United State Army Corps of Engineers
CSWGP	Construction Stormwater General Permit
CWA	Clean Water Act
CY	cubic yards
DCA	disproportionate cost analysis
DW	dangerous waste
Ecology	Washington State Department of Ecology
EDR	engineering design report
EMC	Everett Municipal Code
ESA	Endangered Species Act
FS	Feasibility Study
FWCA	Fish and Wildlife Conservation Act
HASP	health and safety plan
HPA	Hydraulic Project Approval
IHSs	indicator hazardous substances

JARPA	Joint Aquatic Resource Permit Application
Lowland or Lowland Area	Everett Smelter Lowland Area
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MSFCMA	Magnuson-Stevens Fishery Conversation and Management Act
MTCA	Model Toxic Control Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWP 38	Nationwide Permit 38
PCULs	preliminary cleanup levels
POTW	Publicly Owned Treatment Works
PQL	Practical Quantitation Limit
PRB	permeable reactive barrier
QAPP	Quality Assurance Project Plan
QC/QC	quality assurance/quality control
ROW	right-of-way
SEPA	State Environmental Policy Act
Site	Everett Smelter Lowland Area
SMA	Shoreline Management Act
SMS	Sediment Management Standards
SRI	Supplemental Remedial Investigation
S/S	solidification and stabilization
SWPPP	stormwater pollution prevention plan
TESC	temporary erosion and sediment control
TCLP	toxicity leaching characteristic procedure
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
WQC	Water Quality Certification

Table of Contents

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

This document presents the Cleanup Action Plan (CAP) for the Everett Smelter Lowland Area (Lowland or Lowland Area) located in northeast Everett, Washington (Figure 1). The approximately 250-acre 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 smelter facility operated from approximately 1892 to 1912. Figure 2 shows the Upland Area, Lowland Area, and former smelter facility boundary.

This CAP has been prepared pursuant to the requirements of the Model Toxics Control Act (MTCA) administered by the Washington State Department of Ecology (Ecology) under Chapter 173-340 of the Washington Administrative Code (WAC) and the requirements of the Sediment Management Standards (SMS) administered by Ecology under Chapter 173-204 WAC. The purpose of this CAP is to provide a description of the proposed cleanup action for the Lowland Area and to set forth the functional requirements that the cleanup must meet to achieve the cleanup action objectives (CAOs) for the Site. The information provided in this CAP includes the following:

- Description of the Lowland Area, including a summary of its history and extent of contamination presented in the Supplemental Remedial Investigation and Feasibility Study Report (SRI/FS Report; GeoEngineers, 2016);
- Summary of conceptual site model identifying potential transport and exposure pathways to contamination;
- Identification of the site-specific cleanup standards and CAOs;
- Summary of the remedial action alternatives that were considered, evaluation of the remedial action alternatives and selection of the preferred remedial action alternative for the Lowland Area presented in the SRI/FS Report (GeoEngineers, 2016);
- Description of the cleanup action (i.e., selected remedial action alternative) for the Lowland Area; and
- Identification of regulatory requirements for the implementation of the selected cleanup action.

This CAP has been completed on behalf of 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 operation.

2.0 SUMMARY OF SITE CONDITIONS

This section summarizes the Lowland Area history, conceptual site models, site conditions, and the nature and extent of contamination. More detailed descriptions of Lowland Area conditions and the nature and extent of contamination are provided in the SRI/FS report (GeoEngineers, 2016).

Multiple investigations have been conducted at the Everett Smelter Site between 1995 and 2014 that produced data characterizing the conditions in the Lowland Area that include the following:

- 1995 Remedial Investigation, Everett Smelter Site (Hydrometrics, 1995) (herein referred to as the initial RI report for the Lowland Area).
- 1996 Supplemental Investigation of the Everett Smelter Site Lowland Area (Hydrometrics, 1996).
- 1996 Smelter Area Investigation Report, Everett Smelter Site (ASARCO, 1998).
- 1999 Integrated Cleanup Action Plan and Final Environmental Impact Statement for the Upland Area (Ecology, 1999).
- 2000 Comprehensive Lowland Area Remedial Investigation Report for the Everett Smelter Site (ASARCO, 2000).
- 2010 Everett Smelter Site – Draft Lowland Area Site Conditions and Data Gaps Report (SAIC, 2010).

The Supplemental Remedial Investigation (SRI) report prepared in 2015 for the Lowland Area summarizes the investigations performed between 1995 and 2014 (GeoEngineers, 2016). The purpose of the investigations was to collect, develop, and evaluate sufficient information to allow the selection of an appropriate remedial action for the Lowland Area. Media investigated included soil, groundwater, surface water, stormwater runoff and sediment.

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 silt, clay, and peat deposits.

The SRI Report identified metals: arsenic, lead and mercury as the indicator hazardous substances (IHS) and the locations where the contaminants where found in the Lowland Area. In accordance with WAC 173-340-703, IHSs for the Lowland Area were selected based on factors including the frequency and magnitude of individual contaminants (metals) exceeding the cleanup levels, co-occurrence of contaminants at concentrations greater than the cleanup levels and presence of a contaminant in multiple interconnected media at concentrations greater than the cleanup levels.

The Feasibility Study (FS) for the Lowland Area developed and evaluated multiple remedial action alternatives to address the IHSs present in media at concentrations greater than cleanup levels (GeoEngineers, 2016). The preferred remedial action alternative described in this CAP was developed to address arsenic, lead and mercury contamination in the Lowland Area based on the Site conditions.

Multiple subareas were identified within and adjacent to the Lowland Area that are discussed in the SRI/FS and this CAP. The subareas are shown on Figure 3 and include the following:

- Benson Subarea;
- Snohomish County PUD Subarea;
- Slope Subarea;
- Shadow Development/Blunt Family Subarea;
- Riverside Business Park Subarea;
- BNSF Subarea;
- Marine View Drive right-of-way (ROW); and

- Pacific Highway ROW.

2.1. Everett Smelter Site and Lowland Area History

A detailed history of smelter and Lowland Area development and operations is presented in the SRI. Key events and activities in the history of smelter development, operation and closure include the following:

Year(s)	Events/Activities
1894	Lead smelting initiated.
1898	Arsenic extraction facilities were added to the smelter.
1912-1917	Arsenic extraction was shut down and the smelter was dismantled.
1920s – 1930s	ASARCO sold the smelter properties. The last property was sold in 1936.
1930s – 1940s	Former smelter property developed for residential purposes.
1990	Everett Smelter Site discovery.
1990-2015	Various environmental studies up to and including the SRI and FS.
2016	Everett Smelter Site Lowland Area CAP.

Lead smelting operations began at the Everett facility in 1894 and was the primary product produced at the smelter facility. Arsenic extraction was added in 1898. During this time the native surface soil throughout the majority of the Lowland Area primarily consisted of fine sand, silt, clay and peat underlain by alluvium (sand). During the smelter's operations, slag and smelter stack emissions were deposited on the native surface of the Lowland Area. Slag consists of a 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.

After closure of the smelter, the majority of the aboveground smelter facilities were dismantled. The demolition debris was spread around within the facility footprint. ASARCO sold the smelter facility properties and the area was subsequently redeveloped predominantly for residential use. The City of Everett (City) used some of the slag that remained in the Lowland after closure of the smelter facility. Cascade Insulation Company operated a "rock wool" plant in the Lowland Area between approximately 1944 and 1955. They may have deposited rock wool waste on site, consisting of silt- to fine-grained sand sized slag. In 1956, the interchange of Marine View Drive and Pacific Highway was constructed by the City on top of the deposited slag within the former smelter facility area.

Up to ten feet of material dredged from the Snohomish River was placed as fill over the native surface of the Lowland Area after smelter closure. The majority of the fill consists of fine to coarse sands. Near-surface fill includes gravely sand and crushed rock and is up to 5 feet thick. Operations in the Lowland Area post-filling have included Weyerhaeuser-owned wood milling operations (Mills B, C, D and E and the Weyerhaeuser demolition landfill) and other industrial/commercial uses to the present day (2016). The approximate locations of Weyerhaeuser-owned wood milling operations are shown in the SRI/FS Report.

2.2. Conceptual Site Models

Conceptual site models were developed to evaluate contaminant transport and exposure pathways. A conceptual site contaminant transport model was developed to describe historical release(s) of hazardous

substances at the Site and the subsequent potential migration of those hazardous substances in environmental media. The conceptual site contaminant transport model is presented in Section 2.2.1.

A complete exposure pathway consists of: (1) an identified contaminant source, (2) a release/transport mechanism from the source to locations (exposure points) where potential receptors may come in contact with contaminants, and (3) an exposure route (for example, soil ingestion) where potential receptors may be exposed to contaminants. Exposure pathways that were not complete (for example groundwater ingestion) were not considered further in the SRI. Potential future use of the Lowland Area includes commercial and industrial use characterized by paved surfaces with buildings and structures. Exposure models were developed to describe potential exposure pathways for human and ecological receptors. The exposure models are presented in Section 2.2.2.

2.2.1. Sources and Conceptual Site Contaminant Transport Model

Contaminant sources include contaminated soil in the Marine View Drive ROW in the western portion of the Lowland Area; slag in the western portion of the Lowland Area; soil comprising the historical native surface throughout the Lowland Area that was subject to historical aerial deposition of stack emissions; and soil in the Lowland Area contaminated by source material or contaminant transport. The indicator hazardous substances in these sources include a combination of arsenic, lead, and mercury. The transport mechanisms are identified below and shown as Pathways 1 through 14 on Figure 4:

- 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 (Transport Pathway 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 (Transport Pathway 2). Transport from deep groundwater present in Upland Area outwash to deep groundwater in alluvium in the Lowland Area (the lower portion of Transport Pathway 2).
- Transport in shallow groundwater through channel deposits to deep groundwater (Transport Pathway 3).
- Transport in shallow groundwater discharging to sediment and/or surface water in the Lowland Area (Transport Pathway 6).
- Transport of contaminants from slag or fill mixed with slag in shallow groundwater toward the Snohomish River (Transport Pathway 8).
- Transport from historical native surface soil in shallow groundwater toward the Snohomish River (Transport Pathway 10).
- Infiltration of contaminated shallow groundwater into underground pipes and discharge to the Snohomish River shoreline (Transport Pathway 11).
- Discharge of shallow groundwater through sediment at seeps on the Snohomish River shoreline (Transport Pathway 12).
- Transport in runoff flowing into surface waters in the Lowland Area (Transport Pathway 4).
- Surface water flow into ditches and culverts that discharges through outfall LLO-02 to the Snohomish River shoreline (Transport Pathway 5). Transport of suspended sediment in surface water flowing

through ditches and culverts and discharging through an outfall to the Snohomish River shoreline (Transport Pathway 5).

- Potential recharge from surface water in the Lowland Area through sediment to shallow groundwater (Transport Pathway 7).
- Transport in deep groundwater toward the Snohomish River (Transport Pathway 9).
- Discharge of deep groundwater through sediment at seeps on the Snohomish River shoreline (Transport Pathway 13).
- Transport of sediment on Snohomish River shoreline by erosion (Transport Pathway 14).

2.2.2. Conceptual Site Exposure Models

Human health and ecological conceptual site exposure models were developed in the SRI to provide a framework for evaluating Site data. The models were developed to identify complete exposure pathways and potential receptors for the contaminants detected in various environmental media at the Site.

The human health and ecological conceptual site exposure models are summarized in the following sections and are shown in Figure 5.

2.2.2.1. Contaminated Soil and Slag

Receptors that could potentially be exposed to contaminated soil and slag include industrial workers, site visitors, trespassers, and terrestrial and aquatic organisms. The exposure pathways for soil and slag for human and ecological receptors include:

- Industrial workers in Lowland Area – This exposure pathway is based on protection of human health for industrial property use from direct contact of an adult worker with contaminated soil and/or slag resulting from historical smelter operations (Exposure Pathway 1).
- 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 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).
- Wildlife in the Lowland Area – This exposure pathway is based on protection of wildlife on industrial land and is based on no significant adverse effects for the protection and propagation of wildlife (Exposure Pathway 4).
- 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).

2.2.2.2. Groundwater and Surface Water

Receptors that could potentially be exposed to contaminated groundwater and surface water include aquatic organisms, and individuals who consume those organisms. The exposure pathways for groundwater and surface water include:

- 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).
- Individuals consuming aquatic organisms in the Snohomish River - This exposure pathway is based on protection of 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).
- 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).

2.2.2.3. *Sediment*

Receptors that could potentially be exposed to contaminated sediment include aquatic organisms, individuals who consume those organisms, and individuals who come into contact with contaminated sediment. The exposure pathways for sediment include:

- 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).
- 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).
- 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).
- 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).
- Marine benthic organisms 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).

2.3. Summary of Environmental Conditions

The environmental conditions and nature and extent of contamination in the Lowland Area were investigated during multiple investigations performed between 1995 and 2015. Figures 6 through 9 present the extent of contamination and Figure 10 identifies the locations and media requiring remedial action at the Lowland Area based on the investigations. The following sections summarize the environmental conditions and nature and extent of contamination in soil, groundwater, stormwater runoff, and sediment in the subareas of the Lowland Area. Cleanup levels are discussed in Section 3.

2.3.1. Benson Subarea

In the Benson Subarea, remedial alternatives were evaluated for the following contaminated media: soil and slag; shallow and deep groundwater; surface water; and sediment (Figure 10). These contaminated media required evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and slag exceed cleanup levels.
- The soil and slag are the source of arsenic, lead and mercury concentrations exceeding cleanup levels in shallow groundwater in the Benson Subarea and in shallow groundwater adjacent to the Snohomish River shoreline.
- 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 cleanup levels in deep groundwater in the Benson Subarea and Riverside Business Park.
- The soil, slag and shallow groundwater are a source to arsenic and mercury concentrations exceeding cleanup levels in surface water and sediment in the Benson Subarea.
- Surface water in the Benson Subarea is a contributing source to water discharging from an outfall containing arsenic at a concentration exceeding cleanup levels, and where arsenic and mercury are present at concentrations exceeding cleanup levels in sediment on the Snohomish River shoreline.

2.3.2. Marine View Drive ROW

In the Marine View Drive ROW, remedial alternatives were evaluated for the following contaminated media: soil and debris; and shallow and deep groundwater (Figure 10). These contaminated media required evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and debris exceed cleanup levels.
- Soil and debris in the Marine View Drive ROW is a contributing source to arsenic concentrations greater than cleanup levels in shallow groundwater in the Benson Subarea.
- Soil, debris and transient shallow groundwater flow are a source to arsenic concentrations exceeding cleanup levels in deep groundwater in the Marine View Drive ROW, Benson Subarea, and Riverside Business Park.
- Soil, debris and transient shallow groundwater flow in the Marine View Drive ROW are a contributing source to arsenic concentrations exceeding cleanup levels in surface water and sediment in the Benson Subarea.

2.3.3. Riverside Business Park Subarea

In the Riverside Business Park Subarea remedial alternatives were evaluated for the following contaminated media: soil and slag; shallow and deep groundwater; seep and outfall water; and sediment (Figure 10). These contaminated media required evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic in historical native surface soil in three areas (Figure 10) of the Riverside Business Park Subarea exceed cleanup levels.

- The concentrations of arsenic and lead in soil and slag in the northern portion of the Riverside Business Park Subarea exceed cleanup levels.
- The soil and slag in the northern portion of the Riverside Business Park Subarea is a contributing source to arsenic concentrations exceeding cleanup levels in shallow groundwater adjacent to the Snohomish River shoreline.
- Groundwater in the deep aquifer in the central portion of the Riverside Business Park Subarea contains arsenic concentrations exceeding cleanup levels. The arsenic is due to contamination in the Benson Subarea, and the deep aquifer is the transport pathway and source of arsenic concentrations exceeding cleanup levels in deep monitoring wells adjacent the Snohomish River shoreline.
- 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 cleanup levels discharging from an outfall to the Snohomish River. Sediment in the Snohomish River contains arsenic exceeding cleanup levels as a result of the arsenic in the outfall water.
- 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 cleanup levels discharging from an outfall to the Snohomish River. Mercury exceeds cleanup levels in sediment on the Snohomish River shoreline due to the mercury in the outfall water.

Contaminant concentrations exceeding the cleanup levels 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. Therefore, this CAP does not address contamination as a result of the Koppers facility at the Mill E Site.

Arsenic concentrations exceeding the cleanup levels for the Lowland Area were also detected in shallow groundwater (LLMW-16S; Figure 7) and an adjacent seep on the Snohomish River Shoreline (LLSP-06; Figure 9) 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 (ex. no arsenic trioxide, slag or other smelter materials where identified; groundwater concentration gradients do not indicate the smelter is the source; etc.). Therefore, this CAP does not address contamination as a result of the non-smelter related contamination.

2.3.4. Snohomish County PUD Subarea and Pacific Highway ROW

In this area, remedial alternatives were evaluated for the following contaminated media: soil and debris; shallow and deep groundwater; and surface water (Figure 10). These contaminated media required evaluation of remedial alternatives for the following reasons:

- The concentrations of arsenic and lead in soil and debris exceed cleanup levels.
- Soil and debris is a source to lead and mercury concentrations exceeding cleanup levels in shallow groundwater in the Snohomish PUD Subarea.

- Arsenic and mercury concentrations in deep groundwater exceed cleanup levels in the Snohomish County PUD Subarea.
- Shallow groundwater in the Snohomish County PUD Subarea is a contributing source to mercury concentrations exceeding cleanup levels in surface water in the Lowland Area.
- Surface water in the Snohomish County PUD Subarea is a contributing source to water discharging from an outfall where mercury exceeds cleanup levels in sediment on the Snohomish River shoreline.

2.3.5. Shadow Development/Blunt Family Subarea

Contaminant concentrations exceeding the preliminary cleanup levels in the SRI 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 (ex. no arsenic trioxide, slag or other smelter materials where identified; arsenic was not detected at concentrations greater than the CUL in native surface soil; etc.) but are likely the result of other historical activities or operations occurring within the subarea (ex. arsenic at concentrations greater then CUL was detected in surface soil).

The Shadow Development/Blunt Family Subarea is the location of the former Weyerhaeuser Mill C Site. Contamination associated with the former Mill C Site is being addressed under a consent decree between Ecology and Weyerhaeuser. Therefore, this CAP does not address contamination within the Shadow Development/Blunt Family subarea.

2.3.6. Slope Subarea

The contaminated media that required evaluation of remedial alternatives in the Slope Subarea includes soil comprising the historical native surface (Figure 10). The historical native surface soil in the southern portion of the Slope Subarea contains lead and/or arsenic at concentrations that exceed screening levels.

3.0 CLEANUP STANDARDS AND OBJECTIVES

3.1. Cleanup Standards

Cleanup standards consist of cleanup levels that are protective of human health and the environment and the points of compliance at which the cleanup levels must be met. Cleanup levels were developed in accordance with MTCA (WAC 173-340-705[6]), which 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.

This section summarizes the media-specific cleanup levels and points of compliance for the IHSs that were developed and presented in the SRI/FS Report (GeoEngineers, 2016) for the Lowland Area. The Lowland Area media-specific cleanup levels and points of compliance are presented in Tables 1 through 4 and area also summarized on Figure 11. The IHSs for the Lowland Area are arsenic, lead and mercury.

3.1.1. Soil

The cleanup levels and points of compliance for soil IHSs are presented in Table 1. The IHSs for “shallow soil” which includes fill, native surface, silt and till are arsenic, lead and mercury. The IHS for “deeper soil”

which includes alluvium and outwash is arsenic. The depths and locations at which these soils are observed within the Lowland Area vary and are shown on the geologic cross-sections presented in the SRI/FS Report (GeoEngineers, 2016). The cleanup levels for soil were developed based on protection of human health (industrial worker, trespasser and visitor) and terrestrial ecological receptors (plants, soil biota and wildlife). The soil cleanup levels were selected based on the lowest applicable cleanup levels for protection of human health and/or terrestrial ecological receptors, and then adjusted based on background concentrations.

Properties in the Lowland Area are "Industrial Properties" as defined under MTCA. Therefore, the soil cleanup levels for the Lowland Area are primarily based on industrial land use, which includes cleanup levels for protection of industrial workers and wildlife and that apply to the entire Lowland Area. Soil cleanup levels based on protection of trespassers are also applicable in areas between the Marine View Drive ROW and BNSF Subarea where a trespasser exposure pathway potentially exists.

The point of compliance for cleanup levels based on protection of industrial worker are applicable to soil from surface to a depth of 15 feet below ground surface (bgs) which is MTCA standard point of compliance [WAC 173-340-740(6)(d)]. The point of compliance for cleanup levels based on protection of a trespasser are applicable to soil from the surface to a depth of 1-foot bgs, a depth below which trespassers are typically not expected to contact soil. The point of compliance for cleanup levels based on protection of terrestrial ecological receptors (wildlife) are applicable to soil from surface to a depth of 6 feet bgs, which is the MTCA conditional point of compliance for terrestrial ecological evaluation [WAC 173-340-7490(4)].

Cleanup actions that involve capping/containment of hazardous substances typically do not have to meet the soil cleanup levels at the points of compliance described above if the following criteria are demonstrated as required under WAC 173-340-740(6)(f):

- The selected remedy is permanent to the maximum extent practicable using the procedures in WAC 173-340-360;
- The cleanup action is protective of human health;
- The cleanup action is demonstrated to be protective of terrestrial ecological receptors;
- Institutional controls are put in place that prohibit or limit activities that could interfere with the long-term integrity of the containment system;
- Compliance monitoring and periodic reviews are designed to ensure the long-term integrity of the containment systems; and
- The types, levels and amount of hazardous substances remaining on site and the measures that will be used to prevent migration and contact with those substances are specified for the Site.

3.1.2. Groundwater

The cleanup levels and points of compliance for groundwater IHSs are presented in Table 2. The IHSs for shallow aquifer groundwater are arsenic, lead and mercury. The IHS for deep aquifer groundwater is arsenic. The depths of the shallow and deep groundwater aquifers are shown on the geologic cross-sections presented in the SRI/FS Report (GeoEngineers, 2016). The cleanup levels for groundwater were developed based on protection of Lowland Area surface water (wetlands and ponds) and surface water in the Snohomish River since groundwater in the Lowland Area is not classified as a potable water source. The groundwater cleanup levels were selected based on the lowest of the applicable cleanup levels for

protection of surface water in the Lowland Area and/or Snohomish River, and then adjusted based on background concentrations and PQL.

The point of compliance for groundwater in the Lowland Area is where groundwater enters surface waters of the Lowland Area (wetlands and ponds). The point of compliance for groundwater entering the Snohomish River is at the shoreline where groundwater discharges to the Snohomish River.

3.1.3. Surface Water (Includes Seep- and Outfall-Water)

The cleanup levels and points of compliance for surface water IHSs are presented in Table 3. The IHSs for surface water are arsenic and mercury. The cleanup levels for the surface water IHSs were developed based on the same criteria as the cleanup levels for groundwater.

The point of compliance for surface water cleanup levels in the Lowland Area is the surface waters of the Lowland Area (wetlands and ponds). The point of compliance for surface water cleanup levels Snohomish River is the shoreline of the Snohomish River where groundwater, seeps and outfalls discharge to the Snohomish River.

The surface water cleanup levels are not generally applicable to outfall-water comprised of stormwater because stormwater outfalls are regulated under the National Pollutant Discharge Elimination System (NPDES) program. However, outfall-water has been screened using the surface water cleanup levels for Snohomish River surface water to evaluate and address sources of contamination, and contaminant transport pathways including infiltration of groundwater into stormwater pipes that discharge through outfalls on the Snohomish River shoreline.

3.1.4. Sediment

The cleanup levels and points of compliance for sediment IHSs are presented in Table 4. The IHSs for sediment are arsenic and mercury. As detailed in the SRI/FS Report (GeoEngineers, 2016), the cleanup levels for sediment were developed based on protection of benthic organisms, human health and/or aquatic/aquatic-dependent ecological receptors. The sediment cleanup levels were selected based on the lowest applicable cleanup levels based on protection of benthic organisms, human health and/or aquatic/aquatic-dependent ecological receptors, and then adjusted based on background concentrations.

The point of compliance for sediment cleanup levels is 0 to 10 centimeter (cm) (i.e., approximately 0 to 4 inches) below mudline (bml), which is the biologically active zone. The point of compliance of 0 to 10 cm applies to sediment present in Lowland Area surface water features and sediment on the Snohomish River shoreline adjacent to the Lowland Area.

Cleanup actions that involve capping/containment of hazardous substances in sediment typically do not have to be meet the sediment cleanup levels at the above mentioned points of compliance if the criteria required under WAC 173-340-740(6)(f) are demonstrated, as discussed in Section 3.1.1.

3.2. Cleanup Action Objectives (CAOs)

The Cleanup Action Objectives (CAOs) consist of chemical- and media-specific goals for the protection of human health and the environment and are intended to assist in focusing the development and evaluation of remedial alternatives. The objective of the cleanup action is to eliminate, reduce, or otherwise control to the extent feasible and practicable, unacceptable risks to human health and the environment posed by

hazardous substances in contaminated media of the Lowland Area in accordance with the MTCA Cleanup Regulation (WAC 173-340), SMS regulations (WAC 173-204) and other applicable regulatory requirements. The specific CAOs for the Lowland Area are presented in Table 5. The CAOs for the Lowland Area were developed to mitigate contaminant transport and exposure to contaminated media thereby protecting human health, terrestrial ecological receptors, and marine/freshwater aquatic and benthic organisms in the Lowland Area.

4.0 REMEDIAL ALTERNATIVES EVALUATION

The SRI/FS Report (GeoEngineers, 2016) identified fifteen areas that required remedial alternative evaluation (hereinafter referred to as remedial action areas) in the Lowland Area based on locations and concentrations of the IHSs exceeding cleanup levels. For the purposes of developing remedial alternatives as part of the FS, the remedial action areas were grouped into four groups – Groups A through D, based on their location relative to the Snohomish River and interaction of the contaminated media present at these areas with the groundwater contamination (source vs. non-source).

- Group A consists of contaminated upland areas that are primary sources to groundwater contamination and include Remedial Action Areas A1 and A2.
- Group B consists of contaminated upland areas that are contributing sources to groundwater contamination and include Remedial Action Areas B1 through B3.
- Group C consists of contaminated upland areas that do not contain source material to groundwater contamination and include Remedial Action Areas C1 through C3, C5 and C6. Area C4, which was identified as a remedial action area in the FS is not located within the limits of the Lowland Area as discussed in Section 5.8. Therefore Area C4 is no longer considered a remedial action area of the Lowland Area.
- Group D consists of contaminated marine areas on the Snohomish River shoreline and include Remedial Action Areas D1 through Area D4.

Figure 12 shows approximate locations of the remedial action areas and also identifies contaminated media present in each area. Remedial alternatives were first developed for each remedial action area. Up to three remedial alternatives were developed for each remedial action area as part of the FS (GeoEngineers, 2016) to provide a representative range of protectiveness for evaluation purposes. The nomenclature for the remedial alternatives for the individual remedial action areas consist of the remedial action area identification as the prefix (ex. A1, A2, B1, etc.) and alternative sequence number (ex. 1, 2, 3, etc.) as the suffix. For example, the three remedial alternatives developed for Area A1 were identified as A1-ALT-1 through A1-ALT-3. In general, a larger sequence number for a remedial alternative indicates a higher degree of protectiveness achieved either by treatment or removal of contaminated media. The remedial alternatives for each individual area were then combined in multiple ways to develop site-wide remedial alternatives.

Seven site-wide remedial alternatives listed below were developed and evaluated as part the FS. Each of these remedial alternatives were developed such that they address all of the CAOs for the Lowland Area.

- **Site-Wide Remedial Alternative 1(i):** Primarily consists of low permeability surface capping and containment (sheet pile, slurry wall or similar) of the areas that are primary sources to groundwater

contamination (Group A), low permeability surface capping of the areas that are secondary sources to groundwater contamination (Group B) and installing permeable reactive barriers (PRB) to treat shallow and deep groundwater contamination prior to its discharge into the Snohomish River. Groundwater natural attenuation processes are expected to address residual deep groundwater contamination following implementation of the source control remedy selected for the primary groundwater contamination source areas. However, this alternative uses the PRB for deep groundwater as a polishing technology intended to reduce the time to achieve cleanup standards.

- **Site-Wide Remedial Alternative 1(ii):** Primarily consists of in situ solidification/stabilization (S/S) of contaminated media present at the areas that are primary sources to groundwater contamination (Group A), low permeability surface capping of the areas that are secondary sources to groundwater contamination (Group B) and installing PRB to treat shallow as well as deep groundwater contamination prior to its discharge into the Snohomish River. Groundwater natural attenuation processes are expected to address residual deep groundwater contamination following implementation of the source control remedy selected for the primary groundwater contamination source areas. However, this alternative uses the PRB for deep groundwater as a polishing technology intended to reduce the time to achieve cleanup standards.
- **Site-Wide Remedial Alternative 1(iii):** Primarily consists of excavation and off-site disposal of contaminated media present at the areas that are primary sources to groundwater contamination (Group A), low permeability surface capping of the areas that are secondary sources to groundwater contamination (Group B) and installing PRB to treat shallow as well as deep groundwater contamination prior to its discharge into the Snohomish River. Groundwater natural attenuation processes are expected to address residual deep groundwater contamination following implementation of the source control remedy selected for the primary groundwater contamination source areas. However, this alternative uses the PRB for deep groundwater as a polishing technology intended to reduce time to achieve cleanup standards.
- **Site-Wide Remedial Alternative 2:** Primarily consists of excavation and off-site disposal of contaminated media present at the areas that are primary sources to groundwater contamination (Group A), low permeability surface capping of the areas that are secondary sources to groundwater contamination (Group B) and installing a permeable reactive barrier (PRB) to treat shallow groundwater contamination prior to its discharge into the Snohomish River. Alternative 2 relies on groundwater natural attenuation processes to address residual deep groundwater contamination following the implementation of the source control remedy selected for the primary groundwater contamination source areas.
- **Site-Wide Remedial Alternative 3(i):** Primarily consists of in situ solidification/stabilization (S/S) of contaminated media present at areas that are primary and secondary sources to groundwater contamination. Alternative 3(i) relies on groundwater natural attenuation processes to address residual shallow and deep groundwater contamination following the implementation of the source control remedy selected for the primary and secondary groundwater source areas.
- **Site-Wide Remedial Alternative 3(ii):** Primarily consists of excavation and off-site disposal of contaminated media present at areas that are the primary source to groundwater contamination and in situ solidification/stabilization (S/S) of contaminated media present at areas that are secondary sources to groundwater contamination. Alternative 3(ii) relies on groundwater natural attenuation processes to address residual shallow and deep groundwater contamination following the

implementation of the source control remedy selected for the primary and secondary groundwater source areas.

- **Site-Wide Remedial Alternative 4:** Primarily consists of excavation and off-site disposal of contaminated media present at areas that are primary and secondary sources to groundwater contamination. Alternative 4 relies on groundwater natural attenuation processes to address residual shallow and deep groundwater contamination following the implementation of the source control remedy selected for the primary and secondary groundwater source areas.

Details of the site-wide remedial alternatives including identification, description and cost of area remedial alternatives that were combined to develop these site-wide remedial alternatives are presented in the SRI/FS Report (GeoEngineers, 2016). The costs were estimated on a conceptual level to meet the primary objective of the FS to perform a comparative evaluation of site-wide remedial alternatives and identify a preferred remedial alternative for the Lowland Area.

In the FS, the site-wide remedial alternatives were evaluated with respect to the MTCA threshold requirements (WAC 173-340-360(2)(a)) to ensure that they provide protection of human health and environment, compliance with cleanup standards, compliance with applicable State and Federal Laws and provision for compliance monitoring. In accordance with the MTCA, remedial alternatives were also evaluated against the other MTCA requirements (WAC 173-340-360(2)(b)) to determine if they use permanent solutions to the maximum extent practicable, provide for a reasonable restoration time frame and consider public concerns.

As part of the FS, each remedial alternative was assigned a benefit score based on this evaluation. MTCA Disproportionate Cost Analysis (DCA; WAC 173-340-360(3)(e)) was used to compare the benefits of a remedial alternative to the probable cost in order to select an alternative that is the most permanent, practicable and whose incremental costs were not disproportionate to the incremental benefits. The MTCA DCA completed for the site-wide remedial alternative is presented in the FS. The following table summarizes the benefit score, total cost and ratio of the benefit per cost for each remedial alternative. The cost of each remedial alternative was divided by $5 Million to avoid ratios with multiple decimals.

Site-Wide Remedial Alternative	1(i)	1(ii)	1(iii)	2	3(i)	3(ii)	4
Benefit Score (out of 10)	3.7	4.3	5.3	5.1	6.2	6.6	7.4
Total Estimated Cost (Millions)	$15	$18	$21	$19	$107	$110	$221
Benefit/Cost	1.25	1.21	1.29	1.35	0.29	0.30	0.17

- Based on the DCA, the overall cost for Site-Wide Remedial Alternatives 3(i), 3(ii) and 4 were observed to be disproportionate to the environmental benefit that they provide. The environmental benefits for Site-Wide Remedial Alternative 1(iii) were greater than Site-Wide Remedial Alternative 2. However, Site-Wide Remedial Alternative 1(iii) was observed to be less cost effective than the environmental benefit gained through implementing Site-Wide Remedial Alternative 2. Site-Wide Remedial Alternative 2 has the highest benefit/cost ratio as compared to rest of the site-wide remedial

alternatives. As a result, the Site-Wide Remedial Alternative 2 was selected as the cleanup action for the Lowland Area.

5.0 SELECTED CLEANUP ACTION

Site-Wide Remedial Alternative 2 is the selected cleanup action for the Lowland Area. The following Sections 5.1 through 5.12 present a detailed description and cost summary for the remedial actions to be performed in each remedial action area (A1, A2, B1, etc.) as part of the selected cleanup action and Section 5.13 provides a summary of the selected cleanup action.

Detailed cost estimates and specific assumptions, quantity estimates and unit costs used in developing cost estimates are presented in Tables A-1 through A-11 of Appendix A. The cost estimates include costs for design, permitting, construction and performance/compliance monitoring. The assumptions, and quantity/cost estimates are conceptual-level and are based on engineering judgment and current knowledge of site conditions. The final design for the selected cleanup action may require additional characterization and analysis of site media in addition to specific plans for the future development of the site to better define the remedial actions and associated costs. The final design for the selected cleanup action may differ from the descriptions presented in this CAP based on input from the public and other stakeholders, permit requirements, supplemental data that may be collected to support design as well as other factors.

The schedule for implementation of the cleanup action is contingent on the funds available to the Ecology. Given the size of the project, funding requirements, potential construction sequencing needs and diverse cleanup components that are involved in the cleanup action for the Lowland Area, cleanup activities are anticipated to be completed in phases. The cleanup action is currently anticipated to be completed in three to four phases. Based on the available funds, Ecology is prioritizing implementation of the remedial action for Area A1. Implementation of the cleanup action will require completion of public participation requirements, engineering design and permitting prior to construction. These requirements are described in Section 6.0.

The restoration time frame for the cleanup action of the Lowland Area is estimated to be on the order of 10 to 15 years, which includes implementation of the remedial actions for all of the remedial action areas, performance monitoring of remedial actions/natural attenuation process and compliance monitoring. Potential future maintenance of the remedial actions that leave contaminated material in place and additional monitoring requirements may extend the restoration time frame of the cleanup action.

5.1 Remedial Action Area A1

Area A1 is located at the intersection of Marine View Drive and Weyerhaeuser Bridge Road and is a primary source to deep groundwater arsenic contamination at the Lowland Area. The contaminated media present at Area A1 include:

- Soil and slag/debris contaminated with arsenic and lead; and
- Groundwater (shallow and deep) contaminated with arsenic.

The remedial action selected for Area A1 meets soil cleanup levels throughout MTCA's standard point of compliance (0 to 15 feet bgs) by removing contaminated soil and slag/debris that is a source of contamination in shallow and deep groundwater. The points of compliance for groundwater cleanup levels applicable to Area A1 are where groundwater discharges into surface waters in the Lowland Area and the Snohomish River. These points of compliance are located downgradient of Area A1 and within other remedial action areas or the shoreline of the Snohomish River. Groundwater cleanup levels are expected to be met at these points of compliance by a combination of the completion of the remedial action selected for Area A1 and remedial actions in other remedial action areas.

The permit requirements applicable to the remedial action selected for Area A1 are the following and are further described in Section 6.0:

- Washington State Environmental Policy Act (SEPA) Determination;
- City of Everett Grading Permit;
- Washington State Department of Transportation (WSDOT)/City of Everett Right-of-Way Permit; and
- City of Everett Discharge to Publicly Owned Treatment Works (POTW) Permit.

The remedial action activities to be implemented within Area A1 are presented in the following sections. The cost estimate for the selected remedial action in Area A1 is presented in Table A-1 in Appendix A and the location of Area A1 is shown on Figure 12. The cost of the selected remedial action in Area A1 is estimated to be approximately $5.7 million.

5.1.1. Site Preparation and Demolition

Site preparation and demolition activities will include:

- Implementing temporary site controls including temporary traffic controls and temporary erosion and sediment control (TESC) necessary to support remedial excavation activities.
- Locating utilities prior to any earth disturbing activities. Utilities (underground and above ground) will be protected in place and/or temporarily disconnected, rerouted and restored to facilitate excavation and backfilling activities.
- Installing temporary shoring (sheet pile wall, slurry wall or similar) to facilitate excavation and keep portions of East Marine View Drive and the associated sidewalks operational for vehicular/pedestrian traffic during construction. Approximately 450 linear feet of temporary shoring is assumed for the purpose of cost estimating.
- Demolishing existing asphalt/concrete surfaces of streets and sidewalks to provide access to contaminated media that is to be removed. Demolition debris will be disposed at an off-site disposal facility approved by Ecology. For the purposes of cost estimating, approximately 1,200 square yards of paved surfaces within the footprint of Area A1 are assumed to be demolished.

5.1.2. Remedial Excavation

Remedial excavation activities within Area A1 will be focused on removing contaminated soil and slag/debris that are primary source to groundwater contamination. Remedial excavation activities will include:

- Excavating contaminated soil and slag/debris using conventional excavation methods (e.g. excavator, backhoe or similar). Excavation in the vicinity of underground utilities may require use of a vacuum operated suction truck(s) to minimize damage to existing utilities and ensure safety during excavation around utilities. For the purposes of cost estimating, the depth of excavation within Area A1 is assumed to be 15 feet bgs and approximately 12,200 tons of contaminated soil and slag/debris are estimated to be removed. Based on chemical analytical data presented in the SRI/FS Report, 9,700 tons (i.e., approximately 80 percent) are assumed to be non-hazardous and 2,500 tons (i.e., approximately 20 percent) are assumed to be hazardous waste for disposal purposes. As identified in the assumptions presented in Appendix A, material with arsenic and lead concentrations greater than 3,000 milligrams/kilogram (mg/kg) and mercury concentrations greater than 4 mg/kg are considered potentially hazardous waste for cost estimating purposes.
- Performing surveys to document the limits of excavation.
- Stockpiling excavated material on site prior to off-site transport and disposal or transporting excavated material directly off site for disposal. Disposal characterization will be completed either by utilizing the results of in situ sampling and analysis performed prior to excavation and/or by stockpile sampling and analysis. Non-hazardous material will be disposed at a permitted Subtitle D landfill and material designated as hazardous waste will be disposed at a permitted Subtitle C landfill approved by Ecology. Stockpile containment areas will be bermed, lined, covered and include other engineering controls such as a sump, filtering media and/or silt screens to prevent run-on, runoff and erosion (ex. wind dispersion) from the stockpiled material. Stockpile containment areas will be constructed with berms consisting of concrete blocks (ex. Ecology blocks) or other berm material and will be lined across the bottom and covered with plastic sheeting.
- Dewatering, storing, treating (if necessary) and disposing of excavation water to facilitate excavation activities. Collected excavation water will be either transported off site to a permitted disposal facility using appropriate containers (ex. tanker trucks) or discharged to the City's sanitary sewer. Discharge into the City's sanitary sewer would require a temporary sewer discharge permit and City approval.
- Collecting verification soil samples from the limits of remedial excavation for chemical analysis of soil IHSs to monitor compliance with the cleanup standards and/or document contaminant concentrations that will be left in-place. For the purposes of cost estimating, base verification samples are assumed to be collected at a frequency of one sample per 650 square feet of base area. If the area of the base is less than 650 square feet, a minimum of one base sample will be obtained. Sidewall samples will be collected at a frequency of one sample per 40 linear feet of sidewall. At a minimum four sidewall samples will be obtained (i.e., one sample per sidewall assuming a four-sided excavation).
- Backfilling the excavation with clean imported fill material. Approximately 6,800 cubic yards of material is assumed to be imported to backfill the remedial excavation.

5.1.3. Restoration

Excavated and disturbed surfaces will be restored following excavation and backfilling activities. Restoration will include repaving and/or hydroseeding as applicable. Surveys will be performed to document as-built conditions.

5.1.4. Post-Construction Monitoring

Shallow and deep groundwater monitoring is assumed to be performed on a quarterly basis for a period of 1 year following the completion of construction to evaluate performance of the remedy. Additional rounds of groundwater monitoring may be needed to evaluate the performance of the remedy based on the results of 1 year of quarterly monitoring. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purposes of cost estimating, two shallow and two deep groundwater monitoring wells are assumed to be installed to complete post-construction groundwater monitoring for Area A1.

5.2. Remedial Action Area A2

Area A2 is a contaminated soil fill area and is located in the northern portion of the Riverside Business Park (east of Weyerhaeuser Bridge Road) adjacent to the Snohomish River. The contaminated media present at Area A2 include:

- Soil contaminated with arsenic and lead; and
- Groundwater (shallow) contaminated with arsenic and lead.

The remedial action selected for Area A2 meets soil cleanup levels throughout MTCA's standard point of compliance (0 to 15 feet bgs) by removing contaminated soil that is a source of contamination in shallow groundwater. The point of compliance for groundwater cleanup levels applicable to Area A2 is where groundwater discharges to surface water in the Snohomish River. Groundwater cleanup levels are expected to be met at the point of compliance downgradient of Area A2 following the removal of contaminated soil.

The permit requirements applicable to the remedial action selected for Area A2 are the following and are further described in Section 6.0:

- SEPA Determination;
- City of Everett Shoreline Permit;
- City of Everett Grading Permit; and
- City of Everett Discharge to POTW Permit.

The remedial action activities to be implemented within Area A2 are presented in the following sections. The cost estimate for the selected remedial action in Area A2 is presented in Table A-2 in Appendix A and the location of Area A2 is shown on Figure 12. The cost of the selected remedial action in Area A2 is estimated to be approximately $1.5 million.

5.2.1. Site Preparation

Site preparation activities will include:

- Implementing temporary site controls including temporary traffic controls and TESC necessary to support remedial excavation activities.
- Locating utilities prior to any earth disturbing activities. Utilities (underground and above ground) will be protected in place and/or temporarily disconnected, rerouted and restored to facilitate excavation and backfilling activities.

5.2.2. Remedial Excavation

Remedial excavation activities within Area A2 will be focused on removing contaminated soil that is a primary source to groundwater contamination. Remedial excavation activities will include:

- Excavating contaminated soil using conventional excavation methods (e.g. excavator, backhoe or similar). Excavation in the vicinity of underground utilities may require use of a vacuum operated suction truck(s) to minimize damage to existing utilities and ensure safety during excavation around utilities. For the purposes of cost estimating, the depth of excavation within Area A2 is assumed to be 6 feet bgs and approximately 6,000 tons of contaminated soil is estimated to be removed. Based on chemical analytical data presented in the SRI/FS Report, there is no indication of the presence of material that would designate as hazardous waste within Area A2 and therefore, for the purposes of cost estimating, all 6,000 tons are assumed to be non-hazardous.
- Performing surveys to document limits of excavation.
- Stockpiling excavated material on site prior to off-site transport and disposal or transporting excavated material directly off site for disposal. Disposal characterization will be completed either by utilizing the results of in situ sampling and analysis performed prior to excavation and/or by stockpile sampling and analysis. Non-hazardous material will be disposed at a permitted Subtitle D landfill and material designated hazardous waste will be disposed at a permitted Subtitle C landfill approved by Ecology. Stockpile containment areas will be bermed, lined, covered and include other engineering controls such as a sump, filtering media and/or silt screens to prevent run-on, runoff and erosion (ex. wind dispersion) from the stockpiled material. Stockpile containment areas will be constructed with berms consisting of concrete blocks (ex. Ecology blocks) or other berm material and will be lined across the bottom and covered with plastic sheeting.
- Dewatering, storing, treating (if necessary) and disposing of excavation water to facilitate excavation activities. Collected excavation water will be either transported off site to a permitted disposal facility using appropriate containers (ex. tanker trucks) or discharged to the City's sanitary sewer. Discharge into the City's sanitary sewer would require a temporary sewer discharge permit and City approval.
- Collecting verification soil samples from the limits of the remedial excavation for chemical analysis of soil IHSs to monitor compliance with the cleanup standards and/or document contaminant concentrations that will be left in-place. For the purposes of cost estimating, base verification samples are assumed to be collected at a frequency of one sample per 650 square feet of base area. If the area of the base is less than 650 square feet, a minimum of one base sample will be obtained. Sidewall samples will be collected at a frequency of one sample per 40 linear feet of sidewall. At a minimum four sidewall samples will be obtained (i.e., one sample per sidewall assuming a four-sided excavation).
- Backfilling the excavation with clean imported fill material. Approximately 3,400 cubic yards of material is assumed to be imported to backfill remedial excavation.

5.2.3. Restoration

Excavated and disturbed surfaces will be restored following excavation and backfilling activities. Restoration will include repaving and/or hydroseeding as applicable. Surveys will be performed to document as-built conditions.

5.2.4. Post-Construction Monitoring

Shallow groundwater monitoring is assumed to be performed on a quarterly basis for a period of 1 year following the completion of construction to evaluate performance of the remedy. Additional rounds of groundwater monitoring may be needed to evaluate the performance of the remedy based on the results of 1 year of quarterly monitoring. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purposes of cost estimating, two shallow groundwater monitoring wells are assumed to be installed to complete post-construction groundwater monitoring for Area A2.

5.3. Remedial Action Area B1

Area B1 is comprised of portions of Marine View Drive other than Area A1, areas immediately east of Marine View Drive (i.e., the Benson Subarea) and portions of the Pacific Highway ROW. The contaminated media present at Area B1 include:

- Soil and slag/debris contaminated with arsenic and lead;
- Groundwater (shallow) contaminated with arsenic, lead and mercury;
- Groundwater (deep) contaminated with arsenic;
- Surface water contaminated with arsenic and mercury; and
- Sediment (in surface water features) contaminated with arsenic and mercury.

The remedial action selected for Area B1 consists of capping of soil and sediment to eliminate and/or minimize exposure risk and infiltration of stormwater through contaminated soil that may be causing leaching of contaminants. Since the remedial action at Area B1 involves capping, soil and sediment cleanup levels are not required to be met at the points of compliance as discussed in Section 3.0. The points of compliance for groundwater cleanup levels applicable to Area B1 are where groundwater discharges to surface water in the Lowland Area and Snohomish River. The point of compliance for surface water cleanup levels is in surface water. The remedial action at Area B1 also involves dewatering and disposing of contaminated surface water prior to capping sediment in the surface water features. Groundwater cleanup levels are expected to be met at the point of compliance where groundwater discharges to surface water in the Snohomish River located downgradient of Area B1 by completion of a combination of the remedial actions selected for Area B1 and remedial actions in other remedial action areas.

The permit requirements applicable to the remedial action selected for Area B1 are the following and are described further in Section 6.0.

- Federal CWA Section 404 Permit;
- Federal CWA Section 401 Water Quality Certification (WQC);
- Washington State Hydraulic Project Approval (HPA);

- SEPA Determination;
- Washington State Construction Stormwater General Permit (CSWGP);
- City of Everett Grading Permit;
- City of Everett Critical Areas Ordinance Permit;
- WSDOT/City of Everett Right-of-Way Permit; and
- City of Everett Discharge to POTW Permit.

The remedial action activities to be implemented within Area B1 are presented in the following sections. The cost estimate for the selected remedial action in Area B1 is presented in Table A-3 in Appendix A and the location of Area B1 is shown on Figure 12. The cost of the selected remedial action in Area B1 is estimated to be approximately $6.5 million.

5.3.1. Site Preparation

Site preparation activities will include:

- Implementing temporary site controls including temporary traffic controls and TESC necessary to support capping activities.
- Locating utilities prior to any earth disturbing activities. Utilities (underground and above ground) will be protected in place and/or temporarily disconnected, rerouted and restored to facilitate capping activities.
- Clearing and grubbing vegetated areas to facilitate capping. Approximately 8,900 square yards (1.8 acres) within Area B1 are estimated to be cleared and grubbed for the purposes of cost estimating.

5.3.2. Surface Water Dewatering and Disposal

Surface water features will be dewatered prior to capping activities. Collected surface water will be stored and treated (if necessary) and properly disposed of. Water will be either transported off site to a permitted disposal facility using appropriate containers (ex. tanker trucks) or discharged to the City's sanitary sewer. Discharge into the City's sanitary sewer, would require a temporary sewer discharge permit and City approval.

5.3.3. Capping

Capping activities will include:

- Maintaining existing clean soil cover and asphalt/concrete surfaces of streets and sidewalks.
- Constructing a low-permeability cap with drainage controls (asphalt/concrete cap and/or a minimum of 1 foot of soil cover with underlying plastic or similar) over the portions of Area B1 that contain media (soil, slag/debris and sediment in the surface water features) with contaminant concentrations greater than cleanup levels and that currently do not have protective capping/cover. Portions of Area B1 that are capped with clean soil cover will be landscaped or hydroseeded. Approximately 46,000 square yards (9.5 acres), which is approximately 55 percent of the total area of Area B1, are estimated to be capped for the purposes of cost estimating.

- Performing surveys to document as-built conditions.

5.3.4. Mitigation

Loss of surface water features will be mitigated at an off-site location per the requirements of project permits. For the purposes of cost estimating, mitigation of approximately 1.2 acres of wetlands is assumed.

5.3.5. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants), land/groundwater use restrictions and soil/groundwater management plans/requirements.

5.3.6. Post-Construction Monitoring

Post-construction monitoring activities will include:

- Shallow and deep groundwater monitoring is assumed to be performed for a period of 10 years following the completion of construction to evaluate performance of the remedy. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purpose of cost estimating, it is assumed that five existing shallow and seven existing deep wells will be monitored for IHSs over a 10-year period with 1 year of quarterly monitoring, two years of semi-annual monitoring and 7 years of annual monitoring.
- Monitoring cap conditions on an annual basis to assess long-term integrity of the cap. For the purposes of cost estimating, 10 years of cap monitoring is assumed.

5.4. Remedial Action Area B2

Area B2 is located in the northern portion of the Riverside Business Park. The contaminated media present at Area B2 include:

- Soil and slag contaminated with arsenic and lead; and
- Groundwater (shallow and deep) contaminated with arsenic.

The remedial action selected for Area B2 consists of capping soil to eliminate and/or minimize exposure risk and infiltration of stormwater that may be causing leaching of contaminants. Since the remedial action at Area B2 involves capping, soil cleanup levels are not required to be met at the points of compliance as discussed in Section 3.0. The point of compliance for groundwater cleanup levels applicable to Area B2 is where groundwater discharges to surface water in the Snohomish River. Groundwater cleanup levels are expected to be met at the point of compliance through in situ remediation of shallow groundwater using a PRB prior to discharge of groundwater to the Snohomish River and natural attenuation of localized deep groundwater contamination.

The permit requirements applicable to the remedial action selected for Area B2 are the following and are described further in Section 6.0:

- SEPA Determination;
- CSWGP;
- City of Everett Shoreline Permit;

- City of Everett Grading Permit;
- WSDOT/City of Everett Right-of-Way Permit; and
- City of Everett Discharge to POTW Permit.

The remedial action activities to be implemented within Area B2 are presented in the following sections. The cost estimate for the selected remedial action in Area B2 is presented in Table A-4 in Appendix A and the location of Area B2 is shown on Figure 12. The cost of the selected remedial action in Area B2 is estimated to be approximately $4.3 million.

5.4.1. Site Preparation

Site preparation activities will include:

- Implementing temporary site controls including temporary traffic controls and TESC necessary to support capping and in situ remediation activities.
- Locating utilities prior to any earth disturbing activities. Utilities (underground and above ground) will be protected in place and/or temporarily disconnected, rerouted and restored to facilitate capping activities.
- Clearing and grubbing vegetated areas to facilitate capping. Approximately 1,400 square yards (0.3 acres) within Area B2 are estimated to be cleared and grubbed for the purposes of cost estimating.

5.4.2. Capping

Capping activities will include:

- Maintaining existing clean soil cover and asphalt/concrete surfaces of streets and sidewalks.
- Constructing a low-permeability cap with drainage controls (asphalt/concrete cap and/or a minimum of 1 foot of soil cover with underlying plastic or similar) over the portions of Area B2 that contain media (soil and slag/debris) with contaminant concentrations greater than cleanup levels and that currently do not have protective capping/cover. Portions of Area B2 that are capped with clean soil cover will be landscaped or hydroseeded. Approximately 16,900 square yards (3.5 acres), which is approximately 33 percent of the total area of Area B2, are estimated to be capped for the purposes of cost estimating.
- Preforming surveys to document as-built conditions.

5.4.3. Permeable Reactive Barrier

A PRB will be constructed along the shoreline to intercept and treat contaminated shallow groundwater that is flowing downgradient from Areas B1 and B2 toward the Snohomish River. The PRB may be installed as a continuous wall or as a funnel and gate design. The specific design components of the PRB will be determined as part of the engineering design process. For the purposes of cost estimating, a PRB design life of 10 years is assumed and length of the shoreline requiring a PRB is assumed to be 1,500 feet. A pilot-scale PRB will be installed to monitor performance of the PRB in treating groundwater contamination prior to full-scale implementation.

5.4.4. Groundwater Natural Attenuation

Groundwater natural attenuation processes are expected to address localized deep groundwater contamination observed in Area B2 near existing well LLMW-07D. Two of the most recent groundwater monitoring events completed in 2013 as part of the SRI indicate that contaminants in deep groundwater are below cleanup levels in Area B2 (GeoEngineers, 2016).

5.4.5. Repairs to Stormwater Pipes

Stormwater pipes will be repaired, lined and/or replaced to eliminate infiltration and transport of contaminants from Area B2 to the outfall at Area D2. For the purposes of cost estimating, repairs to approximately 1,600 feet of stormwater pipes are assumed.

5.4.6. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants), land/groundwater use restrictions and soil/groundwater management plans/requirements.

5.4.7. Post-Construction Monitoring

Post-construction monitoring activities will include:

- Completing shallow groundwater monitoring upgradient, downgradient and side-gradient (as necessary) of the PRB to evaluate performance of the PRB both in terms of performance objectives and overall compliance with the cleanup standards. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using new wells. Existing wells will be used for monitoring purposes if possible. For the purpose of cost estimating, it is assumed that 20 new shallow wells will be installed and monitored over a period of 10 years with two years of quarterly monitoring and eight years of semi-annual monitoring.
- Completing deep groundwater monitoring in the vicinity of the existing well LLMW-07D (the only location within Area B2 where deep groundwater contamination has been observed) to evaluate natural attenuation processes and compliance with the cleanup standards. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using new wells. Existing wells will be used for monitoring purposes if possible. For the purpose of cost estimating, it is assumed that two new deep wells will be installed and monitored over a 10-year period with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
- Monitoring cap conditions on an annual basis to assess long-term integrity of cap. For the purposes of cost estimating, 10 years of monitoring is assumed.

5.5. Remedial Action Area B3

Area B3 is located in the central-west portion of the Riverside Business Park. The contaminated media present at Area B3 include:

- Soil contaminated with arsenic and lead; and
- Groundwater (shallow) contaminated with lead.

The selected remedial action at Area B3 consists of maintaining the existing clean soil cover and natural attenuation of contaminated groundwater. The 6 feet of clean soil cover that exists at Area B3 eliminates and/or minimizes risk of exposure to deeper soil with contaminant concentrations greater than the cleanup levels and meets the MTCA point of compliance for protection of terrestrial ecological receptors (0 to 6 feet bgs). Institutional controls (environmental covenants) will be implemented to eliminate and/or minimize human exposure to soil at depths greater than 6 feet. The point of compliance for groundwater cleanup levels applicable to Area B3 is where groundwater discharges to surface water in the Snohomish River. Groundwater contamination at Area B3 is localized, is not known to be causing an exceedance of shallow groundwater cleanup levels at the point of compliance and appears to be naturally attenuating.

The selected remedial action at Area B3 doesn't require permitting because construction activities are not needed to maintain the existing soil cover or to perform the monitoring of natural attenuation in groundwater.

The remedial action activities to be implemented within Area B3 are presented in the following sections. The cost estimate for the selected remedial action in Area B3 is presented in Table A-5 in Appendix A and the location of Area B3 is shown on Figure 12. The cost of the selected remedial action in Area B3 is estimated to be approximately $179,000.

5.5.1. Maintaining Existing Clean Soil Cover

The existing 6 feet of clean soil cover will be maintained to eliminate and/or minimize exposure risk from deeper soil with contaminant concentrations greater than the cleanup levels.

5.5.2. Groundwater Natural Attenuation

Contaminated shallow groundwater is expected to be addressed by groundwater natural attenuation processes. Contaminants in shallow groundwater at Area B3 have been observed to be below cleanup levels during three of four groundwater monitoring events completed in 2013 as part of the SRI (GeoEngineers, 2016).

5.5.3. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) land/groundwater use restrictions and soil/groundwater management plans/requirements.

5.5.4. Post-Construction Monitoring

Post-construction monitoring activities will include:

- Completing shallow groundwater monitoring downgradient of the area to evaluate performance of groundwater natural attenuation processes. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purpose of cost estimating, it is assumed that two new shallow wells will be installed and monitored over a period of 10 years with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
- Monitoring cap conditions on an annual basis to assess long-term integrity of the existing 6-feet of clean soil cover. For the purposes of cost estimating, 10 years of monitoring is assumed.

5.6. Remedial Action Area C1

Area C1 is located in the central portion of the Riverside Business Park. The contaminated media present at Area C1 is:

- Groundwater (deep) contaminated with arsenic.

The selected remedial action at Area C1 consists of monitoring groundwater natural attenuation processes. The point of compliance for groundwater cleanup levels applicable to Area C1 is where groundwater discharges to surface water in the Snohomish River. The remedial action selected for Area C1 relies on natural attenuation processes to meet cleanup levels at the point of compliance following the implementation of remedial actions at other upgradient remedial action areas including the removal of contaminated soil and slag/debris in Area A1 that is a primary source of deep groundwater contamination.

The selected remedial action at Area C1 doesn't require permitting because construction activities are not needed to perform the monitoring of natural attenuation in groundwater.

The remedial action activities to be implemented within Area C1 are presented in the following sections. The cost estimate for the selected remedial action in Area C1 is presented in Table A-6 in Appendix A and the location of Area C1 is shown on Figure 12. The cost of the selected remedial action in Area C1 is estimated to be approximately $115,000.

5.6.1. Groundwater Natural Attenuation

Contaminated deep groundwater is expected to be addressed by groundwater natural attenuation processes following the implementation of remedial actions to address upgradient sources to groundwater contamination.

5.6.2. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) groundwater use restrictions and groundwater management plans/requirements.

5.6.3. Post-Construction Monitoring

Post-construction monitoring activities will include completing deep groundwater monitoring downgradient of Area C1 to evaluate performance of groundwater natural attenuation processes and compliance with the cleanup standards. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purpose of cost estimating, it is assumed that two existing deep groundwater wells will be monitored for IHSs over a period of 10 years with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.

5.7. Remedial Action Areas C2 and C3

Areas C2 and C3 are located within the steep, forested Slope Subarea. The contaminated media present at Areas C2 and C3 is:

- Soil contaminated with arsenic.

The selected remedial action at Areas C2 and C3 consists of implementing institutional controls including installing fencing and signage. The remedial action selected for Areas C2 and C3 does not meet MTCA points of compliance for soil. However, the selected remedial action for Areas C2 and C3 eliminates and/or minimizes exposure risk to the contaminated soil by providing a barrier (fencing) and notification (signage) not allowing access to these areas.

The permit requirement applicable to the remedial action selected for Areas C2 and C3 is the following and is further described in Section 6.0:

- SEPA Determination.

The remedial action activities to be implemented within Areas C2 and C3 are presented in the following sections. The cost estimate for the selected remedial action in Area C2 and Area C3 is presented in Table A-7 in Appendix A and the location of Areas C2 and C3 are shown on Figure 12. The cost of the selected remedial action in Areas C2 and C3 is estimated to be approximately $337,000.

5.7.1. Fencing/Signage

Fencing and signage warning of the potential risk of exposure to the contaminated soil will be installed around Areas C2 and C3 to eliminate and/or minimize exposure risk. For the purposes of cost estimating, 6,000 feet of fencing is assumed.

5.7.2. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) land use restrictions and soil management plans/requirements.

5.7.3. Post-Construction Monitoring

Monitoring of the conditions of the fencing and warning signage will be performed on an annual basis to assess long-term integrity. For the purposes of cost estimation, 10 years of monitoring is assumed.

5.8. Remedial Action Area C4

Area C4 is a relatively small area located west of Marine View Drive which had been included in the RI for the Lowland Area and identified as a remedial action area in the FS. However, Area C4 is located outside the limits of the Lowland Area and within the Everett Smelter Uplands Area (Uplands Area). Therefore, this area is no longer considered a remedial action area of the Lowland Area and will be evaluated based on the requirements of the Everett Smelter Upland Area.

5.9. Remedial Action Area C5

Area C5 is located in the southern portion of the Riverside Business Park. The contaminated media present at Area C5 is:

- Soil contaminated with arsenic.

The selected remedial action at Area C5 consists of maintaining the existing clean soil cover and cutting and plugging underdrains or otherwise eliminating the potential for discharges of contaminated groundwater to the outfall at Area D3. The 6 feet of clean soil cover that exists at Area C5 eliminates and/or

minimizes risk of exposure to deeper soil with contaminant concentrations greater than the cleanup levels and meets the MTCA conditional point of compliance for protection of terrestrial ecological receptors (i.e., 0 to 6 feet bgs). Institutional controls (environmental covenants) will be implemented to eliminate and/or minimize human exposure to soil at depths greater than 6 feet.

The permit requirement applicable to the remedial action selected for Area C5 is the following and is described further in Section 6.0:

- SEPA Determination.

The remedial action activities to be implemented within Area C5 are presented in the following sections. The cost estimate for the selected remedial action in Area C5 is presented in Table A-8 in Appendix A and the location of Area C5 is shown on Figure 12. The cost of selected remedial action in Area C5 is estimated to be approximately $92,000.

5.9.1. Maintaining Existing Clean Soil Cover

The existing 6 feet of clean soil cover will be maintained to eliminate and/or minimize exposure risk from deeper soil with contaminant concentrations greater than the cleanup levels.

5.9.2. Cut and Plug Underdrains

The underdrain that is potentially responsible for transport of contaminants from Area C5 to the outfall at Area D3 will be cut and plugged.

5.9.3. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) land use restrictions and soil management plans/requirements.

5.9.4. Post-Construction Monitoring

Monitoring of the conditions of the cap will be performed on an annual basis to assess long-term integrity of the existing 6 feet of clean soil cover. For the purposes of cost estimation, 10 years of monitoring is assumed.

5.10. Remedial Action Area C6

Area C6 is located at the Snohomish County PUD Subarea. The contaminated media present at Area C6 is:

- Groundwater (deep) contaminated with arsenic.

The remedial action selected for Area C6 consists of natural attenuation of contaminants in deep groundwater. The point of compliance for groundwater cleanup levels applicable to Area C6 is where groundwater discharges to surface water in the Snohomish River. Groundwater contamination at Area C6 is localized, in not known to be causing an exceedance of groundwater cleanup levels at the point of compliance and appears to be naturally attenuating.

The selected remedial action at Area C6 doesn't require permitting because construction activities are not needed to perform the monitoring of natural attenuation in groundwater.

The remedial action activities to be implemented within Area C6 are presented in the following sections. The cost estimate for the selected remedial action in Area C6 is presented in Table A-9 in Appendix A and the location of Area C1 is shown on Figure 12. The cost of the selected remedial action in Area C6 is estimated to be approximately $117,000.

5.10.1. Groundwater Natural Attenuation

Contaminated deep groundwater is expected to be addressed by groundwater natural attenuation processes. Contaminants in deep groundwater at Area C6 have been observed to be below cleanup levels during two of four groundwater monitoring events completed in 2013 as part of the SRI (GeoEngineers, 2016).

5.10.2. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) groundwater use restrictions and groundwater management plans/requirements.

5.10.3. Post-Construction Monitoring

Post-construction monitoring activities will include completing deep groundwater monitoring downgradient of Area C6 to evaluate performance of groundwater natural attenuation processes. Groundwater samples will be analyzed for groundwater IHSs. Groundwater monitoring will be completed using existing wells and/or new wells will be installed if necessary. For the purpose of cost estimating, it is assumed that an existing deep groundwater well will be monitored over a period of 10 years with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.

5.11. Remedial Action Areas D1, D2 and D3

Areas D1, D2 and D3 are marine areas located on the Snohomish River shoreline. Area D1 is north of Pacific Highway, Area D2 is located adjacent to the northern portion of the Riverside Business Park and Area D3 is located adjacent to the central portion of the Riverside Business Park.

The contaminated media present at Area D1 include:

- Outfall-water contaminated with arsenic; and
- Sediment contaminated with arsenic and mercury.

The contaminated media present at Area D2 include:

- Outfall-water contaminated with arsenic; and
- Sediment contaminated with arsenic.

The contaminated media present at Area D3 include:

- Outfall-water contaminated with arsenic; and
- Sediment contaminated with mercury.

The remedial action selected for Areas D1, D2 and D3 relies on the completion of remediation of upgradient sources in Areas B1, B2 and C5, respectively, to address contamination in water discharging from outfalls in Areas D1, D2 and D3 and natural recovery to address sediment contamination. Following implementation of remedial actions at Areas B1, B2 and C5, it is expected that outfall-water at Areas D1, D2 and D3 will meet the cleanup levels at the point of compliance which is the point where outfall-water discharges into the Snohomish River. Following remedial actions to address contamination in outfall-water which is a source to sediment contamination, sediment at Areas D1, D2 and D3 is expected to meet cleanup levels at the point of compliance (0 to 10 cm) as a result of natural recovery processes occurring over a period of approximately 10 years.

The selected remedial action at Areas D1, D2 and D3 doesn't require permitting because construction activities are not needed to perform the monitoring of water from the outfalls or natural recovery of the sediment.

The remedial action activities to be implemented within Areas D1, D2 and D3 are presented in the following sections. The cost estimate for the selected remedial action Areas D1, D2 and D3 are presented in Table A-10 in Appendix A and the locations of Areas D1, D2 and D3 are shown on Figure 12. The cost of the selected remedial action in Areas D1, D2 and D3 is estimated to be approximately $180,000.

5.11.1. Outfall-Water Monitoring

Water discharging from outfalls at Areas D1, D2 and D3 will be monitored to evaluate performance of the cleanup actions that will be implemented at upgradient Areas B1, B2 and C5. Areas B1, B2 and C5 contain sources to outfall-water contamination observed at Areas D1, D2 and D3, respectively. Cleanup actions selected for Areas B1, B2 and C5 are intended to address the sources. The water discharging from the outfalls will be monitored for IHSs following the implementation of cleanup action at Areas B1, B2 and C5. For the purposes of cost estimating, quarterly outfall-water monitoring is assumed to be completed for a period of 1 year. Additional rounds of monitoring may be needed to evaluate performance of the remedy based on the results of 1 year of quarterly monitoring.

5.11.2. Sediment Natural Recovery

Natural recovery processes are expected to address contaminated sediment present at Areas D1, D2 and D3 following completion of the remedial actions at Areas B1, B2 and C5 that will be performed to address sources to sediment contamination (contaminated outfall-water).

5.11.3. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) and area use restrictions and sediment management plans/requirements.

5.11.4. Post-Construction Monitoring

Post-construction monitoring activities will include completing sediment monitoring to assess natural recovery processes. Periodic collection and analysis of surface sediment (0 to 10 cm) samples will be performed in Areas D1, D2 and D3. For the purposes of cost estimating, an annual monitoring event is assumed to be performed for a period of 10 years. During each monitoring event, one sediment sample is assumed to be collected from each area for analyses of IHSs.

5.12. Remedial Action Area D4

Area D4 is a marine area located on the Snohomish River shoreline adjacent to the northern portion of the Riverside Business Park. The contaminated media present at Area D4 is:

- Seep-water contaminated with mercury.

The remedial action selected for Area D4 relies on the completion of remediation of the upgradient source in Area B2 to address seep-water contamination. Following implementation of remedial action at Area B2, it is expected that seep-water at Area D4 will meet the cleanup levels at the point of compliance which is where seep-water discharges into the Snohomish River.

The selected remedial action at Area D4 doesn't require permitting because construction activities are not needed to perform the monitoring of water from the outfall.

The remedial action activities to be implemented within Area D4 are presented in the following sections. The cost estimate for the selected remedial action Area D4 are presented in Table A-11 in Appendix A, and the location of Area D4, is shown on Figure 12. The cost of the selected remedial action in Area D4 is estimated to be approximately $41,000.

5.12.1. Seep-Water Monitoring

Water discharging from the seep at Area D4 will be monitored to evaluate performance of the cleanup actions that will be implemented at upgradient Area B2. Area B2 is a source to seep-water contamination observed at Area D4 and cleanup actions selected for Area B2 are intended to address the source to seep-water contamination. The water discharging from the seep will be monitored for IHSs. For the purposes of cost estimating, quarterly seep-water monitoring is assumed to be completed for a period of 1 year. Additional rounds of monitoring may be needed to evaluate performance of the remedy based on the results of 1 year of quarterly monitoring.

5.12.2. Institutional Controls

Institutional controls will include implementing governmental/property controls (environmental covenants) and water use restrictions.

5.13. Summary of the Selected Cleanup Action

In summary, implementation of Site-Wide Remedial Alternative 2 uses a combination of remedial technologies to mitigate the risk of exposure to contaminated media present in the Lowland Area that includes the following:

- Removal of contaminated material from Areas A1 and A2 that is a primary source to groundwater contamination at the Site;
- Capping within Areas B1 through B3 and C5 to reduce infiltration of stormwater/surface water and prevent exposure to contaminated media;
- Application of a shallow PRB within Area B2 to treat shallow groundwater contamination;
- Implementation of institutional controls in the form of fencing and signage encompassing Areas C2 and C3 to prevent exposure to contaminated soil;

- Repairing, lining or replacing stormwater pipes that may allow infiltration and transport of contaminants from Area B2 to the outfall located at Area D2;
- Cutting and plugging the underdrain to eliminate the potential for transport of contaminants from Area C5 to the outfall at Area D3;
- Monitoring of the natural attenuation of contaminant concentrations in groundwater;
- Monitored natural recovery of contaminated sediment near stormwater outfalls to the Snohomish River; and
- Completing groundwater monitoring to assess performance of the remedies or groundwater natural attenuation processes and compliance with the cleanup standards.

Based on the comparative analysis of the DCA, Site-Wide Remedial Alternative 2 uses permanent solutions to the maximum extent practicable and achieves the highest benefit to cost ratio.

6.0 REPORTING, DESIGN AND PERMITTING

Implementation of the cleanup action for the Lowland Area described in this CAP requires completion of public participation requirements, engineering design and permitting prior to construction. The following sections summarize these requirements.

6.1. Public Participation

MTCA (WAC 173-340-380 [2]) requires that Ecology notify the public of preparation of the draft CAP to provide the opportunity for public comment. After review and consideration of the comments received from the public, Ecology will issue the final CAP that provides the basis for the cleanup to be implemented in the Lowland Area.

6.2. Engineering Design

Engineering design including preparation of an engineering design report (EDR) and construction plans and specifications is performed following completion of the CAP. Since the cleanup action for the Lowland Area is anticipated to be implemented in phases as discussed in Section 5.0, an EDR and construction plans and specifications will be prepared for each phase of cleanup.

An EDR will be prepared in accordance with the requirements of WAC 173-340-400(4)(a) to document engineering concepts and design criteria used for design of the cleanup action and will include sufficient information for the development of construction plans and specifications as well as support project permitting.

The construction plans and specifications may be included as an attachment to the EDR if prepared in conjunction with the EDR. A compliance monitoring plan/sampling and analyses plan will be prepared as an attachment to the EDR to describe monitoring and sampling and analyses activities to be performed during and following the cleanup action in accordance with WAC 173-340-410 and 173-340-820. Attachments to the EDR will also include a health and safety plan (HASP) that will present health and safety requirement for personnel monitoring the remedial actions and a Quality Assurance Project Plan (QAPP) to present quality assurance/quality control (QC/QC) requirements applicable to the sampling and analyses activities.

MTCA reporting requirements (WAC 173-340-400) will be followed during all cleanup activities. Construction plans and specifications will be prepared with sufficient details and in conformance with currently accepted engineering practices and techniques to support selection of a contractor and execution of contract work.

6.3. Permitting

The cleanup action is being completed by Ecology under MTCA. Therefore, the cleanup action meets the permit exemption provisions of MTCA (WAC 173-340-710[9]), removing the need to follow the procedural requirements of most state and local permits that would otherwise apply to the action. However, the substantive requirements of applicable state and local permits must be met. The MTCA exemptions do not apply to federal permits and therefore, the cleanup action must meet substantive as well as procedural requirements of applicable federal permits. The following sections summarize federal, state and local permits/permit exemptions that are anticipated to be applicable to the cleanup actions in the Lowland Area. Permits that are applicable to each remedial action area are identified in Section 5.0.

6.3.1. Federal CWA Section 404 Permit

Section 404 of the federal Clean Water Act (CWA) requires a permit for activities involving discharge of dredge or fill material into waters of the United States, including wetlands. The cleanup action involves filling activities within the wetlands identified in the Lowland Area (GeoEngineers, 2016) and therefore, requirements of Section 404 are applicable. The United State Army Corps of Engineers (Corps) administers and issues permits under Section 404. Hazardous and toxic waste cleanup activities that are performed, ordered, or sponsored by a government agency with established legal or regulatory authority are permitted by the Corps under a Nationwide Permit (NWP) 38, which is issued under the statutory authority of Section 404. A Joint Aquatic Resource Permit Application (JARPA) will be completed and submitted to the Corps to obtain Section 404 permit (NWP 38) coverage for the cleanup action.

As part of the JARPA review process, the Corps will consult with United States Fish and Wildlife Services (USFWS), National Oceanic and Atmospheric Administration (NOAA) Fisheries, and Ecology to ensure that the requirements and conditions of Endangered Species Act (ESA), Magnuson-Stevens Fishery Conversation and Management Act (MSFCMA), and Fish and Wildlife Conservation Act (FWCA) are met. The ESA protects fish, wildlife and plants that are threatened or endangered with extinction. The MSFCMA is the primary law that governs marine fisheries management and fosters long-term biological and economic sustainability of fisheries out to 200 nautical miles from shores of the United States. The FWCA authorizes financial and technical assistance to the states for the development, revision, and implementation of conservation plans and programs for nongame fish and wildlife. Non-game fish and wildlife are fish and wildlife that are not taken for food or sport, that are not endangered or threatened and that are not domesticated. Based on Corps consultation with USFWS, NOAA Fisheries and Ecology, development of a biological assessment (BA) or biological opinion (BO) for the project may be needed to demonstrate compliance.

6.3.2. Federal CWA Section 401 Water Quality Certification (WQC)

Applicants receiving a Section 404 Permit from the Corps may be required to obtain a Section 401 Water Quality Certification (WQC) from Ecology to demonstrate compliance with the state water quality standards and other aquatic resource protection requirements under Ecology's authority. A completed JARPA will be submitted to Ecology's Federal Permits division to obtain a Section 401 WQC if needed.

6.3.3. Washington State Hydraulic Project Approval (HPA)

Any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water or saltwater of the state requires a construction permit called the Hydraulic Project Approval (HPA). These requirements are applicable due to the filling of surface water features in wetland areas as part of the selected cleanup action. The Washington Department of Fish and Wildlife (WDFW) administers the HPA program under the Washington State Hydraulic Code (Chapter 220-66 WAC). Cleanup actions performed by Ecology under MTCA are exempt from procedural requirements of the HPA but must comply with the substantive requirements (WAC 220-660-040). To meet the substantive requirements of the HPA, WDFW's Aquatic Protection Permitting System (APPS) online HPA application will be completed and required documents will be submitted to obtain an HPA.

6.3.4. Washington State Environmental Policy Act (SEPA) Determination

The Washington State Environmental Policy Act (SEPA) provides a way to identify possible environmental impacts that may result from governmental decisions. Information provided during the SEPA review process helps agency decision-makers, applicants, and the public understand how a project will affect the environment. SEPA is intended to ensure that state and local government officials consider environmental values when making decisions or taking an official action such as approving the CAP. The requirements will be met by preparing a SEPA checklist and obtaining SEPA determination from the lead agency. SEPA lead agency for the project is Ecology.

6.3.5. Washington State Construction Stormwater General Permit (CSWGP)

Construction site operators are required to be covered by a Construction Stormwater General Permit (CSWGP) if they are engaged in clearing, grading, and excavating activities that disturb one or more acres and discharge stormwater to surface waters of the state. The cleanup action will result in disturbances to an area greater than 1 acre and therefore, CSWGP is applicable. An application will be completed and submitted to Ecology's Water Quality division to obtain coverage under CSWGP. In addition, a stormwater pollution prevention plan (SWPPP) will be prepared as per the requirements of CSWGP to describe the best management practices (BMPs) that will be implemented to protect water quality.

6.3.6. City of Everett Shoreline Permit

The Washington State Shoreline Management Act (SMA) (RCW 90.58) and its implementing regulations, as promulgated by the local government shoreline management program, establish requirements for substantial developments occurring within waters of the state or within 200 feet of the shoreline. The cleanup action involves construction activities within 200 feet of Snohomish River shoreline and therefore, this requirement is applicable. Cleanup actions performed under MTCA, although exempt from procedural requirements of the SMA Permit, must comply with the substantive requirements. The City will be consulted and an application with required documents will be submitted to the City.

6.3.7. City of Everett Grading Permit

The City Grading Code (Title 18 Chapter 28 of Everett Municipal Code [EMC]) requirements are applicable to activities that may disturb or remove existing features and therefore, is considered applicable to the cleanup action. The Title 18 Chapter 28 of EMC (Land Division Evaluation Criteria and Development Standards) requires a grading plan to be submitted to the City engineer before any site modification where existing natural features would be disturbed or removed. Cleanup actions performed by Ecology under

MTCA, although exempt from procedural requirements, must comply with the substantive requirements. The City will be consulted and an application with required documents (e.g. grading plans) will be submitted to the City.

6.3.8. City of Everett Critical Areas Ordinance Permit

The City's Critical Areas Ordinance (Title 19 Chapter 37 of EMC) was developed under the directives of the Washington State Growth Management Act to designate and protect critical areas and to establish regulations for development within or near critical areas. Critical areas include steep slopes, lakes, streams, wetlands, springs, erosion hazard areas, landslide hazard areas, seismic hazard areas, or other unstable soil conditions. The provisions of the ordinance pertaining to the protection of wetland functions and values are applicable to the cleanup action. Cleanup actions performed by Ecology under MTCA are exempt from procedural requirements of the Critical Areas Ordinance Permit but must comply with the substantive requirements. An application with required documents will be submitted to City.

6.3.9. Washington State Department of Transportation (WSDOT)/City of Everett Right-of-Way Permit

The cleanup action involves excavation, filling and grading work within the vicinity of and adjacent to East Marine View Drive which is within the Washington State Department of Transportation (WSDOT) and City ROW. Therefore, a Right-of-Way permit is applicable to the cleanup action. WSDOT and the City will be contacted; the required documentation will be submitted to obtain the permit.

6.3.10. City of Everett Discharge to Publicly Owned Treatment Works (POTW) Permit

This permit will be applicable to the cleanup action if construction water (excavation water, stormwater, etc.) is discharged into the City's sewer system. To obtain this permit, the City will be contacted and required documentation will be provided to obtain the permit.

7.0 FIVE-YEAR REVIEW

Because the cleanup action outlined in this CAP will result in hazardous substances remaining at the Site at concentrations exceeding cleanup levels and because environmental covenants are included as part of the remedy, Ecology will review the remedial action described in this CAP every five years to ensure protection of human health and the environment. Consistent with the requirements of WAC 173-340-420, the five-year review shall include the following:

- A review of the title of the real property subject to the environmental covenant to verify that the covenant is properly recorded;
- A review of available monitoring data to verify the effectiveness of completed cleanup actions, including engineered caps and institutional controls, in limiting exposure to hazardous substances remaining at the Site;
- A review of new scientific information for individual hazardous substances or mixtures present at the Site;
- A review of new applicable state and federal laws for hazardous substances present at the Site;
- A review of current and projected future land and resource uses at the Site;
- A review of the availability and practicability of more permanent remedies; and

- A review of the availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology will publish a notice of all periodic reviews in the Site Register and will provide an opportunity for review and comment by the potentially liable persons and the public. If Ecology determines that substantial changes in the cleanup action are necessary to protect human health and the environment at the Site, a revised CAP will be prepared and provided for public review and comment in accordance with WAC 173-340-380 and 173-340-600.

8.0 REFERENCES

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Table 1

Soil Cleanup Levels and Points of Compliance for Indicator Hazardous Substances

Everett Smelter Site - Lowland Area

Everett, Washington

Indicator Hazardous Substances (IHSs)[1]	Points of Compliance (feet bgs)	Lowest Applicable Soil Cleanup Levels[2] (mg/kg)			Background Concentrations[3] (mg/kg)	Soil Cleanup Levels[4] (mg/kg)
		Based on Protection of Human Health		Based on Protection of Terrestrial Ecological Receptors		
		Industrial Worker	Trespassers	Wildlife		
Arsenic	0 to 1	88	9	132	20	20 or 88[5]
	1 to 6	88	--	132	20	88
	6 to 15	88	--	--	20	88
Lead	0 to 1	1,000	250	118	24	118
	1 to 6	1,000	--	118	24	118
	6 to 15	1,000	--	--	24	1,000
Mercury	0 to 1	1,100	1,500	5.5	0.07	5.5
	1 to 6	1,100	--	5.5	0.07	5.5
	6 to 15	1,100	--	--	0.07	1,100

Notes:

[1] The IHSs for "shallow soil" which includes fill, native surface, silt and till are arsenic, lead and mercury. The IHS for "deeper soil" which includes alluvium and outwash is arsenic. The depths and locations at which these soils are observed within the Lowland Area vary and are generally shown on the geologic cross-sections prepared as part of the SRI/FS Report (GeoEngineers 2016).

[2] Lowest of the applicable cleanup levels are identified for each category. Refer to the SRI/FS Report (GeoEngineers, 2016) for a complete list of applicable cleanup levels considered in determining lowest applicable cleanup level for each category.

[3] Background concentrations (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

[4] The soil cleanup levels are lowest of the lowest applicable soil cleanup levels except where the background concentration is higher than the lowest applicable cleanup level. Refer to the SRI/FS Report (GeoEngineers 2016) for detailed derivation of the soil cleanup levels.

[5] Arsenic cleanup level of 20 mg/kg applies to 0 to 1 foot bgs in the areas where there is a potential for trespasser exposure (i.e., areas west of BNSF Railroad and located adjacent to residential areas, public access and street right-of-ways). Tresspasser exposure is not applicable to areas located east of BNSF Railroad and therefore, arsenic cleanup levels applicable to 0 to 1 foot bgs for these areas is 88 mg/kg.

bgs = below ground surface

mg/kg = milligrams per kilogram

"--" = not applicable

Table 2

Groundwater Cleanup Levels and Points of Compliance for Indicator Hazardous Substances

Everett Smelter Site - Lowland Area

Everett, Washington

Indicator Hazardous Substances (IHSs)[1]	Points of Compliance	Lowest Applicable Groundwater Cleanup Levels[2] (µg/l)				Background Concentrations (µg/l)	Groundwater Cleanup Levels[4,5] (µg/l)
		Based on Protection of Surface Water in Lowland Area[3]	Based on Protection of Surface Water in Snohomish River				
		Fresh Water Criteria/Protection of Aquatic Life	Marine Water Criteria/Protection of Aquatic Life	Marine Water Criteria/Protection of Human Health	Marine Water Criteria/Protection of Sediment		
Shallow Aquifer Groundwater							
Arsenic	Surface water within the Lowland Area	150	--	--	--	5[6]	150
	Groundwater discharging into the Snohomish River	--	36	0.14	2,000	5[6]	5
Lead	Surface water within the Lowland Area	2.2	--	--	--	NE	2.2
	Groundwater discharging into the Snohomish River	--	8.1	NE	45	NE	8.1
Mercury	Surface water within the Lowland Area	0.012	--	--	--	NE	0.02[7]
	Groundwater discharging into the Snohomish River	--	0.025	0.15	7.9	NE	0.025
Deep Aquifer Groundwater							
Arsenic	Surface water within the Lowland Area[3]	--	--	--	--	--	--
	Groundwater discharging into the Snohomish River	--	36	0.14	2,000	5[6]	5

Notes:

[1] The IHSs for shallow aquifer groundwater are arsenic, lead and mercury. The IHS for deep aquifer groundwater is arsenic. The depths of shallow and deep groundwater aquifer are generally shown on the geologic cross-section prepared as part of the SRI/FS Report (GeoEngineers 2016).

[2] Lowest of the applicable cleanup levels are identified for each category. Refer to the SRI/FS Report (GeoEngineers, 2016) for a complete list of applicable cleanup levels considered in determining lowest applicable cleanup level for each category.

[3] The 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 does not discharge to surface water in the Lowland Area.

[4] The groundwater cleanup levels are lowest of the lowest applicable groundwater cleanup levels except if the background groundwater concentration or laboratory PQL is higher. Refer to the SRI/FS Report (GeoEngineers 2016) for detailed derivation of the groundwater cleanup levels.

[5] 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.

[6] Background for arsenic is established in the MTCA A Table 720-1 (WAC 173-340-900).

[7] The laboratory PQL for mercury is used for the groundwater cleanup level.

PQL = Practical quantitation limit

µg/l = Micrograms per liter

"--" = not applicable

NE = No criteria is currently established for this analyte

Table 3

Surface Water Cleanup Levels and Points of Compliance for Indicator Hazardous Substances

Everett Smelter Site - Lowland Area

Everett, Washington

Indicator Hazardous Substances (IHSs)	Points of Compliance	Lowest Applicable Surface Water Cleanup Levels[1] (µg/l)				Background Concentrations (µg/l)	Surface Water Cleanup Levels[2,3] (µg/l)
		Based on Protection of Surface Water in Lowland Area	Based on Protection of Surface Water in Snohomish River				
		Fresh Water Criteria/Protection of Aquatic Life	Marine Water Criteria/Protection of Aquatic Life	Marine Water Criteria/Protection of Human Health	Marine Water Criteria/Protection of Sediment		
Arsenic	Surface water within the Lowland Area	150	--	--	--	5[4]	150
	Groundwater, seep-water, and outfall-water that discharging into the Snohomish River	--	36	0.14	2,000	5[4]	5
Mercury	Surface water within the Lowland Area	0.012	--	--	--	NE	0.02[5]
	Groundwater, seep-water, and outfall-water that discharging into the Snohomish River	--	0.025	0.15	7.9	NE	0.025

Notes:

[1] Lowest of the applicable cleanup levels are identified for each category. Refer to the SRI/FS Report (GeoEngineers, 2016) for a complete list of applicable cleanup levels considered in determining lowest applicable cleanup level for each category.

[2] The surface water cleanup levels are lowest of the lowest applicable surface water cleanup levels except if the background groundwater concentration or laboratory PQL are higher. Refer to the SRI/FS Report (GeoEngineers, 2016) for detailed derivation of the surface water cleanup levels.

[3] 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.

[4] Background for arsenic is established in the MTCA A Table 720-1 (WAC 173-340-900).

[5] The laboratory PQL for mercury is used for the groundwater cleanup level.

PQL = Practical quantitation limit

µg/l = Micrograms per liter

"--" = not applicable

NE = No criteria is currently established for this analyte

Table 4

Sediment Cleanup Levels and Points of Compliance for Indicator Hazardous Substances

Everett Smelter Site - Lowland Area

Everett, Washington

Indicator Hazardous Substance (IHS)	Points of Compliance (cm bml)	Lowest Applicable Sediment Cleanup Levels[1] (mg/kg - DW)				Background Concentrations[2] (mg/kg - DW)	Sediment Cleanup Levels[3]
		Based on Fresh Water Criteria for Protection of Benthic Organisms	Based on Marine Water Criteria for Protection of Benthic Organisms	Based on Protection of Human Health (Direct Contact/ Bioaccumulation)	Based on Protection of Aquatic/Aquatic Dependent Ecological Receptors (Bioaccumulation)		
Arsenic	0 to 10 cm of sediment within surface water features in the Lowland Area	14	--	--	--	20	20
	0 to 10 cm of sediment on the shoreline of the Snohomish River	--	57	0.00028	0.59	20	20
Mercury	0 to 10 cm of sediment within surface water features in the Lowland Area	0.66	--	--	--	0.07	0.66
	0 to 10 cm of sediment on the shoreline of the Snohomish River	--	0.41	0.15	0.0074	0.07	0.07

Notes:

[1] Lowest of the applicable cleanup levels are identified for each category. Refer to the SRI/FS Report (GeoEngineers, 2016) for a complete list of applicable cleanup levels considered in determining lowest applicable cleanup level for each category.

[2] Background concentrations (Puget Sound Region 90th percentile values) are from Natural Background Soil Metals Concentrations in Washington State (Ecology Publication #94-115, 1994) except for arsenic. Background for arsenic as established in the MTCA Method A Table 745-1 (WAC 173-340-900).

[3] The sediment cleanup levels are lowest of the lowest applicable sediment cleanup levels, except if background concentration is higher. Refer to the SRI/FS Report (GeoEngineers, 2016) for detailed derivation of the sediment cleanup levels.

bml = below mudline

mg/kg - DW = milligram per kilogram, dry weight

Table 5

Cleanup Action Objectives (CAOs)

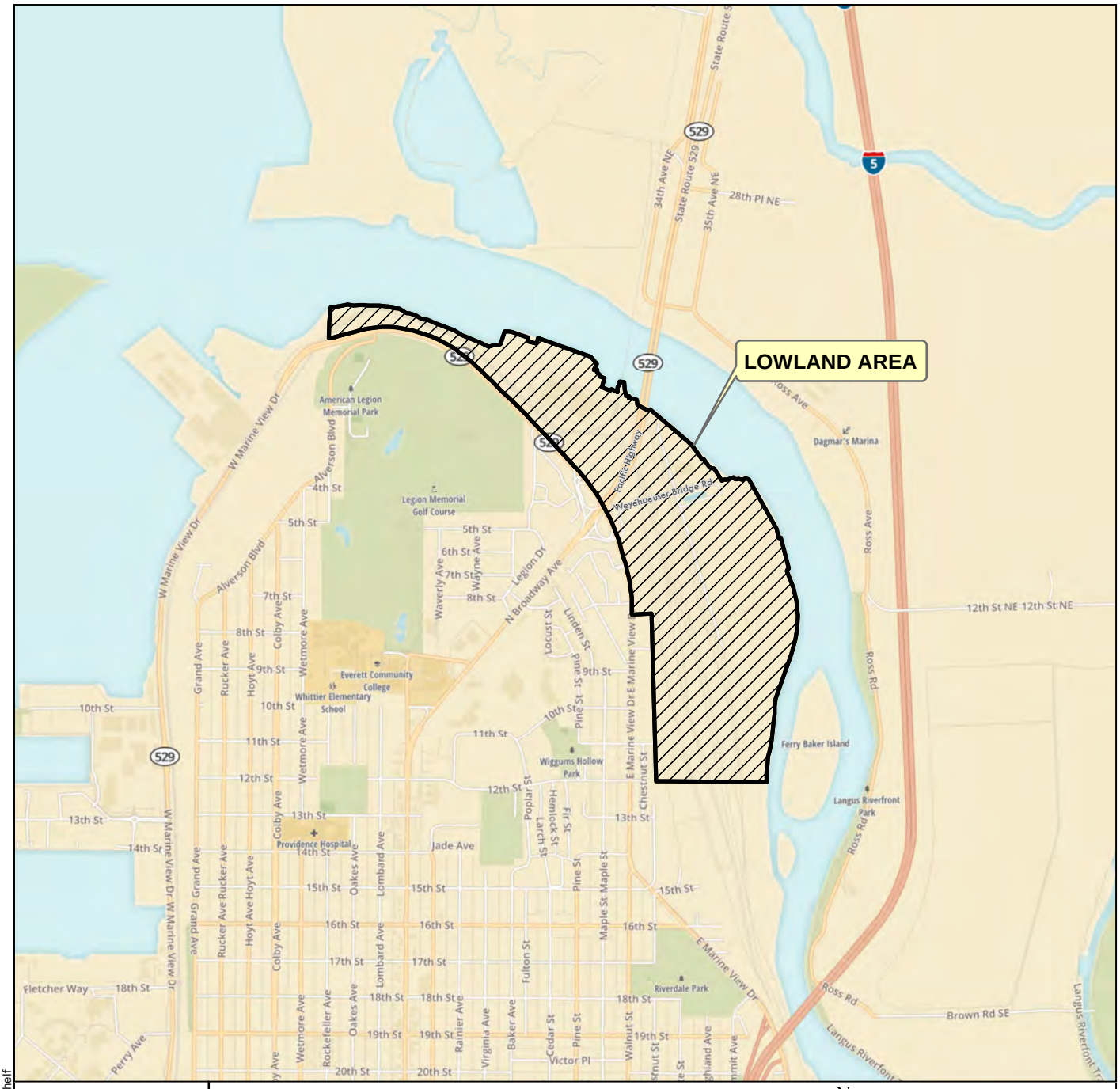
Everett Smelter Site - Lowland Area

Everett, Washington

Identification	CAOs	Applicable Area														Comments
		A1	A2	B1	B2	B3	C1	C2	C3	C5	C6[1]	D1	D2	D3	D4	
CAO-1	Mitigate risk of human exposure from direct contact with contaminated soil and/or slag/debris.	X	X	X	X	X		X	X	X						Contaminated soil and slag/debris are not present at Areas C1, C6, and D1 through D4 and therefore, this CAO is not applicable to these areas.
CAO-2	Mitigate risk of terrestrial ecological receptor (wildlife) exposure from direct contact with contaminated soil and/or slag/debris.	X	X	X	X			X	X							Contaminated soil and slag/debris are not present at Areas C1, C6, and D1 through D4 and therefore, this CAO is not applicable to these areas. Contaminated soil at Areas B3 and C5 is located 6 feet below ground surface which is the MTCA conditional point of compliance for terrestrial ecological receptors and therefore, this CAO is not applicable to Areas B3 and C5.
CAO-3	Mitigate risk associated with the discharge of contaminated shallow groundwater into Lowland Area surface water. The discharge of contaminated shallow groundwater poses an exposure risk to freshwater aquatic organisms.			X												Based on data collected as part of the supplemental remedial investigation (SRI), the risk of contaminated shallow groundwater discharge to surface water in the Lowland Area exists only for the surface water features located within Area B1. Therefore this CAO is only applicable to Area B1.
CAO-4	Mitigate risk associated with the discharge of contaminated shallow groundwater into Snohomish River surface water. The discharge of contaminated shallow groundwater poses an exposure risk to marine aquatic organisms as well as human health resulting from consumption of contaminated marine aquatic organisms.		X		X											Based on data collected as part of the SRI, the risk of contaminated shallow groundwater discharge to the Snohomish River is present only at Areas A2 and B2. Therefore this CAO is only applicable to Areas A2 and B2.
CAO-5	Mitigate risk associated with the discharge of contaminated shallow groundwater into Snohomish River surface water in the form of seep-water.				X											Based on data collected as part of the SRI, contaminated seep-water is only present at Area D4. The source of this seep-water contamination is contaminated shallow groundwater from Area B2. Therefore this CAO is only applicable to Area B2.
CAO-6	Mitigate risk associated with the discharge of the contaminated deep groundwater into Snohomish River surface water. The discharge of contaminated deep groundwater poses an exposure risk to marine aquatic organisms as well as human health resulting from consumption of contaminated marine aquatic organisms.				X		X									Based on data collected as part of the SRI, the risk of contaminated deep groundwater discharge to the Snohomish River is present only at Areas B2 and C1. Therefore this CAO is only applicable to Areas B2 and C1.
CAO-7	Mitigate risk of freshwater aquatic and benthic organism exposure to contaminated surface water and sediment in the Lowland Area.			X												Based on data collected as part of the SRI, contaminated surface water and sediment in the Lowland Area are only present within Area B1. Therefore this CAO is only applicable to Area B1.
CAO-8	Mitigate contaminant transport from upgradient sources to outfalls where contaminated outfall-water is a source of Snohomish River sediment contamination.			X	X					X						Sources to outfall-water contamination are located at Areas B1, B2 and C5. Therefore this CAO is only applicable to Areas B1, B2 and C5.
CAO-9	Mitigate risk of human exposure from direct contact with contaminated sediment.											X	X	X		Based on data collected as part of the SRI, contaminated sediment is present only at Areas D1 through D3. Therefore, this CAO is applicable only to Areas D1 through D3.
CAO-10	Mitigate risk of marine benthic organisms exposure to contaminated sediment.											X	X	X		Based on data collected as part of the SRI, contaminated sediment is present only at Areas D1 through D3. Therefore this CAO is applicable only to Areas D1 through D3.
CAO-11	Mitigate risk of marine aquatic organism exposure to contaminated sediment as well as human exposure resulting from consumption of contaminated marine aquatic organisms.											X	X	X		Based on data collected as part of the SRI, contaminated sediment is present only at Areas D1 through D3. Therefore this CAO is applicable only to Areas D1 through D3.
CAO-12	Mitigate risk of marine aquatic organism exposure to contaminated seep-water as well as human exposure resulting from consumption of contaminated marine aquatic organisms.														X	Based on data collected as part of the SRI, seep-water contamination is only present at Area D4. Therefore this CAO is only applicable to Area D4.

Notes:

1 The SRI/FS Report (GeoEngineers, 2016) does not indicate presence of any contaminant exposure and transport pathways for Area C6 since the only contaminated media present at Area C6 is deep groundwater and this deep groundwater contamination is observed to be localized and is not migrating downgradient.



N
W E
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2,000 0 2,000

Feet

Vicinity Map

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 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: Mapbox Open Street Map, 2015

Projection: NAD 1983 UTM Zone 10N

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Legend

- Everett Smelter Lowland Area
- Everett Smelter Upland Area
- Former Everett Smelter Facility Boundary

N
W E
S

700 0 700
Feet

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Data Source: GoogleEarth Pro, 2013. Snohomish County GIS, 2012.

Everett Smelter Site

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 2

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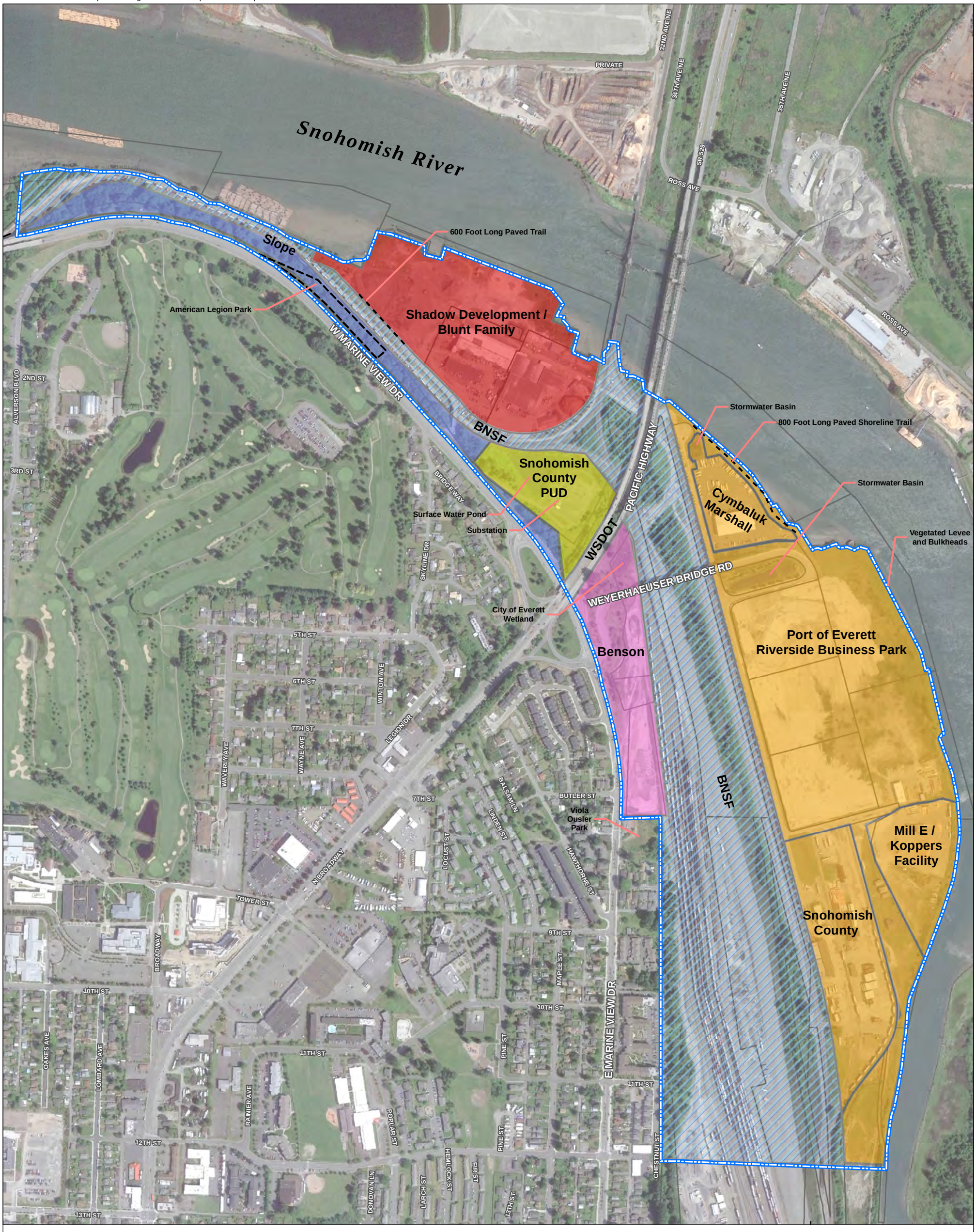

Legend

- Lowland Area
- Snohomish County Parcel Boundary
- American Legion Park
- Paved Trail

N W E S

600 0 600

Feet

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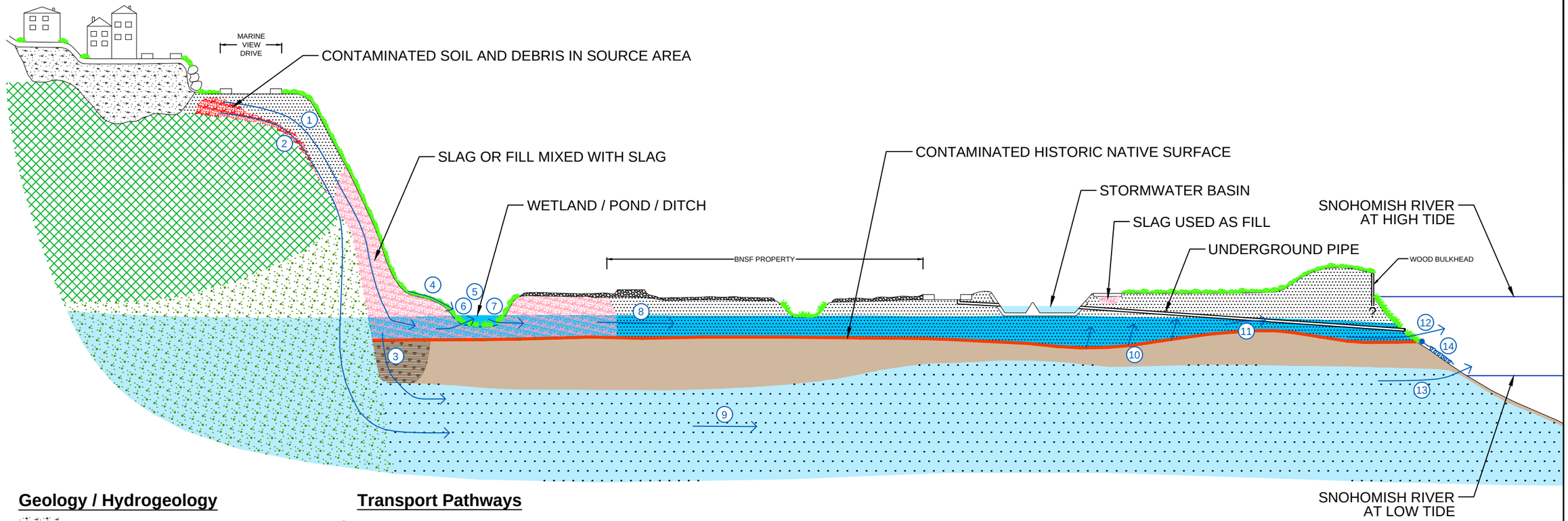
Lowland Subareas

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 3



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 4

Notes:
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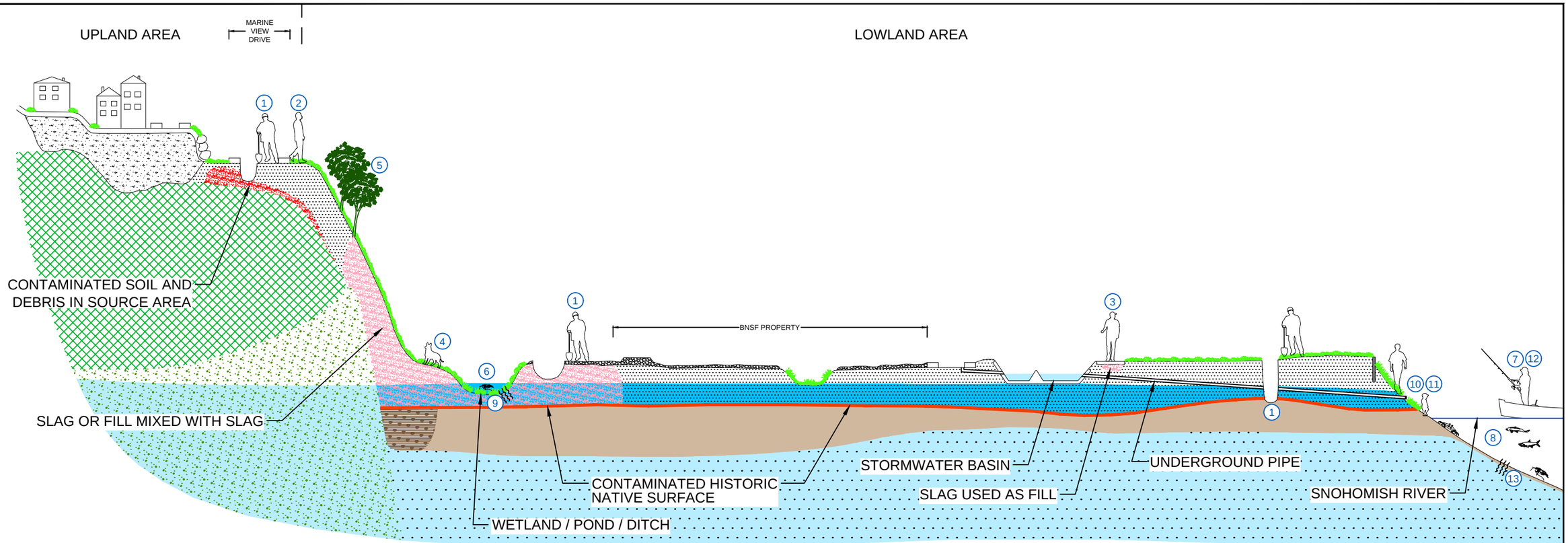

Geology / Hydrogeology

- 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

Notes:
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NOT TO SCALE

Conceptual Site Model
Exposure Pathways and Receptors

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 5

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Inset A
1 in = 200 ft

Inset C
1 inch = 40 feet

Inset B
1 inch = 200 feet

Shadow Development / Blunt Family Subarea

Slope Subarea

W-West Site

Snohomish County PUD Subarea

Benson Subarea

Marine View Drive ROW

Riverside Business Park Subarea

W-Mill E / Koppers Facility Site

Focused Source Area Investigation (See Inset C)

See Inset A

See Inset B

PACIFIC HIGHWAY

BNSF

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 Cleanup Levels (CULs) 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 CULs 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 CULs
- Sample Was Not Analyzed for the Identified Contaminant
- Area Requiring Evaluation of Remedial Alternatives

N W E S

600 0 600
Feet

Notes:
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Summary of Arsenic and Lead Exceedances in Soil

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 6

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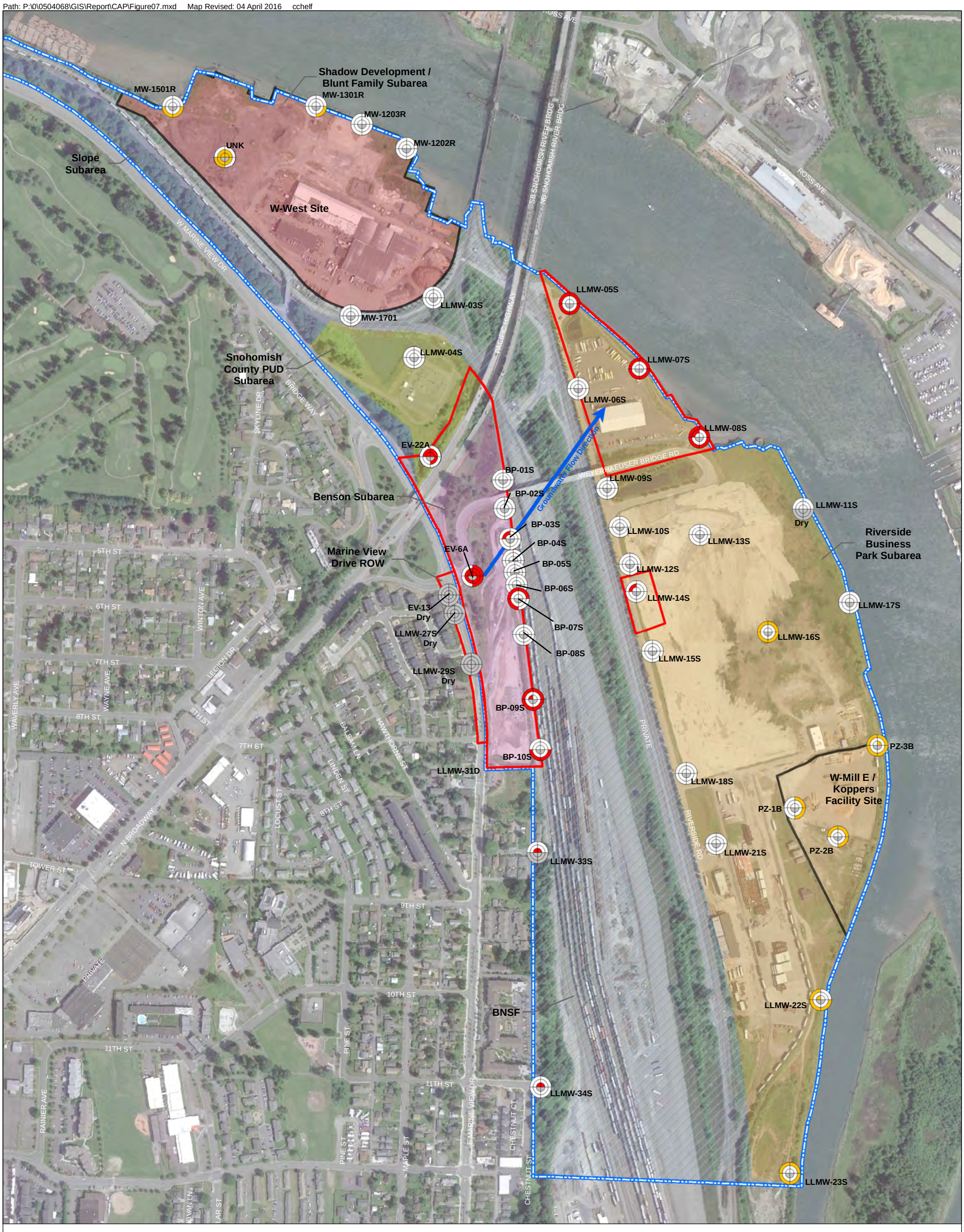

Legend

Arsenic Q1 Q2 Mercury
Lead Q4 Q3

- The Contaminant Concentration was Greater Than the Cleanup Levels (CULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- The Contaminant Concentration was Greater Than CULs 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 CULs
- Sample Was Not Analyzed for the Identified Contaminant
- Area Requiring Evaluation of Remedial Alternatives

N W E S

500 0 500
Feet

Summary of Arsenic, Lead, and Mercury Exceedances in Shallow Groundwater

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 7

Notes:
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Legend

Arsenic: Q1, Q2, Q3, Q4

- The Contaminant Concentration was Greater Than the Cleanup Levels (CULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations
- The Contaminant Concentration was Greater Than CULs 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 CULs
- Sample Was Not Analyzed for the Identified Contaminant
- Area Requiring Evaluation of Remedial Alternatives

N, W, E, S

500 0 500

Feet

Summary of Arsenic Exceedances in Deep Groundwater

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 8

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

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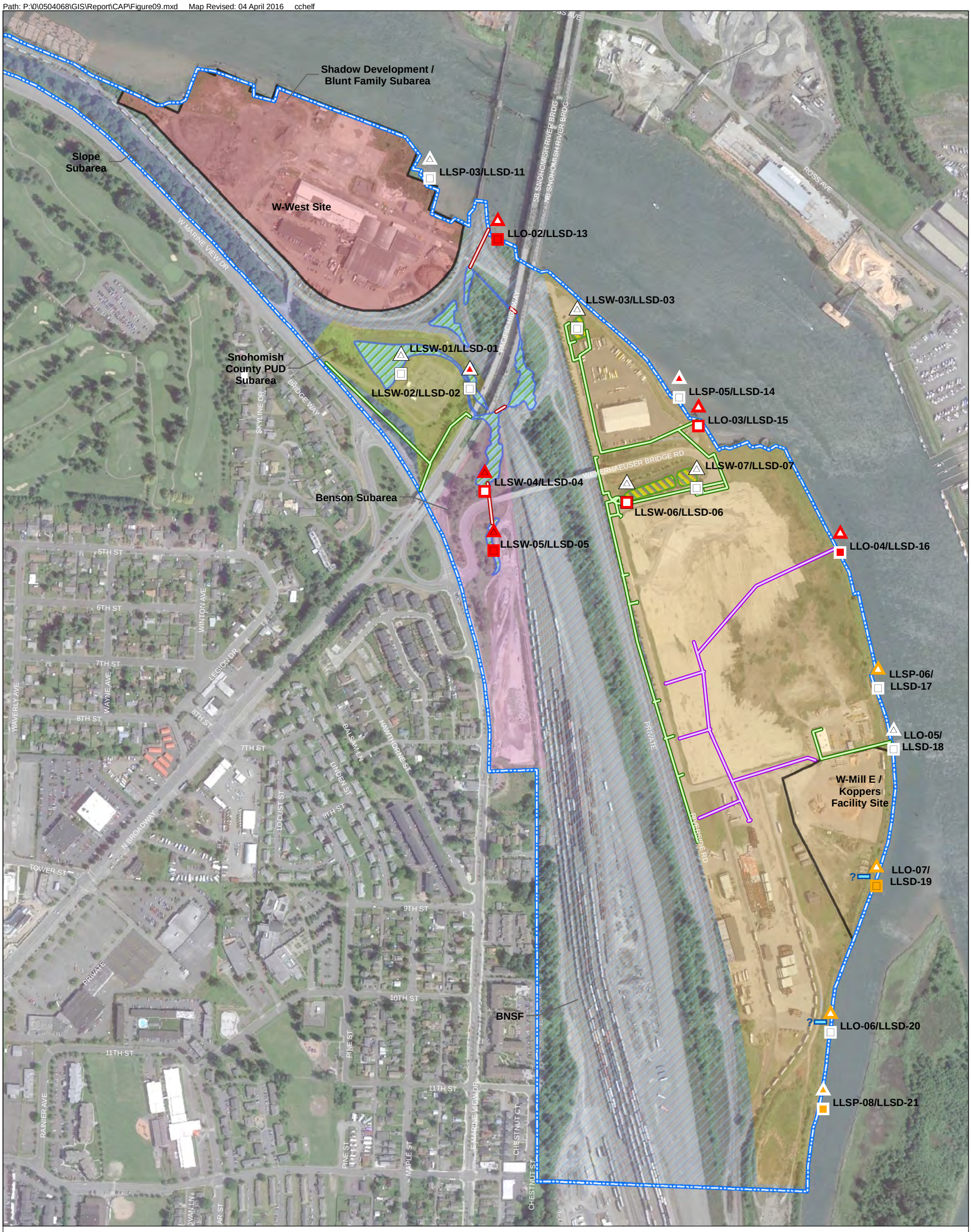

Legend

Arsenic / Mercury — Surface Water, Stormwater, Seep, and Outfall Water

Arsenic / Mercury — Sediment

The Contaminant Concentration was Greater Than the Cleanup Levels (CULs) in Sample from the Investigation Location and the Contamination Was Identified to be the Result of Smelter Operations

The Contaminant Concentration was Greater Than CULs 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 CULs

Area Requiring Evaluation of Remedial Alternatives

Stormwater Pipe

Culvert

Wetland, Pond or Ditch

Under Drain

? Unknown Source

Stormwater Basin

Notes:
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N W E S

500 0 500

Feet

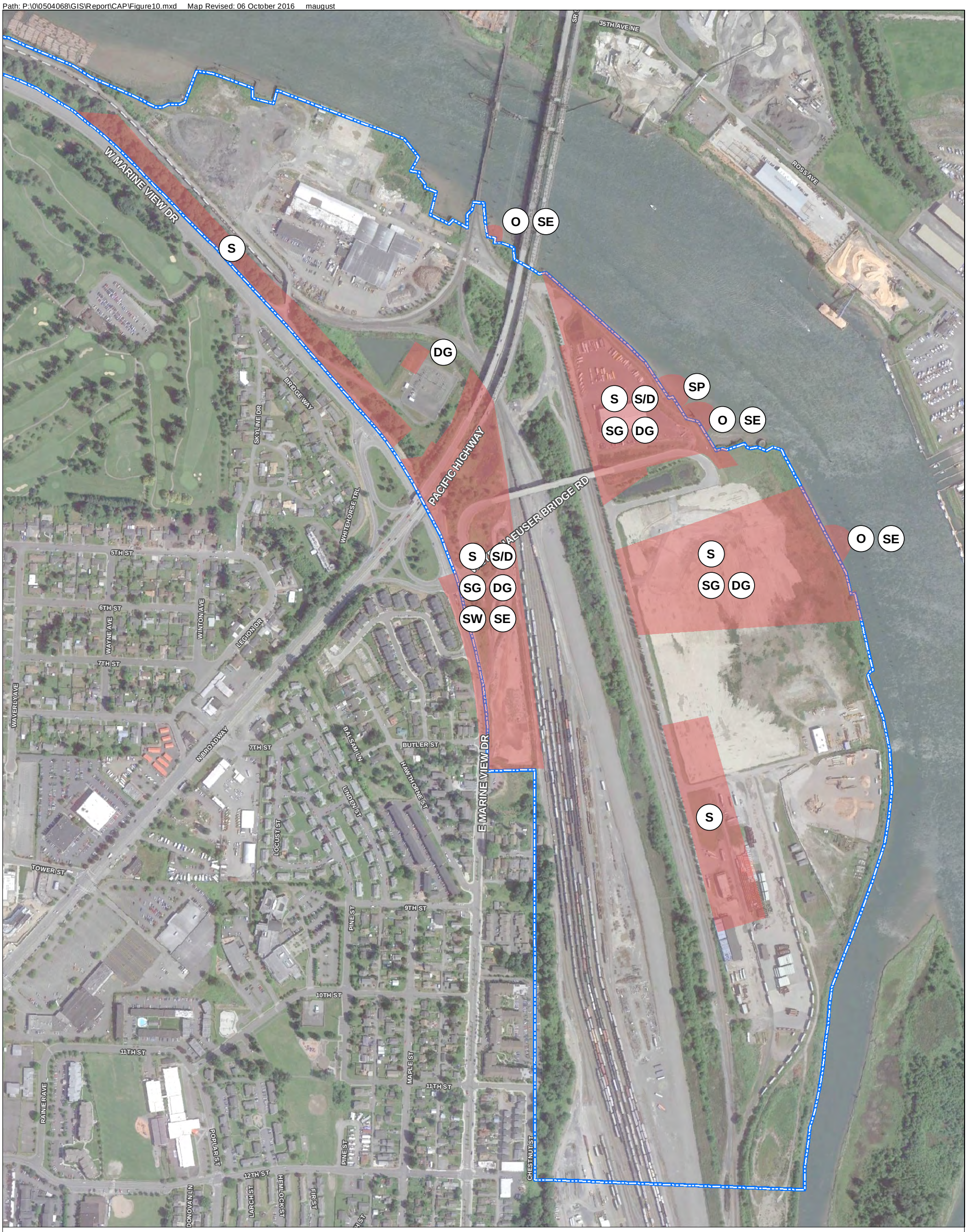
Summary of Arsenic and Mercury Exceedances in Surface Water, Seeps, Outfalls and Sediment

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 9

Path: P:\0\0504068\GIS\Report\CAP\Figure10.mxd Map Revised: 06 October 2016 maugust



Legend

Lowland Area

Area Requiring Evaluation of Remedial Alternatives

Media Requiring Evaluation of Remedial Alternatives

- S — Soil
- S/D — Slag or Debris
- SG — Shallow Groundwater
- DG — Deep Groundwater
- SW — Surface Water
- SP — Seep Water
- O — Outfall Water
- SE — Sediment

N W E S

500 0 500

Feet

Areas Requiring Evaluation of Remedial Alternatives As Part of Feasibility Study

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 10

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

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MEDIA *and* Points of Compliance	CLEANUP LEVELS for IHSs		
	Arsenic	Lead	Mercury
SURFACE WATER[1] IN THE SNOHOMISH RIVER (µg/l)			
■ Groundwater, seep- and outfall-water discharge into the river	5	NA	0.025
SEDIMENT IN THE SNOHOMISH RIVER (mg/kg)			
■ From 0 to 10 centimeter bml	20	NA	0.07

MEDIA *and* Points of Compliance	CLEANUP LEVELS for IHSs		
	Arsenic	Lead	Mercury
SHALLOW GROUNDWATER[1] (µg/l)			
■ Shallow groundwater discharge into the river	5	8.1	0.025
DEEP GROUNDWATER[1] (µg/l)			
■ Deep groundwater discharge into the river	5	NA	NA

MEDIA *and* Points of Compliance	CLEANUP LEVELS for IHSs		
	Arsenic	Lead	Mercury
SOIL (mg/kg)			
■ From 0 to 1 foot bgs	20	118	5.5
■ From 1 to 15 feet bgs	88	1,000	1,100
SHALLOW GROUNDWATER[1] (µg/l)			
■ Shallow groundwater discharge into surface water features	150	2.2	0.02
■ Shallow groundwater discharge into the river	5	8.1	0.025
DEEP GROUNDWATER[1] (µg/l)			
■ Deep groundwater discharge into the river	5	NA	NA
SURFACE WATER[1] WITHIN THE LOWLAND AREA (µg/l)			
■ Surface water within the Lowland Area	150	NA	0.02
SEDIMENT IN SURFACE WATER FEATURES (mg/kg)			
■ From 0 to 10 cm bml	20	NA	0.66

MEDIA *and* Points of Compliance	CLEANUP LEVELS for IHSs		
	Arsenic	Lead	Mercury
SOIL (mg/kg)			
■ From 0 to 1 foot bgs	88	118	5.5
■ From 1 to 15 feet bgs	88	1,000	1,100
SHALLOW GROUNDWATER[1] (µg/l)			
■ Shallow groundwater discharge into the river	5	8.1	0.025
DEEP GROUNDWATER[1] (µg/l)			
■ Deep groundwater discharge into the river	5	NA	NA
SURFACE WATER[1] WITHIN THE LOWLAND AREA			
■ Not applicable since surface water features do not exist within this area			
SEDIMENT IN SURFACE WATER FEATURES			
■ Not applicable since surface water features do not exist within this area			

The BNFS properties are being evaluated separately and are not part of the Lowland Area Supplemental Remedial Investigation/ Feasibility Study (SRI/FS) and Cleanup Action Plan (CAP).

Legend

- Lowland Area
- B2 Remedial Action Area and its Identification
- Surface Water Features (Wetland, Pond or Ditch)
- Stormwater Basin
- Stormwater Pipe, Culvert and/or Under Drain

IHS indicator hazardous substances
bgs below ground surface
bml below mudline
mg/kg milligrams/kilogram
µg/L micrograms/liter
NA not applicable since lead is not an IHS for the media

Notes:
1. The groundwater and surface water cleanup levels listed for each IHS apply to the dissolved fraction with the exception of mercury. The cleanup level for mercury applies to the total mercury concentration.
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.

N W E S

600 0 600

Feet

Lowland Area Cleanup Levels and Points of Compliance

Everett Smelter - Lowland Area

GeoEngineers

Figure 11

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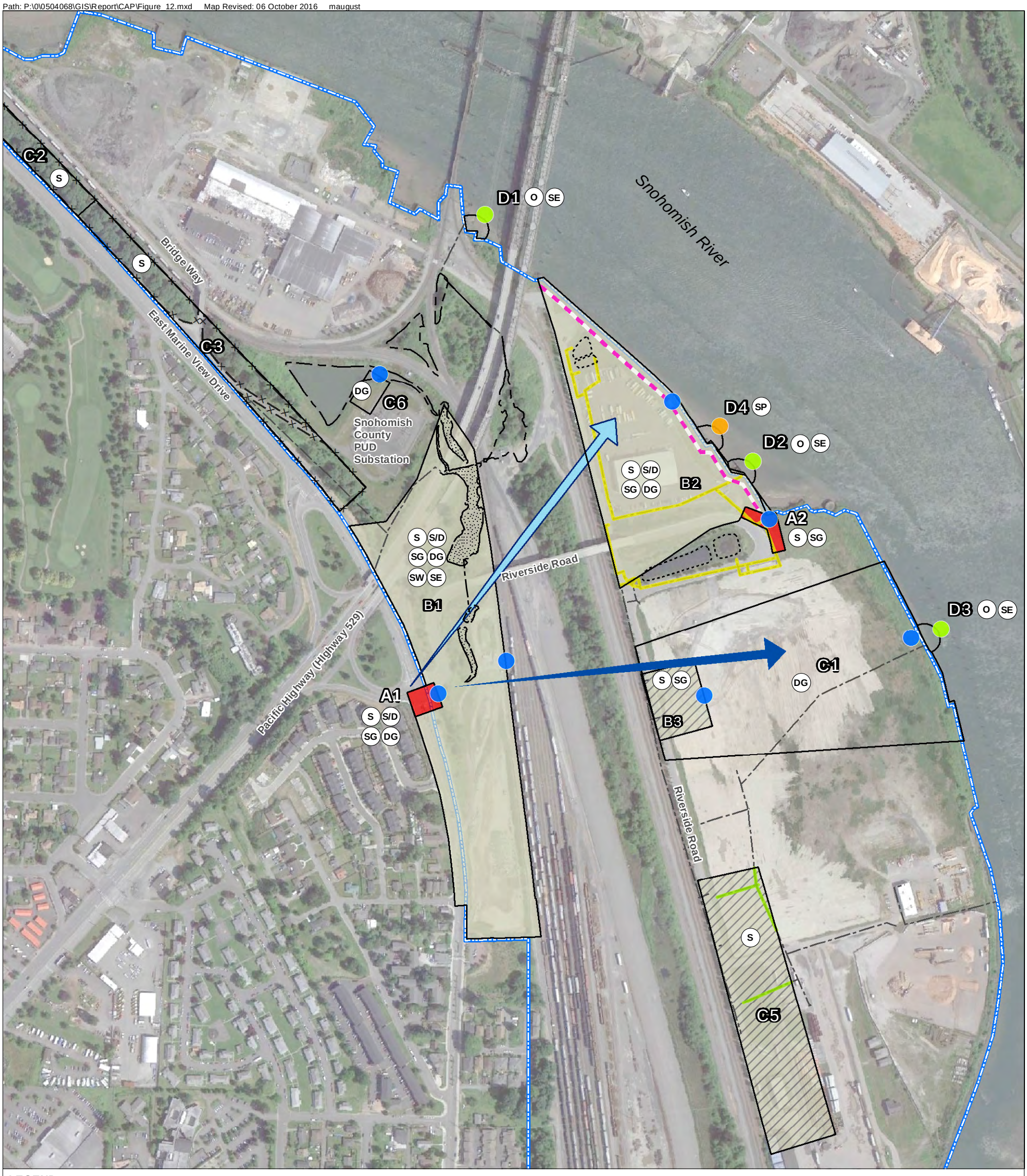

LEGEND

- Everett Smelter - Lowland
- B2 — Remedial Action Area and its Identification
- Surface Water Features (Wetland, Pond or Ditch)
- Stormwater Basin
- Stormwater Pipe, Culvert and/or Under Drain
- Shallow Groundwater Flow Direction
- Deep Groundwater Flow Direction

Contaminated Media[1]

- S — Soil
- S/D — Slag or Debris
- SG — Shallow Groundwater
- DG — Deep Groundwater
- SW — Surface Water
- SP — Seep Water
- O — Outfall Water
- SE — Sediment

Selected Remedial Actions

- Perform excavation and off-site disposal of contaminated media[1]
- Maintain existing clean soil cover and asphalt/concrete surfaces of streets, sidewalks and/or parking lots. Construct a low-permeability cap with drainage controls (asphalt/concrete cap and/or a minimum of 1-foot of soil cover with underlying plastic or similar) over the portions that contain contaminated media1 and currently do not have this kind of protective capping/cover.
- Maintain the existing 6-feet of clean soil cover.
- Construct a low-permeability cap with drainage controls consisting a minimum of 1-foot of soil cover with underlying plastic or similar.
- Areas to be dewatered. Water will be collected, treated (if necessary) and disposed appropriately.
- Install fence
- Install permeable reactive barrier (PRB) to treat shallow contaminated groundwater
- Cut and plug (or backfill with grout slurry) underdrains that are potentially responsible for transport of contaminants from Area C5 to the outfall at Area D3
- Repair, install linings or replace stormwater pipes that may allow infiltration and are potentially responsible for transport of contaminants from Area B2 to the outfall at Area D2
- Monitor groundwater conditions at/downgradient of the area to evaluate performance of the remedies/natural attenuation processes/compliance with the cleanup standards.
- Monitor outfall-water and sediment conditions at the area to evaluate performance of the remedies/natural recovery processes/compliance with the cleanup standards.
- Monitor seep-water conditions at the area to evaluate performance of the remedies/natural attenuation processes/compliance with the cleanup standards.

N W E S

400 0 400
Feet

Notes:
1. Locations and depths of contamination at the Lowland Area are presented in the RI/FS Report (GeoEngineers, 2015a). 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.

Summary of Selected Cleanup Actions

Everett Smelter Site, Lowland Area
Everett, Washington

GeoEngineers

Figure 12

APPENDIX A
Area Remedial Alternative Cost

Table A-1

Area A1 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area
Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 187,634	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital cost thereafter.
2	Abandonment of Monitoring Wells	1	$5,700	LS	$ 5,700	Decommission monitoring wells EV-13, EV-19B and EV-20B by a Washington State licensed well driller. Assumes drill-out and/or chip-in-place monitoring wells to decommission as applicable.
3	Utility protection and/or temporary reroute and restoration	1	$100,000	LS	$ 100,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
4	Demolition, Transportation and Off-Site Disposal of Demolition Debris	1,200	$14	SY	$ 16,800	Includes demolition of existing paved (asphalt/concrete) surfaces in the area to assess contaminated material.
5	Hazardous Material Excavation, Transportation and Off-Site Disposal[3]	2,500	$420	Ton	$ 1,050,000	Assumes 20% of the total contaminated material excavated from the area to be hazardous.
6	Non-Hazardous Material Excavation, Transportation and Off-Site Disposal	9,700	$90	Ton	$ 873,000	Includes excavation, transportation and disposal of remedial excavation material (assumes 80% of the total contaminated material excavated as non-hazardous).
7	Excavation Dewatering, Treatment (if necessary) and Disposal	1	$35,000	LS	$ 35,000	Perform dewatering, storage, treatment (if necessary) and permitted disposal of excavation water.
8	Temporary Shoring for Excavation	450	$1,500	LF	$ 675,000	Construct shoring system to facilitate excavation and keep portions of the East Marine View Drive operational during construction.
9	Disposal Characterization Sampling and Analysis	18	$140	Each	$ 2,520	Obtain soil samples for chemical analysis of IHSs to support waste disposal characterization. Assumes minimum of 3 samples for up to 100 cy, 5 samples for up to 500 cy, 7 samples for up to 1,000 cy, 10 samples for up to 2,000 cy and 1 addition sample for every 500 cy over 2,000 cy.
10	Verification Sampling and Analysis	38	$60	Each	$ 2,280	Obtain soil samples for chemical analysis of IHSs to verify the limit of remedial excavation. Assumes 1 sample per 650 SF of remedial excavation base, 1 sample per 40 LF of remedial excavation sidewall and 10% duplicate samples.
11	Purchase and Placement of Backfill Material	6,800	$29	CY	$ 195,840	Includes purchase, placement and compaction of backfill material to fill remedial excavation.
12	Restoration of Paved Surfaces	1,200	$40	SY	$ 48,000	Restoration of asphalt/concrete surfaces demolished or disturbed due to the remedy.
13	Landscaping (Placement of a Thin Layer of Top Soil and Hydroseeding)	170	$10	SY	$ 1,700	Restoration of landscaped/unpaved surfaces.
14	Monitoring Well Installation	1	$14,500	LS	$ 14,500	Assumes the installation of 2 shallow and 2 deep monitoring wells.
15	Surveying (Pre-/Post-Construction)	1	$3,800	LS	$ 3,800	Perform site survey to document existing conditions and as-built conditions.
16	Surveying (Progress)	1	$3,100	LS	$ 3,100	Perform site survey to document excavation limits. Assumes 2 progress surveys.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
17	1-Year of Post-Construction Shallow and Deep Groundwater Monitoring	4	$6,500	Event	$ 26,000	Monitor groundwater to evaluate natural attenuation performance and/or compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 2 shallow and 2 deep wells will be monitored for IHSs on a quarterly basis for 1 year.
18	10-Years of Post-Construction Cap Monitoring		$2,000	Event	$ -	Monitor cap conditions on an annual basis to assess long-term integrity of cap.
	Direct Capital Cost		--	--	$ 3,214,874	Sum of line item 1 through 16. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost		36	%	$ 1,157,355	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost		--	--	$ 26,000	Sum of line item 17 and 18. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 3,900	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 1,320,639	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 5,722,768	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

[3] Material with arsenic and lead concentrations greater than 3,000 milligrams per kilogram (mg/kg) and mercury concentrations greater than 4 mg/kg are considered potentially hazardous for cost estimation purposes of alternative that involve excavation and disposal. This assumption is based on following:

- Arsenic: The toxicity leaching characteristic procedure (TCLP) studies completed as part of Smelter Area Investigation Report (ASARCO, 1998; SAI Report) concluded that the material with arsenic concentrations at or above 3,000 milligrams/kilogram (mg/kg) has a potential of exceeding the TCLP standard for arsenic of 5 milligrams per liter (mg/L) (i.e., a potential federal hazardous waste). Based on results of bioassay studies completed as part of a report prepared by SAI, state dangerous waste (dangerous waste [DW] and extremely hazardous waste [EHW]) levels for arsenic were above 10,000 mg/kg. For quantity/cost estimation purposes, material with arsenic concentrations at or above 3,000 mg/kg (i.e., a more conservative number between federal and state) was considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with arsenic concentrations greater than 3,000 mg/kg that are considered for excavation and disposal as part of the area remedial alternatives are only located within Areas A1 and B1.
- Lead: The TCLP data evaluated as part of the SAI Report indicates that the lead concentrations of less than 3,000 mg/kg do not exceed TCLP lead standard of 5 mg/L. Bioassay studies to determine state dangerous waste concentrations of lead was not completed as part to the SAI Report. However, based on the book designation method, the SAI Report indicated that the state dangerous waste concentration for lead is at or above 10,000 mg/kg. For quantity/cost estimation purposes, material with lead concentrations at or above 3,000 mg/kg (i.e., a more conservative number between federal and state) was considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with lead concentrations greater than 3,000 mg/kg that are considered for excavation and disposal as part of the area remedial alternatives are only located within Areas A1 and B1.
- Mercury: The SAI Report did not evaluate mercury for dangerous waste purposes. The 20-times rule (EPA, 1992) indicates that mercury concentration of 4 mg/kg (20 times the TCLP mercury standard of 0.2 mg/L) has a potential of exceeding TCLP mercury standard. Based on the book designation method, the state dangerous waste concentration for mercury is at 10 mg/kg. For quantity/cost estimation purposes, material with mercury concentrations at or above 4 mg/kg (i.e., a more conservative number between federal and state) would be considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with mercury concentrations at or above 4 mg/kg is not present within the Lowland Area.

% = percent

LS = lump sum

SY = square yard

LF = linear foot

CY = cubic yard

O&M = operation and maintenance

S/S = Solidification/Stabilization

IHS = indicator hazardous substance

Table A-2

Area A2 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 50,786	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital cost thereafter.
2	Abandonment of Monitoring Wells	1	$1,000	LS	$ 1,000	Decommission monitoring wells LLMW-08S/D by a Washington State licensed well driller. Assumes drill-out and/or chip-in-place monitoring wells to decommission as applicable.
3	Utility protection and/or temporary relocation and restoration	1	$20,000	LS	$ 20,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
4	Non-Hazardous Material Excavation, Transportation and Off-Site Disposal	6,000	$90	Ton	$ 540,000	Includes excavation, transportation and disposal of remedial excavation material (assumes 100% of the total contaminated material excavated as non-hazardous).
5	Excavation Dewatering, Treatment (if necessary) and Disposal	1	$50,000	LS	$ 50,000	Perform dewatering, storage and treatment (if necessary) and permitted disposal of excavation water.
6	Disposal Characterization Sampling and Analysis	13	$140	Each	$ 1,820	Obtain soil samples for chemical analysis of IHSs to support waste disposal characterization. Assumes minimum of 3 samples for up to 100 cy, 5 samples for up to 500 cy, 7 samples for up to 1,000 cy, 10 samples for up to 2,000 cy and 1 addition sample for every 500 cy over 2,000 cy.
7	Verification Sampling and Analysis	45	$60	Each	$ 2,700	Obtain soil samples for chemical analysis of IHSs to verify the limit of remedial excavation. Assumes 1 sample per 650 SF of remedial excavation base, 1 sample per 40 LF of remedial excavation sidewall and 10% duplicate samples.
8	Purchase and Placement of Backfill Material	3,400	$29	CY	$ 97,920	Includes purchase, placement and compaction of backfill material to fill remedial excavation.
9	Landscaping (Placement of a Thin Layer of Top Soil and Hydroseeding)	1,700	$10	SY	$ 17,000	Restoration of landscaped/unpaved surfaces.
10	Monitoring Well Installation	1	$7,500	LS	$ 7,500	Assumes the installation of 2 shallow monitoring wells.
11	Surveying (Pre-/Post-Construction)	1	$4,700	LS	$ 4,700	Perform site survey to document existing conditions and as-built conditions.
12	Surveying (Progress)	1	$3,800	LS	$ 3,800	Perform site survey to document excavation limits. Assume 2 progress surveys.
13	1-Year of Post-Construction Shallow Groundwater Monitoring	4	$5,300	Event	$ 21,200	Monitor groundwater to evaluate natural attenuation performance and/or compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 2 shallow wells will be monitored for IHSs on a quarterly basis for 1 year.
	Direct Capital Cost	--	--	$ 797,226		Sum of line item 1 through 12. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost	36	%	$ 287,002		Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, and other technical and professional services).

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
	Direct O&M Cost		--	--	$ 21,200	line item 13. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 3,180	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 332,582	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 1,441,190	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent
LS = lump sum
SY = square yard
LF = linear foot
CY = cubic yard
O&M = operation and maintenance
S/S = Solidification/Stabilization
IHS = indicator hazardous substance

Table A-3

Area B1 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 201,762	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital cost thereafter.
2	Abandonment of Monitoring Wells	1	$19,000	LS	$ 19,000	Decommission monitoring wells BP-02S/D, BP-04S/D/D2, BP-06S/D, BP-08S/D, BP-10S/D, EV-6A/B, EV-7B, EV-22A/B, LLMW-27S/D, LLMW-31D and LLMW-36D by a Washington State licensed well driller. Assumes drill-out and/or chip-in-place monitoring wells to decommission as applicable.
3	Clearing and Grubbing	8,900	$3	SY	$ 26,700	Includes clearing, grubbing and off-site disposal of cleared trees/vegetation.
4	Dewatering of Surface Water Features	1	$100,000	LS	$ 100,000	Includes collection, storage and treatment (if necessary) and permitted disposal of water.
5	Capping - Low-Permeability Cap	46,000	$40	SY	$ 1,839,999	Assumes installation of asphalt/concrete cap over the portions containing contaminated material.
6	Mitigation for the Impacts to Surface Water Features	1.2	$500,000	Acre	$ 600,000	Mitigate impacts to surface water features at an off-site location as per the requirements of the project permit.
7	Landscaping (Placement of a Thin Layer of Top Soil and Hydroseeding)	46,000	$10	SY	$ 460,000	Includes landscaping of 6-foot of soil cap.
8	Re-Vegetation	2	$10,000	Acre	$ 20,000	Planting trees/shrubs within the existing area that was cleared and grubbed.
9	Surveying (Pre-/Post-Construction)	1	$197,000	LS	$ 197,000	Perform site survey to document existing conditions and as-built conditions.

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
10	10-Years of Post-Construction Shallow and Deep Groundwater Monitoring	15	$9,500	Event	$ 142,500	Monitor groundwater to evaluate natural attenuation performance and/or compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 5 existing shallow and 7 existing deep wells will be monitored for IHSs over a 10-year period with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
11	10-Years of Post-Construction Cap Monitoring Throughout Area B1	10	$7,000	Event	$ 70,000	Monitor cap conditions on an annual basis to assess long-term integrity of cap.
	Direct Capital Cost	--	--		$ 3,464,461	Sum of line item 1 through 9. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost	36	%		$ 1,247,206	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost	--	--		$ 212,500	Sum of line item 10 and 11. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost	15	%		$ 31,875	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency	30	%		$ 1,486,813	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 6,442,855	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

[3] Material with arsenic and lead concentrations greater than 3,000 milligrams/kilogram (mg/kg) and mercury concentrations greater than 4 mg/kg are considered potentially hazardous for cost estimation purposes of alternative that involve excavation and disposal. This assumption is based on following:

- Arsenic: The toxicity leaching characteristic procedure (TCLP) studies completed as part of Smelter Area Investigation Report (ASARCO, 1998; SAI Report) concluded that the material with arsenic concentrations at or above 3,000 milligrams/kilogram (mg/kg) has a potential of exceeding the TCLP standard for arsenic of 5 milligrams per liter (mg/L) (i.e., a potential federal hazardous waste). Based on results of bioassay studies completed as part of a report prepared by SAI, state dangerous waste (dangerous waste [DW] and extremely hazardous waste [EHW]) levels for arsenic were above 10,000 mg/kg. For quantity/cost estimation purposes, material with arsenic concentrations at or above 3,000 mg/kg (i.e., a more conservative number between federal and state) was considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with arsenic concentrations greater than 3,000 mg/kg that are considered for excavation and disposal as part of the area remedial alternatives are only located within Areas A1 and B1.
- Lead: The TCLP data evaluated as part of the SAI Report indicates that the lead concentrations of less than 3,000 mg/kg do not exceed TCLP lead standard of 5 mg/L. Bioassay studies to determine state dangerous waste concentrations of lead was not completed as part to the SAI Report. However, based on the book designation method, the SAI Report indicated that the state dangerous waste concentration for lead is at or above 10,000 mg/kg. For quantity/cost estimation purposes, material with lead concentrations at or above 3,000 mg/kg (i.e., a more conservative number between federal and state) was considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with lead concentrations greater than 3,000 mg/kg that are considered for excavation and disposal as part of the area remedial alternatives are only located within Areas A1 and B1.
- Mercury: The SAI Report did not evaluate mercury for dangerous waste purposes. The 20-times rule (EPA, 1992) indicates that mercury concentration of 4 mg/kg (20 times the TCLP mercury standard of 0.2 mg/L) has a potential of exceeding TCLP mercury standard. Based on the book designation method, the state dangerous waste concentration for mercury is at 10 mg/kg. For quantity/cost estimation purposes, material with mercury concentrations at or above 4 mg/kg (i.e., a more conservative number between federal and state) would be considered hazardous waste for disposal purposes. Based on data presented in the SRI Report (GeoEngineers, 2015), contaminated material with mercury concentrations at or above 4 mg/kg is not present within the Lowland Area.

% = percent
LS = lump sum
SY = square yard
LF = linear foot
CY = cubic yard
O&M = operation and maintenance
S/S = Solidification/Stabilization
IHS = indicator hazardous substance

Table A-4

Area B2 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 119,982	Includes mobilization to the site, installation of temporary site controls including temporary traffic, and erosion and sediment controls (as applicable), and demob from the site. Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital cost thereafter.
2	Abandonment of Monitoring Wells	1	$4,400	LS	$ 4,400	Decommission monitoring wells LLMW-05S/D through LLMW-09S/D by a Washington State licensed well driller. Assumes drill-out and/or chip-in-place monitoring wells to decommission as applicable.
3	Utility protection and/or temporary relocation and restoration	0.1	$150,000	LS	$ 15,000	Protect utilities and/or temporarily reroute and restore to facilitate remedial excavation activities.
4	Clearing and Grubbing	1,400	$3	SY	$ 4,200	Includes clearing, grubbing and off-site disposal of cleared trees/vegetation.
5	Capping - Low-Permeability Cap	16,900	$40	SY	$ 676,000	Includes purchase, placement, and compaction of 1-foot of soil cap with plastic (or similar) underliner.
6	Installation of Permeable Reactive Barrier (PRB)	1	$849,000	LS	$ 849,000	Includes purchase of reagents and installation of both pilot (30 feet long by 10 feet wide by 8 feet deep) and full-scale (1500 feet long by 10 feet wide by 8 feet deep) shallow groundwater PRB along the shoreline of Area B2.
7	Stormwater Line Repair	1,600	$84	LF	$ 133,600	Includes installation of slip liner, repairing and/or replacement of damaged stormwater pipes.
8	Restoration of Paved Surfaces	100	$40	SY	$ 4,000	Includes restoration of asphalt/concrete surfaces disturbed due to construction of containment wall.
9	Landscaping (Placement of a Thin Layer of Top Soil and Hydroseeding)	4,400	$10	SY	$ 44,000	Includes landscaping of 1-foot of soil cap.
10	Monitoring Well Installation	1	$49,800	LS	$ 49,800	Assumes installation of 20 shallow and 2 deep monitoring wells for B2-ALT-1.
11	Surveying (Pre-/Post-Construction)	1	$119,700	LS	$ 119,700	Perform site survey to document existing conditions and as-built conditions.
12	10-Years of Post-Construction PRB Performance/Shallow Groundwater Monitoring	24	$14,300	Event	$ 343,200	Monitor groundwater to evaluate in situ groundwater treatment performance and/or compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 20 new shallow wells will be monitored for IHSs over a period of 10 years with 2 years of quarterly monitoring and 8 years of semi-annual monitoring.
13	10-Years of Post-Construction Deep Groundwater Monitoring	15	$5,100	Event	$ 76,500	Monitor groundwater to evaluate groundwater natural attenuation performance and/or compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 2 new deep wells will be monitored for IHSs over a 10-year period with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
14	10-Years of Post-Construction Cap Monitoring Throughout Area B2	10	$6,000	Event	$ 60,000	Monitor cap conditions on an annual basis to assess long-term integrity of cap.
	Direct Capital Cost		--	--	$ 2,019,682	Sum of line item 1 through 11. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost		36	%	$ 727,085	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost		--	--	$ 479,700	Sum of line item 12 through 14. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 71,955	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 989,527	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 4,287,949	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent
LF = linear foot
S/S = Solidification/Stabilization
LS = lump sum
CY = cubic yard
IHS = indicator hazardous substance
SY = square yard
O&M = operation and maintenance

Table A-5

Area B3 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	10-Years of Post-Construction Shallow Groundwater Monitoring	15	$5,300	Event	$ 79,500	Monitor groundwater following construction to evaluate groundwater natural attenuation processes and compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 2 shallow wells will be monitored for IHSs over a 10-year period with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
2	10-Years of Post-Construction Cap Monitoring	10	$4,000	Event	$ 40,000	Monitor cap conditions on an annual basis to assess long-term integrity of cap.
	Direct Capital Cost	--	--		$ -	Not applicable.
	Indirect Capital Cost	36	%		$ -	Not applicable.
	Direct O&M Cost	--	--		$ 119,500	Sum of line item 1 and 2. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost	15	%		$ 17,925	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency	30	%		$ 41,227.50	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 178,653	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent
LS = lump sum
SY = square yard
LF = linear foot
CY = cubic yard
O&M = operation and maintenance
S/S = Solidification/Stabilization
IHS = indicator hazardous substance

Table A-6

Area C1 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	10-Years of Post-Construction Deep Groundwater Monitoring	15	$5,100	Event	$ 76,500	Monitor groundwater to evaluate natural attenuation performance and compliance with cleanup standards. For the purpose of cost estimating, it is assumed that 2 deep wells will be monitored for IHSs over a 10-year period with 1 year of quarterly monitoring, 2 years of semi-annual monitoring and 7 years of annual monitoring.
	Direct Capital Cost		--	--	$ -	Not applicable
	Indirect Capital Cost		36	%	$ -	Not applicable
	Direct O&M Cost		--	--	$ 76,500	Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 11,475	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 26,392.50	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 114,368	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent
LS = lump sum
SY = square yard
LF = linear foot
CY = cubic yard
O&M = operation and maintenance
PRB = Permeable Reactive Barrier
IHS = indicator hazardous substance

Table A-7

Areas C2 and C3 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 15,000	Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital costs thereafter.
2	Installation of Perimeter Fence	6,000	$25	LF	$ 150,000	Assumes 6-foot tall chain link fence.
3	10-Years of Post-Construction Fence Monitoring	10	$3,000	Event	$ 30,000	Monitor fence conditions on an annual basis to assess long-term integrity of fence.
	Direct Capital Cost		--	--	$ 165,000	Sum of line items 1 and 2. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost		36	%	$ 59,400	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost		--	--	$ 30,000	Includes line item 3. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 4,500	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 77,670	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 336,570	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent

LS = lump sum

SY = square yard

LF = linear foot

CY = cubic yard

O&M = operation and maintenance

IHS = indicator hazardous substance

Table A-8

Area C5 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 2,880	Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital costs thereafter.
2	Cut-Off Underdrains	1	$24,000	LS	$ 24,000	Cut and cap underdrain pipe at the remedial area limit and backfill underdrains with grout slurry.
3	10-Years of Post-Construction Cap Monitoring	10	$3,000	Event	$ 30,000	Monitor cap conditions on an annual basis to assess long-term integrity of cap.
	Direct Capital Cost	--	--		$ 26,880	Sum of line items 1 and 2. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost	36	%		$ 9,676.80	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost	--	--		$ 30,000	Includes line item 3. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost	15	%		$ 4,500	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency	30	%		$ 21,317.04	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 92,374	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent
LS = lump sum
SY = square yard
LF = linear foot
CY = cubic yard
O&M = operation and maintenance
S/S = Solidification/Stabilization
IHS = indicator hazardous substance

Table A-9

Area C6 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	10-Years of Post-Construction Deep Groundwater Monitoring	15	$5,200	Event	$ 78,000	Assumes collection of groundwater samples from existing wells at/downgradient of the area for chemical analysis of IHSs. Assumes a total of 10-years of monitoring including four quarters of monitoring for first year, semi-annual monitoring for second and third year, and annual monitoring thereafter.
	Direct Capital Cost	--	--	$ -	Not applicable.	
	Indirect Capital Cost	36	%	$ -	Not applicable.	
	Direct O&M Cost	--	--	$ 78,000	Includes line item 1. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.	
	Indirect O&M Cost	15	%	$ 11,700	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.	
	Contingency	30	%	$ 26,910	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.	
	Total Remedial Alternative Cost:			$ 116,610	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.	

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent

O&M = operation and maintenance

IHS = indicator hazardous substance

Table A-10

Areas D1, D2, and D3 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	Mobilization/Site Controls/Demobilization	1	6 to 12	%	$ 1,800	Assumes 12% of the other direct capital costs for first $100,000 and 6% of the other direct capital costs thereafter.
2	Bathymetric Surveying (Pre-/Post-Construction)	1	$15,000	LS	$ 15,000	Perform site survey to document existing conditions, excavation limits and as-built conditions.
3	10-Years of Post-Construction Sediment Sampling and Analysis to assess Natural Sediment Recovery Processes	10	$7,200	Event	$ 72,000	Sample and analyze surface sediment (0 to 10 cm; i.e., biologically active zone) for the IHSs. Assume 1 sample per remediation area per event.
4	1-Year of Post-Construction Stormwater Outfall Sampling and Analysis	4	$7,200	Event	$ 28,800	Sample stormwater outfalls for IHSs to assess the performance of remedies implemented in upgradient areas to address sources contamination.
	Direct Capital Cost		--	--	$ 16,800	Sum of line items 1 and 2. Consists of equipment, labor and material costs, including contractor markups such as overhead and profit, necessary to construct the remedial alternative.
	Indirect Capital Cost		36	%	$ 6,048	Assumes 36% of the direct capital cost. Consists of costs that are not part of the actual construction project but necessary to implement the remedial alternative (e.g., engineering, legal, construction management, reporting and other technical and professional services).
	Direct O&M Cost		--	--	$ 100,800	Sum of line items 3 and 4. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 15,120	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 41,630	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 180,398	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent

LS = lump sum

CY = cubic yard

O&M = operation and maintenance

IHS = indicator hazardous substance

Table A-11

Area D4 Remedial Action Cost Estimate

Everett Smelter Site - Lowland Area

Everett, Washington

Item No.	Item Description	Estimated Quantity[1]	Unit Cost[2]	Unit	Estimated Cost	Notes/Assumptions
1	1-Year of Post-Construction Seep Sampling and Analysis	4	$6,900	Event	$ 27,600	Sample and analyze seep-water for IHSs. Assumes four quarters of monitoring with 1 sample per event.
	Direct Capital Cost		--	--	$ -	Not applicable.
	Indirect Capital Cost		36	%	$ -	Not applicable.
	Direct O&M Cost		--	--	$ 27,600	Includes line item 1. Consists of equipment, labor and material costs associated with activities necessary to ensure or verify the continued effectiveness of remedial alternative.
	Indirect O&M Cost		15	%	$ 4,140	Assumes 15% of the direct O&M cost. Consists of expenditures for professional and technical services including reporting necessary to support O&M activities.
	Contingency		30	%	$ 9,522	Covers unknowns, unforeseen circumstances, or unanticipated conditions associated with construction and O&M activities.
	Total Remedial Alternative Cost:				$ 41,262	Accuracy of the total remedial alternative cost is considered -30 to +50 % based on EPA's Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

Notes:

[1] Concept design level.

[2] Unit costs based on a combination of published engineering reference manuals (i.e., RS Means Heavy Construction Cost Data Manual); construction cost estimates solicited from applicable vendors and contractors; review of actual costs incurred during similar, applicable projects; and professional judgment. Unit costs are based on 2015 rates.

% = percent

LS = lump sum

CY = cubic yard

O&M = operation and maintenance

IHS = indicator hazardous substance

APPENDIX B
Report Limitations and Guidelines for Use

APPENDIX B
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

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

Environmental Services are Performed for Specific Purposes, Persons and Projects

GeoEngineers has performed this work for the Everett Smelter – Lowland Area in general accordance with the contract (Contract No.: C1100145) 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 environmental 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 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.

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

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.