UPLAND REMEDIAL INVESTIGATION WORK PLAN

WEYERHAEUSER SAWMILL ABERDEEN/SEAPORT LANDING
FACILITY SITE ID 1126, CLEANUP SITE ID 4987, AGREED ORDER ID 11225

Prepared for

GRAYS HARBOR HISTORIC SEAPORT AUTHORITY

UPLAND REMEDIAL INVESTIGATION WORK PLAN

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ACRONYMS AND ABBREVIATIONS

ACM	asbestos-containing material
ARAR	applicable or relevant and appropriate requirements
bgs	below ground surface
COC	contaminants of concern
cPAH	carcinogenic polycyclic aromatic hydrocarbon
CSM	conceptual site model
E&E	Ecology and Environment, Inc.
Ecology	Department of Ecology (Washington)
EMCON	EMCON Northwest, Inc.
ESA	environmental site assessment
FS	feasibility study
GHHSA	Grays Harbor Historical Seaport Authority
GPR	ground penetrating radar
HASP	health and safety plan
IRA	independent remedial action
LBP	lead-based paint
MFA	Maul Foster & Alongi, Inc.
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
MTCA A	Model Toxics Control Act Method A
MTCA B	Model Toxics Control Act Method B
MTCA C	Model Toxics Control Act Method C
NFA	no further action
NVLAP	National Voluntary Laboratory Accreditation Program
PA	preliminary assessment
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyls
PCP	pentachlorophenol
RAU	remedial action unit
RCRA	Resource Conservation and Recovery Act
REC	recognized environmental condition
RI	remedial investigation
SAP	sampling and analysis plan
SQS	Washington Sediment Quality Standards
SVOC	semivolatile organic compound
TBA	Targeted Brownfields Assessment by Ecology and Environment, Inc.
TCA	1,1,1-trichloroethane
the Property	upland portion of the Seaport Landing site, located at 500 N Custer Street, Aberdeen, Washington
the Site	upland portion of the Property and the aquatic land lease area where contamination originating from the Property

	may have come to be located at concentrations that exceed regulatory cleanup levels, as defined by the MTCA 173-340-200 of WAC
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WAC	Washington Administrative Code
XRF	x-ray fluorescence

1 INTRODUCTION

Maul Foster & Alongi, Inc. (MFA) has prepared this upland remedial investigation (RI) work plan for the Grays Harbor Historical Seaport Authority (GHHSA). This work plan develops the framework to characterize the nature and extent of environmental impacts at the upland portion of the Seaport Landing site, formerly the Weyerhaeuser Aberdeen Sawmill, located at 500 North Custer Street in Aberdeen, Washington (the Property) (see Figure 1-1). The Weyerhaeuser Sawmill Aberdeen/Seaport Landing site is listed on Ecology's database as Facility Site ID 1126/Cleanup Site ID 4987.

The Site, as defined by the Model Toxics Control Act (MTCA) 173-340-200 of Washington Administrative Code (WAC), includes the upland portion of the Property and the aquatic land lease area, where contamination originating from the Property may have come to be located at concentrations that exceed regulatory cleanup levels. This work plan focuses on the upland portion of the Site, i.e., the Property; a separate RI work plan has been prepared for the in-water portion of the Site.

A sawmill has existed on the Property since before 1900. Activities associated with this use have resulted in the release of hazardous substances, impacting environmental media at the Property.

The purpose of the RI is to collect sufficient information to enable development and evaluation of technically feasible cleanup alternatives in accordance with WAC 173-340-360 through 173-340-390. The RI will provide sufficient data to refine the conceptual site model (CSM) for use in evaluating technically feasible cleanup alternatives and selecting a final cleanup action applicable to the Site.

1.1 Regulatory Framework

On March 28, 2019, the GHHSA entered into Agreed Order DE 15953 with the Washington State Department of Ecology (Ecology). The Agreed Order requires the GHHSA to conduct an RI and feasibility study (FS) and develop a preliminary draft cleanup action plan for the Site that complies with MTCA cleanup regulations (WAC 173-340). This RI work plan has been prepared to satisfy the requirements of the Agreed Order for the upland portion of the Site.

The RI work plan is a deliverable required by the Agreed Order. It includes a health and safety plan (HASP; Appendix A) and a sampling and analysis plan (SAP; Appendix B), which were prepared in accordance with MTCA cleanup regulations (WAC 173-340-350) and pursuant to the Agreed Order. Per the Agreed Order, this work plan references past investigations and includes a summary of remaining data gaps to understand the nature and extent of contamination at the Site. Quarterly progress reports will be submitted during the RI and an RI report will be submitted after completion of the RI.

1.2 Remedial Investigation Objectives and Scope

The objectives of the RI are to define the nature and extent of the contaminants concern (COCs) in the media of concern, to evaluate the impact on human health and the environment, and to collect and evaluate sufficient information to enable selection of a cleanup action for the Site. This comprehensive sitewide evaluation will support recommendation of a cleanup alternative to meet MTCA criteria and be consistent with the GHHSA's future land-use goals.

The scope of work presented in this RI work plan will characterize the nature and extent of COCs in groundwater and soil at the Site, identify the applicable or relevant and appropriate requirements (ARARs) for the Site to define the appropriate cleanup standards for a cleanup action, and comply with the requirements of WAC 173-340-350 and the Agreed Order.

The RI work plan describes the project objectives and organization, functional activities, and quality assurance/quality control protocols that will be used to complete the RI. The purpose of the RI work plan is to:

- Provide a summary of previous investigations at the Site.
- Describe the preliminary CSM.
- Identify data gaps that require investigation to enable evaluation and selection of a cleanup action.
- Provide the rationale for the scope of work to be performed for the RI.
- Provide detailed methods for sampling and analysis, and a schedule for the RI.
- Provide a summary of the elements to be included in the RI report.

1.3 Organization of the Remedial Investigation Work Plan

The format of the RI work plan and supporting documents is in accordance with WAC 173-340-810 through 173-340-840 and the Agreed Order. Section 2 of the RI work plan provides a description of the Site and vicinity, a summary of background information, and a summary of previous investigations conducted at the Property. Section 3 describes the technical issues for the RI, including applicable screening levels, potential media of concern and pathways, the COCs, and preliminary ARARs. Section 4 summarizes the preliminary CSM. Section 5 describes the scope of work for the RI. The reporting requirements for the RI are presented in Section 6. Section 7 provides a list of documents used in preparation of this RI work plan.

The HASP is provided in Appendix A. The SAP provides specific requirements for sample collection and analytical activities and is included in Appendix B. The SAP also details the quality assurance/quality control protocols for the RI. Boring and well construction logs from previous investigations are included in Appendix C. Analytical data from previous investigations is tabulated in Appendix D. Appendix E provides the report for the geophysical survey conducted in October 2019.

Appendix F provides a description of the groundwater and surface water interaction study. All appendices should be referenced in conjunction with the entire RI work plan.

2 SITE DESCRIPTION AND BACKGROUND

2.1 Property Description

The Property includes upland areas and leased tideland property (outlined in Figure 1-1), and is located along the shoreline of the tidally influenced Chehalis River in Aberdeen, Washington. The Property is located in the alluvial meander plain of the Chehalis River in the northwestern margins of the Willapa Hills physiographic region of southwest Washington. Located at 500 N Custer Street in Aberdeen, the Property is approximately 2 miles upriver from Grays Harbor. The City of Aberdeen is situated in southwestern Washington, approximately 15 miles from the Pacific Ocean and approximately 70 air miles west-southwest of Tacoma, Washington. U.S. Highway 101 and U.S. Highway 105 are located less than 0.25 miles south of the Property.

The Property is situated in sections 9 and 10 of township 17 north, range 9 west, Willamette Meridian, and occupies approximately 24 acres of upland land and 14.4 acres of Washington State-owned aquatic lands along the Chehalis River (including filled tidelands, tidelands, and river bedlands). The Property is bordered on the west by a former boat yard; to the east by a log storage yard; to the north by the Chehalis River; and to the south by residential and commercial development.

Given the large number of COCs identified, the length of time the Property has been industrially utilized, and the proposed plans for redevelopment of the Property, the Property has been divided into multiple remedial action units (RAUs). This approach, creating RAUs and then identifying COCs associated with each RAU, best utilized available resources to move the Property toward completion of the RI/FS and productive reuse. In keeping with this approach, the upland RAUs are discussed and defined below, depicted on Figure 2-1, and described in Table 2-1. Property features are presented on Figure 2-2.

2.2 Geology and Hydrogeology

The Chehalis River Valley is filled with variable thicknesses of recent alluvium consisting of river-deposited gravels, sands, and silts. Near the ocean, the thicknesses of these alluvial deposits can be significant (greater than 100 feet) because of valley filling, as rising sea levels decrease the ability of the river to transport sediments downstream. Well logs from resource-protection wells in the vicinity of the Property indicate that alluvium in the area is at least 60 feet thick and consists of sands, silts, and clayey silts. Logs from borings located along State Highway 12 to the north indicate that the bedrock encountered below the alluvium is silt/sandstone.

Historical maps indicate that much of the area of the main mill facilities was tideland prior to, and during, the early development of the Property in the late 1800s and early 1900s. Most of the early structures were constructed on wood-piling support platforms.

The subsurface investigations completed at the Property indicate that subsurface soil, at areas of investigation, consists generally of fill material. The fill material consists of gravelly sand and sandy gravel or sand ranging from approximately the surface to 4 feet below ground surface (bgs). At depth, woody debris, gravels, sands, and silt are logged to 14 feet bgs, the maximum depth explored. These subsurface observations were consistent with geologic logs from the environmental borings previously completed at the Property.

Depth to water observations during past investigations measured in reconnaissance borings was approximately 4 to 6 feet bgs. Based on geologic logs from previous environmental investigations, groundwater flow in the area is generally to the northwest; however, flow direction and gradient may be tidally affected.

2.3 Site History

A detailed description of historical operations is presented in the Level 1 environmental site assessment (ESA; PES, 2010) and summarized below. A sawmill has existed on the Property since before 1900. Weyerhaeuser Company acquired the Property in 1955 and operated several sawmills and associated support facilities through January 2009, when the small log sawmill was permanently closed. When the facility was operational, raw logs were brought to the Property in log rafts in the Chehalis River and tied up to pilings in the river in front of the Big Mill until the mid-1960s. After the mid-1960s, raw logs were brought to the Property by truck and staged on log decks at various locations in and adjacent to the Property. The Big Mill was originally configured to manufacture shingles and slats for housing construction. During World War II, the Big Mill was converted to manufacture ship keels for the war effort. The precursor to the Small Log Mill was added in 1972. The last upgrade to the Small Log Mill was in 2003. In 2006, the Big Mill and attached finger pier were closed; the associated structures were removed from the Property between 2006 and 2008. This area is now known as the Former Mill Area (Figure 2-2). The Property continued to operate a second mill (the Small Log Mill) into early 2009. GHHSA acquired the property on March 29, 2013. See Figure 2-2 for the locations of these features.

2.4 Previous Environmental Investigations

Several environmental investigations have been conducted at the Property, documenting assessments of soil, soil vapor, and groundwater at the Property. Sampling results and conclusions of previous environmental investigations at the Property are summarized in the Targeted Brownfields Assessment (TBA) report (Ecology and Environment, Inc. [E&E], 2018) and are described below. Previous investigations related to the in-water portion of the Site are described separately in the in-water RI work plan. The monitoring wells and boring locations for these investigations are shown on Figure 2-3 and 2-4, respectively. Analytical data tables from the previous investigations conducted post-2010 are included in Appendix D.

2.4.1 Independent Remedial Action Report (EMCON, 1997)

In 1997, EMCON Northwest, Inc. (EMCON) presented an independent remedial action (IRA) report for the Weyerhaeuser Aberdeen Sawmill to the Weyerhaeuser Company. This report summarized environmental characterization and remedial efforts that had occurred at the Property from 1989 through 1993, all focused on the planer/grader building and immediately adjacent land area (EMCON, 1997).

The first sampling at the Property took place in October 1989, to investigate potential releases of pentachlorophenol (PCP) and NP-1 anti-sapstain compounds. By that time, use of PCP as an anti-sapstain agent had been discontinued at the Property. Samples collected during this 1989 investigation confirmed the release of PCP to surface soils. Following these efforts, additional sampling and testing was performed in May 1990. These efforts documented impacts across a greater area, including PCP-impacted soils and sawdust in the planer/grader building.

Five groundwater wells (D-01 through D-05) were installed in May 1990 (see Figure 2-3 and Appendix C for well logs). According to EMCON's report, samples of soil collected during well installation confirmed the presence of PCP impacts in subsurface soils, extending up to 16 feet bgs at well D-05. PCP was also identified in groundwater at three locations (D-02, D-04e, and D-05), with the highest PCP concentration in groundwater at well D-05. Further surface and subsurface soil sampling was undertaken in July 1990, confirming the presence of PCP-contaminated soil between 2 and 6 feet bgs, with the highest concentration again near well D-05.

In August 1990, four additional groundwater monitoring wells (D-06 through D-09; see Figure 2-3) were installed at greater distance from the area of PCP impacts at the planer/grader building. Several semivolatile organic compounds (SVOCs) were detected in both soils and groundwater samples collected from these locations, including naphthalene at low concentrations in well D-09; however, PCP was not detected at these locations. The sampling and/or laboratory report(s) that included the SVOC and PCP analytical data discussed by EMCON was/were not available as an attachment to their cleanup report or from Ecology file records, limiting the ability to confirm their findings, or identify other COCs (EMCON, 1997).

After EMCON's review of subsurface sampling data generated to date, and consultation with Ecology, PCP was identified as the only contaminant of concern for remediation. Eight separate areas were identified for remediation by excavation within the northern portion of the planer/grader building. Work was staged to coincide with an upgrade to the anti-sapstain spray booth, and various process modifications were made to minimize the chance for similar future releases. Remediation included the removal of impacted soil using a small backhoe, a vacuum truck, or, when access was severely constrained, by hand (EMCON, 1997).

A total of 522 tons of PCP-contaminated soil were removed from the Property during three separate removal events; however, due to the relatively shallow water table, physical access constraints, and concerns about undermining building foundations, soils contaminated with PCP were left in place at some locations. PCP concentrations in soils at three of the eight cleanup areas exceeded the MTCA Method C (MTCA C) cleanup level in effect at that time, which was 1,090 milligrams per kilogram (mg/kg) (EMCON, 1997). Note that since that work was completed, MTCA cleanup levels for PCP have become more stringent. The current MTCA C cleanup level for PCP is 330 mg/kg and the MTCA Method B (MTCA B) soil cleanup level for protection of direct contact, cancer, is 2.5 mg/kg.

With respect to groundwater, although PCP was detected in groundwater, this detection was a regular occurrence in only one well (D-05), with infrequent PCP detections at other well locations. Surveys of the groundwater elevations indicated a north/northwesterly flow direction, towards the Chehalis River. Based on a statistical analysis of groundwater analytical data, EMCON determined that PCP did not appear to be migrating to or affecting the Chehalis River's water quality (EMCON, 1997).

2.4.2 Independent Remedial Action Report Addendum (EMCON, 1998)

Following completion of the IRA, EMCON presented the results of the work that had been done to Ecology, with a request that a no further action (NFA) status be granted for the Property. As outlined in EMCON's April 1998 memorandum, after review of the IRA report, Ecology requested that one additional groundwater sample be collected to further corroborate that PCP was not migrating towards the Chehalis River. Ecology also requested the Site's restrictive covenant be revised to incorporate changes to the standard language used by Ecology for such covenants in 1998. The additional sample was collected from temporary well point GP-1, installed near the northwest corner of the planer/grader building, between wells D-06 and D-07. PCP was not present above the analytical method reporting limit in this sample (EMCON, 1998).

2.4.3 No Further Action Letter for Remedial Actions (Ecology, 1999)

After obtaining groundwater data and revising the restrictive covenant for the Property, Ecology granted an NFA with restrictive covenant status for this PCP release. In light of the PCP contamination that had been left in place, maintaining the Property's NFA status required the property owners to comply with certain limitations on use, redevelopment, and conveyance, as memorialized in the restrictive covenant filed for the Property (Ecology, 1999).

2.4.4 Level I Environmental Site Assessment (PES Environmental, 2010)

In August 2010, PES provided the Weyerhaeuser Company with the results of their Level I ESA of the Aberdeen Sawmill property (i.e., Seaport Landing). The goal of the report was to identify recognized environmental conditions (RECs) associated with the Property. In doing this, PES reviewed various federal, state, and local data sources; environmental regulatory agency files for the site and vicinity; and available permits, plans, and reports for the Property. PES also conducted historic research regarding property use and development, performed a site walk, and interviewed individuals knowledgeable of the site (PES, 2010).

Given the data-dense nature of the ESA report, and that details on site use and development history have been previously summarized, this recap focuses on the RECs identified in the ESA and provides additional background context for these RECs. The RECs identified in the ESA report are included below (see Figure 2-2; PES, 2010):

1. A documented release of PCP to soil and groundwater in the vicinity of the planer/grader building.

2. A release of petroleum hydrocarbons from an underground storage tank (UST) that had been located near the southeast corner of the maintenance shop. Interviews conducted during the ESA also revealed that additional USTs may have been present near the maintenance shop, including one near the southwest corner and four near the northeast corner of the maintenance shop. Reports available to PES only documented the removal of the one UST southwest of the maintenance shop, with subsurface soil and groundwater impacted by petroleum products exceeding current-day MTCA Method A (MTCA A) cleanup levels; free-product was observed in the removal excavation at the time of UST removal. Based on review of PES's report, it also appears that four "nested" USTs may have been removed from near the northeast corner of the maintenance shop in conjunction with demolition of the old structure and construction of the currently existing building in 1994.

   To assess whether additional USTs and subsurface environmental impacts remain near the maintenance shop, subsequent subsurface characterization work, including a geophysical survey, was undertaken in 2015 and 2017.

3. For a period of nine years, ending in June 1989, paint wastes were released from the Property to Shannon Slough (see Figure 2-2). As a result, in 1990, Weyerhaeuser Company was convicted for illegal discharge under the Clean Water Act (Lewis, 1990). This waste had been generated while stencils were cleaned near the southeast corner of the planer/grader building. Contaminants found in the slough at/near the discharge point included 1,1,1-trichloroethane (TCA), naphthalene, and other petroleum products. Although the exact waste handling process was not well defined in available reports, the waste appears to have been stored in various tanks, including what has been referred to as the "Paint Waste UST". Wastewater from this process was also discharged to Shannon Slough by way of a trench in the stencil cleaning area that led to the stormwater management system and an outfall on the Shannon Slough. Sediment sampling along Shannon Slough, undertaken to characterize the extent of these and other releases from the site, identified TPH, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and metals in sediments.

   While the associated cleanup reports did not appear to be available to PES, in 1993, a letter from the U.S. Environmental Protection Agency (USEPA) noted that conditions leading to the 1990 conviction had been corrected, and the site was removed from the USEPA's list of "violating facilities." Although the exact relationship between a 1992 Resource Conservation and Recovery Act (RCRA) preliminary assessment (PA) of the Property and this statement by USEPA are not spelled out in PES's Level I ESA, analytical data for samples collected during the RCRA PA documented sediment conditions were compliant with Washington Sediment Quality Standards (SQS) or, when a related SQS value was not available, the MTCA A cleanup levels in effect at the time of sampling.

   The RCRA PA also noted that the fuel and chemical storage building located had functioned as both a hazardous waste storage area and a vehicle washstand (see Figure 2-2). As releases had reportedly occurred in that area, the RCRA PA recommended follow-on sampling and testing near the fuel and chemical storage building. This recommendation for follow-on sampling does not appear to have been called out in the PES Level I report.

4. At some point, apparently after the illegal discharge activities, the Paint Waste UST served as an intermediary holding tank before the paint waste was transferred to a second storage tank and then disposed of off site (WEST, 1992). The Paint Waste UST was removed from a location nearly adjacent to the southeast corner of the planer/grader building, and owing to this location, impacted soils were left in place to minimize the risk of undermining the adjacent building's foundation. During removal of the Paint Waste UST, TCA and petroleum impacts were noted in soil and groundwater. While TCA was not detected in soil samples collected from the sidewalls and bottom at the limits of the removal/remedial excavation, TPH in the form of either hydraulic oil or lube oil remained in soils at concentrations in excess of current-day MTCA A cleanup levels.

   In addition, it appears that the well network installed to assess groundwater quality in relation to PCP releases (EMCON, 1997) may in fact have been originally installed to assess impacts related to the Paint Waste UST release (DOF, 1990). While available information does not define the separation distance between the Paint Waste UST removal excavation and the nearest well(s), several VOCs were detected in these wells, including the TCA breakdown product 1,1-dichloroethane. Vinyl chloride was also detected in one of the 36 samples collected from the well network (PES, 2010; WEST, 1992).

5. The Level 1 ESA also detailed multiple releases of petroleum products to the Chehalis River along the Property shoreline. Information on these spills/releases appears to have been found during review of the facility's Stormwater Pollution Prevention Plan and other Weyerhaeuser Company-maintained files, as well as detailed during interviews with individuals that are knowledgeable of the Property.

6. The past presence of an additional sawmill facility east of Shannon Slough, at the current-day location of the chip truck lift and chip piles, was also noted as a REC. While that property was also owned by Weyerhaeuser Company, only a small portion of that land area was conveyed to the GHHSA. Potential contaminants of concern in that area included hydraulic oils, petroleum products, and other potentially hazardous materials.

During PES's review of the Property's general history, the following potential sources of environmental impact were identified (PES, 2010):

1. Given that the Property had been used for industrial purposes for more than 100 years, unknown/unassessed areas of environmental impact may be present.

2. As previously discussed, the mill had originally been constructed on an over-water, piling-supported pier. Over time, this area was filled. The source, content, and/or environmental quality of this fill material is unknown.

3. Wood-fired boilers and refuse burners were historically used on the Property. Where or how the ash was disposed of is not known.

The ESA also identified the following data gaps regarding potential environmental issues at the Property (PES, 2010):

4. The former oil tank and chemical storage shed was located in the northwest corner of the storage shed (see Figure 2-2). Other than its presence on a historic facility map, no information was available regarding this building and/or potentially associated tanks.

5. Per Weyerhaeuser Company's responses provided on a March 2000 questionnaire, multiple USTs were reportedly removed from the Property between 1977 and 1979 (Weyerhaeuser Company, 2000). In addition, PES's review of UST databases maintained by Ecology revealed that three USTs were removed from the Property; two of these tanks (a 10,000-gallon diesel UST and a 600-gallon gasoline UST) were listed as removed in December 1988. There is conflicting data on whether the third UST, which was removed in 1993, stored used oil or leaded gasoline. Interviews with individuals knowledgeable of the Property provide anecdotal accounts of additional USTs potentially removed from the Property.

   No information was available regarding the location of the remaining USTs or the potential presence of related environmental impacts. The relationship (if any) between the tanks listed in Ecology's database, the tanks listed in the March 2000 questionnaire and Ecology's files, or the tanks described by site knowledgeable individuals is not clear (Weyerhaeuser Company, 2000).

6. The March 2000 questionnaire also stated that although the fill pipe was left in place, a UST formerly located adjacent to the guard shed had been removed (Weyerhaeuser Company, 2000). Further documentation on this UST removal and/or related sampling and testing work was not available. This fill pipe was noted on site during E&E site visit's in February 2017.

7. During document review, PES noted multiple references to an independent cleanup action report that had been submitted to Ecology in 1991. This report appeared to have been related to characterization and cleanup efforts taken in response to releases of paint waste discussed in items no. 3 and 4 of this section. Although references to the Paint Waste UST removal efforts were noted in a draft groundwater characterization report that provided the background for discussion in item no. 4 of this section, PES was unable to obtain copies of the cleanup action report(s) from either Ecology or Weyerhaeuser Company.

2.4.5 Sediment Sampling Report (MFA, 2014)

In February 2014, MFA presented GHHSA with the results of "bookend" sediment sampling work performed in connection with the Former Mill Area (i.e., a comparison of sediment conditions prior to and at the end of the lease period). This sampling event was undertaken to document sediment conditions in the intertidal land lease at the end of Weyerhaeuser Company's occupancy of the Property. Sampling locations included nearshore surface and subsurface sediments along the "pocket beach" north of the maintenance shop, and surface sediments farther offshore from the Property, within the Chehalis River.

Findings from that study potentially relevant to sampling efforts undertaken on the upland area included the presence of significant quantities of woodwaste in surface and subsurface sediment sample locations; sheens, petroleum-like odors, and dark-colored water noted in both surface and subsurface sediment samples; and the presence of diesel- to heavy oil-range TPHs and polychlorinated biphenyls (PCBs) in both surface and subsurface sediments (MFA, 2014). E&E's TBA report did not identify the source of those impacts; however, given the development history of the Site and that these sample locations are downgradient of the maintenance area, spills/leaks/releases from the Big Mill or downgradient migration from other upland sources may have caused this contamination (E&E, 2018).

2.4.6 Draft Disproportionate-Cost Analysis (MFA, 2016a)

In April 2016, MFA presented GHHSA with a Draft Disproportionate-Cost Analysis, focused on the contamination left in place beneath the planer/grader building (MFA, 2016a). The cost analysis compared overall cost, protectiveness, permanence, long-term effectiveness, short-term risk management, implementability, and the anticipated public concern for use of two different remedial approaches to address contamination near and beneath the planer/grader building. Given the proposed change in use, MFA compared contaminant levels to either MTCA A or B cleanup levels for unrestricted land use when determining the amount of material requiring remediation. The first approach proposed removal and off-site disposal of an estimated 10,640 cubic yards of contaminated material; the second approach was to leave contamination in place and control potential exposure using an engineered cap and institutional controls. Ultimately, while differences were noted in many metrics, given off-site disposal was estimated to cost approximately four times that of an engineered cap construction, the second option (i.e., engineered cap) was the recommended remedial approach (MFA, 2016a).

In addition, this cost analysis included a brief discussion and summary of analytical data for groundwater sampled from temporary wells placed along the current shoreline, north of the planer/grader building and maintenance shop. While no PCP was detected in groundwater sampled from these locations, TPH was detected at concentrations above the MTCA A cleanup level (MFA, 2016a). Additional discussion of soil, sediment, and groundwater sampling data from these locations is included in Section 2.4.8.

2.4.7 Stormwater System Evaluation and Site Reconnaissance (MFA, 2016b)

MFA's review of existing stormwater system plans available for the Property indicated inconsistences between 'as-built' drawings of stormwater features at the Property and the actual location of features. From an environmental perspective, stormwater conveyance is important for understanding potential migration pathways from the Property to the aquatic environment.

MFA field-verified the stormwater system features, including catch basins and outfalls, and recorded locations using a handheld global positioning system receiver. When possible, stormwater conveyance features were opened to verify the diameter of pipe connections present and approximate direction of piping entering and leaving the feature. Facility floor drain features and possible connections to the stormwater conveyance system were noted. Locations of stormwater features observed at the Property are included in Figure 2-5.

During Property reconnaissance, two catch basins with associated outfalls (OF 2 and OF 14) were observed adjacent to the west of the Property and appear to discharge on the neighboring Pakonen Boatyard facility (see Figure 2-5). The ultimate location of the outfall was not visually observed due to dense vegetation and high tide at the time of observation. The outlet from the catch basin attached to OF 14 is comprised of a cement, 8-inch-diameter pipe, while OF 2 piping is comprised of a 12-inch-diameter, corrugated metal pipe. No water was present in these catch basins during observation; however, indications of recent stormwater flow though these catch basins was observed. OF 2 drains an area where lumber was formally stored and loaded onto ships, while OF 14 drains a driveway that accesses the Property on the west side.

2.4.8 Focused Investigation Report (MFA, 2016c)

In July 2016, MFA presented GHHSA with their Focused Investigation Report, summarizing and discussing subsurface characterization work performed in the uplands area of the Property. Prior to conducting their investigation, MFA reviewed PES's Level I ESA and identified areas of potential concern on the site, prioritizing those perceived to have the greatest risk of impact on the northern adjacent leased tidelands. Sampling locations were selected, and overall project scope was informed by review of the Level I ESA and the results of a geophysical survey conducted at the site in 2015 (MFA, 2016c).

The geophysical survey was performed in May 2015, in light of the uncertainty regarding the number, location, and status of USTs reportedly located on the Property. This survey was performed based on the potential presence of six USTs identified during the Level I ESA conducted on the Property (PES, 2010). Five USTs were suspected in the vicinity of the maintenance shop at the Property, while one UST was suspected to be located adjacent to the guard shed. The geophysical survey targeted the area of both the maintenance shop and guard shed (see Figure 2-2). The geophysical survey identified nine subsurface anomalies that may have been USTs along the northern and western exterior of the maintenance shop; however, based on review of the geophysical data and discussions with Property knowledgeable individuals, MFA suggested that these anomalies were likely cement vaults associated with the facilities' electrical and fire systems. MFA also noted two additional anomalies southeast and southwest of the maintenance shop that, based on their size, burial depth, and location, may have been UST locations. While the geophysical survey identified disturbed soil near the guard shed, no evidence that a UST remained at this location was encountered (MFA, 2016c).

Three borings (B01, B02, and B03) were advanced surrounding the maintenance shop (see Figure 2-4). Soils were recovered to the full depth of exploration (10 feet bgs) for screening and/or sampling, and the borings were completed as temporary groundwater monitoring points. Diesel- and/or heavy oil-range TPHs were present in soils from both B02 and B03; however, only the concentrations of TPH in B02 exceeded the current MTCA A cleanup levels. TPH concentrations in groundwater from both B02 and B03 were above MTCA A cleanup levels, (MFA, 2016c).

Additionally, while groundwater sampled from B02 also contained total chromium and lead above MTCA A cleanup levels, as the sample had relatively high turbidity and the dissolved concentrations of those metals were below cleanup levels, these detections were not interpreted to indicate that groundwater posed an elevated exposure risk to human health or the environment. Total carcinogenic PAH (cPAH) concentrations in groundwater from B02 also exceeded MTCA A cleanup levels; however, based on the high detection limits associated with this sample and the method used to calculate total cPAH toxicity, this data was interpreted as inconclusive (MFA, 2016c).

2.4.9 Study Area Investigation—Aquatic Lands Lease (MFA, 2019)

In June 2019, MFA completed the Study Area Investigation report (MFA, 2019). The investigation was undertaken in 2015 and 2016 to characterize the nature and extent of environmental impacts on the approximately 16.9-acre leased tidelands at the Seaport Landing Site (i.e., areas generally north of the inner harbor line). This report summarized prior Site investigations and reported the results for the sediment and limited upland sampling efforts. Characterization efforts included collection of soil and groundwater samples from four upland borings, and numerous surface and subsurface sediment samples (MFA, 2019).

This study further characterized the extent of woodwaste in surface and subsurface soil and sediment sample locations. Soil data was compared to either MTCA A or, if no such value existed, the applicable MTCA B soil cleanup levels. Soil sampled from the borings CR-20 and CR-21 contained heavy oil-range TPHs at concentrations above the screening level. Benzo(a)pyrene and the cPAHs total toxicity value exceeded applicable screening levels in borings CR-20 and CR-21, while PCB concentrations in CR-20 also exceeded the cleanup value. Diesel- and/or lube oil-range TPHs concentrations in groundwater were above screening levels at CR-20, CR-21, CR-22 and CR-23. Sheens and non-aqueous phase liquids (i.e., free product) were also noted on the groundwater at sediment boring location CR-11, and although the deep sediment sample collected from this boring did not contain TPH concentrations above cleanup levels, the sample was collected approximately 23 feet bgs (or below mudline) (MFA, 2019).

2.4.10 Vapor Intrusion Assessment (MFA, 2017)

In October 2017, MFA completed a Vapor Intrusion Study Report for the maintenance shop (MFA, 2017). A manometer was used to measure the pressure differential in the building during sampling conducted in July and September 2017. The building averaged a positive pressure with the building bay doors open and a negative pressure with the building bay doors closed. Subslab monitoring points were installed, and samples were collected from five sampling points. The results of the vapor intrusion study conducted in July and September 2017 do not indicate that vapors from soil and groundwater contamination are impacting the building, and there currently is no known health risk related to vapor intrusion at the Property. Additionally, known carcinogens such as benzene, tetrachloroethene, and trichloroethene were either not detected in subslab soil vapor or at concentrations above screening level values.

Soil gas concentrations at the building were not above Ecology vapor intrusion subslab soil gas Method B cleanup levels. Hence, it appears vapor intrusion is not a pathway of concern to current or future indoor air quality at the maintenance shop. No further assessment activities were recommended.

2.4.11 Targeted Brownfields Assessment (E&E, 2018)

In May 2018, E&E completed and presented the USEPA with the TBA report (E&E, 2018). The assessment was undertaken to identify the types and concentrations of contaminants in the upland area of the Property. This assessment involved sampling surface soil, subsurface soil, and groundwater related to specific areas of concern within the study area.

A geophysical survey was conducted in an attempt to identify USTs or other infrastructure, interpreted potential sources of contamination, or preferential contaminant migration pathways (e.g., utility corridors and fill areas).

The TBA focused on target analyte list metals; SVOCs, including PAHs and cPAHs; TPH (diesel- and lube oil-range); VOCs; and PCBs as the potential contaminants of concern at the Property. Constituents that were detected at concentrations that exceeded one or more MTCA cleanup level included 11 metals, heavy oil-range TPHs, PCP, several SVOCs, and one or more of the cPAHs individually or as represented by the calculated benzo(a)pyrene toxicity equivalent (TEQ) value. Regarding metals, however, several analytes that exceeded MTCA A/MTCA B cleanup levels were present at concentrations in line with naturally occurring background levels. For this reason, they are likely not indicative of contamination.

Sampling during the TBA identified and/or confirmed the presence of multiple areas of subsurface soil and groundwater contamination at the Site. These include:

- Areas of petroleum-impacted soil and/or groundwater in RAU1 north of the maintenance shop and surrounding the fuel and chemical storage building; as well as in RAU2 on the west side of the planer/grader building, and in surface soil in the conveyor trench on the north side of this building.
- Dispersed PCP-impacted groundwater in RAU1, generally between the maintenance shop and fuel and chemical storage building. PCP impacted soil in RAU1 was only identified on the north side of the fuel and chemical storage building.
- A localized area of PCP-impacted soil and groundwater in RAU2 on the west-central side of the planer/grader building. This area of contaminated soil appears to be the remnants of PCP-impacted soil identified and remediated in the 1990s.
- Widespread presence of manganese in groundwater at concentrations in excess of various groundwater- and surface water-related cleanup levels. As manganese concentrations in soil were typically within expected background levels, elevated concentrations of manganese in groundwater may be indicative of ongoing anaerobic biodegradation of organic compounds and/or contaminants.
- Localized areas of other metals, such as lead and copper, in soil and groundwater at concentrations in excess of applicable cleanup levels and in excess of natural background levels.

- Areas with SVOC-impacted soil and groundwater, often as represented by the cPAH TEQ value. These areas include shallow subsurface soils in RAU3 near the former oil tank and chemical storage shed, and in RAU2 at the Paint Waste UST removal area. In many cases, SVOC-impacted media coincided with locations with petroleum impacts.

In many instances, the source of these impacts was not well understood, and additional sampling and testing would be required to identify related sources.

3 TECHNICAL APPROACHES FOR THE REMEDIAL INVESTIGATION

This section summarizes the technical issues to be considered for the RI of the Site that were identified from previous investigations and the operational history of the Site. The technical approaches discussed below may be modified as appropriate, based on the results of the RI.

3.1 Screening Levels

Regulatory standards considered for soil and groundwater are included in Table 3-1 and Table 3-2, respectively.

The screening levels to identify the concentrations of COCs that present a risk to human health and the environment in groundwater and soil at the Site for this RI are consistent with MTCA values established under WAC 173-340. Multiple screening levels have been used historically at the Site. The Disproportionate-Cost Analysis Report (MFA, 2016a) and Study Area Investigation Report (MFA, 2019) utilized MTCA A and MTCA B when MTCA A was not available. Prior to 2016, the MTCA Method C (for industrial sites) was originally selected as the cleanup level, specifically for PCP in soil. This was the appropriate screening criterion at the time. However, Site operations have since changed, and the MTCA A or B cleanup levels (for unrestricted land use) are more appropriate. The TBA report (E&E, 2018) used the most restrictive cleanup level for soils, and that value was typically the MTCA B cleanup level established for the protection of groundwater in saturated soil.

For the purposes of this RIWP, MFA has included the MTCA B cleanup levels for soil protective of groundwater in saturated soils in Table 3-1 and in the soil performance criteria table in the SAP (Table B-3) in determining the most restrictive cleanup level for soil. Given that for each boring location, both an unsaturated soil sample and a groundwater sample are proposed for analysis, the screening level for soil for the RI and FS may be updated to be MTCA B cleanup level for protection of direct contact and not for protection of groundwater, given that groundwater data will be available to empirically demonstrate that measured soil concentrations will not cause an exceedance of the applicable groundwater cleanup levels.

3.1.1 Soil

Soil concentrations will be evaluated relative to MTCA A and B soil values. MTCA A values rely on various endpoints described in WAC 173-340-900 Table 740-1 and are applicable for simple sites undergoing routine cleanup actions or sites with relatively few hazardous substances. MTCA B values will be applied in cases where MTCA A values are unavailable. MTCA B is applicable to all sites; generic default assumptions are used to calculate risk-based screening levels protective against direct contact via ingestion or dermal contact by humans, with target risk levels set at the MTCA acceptable risk level. In cases where cancer and noncancer effects values are available for a chemical, the lower value is applied. Finally, metals concentrations will also be compared with natural background values developed by Ecology for the Western Washington (i.e., "Group W") region (Ecology, 1994).

3.1.2 Groundwater

Groundwater likely discharges to the Chehalis River, and groundwater/surface water interaction will be studied as part of this RI. For the purposes of the RI, groundwater will be screened to MTCA A values and MTCA B when MTCA A is not available. Additionally, groundwater concentrations from locations likely to interact with surface water will be compared with surface water screening levels protective of human health and aquatic receptors, as an initial step to evaluate potential groundwater discharge to surface water impacts. Specifically, water chemistry will be compared to the most stringent USEPA freshwater[1] National Recommended Water Quality Criteria (WQC) for the protection of aquatic life and human health in surface water (USEPA, 2019). Where WQC are not available, water data will be compared to MTCA B screening surface water values. In cases where cancer and noncancer effects MTCA B are available for a chemical, the lower value will be applied. For TPH, the MTCA A cleanup level for groundwater will be used. Note that groundwater is not used as a drinking water source at the Site.

3.2 Contaminants of Concern

The COCs identified for the RI are based on the concentrations of COCs that exceed screening levels detected in previous investigations at the Site, as summarized in Section 2.4. Analytical data from previous investigations is included in Appendix D. The COCs detected above the screening levels in previous investigations conducted at the Site include:

- TPH: diesel-range and heavy oil-range organics
- SVOCs: 2,4-Dichlorophenol, Bis(2-chloroethyl)ether, Bis(2-ethylhexyl)phthalate, PCP
- VOCs: benzene
- PAHs: Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-cd)pyrene, cPAH toxicity equivalence

[1] According to Ecology's "Water Quality Atlas" application, waters in the vicinity of the site are considered to be fresh for the purposes of WQC (Ecology, 2016).

- PCBs: Aroclor 1254, Aroclor 1260, total PCBs
- Chlorinated dibenzo-p-dioxins/chlorinated dibenzofurans (collectively referred to as dioxins/furans)
- Metals: aluminum, arsenic, barium, cadmium, chromium, copper, lead, manganese, nickel, silver, thallium, vanadium, zinc

  The metals target analyte list developed for the TBA report (E&E, 2018) was aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. For this RI, based on communications with Ecology, the following metals were selected for analysis based on the criteria exceedances from the TBA report: arsenic, cadmium, copper, lead, manganese, nickel, and zinc. Mercury, which was not included in the TBA report, is included on for this RI because it is of interest for the in-water RI. In addition, chromium is included to ensure potential contaminants that could be present are not missed.

Sulfide is a COC identified for the in-water portion of the Site due to its toxicity to biological receptors. Sulfides are associated with woodwaste degradation. Groundwater from borings adjacent to the shoreline will be analyzed for sulfide if there is woodwaste or a sulfide odor present. This data will be used to determine whether groundwater to surface water interactions are contributing sulfide to the in-water portion of the Site.

Tables B-3 and B-4 of Appendix B summarize the COCs, laboratory reporting limits, and proposed screening levels for soil and groundwater at the Site, respectively.

3.3 Preliminary Applicable or Relevant and Appropriate Requirements

The preliminary ARARs and other information specific to the Site to be considered for the RI have been categorized as chemical-specific, location-specific, and action-specific. Potential chemical-specific and location-specific ARARs have been identified based on data collected during previous investigations. The preliminary action-specific ARARs have been developed to assist with the evaluation of general response actions. The preliminary ARARs and other information specific to the Site to be considered for the RI include:

Chemical-specific:

- MTCA (WAC 173-340)
- Dangerous Waste Regulations (WAC 173-303)
- Ambient WQC (Federal Clean Water Act Section 304)

Location-specific:

- Water Quality Standards for Groundwater of the State of Washington (WAC 173-200)

- Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A)
- Protection of Upper Aquifer Zones (WAC 173-154).

Action-specific:

- Safety Standards for Construction Work (WAC 296-155)
- Minimum Standards for Construction and Maintenance of Wells (WAC 173-160)
- Accreditation of Environmental Laboratories (WAC 174-50).

Additional ARARs and other information identified during implementation of the RI to be considered will be included in the evaluation. The primary ARARs will be defined in the RI Report.

4 PRELIMINARY CONCEPTUAL SITE MODEL

The preliminary CSM has been developed to summarize the current understanding of the Site to assist with identification of the applicable COCs, the confirmed or potential sources of COCs, the media of concern with concentrations of COCs above the screening levels, and potential migration and exposure pathways. The sources of data used in developing the preliminary CSM for this RI work plan include investigations conducted by MFA, E&E, EMCON, and PES. The preliminary CSM has been used to develop the scope of work presented in this RI work plan to meet the data requirements for completion of the RI in accordance with WAC 173-340-350.

The elements comprising the preliminary CSM include:

- The confirmed and potential source(s) of COCs
- COCs and affected media
- The nature and extent and known or potential routes of COC migration
- Known or suspected human and environmental receptors
- Data gaps

Each of these elements is summarized below.

The human health and ecological CSM, depicting exposure pathways and potential receptors, is shown in Figure 4-1. Note that CSMs are dynamic, and the CSM will be reevaluated and updated as part of the forthcoming RI as additional information is obtained.

4.1 Confirmed and Potential Sources of COCs

The confirmed and potential sources of the COCs detected above the screening levels within specific RAUs at the Site (see Figure 2-1, Figure 4-1, and Figure 4-2) include:

- RAU 1: Maintenance Shop, Fuel and Chemical Storage Building

- RAU 2: Planer/Grader Building, Former Paint Waste UST
- RAU 3: Former Oil Tank and Chemical Storage Shed
- RAU 4: Former Vehicle Maintenance Area, Former Sodium Hydroxide Release Area, Small Log Mill, Pee Wee Mill
- RAU 5: Former Guard Shed UST, Generator Shed Diesel Aboveground Storage Tank
- RAU 6: No identified sources and no previous sampling.
- RAU 7: Chip Area Blower Building, Chip Lift Truck, Area of Paint Waste Discharge to Shannon Slough

Concentrations of COCs may have migrated downgradient from each of these features in groundwater and may have reached the Chehalis River.

The locations of these features are depicted on Figure 2-2. Additional investigation is necessary to evaluate the sources of COCs.

4.2 COCs and Affected Media

The COCs identified for the Property are based on the results of previous investigations as summarized in the preceding sections of this document.

The media of concern for the Property include soil and groundwater, as well as indoor ambient air. For the in-water portion of the Site, the media of potential concern (that may be affected by upland media) are sediments and surface water. Sediments are discussed as part of the in-water RI work plan and groundwater to surface water interactions will be evaluated as described in this upland RI work plan.

4.3 Nature and Extent of Known or Potential Routes of COC Migration

The nature and extent of COCs in soil and groundwater is not adequately defined laterally or vertically. Figures 4-2 and 4-3 show the current understanding of the nature and extent of COCs in soil and groundwater, respectively. Note that Figure 4-2 shows soil exceedances of MTCA A, MTCA B direct contact, or MTCA B protection of groundwater in saturated soils. As described in Section 3.1, soil data collected for the RI may not be screened against MTCA B protection of groundwater in saturated soils if groundwater data from the location is available to empirically demonstrate that measured soil concentrations will not cause an exceedance of the applicable groundwater cleanup levels.

Analytical data from previous investigations is included in Appendix D.

The pathways for migration described below of the COCs will be considered for the RI to evaluate the nature and extent of COCs released at the Property. Potential pathways for the migration of COCs include:

- Leaching from soil to groundwater

- Lateral and vertical transport in groundwater
- Volatilization from soil and/or groundwater to indoor ambient air
- Discharge from groundwater to surface water

4.3.1 Leaching from Soil to Groundwater

Leaching from soil to groundwater as a potential migration pathway will be considered. Unsaturated soil samples will be collected from borings for analysis to fill data gaps associated with the extent of COCs above screening levels.

4.3.2 Lateral and Vertical Transport in Groundwater

Concentrations of COCs above the screening levels have been detected in groundwater. These exceedances are likely the result of lateral and vertical migration of COCs. Lateral and vertical transport of COCs in groundwater is a potential migration pathway and will be assessed in this scope of work.

4.3.3 Volatilization from Soil and/or Groundwater to Indoor Ambient Air

Subslab vapor sampling conducted in 2017 indicated soil gas concentrations at the maintenance shop were not above Ecology vapor intrusion subslab soil gas Method B CULs.

However, vapor intrusion from groundwater may be a migration pathway for contamination of indoor air in buildings located above groundwater with concentrations of VOCs above the action levels established as protective for this exposure pathway. Investigation of groundwater quality will be included in the scope of work for the RI to identify buildings that may have a vapor intrusion exposure pathway.

4.3.4 Discharge from Groundwater to Surface Water

Groundwater at the Property may discharge to surface water in the Chehalis River. The scope of work for the RI will include investigation of the nature and extent of COCs to assess whether the surface water of the Chehalis River has been impacted by releases from the Property. A groundwater/surface water interaction study will be included during the RI to determine tidal influence and groundwater fluctuations associated with tidal shifts.

4.4 Known or Suspected Human and Environmental Receptors

The preliminary CSM developed indicates the following potential receptors to be considered in the evaluation of impacts on human health and the environment. Identified potential receptors include:

- Workers who may contact accessible soil or groundwater during construction/maintenance work currently or in the future.

- Workers who inhale indoor air via vapor intrusion from shallow groundwater or shallow soil currently or in the future.
- Workers, visitors, and aquatic ecological receptors that may be exposed via groundwater discharge to surface water in the Chehalis River.
- Visitors who may contact accessible soil or inhale indoor air in the future.
- Humans who drink groundwater, if groundwater is brought to the surface for this purpose in the future.

These potential receptors have been considered in the RI scope of work.

4.5 Data Gaps

The following data gaps have been identified in the preliminary CSM as necessary information needed to accomplish the goals of the RI and enable the evaluation and selection of a technically feasible cleanup alternative for the Site. These data gaps are:

- The lateral and vertical nature and extent of site-related COCs in soil.
- The lateral and vertical nature and extent of site-related COCs in groundwater.
- The concentrations of COCs in groundwater migrating to the Site from upgradient sources.
- The groundwater flow direction and gradient.
- The potential for site-related COCs in groundwater to interact with surface water of the Chehalis River.
- The locations of underground storage tanks and preferential pathways.
- The presence of hazardous building materials.

5 UPLAND REMEDIAL INVESTIGATION SCOPE OF WORK

This section provides the approach and scope of work for the RI. The scope of work is designed to address the data gaps presented in Section 4.5 and to provide sufficient information to evaluate and select a technically feasible cleanup alternative.

5.1 Project Planning

Project planning is part of the project management task that provides overall management of the RI to ensure that work is performed on schedule and according to specified technical standards. Additional project management activities will include:

- Tracking the performance of each task
- Administering subcontracts
- Preparing quarterly progress reports

The objective of the project planning activities is to develop plans for collecting data and to manage data collection and evaluation throughout the RI. Planning activities conducted during the scoping effort for this RI have resulted in the development of the scope of work for this RI work plan. Project planning process activities to date include:

- Reviewing existing data to identify the conditions in the Site
- Identifying the objectives of the RI
- Preparing project planning documents, including the work plan, HASP, and the SAP, which includes standard operating procedures governing field data collection, sample handling, quality control and assurance procedures, laboratory analytical methods, laboratory quality assurance and quality control requirements, and data analysis

5.2 Remedial Investigation Approach

The RI scope includes a geophysical survey, a soil and groundwater investigation to identify potential impacts that may remain from the Property's historical use, a groundwater/surface water interaction study, and a hazardous buildings material survey.

5.3 Geophysical Survey

A geophysical survey was completed by Pacific Geophysics using ground penetrating radar (GPR) and electromagnetics in October 2019. The geophysical survey was focused in areas that have not formerly been surveyed: RAU3, RAU4, and RAU6. The purpose of the survey was to identify USTs or other infrastructure, interpreted potential sources of contamination, and preferential contaminant migration pathways (e.g., utility corridors and fill areas). The geophysical survey informed the placement of select boring locations as well as cleared all boring locations (for utilities, etc.) prior to drilling as a private utility locate.

The October 2019 geophysical survey report is provided as Appendix E. In summary, no USTs were detected in RAU3, RAU4, or RAU6. Several magnetic anomalies were identified and investigated. Most anomalies were interpreted to be caused by non-three-dimensional or small three-dimensional objects, including surface metal, pipes, concrete pads, or small objects. There were several prominent groups of anomalies that were interpreted to be non-contiguous metallic debris, such as small, individual pieces of ferrous metal.

The following borings (described below in Section 5.4 in greater detail) are proposed to be advanced in the vicinity of these anomalies interpreted as non-contiguous metallic debris: RAU3-03, RAU4-01, RAU4-02, RAU4-12, and RAU6-01.

A summary of the results of previous geophysical surveys conducted in 2015 and 2017 is provided in Table 2-1.

5.4 Proposed Environmental Media Sampling

Table 5-1 details the proposed soil and groundwater samples, including the location ID for the corresponding feature of interest and the soil and groundwater analyses. Figure 5-1 shows the proposed sample locations and Figure 5-2 depicts both the historic sample locations and the proposed sample locations to demonstrate the anticipated sample density and layout at the conclusion of the RI.

In addition to the private utility locate to be conducted by the geophysical surveyor, a public One Call utility locate will also be requested prior to subsurface investigation activities.

All borings are proposed to be advanced to a depth of 10 feet using a direct push probe drilling rig. Actual depths will be based on conditions encountered while drilling. Borings that will be completed as monitoring wells are anticipated to be completed to 15 feet below ground surface. Sample collection (depth and number of samples per boring) will be determined based on field observations, but it is anticipated that one unsaturated soil sample and one groundwater sample will be collected per boring. The unsaturated soil sample is anticipated to be collected within the surface to four feet bgs interval, dependent on field conditions. An additional soil sample may be collected and submitted to the laboratory as archived, pending the results of the initial unsaturated soil sample.

If visual or olfactory indications of impacted media are observed during the fieldwork, additional borings may be advanced beyond those proposed in this work plan to delineate the extent of those impacts. MFA will communicate unanticipated discoveries with the Ecology project manager during the fieldwork.

5.4.1 Remedial Action Unit 1

Sampling and testing of subsurface soil and groundwater at intermediate locations between the maintenance shop and the Chehalis River (RAU1-01 through RAU1-06) is recommended to confirm the extent of TPH contamination previously identified in this area. To delineate the upgradient extent of these TPH impacts, sampling and testing from locations within the maintenance shop building (RAU1-07 and RAU1-08) is required. An additional boring (RAU1-09) south of historical sample point MS02 will help define the upgradient extent of impact near the maintenance shop building. PCP was not detected in the groundwater sample from historical sample B01, which is located approximately 15 feet south of MS02. However, the detection limit was elevated to 10 micrograms per liter, which is well above the MTCA B groundwater direct contact, cancer cleanup level of 0.22 micrograms per liter. Analytes for these soil and groundwater samples from RAU1-01 through RAU1-09 include a combination of diesel-range organic hydrocarbons, metals, VOCs, and SVOCs. Select locations will also be analyzed for dioxins/furans and PCBs, constituents that have been detected in adjacent Chehalis River sediments as well as above screening levels in soil at CR-20 (PCBs and dioxins/furans) and at CR-22 (dioxins/furans). Groundwater from select borings adjacent to the shoreline will also be analyzed for sulfide if wood waste is noted in soil from the boring or if there is a sulfide odor.

To better delineate the extent of previously identified PCP impacts at historical sample points FC01, MS01, MS02, and MS03, additional soil and groundwater sampling and testing north of, and within, the fuel and chemical storage building's hazardous material storage area is recommended (RAU1-10 and RAU1-11). Analytes for these soil and groundwater samples include diesel-range organic hydrocarbons, metals, and SVOCs. Given the proximity to the former wigwam burner, shallow soil from RAU1-10 will be analyzed for dioxins/furans.

TPH-contaminated soil and/or groundwater was also identified around the fuel and chemical storage building. The past presence of a hydraulic-oil aboveground storage tank, a diesel/gas tank (unknown if above or below ground), a hazardous waste storage area (including a blind sump) at/in the northern portion of the building, along with the petroleum storage and related concrete containment on the west/southwest portion of the building represent potential sources of release. Sampling subsurface soil and groundwater within the footprint of this building (RAU1-12) may help pinpoint the sources and/or location of related spills or releases. Previous sampling in this area included VOCs, but not gasoline-range organic hydrocarbons. FC02 had detections of ethylbenzene, suggesting that gasoline-range organic hydrocarbons are a contaminant of concern in the area. Analytes for soil and groundwater samples from RAU1-12 include gasoline-range organic hydrocarbons, diesel-range organic hydrocarbons, metals, VOCs, and SVOCs.

5.4.2 Remedial Action Unit 2

Subsurface sampling at locations north, east, south, and west of PB02 are needed to better understand the extent of TPH impacts in this area (RAU2-01 through RAU2-04). Boring locations are selected to assess potential spills associated with the hydraulic equipment, upgradient oil/water separator, the conveyor line, and, as accessible, areas within the east adjacent building. Moreover, because the integrity of the conveyor trench located north of the planer/grader building is not currently known, additional subsurface soil and groundwater sampling from locations adjacent to the trench are warranted to assess whether leakage from the trench to the surrounding soils has impacted subsurface environmental conditions (RAU2-05 and RAU2-06). Analytes for these soil and groundwater samples include diesel-range organic hydrocarbons, metals, and SVOCs.

Given the absence of PCP in previous samples collected from RAU2, PCP that remains in RAU2 does not appear to be mobile or has naturally attenuated, and remedial actions undertaken appear to be/have been protective of groundwater quality in the area surrounding the building. Testing soil in the samples described above for PCP is necessary to confirm this assumption and provide a more accurate estimate of the volume of soil with PCP concentrations above current cleanup levels. Therefore, soil and groundwater samples in RAU2 include SVOCs in the analyte list.

TPH and total cPAHs impacts to soil were previously identified in the vicinity of the removed Paint Waste UST and beneath the adjacent building. Soil sampling and testing within this building footprint is required to further assess the extent of impacts that may exist beneath this portion of the planer/grader building (RAU2-07). Analytes for RAU2-07 soil and groundwater samples include diesel-range organic hydrocarbons, metals, and PAHs. RAU2-07 will also be analyzed for VOCs because of the potential for solvent use in paint operations.

The area surrounding the former powerhouse and transformer has not been investigated. RAU2-08 is proposed to assess potential spills related to operations at these locations, including a former hydraulic oil UST. Analytes for RAU2-08 soil and groundwater samples include diesel-range organic hydrocarbons, metals, SVOCs, and PCBs. This boring will be completed as a monitoring well for the groundwater/surface water interaction study. This boring location may be shifted dependent on subsurface conditions encountered during drilling.

The area surrounding the former compressor building has not be investigated. RAU2-09 is proposed to assess potential spills related to operations at this location in the vicinity of the pocket beach. Analytes for RAU2-09 soil and groundwater samples include diesel-range organic hydrocarbons, metals, SVOCs, and PCBs. Groundwater from RAU2-09 will also be analyzed for sulfide if wood waste is noted in soil from the boring or if there is a sulfide odor. This boring will be completed as a monitoring well for the groundwater/surface water interaction study.

5.4.3 Remedial Action Unit 3

At the former oil tank and chemical storage shed, previous shallow subsurface soil samples from both OC01 and OC02 were impacted by total cPAHs. Shallow soil samples from the three borings in this area also contained heavy oil-range TPHs; however, they were detected at concentrations below cleanup levels. Sources for these impacts could include the storage shed and tank. Alternatively, given the analytical data, the past use of this area for lumber storage, and that the area was filled over time with materials from unknown sources, heavy equipment used to move lumber and/or the fill material represent potential contaminant sources.

Sampling and testing to further define the extent of previously identified total cPAH and TPH impacts in the vicinity of the former oil tank and chemical storage shed is recommended (RAU3-01 and RAU3-02). Given the open access to this area, the apparently shallow nature of contamination, and the uncertainty regarding sources, this sampling may be best undertaken through test pitting. Test pitting may also be an appropriate approach to better understand the buried "spherical" object identified by a previous geophysical survey. Analytes for soil samples, which are anticipated to be collected from a depth of 3 feet bgs, include diesel-range organic hydrocarbons, metals, and PAHs.

No sampling has been conducted in the western and southern portions of RAU3. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). Four borings proposed for this area (RAU3-03 through RAU3-06) will be placed in the vicinity of features identified from the geophysical survey, adjacent to stormwater features, or adjacent to former buildings to assess potential impacts. Analytes for these soil and groundwater samples include petroleum hydrocarbon identification (HCID) and metals. Depending on the initial results from the HCID, appropriate follow-ups will be analyzed using MTCA Regulation and Statute Table 830-1 (Ecology, 2013), which identifies carcinogenic and noncarcinogenic hazardous substances that may be associated with a release of TPH. Potential follow-ups include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs. Boring RAU3-03 is in the vicinity of a non-contiguous metallic debris anomaly identified from the geophysical survey. This location will be completed as a monitoring well for the groundwater/surface water interaction study.

No sampling has been conducted in the wharf area. Boring RAU3-07 is proposed for this area. Analytes for this soil and groundwater sample include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups will be analyzed using MTCA Regulation and Statute Table 830-1 (Ecology, 2013), which identifies carcinogenic and noncarcinogenic hazardous substances that may be associated with a release of TPH. Potential follow-ups include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs.

5.4.4 Remedial Action Unit 4

Previously identified TPH, metals, and cPAH concentrations at FC03 in groundwater exceeded cleanup levels. Based on this, and the observed free-product in soil and groundwater from this location, additional sampling is warranted to identify the source and extent of these impacts. FC03 was placed northwest, and hydrologically cross- to downgradient of an area where discolored concrete was observed beneath now removed mill equipment, and an aboveground storage tank (the use for which is not currently known) and palletized buckets were present at the time of E&E's drilling, all of which represent potential contamination sources. Historical surface drainage plans detail this equipment as a tray sorter and depict a hydraulic drip pan and oil/water separator in this area. Additional subsurface sampling and testing in this area is required to better delineate the extent and source of impacts in this area (RAU4-01 and RAU4-02). Analytes for these soil and groundwater samples include diesel-range organic hydrocarbons, PAHs, VOCs, and metals. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). Borings RAU4-01 and RAU4-02 are in the vicinity of a non-contiguous metallic debris anomaly identified from the geophysical survey.

No sampling has been conducted in the eastern portion of RAU4. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). There were no USTs identified. One boring is proposed for this area (RAU4-03), to be placed adjacent to Shannon Slough. Analytes for this soil and groundwater sample include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013). This boring will be completed as a monitoring well for the groundwater/surface water interaction study.

Hydraulic oil ASTs were located in the Small Log Mill. A boring (RAU4-04) is proposed for this area to assess potential impacts from the ASTs and other operations in the Small Log Mill. Analytes for this soil and groundwater sample include diesel-range organic hydrocarbons, metals, PAHs, and PCBs.

There was oil storage in the main shipping shed. A boring (RAU4-05) is proposed for this area to assess potential impacts from oil storage and other operations in the main shipping shed. Analytes for this soil and groundwater sample include diesel-range organic hydrocarbons, metals, PAHs, and PCBs.

No sampling has been conducted in the southern portion of RAU4 in the vicinity of the Pee Wee Mill. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). There were no USTs identified. One boring is proposed for this area (RAU4-06), to be placed in the vicinity of the Pee Wee Mill. Analytes for these soil and groundwater samples include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013).

No sampling has been conducted in the northern portion of RAU4. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). There were no USTs identified. Five borings are proposed for this area (RAU4-07 through RAU4-11), to be placed to obtain geographical coverage of the area. Analytes for these soil and groundwater samples include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013). Groundwater from select borings adjacent to the shoreline will also be analyzed for sulfide if wood waste is noted in soil from the boring or if there is a sulfide odor.

No sampling has been conducted in the northeastern portion of RAU4. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). There were no USTs identified, though there were anomalies associated with ferrous debris noted. One boring is proposed for this area (RAU4-12), to be placed in the vicinity of these anomalies adjacent to a catch basin and Shannon Slough. Analytes for this soil and groundwater sample include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013).

Depending on access, select borings for RAU4 may be inside or outside the buildings.

5.4.5 Remedial Action Unit 5

No sampling has been conducted in RAU5. As per Weyerhaeuser Company's responses provided on a March 2000 questionnaire, a UST formerly located adjacent to the guard shed had been removed, although the fill pipe was left in place (Weyerhaeuser Company, 2000). Further documentation on this UST removal and/or related sampling and testing work was not available. This fill pipe was noted at the Property during a site visit conducted by E&E in February 2017. A geophysical survey performed in 2016 identified disturbed soil near the guard shed, but no evidence that a UST remained at this location was encountered. The geophysical survey conducted in October 2019 also confirmed there was no metallic object detected under the asphalt patch in the vicinity of this area (Appendix E). No sampling has been conducted in the vicinity of this former tank. Therefore, subsurface sampling and testing in this area will determine whether there are impacts related to the former UST in this area (RAU5-01).

Also present in RAU5 is a generator shed and diesel aboveground storage tank. Subsurface sampling and testing in this area will identify whether there are impacts in this area (RAU5-02).

Analytes for these soil and groundwater samples include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013).

5.4.6 Remedial Action Unit 6

No sampling has been conducted in RAU6. A geophysical survey was conducted in this area to determine if there were features of interest to be further assessed (Appendix E). There were no USTs identified. Three borings proposed for RAU6 (RAU6-01 through RAU6-03) will be placed in the vicinity of features identified from the geophysical survey, adjacent to the oil/water separator or stormwater catch basin, and in the area adjacent to Shannon Slough to assess potential impacts. Boring RAU6-01 is in the vicinity of a non-contiguous metallic debris anomaly identified from the geophysical survey. Analytes for these soil and groundwater samples include HCID and metals. Depending on the initial results from the HCID, appropriate follow-ups may include diesel-range organic hydrocarbons, gasoline-range organic hydrocarbons, VOCs, PAHs, and PCBs, per MTCA Regulation and Statute Table 830-1 (Ecology, 2013).

Boring RAU6-02 will be completed as a monitoring well for the groundwater/surface water interaction study.

5.4.7 Remedial Action Unit 7

No sampling has been conducted in RAU7. According to the Level 1 ESA conducted in 2010 (PES, 2010), there was a diesel fuel above ground storage tank located within containment at the chip truck lift and a hydraulic oil reservoir for the lift mechanism. Subsurface sampling in the vicinity of these features would determine whether there are impacts due to the use of hydraulic oil and other COCs in this area (RAU7-01 and RAU7-02). Analytes for these soil and groundwater samples include diesel-range organic hydrocarbons, metals, PAHs, and PCBs (only in soil).

5.5 Proposed Groundwater/Surface Water Level Study

Based on the known impacted groundwater and sediment at the Site, MFA proposes completion of a 12-month groundwater/surface water tidal study at the Property. The purpose of this study is to understand the mechanisms and duration of influence between upland groundwater to surface water/sediment. MFA believes a 12-month study will be informative in understanding seasonal variation and influence between the upland and in-water systems at the Site.

The Site is located on the south bank of the estuarine Chehalis River in an area that receives tidal influence from the adjacent Pacific Ocean. It is likely that tidal shifts affect groundwater elevations and groundwater migration at the Site. Groundwater is relatively shallow at the Property (i.e., 4 to 6 feet bgs) and is hydrologically connected to the tidal fluctuations within the adjacent river system.

Historically, a tidal study was conducted at the Site in 1996 (EMCON, 1997). The study was conducted using manual water level measurements over the course of 41 to 67 hours in the spring of 1996 and was focused in the area around the planer/grader building located in RAU2 at the Site where PCP impacts were present. The study monitored eight monitoring wells and found groundwater elevations ranged from approximately 9 to 11 feet bgs at the Property and identified a groundwater gradient flowing from the upland to the river of approximately 0.003 feet/foot within the monitored area and a 0.015 feet/foot gradient between the monitored area and the Chehalis River (EMCON, 1997). EMCON concluded that the groundwater level elevations varied slightly during the tidal variations and did not seem to be significantly affected by diurnal tidal fluctuations, generally showing that groundwater migration was not significantly influenced by tidal variation during the limited time of the study.

Pressure transducers will be installed in five existing monitoring wells as well as five new monitoring wells (see Figure 5-3). The pressure transducers will monitor water level elevations, conductivity, and temperature at a 15-minute interval for the duration of the study. A transducer will also monitor for barometric pressure to provide a correcting feature for the water level measurements. Conductivity and temperature measurements help understand the amount of surface water/groundwater mixing happening at the Site.

The monitoring well network will consist of a north-south transect of six monitoring wells located approximately perpendicular to the Chehalis River (see Figure 5-3). Transducers will be deployed in four monitoring wells along the boundary of the Site to provide a Site-wide indication of groundwater fluctuations. Additionally, a barometric pressure transducer will be installed on the exterior of a building. The barometric pressure transducer is necessary to provide a correction for the non-vented pressure transducers in the wells. A staff gauge will be installed within the river to provide continuous surface water measurements adjacent to the Site. MFA proposes downloading the transducer data approximately every three months, analyzing the data to understand tidal lag, bank storage, tidal efficiency, hydraulic gradient, and hydraulic conductivity, and using the analyses to understand how the tidal variations on the Site may affect contaminant migration between the upland soil and groundwater and river water and sediment. See Appendix F for a work plan for the water level study.

5.6 Proposed Hazardous Building Materials Sampling

Multiple buildings at the Property are slated for reuse or demolition. MFA will conduct a hazardous building material survey on selected buildings slated for demolition (see Figure 5-4). Some buildings have been sampled previously for asbestos-containing materials (ACM), and MFA will confirm the sampling and supplement any additional sampling to support demolition. Lead-based paint (LBP) will be assessed throughout the structures.

5.6.1 Asbestos-Containing Material

Prior to the physical inspection of the buildings, available documentation that may indicate that ACM has been used in the construction and maintenance of the building will be reviewed. This documentation may include:

- Construction, asbestos-related maintenance, and renovation documents such as drawings, specifications, plans, and figures
- On-site inspections and interviews with available building representatives

- Prior asbestos surveys, operation and maintenance plans, asbestos management programs, abatement plans and specifications, and asbestos abatement project records
- Asbestos bulk sampling analytical results

Once all relevant, available documents have been reviewed, accredited inspectors will conduct a physical survey of the buildings. The survey will include, but is not limited to:

- On-site visual inspection of all accessible areas of the building
- Identification of areas of homogeneous material
- Identification of all locations where ACM may be present but cannot be sampled
- Collection of bulk samples of all friable and non-friable suspected ACM, which may include thermal system insulation, surfacing materials, and miscellaneous materials, consistent with Asbestos Hazard Emergency Response Act of 1986 protocol
- Identification of sampling locations on figures and description of samples on the field sampling data sheets
- Submittal of bulk samples to a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP)

Sampling locations will be chosen by the accredited inspections, based on identification of suspected ACM and ability to access those locations. Samples will be extracted using hand tools and will be placed into sealed, labeled sample bags. Upon collection of the bulk sample, the following information will be recorded on the field sampling data sheet:

- Quantity of the material
- Physical condition of the material (assessment category and whether the material is friable)
- Description of the material
- Location of the material

When layers are present in the building material, they will be penetrated and incorporated into each sample. Samples will be sent an NVLAP-accredited laboratory for analysis for asbestos fibers by USEPA polarized light microscopy Method 600/R-93-116.

5.6.2 Lead-Based Paint

Interior and exterior paint coatings will be surveyed using a portable x-ray fluorescence (XRF) device. Sampling locations will be chosen by the inspectors, based on identification of painted surfaces and ability to access those locations. Each color and/or layer identified will be assessed. Generally, if a painted surface has detectable lead, it is considered to be lead-containing. LBP is quantified as paint containing lead concentrations of over 5,000 parts per million (greater than 0.5 percent) as defined by USEPA (40 Code of Federal Regulations 745) and the Washington State Department of Health.

For quality assurance, representative paint chip samples will be collected and submitted for analysis for approximately 5 percent of XRF readings taken. Paint that is observed generally in the same homogeneous area and consisting of visually similar color is assumed to be similar to testing locations and representative of the test result of that color.

Paint chip samples will be placed in sealed, labeled sample bags and sent to a laboratory for analysis by USEPA Method 6020A.

5.6.3 Mercury, Polychlorinated Biphenyls, and Other Materials

A visual survey will be conducted to identify fixtures that may contain mercury, PCBs, and/or other potentially hazardous materials, such as containers with residual hazardous chemicals and mold. Items will be tracked on field sampling data sheets and information such as location of the item, description of the item, and quantity of the item will be recorded.

5.6.4 Pentachlorophenol in Building Materials

PCP was used in the planer/grader building as a spray-on application for anti-sapstain (PES, 2010). Two potential areas of PCP application have been identified in the planer/grader building and will be tested (see Figure 5-4). Concrete flooring and woody debris from each area will be sampled and analyzed for PCP to assess if building debris generated during demolition activities will be considered hazardous waste or Washington State dangerous waste to inform building debris waste disposal. The samples will be analyzed for PCP by USEPA method 8270. Depending on the results of the analysis, a toxicity characteristic leaching procedure analysis for PCP may be completed to inform handling and disposal requirements.

5.7 Additional Technical Assessment

Geotechnical Assessment—A geotechnical assessment of the Property will be conducted to inform the FS by providing information on soil stability and load bearing capacity. The assessment will include borings to provide preliminary geotechnical input related to channel modifications to Shannon Slough and related potential excavations for removal of contaminated soils in the "pocket beach area". In addition, the assessment will provide conceptual-level geotechnical input related to future development of the Site. The Quinault Indian Nation requested that if assessment extends beyond the depth of fill material into native soils, an archaeological monitor should be present to observe the soil. Due to the proposed geotechnical borings being advanced to 25 feet below ground surface, an archaeologist will be present during this assessment activity to observe conditions.

Historical and Cultural Resources Assessment —A study will be conducted to evaluate the potential for Site activities to encounter protected historic and/or archaeological resources and will recommend mitigation strategies if needed. Cultural resources training will be provided to the staff carrying out the environmental field investigations. This training will include reviewing the project's plan and procedures for unanticipated discoveries and the types of cultural resources that may be encountered. The Washington Department of Archaeology and Historic Preservation made the determination on August 5, 2019 of no cultural resource impacts, with the stipulation for an inadvertent discovery plan but no archeological monitor required if assessment activities do not extend beyond the fill material into native soils.

Natural Resources Assessment —A natural resources assessment will be conducted at the Property, which includes Ordinary High Water Mark Determination, Shoreline Habitat Assessment, and Wetland Delineation and Functional Assessment. A critical areas report will be prepared based on the results of the field assessments and delineations. The critical areas report will inform FS evaluation of potential impacts of cleanup options to protected natural resources and environmental permitting requirements.

Topographic Survey—A topographic survey of the Property will be conducted. The survey provides fundamentally important information to be able to accurately delineate contamination relative to ground contours as well as to be able to inform the FS and cleanup design.

Hydraulic and Hydrologic Study—Assessment of sedimentation and hydraulic dynamics will be conducted. The assessments provide fundamentally important information to understand how to design a cleanup that is resilient to climate change and can withstand the tidal conditions and flood flows of the Chehalis River.

6 PROJECT MANAGEMENT PLAN

6.1 Key Personnel

Project management for implementation of this RI work plan, including planning, coordination sampling, documentation, and reporting tasks, will be undertaken by MFA. All project work will be supervised by a Washington-registered geologist employed at MFA. MFA will use subcontractors for various activities, including sampling and laboratory services.

The roles and responsibilities of project leadership and management, as well as stakeholders and contractors involved with this project, are presented below.

GRAYS HARBOR HISTORICAL SEAPORT AUTHORITY

Brandi Bednarik, Executive Director—Ms. Bednarik will be the lead contact with GHHSA and other governmental agencies. She will be responsible for providing policy guidance to the consulting team. Ms. Bednarik will ensure that the project team is aware of and focuses on the key issues of importance to GHHSA and the community. She will be the point person for communications with the public and media.

MFA CONSULTING TEAM

Emily Hess, MFA Project Manager—Ms. Hess will be the primary point of contact between GHHSA and other governmental agencies, as well as the project team for each of the tasks. Ms. Hess will be responsible for day-to-day coordination of the project team. She will be the nexus for integrating environmental due diligence and redevelopment planning. Ms. Hess will be responsible for drafting monthly project updates and tracking budget and for ensuring the quality of work products, project schedule, and budget.

ASSESSMENT SERVICES

Philip Nerenberg, Apex Laboratories, LLC, Lab Director—Apex Laboratories, LLC, will be the primary laboratory contracted for the analysis of environmental media including soil and aqueous matrices. Kent Patton is the Apex quality assurance manager who will coordinate and provide laboratory analytical services in accordance with its laboratory quality assurance manual and other project-related communications. Dioxin/furan analyses will be subcontracted to Cape Fear Analytical out of Wilmington, North Carolina.

Nikos Tzetos, Pacific Geophysics—Mr. Tzetos will conduct a geophysical survey and will utilize GPR and/or electromagnetics to determine if USTs, and/or ancillary piping, are present. The geophysical survey will inform the placement of select boring locations as well as clear all boring locations for utilities as a private utility locate.

Dale Smith, Holt Services, Inc., Project Manager—Holt Services, Inc. will be the drilling contractor. On-site personnel will have completed any applicable Occupational Safety and Health Administration training and will be required to comply with all site safety requirements covered in the HASP. The drilling contractor will also be responsible for developing and implementing their own HASP.

Rob Ross, Zipper Geo Associates, LLC, Principal—Mr. Ross will conduct a geotechnical assessment of the Property.

Margaret Berger, Cultural Resource Consulting, Principal—Ms. Berger will conduct the cultural resources assessment of the Site.

Scott Maharry, Grette Associates, LLC, Project Manager—Mr. Maharry will conduct the natural resources assessment for the Site.

Hari Sharma, Berglund, Schmidt & Associates, Inc., Project Manager—Mr. Sharma will conduct a topographic survey of the Property.

Larry Karpack, Watershed Science & Engineering, Project Manager—Mr. Karpack will conduct sedimentation and hydraulic assessments for the Site.

6.2 Schedule

The following is the anticipated schedule:

Task	Start Date	Completion
Complete draft RI work plan	Not applicable.	August 2019
Geophysical survey	After completion of the draft work plan and upon Ecology approval.	October 2019
Complete final RI work plan	Receipt of Ecology comments on draft work plan.	December 2019
Fieldwork	After completion of the final work plan. Time frame includes fieldwork and laboratory analyses and appropriate follow-up analysis.	December 2019
Draft RI report	After completion of fieldwork and receipt of final data packages.	March 2020
Final RI report	Receipt of Ecology comments on draft RI report.	April 2020
Draft FS report	After completion of RI report.	May 2020
Final FS report	Receipt of Ecology comments on draft FS report.	June 2020
Draft interim cleanup action plan	After completion of FS report.	July 2020

The time frames for the work to be performed may change, based on changes to the scope of work and issues involving site access, and are subject to subcontractor availability and Ecology approval.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLES

MAUL FOSTER ALONGI

Table 2-1
Upland Remedial Action Unit Summary
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

	RAU 1	RAU 2	RAU 3	RAU 4	RAU 5	RAU 6	RAU 7
Buildings	- Maintenance Shop - Fuel and Chemical Storage Building	- Planer/Grader Building - Powerhouse - Compressor Building	- Storage Shed	- Small Log Mill - Pee Wee Mill - Main Shipping Shed	- Guard Shed - Generator Building - Office	None	- Chip Area Blower Building
Features	- 900-Gallon, Single Wall Hydraulic Tank - Nested USTs and Oil/Water Separator - Location of Current Hydraulic and Historic Diesel/Gas ASTs - Hazardous Waste Storage Area - Petroleum/Drum Storage	- Hydraulic Unit with Drip Pad - Oil/water Separator - Former Paint Waste UST - Transformer Pad - Pentachlorophenol Application	- Former Kilns - Former Oil Tank & Chemical Storage Shed - Former Green Chain Building	- Oil/Water Separator - Tray Sorter - Hydraulic Unit with Drip Pan - Former Vehicle Maintenance Area - Former NaOH Release Area	- Former Guard Shed UST - Water Tank - Generator Shed Diesel AST - Aberdeen Pad Transformer	None	- Chip Lift Truck - Shannon Slough - Area of Paint Waste Discharge
Recognized Environmental Concerns	- Contaminated subsurface soil and groundwater near the Maintenance Shop	- Contaminated subsurface soil and groundwater near the Former Planer/Grader Building - Contaminated subsurface soil and groundwater near the Former Paint Waste UST	- Unknown condition of soil and groundwater near the Former Oil Tank & Chemical Storage Shed	- Unknown conditions of soil and groundwater near Pee Wee Mill and oil storage area near the southeast corner of the Main Shipping Shed	- Area of an AST associated with an on-site backup generator - Reportedly decommissioned UST that had been located on the northern side of the Guard Shed	None	- Unknown condition of soil and groundwater near the Chip Area Blower Building - Unknown conditions from the former sawmill located on the eastern adjacent property, near the chip lift truck
Previous Geophysical Investigations	- Geophysical Survey (2015) around maintenance shop identified nine anomalies as potential USTs - Geophysical Survey (2017) around fuel and chemical storage building identified anomalies likely associated with utilities/piping	None	- Geophysical Survey (2017) around former oil tank and chemical storage shed tentatively identified buried spherical object as potential UST	None	- Geophysical Survey (2015) around Guard Shed identified anomalies likely associated with utilities/piping	None	None
Previous Remedial Actions	- Removal of USTs in 1970s and 1980s	- Cleanup of PCP-impacted soil conducted in the early 1990s - Paint Waste UST removal in 1991	None	None	- Guard Shed UST removal (unknown date)	None	None
TBA 2017 Soil/Groundwater Investigations	- TPH-impacted soil and groundwater, as well as free-product - Groundwater contained concentrations of PCP in excess of SLVs - PCP and TPH impacts in soil and groundwater from the Fuel and Chemical Storage Building	- Heavy oil-range TPH in soil and groundwater and PAH impacts in soil - PCP impacted soil and groundwater	- PAH impacts in soil - TPH impacts in soil were below SLVs	- Metals exceedances in soil from former NaOH Release Area and former Vehicle Maintenance Area	Not Assessed	Not Assessed	Not Assessed

MAUL FOSTER ALONGI

Table 2-1
Upland Remedial Action Unit Summary
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

	RAU 1	RAU 2	RAU 3	RAU 4	RAU 5	RAU 6	RAU 7
RI/FS Work Plan Investigation Approach	- Identify lateral extent of TPH contamination that extends from the Maintenance Shop north to the Chehalis River shoreline - Confirm isolated hot spots of TPH contamination in shallow soils - Determine source of PCP groundwater impacts - Identify the sources and/or locations of spills or releases from Fuel and Chemical Storage Building, including gasoline. Delineate the extent and source of impacts - Assess fill material	- Assess potential spills associated with the hydraulic equipment, upgradient oil/water separator, the conveyor line, and areas within the east adjacent building - Subsurface soil and groundwater sampling from locations adjacent to the trench to assess potential impacts - Sampling for PCP to provide more accurate estimate of volume of soil with PCP concentrations above current cleanup levels - Assess fill material	- Define extent of impacts in the vicinity of former Oil Tank & Chemical Storage Shed using test pitting - Conduct geophysical survey to identify any features of interest. Advance borings in vicinity of these features - If no features of interest identified, advance borings adjacent to stormwater features - Assess fill material	- Define extent and source of impacts in the Tray Sorter area - Assess potential impacts from transformer, former hydraulic oil USTs, and oil storage area - Conduct geophysical survey to identify any features of interest; advance borings in vicinity of these features - If no features of interest identified, advance boring adjacent to former Pee Wee Mill and waterward of mills to assess potential impacts - Assess fill material	- Assess potential impacts from former UST at Guard Shack and former diesel AST at Generator Shed.	- Conduct geophysical survey to identify any features of interest; advance borings in vicinity of these features - If no features of interest identified, advance borings adjacent to catch basin and oil/water separator	- Assess potential spills associated with hydraulic equipment in the Chip Area Blower Building
Site-wide Investigation Approach	- Deploy transducers in 10 monitoring wells and river gauge for a Chehalis River/Groundwater tidal influence study (~12 month deployment). Objective is to understand groundwater/surface water interaction and potential fate and transport for contaminants in upland soil/groundwater and in-water woody debris. Focus on existing well network within core area of contamination as well as a few wells on site boundary. Will inform design and removal decisions. - Additional technical services: natural resources assessment, geotechnical assessment, cultural resources assessment						
Proposed Hazardous Building Materials Survey	- Fuel and Chemical Storage Building	- Planer/Grader Building	- Storage Shed	- Pee Wee Mill - Main Shipping Shed	None	None	None
Future Development Plans	Convert the former Maintenance Shop to an educational/interpretive center	Construction of a hotel, restaurant, brewery, or other similar attraction(s)	Construction of a hotel, restaurant, brewery, or other similar attraction(s)	Outside of the areas targeted for the most immediate redevelopment efforts	Near-term redevelopment is not expected to occur	Outside of the areas targeted for the most immediate redevelopment efforts	Outside of the areas targeted for the most immediate redevelopment efforts

NOTES:
AST = aboveground storage tank.
EMCON = EMCON Northwest, Inc.
NaOH = sodium hydroxide.
PAH = polycyclic aromatic hydrocarbon.
PCP = pentachlorophenol.
RAU = remedial action unit.
RI/FS = remedial investigation and feasibility study.
SLV = screening level value.
TBA = Targeted Brownfields Assessment, conducted by Ecology & Environment in 2017.
TPH = total petroleum hydrocarbon.
UST = underground storage tank.

MAUL FOSTER ALONGI

Table 3-1
Soil Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	MTCA A	MTCA B			Background Metals
			Non-Cancer	Cancer	Protect of GW (Saturated)	
Total Metals		mg/kg				
Arsenic	7440-38-2	20	24	0.67	0.15	8.47
Cadmium	7440-43-9	2	80	--	0.035	0.1
Chromium	16065-83-1	2000[a]	120000[a]	--	24000[a]	78.5
Copper	7440-50-8	--	3,200	--	14	52.9
Lead	7439-92-1	250	--	--	150	10.9
Manganese	7439-96-5	--	3,700	--	--	691.8
Mercury	7439-97-6	2	--	--	0.1	--
Nickel	7440-02-0	--	1,600	--	6.5	54.2
Zinc	7440-66-6	--	24,000	--	300	85.6
Hexavalent Chromium	18540-29-9	19	--	240	0.93	--
Petroleum Hydrocarbons		mg/kg				
Gasoline-range organics	NA	30/100[b]	--	--	--	--
Diesel-range organics	NA	2,000	--	--	--	--
Lube-oil-range organics	NA	2,000	--	--	--	--
VOCs		ug/kg				
1,1,1,2-Tetrachloroethane	630-20-6	--	2,400,000	38,000	--	--
1,1,1-Trichloroethane	71-55-6	2,000	160,000,000	--	84	--
1,1,2,2-Tetrachloroethane	79-34-5	--	1,600,000	5000	0.08	--
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	76-13-1	--	2,400,000,000	--	--	--
1,1,2-Trichloroethane	79-00-5	--	320,000	18,000	1.8	--
1,1-Dichloroethane	75-34-3	--	16,000,000	180,000	2.6	--
1,1-Dichloroethene	75-35-4	--	4,000,000	--	2.5	--
1,1-Dichloropropene	563-58-6	--	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	--	--	--	--	--
1,2,3-Trichloropropane	96-18-4	--	320,000	33	--	--
1,2,4-Trichlorobenzene	120-82-1	--	800,000	34,000	29	--
1,2,4-Trimethylbenzene	95-63-6	--	800,000	--	--	--
1,2-Dibromo-3-chloropropane	96-12-8	--	16,000	1300	--	--
1,2-Dibromoethane	106-93-4	5	720,000	500	--	--
1,2-Dichlorobenzene	95-50-1	--	7,200,000	--	400	--
1,2-Dichloroethane	107-06-2	--	480,000	11,000	1.6	--
1,2-Dichloropropane	78-87-5	--	3,200,000	27,000	1.7	--
1,3,5-Trimethylbenzene	108-67-8	--	800,000	--	--	--
1,3-Dichlorobenzene	541-73-1	--	--	--	--	--
1,3-Dichloropropane	142-28-9	--	2,400,000	10000	0.14	--
1,4-Dichlorobenzene	100-25-4	--	5,600,000	190000	68	--
2,2-Dichloropropane	594-20-7	--	--	--	--	--
2-Butanone	78-93-3	--	48,000,000	--	--	--
2-Chlorotoluene	95-49-8	--	1,600,000	--	--	--
2-Hexanone	591-78-6	--	400,000	--	--	--
4-Chlorotoluene	95-49-8	--	--	--	--	--
4-Isopropyltoluene	99-87-6	--	--	--	--	--
4-Methyl-2-pentanone	108-10-1	--	6,400,000	--	--	--

Analyte	CAS #	MTCA A	MTCA B			Background Metals
			Non-Cancer	Cancer	Protect of GW (Saturated)	
Acetone	67-64-1	--	72,000,000	--	2,100	--
Benzene	71-43-2	30	320,000	18,000	1.7	--
Bromobenzene	108-86-1	--	--	640,000	33	--
Bromochloromethane	74-97-5	--	--	--	--	--
Bromodichloromethane	75-27-4	--	1,600,000	16,000	2.4	--
Bromoform	75-25-2	--	1,600,000	130,000	23	--
Bromomethane	74-83-9	--	110,000	--	3.3	--
Carbon disulfide	75-15-0	--	8,000,000	--	270	--
Carbon tetrachloride	56-23-5	--	320,000	140,00	2.2	--
Chlorobenzene	108-90-7	--	1,600,000	--	51	--
Chloroethane	75-00-3	--	--	--	--	--
Chloroform	67-66-3	--	800,000	32,000	4.8	--
Chloromethane	74-87-3	--	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	--	--	160	0.0052	--
cis-1,3-Dichloropropene	10061-01-5	--	--	--	--	--
Dibromochloromethane	124-48-1	--	1,600,000	12,000	1.8	--
Dibromomethane	74-95-3	--	800,000	--	--	--
Dichlorodifluoromethane	75-71-8	--	16,000,000	--	--	--
Ethylbenzene	100-41-4	6,000	8,000,000	--	340	--
Hexachlorobutadiene	87-68-3	--	80,000	13,000	30	--
Isopropylbenzene	98-82-8	--	8,000,000	--	--	--
m,p-Xylene	1330-20-7	--	--	--	--	--
Methyl tert-butyl ether	1634-04-4	100	--	560,000	7.2	--
Methylene chloride	75-09-2	20	480,000	500,000	1.5	--
Naphthalene	91-20-3	5,000	1,600,000	--	240	--
n-Butylbenzene	104-51-8	--	4,000,000	--	--	--
n-Propylbenzene	103-65-1	--	8,000,000	--	--	--
o-Xylene	95-47-6	--	16,000,000	--	840	--
sec-Butylbenzene	135-98-8	--	8,000,000	--	--	--
Styrene	100-42-5	--	16,000,000	--	120	--
tert-Butylbenzene	98-06-6	--	8,000,000	--	--	--
Tetrachloroethene	127-18-4	50	480,000	480,000	2.8	--
Tetrahydrofuran	109-99-9	--	72,000,000	--	--	--
Toluene	108-88-3	7,000	6,400,000	--	270	--
trans-1,2-Dichloroethene	156-60-5	--	1,600,000	--	32	--
trans-1,3-Dichloropropene	10061-02-6	--	2,400,000	10,000	0.14	--
Trichloroethene	79-01-6	30	40,000	12,000	1.5	--
Trichlorofluoromethane	75-69-4	--	24,000,000	--	--	--
Vinyl chloride	75-01-4	--	240,000	670	0.089	--
SVOCs		ug/kg				
1,2,4-Trichlorobenzene	120-82-1	--	800,000	34,000	29	--
1,2-Dichlorobenzene	95-50-1	--	7,200,000	--	400	--
1,2-Dinitrobenzene	528-29-0	--	8,000	--	--	--
1,3-Dichlorobenzene	541-73-1	--	--	--	--	--
1,3-Dinitrobenzene	99-65-0	--	8,000	--	--	--
1,4-Dichlorobenzene	106-46-7	--	5,600,000	190,000	68	--

MAUL FOSTER ALONGI

Table 3-1
Soil Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	MTCA A	MTCA B			Background Metals
			Non-Cancer	Cancer	Protect of GW (Saturated)	
1,4-Dinitrobenzene	100-25-4	--	8,000	--	--	--
1-Methylnaphthalene	90-12-0	--	5,600,000	34,000	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	--	2,400,000	--	--	--
2,3,5,6-Tetrachlorophenol	935-95-5	--	--	--	--	--
2,3,5-Trimethylnaphthalene	2245-38-7	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	8,000,000	--	1,500	--
2,4,6-Trichlorophenol	98-06-2	--	8,000,000	--	1,500	--
2,4-Dichlorophenol	120-83-2	--	240,000	--	10	--
2,4-Dimethylphenol	105-67-9	--	1,600,000	--	79	--
2,4-Dinitrophenol	51-28-5	--	160,000	--	9.2	--
2,4-Dinitrotoluene	121-14-2	--	160,000	3,200	0.11	--
2,6-Dimethylnaphthalene	581-42-0	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	--	24,000	670	0.021	--
2-Chloronaphthalene	91-58-7	--	6,400,000	--	--	--
2-Chlorophenol	95-57-8	--	400,000	--	27	--
2-Methylnaphthalene	91-57-6	--	320,000	--	--	--
2-Methylphenol	95-48-7	--	4,000,000	--	150	--
2-Nitroaniline	88-74-4	--	800,000	--	--	--
2-Nitrophenol	88-75-5	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	--	--	2,200	0.2	--
3+4-Methylphenol(s)	NA	--	4,000,000	--	--	--
3-Nitroaniline	99-09-2	--	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	--	6,400	--	--	--
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	--	8,000,000	--	--	--
4-Chloroaniline	106-47-8	--	320,000	5,000	0.077	--
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	--
4-Nitroaniline	100-01-6	--	320,000	--	--	--
4-Nitrophenol	100-02-7	--	--	--	--	--
Acenaphthene	83-32-9	--	4,800,000	--	5,000	--
Acenaphthylene	208-96-8	--	--	--	--	--
Aniline	62-53-3	--	560,000	180,000	--	--
Anthracene	120-12-7	--	24,000,000	--	110,000	--
Azobenzene	103-33-3	--	--	9,100	--	--
Benz(a)anthracene	56-55-3	--	--	--	--	--
Benzidine	92-87-5	--	240,000	4.3	--	--
Benzo(a)pyrene	50-32-8	100	24,000	190	190	--
Benzo(b)fluoranthene	205-99-2	--	--	--	--	--
Benzo(b+k)fluoranthene(s)	NA	--	--	--	--	--
Benzo(e)pyrene	192-97-2	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	--
Benzo(k)fluoranthene	207-08-9	--	--	--	--	--
Benzoic acid	65-85-0	--	320,000,000	--	18,000	--
Benzyl alcohol	100-51-6	--	8,000,000	--	--	--
Biphenyl	92-52-4	--	--	--	--	--
Bis(2-Chloroethoxy) methane	111-91-1	--	--	--	--	--

Table 3-1
Soil Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	MTCA A	MTCA B			Background Metals
			Non-Cancer	Cancer	Protect of GW (Saturated)	
Bis(2-Chloroethyl) ether	111-44-4	--	--	910	0.014	--
Bis(2-Chloroisopropyl) ether	39638-32-9	--	--	--	--	--
Bis(2-Ethylhexyl) adipate	103-23-1	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	--	1,600,000	71,000	670	--
Butyl benzyl phthalate	85-68-7	--	16,000,000	530,000	650	--
Carbazole	86-74-8	--	--	--	--	--
Chrysene	218-01-9	--	--	--	--	--
Dibenz(a,h)anthracene	53-70-3	--	--	--	--	--
Dibenzofuran	132-64-9	--	80,000	--	--	--
Diethylphthalate	84-66-2	--	64,000,000	--	4,700	--
Dimethylphthalate	131-11-3	--	--	--	--	--
Di-n-butylphthalate	84-74-2	--	8,000,000	--	3,000	--
Di-n-octyl phthalate	117-84-0	--	800,000	--	13,000,000	--
Fluoranthene	206-44-0	--	3,200,000	--	32,000	--
Fluorene	86-73-7	--	3,200,000	--	5,100	--
Hexachlorobenzene	118-74-1	--	64,000	630	44	--
Hexachlorobutadiene	87-68-3	--	80,000	13,000	30	--
Hexachlorocyclopentadiene	77-47-4	--	480,000	--	9,600	--
Hexachloroethane	67-72-1	--	56,000	25,000	2.3	--
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	--	--	--
Isophorone	78-59-1	--	16,000,000	1,100,000	15	--
Naphthalene	91-20-3	5,000	1,600,000	--	240	--
Nitrobenzene	98-95-3	--	160,000	--	6.5	--
N-Nitrosodimethylamine	62-75-9	--	640	20	--	--
N-Nitroso-di-n-propylamine	621-64-7	--	--	140	0.0039	--
N-Nitrosodiphenylamine	86-30-6	--	--	200,000	28	--
Pentachlorophenol	87-86-5	--	400,000	2,500	0.88	--
Perylene	198-55-0	--	--	--	--	--
Phenanthrene	85-01-8	--	--	--	--	--
Phenol	108-95-2	--	24,000,000	--	760	--
Pyrene	129-00-0	--	2,400,000	--	33,000	--
Pyridine	110-86-1	--	80,000	--	--	--
cPAH TEQ	NA	100	24,000	190	190	--
PCBs		ug/kg				
Aroclor 1016	12674-11-2	--	5,600	14,000	--	--
Aroclor 1221	11104-28-2	--	--	--	--	--
Aroclor 1232	11141-16-5	--	--	--	--	--
Aroclor 1242	53469-21-9	--	--	--	--	--
Aroclor 1248	12672-29-6	--	--	--	--	--
Aroclor 1254	11097-69-1	--	1,600	500	--	--
Aroclor 1260	11096-82-5	--	--	500	--	--
Aroclor 1262	37324-23-5	--	--	--	--	--
Aroclor 1268	11100-14-4	--	--	--	--	--
Total PCBs	1336-36-3	1000	500	--	--	--

MAUL FOSTER ALONGI

Table 3-1
Soil Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	MTCA A	MTCA B			Background Metals
			Non-Cancer	Cancer	Protect of GW (Saturated)	
Dioxins/Furans		pg/g				
2,3,7,8 - TCDF	51207-31-9	--	--	--	--	--
1,2,3,7,8 - PeCDF	57117-41-6	--	--	--	--	--
2,3,4,7,8 - PeCDF	57117-31-4	--	--	--	--	--
1,2,3,4,7,8 - HxCDF	70648-26-9	--	--	--	--	--
1,2,3,6,7,8 - HxCDF	57117-44-9	--	--	--	--	--
2,3,4,6,7,8 - HxCDF	72918-21-9	--	--	--	--	--
1,2,3,7,8,9 - HxCDF	60851-34-5	--	--	--	--	--
1,2,3,4,6,7,8, - HpCDF	67562-39-4	--	--	--	--	--
1,2,3,4,7,8,9 - HpCDF	55673-89-7	--	--	--	--	--
OCDF	39001-02-0	--	--	--	--	--
2,3,7,8 - TCDD	1746-01-6	--	93	13	--	--
1,2,3,7,8 - PeCDD	40321-76-4	--	--	--	--	--
1,2,3,4,7,8 - HxCDD	39227-28-6	--	--	--	--	--
1,2,3,6,7,8 - HxCDD	57653-85-7	--	--	--	--	--
1,2,3,7,8,9 - HxCDD	19408-74-3	--	--	160	--	--
1,2,3,4,6,7,8 - HpCDD	35822-46-9	--	--	--	--	--
OCDD	3268-87-9	--	--	--	--	--
Dioxin/Furan TEQ	NA	--	93	13	--	--

NOTES:

Yellow highlighted cells are used to indicate the lowest regulatory criteria value for the given matrix, selected from soil MTCA Method A unrestricted land use, MTCA Method B (the lower of available cancer or non-cancer value), and MTCA Method B protection of groundwater in saturated soil. Natural background values developed by Ecology for the Western Washington (i.e., "Group W") region are included for comparison to metal concentrations.

-- = no associated screening level.

CAS = Chemical Abstracts Services.

cPAH = carcinogenic polycyclic aromatic hydrocarbon.

mg/kg = milligram per kilogram.

MTCA = Model Toxic Control Act.

NA = not applicable.

PCBs = polychlorinated biphenyls.

pg/g = picogram per gram.

SVOCs = semivolatile organic compounds.

TEQ = toxic equivalent.

ug/kg = micrograms per kilogram.

VOCs = volatile organic compounds.

[(a)] Value is for Chromium III.

[(b)] Clean up level is for gasoline-range organics with benzene present/gasoline-range organics with no detectable benzene.

Table 3-2
Groundwater and Surface Water Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	Groundwater					Surface Water								
		MTCA A	MTCA B				MTCA B		Aquatic Life Fresh Water				Human Health Fresh Water		
			Non-Cancer	Cancer	Protective of VI Non-Cancer	Protective of VI Cancer	Non-Cancer	Cancer	Acute 173-201A WAC	Acute CWA §304	Chronic 173-201A WAC	Chronic CWA §304	173-201A WAC	40 CFR 131.45	CWA §304
Total and Dissolved Metals		ug/L					ug/L								
Arsenic	7440-38-2	5	4.8	0.058	--	--	18	0.098	360	340	190	150	10	0.018	0.018
Cadmium	7440-43-9	5	8	--	--	--	41	--	3.7	1.8	1	0.72	--	--	--
Chromium	16065-83-1	50	24,000[(a)]	--	--	--	240000	--	550 [(a)]	570 [(a)]	180 [(a)]	74 [(a)]	--	--	--
Copper	7440-50-8	--	640	--	--	--	2900	--	17	--	11	--	1300	--	1300
Lead	7439-92-1	15	--	--	--	--	--	--	65	65	2.5	2.5	--	--	--
Manganese	7439-96-5	--	750	--	--	--	--	--	--	--	--	--	--	--	50
Mercury	7439-97-6	2	--	--	0.29	--	--	--	2.1	1.4	0.012	0.77	--	--	--
Nickel	7440-02-0	--	320	--	--	--	1100	--	1400	470	160	52	150	80	610
Zinc	7440-66-6	--	4,800	--	--	--	17000	--	110	120	100	120	2300	1000	7400
Hexavalent Chromium	18540-29-9	--	48	--	--	--	490	--	15	16	10	11	--	--	--
Petroleum Hydrocarbons		ug/L					ug/L								
Gasoline-range organics	NA	800/1000[(b)]	--	--	--	--	--	--	--	--	--	--	--	--	--
Diesel-range organics	NA	500	--	--	--	--	--	--	--	--	--	--	--	--	--
Lube-oil-range organics	NA	500	--	--	--	--	--	--	--	--	--	--	--	--	--
VOCs		ug/L					ug/L								
1,1,1,2-Tetrachloroethane	630-20-6	--	240	1.7	--	7.4	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71-55-6	200	16,000	--	5500		930000	--	--	--	--	--	47000	20000	10000
1,1,2,2-Tetrachloroethane	79-34-5	--	160	0.22		6.2	10000	6.5	--	--	--	--	0.12	0.1	0.2
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	76-13-1	--	240,000	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79-00-5	--	32	0.77	4.6	7.9	2300	25	--	--	--	--	0.44	0.35	0.55
1,1-Dichloroethane	75-34-3	--	1,600	7.7		11	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	75-35-4	--	400		130	--	23000	--	--	--	--	--	1200	700	300
1,1-Dichloropropene	563-58-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	87-61-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichloropropane	96-18-4	--	32	0.0015	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	120-82-1	--	80	1.5	--	--	230	2	--	--	--	--	0.12	0.036	0.071
1,2,4-Trimethylbenzene	95-63-6	--	80	--	240	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	96-12-8	--	1.6	0.055	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	106-93-4	0.01	72	0.022	270	0.27	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	--	720	--	2,600	--	--	--	--	--	--	--	2000	700	1000
1,2-Dichloroethane	107-06-2	5	48	0.48	140	4.2	13000	59	--	--	--	--	9.3	8.9	9.9
1,2-Dichloropropane	78-87-5	--	320	1.2	28	10	25000	43	--	--	--	--	0.71	--	0.9
1,3,5-Trimethylbenzene	108-67-8	--	80	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	541-73-1	--	--	--	--	--	--	--	--	--	--	--	13	2	7
1,3-Dichloropropane	142-28-9	--	--	--	--	--	41000	34	--	--	--	--	--	--	--
1,4-Dichlorobenzene	100-25-4	--	560	8.1	7,900	4.9	3300	22	--	--	--	--	460	200	300
2,2-Dichloropropane	594-20-7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	78-93-3	--	4,800	--	1,700,000	--	--	--	--	--	--	--	--	--	--
2-Chlorotoluene	95-49-8	--	160	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	591-78-6	--	40	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorotoluene	95-49-8	--	160	--	--	--	--	--	--	--	--	--	--	--	--

Table 3-2
Groundwater and Surface Water Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	Groundwater					Surface Water								
		MTCA A	MTCA B				MTCA B		Aquatic Life Fresh Water				Human Health Fresh Water		
			Non-Cancer	Cancer	Protective of VI Non-Cancer	Protective of VI Cancer	Non-Cancer	Cancer	Acute 173-201A WAC	Acute CWA §304	Chronic 173-201A WAC	Chronic CWA §304	173-201A WAC	40 CFR 131.45	CWA §304
4-Isopropyltoluene	99-87-6	--		--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	108-10-1	--	640	--	470,000	--	--	--	--	--	--	--	--	--	--
Acetone	67-64-1	--	7,200	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	71-43-2	5	32	0.8	100	2.4	2000	23	--	--	--	--	0.44	--	0.58
Bromobenzene	108-86-1	--	64	--	620	--	--	--	--	--	--	--	--	--	--
Bromochloromethane	74-97-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	75-27-4	--	160	0.95	--	1.8	14000	28	--	--	--	--	0.77	0.73	0.95
Bromoform	75-25-2	--	160	5.5	--	200	14000	220	--	--	--	--	5.8	4.6	7
Bromomethane	74-83-9	--	11	--	--	--	970	--	--	--	--	--	520	300	100
Carbon disulfide	75-15-0	--	800	--	400	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	56-23-5	--	32	0.63	62	0.56	550	4.9	--	--	--	--	0.2	--	0.4
Chlorobenzene	108-90-7	--	160	--	290	--	5000	--	--	--	--	--	380	100	100
Chloroethane	75-00-3	--	--	--	18,000	--	--	--	--	--	--	--	--	--	--
Chloroform	67-66-3	--	80	1.4	490	1.2	6900	56	--	--	--	--	260	100	60
Chloromethane	74-87-3	--	--	--	150	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	--	16	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	10061-01-5	--	240	0.44	23	1.6	--	--	--	--	--	--	--	--	--
Dibromochloromethane	124-48-1	--	160	0.52	--	--	14000	21	--	--	--	--	0.65	0.6	0.8
Dibromomethane	74-95-3	--	80	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	75-71-8	--	1,600	--	5.6	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	700	800	--	--	--	6900	--	--	--	--	--	200	29	68
Hexachlorobutadiene	87-68-3	--	8	0.56	--	0.81	930	30	--	--	--	--	0.69	0.01	0.01
Isopropylbenzene	98-82-8	--	800	--	720	--	--	--	--	--	--	--	--	--	--
m,p-Xylene	1330-20-7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-butyl ether	1634-04-4	20	--	24	86,000	600	--	--	--	--	--	--	--	--	--
Methylene chloride	75-09-2	5	48	22	4,800	4,400	17000	3600	--	--	--	--	16	10	20
Naphthalene	91-20-3	160	160	--	170	8.9	4900	--	--	--	--	--	--	--	--
n-Butylbenzene	104-51-8	--	400	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	103-65-1	--	800	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	95-47-6	--	1,600	--	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	135-98-8	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	100-42-5	--	1,600	--	8,200	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	98-06-6	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	127-18-4	5	48	21	46	24	500	100	--	--	--	--	4.9	2.4	10
Tetrahydrofuran	109-99-9	--	7,200	--		--	--	--	--	--	--	--	--	--	--
Toluene	108-88-3	1,000	640	--	15,000	--	19000	--	--	--	--	--	180	72	57
trans-1,2-Dichloroethene	156-60-5	--	160	--	--	--	33000	--	--	--	--	--	600	200	100
trans-1,3-Dichloropropene	10061-02-6	--	240	0.44	23	1.6	--	--	--	--	--	--	--	--	--
Trichloroethene	79-01-6	5	4	0.54	3.8	1.5	120	13	--	--	--	--	0.38	0.3	0.6
Trichlorofluoromethane	75-69-4	--	2,400	--	120	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75-01-4	0.2	24	0.029	57	0.35	6600	3.7	--	--	--	--	0.02	--	0.022

Table 3-2
Groundwater and Surface Water Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	Groundwater					Surface Water									
		MTCA A	MTCA B				MTCA B		Aquatic Life Fresh Water				Human Health Fresh Water		
			Non-Cancer	Cancer	Protective of VI Non-Cancer	Protective of VI Cancer	Non-Cancer	Cancer	Acute 173-201A WAC	Acute CWA §304	Chronic 173-201A WAC	Chronic CWA §304	173-201A WAC	40 CFR 131.45	CWA §304
SVOCs		ug/L					ug/L									
1,2,4-Trichlorobenzene	120-82-1	--	80	1.5	39	--	--	--	--	--	--	--	0.12	0.036	0.071
1,2-Dichlorobenzene	95-50-1	--	720	--	2,600	--	4200	--	--	--	--	--	2000	700	1000
1,2-Dinitrobenzene	528-29-0	--	1.6	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	541-73-1	--	--	--	--	--	--	--	--	--	--	--	13	2	7
1,3-Dinitrobenzene	99-65-0	--	1.6	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	106-46-7	--	560	8.1	7,900	4.9	3300	22	--	--	--	--	460	200	300
1,4-Dinitrobenzene	100-25-4	--	1.6		--	--	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	90-12-0	--	560	1.5	--	--	--	--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	58-90-2	--	480	--	--	--	--	--	--	--	--	--	--	--	--
2,3,5,6-Tetrachlorophenol	935-95-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,3,5-Trimethylnaphthalene	2245-38-7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	800	--	--	--	--	--	--	--	--	--	--	--	300
2,4,6-Trichlorophenol	98-06-2	--	8	4	--	--	17	3.9	--	--	--	--	0.25	--	1.5
2,4-Dichlorophenol	120-83-2	--	24	--	--	--	190	--	--	--	--	--	25	10	10
2,4-Dimethylphenol	105-67-9	--	160	--	--	--	550	--	--	--	--	--	85	--	100
2,4-Dinitrophenol	51-28-5	--	32	--	--	--	3500	--	--	--	--	--	60	30	10
2,4-Dinitrotoluene	121-14-2	--	32	0.28	--	--	1400	5.5	--	--	--	--	0.039	--	0.049
2,6-Dimethylnaphthalene	581-42-0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	--	4.8	0.058	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	91-58-7	--	640	--	--	--	1000	--	--	--	--	--	170	100	800
2-Chlorophenol	95-57-8	--	40	--	--	--	97	--	--	--	--	--	15	--	30
2-Methylnaphthalene	91-57-6	--	32	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	95-48-7	--	400	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	88-74-4	--	160	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	88-75-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	--	--	0.19	--	--	--	--	--	--	--	--	0.0031	--	0.049
3+4-Methylphenol(s)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	99-09-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	--	1.3	--	--	--	--	--	--	--	--	--	7.1	3	2
4-Bromophenyl phenyl ether	101-55-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	--	1,600	--	--	--	--	--	--	--	--	--	36	--	500
4-Chloroaniline	106-47-8	--	32	0.22	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	7005-72-3	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitroaniline	100-01-6	--	64	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100-02-7	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	--	960	--	--	--	640	--	--	--	--	--	110	30	70
Acenaphthylene	208-96-8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aniline	62-53-3	--	56	7.7	--	--	--	--	--	--	--	--	--	--	--
Anthracene	120-12-7	--	4,800	--	--	--	26000	--	--	--	--	--	3100	100	300
Azobenzene	103-33-3	--	--	0.8	--	--	--	--	--	--	--	--	--	--	--
Benz(a)anthracene	56-55-3	--	--	--	--	--	--	--	--	--	--	--	0.014	0.00016	0.0012
Benzidine	92-87-5	--	48	0.00038	--	--	89	0.00032	--	--	--	--	--	--	--

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Table 3-2
Groundwater and Surface Water Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	Groundwater					Surface Water								
		MTCA A	MTCA B				MTCA B		Aquatic Life Fresh Water				Human Health Fresh Water		
			Non-Cancer	Cancer	Protective of VI Non-Cancer	Protective of VI Cancer	Non-Cancer	Cancer	Acute 173-201A WAC	Acute CWA §304	Chronic 173-201A WAC	Chronic CWA §304	173-201A WAC	40 CFR 131.45	CWA §304
Benzo(a)pyrene	50-32-8	0.1	4.8	0.023	--	--	--	--	--	--	--	--	0.0014	0.000016	0.00012
Benzo(b)fluoranthene	205-99-2	--	--	--	--	--	--	--	--	--	--	--	0.014	0.00016	0.0012
Benzo(b+k)fluoranthene(s)	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	192-97-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	191-24-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	207-08-9	--	--	--	--	--	--	--	--	--	--	--	0.014	0.0016	0.012
Benzoic acid	65-85-0	--	64,000	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	100-51-6	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Biphenyl	92-52-4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-Chloroethoxy) methane	111-91-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-Chloroethyl) ether	111-44-4	--	--	0.04	--	26	--	0.85	--	--	--	--	0.02	--	0.03
Bis(2-Chloroisopropyl) ether	39638-32-9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-Ethylhexyl) adipate	103-23-1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl)phthalate	117-81-7	--	320	6.3	--	--	400	3.6	--	--	--	--	0.23	0.045	0.32
Butyl benzyl phthalate	85-68-7	--	3,200	46	--	--	1300	8.2	--	--	--	--	0.56	0.013	0.1
Carbazole	86-74-8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	218-01-9	--	--	--	--	--	--	--	--	--	--	--	1.4	0.016	0.12
Dibenz(a,h)anthracene	53-70-3	--	--	--	--	--	--	--	--	--	--	--	0.0014	0.000016	0.00012
Dibenzofuran	132-64-9	--	16	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzothiophene	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	84-66-2	--	13,000	--	--	--	28000	--	--	--	--	--	4200	200	600
Dimethylphthalate	131-11-3	--		--	--	--	--	--	--	--	--	--	92000	600	2000
Di-n-butylphthalate	84-74-2	--	1,600	--	--	--	2900	--	--	--	--	--	450	8	20
Di-n-octyl phthalate	117-84-0	--	160	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	206-44-0	--	640	--	--	--	90	--	--	--	--	--	16	6	20
Fluorene	86-73-7	--	640	--	--	--	3500	--	--	--	--	--	420	10	50
Hexachlorobenzene	118-74-1	--	13	0.055	--	--	0.24	0.00047	--	--	--	--	0.000051	0.000005	0.000079
Hexachlorobutadiene	87-68-3	--	8	0.56	--	0.81	930	30	--	--	--	--	0.69	0.01	0.01
Hexachlorocyclopentadiene	77-47-4	--	48	--	--	--	3600	--	--	--	--	--	150	1	4
Hexachloroethane	67-72-1	--	5.6	1.1	190	3.1	21	1.9	--	--	--	--	0.11	0.02	0.1
Indeno(1,2,3-cd)pyrene	193-39-5	--	--	--	--	--	--	--	--	--	--	--	0.014	0.00016	0.0012
Isophorone	78-59-1	--	1,600	46			120000	1600	--	--	--	--	27	--	34
Naphthalene	91-20-3	160	160	--	170	8.9	4900	--	--	--	--	--	--	--	--
Nitrobenzene	98-95-3	--	16	--	10000	160	1800	--	--	--	--	--	55	30	10
N-Nitrosodimethylamine	62-75-9	--	0.064	0.00086	--	--	800	4.9	--	--	--	--	0.00065	--	0.00069
N-Nitroso-di-n-propylamine	621-64-7	--		0.013	--	--	--	9.7	--	--	--	--	0.62	--	3.3
N-Nitrosodiphenylamine	86-30-6	--		18	--	--	--	0.82	--	--	--	--	0.0044	--	0.005
Pentachlorophenol	87-86-5	--	80	0.22	--	--	1200	1.5	20	19	13	15	0.046	0.002	0.03
Perylene	198-55-0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	85-01-8	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	108-95-2	--	2,400	--	--	--	560000	--	--	--	--	--	18000	9000	4000
Pyrene	129-00-0	--	480	--	--	--	2600	--	--	--	--	--	310	8	20
Pyridine	110-86-1	--	8	--	--	--	--	--	--	--	--	--	--	--	--
cPAH TEQ	NA	0.1	4.8	0.023	--	--	26	0.035	--	--	--	--	--	--	--

Table 3-2
Groundwater and Surface Water Regulatory Criteria
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Analyte	CAS #	Groundwater					Surface Water								
		MTCA A	MTCA B				MTCA B		Aquatic Life Fresh Water				Human Health Fresh Water		
			Non-Cancer	Cancer	Protective of VI Non-Cancer	Protective of VI Cancer	Non-Cancer	Cancer	Acute 173-201A WAC	Acute CWA §304	Chronic 173-201A WAC	Chronic CWA §304	173-201A WAC	40 CFR 131.45	CWA §304
PCBs		ug/L					ug/L								
Aroclor 1016	12674-11-2	--	1.1	1.3	--	--	0.0058	0.003	--	--	--	--	--	--	--
Aroclor 1221	11104-28-2	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	11141-16-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1242	53469-21-9	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	12672-29-6	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	11097-69-1	--	0.32	0.044	--	--	0.0017	0.0001	--	--	--	--	--	--	--
Aroclor 1260	11096-82-5	--	--	0.044	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1262	37324-23-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1268	11100-14-4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	1336-36-3	0.1	--	0.044	--	--	--	0.0001	2	--	0.014	0.014	0.00017	0.000007	0.000064
Conventionals		ug/L					ug/L								
Sulfide	18496-25-8	--	--	--	--	--	--	--	--	--	--	--	--	--	--

NOTES:
Yellow highlighted cells are used to indicate the lowest regulatory criteria value for the given matrix.
§ = section.
-- = no associated screening level.
CAS = Chemical Abstracts Services.
CFR = Code of Federal Regulations.
cPAH = carcinogenic polycyclic aromatic hydrocarbon.
CWA = Clean Water Act.
mg/kg = milligram per kilogram.
MTCA = Model Toxic Control Act.
NA = not applicable.
PCBs = polychlorinated biphenyls.
pg/kg = picogram per kilogram.
SVOCs = semivolatile organic compounds.
TEQ = toxic equivalent.
TPH = total petroleum hydrocarbons.
ug/L = micrograms per liter.
USEPA = U.S. Environmental Protection Agency.
VI = vapor intrusion.
VOCs = volatile organic compounds.
WAC = Washington Administrative Code.
[a] Value is for Chromium III.
[b] Clean up level is for gasoline-range organics with benzene present/gasoline-range organics with no detectable benzene .

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

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RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[a]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU1	Maintenance Shop	RAU1-01	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs PCBs	Dx Metals SVOCs Sulfide[b] VOCs	Confirm extent of contamination between Maintenance Shop and Chehalis River. Dioxins, PCBs, and VOCs at select locations.
		RAU1-02	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs PCBs	Dx Metals SVOCs Sulfide[b] VOCs	
		RAU1-03	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
		RAU1-04	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs PCBs Dioxins/furans	Dx Metals SVOCs VOCs	
		RAU1-05	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs PCBs Dioxins/furans	Dx Metals SVOCs VOCs	
		RAU1-06	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs Dioxins/furans	Dx Metals SVOCs VOCs	

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[a]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU1	Maintenance Shop	RAU1-07	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs VOCs	Dx Metals SVOCs VOCs	Confirm extent of contamination in vicinity of Maintenance Shop.
		RAU1-08	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
		RAU1-09	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals VOCs SVOCs	Dx Metals VOCs SVOCs	Identify upgradient extent of impact near Maintenance Shop.
	Hazardous Waste Storage Area	RAU1-10	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs Dioxins/furans	Dx Metals SVOCs	Confirm extent of contamination within Hazardous Waste Storage Area. Assess if dioxin impacts from former Wigwam Burner.
		RAU1-11	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	Confirm extent of contamination within Hazardous Waste Storage Area.
	Fuel and Chemical Storage Building	RAU1-12	Unsaturated Soil (1) Groundwater (1)	10	Dx Gx Metals VOCs SVOCs	Dx Gx Metals VOCs SVOCs	Identify potential source of spills or releases within Fuel and Chemical Storage Building.

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[a]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU2	Hydraulic Equipment	RAU2-01	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	Assess potential spills related to hydraulic equipment, upgradient oil/water separator, conveyor line, and areas within the east adjacent building.
		RAU2-02	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
		RAU2-03	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
		RAU2-04	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
	Planer Conveyor Trench	RAU2-05	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	Assess potential leakage from conveyor trench to surrounding soils.
		RAU2-06	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs	Dx Metals SVOCs	
	Paint Waste UST	RAU2-07	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals VOCs PAHs	Dx Metals VOCs PAHs	Assess extent of impacts beneath the Planer/Grader Building.
	Powerhouse & Transformer	RAU2-08	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs PCBs	Dx Metals SVOCs PCBs	Assess potential spills related to Powerhouse/Transformer, and former hydraulic oil USTs. Complete as monitoring well for tidal study.
	Compressor Building/Pocket Beach	RAU2-09	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals SVOCs PCBs	Dx Metals SVOCs PCBs Sulfide[b]	Assess potential spills related to former Compressor Building and pocket beach. Complete as monitoring well for tidal study.

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[(a)]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU3	Former Oil Tank & Chemical Storage Shed	RAU3-01	Test Pit Soil (1)	3	Dx Metals PAHs	--	Define extent of impacts in the vicinity of the former Oil Tank & Chemical Storage Shed.
		RAU3-02	Test Pit Soil (1)	3	Dx Metals PAHs	--	
	Geophysical Survey Anomaly and Stormwater Feature	RAU3-03	Unsaturated Soil (1) Groundwater (1)	10	HCID[(c)] Metals	HCID[(c)] Metals	Assess non-contiguous metallic debris anomaly identified from geophysical survey and potential impacts from stormwater feature. Complete as monitoring well for tidal study.
	Catch Basin	RAU3-04	Unsaturated Soil (1) Groundwater (1)	10	HCID[(c)] Metals	HCID[(c)] Metals	Assess potential impacts from stormwater catch basin.
	Former Green Chain Building	RAU3-05	Unsaturated Soil (1) Groundwater (1)	10	HCID[(c)] Metals	HCID[(c)] Metals	Assess potential impacts from former green chain building.
	Western Area	RAU3-06	Unsaturated Soil (1) Groundwater (1)	10	HCID[(c)] Metals	HCID[(c)] Metals	Assess whether any impacts in western area.
	Wharf Area	RAU3-07	Unsaturated Soil (1) Groundwater (1)	10	HCID[(c)] Metals	HCID[(c)] Metals	Assess whether any impacts in wharf area.
RAU4	Geophysical Survey Anomaly and Tray Sorter	RAU4-01	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs VOCs	Dx Metals PAHs VOCs	Delineate extent and source of impacts in the Tray Sorter area. Assess non-contiguous metallic debris anomaly identified from geophysical survey.
		RAU4-02	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs VOCs	Dx Metals PAHs VOCs	

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[a]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU4	Eastern Area near Shannon Slough	RAU4-03	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts along eastern area near Shannon Slough. Complete as monitoring well for tidal study.
	Former Hydraulic Oil ASTs in Small Log Mill	RAU4-04	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs PCBs	Dx Metals PAHs PCBs	Assess potential impacts from hydraulic oil ASTs at the Small Log Mill.
	Oil Storage in Main Shipping Shed	RAU4-05	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs PCBs	Dx Metals PAHs PCBs	Assess potential impacts from oil storage in Main Shipping Shed.
	Pee Wee Mill	RAU4-06	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts from former Pee Wee Mill.
	Northern Area	RAU4-07	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts from operations waterward of mills.
		RAU4-08	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	
		RAU4-09	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	
		RAU4-10	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals Sulfide[b]	
		RAU4-11	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals Sulfide[b]	
	Geophysical Survey Anomaly, Catch Basin, and Shannon Slough	RAU4-12	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess metallic debris anomaly identified from geophysical survey and potential impacts from catch basin in vicinity of Shannon Slough.

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

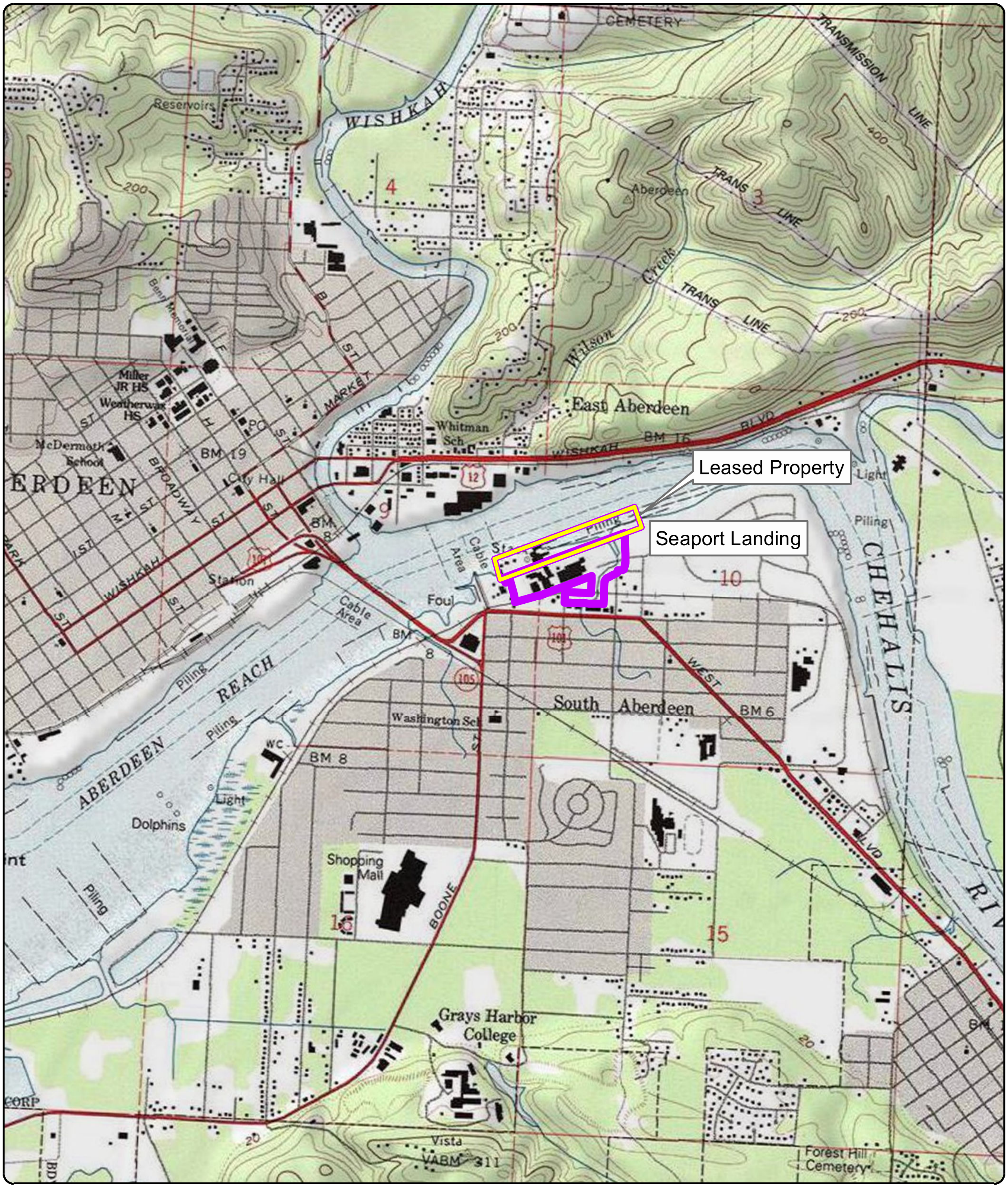
RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[a]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU5	Former Guard Shack UST	RAU5-01	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts from former UST at the Guard Shack. Expanded analyte list because no previous data in vicinity.
	Generator Shed & Diesel AST	RAU5-02	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts from former diesel AST at Generator Shed. Expanded analyte list because no previous data in vicinity.
RAU6	Geophysical Survey Anomaly and Oil/Water Separator	RAU6-01	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess non-contiguous metallic debris anomaly identified from geophysical survey and potential impacts from oil/water separator.
	Catch Basin	RAU6-02	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess potential impacts from stormwater catch basin. Complete as monitoring well for tidal study.
	Southeastern Area Adjacent to Shannon Slough	RAU6-03	Unsaturated Soil (1) Groundwater (1)	10	HCID[c] Metals	HCID[c] Metals	Assess whether any impacts on southeastern area adjacent to Shannon Slough.

Table 5-1
Proposed Upland Sampling Locations and Analyses
Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

RAU	Feature of Interest	Location ID	Sample Type	Boring Depth (feet bgs)[(a)]	Unsaturated Soil Analysis	Groundwater Analysis	Notes
RAU7	Chip Area Blower Building	RAU7-01	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs PCBs	Dx Metals PAHs	Assess potential impacts from former hydraulic oil AST at the Chip Area Blower Building. Expanded analyte list because no previous data in vicinity.
		RAU7-02	Unsaturated Soil (1) Groundwater (1)	10	Dx Metals PAHs PCBs	Dx Metals PAHs	

NOTES:
-- = not applicable.
AST = aboveground storage tank.
bgs = below ground surface.
CUL = cleanup level.
Dx = diesel-range and heavy oil-range total petroleum hydrocarbons.
Gx = gasoline-range total petroleum hydrocarbons.
HCID = hydrocarbon identification.
Metals = arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc.
MTCA = Model Toxics Control Act.
PAH = polycyclic aromatic hydrocarbon.
PCB = polychlorinated biphenyl.
RAU = remedial action unit.
SVOC = semi-volatile organic compound.
TBA = Targeted Brownfields Assessment by Ecology and Environment, Inc.
UST = underground storage tank.
VOC = volatile organic compound.
[(a)]Proposed boring depths are approximate. Actual depths will be based on conditions encountered while drilling. Monitoring wells are anticipated to be completed to 15 feet bgs.
[(b)]If wood waste is noted in soil from the boring or if there is a sulfide odor, groundwater from the boring will be analyzed for sulfide.
[(c)]Follow-up analyses will be determined using MTCA Regulation and Statute Table 830-1, based on certain carcinogenic and noncarcinogenic hazardous substances that may be associated with a release of total petroleum hydrocarbons.

FIGURES



Site Address: 500 North Custer Street, Aberdeen, Washington
Source: US Geological Survey (1990) 7.5-minute topographic quadrangle: Aberdeen
Section 9 & 10, Township 17 North, Range 9 West

Approximate Aquatic Lease Area

Seaport Authority Property

Figure 1-1
Property Location

Aberdeen, Washington

GRAYS HARBOR HISTORICAL SEAPORT

0 1,000 2,000
Feet

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Path: X:\1044.02.06\Projects\Fig1_1_PropertyLocation.mxd
Print Date: 8/28/2019
Approved By:
Produced By: jputnam
Project: 1044.02.06

Source: Aerial photograph obtained from Esri ArcGIS Online.
Notes:
1. MHHW = mean higher high waterline.
2. RAU = remedial action unit.

Legend

Approximate MHHW

Remedial Action Unit Boundaries

- RAU1
- RAU2
- RAU3
- RAU4
- RAU5
- RAU6
- RAU7

Figure 2-1
Remedial Action Unit Boundaries
Aberdeen, Washington

GRAYS HARBOR HISTORICAL SEAPORT

0 100 200
Feet

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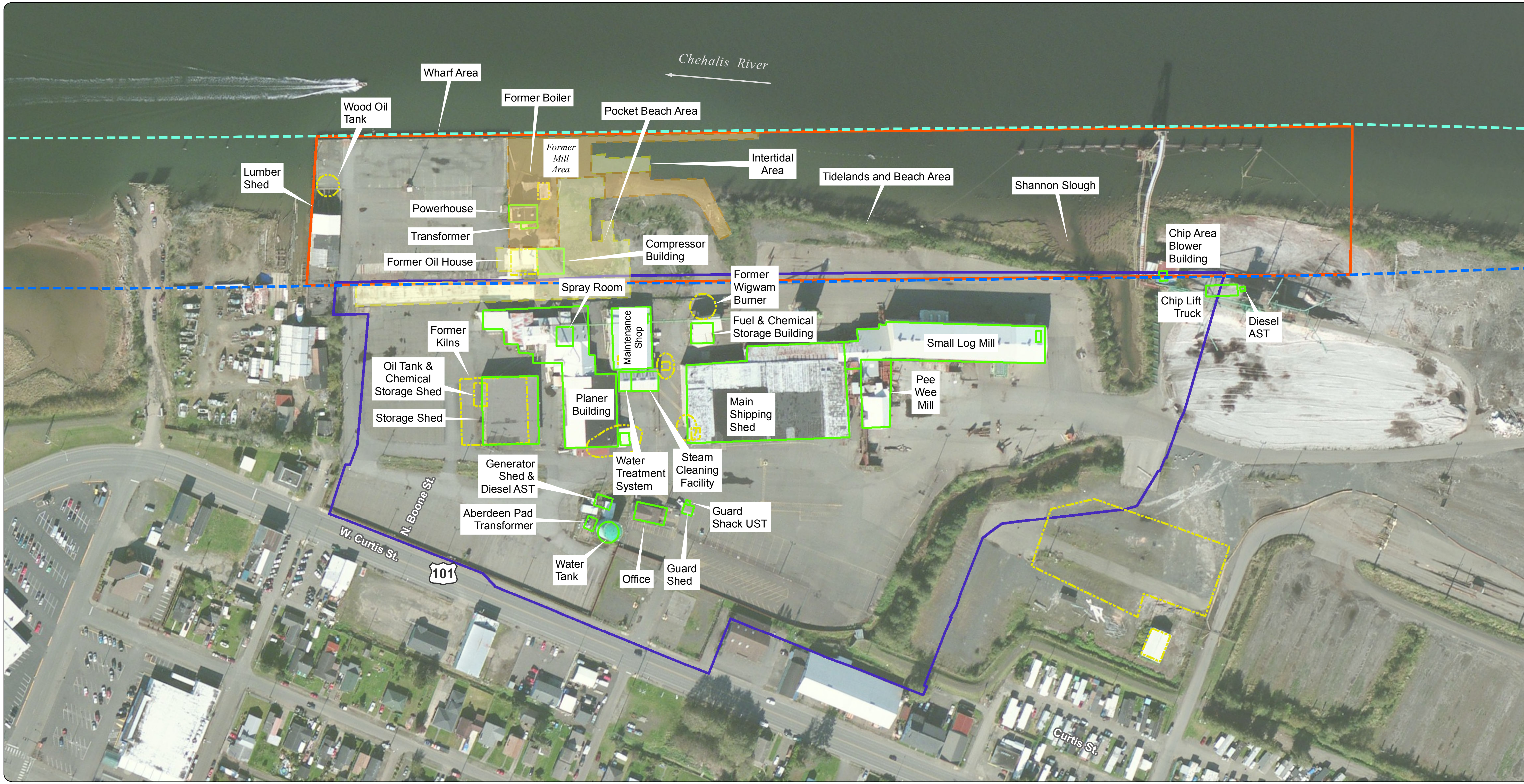

Source:
Aerial photograph obtained from Esri ArcGIS Online.
Parcels and roads obtained from Grays Harbor County.
Harbor lines obtained from Washington Dept. of Natural Resources.
Former features from Level I Environmental Site Assessment, PES Environmental; August 13, 2010.

Legend

- Former Mill
- Former Wharf Extension
- Existing Buildings/Features
- Former Buildings/Features
- Inner Harbor Line
- Outer Harbor Line
- Seaport Authority Property
- Leased Property Area

0 100 200
Feet

GRAYS HARBOR HISTORICAL SEAPORT

Figure 2-2
Historical and Current Property Features
Aberdeen, Washington

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Source: Aerial photograph obtained from Esri ArcGIS Online.
Notes:
1. MHHW = mean higher high waterline.

Legend

Approximate MHHW
Monitoring Well Locations

Figure 2-3
Monitoring Well Locations
Aberdeen, Washington

0 100 200
Feet

GRAYS HARBOR HISTORICAL SEAPORT

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Print Date: 8/28/2019
Approved By:
Produced By: jputnam
Project: 1044.02.06

Source: Aerial photograph obtained from Esri ArcGIS Online.

Notes:
1. E&E = Ecology & Environment, Inc.
2. MHHW = mean higher high waterline.
3. RAU = remedial action unit.

Legend

Approximate MHHW

E&E 2018 Sample Locations

MFA 2015 Upland Samples

Remedial Action Unit Boundaries

RAU1
RAU2
RAU3
RAU4
RAU5
RAU6
RAU7

0 100 200
Feet

GRAYS HARBOR HISTORICAL SEAPORT

Figure 2-4
Historical Sampling Locations
Aberdeen, Washington

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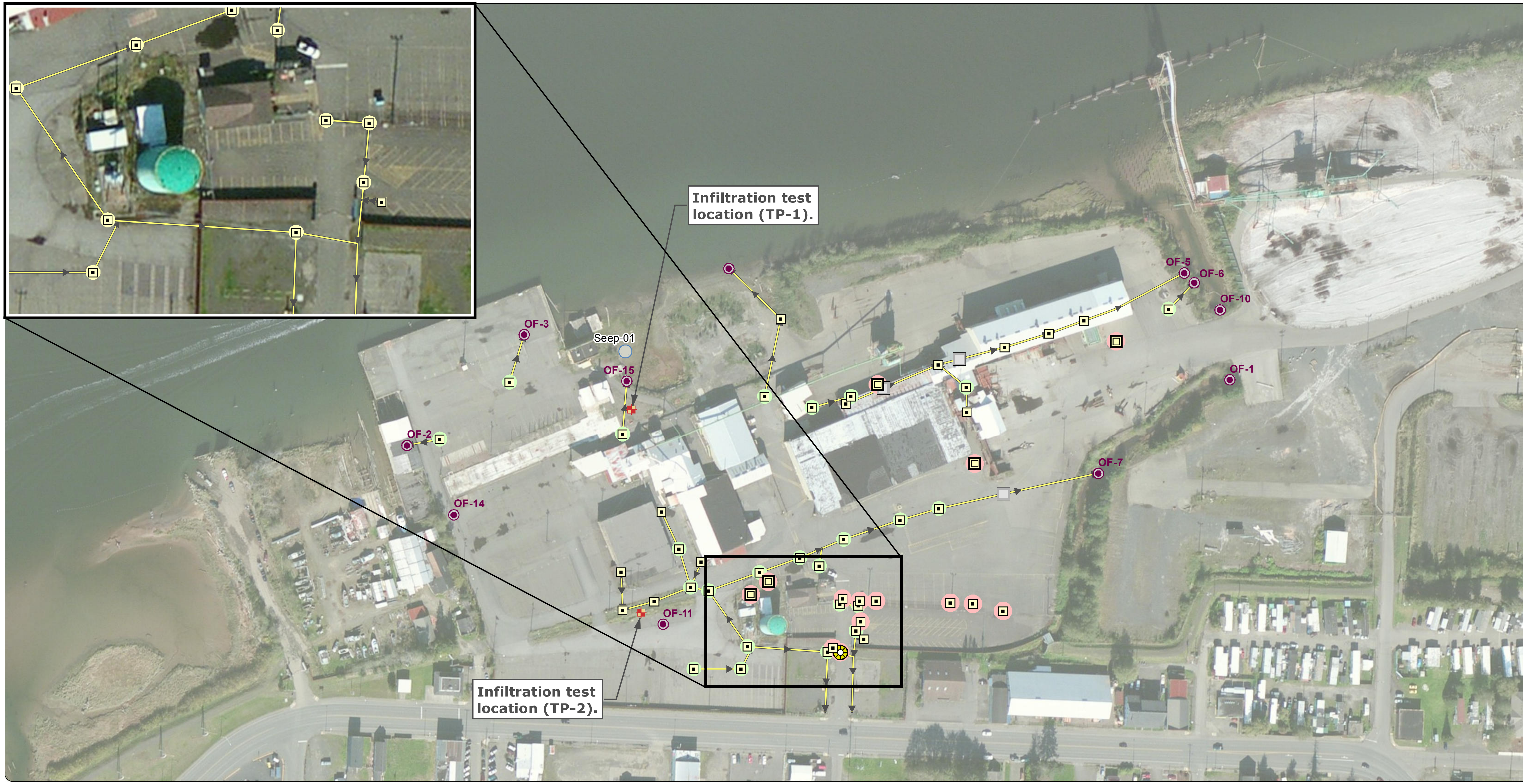
Path: X:\1044.02.06\Projects\Fig2_Historical Sampling Locationsv2.mxd Print Date: 8/28/2019 Approved By: Produced By: jputnam Project: 1044.02.06

Path: X:\1044.02.01-02 Grays Harbor Seaport Authority\Projects\Fig2-2_Surface Drainage Features.mxd



Source: Aerial photograph obtained from Esri ArcGIS Online; 1993 stormwater features digitized from Level I Environmental Site Assessment report, Appendix A-2 (PES Environmental, Inc., 2010); 2000 stormwater features digitized from plan set of existing storm drainage system and grading and drainage plan prepared by Berglund, Schmidt, and Assoc., Inc.

Legend

- Catch Basin
- Electrical Vault
- Sanitary Manhole
- Drain Pipe (with flow direction)
- Infiltration Test Location (10/27/15)
- Oil/Water Separator
- Outfall (field verified)
- Verified
- GPS located

Note: All features are approximate.

0 100 200
Feet

Figure 2-5
Surface Drainage Features
Aberdeen, Washington

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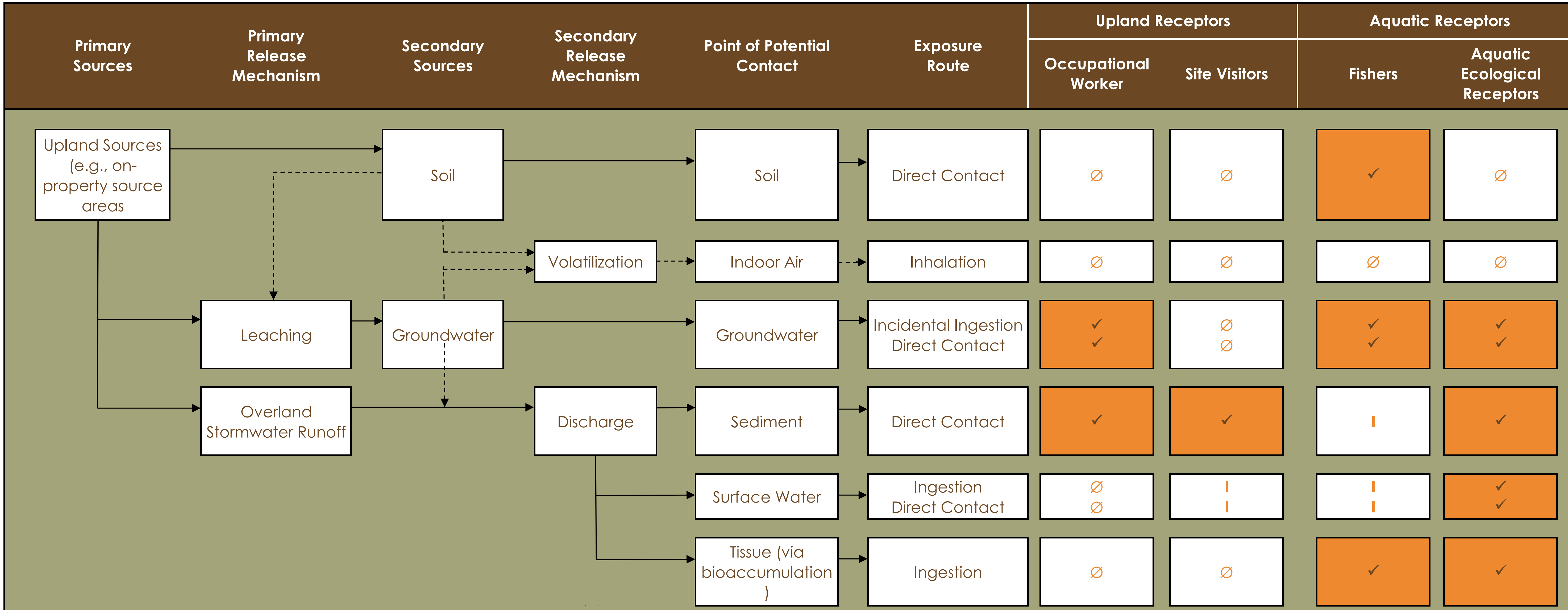
Print Date: 02/17/2016
Approved By: mnovak
Produced By: jmiller
Project: 1044.02.02-01

Figure 4-1
Preliminary Conceptual Site Model
Seaport Landing
Aberdeen, Washington



Notes:

Aquatic ecological receptors include aquatic plants, benthos, fish, and piscivorous birds, shorebirds, and mammals.

Terrestrial receptors include terrestrial plants, invertebrates, and animals.

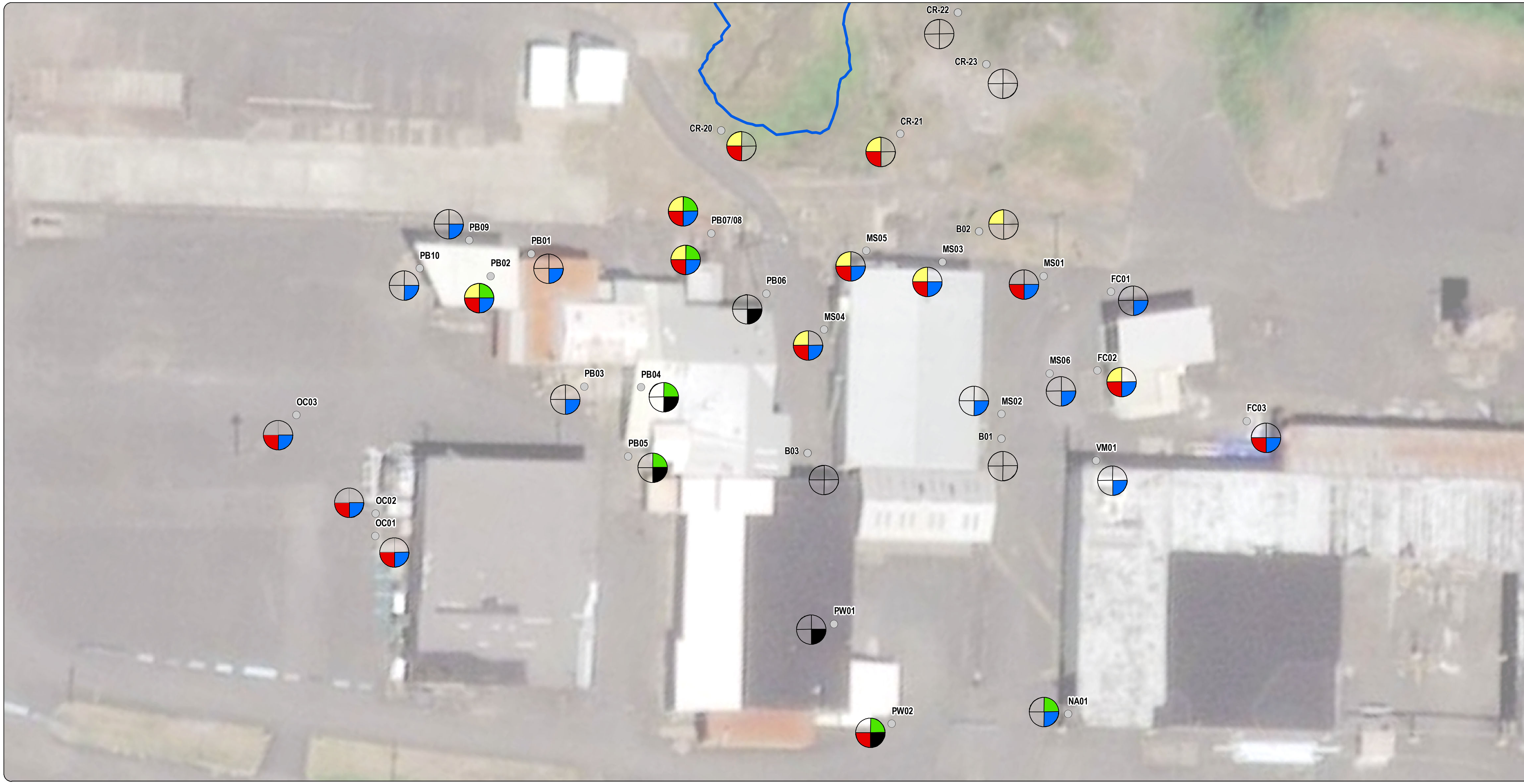
Primary pathway ⟶

Insignificant pathway - - →

Potentially complete exposure route ✓

Incomplete exposure route ∅

Insignificant exposure route I



Source: Aerial photograph obtained from Esri ArcGIS Online.

Notes:

FC02 has an exceedance for volatile organic compounds. CR-20 has an exceedance for polychlorinated biphenyls. CR-20 and CR-22 had exceedances for dioxin toxicity equivalence quotient. No other locations analyzed for these analytes had exceedances.

Soil from boring location exceeds Washington Department of Ecology Model Toxics Control Act Method A/B Direct Contact Cleanup Levels or Soil Protection of Groundwater, Saturated.

MHHW = mean higher high waterline.

Legend

Approximate MHHW

Boring Sample

Semivolatile Organic Compounds

Metals

Polycyclic Aromatic Hydrocarbons

Diesel- and/or Lube Oil-Range Hydrocarbons

Not Analyzed

Figure 4-2
Chemical Exceedances in Soil
Aberdeen, Washington

0 50 100
Feet

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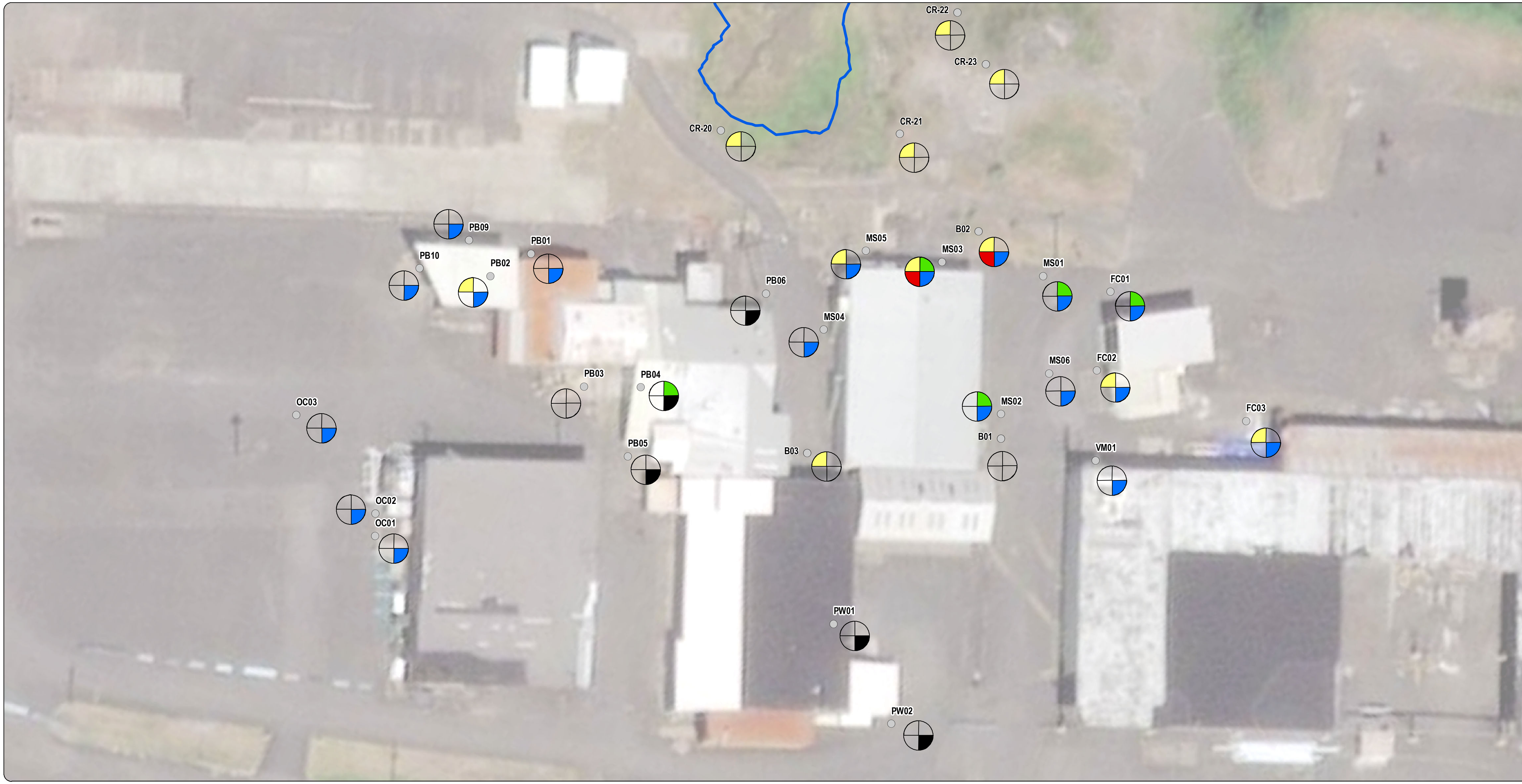
Print Date: 9/18/2019
Approved By:
Produced By: mjosef
Project: 1044.02.06



Source: Aerial photograph obtained from Esri ArcGIS Online.
Notes:
Groundwater from boring location exceeds Model Toxics Control Act (MTCA) Method A for groundwater. Where MTCA A cleanup levels are not available, the lower of available cancer or non-cancer MTCA Method B groundwater cleanup levels are applied.
There were no exceedances for polychlorinated biphenyls or volatile organic compounds for the locations analyzed for these analytes.
MHHW = mean higher high waterline.

Legend

- Approximate MHHW
- Boring or Monitoring Well Sample
- Semivolatile Organic Compounds
- Metals
- Polycyclic Aromatic Hydrocarbons
- Diesel- and/or Heavy Oil-Range Hydrocarbons
- Not Analyzed

Figure 4-3
Chemical Exceedances in Groundwater
Aberdeen, Washington

GRAYS HARBOR HISTORICAL SEAPORT

0 50 100
Feet

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Source: Aerial photograph obtained from Esri ArcGIS Online.

Notes:
1. Proposed locations are approximate and will be determined based on field conditions.
2. MHHW = mean higher high waterline.
3. RAU = remedial action unit.

Legend

Approximate MHHW

Proposed Sample Locations

Remedial Action Unit Boundaries

- RAU1
- RAU2
- RAU3
- RAU4
- RAU5
- RAU6
- RAU7

Figure 5-1
Proposed Upland Sampling Locations
Aberdeen, Washington

GRAYS HARBOR HISTORICAL SEAPORT

0 100 200
Feet

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Path: X:\1044_02_13\Projects\Fig5_1_Proposed Sampling Locations.mxd
Print Date: 12/17/2019
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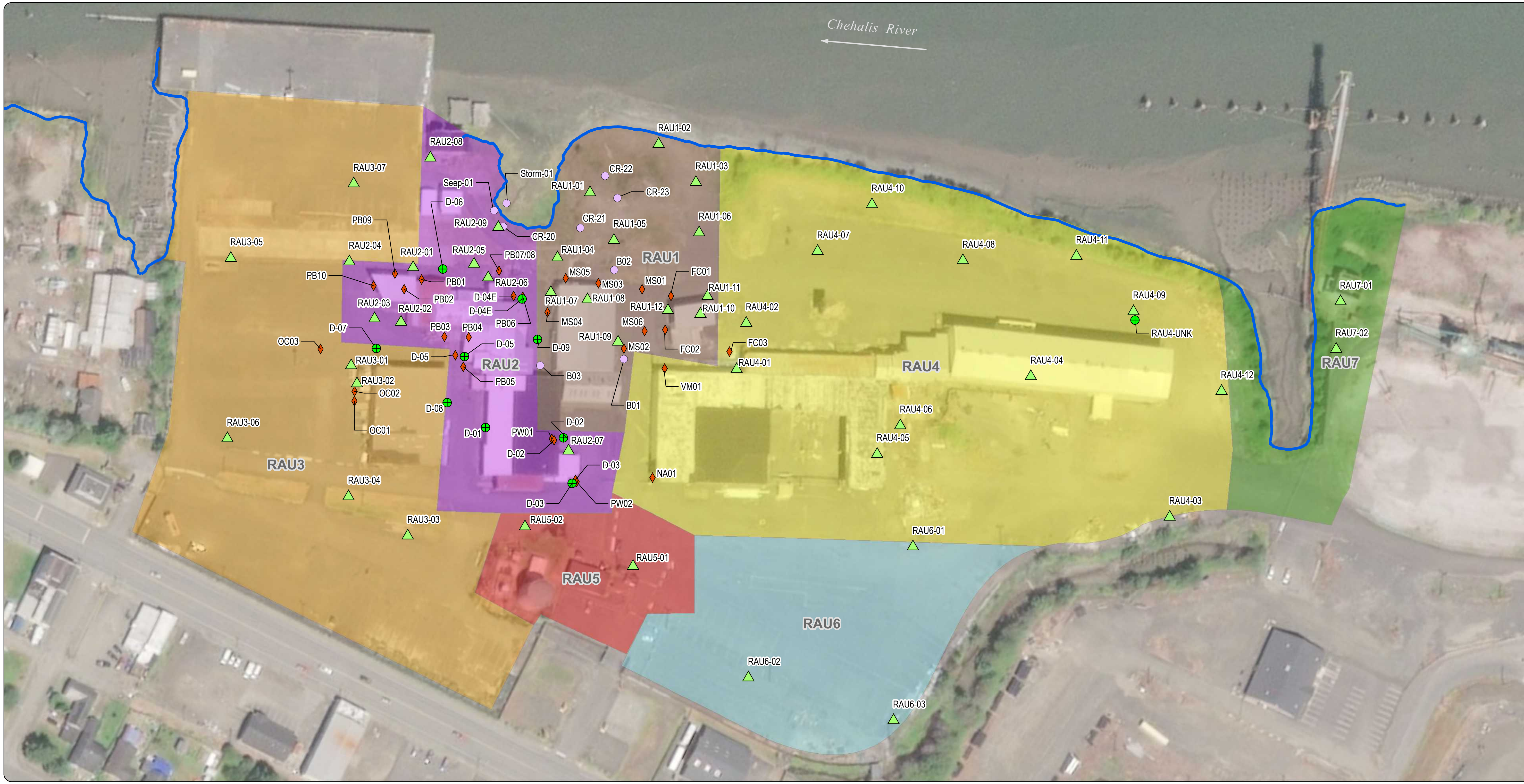
Produced By: aguse
Project: 1044.02.06



Source: Aerial photograph obtained from Esri ArcGIS Online.

Notes:
1. Proposed locations are approximate and will be determined based on field conditions.
2. E&E = Ecology & Environment, Inc.
3. MHHW = mean higher high waterline.
4. RAU = remedial action unit.

Legend

- Approximate MHHW
- E&E 2018 Sample Locations
- MFA 2015 Upland Samples
- Monitoring Wells

Remedial Action Unit Boundaries

- RAU1
- RAU2
- RAU3
- RAU4
- RAU5
- RAU6
- RAU7

0 100 200
Feet

GRAYS HARBOR HISTORICAL SEAPORT

Figure 5-2
Historical and Proposed Upland Sampling Locations

Aberdeen, Washington

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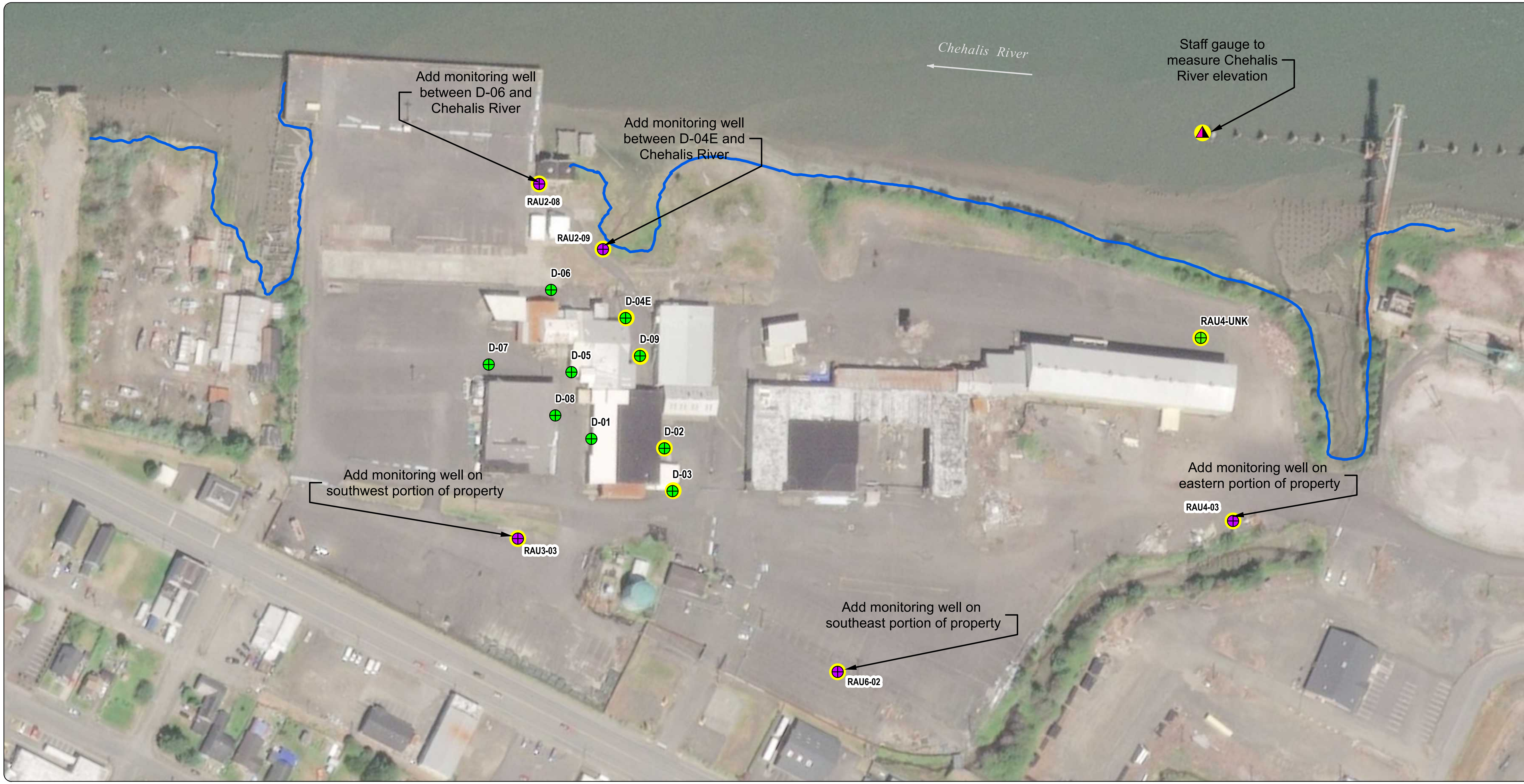
Path: X:\1044.02.06\Projects\Fig6_HistoricalAndProposedSamplingLocations_Labeled.mxd
Print Date: 11/8/2019
Approved By:
Produced By: aguse
Project: 1044.02.06



Source: Aerial photograph obtained from Esri ArcGIS Online.
Notes:
1. MHHW = mean higher high waterline.
2. Proposed locations are approximate and will be determined based on field conditions.

Legend

- Approximate MHHW
- Proposed 2019 Monitoring Well
- Existing Monitoring Well
- Proposed Staff Gauge to Measure River Height
- Transducer to be Deployed at Location

0 100 200
Feet

Figure 5-3
Tidal Study Monitoring Well Locations
Aberdeen, Washington

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Path: X:\1044.02.13\Projects\Fig5-3_TidalStudyMonitoringWellLocations.mxd
Print Date: 11/8/2019
Approved By: mstringer
Produced By: aguse
Project: 1044.02.06

Source: Aerial photograph obtained from Esri ArcGIS Online; parcels and roads obtained from Grays Harbor County; harbor lines obtained from Washington Dept. of Natural Resources.

Legend

- Spray application areas to be sampled for pentachlorophenol
- Hazardous Building Material Survey Extents

Figure 5-4
Hazardous Building Materials Survey
Aberdeen, Washington

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0 100 200
Feet

Project: 1044.02.06 Produced By: jputnam Approved By: Print Date: 8/28/2019 Path: X:\1044.02.06\Projects\Fig9_HazardousBuildingMaterialsSurvey.mxd

APPENDIX A
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

WEYERHAEUSER SAWMILL ABERDEEN/SEAPORT LANDING
500 NORTH CUSTER STREET
ABERDEEN, WASHINGTON

Prepared for

GRAYS HARBOR HISTORICAL SEAPORT AUTHORITY

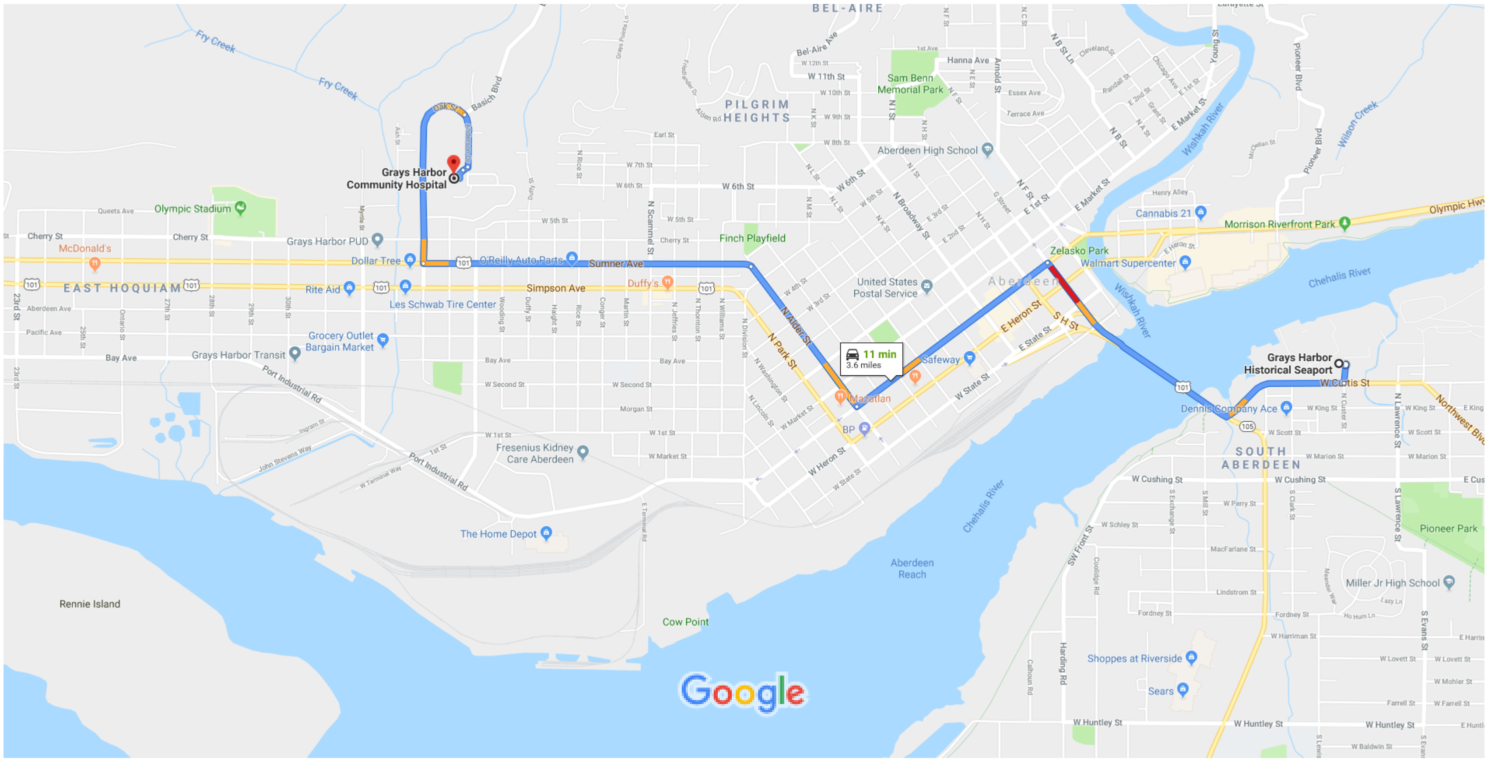
November 4, 2019
Project No. 1044.02.14

Prepared by
Maul Foster & Alongi, Inc.
2815 2nd Avenue, Suite 540, Seattle, WA 98121

MAUL
FOSTER
ALONGI

Grays Harbor Historical Seaport to Grays Harbor Community Hospital

Drive 3.6 miles, 11 min



Map data ©2019 Google 1000 ft

Grays Harbor Historical Seaport

500 N Custer St, Aberdeen, WA 98520

1. Head south on N Custer St toward W Curtis St

24 s (259 ft)

Continue on US-101 N. Take Sumner Ave to Oak St

8 min (2.9 mi)

2. Turn right onto US-101 N/W Curtis St

   Continue to follow US-101 N

1.0 mi

3. Turn left onto E Wishkah St

0.6 mi

4. Turn right onto S Alder St

0.5 mi

5. S Alder St turns slightly left and becomes Sumner Ave

0.9 mi

Continue on Oak St to your destination

2 min (0.7 mi)

6. Turn right onto Oak St

0.5 mi

7. Continue straight onto Anderson Dr

0.1 mi

8. Turn right

82 ft

9. Continue straight

Destination will be on the right

128 ft

Grays Harbor Community Hospital

915 Anderson Dr, Aberdeen, WA 98520

HEALTH AND SAFETY PLAN

SEAPORT LANDING SITE
500 NORTH CUSTER STREET
ABERDEEN, WASHINGTON

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

Meaghan Pollock

Meaghan Pollock, GIT
Staff Geologist

Emily Hess

Emily Hess, LG
Project Geologist

CONTENTS

CONTENTS (CONTINUED)

1 NEAREST HOSPITAL/EMERGENCY MEDICAL CENTER

1.1 Nearest Hospital

Grays Harbor Community Hospital
915 Anderson Drive
Aberdeen, Washington 98520

Phone: (360)532-8330

Distance: 3.6 miles (mi)

Travel Time: 11 minutes

1.2 Route to Hospital from Site

See map on first page of this document.

1.2.1 Driving Directions to Hospital from Site

1. Head south on North Custer Street toward West Curtis Street (259 feet [ft])
2. Turn right onto US-101 North/West Curtis Street (1.0 mi)
3. Turn left onto East Wishkah Street (0.6 mi)
4. Turn right onto South Alder Street (0.5 mi)
5. South Alder Street turns slightly left and becomes Sumner Avenue (0.9 mi)
6. Turn right onto Oak Street (0.5 mi)
7. Continue straight onto Anderson Drive (0.1 mi)
8. Turn right (82 ft)
9. Continue straight (128 ft). Destination will be on the right.

1.3 Emergency Phone Numbers

Ambulance, Police, Fire	**Dial 911**
Emily Hess Project Manager	Phone: (360)433-0244 Cell: (360)980-2497
Michael Stringer Project Director	Phone: (206)858-7617 Cell: (206)498-9147
Emily Curtis Health and Safety Coordinator (HSC)	Phone: (503)501-5233 Cell: (503)410-1524

2 PLAN SUMMARY

This health and safety plan (HASP) was developed to describe the procedures and practices necessary for protecting the health and safety of Maul Foster & Alongi, Inc. (MFA) employees conducting activities at the Weyerhaeuser Sawmill Aberdeen/Seaport Landing site (the Site). Other employers, including contractors and subcontractors, are expected to develop and implement their own HASPs to manage the health and safety of their personnel.

MFA personnel conducting activities at the Site are responsible for understanding and adhering to this HASP. Before fieldwork begins, a site safety officer (SSO) who is familiar with health and safety procedures and with the Site will be designated by the on-site personnel. Safety deficiencies should be immediately communicated to the SSO and, if necessary, to MFA's HSC.

All contractors and subcontractors have the primary responsibility for the safety of their own personnel on the Site. All personnel on the Site have "stop work" authority if they observe conditions that they believe create an imminent danger.

If MFA employees work on the Site for more than a year, this HASP will be reviewed at least annually. The plan will be updated as necessary to ensure that it reflects the known hazards, conditions, and requirements associated with the Site.

MFA personnel who will be working on the Site are required to read and understand this HASP. MFA personnel entering the work area must sign the Personnel Acknowledgment Sheet (Section 16), certifying that they have read and that they understand this HASP and agree to abide by it.

3 KEY PROJECT PERSONNEL

Name	Responsibility
Michael Stringer	Project Director
Emily Hess	Project Manager/Field Personnel
Kyle Roslund	Field Personnel
Meaghan Pollock	Field Personnel
Blair Paulik	Field Personnel
Emily Curtis	HSC

4 SITE DESCRIPTION AND BACKGROUND

4.1 Type of Site

The Site is located north of Curtis Street along the Chehalis River in Aberdeen, Washington. The Site is comprised of a 0.9-acre tax parcel (parcel number 029901100501); a 9.27-acre tax parcel (parcel number 029901100100); two 1.04-acre tax parcels (parcel numbers 027400400000, 027600300101); a 1.39-acre tax parcel (parcel number 027401900000); a 3.96-acre tax parcel (parcel number 029901000101); a 1.74-acre tax parcel (parcel number 027400300100); three 0.14-acre tax parcels (parcel numbers 027400301700, 027400200700, 027400200900); a 1.33-acre tax parcel (parcel number 027400200100); a 0.66-acre tax parcel (parcel number 027601800700); a 1.29-acre tax parcel (parcel number 027600800101); a 0.95-acre tax parcel (parcel number 027400100000); a 0.15-acre tax parcel (parcel number 027600900101); and the tidelands between the Site and the Chehalis River.

4.2 Building/Structures

On-site buildings and structures related to former sawmill operations consist of a small log mill, "Pee Wee" mill, main shipping shed, steam cleaning facility, fuel and chemical storage building, maintenance shop, planer building, compressor building, former oil house, lumber shed, storage shed, office, guard shack, generator shed, wharf, two diesel aboveground storage tanks, and an underground storage tank.

4.3 Topography

Topography of the Site is generally flat with a slight slope to the north toward the adjacent Chehalis River.

4.4 General Geologic/Hydrologic Setting

The Site and vicinity are located within the alluvial plain of the Chehalis River. The Site and vicinity have been mapped as artificial fill and recent alluvium. Alluvium deposits, according to well logs from resource protection wells in the area, consist of sands, silts, silty sands, and clayey silts that are at least 60-ft thick. Artificial fill is comprised of silty sand gravel and gravel. Boring logs also indicate that sandstone was encountered below the alluvium.

Depth to water in the vicinity ranges from 5 to 6 ft below ground surface. Based on geologic logs from previous environmental investigations, groundwater flow in the area is generally to the northwest; however, flow direction and gradient may be tidally affected.

4.5 Site Status

The Site is currently zoned light industrial, and several former sawmill-related buildings are extant. Much of the surface of the Site is paved with asphalt.

4.6 General Site History

The operational history of the Site is detailed in an environmental site assessment.[1] Before 1900, sawmills operated on the Site, on both the uplands and leased tidelands portion of the Site. Since the early 1890s, the South Aberdeen waterfront has been developed for commercial and industrial use. In the late 1890s, the Aberdeen Lumber sawmill was constructed on the upland property with logs rafted along the shoreline to feed the mill. The Aberdeen Lumber sawmill was later sold, becoming the Schafer Brothers Lumber and Door Company Mill #4. The business expanded and so did its footprint. Schafer Brothers later sold the Site to Simpson Timber Company.

Weyerhaeuser acquired the Site in 1955 and operated several sawmills and associated support facilities through January 2009, when the mill known as the Small Log Sawmill was permanently closed. Until the mid-1960s, raw logs were brought to the Site in log rafts on the Chehalis River and tied up to pilings in the river in front of the mill known as the Big Mill. After the mid-1960s, raw logs were brought to the Site by truck and staged on log decks at various locations in and adjacent to the Site. The Big Mill was originally configured to manufacture shingles and slats for housing construction. During World War II, the Big Mill was converted to manufacture ship keels for the war effort. The precursor to the Small Log Mill was added in 1972; small log mill operations were performed in the upland portion of the Site outside of the leased property. The last upgrade to the Small Log Mill took place in 2003. In 2006, the Big Mill and attached finger pier were closed; the associated structures were removed from the Site between 2006 and 2008. This area is now known as the Former Mill Area. The Site continued to operate the Small Log Mill into early 2009. The Grays Harbor Historical Seaport Authority acquired the uplands portion of the Site on March 29, 2013. Currently, there are no active wood-product manufacturing operations at the Site.

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[1] PES. 2010. Level I Environmental Site Assessment, Weyerhaeuser NR Company, Aberdeen Sawmill, 500 N. Custer Street, Aberdeen, WA. Prepared by PES Environmental, Inc. August 13.

5 HAZARD EVALUATION

5.1 Site Tasks and Operations

MFA has completed job hazard analyses (JHAs) for specific tasks that likely could be completed on the Site, depending on the scope of work. These tasks are provided in Appendix A. The following list generally summarizes planned tasks and operations:

- General work near heavy equipment
- Work in and around excavations
- Working around structurally hazardous areas
- Collecting soil and groundwater samples
- Collecting sediment samples
- Collecting soil vapor, indoor air, outdoor air, and subslab vapor samples
- Collecting asbestos and lead samples
- Working over water from boats and/or docks

The control measures that field personnel must use to eliminate or minimize these hazards, such as air monitoring, personal protective equipment (PPE), and decontamination procedures, are detailed in the JHAs and in subsequent sections of this plan.

5.2 Chemical Hazard Evaluation

Chemicals of potential concern (COPCs) for the Site are summarized in Appendix B. Action levels and associated controls are specified in Appendix C.

5.3 Physical Hazards

The specific physical hazards and associated controls for work on the Site are described in Appendix A, JHAs.

6 HEALTH AND SAFETY TRAINING

MFA personnel working on site and who could be exposed to COPCs will have completed training consistent with the hazardous waste operations and emergency response requirements in 29 Code of Federal Regulations (CFR) 1910.120(e). The training will include:

- Identity of site safety and health personnel

- Safety and health hazards identified on the Site
- Proper use of required PPE
- Safe work practices required on the Site, e.g., fall protection, confined space entry procedures, hot work permits, general safety rules
- Safe use of engineering controls and equipment on the Site
- Medical surveillance requirements, including the recognition of signs and symptoms that might indicate overexposure to hazards
- The site emergency response plan/spill containment plan

The HSC will oversee training for site personnel. Training records, including an outline, sign-offs, and competency records, will be maintained by the HSC.

7 SAFETY EQUIPMENT

7.1 Personal Protective Equipment

PPE must be worn by individuals on the Site to protect against physical hazards. PPE required on the Site is modified Level D, which consists of:

- Type 1 hard hat
- High-visibility vest
- Work boots
- Safety glasses with side shields
- Nitrile gloves or equivalent when handling known or potentially impacted media
- Work gloves (if handling materials that might have sharp edges, protrusions, or splinters)

Additional PPE may be necessary for specific tasks with additional hazards. The SSO will be responsible for designating additional PPE for specific tasks. Depending on the activity, additional PPE may include:

- Hearing protection (during high-noise tasks)
- Chemical-resistant clothing, e.g., Tyvek® coveralls
- Chemical-resistant boots
- Chemical-resistant goggles
- Chemical-resistant gloves
- Faceshield
- Respiratory protection

Additional PPE may be required if workers discover unexpected contamination. Characteristics of unexpected contamination could include unusual odors, discolored media, a visible sheen, etc. The SSO and, if necessary, the HSC will be contacted as soon as possible after the discovery of unexpected contamination, and the SSO and/or the HSC will determine the need for additional controls and/or training.

PPE used at the Site must meet the requirements of recognized consensus standards (e.g., American National Standards Institute, National Institute for Occupational Safety and Health [NIOSH]), and respiratory protection shall comply with the requirements set forth in 29 CFR 1910.134.

Project personnel are not permitted to reduce the level of specified PPE without approval from the SSO or the HSC.

7.2 Safety Equipment

The SSO will be responsible for ensuring that the following safety equipment is available on site and is properly inspected and maintained:

- Soap and water for decontamination
- Caution tape, traffic cones, and/or barriers
- First-aid kit
- Fire extinguisher
- Fluids for hydration, e.g., drinking water or sports drink

7.3 Air Monitoring Equipment

The following air monitoring equipment will be available to identify site conditions that may require additional controls:

- Photoionization detector

See Appendix C for specified action levels and followup actions.

7.4 Communications Equipment

MFA personnel should have a mobile phone or a radio available in case of emergency.

8 DECONTAMINATION PROCEDURES

8.1 Partial Decontamination Procedures

MFA employees will implement the following partial decontamination procedures when exiting the exclusion zone but remaining on the Site:

- Wash and rinse boots and outer gloves in containers in the contamination-reduction zone.
- Inspect Tyvek® suit for stains, rips, or tears. If suit is contaminated and is to be used again, full decontamination will be performed as described in Section 8.2. If the suit is damaged, it should not be reused.
- Remove outer gloves. Inspect and discard in a container labeled for disposable items if ripped or damaged.
- Remove respirator, if worn, and clean with premoistened alcohol wipes. Discard used cartridges at the frequency dictated by the SSO.
- Wash hands and face with soap and water.

8.2 Full Decontamination Procedures

MFA employees will follow the full decontamination procedures listed below when exiting the exclusion zone and leaving the Site, e.g., at the end of the work shift:

- Wash and rinse boots and outer gloves in containers in the contamination-reduction zone.
- Remove outer gloves and Tyvek® suit and deposit in a container labeled for disposable items.
- Remove respirator and discard used cartridges at the frequency dictated by the SSO.
- Wash and rinse respirator in a "respirators only" decontamination container.
- Remove work boots and put on street shoes. Place work boots in a plastic bag or container for later reuse.
- Remove inner gloves and deposit in a container labeled for disposable items.
- Wash hands and face with soap and water.
- Shower as soon after the work shift as practicable.

9 MEDICAL SURVEILLANCE

MFA will ensure that its employees who meet the following criteria are enrolled in a medical surveillance program consistent with 29 CFR 1910.120(f):

- The employees are, or may be, exposed to hazardous substances or health hazards at or above established permissible exposure limits for 30 or more days per year.
- The employees are required to wear a respirator for 30 or more days per year.

MFA employees who exhibit signs or symptoms consistent with overexposure to site contaminants will be offered medical surveillance consistent with Washington Administrative Code 296-843-21005.

MFA will ensure that its employees who are authorized to wear respirators are medically evaluated consistent with the respiratory protection standard (29 CFR 1910.134). The HSC or administrative designee (e.g., human resources manager) will maintain medical evaluation records.

10 AIR MONITORING

Based on site conditions, air monitoring is not anticipated; however, air monitoring equipment will be available in case workers encounter conditions that indicate the presence of unexpected contamination, such as unusual odors, discolored media, or a visible sheen. If such conditions are discovered, workers will exit the area and contact the SSO and, as needed, the HSC. If necessary, MFA will use the air monitoring equipment to evaluate the conditions and determine if additional controls and/or training are required. Action levels and followup actions are provided in Appendix C.

Air monitoring, if conducted, must be performed by individuals familiar with the calibration, use, and care of the required instruments. Measurements shall be documented, and the records should include the following information:

- The name of the person conducting the measurements
- The identity of workers, if any, who have exposure indicated by measurement result
- Information about the instrument, e.g., type, make, model, serial number
- The location of the measurement
- The measurement date and start/stop time

- Conditions represented by the measurement, including applicable activities, work practices, weather conditions, site conditions, and controls in place
- Measurement results
- Other relevant observations or notes

10.1 Air Monitoring Action Levels

If air monitoring is conducted, the results will be compared to the action levels provided in Appendix C. The air monitoring action levels are established to comply with OSHA Permissible Exposure Levels, American Conference of Governmental Industrial Hygienists threshold limit values, and NIOSH recommendations for the chemicals that may be encountered on the Site. The action levels are also adjusted for the relative response of common PIDs to motor-fuel vapors.

10.2 Explosion Hazard Action Levels

MFA employees working on site will take measurements when working near known or suspected sources of explosive gases or vapors. The instrument alarm should be set to sound at 10 percent of the lower explosive limit. When measurements exceed this level, MFA employees on site will:

1. Extinguish ignition sources and shut down powered equipment in the work area.
2. Move personnel at least 100 ft away from the work area.
3. Contact the SSO and the HSC.
4. At the instruction of the HSC and after waiting 15 minutes for explosive gases to dissipate, the SSO may use the combustible gas meter to approach the worksite to measure combustible gases in the work area. The SSO shall not enter (or allow any personnel to enter) any area where the combustible gas meter readings exceed the explosivity action level, nor shall the SSO approach if there is a potential for fire or explosion.
5. The SSO may authorize personnel to reenter the work area after the source of the combustible gases has been identified and controlled.

10.3 Instrument Calibrations

Instruments shall be calibrated consistent with manufacturers' recommendations. Calibrations shall be coordinated by the SSO. Calibration and monitoring records shall be maintained by the SSO and/or the project manager.

11 SITE CONTROL MEASURES

Access to the Site will be controlled as part of the site preparation. Control measures may include fencing, gates, and signs limiting access to everyone except authorized personnel. Work zones and contaminant reduction zones will be designated by the SSO.

MFA requires the "buddy system" if personnel conduct operations that may involve exposure to site hazards. The buddy system may involve working with non-MFA personnel.

12 EMERGENCY RESPONSE / SPILL CONTAINMENT / CONFINED SPACE

MFA employees on site will follow the emergency response, spill response, and confined space procedures described in the MFA Health and Safety Manual. Incidents will be documented on the incident report form included with Appendix D.

13 PRE-ENTRY BRIEFING

MFA employees on site will conduct pre-entry briefings, e.g., tailgate meetings, before starting work on the Site and/or as the scope of work changes throughout the project to ensure that employees are familiar with the HASP and that the plan is being followed. Attendance and discussion topics will be documented on sign-in sheets, which will be maintained by the SSO. A tailgate safety meeting checklist is included as Appendix E.

14 PERIODIC EVALUATION

The project manager or designee will evaluate the effectiveness of this HASP. As part of the evaluation, the project manager or designee will track ongoing health and safety feedback from field personnel working on the project. This feedback will be reviewed and incorporated into either immediate or annual updates of the HASP. HASPs will be reviewed and updated at least annually. Updating the plan as necessary ensures that it reflects the known hazards, conditions, and requirements associated with the Site. MFA will maintain periodic evaluation records and will track all HASP revisions.

15 SAFE WORK PRACTICES

The following safe work practices are provided to supplement the other information included with this HASP:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in areas with potentially contaminated materials.
2. Field personnel will, whenever practicable, remain upwind of drilling rigs, open excavations, and other site-disturbing activities.
3. Subsurface work shall not be performed at any location until the area has been confirmed by a utility-locator firm to be free of underground utilities or other obstructions.

16 ACKNOWLEDGMENT

MFA cannot guarantee the health or safety of any person entering the Site. Because of the potentially hazardous nature of visits to active sites, it is not possible to discover, evaluate, and provide protection against all possible hazards that may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury and illness at the Site. The health and safety guidelines in this plan were prepared specifically for the Site and should not be used on any other site without prior evaluation by trained health and safety personnel.

MFA personnel who will work at the Site are to read, understand, and agree to comply with the specific practices and guidelines described in this HASP regarding field safety and health hazards.

This HASP has been developed for the exclusive use of MFA personnel. MFA may make this plan available for review by contracted or subcontracted personnel for information only. This plan does not cover the activities performed by employees of any other employer on the Site. All contracted or subcontracted personnel are responsible for implementing their own health and safety program, including generating and using their own plan.

I have read and I understand this HASP and all attachments, and agree to comply with the requirements described herein:

Name	Title	Date

APPENDIX A
JOB HAZARD ANALYSES

Job Hazard Analysis (JHA)

Task/Operation: Asbestos and Lead-Based Paint Sampling	
Project Number: 1044.02.14	**Location Where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington
Date Prepared: 4/29/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct sampling for asbestos-containing materials (ACM) and lead-based paint.

Physical Hazards

Name of Physical Hazard	Source of Hazard/Risk	Hazard/Risk Mitigation
Bodily harm or death	Possible fall from heights.	Stay a safe distance from edges of buildings, floor openings, and structurally hazardous areas. Signs, cones, barrier tape, or equivalent methods will be used to mark edges and floor openings.
Bodily harm	Potentially violent transients occupying vacant buildings.	Do not engage with transients. Contact site security and/or the local police to remove transients before accessing area.
Eye injury	Debris and spills.	Wear eye protection with side shields.
Respiratory	Building materials.	ACM, lead-based paint, and mold have been found in the buildings. Use respirator with high-efficiency particulate air filters when working around abatement areas.
Injuries caused by improper lifting	Equipment, sample coolers.	Use proper bending/lifting techniques by bending and lifting with legs and not with back. Do not twist at the waist when turning core samplers or other devices. Use buddy system for heavy objects.
Accidents with equipment/tools	Sample collection equipment/tools.	Use an equipment checklist to verify that you have the appropriate equipment/tools for your tasks. Consult appropriate JHAs. Stow tools in vehicle properly; use appropriate cases and bags. Secure equipment in vehicle with netting or straps; do not leave loose. Loose equipment can cause property damage or injuries to others or yourself.

Task/Operation: Asbestos and Lead-Based Paint Sampling		
Biological/Chemical/Radiological Hazards		
Biological—mold	Dilapidated building materials.	Avoid areas containing mold, if practicable. Employees who enter areas where mold is disturbed must use a respirator and, if necessary, Tyvek® suits or similar.
Chemical	Personnel performing tasks may come into direct contact with contaminant-containing material.	If necessary, see Chemicals of Potential Concern Table for applicable chemical hazards. Wear the appropriate personal protective equipment (PPE), including nitrile gloves or similar, during sampling to prevent direct contact with contaminant-containing material. Use of a half-face respirator may be necessary.
Biological—radiation	Portable x-ray fluorescence (XRF) device.	The analyst should undergo proper training for safely operating the XRF instrument and radiation training before using the instrument in the field.
Additional Control Measures and Guidance		
Engineering Controls: No engineering controls specified.		
General Safe-Work Practices and Guidance: • Avoid areas containing mold, if practicable. • Follow protocols for radiation safety provided in the XRF instrument operator's manual. • Triple-rinse sampling equipment using distilled or deionized water and alconox soap for first rinse, and distilled water for second and third rinses. • Clean materials between locations at the site to avoid cross-contamination. • Do not bring equipment back to the office without proper decontamination.		
PPE: Respirator (if necessary), hard hat, work boots, high-visibility vest, safety glasses with side shields, nitrile gloves or equivalent.		

Job Hazard Analysis (JHA)

Task/Operation: Sediment Sampling		
Project Number: 1044.02.14	**Location/Site where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington	
Date Prepared: 4/29/2019 **Date Reviewed:** 5/1/2019	**Employee Preparing this JHA:** Meaghan Pollock **Employee Reviewing and Certifying this JHA:** Emily Hess	
Job/Task Description		
Employees will conduct sediment sampling. This will require occasional work near potentially contaminated media.		
Physical Hazards		
Physical Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Drowning	Entering body of water where work is being conducted.	Wear a personal floatation device.
Eye injury	Debris (e.g., sediment) coming into contact with eyes.	Wear eye protection with side shields.
Injuries caused by improper lifting	Equipment, core sampler, sample coolers.	Use proper bending/lifting techniques by bending and lifting with legs and not with back. Do not twist at the waist when turning the core sampler. Use buddy system for heavy objects.
Accidents with equipment/tools	Sample collection equipment/tools.	Verify you have the appropriate equipment/tools for tasks. Use equipment/tools only as intended by the manufacturer. Stow all tools in vehicle properly; use appropriate cases and bags. Secure equipment in vehicle with netting or straps—do not leave loose.
Biological/Chemical Hazards		
Biological/Chemical Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Chemical	Personnel performing tasks may come into direct contact with contaminated materials in the sediment.	If necessary, see Chemical Hazards Summary Table for applicable chemical hazards. Wear appropriate personal protective equipment (PPE), including nitrile gloves, during sampling to prevent direct contact with contaminants in sediment.
Biological—animals	Biting or stinging insects and spiders.	When necessary, use bug repellent.
Additional Control Measures and Guidance		
Engineering Controls: No engineering controls specified.		
Chemical or Biological Concerns Specific to this JHA: None.		

Task/Operation: Sediment Sampling
General Safe-Work Practices and Guidance: • Triple-rinse sampling equipment using distilled or deionized water and alconox for first rinse, and distilled water for second and third rinses. • Always clean materials between locations at the site to avoid cross-contamination. • Do not take equipment from the site without first properly decontaminating said equipment. • Do not eat or drink in the immediate area where sampling is being conducted. • Wash hands and face before eating or drinking. • Dispose of used nitrile gloves in an appropriate container. • Always carry a cellular phone while working in remote areas.
PPE: Hard hat, work boots, high-visibility vest, personal flotation device, safety glasses with side shields, nitrile gloves, and hearing protection if sampling using a drill-rig or around heavy equipment.

Job Hazard Analysis (JHA)

Task/Operation: Soil and Groundwater Sampling	
Project Number: 1044.02.14	**Location/Site Where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington
Date Prepared: 4/29/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct soil and groundwater sampling. This will require occasional work near potentially contaminated media.

Physical Hazards

Physical Hazard/Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
Heat/cold/sunburn	Weather.	Wear sunscreen on exposed skin. Stop work if an employee feels symptoms of dehydration, overheating, or heat stroke. Move to a shaded area and consume water. During cold conditions, wear adequate clothing to reduce the potential for hypothermia.
Eye injury	Construction debris and splashes (e.g., soil, water) coming into contact with eyes.	Wear eye protection with side shields.
Physical stress	Heavy lifting of equipment and bailing water.	Use proper lifting techniques, and take breaks and rest as needed.
Accidents with equipment/tools	Sample-collection equipment/tools.	Only use appropriate equipment for its intended use. Secure equipment in vehicle with netting or straps—do not leave loose.

Biological/Chemical Hazards

Biological/Chemical Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
Chemical	Personnel performing tasks may come into direct contact with contaminated materials in the soil and/or groundwater.	If necessary, see Chemical Hazards Summary Table for applicable chemical hazards. Wear appropriate personal protective equipment (PPE), including nitrile gloves and safety glasses, during sampling to prevent direct contact with contaminants in soil and/or groundwater.
Biological—animals	Biting or stinging insects, spiders, snakes, and livestock.	When necessary, use bug repellent. Use snake chaps or shin guards when grass is above the ankle. Use a bar to clear spiders and/or snakes from objects and/or vegetation.

Task/Operation: Soil and Groundwater Sampling
Additional Control Measures and Guidance
Engineering Controls: No engineering controls specified.
General Safe-Work Practices and Guidance: • Do not eat or drink in the immediate area where sampling is being conducted. • Wash hands and face before eating or drinking. • Dispose of used nitrile gloves in an appropriate container. • Avoid working with breathing zone directly above the opening of the well casing. When possible, work upwind of the well casing. • If work is conducted in or near traffic areas, wear high visibility vests. Use cones, flagging, or other devices to mark out the work area. • Always carry a cellular phone while working in remote areas. • Avoid direct contact with soil and groundwater.
PPE: Hard hat, work boots, high-visibility vest, safety glasses with side shields, and disposable nitrile gloves.

Job Hazard Analysis (JHA)

Task/Operation: Soil Vapor, Outdoor Air, Indoor Air, and Subslab Vapor Sampling	
Project Number: 1044.02.14	**Location/Site where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington
Date Prepared: 5/1/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct work such as soil vapor, outdoor air, indoor air, and subslab vapor sampling. This will require occasional work near potentially contaminated media and compressed gas.

Physical Hazards

Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Asphyxiation	Helium gas.	Do not place head inside Helium shroud.
Eye injury	Construction debris coming into contact with eyes.	Wear eye protection with side shields.
Physical stress	Heavy lifting of sampling equipment, compressed gas cylinders, sample coolers; kneeling on hard or gravel surfaces.	Use proper bending/lifting techniques by bending and lifting with legs and not with back. Do not twist at the waist when turning. Use buddy system for heavy objects. Use knee pads or kneeling pad. Take breaks and rest as needed.
Accidents with equipment/tools	Sample-collection equipment/tools.	Verify you have the appropriate equipment/tools for your tasks. Use equipment/tools as intended by the manufacturer. Stow all tools in vehicle properly and use appropriate cases and bags. Secure equipment (including compressed gas cylinders) in vehicle with netting, straps, and/or chains—do not leave loose, doing so can cause property damage or serious injuries to others or yourself.
Noise	Roto-hammer.	Wear proper ear protection.

Biological and Chemical Hazards

Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Chemical	None specific to this JHA. Chemical hazards related to the site are described in the Chemical Hazards Summary Table.	None.
Biological—animals	Stinging insects, spiders, and snakes.	Use bug repellent as necessary. Use snake chaps or shin guards when grass is above the ankle. Use a bar to clear out objects and/or vegetation, as well as spiders and/or snakes (do not use your hands or feet).

Additional Control Measures and Guidance

Engineering Controls: No engineering controls specified.

Task/Operation: Soil Vapor, Outdoor Air, Indoor Air, and Subslab Vapor Sampling
General Safe-Work Practices and Guidance: • Always wear nitrile gloves when handling samples and sampling equipment. • Do not eat or drink in the immediate area where sampling is conducted. • Wash hands and face before eating or drinking. • Used nitrile gloves should be disposed of in a container labeled for disposable items. • Secure compressed gas cylinder appropriately during transport and use. • Attach regulator and hose to compressed gas cylinder in appropriate manner. • Grasp or secure hose when in use—do not allow to whip. • Employees should use caution when working around rodent droppings. If possible, use Shop-Vac® to remove rodent droppings before commencing work. • Secure equipment in vehicle with netting or straps; do not leave loose.
Personal Protective Equipment: Hard hat (if overhead hazard is present); work boots (if working near heavy equipment); high-visibility vest; safety glasses; disposable nitrile gloves; and hearing protection (i.e., ear plugs or ear muffs) as needed.

Job Hazard Analysis (JHA)

Task/Operation: Working around Excavations	
Project Number: 1044.02.14	**Location/Site where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington

Date Prepared: 4/1/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct work around excavations, such as excavation backfill and drilling oversight.

Physical Hazards

Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Bodily harm or death	Possible to fall into open excavation from heights.	Stay a safe distance from excavation area. Signs, cones, barrier tape, or other equivalent methods will be used to mark open excavations.
Eye injury	Construction debris (e.g., soil) coming into contact with eyes.	Wear eye protection with side shields.
Head injury	Possible to fall into open excavation from heights.	Stay a safe distance from excavation area. Signs, cones, barrier tape, or other equivalent methods will be used to mark open excavations.

Biological and Chemical Hazards

Hazard/Risk	**Source of Hazard/Risk**	**Hazard/Risk Mitigation**
Chemical	None specific to this JHA, unless contact made with contaminated materials.	If necessary, see Chemical Hazards Summary Table for applicable chemical hazards.
Biological	No unique source of biological hazards warranting specific controls.	None.

Additional Control Measures and Guidance

Engineering Controls: No engineering controls specified.

General Safe-Work Practices and Guidance: Personnel will stay out of excavation areas at all times. If heavy equipment is being operated, the JHA for working around heavy equipment will be referenced. Signs, cones, barrier tape, or other equivalent methods will be used to mark open excavations, if feasible. Any work that must be conducted near excavations will be conducted using a buddy system.

Personal Protective Equipment: Hard hat; work boots; high-visibility vest; safety glasses with side shields; hearing protection (i.e., ear plugs or ear muffs); and nitrile gloves if handling potentially impacted media.

Job Hazard Analysis (JHA)

Task/Operation: Working Around Structurally Hazardous Areas	
Project Number: 1044.02.14	**Location Where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington
Date Prepared: 4/29/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct sampling for asbestos-containing materials and lead-based paint. This will require occasional work near structurally hazardous areas.

Physical Hazards

Name of Physical Hazard	Source of Hazard/Risk	Hazard/Risk Mitigation
Bodily harm or death	Possible to fall from heights.	Stay a safe distance from structurally hazardous areas. Signs, cones, barrier tape, or equivalent methods will be used to mark structurally hazardous areas.
Eye injury	Debris coming into contact with eyes.	Wear eye protection with side shields.
Head injury	Possible to fall from heights.	Stay a safe distance from structurally hazardous areas. Signs, cones, barrier tape, or equivalent methods will be used to mark structurally hazardous areas.

Biological/Chemical Hazards

Biological	No unique source of biological hazards warranting specific controls.	None.
Chemical	None specific to this JHA, unless contact made with contaminated materials.	If necessary, see Chemicals of Potential Concern Table for applicable chemical hazards.

Additional Control Measures and Guidance

Engineering Controls: No engineering controls specified.

General Safe-Work Practices and Guidance: Personnel will stay away from structurally hazardous areas at all times. Signs, cones, barrier tape, or equivalent methods will be used to mark structurally hazardous areas, if feasible. Use the buddy system for any work that must be conducted near structurally hazardous areas.

Personal Protective Equipment: Hard hat, work boots, high-visibility vest, safety glasses with side shields, and nitrile gloves or equivalent if handling potentially impacted media.

Job Hazard Analysis (JHA)

Task/Operation: Working Near Heavy Equipment	
Project Number: 1044.02.14	**Location/Site Where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington
Date Prepared: 4/29/2019	**Employee Preparing this JHA:** Meaghan Pollock
Date Reviewed: 5/1/2019	**Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct work around heavy equipment during investigations at the site. This will require occasionally working near drill rigs and other heavy equipment.

Physical Hazards

Hazard/Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
Bodily harm or death	Heavy equipment operating on site creates a potential for site workers to be struck, crushed, or impacted by moving parts.	Stay a safe distance from equipment and maintain eye contact with equipment operators. Wear a safety vest for enhanced visibility.
Eye injury	Construction debris (e.g., soil) coming into contact with eyes.	Wear eye protection with side shields.
Head injury	Heavy equipment and/or tools impacting the head.	Wear a hard hat.
Penetration of feet	Sharp objects that could be stepped on; large objects falling on feet.	Wear steel-toe boots with steel shank.
Hearing loss	Noise generated by heavy equipment/machinery.	Wear hearing protection such as ear plugs or ear muffs.
Injury to bystanders	Pedestrians in the locality of work.	Use cones and caution tape to cordon off the immediate work area. Watch for and escort pedestrians away from work area. Pause work if necessary.
Hand injury	Pinch points.	Wear protective gloves whenever possible. Avoid placing hands near operating equipment.

Biological and Chemical Hazards

Hazard/Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
None	None specific to this JHA. Chemical hazards related to the site are described in the Chemical Hazards Summary Table.	None.

Additional Control Measures and Guidance

Engineering Controls: No engineering controls specified.

Chemical or Biological Concerns Specific to this JHA: None.

General Safe-Work Practices and Guidance:

- Personnel should stay upwind and out of the impact area of heavy equipment, if feasible.
- Cones, barrier tape, or other equivalent methods will be used to establish the impact area, if feasible.
- Work conducted in the impact area must be coordinated with the equipment operator using pre-established methods of communication, such as direct eye contact, hand signals, and/or verbal communication.

Personal Protective Equipment: Hard hat; steel-toe work boots with steel shank; high-visibility safety vest or outer garment; safety glasses with side shields; nitrile gloves; and hearing protection, i.e., ear plugs or ear muffs.

Job Hazard Analysis (JHA)

Task/Operation: Working over Water from Boats and Docks	
Project Number: 1044.02.14	**Location/Site where Task/Operation Performed:** Seaport Landing, Aberdeen, Washington

Date Prepared: 4/29/2019 **Date Reviewed:** 5/1/2019	**Employee Preparing this JHA:** Meaghan Pollock **Employee Reviewing and Certifying this JHA:** Emily Hess

Job/Task Description

Employees will conduct work near (on a bank), in (wading), or over (boat) water, which can be dangerous.

Physical Hazards

Hazard/Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
Drowning	Entering body of water where work is being conducted.	Wear a personal flotation device (PFD).

Biological and Chemical Hazards

Hazard/Risk	Source of Hazard/Risk	Hazard/Risk Mitigation
None	None specific to this JHA. Chemical hazards related to the site are described in the Chemical Hazards Summary Table.	None.

Additional Control Measures and Guidance

Engineering Controls: No engineering controls specified.

General Safe-Work Practices and Guidance:

- At least one extra PFD will be kept on hand in case one becomes damaged.
- Suitable rescue equipment, for example, a lifebelt or lifeline, is to be in position and deemed serviceable before activities begin.
- The boat will be boarded, loaded, and unloaded from a dry and stable location.
- The site supervisor or designee is to make regular and frequent checks on number of personnel working.
- Any work over water is to be carried out by a minimum of two persons; no lone workers are permitted.
- Special care must be taken in fog, snow, or rain; extra checks will be made by the site supervisor under these conditions.
- In a small utility boat, keep weight towards the middle, both fore and aft and side to side.
- If you see waves approaching, take them on the bow.
- Do not overload the boat.
- A secondary means of propulsion should be available (oars or paddle).

Personal Protective Equipment: United States Coast Guard–approved PFD must be used. The PFDs will be inspected daily for defects or chemical damage before use.

APPENDIX B
CHEMICALS OF POTENTIAL CONCERN

Table B-1
Chemical Hazards
Seaport Landing Upland Remedial Investigation Workplan

	OSHA PEL (TWA)	ACGIH TLV (TWA)	NIOSH IDLH	LEL (%)	IP (eV)	Other Hazard
TPH						
Gasoline-Range Organics (TPH-G)	NA	300 ppm	NA	1.4	NA	C, E, F, P
Diesel-Range Organics (TPH-D)	NA	100 mg/m^3	NA	NA	NA	E, F, P
Residual-Range Organics (TPH-O)	NA	NA	NA	NA	NA	E, F, P
VOCs						
1,1-Dichloroethane	100 ppm	100 ppm	3000 ppm	5.4	11.06	--
1,2-Dichloroethane	50 ppm	NE	50 ppm	6.2	11.05	--
cis-1,2-Dichloroethene	200 ppm	NE	1000 ppm	5.6	9.32	P
Tetrachloroethene	100 ppm	25 ppm	150 ppm	NA	9.32	C
Trichloroethylene	100 ppm	300 ppm	1,000 ppm	NA	9.45	C, P
Vinyl chloride	1 ppm	5 ppm	NA	3.6	9.99	C, F
PAHs						
Anthracene	0.2 mg/m^3	0.2 mg/m^3	80 mg/m^3	0.6	NA	F, P
Acenaphthene	NE	NE	NE	0.6	NA	F, P
Acenaphthylene	NE	NE	NE	NA	NA	F, P
Benzo(a)anthracene	NE	NE	NE	NA	NA	C, P
Benzo(a)pyrene	0.2 mg/m^3	0.2 mg/m^3	80 mg/m^3	NA	NA	C, P
Benzo(b)fluoranthene	NE	NE	NE	NA	NA	C, P
Benzo(g,h,i)perylene	NE	NE	NE	NA	NA	P
Benzo(k)fluoranthene	NE	NE	NE	NA	NA	C, P
Chrysene	0.2 mg/m^3	0.2 mg/m^3	80 mg/m^3	NA	7.59	C, P
Dibenz(a,h)anthracene	NE	NE	NE	NA	NA	C, P
Fluoranthene	NE	NE	NE	NA	NA	SC, P
Fluorene	NE	NE	NE	NA	NA	--
Indeno(1,2,3-cd)pyrene	NE	NE	NE	NA	NA	SC
Naphthalene	10 ppm	10 ppm	250 ppm	0.9	8.12	SC, E, F, P
Phenanthrene	0.2 mg/m^3	0.2 mg/m^3	80 mg/m^3	NA	NA	--
Pyrene	0.2 mg/m^3	0.2 mg/m^3	80 mg/m^3	NA	NA	P
1-Methylnaphthalene	NE	0.5 ppm	NE	NA	NA	SC, E, F, P
2-Methylnaphthalene	NE	0.5 ppm	NE	NA	NA	SC, E, F, P
Remaining PAH constituents	NA	NA	NA	NA	NA	NA
Metals						
Arsenic	0.01 mg/m^3	0.01 mg/m^3	5 mg/m^3	NA	NA	C, P
Barium	0.5 mg/m^3	0.5 mg/m^3	NE	NA	NA	R, P
Cadmium	0.0050 mg/m^3	0.002 mg/m^3	9 mg/m^3	NA	NA	C
Chromium	1 mg/m^3	0.5 mg/m^3	250 mg/m^3	NA	NA	R, P
Chromium (VI)	0.001 mg/m^3	0.05 mg/m^3	15 mg/m^3	NA	NA	R, C
Lead	0.05 mg/m^3	0.05 mg/m^3	100 mg/m^3	NA	NA	C, P
Mercury	0.1 mg/m^3	0.01 mg/m^3	2 mg/m^3	NA	NA	R, P
Selenium	0.2 mg/m^3	0.2 mg/m^3	1 mg/m^3	NA	NA	R, P
Silver	0.01 mg/m^3	0.1 mg/m^3	10 mg/m^3	NA	NA	R, P

Table B-1
Chemical Hazards
Seaport Landing Upland Remedial Investigation Workplan

	OSHA PEL (TWA)	ACGIH TLV (TWA)	NIOSH IDLH	LEL (%)	IP (eV)	Other Hazard
Additional						
Asbestos	0.1 fiber/cc	0.1 fiber/cc	NE	NA	NA	C
Benzene	1 ppm	5 ppm	500 ppm	1.2	9.24	F, C, P, R
Ethylbenzene	100 ppm	125 ppm	800 ppm	0.8	8.76	F, P
Pentachlorophenol	0.5 mg/m^3	1.5 mg/m^3	2.5 mg/m^3	NA	NA	C, P
Polychlorinated biphenyls	0.5 mg/m^3	1 mg/m^3	5 mg/m^3	NA	NA	C
Toluene	100 ppm	150 ppm	500 ppm	1.1	8.82	E, F, P, R
Xylenes	100 ppm	150 ppm	900 ppm	0.9	8.44–8.56	F, P

NOTES:

IDLH values taken from http://www.cdc.gov/niosh/idlh/intridl4.html.

-- = not applicable.

ACGIH = American Conference of Governmental Industrial Hygienists®.

C = carcinogen.

cc = cubic centimeter.

E = explosive.

F = flammable.

IDLH = immediately dangerous to life and health.

IP (eV) = ionization potential.

LEL = lower explosive limit.

mg/m^3 = milligrams per cubic meter.

NA = not available.

NE = not established.

NIOSH = National Institute for Occupational Safety and Health.

OSHA = Occupational Safety and Health Administration.

P = poison.

PAH = polycyclic aromatic hydrocarbon.

PEL = permissible exposure level.

ppm = parts per million.

R = reactive.

SC = suspected carcinogen.

TLV = threshold limit value.

TPH = total petroleum hydrocarbons.

TWA = time-weighted average.

VOC = volatile organic compound.

APPENDIX C
AIR MONITORING ACTION LEVELS

Air Monitoring Procedures and Toxicity Action Levels

Instrument	Action Level	Initial Action	Followup Action
FID or PID[a]	Detection of **1 ppm** (above ambient) or greater in breathing zone **sustained for two minutes.**	Dräger tube test for **benzene**. If **1 ppm benzene** detected with Dräger tube, upgrade to level C.	Ventilate area, always work upwind.
Dräger tube test (benzene)	Over **1 ppm benzene sustained** in breathing zone.	After upgrade to Level C, continue to monitor breathing zone with Dräger tube. If **10 ppm or greater benzene**, leave exclusion zone. Return only if levels decrease to below 10 ppm.	Ventilate area, always work upwind.
FID or PID[a]	Detection of 10 ppm (above ambient) in breathing zone **and determined not to be benzene.**	Upgrade to Level C and continue to monitor breathing zone with Dräger tube. **If 50 ppm, leave exclusion zone.** Return only if levels decrease to below 50 ppm.	Ventilate area, always work upwind.
CGI[b]	At or above 10% of the LEL.	Cease activities; turn off all potential sources of ignition. Evacuate.	Determine source of flammable vapors.
Dust Meter	0.05 milligrams per cubic meter of air.	Dust suppression, e.g., misting.	Adjust operations.

NOTES:

CGI = combustible gas indicator.

FID = flame ionization detector.

LEL = lower explosive limit.

PID = photoionization detector.

ppm = parts per million.

[a]Some PIDs do not work in high (e.g., greater than 90%) humidity or rainy weather. Under these atmospheric conditions, only PIDs certified for use in high humidity should be used.

[b]See Section 10.2 of the Health and Safety Plan (to which this table is attached) for complete explosion hazard action levels.

APPENDIX D
INCIDENT REPORT FORM

MAUL FOSTER & ALONGI, INC.
HEALTH & SAFETY INCIDENT REPORT

THIS REPORT MUST BE COMPLETED IN FULL AND SUBMITTED WITHIN 24 HOURS TO THE MFA HEALTH AND SAFETY COORDINATOR

Project Name: ______________________________

Project Number: ______________________________

Date of Incident: ______________________________

Time of Incident: ______________________________

Location: ______________________________

Type of Incident (Check all applicable items)

- ☐ **Illness**
- ☐ **Health & Safety Infraction**
- ☐ **Vehicular Accident**
- ☐ **Injury**
- ☐ **Fire, Explosion, Flash**
- ☐ **Electric Shock**
- ☐ **Property Damage**
- ☐ **Unexpected Exposure**
- ☐ **Near Miss**
- ☐ **Other (describe):** ______________________________

DESCRIPTION OF INCIDENT

(Describe what happened and the possible cause of the incident. Identify individual(s) involved, witnesses, and their affiliations. Describe emergency or corrective action taken. Attach additional sheets, drawings, or photographs as needed.)

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INCIDENT REPORTER

PRINT NAME	SIGNATURE	DATE

Site Safety Officer must deliver this report to the Health & Safety Coordinator within 24 hours. Reviewed by:

PRINT NAME MFA Health & Safety Coordinator	SIGNATURE MFA Health & Safety Coordinator	DATE

APPENDIX E

TAILGATE SAFETY MEETING CHECKLIST

Tailgate Safety Meeting Checklist

MAUL FOSTER ALONGI

Client Name:	
Project No.:	
Communicated By:	
Date:	

Yes	NA	Information Reviewed
☐	☐	Emergency Procedures and Site Evacuation Routes
☐	☐	Route to Hospital
☐	☐	HASP Review and Location
☐	☐	Key Project Personnel
☐	☐	Emergency Phone Numbers
☐	☐	Stop Work Authority
☐	☐	General Site Description/History and Chemical Hazards
☐	☐	For Active Sites—Site Activities and Vehicular/Equipment Traffic
☐	☐	Site-Specific Physical Hazards
☐	☐	Required Personal Protective Equipment
☐	☐	Available Safety Equipment and Location
☐	☐	Daily Scope of Work (Reference JHAs as applicable)
☐	☐	Decontamination Procedures
☐	☐	Identify Work Zones, Exclusion Zones, and Decontamination Zones
☐	☐	Hazardous Atmospheres
☐	☐	Air Monitoring Equipment and Procedures
☐	☐	Identify Potential Site-Specific Slip, Trip, and Fall Hazards
☐	☐	Dust and Vapor Control
☐	☐	Confined Space(s)
☐	☐	Open Pits and Excavation
☐	☐	Extreme Temperatures
☐	☐	Incident Reporting
☐	☐	Other: ________________________________

Suggestions to Improve H&S Practices

Attendees

Name	Signature	Company
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		

APPENDIX B
SAMPLING AND ANALYSIS PLAN

UPLAND SAMPLING AND ANALYSIS PLAN

WEYERHAEUSER SAWMILL ABERDEEN/SEAPORT LANDING
FACILITY SITE ID 1126, CLEANUP SITE ID 4987, AGREED ORDER ID 11225

Prepared for
GRAYS HARBOR HISTORIC SEAPORT AUTHORITY
December 20, 2019
Project No. 1044.02.136

MAUL
FOSTER
ALONGI

Prepared by
Maul Foster & Alongi, Inc.
109 East 13th Street, Vancouver, WA 98660

UPLAND SAMPLING AND ANALYSIS PLAN
WEYERHAEUSER SAWMILL ABERDEEN/SEAPORT LANDING SITE
FACILITY SITE ID 1126, CLEANUP SITE ID 4987, AGREED ORDER ID 11225

The material and data in this plan were prepared under the supervision and direction of the undersigned.

MAUL FOSTER & ALONGI, INC.

Emily Hess, LG
Project Geologist

Kyle Roslund, LG
Senior Geologist

CONTENTS

TABLES

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ASTM	ASTM International
bgs	below ground surface
COC	chain of custody
EDD	electronic data deliverable
IDW	investigation-derived waste
LCS	laboratory control sample
LDS	laboratory duplicate sample
MFA	Maul Foster & Alongi, Inc.
MS/MSD	matrix spike and matrix spike duplicate
pH	potential hydrogen
PID	photoionization detector
QA	quality assurance
QC	quality control
RAU	remedial action unit
RI work plan	upland remedial investigation work plan
RPD	relative percent difference
SAP	sampling and analysis plan
site	Seaport Landing site, formerly the Weyerhaeuser Aberdeen Sawmill, located at 500 North Custer Street in Aberdeen, Washington
USEPA	U.S. Environmental Protection Agency

1 INTRODUCTION

On behalf of Grays Harbor Historical Seaport Authority, Maul Foster & Alongi, Inc. (MFA) has prepared this sampling and analysis plan (SAP) for remedial investigation activities to be conducted in the upland portion of the of the Seaport Landing site, formerly the Weyerhaeuser Aberdeen Sawmill, located at 500 North Custer Street in Aberdeen, Washington (the site; see Figure 1-1 of the upland remedial investigation work plan [RI work plan]).

This document describes the general procedures to be used for collection of samples of various media, as well as field measurement and sample preparation procedures. These procedures may require modification, based on site conditions. This document also outlines the requirements for field sampling and laboratory analytical activities associated with the project to ensure that the investigation produces complete and accurate environmental data sets that have high precision and low bias.

Additional information about project background and objective is provided in the RI work plan. This SAP specifies field and analytical methods, including quality assurance (QA) and quality control (QC) requirements.

2 SAMPLING AND FIELD PROCEDURES

Soil and groundwater samples will be collected and submitted for chemical analysis as described in the following sections. Sampling methods for each matrix, field testing procedures, and all relevant information are discussed below.

Note that buried underground utilities present a hazard for subsurface sampling. Private and public utility-location services will be used to identify locatable utilities in the subsurface sampling area before field sampling activities begin.

2.1 Soil Borings

Borings will be advanced using a direct-push probe drilling rig at the locations shown in Figure 5-1 of the RI work plan. A continuous core will be collected throughout the boring depth for visual characterization of material for the entire length of the core. Changes in the lithology of the core will be noted and a log of material from each boring will be prepared in the field by a geologist, hydrogeologist, scientist, or engineer licensed by the State of Washington or working under the direct supervision of a geologist licensed by the State of Washington.

A photoionization detector (PID) with 10.6-electron volt lamp will be used for prescreening of each core. As soon as the core is split open, the PID monitor will be held in the ambient air space just above the open core and slowly moved down the core from top to bottom. PID readings will be recorded in the field notebook.

Headspace screening, which will be conducted for each sample, will involve the following:

- A small representative sample will be collected from each sample interval to be screened, using a decontaminated sampling spoon. The material will be placed in a resealable plastic bag or a glass jar with a septum lid.
- The bag or jar will be tightly sealed and the material will be allowed to warm at least to the ambient temperature (>32 degrees Fahrenheit). The sample will be allowed to sit for at least ten to no more than 60 minutes to allow headspace concentrations to develop and will be shaken periodically for at least 30 seconds.
- The PID probe tip will be inserted into the container headspace, with care taken to avoid taking sediment or moisture into the probe.
- The highest reading (excluding possible erratic readings) on the meter will be recorded for the sample.

Samples may be collected from the continuous core. These will be prepared, handled, and documented as follows:

- New, disposable gloves will be used before the collection of each sample.
- Sampling equipment will be decontaminated before it is used at each sampling location.
- A gloved hand or a decontaminated stainless-steel spoon, trowel, or knife will be used to obtain samples from intervals.
- Samples for laboratory analysis will be transferred directly from the sampling device or stainless-steel bowl into laboratory-supplied glass jars, using a gloved hand or a decontaminated stainless-steel spoon, trowel, or knife.
- Borehole completion information should be provided in the boring logs (example provided in Appendix B1) for any borehole, regardless of whether it is backfilled or completed as a monitoring well or piezometer.
- Boring logs will include the project name and location; the name of the individual logging the borehole; the name of the drilling contractor; the drilling method; the make and model of drilling equipment; the casing diameter; the sampling method; soil sample depths; depth of groundwater encountered (if applicable); contact points for waste rock, native soil, and bedrock; total borehole depth; and a description of material encountered. Sampled material will be described using ASTM International (ASTM) designation D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), including estimated percentages of fines, sand, gravel, and cobbles. The standard involves describing color, grain size, moisture content, density, organic matter, and other observed characteristics.

Boreholes may be constructed as monitoring wells or abandoned by filling with bentonite chips, granules, or grout slurry, as appropriate. When the top of the bentonite chips or granules has been brought above the static water level, water will be added to hydrate these materials. The volume required to fill the borehole and the actual amount of bentonite chips, granules, or grout added will be recorded on a well construction form.

2.2 Test Pits

Test pits will be excavated to a depth described in the RI work plan, or until groundwater/field conditions prevent advancement. The soil throughout the excavation will be visually inspected to determine the lithology and will be described in boring logs.

Samples may be collected from within the excavation itself if the excavation conditions are safe (e.g., excavation wall no higher than 4 feet) by use of a decontaminated stainless-steel tool or a clean-gloved hand. If the test pit is unsafe for entry, then the excavators will be directed to collect samples with the excavator bucket, using a clean-gloved hand and sampling from material not in contact with the excavation equipment itself. Samples will be prepared, handled, and documented as follows:

- New, disposable gloves will be used for the collection of each sample.
- Sampling equipment will be decontaminated before it is used at each sampling location.
- Samples will be obtained from intervals specified in Table 5-1 of the RI work plan, in accordance with the methods outlined immediately above. The sampling interval may be changed to reflect project objectives and/or field conditions.
- Samples for laboratory analysis will be transferred directly from the sampling device or stainless-steel bowl into laboratory-supplied glass jars, using a gloved hand or a decontaminated stainless-steel spoon, trowel, or knife.
- Test pit logs will include the project name and location; the name of the individual logging the test pit; the name of the excavating contractor; the excavating method; the make and model of excavating equipment; the sampling method; the soil sample depth; the depth of groundwater encountered (if applicable); the total test pit depth; and a description of material encountered. Sampled material will be described using ASTM designation D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedures), including estimated percentages of fines, sand, gravel, and cobbles. The standard involves describing color, grain size, moisture content, density, organic matter, and other observed characteristics.

Generally, upon completion, test pits will be backfilled with the excavated material, unless conditions necessitate otherwise.

2.3 Groundwater Monitoring Well Development

It is anticipated that five borings will be completed as monitoring wells (see Figure 5-3 of RI work plan). Installed monitoring wells will be surveyed, by a surveyor licensed in the state of Washington, to the nearest 0.01 foot vertical and 0.10 foot horizontal at a minimum.

The measuring point elevation in a monitoring well typically will be measured on the north rim of the well casing, unless otherwise marked.

Installed wells will be developed at least 24 hours after installation by surging, bailing, or pumping to remove sediment that may have accumulated during installation and to improve the hydraulic connection with the water-bearing zone.

Depending on site conditions, wells will be developed using a peristaltic pump or an inertia pump in conjunction with a surge block or bailer, and will follow U.S. Environmental Protection Agency (USEPA) monitoring well development standard operating procedures (USEPA, 2001). Water quality field parameters such as specific conductance, potential hydrogen (pH), temperature, and turbidity will be measured during well development. The wells will be developed until final field parameters meet the following criteria, to the extent practical:

- Turbidity measurements are 10 nephelometric turbidity units or less, or until there is no noticeable decrease.
- Specific conductance is within 3 percent of the previous reading.
- pH is within 0.1 standard unit of the previous reading.
- Temperature is within 0.1 degree Celsius (°C) of the previous reading.

Field parameters, water level, and volume of water extracted from the well will be recorded on a field form. If feasible, at least five times the volume of water introduced during borehole drilling and well installation should be extracted.

2.4 Water Level Measurements

Before well development or sampling, the well cap will be removed and, after the well has been allowed to equilibrate with the atmosphere for a minimum of 10 minutes, the water level will be measured from the north side of the well casing. The depth to water in the well will be measured and recorded.

2.5 Monitoring Well Groundwater Sampling

Sampling methods are designed to collect samples representative of in situ groundwater. Before sampling, the well will be purged to minimize solids and to ensure that a representative sample is collected. Generally, the well will be purged using a peristaltic pump or a submersible pump equipped with new polyethylene tubing (Puls and Barcelona, 1996; USEPA, 2002). A submersible pump will be used if the groundwater is too deep to retrieve with a peristaltic pump.

New tubing or pump intake is lowered to the middle of well screen or, if the water level is below the top of the screen, from the middle of the water column, avoiding disturbing the sediments at the bottom. Low-flow purging will be conducted at a rate between 0.1 and 0.5 liter per minute. The water level will be monitored before and during purging. Once the purge rate is stabilized, drawdown of more than 0.3 foot should be avoided. Field parameters will be measured using the procedures in Section 2.7. Once stable conditions are observed, the groundwater samples will be collected directly into laboratory-supplied bottles.

One groundwater sample set per well will be collected for laboratory analysis. Groundwater submitted for analysis of dissolved constituents will be field-filtered using a new 0.45-micron inline filter before containerization. The first 100 to 300 milliliters of a groundwater sample (depending on sample turbidity) taken through the in-line filter will not be collected for a sample in order to ensure that the filter media have equilibrated to the sample (the manufacturer's recommendations also should be considered). Water samples to be submitted for laboratory analysis will be collected in laboratory-supplied containers.

2.6 Reconnaissance Groundwater Sampling

Temporary borings will be advanced in an effort to encounter and sample groundwater. When groundwater is encountered, the static water level will be evaluated after allowing the water level in the borehole to equilibrate for approximately 10 minutes. The depth to water will be measured and recorded.

Sampling methods are designed to collect samples representative of in situ groundwater. Reconnaissance groundwater samples will be collected by advancing the boring to the desired sampling depth, at a minimum of 5 feet below the top of the water table, if applicable. Then, the borehole will be cleaned of loose soil and purged to minimize solids and ensure that a representative groundwater sample can be collected from the drill rod casing. Both purging and sampling will employ a peristaltic pump and new polyethylene tubing. Field parameters will be measured using the procedures in Section 2.7. Once stable conditions are observed, if feasible, the groundwater samples will be collected directly into laboratory-supplied bottles.

One groundwater sample set per boring will be collected for laboratory analysis. Groundwater submitted for analysis of dissolved constituents will be field-filtered using a 0.45-micron inline filter before containerization. The first 100 to 300 milliliters of a groundwater sample (depending on sample turbidity) taken through the in-line filter will not be collected for a sample in order to ensure that the filter media have equilibrated to the sample (the manufacturer's recommendations also should be considered). Groundwater samples to be submitted for laboratory analysis will be collected in laboratory-supplied containers.

2.7 Field Parameter Measurements and Groundwater Sample Collection

Prior to sampling, groundwater parameters and water level will be measured periodically (every three to five minutes, depending on flow rate) during purging to evaluate conditions. The following water quality parameters will be measured in situ with a multiparameter, handheld meter and will be recorded on a field sampling data sheet (see Appendix B1): temperature, pH, specific conductance, and turbidity. Groundwater samples will be collected after three consecutive readings indicate that the system is stable and the above parameters meet the following criteria (Puls and Barcelona, 1996; USEPA, 2002):

- Specific conductance within 3 percent
- Temperature within 0.1°C
- pH within 0.1 standard units
- Turbidity below 5 nephelometric turbidity units, or 10 percent for values greater than 5 nephelometric turbidity units

Note that groundwater samples may be collected from reconnaissance locations before three consecutive readings have been taken.

2.8 Sample Nomenclature

The field personnel will be responsible for labeling samples and establishing identification. All data will be keyed to the sample's unique sample designation, which will be used on sample containers and associated field data forms, as well as being used to key the sample identification in the project database.

The field personnel will clearly label each sample container, using permanent ink on a waterproof sample label, as soon as possible following collection. At a minimum, the following information will be written on the sample label:

- Unique sample identification code
- Time and date of collection
- Name of field investigation contractor
- Site project number
- Preservative, if appropriate

In order to maintain sample identification consistency in the project database, the unique sample identification code will be assigned according to the following convention:

- Unique sample location – matrix type – depth (if applicable).
- The unique sample location will be represented using the remedial action unit (RAU) number and the boring number within that RAU.
- Typical matrix type codes include the following:
  - SO = soil
  - GW = groundwater

- Depth below ground surface (bgs): the sample collection midpoint will be used.
- Field duplicate samples will include "DUP" at the end of the ID.
- Rinsate blanks will include "RB" at the end of the ID.
- Filter blanks will include "FB" at the end of the ID.

For example, a soil sample collected from a boring at RAU 3 at boring location four from 3 to 5 feet bgs would have the following sample ID: RAU3-04-SO-4. A groundwater sample collected from the same location at 8 feet bgs would be RAU3-04-GW-8, and a field duplicate of the groundwater sample would be RAU3-04-GW-8-DUP.

2.9 Sample Equipment Decontamination

Sampling equipment and reusable materials that contact sample media will be decontaminated between uses. Decontamination methods appropriate for the specific media and equipment being used will typically involve the following:

1. Distilled-water rinse
2. Wash with scrub brush and Alconox™ soap and distilled water solution
3. Distilled-water rinse
4. Methanol solution rinse (1:1 solution with distilled water)
5. Final distilled-water rinse

Liquid generated by decontamination will be properly handled, according to procedures described in Section 2.11.

2.10 Positioning

A global positioning system will be used to locate the sampling position for each proposed location shown on Figure 5-1 in the RI work plan. Efforts will be made to collect samples from each location; however, some locations may be inaccessible. Samples may be field adjusted and will be collected as close as possible to the intended sample location. The global positioning system will be used to record each location that has been field-adjusted.

2.11 Management of Investigation-Derived Waste

Generally, investigation-derived waste (IDW) will include unsaturated and saturated soil cuttings, purged groundwater, and decontamination fluids. The IDW will be segregated (e.g., soil, and water will be containerized separately). Drums (tops and sides) will be labeled with their contents, the volume of material, the date of collection, and the origin of the material. At the end of each workday, the drums will be sealed and transferred to a designated secured area on the site, where they will be stored pending waste profiling, transport, and off-site disposal at a permitted facility. A composite sample will be collected from each drum to determine waste profiling. The sampling suite may include toxicity characteristic leaching procedure (TCLP) for evaluation of TCLP results relative to applicable RCRA criteria. Handling procedures may change, depending on site-specific conditions. Personal protective equipment will be disposed of as solid waste.

3 SAMPLE HANDLING AND FIELD QUALITY CONTROL AND QUALITY ASSURANCE PROCEDURES

In order to maintain sample integrity between the field collection and the laboratory analysis, the storage, handling, and shipping of samples will follow the procedures described in this section.

3.1 Sampling and Analysis Methods

All samples will be collected consistent with the requirements and best practices for media being sampled and the analytes of interest. Samples will be collected in containers supplied by the analyzing laboratory in order to ensure that the container has been properly cleaned and sufficient sample material is collected. Sample container and preservation requirements for the analyte groups of contaminants of concern are listed in Tables B-1 and B-2 for soil and groundwater, respectively.

Apex Laboratories will be the primary laboratory contracted for analysis of environmental media. Their reporting limits and laboratory control limit criteria typical of soil and groundwater analyses are provided in Tables B-3 and B-4, respectively. The soil and groundwater reporting limits are compared to selected screening levels. If reporting limits are insufficient to achieve the project goals, adjusted reporting limits or alternative low-level methods may be used as necessary and available.

3.2 Sample Storage

In order to maintain sample integrity, samples will be placed in coolers filled with ice or equivalent immediately after collection. Samples will be maintained at approximately 4°C.

3.3 Sample Custody

The field investigation personnel and analytical laboratory contractor(s) will be responsible for following sample custody procedures during sampling and analysis, as well as for providing sample tracking. Sample custody procedures will include documentation of the history of samples from the time of sample collection through shipment, analysis, and disposal. Samples and sample documentation will be maintained in the physical possession of authorized field personnel or under control in a secure location.

3.3.1 Sample Custody in the Field

The field investigation contractor personnel will be responsible for completing the chain-of-custody (COC) forms upon sample collection. Each COC form will contain, at a minimum, the following information:

- Project number
- Project name
- Project manager
- Unique sample identification code
- Time and date of collection
- Field sampler's name
- Separate shipping papers
- Signature, printed name, and organization name of all persons having custody of samples; date and time of transfer
- Sample matrix
- Sample preservation
- Quantity of sample containers
- Requested analyses for each sample
- Requested analytical turnaround time
- Any additional information on requested analysis, e.g., holding time, specific matrix spike and matrix spike duplicate (MS/MSD) samples

3.3.2 Sample Packaging and Shipment

Persons in possession of the samples will be required to sign and date the COC form whenever samples are transferred between individuals or organizations (with the exception of freight carriers).

Samples will be delivered to the laboratory by ground transportation (laboratory courier or field personnel), and the following custody procedures will be followed: samples will be packed in the appropriate shipping containers. The top copy of the COC form will accompany the samples. If samples are transported by courier, the laboratory courier will retain a second copy of the COC and shipping forms to allow sample tracking. The COC form will accompany the samples from point of release from the site to the laboratory. If transported to the laboratory by field personnel, COCs will be signed and copies distributed at the time of sample delivery to the laboratory.

The laboratory will implement its in-house custody procedures, which begin when sample custody is transferred to laboratory personnel.

3.3.3 Sample Custody in Laboratory

The analytical laboratory contractor's sample custodian will be responsible for handling and documentation of samples received at the laboratory. The designated sample custodian will accept custody of the received samples and will verify that the COC form matches the samples received. The shipping container or set of containers will be given a laboratory identification number, and each sample will be assigned a unique sequential identification number.

3.4 Sample Documentation and Records

3.4.1 Field Logbooks and Forms

Field investigation personnel will be responsible for maintaining a daily record of significant events, observations, and measurements during field investigations. Field records may be recorded in a bound logbook or on paper or electronic field data sheets. A separate entry will be made for each sample collected. Field logbooks and forms will be included in the project files at the end of field activities to provide a record of sampling.

3.4.2 Equipment Calibration Log

Field investigation personnel will be responsible for maintaining an equipment calibration log to record the calibration measurements and frequencies. This log may be incorporated into the field logbook notes for a specific date and activity.

3.5 Field Quality Control Samples

Field QC samples are used to assess the accuracy and precision of the field sample-collection and -handling activities. Field QC samples will be analyzed for the same parameters as the investigative samples (where applicable). The results of the field QC samples will be reported along with investigative sampling results. Tables B-5 and B-6 summarize the QA/QC sampling requirements and frequency for soil and groundwater, respectively.

- **Field Duplicate:** Field duplicate samples are collected to assess reproducibility of field procedures and homogeneity of the samples. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the duplicate sample. Field duplicate samples will be collected following the same procedures used to collect investigative samples. They will be collected from the same location and depth interval (if applicable) as the parent-investigative sample immediately after the parent-investigate sample is collected.
- **Temperature Blank:** The laboratory will provide temperature blanks in each cooler and will use analyte-free (reagent) water to prepare temperature blanks. Temperature blanks are used by the laboratory to record the temperature of each cooler used to transport samples from the field to the laboratory. The laboratory will verify that the temperature blank measurement is within the acceptable range specific to the analytical method.

- **Equipment Rinsate Blank:** Analyses of equipment rinsate blanks will be used to assess the efficiency of field equipment decontamination procedures in preventing cross-contamination of samples. Equipment rinsate blanks will be collected by pouring laboratory-certified distilled or deionized water over or through decontaminated sampling equipment used in the collection of investigative samples and subsequently collected in prepared sampling containers. Additives or preservatives will be included in the equipment rinsate blanks as required for analysis. The equipment rinsate blanks will be shipped with the associated field samples. Equipment rinsate blanks will not be required if dedicated, disposable equipment is used for sampling.
- **Trip Blank:** Trip blanks are collected for volatile organic compound sample analysis to assess whether sample cross-contamination has occurred during transport to the site, sample collection, and transport to the laboratory. Trip blanks are prepared in the laboratory, using analyte-free water. Trip blanks should be inspected for air bubbles by both the laboratory (before shipping) and the field team. Any vials containing visible air bubbles should be discarded. One trip blank is included for each sample cooler collected for analysis of volatile organic compounds and shipped to the laboratory.
- **Aqueous Filter Blank:** Aqueous filter blanks are collected to assess the contamination of aqueous samples from target analytes in the filters used for samples for dissolved analyses. Certified reagent water filters will be from the same manufacturing lot of filters used for the associated investigative samples and will be collected in prepared sample containers. Aqueous filter blanks are collected by filtering deionized water into a sample container through a filter from the filter lot being used for the sampling event.

4 LABORATORY ANALYTICAL METHODS

4.1 Chemical Analyses

Tables B-1 and B-2 summarize analytical methods, preservation requirements, and holding times for soil and groundwater samples, respectively.

4.2 Method Reporting Limits

Method reporting limits (including method detection and estimated detection limits) and screening-level criteria are included in Tables B-3 and B-4. The laboratory will make every effort to meet analyte quantitation limits below screening-level criteria. Method detection limits may also be evaluated to achieve analyte detections below screening level criteria. Unforeseen matrix interference could cause elevated quantitation limits for some compounds. All reasonable means, including additional cleanup steps and method modifications, will be used to bring sample quantitation limits below the screening levels. USEPA Method 1613B dioxin/furan will also be evaluated and reported with estimated detection limits.

4.3 Holding Times and Sample Preservation

Tables B-1 and B-2 summarize sample preservation and holding times for each matrix and analysis. All samples will be preserved by storage at approximately 4°C.

5 LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

5.1 Quality Assurance and Quality Control Checks

USEPA methods include specific instructions for the analysis of QC samples and the completion of QC procedures during sample analysis. These QC samples and procedures verify that the instrument is calibrated properly and remains in calibration throughout the analytical sequence, and that the sample preparation procedures have been effective and have not introduced contaminants into the samples. Additional QC samples are used to identify and quantify positive or negative interference caused by the sample matrix. The following laboratory QC procedures are required for most analytical procedures:

- **Calibration Verification**—Initial calibration of instruments will be performed at the start of the project or sample run, as required, and when any ongoing calibration does not meet control criteria. The number of points used in the initial calibration is defined in the analytical method. Continuing calibration will be performed as specified in the analytical method to track instrument performance. If a continuing calibration does not meet control limits, analysis of project samples will be suspended until the source of the control failure is either eliminated or reduced to within control specifications. Any project samples analyzed while the instrument was outside control limits will be reanalyzed.
- **Method Blanks**—Method blanks are used to assess possible laboratory contamination of samples associated with all stages of preparation and analysis of samples and extracts. The laboratory will not apply blank corrections to the original data. A minimum of one method blank will be analyzed for every sample extraction group, or one for every 20 samples, whichever is more frequent.
- **MS/MSD Samples**—MS samples are analyzed to assess the matrix effects on the accuracy of analytical measurements. A minimum of one MS will be analyzed for each analytical batch, or one for every aqueous 20 samples, whichever is more frequent, when MSs/MSDs are required by the method. Because the MS is a duplicate sample, it measures the quality of laboratory preparatory techniques and the heterogeneity of the sample.
- **Surrogate Spike Compounds and Labeled Analogues**—Surrogate spikes and labeled analogues are used to evaluate the recovery of an analyte from individual samples. All project samples to be analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the associated analytical method. Recoveries

determined using these compounds will be reported by the laboratory; however, the laboratory will not correct sample results using these recoveries.

- **Laboratory Control Samples (LCSs)**—Analysis is conducted on LCSs and LCS duplicates that have been prepared by spiking laboratory-certified, reagent-grade water, or sand blanks with the analytes of interest or a certified reference material. The result for percent recovery and relative percent difference (RPD) of the LCSs and LCS duplicates is a data quality indicator of the accuracy and reproducibility of the analytical method and laboratory performance.
- **Laboratory Duplicate Samples (LDSs)**—LDSs are prepared by the laboratory by splitting an investigative sample into two separate aliquots and performing separate sample preparation and analysis on each aliquot. The results for RPD of the primary investigative sample and the respective LDSs are used to measure precision in the analytical method and laboratory performance. For nonaqueous matrices, sample heterogeneity may affect the measured precision for the LDS.

5.2 Calibration and Preventative Maintenance

The laboratory calibration ranges specified in SW-846 (USEPA, 1986) will be followed, when applicable.

Preventative maintenance of laboratory equipment will be the responsibility of the laboratory personnel and analysts. This maintenance includes routine care and cleaning of instruments, and inspection and monitoring of carrier gases, solvents, and glassware used in analyses. The preventative-maintenance approach for specific equipment will follow the manufacturers' specifications and good laboratory practices.

Precision and accuracy data will be examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to change, as indicated by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet any of the QC criteria.

6 DATA ANALYSIS AND RECORDKEEPING

6.1 Data Management

Databases will be managed by the data managers and chemists. Data managed include field and laboratory data as described in the following sections.

6.1.1 Field Data

Field data may be recorded in a bound logbook or on paper or electronic field data sheets. Hard copies of all field data will be scanned and saved electronically. Field data collected on field data sheets may be imported into a project database. Should field data require hand-entry into an electronic format prior to importation into the project database, the data will subsequently be reviewed for data entry errors by different, qualified individuals.

6.1.2 Laboratory Data

The laboratory shall record the results of each analysis in their own internal database in accordance with the contracted laboratory's QA plan. The laboratory will provide both method detection limits and method reporting limits with the reported data. Data will be provided to the consultant data manager as electronic data deliverables (EDDs). EDDs will be imported directly into a project database used for data storage. Validated laboratory results will be exported and provided as part of the final report for each project.

Laboratory data deliverables are listed below. EDDs will contain all data that are presented in the pdf report:

- Transmittal cover letter
- Case narrative
- Analytical results
- COC
- Surrogate and internal standard recoveries
- Method blank results
- LCS results
- MS/MSD results
- Laboratory duplicate results
- Chromatograms for diesel- and oil-range petroleum hydrocarbon results
- EDD

6.2 Data Review, Verification, and Validation

Data validation is the process of evaluating the completeness, correctness, and compliance of a specific data set against the method, procedural, or contractual specifications. Data validation is confirmation by examination and provision of objective evidence that the particular requirements for specific intended use have been fulfilled; it is an analyte- and sample-specific process that extends the evaluation of data beyond method, procedural, or contractual compliance (i.e., data verification) to the analytical quality of a specific data set. Data review, verification, and validation will be conducted by MFA.

MFA uses EQuIS environmental data management software to manage all laboratory data. The laboratory will provide the analytical results in electronic EQuIS-deliverable format. Following data evaluation, data qualifiers and analytical results will be entered into MFA's EQuIS database as well as into Ecology's Environmental Information Management EIM database. Consistent with Washington Administrative Code 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840 (Data Submittal Requirements), data will be submitted simultaneously in both written and electronic formats.

6.3 Data Verification Methods

6.3.1 Laboratory Data Verification Methods

The laboratory analyst will be responsible for the reduction of raw data generated at the laboratory bench and verification that data reduction performed by the laboratory instrument or Laboratory Information Management System is correct.

Data verification QC checks that will be performed for all generated data are as follows:

- Verify that batch QC were analyzed at the specified frequency.
- Verify that calibrations and calibration checks comply with laboratory criteria.
- Verify that holding times for extraction and analyses and sample preservation were met.
- Verify that the quantitation limits and method detection limits were met.
- Verify that all project and QC sample results were properly reported and flagged appropriately for any failing laboratory QC or as necessary to address other data quality issues.
- Review COC documentation to verify completeness of the sample set for each data package submitted.
- Assess the impact of laboratory and field QC results.

These QC checks will be performed by laboratory analysts, the assigned laboratory project manager or supervisor, laboratory QC specialists, or a combination of these personnel. After the data reports have been reviewed and verified, the laboratory reports will be signed and released for distribution.

6.3.2 Field Data Verification Methods

Field data collected during field activities will be evaluated for usability by a QA review that consists of checking procedures followed and comparing the data to previous measurements. Field QC samples will be evaluated to ensure that field measurements and sampling protocols have been observed and followed.

The field data verification process will be performed at two levels. The first level will be conducted at the time of collection and consists of following standard procedures and QC checks. The second level will be performed during compilation of field data and will include checks for data anomalies. Anomalies or inconsistent data will be resolved by seeking clarification from field personnel responsible for collecting the data, and will be documented during the data verification process.

6.4 Data Validation Methods

Validation of the analytical data will be performed by the consultant chemist. The chemist will review laboratory performance criteria and sample-specific criteria consistent with Sections 2.5 and 2.6. Validation reports and corresponding laboratory reports will be made available with project reports.

Validation will be performed for 100 percent of the data report packages for each analysis type generated by each analytical laboratory. The independent data validation review will include review of the following items from the Tier II (S2AVM) laboratory data reports: consistency with the COC, holding times, surrogate recoveries, MS recoveries, field duplicate agreement, MSD and laboratory duplicate precision, equipment blanks, and method blank analyses and items identified in Sections 2.5 and 2.6. Refer to USEPA (2009) for S2AVE level data validation and verification requirements.

If Tier II data validation reviews reveal systemic data quality issues, a Tier IV (S4VEM) will be conducted on selected data packages to assess laboratory performance criteria (e.g., initial calibration, continuing calibration, tuning, sensitivity, degradation), chromatograms, and calculation checks. Refer to USEPA (2009) for S4VEM level data validation and verification requirements. The QC elements to be reviewed for the full data validation include the following for organic and inorganic analyses:

Organic Analyses

- Consistency with COC
- Holding times
- Initial calibration
- Continuing calibration
- Blanks
- Surrogate recovery
- MS/MSD recovery
- LCS recovery
- LDS RPD
- Internal standard performance
- Field duplicate sample analysis RPD
- Compound identification
- Compound quantitation and detection limits
- Tentatively identified compound verification (gas chromatograph/mass spectrograph analysis)
- System performance
- Overall assessment of the data

Inorganic Analyses

- Consistency with COC
- Holding times

- Initial calibration
- Continuing calibration
- Blanks
- MS/MSD recovery
- LCS recovery
- LDS RPD
- Interference check (inductively coupled plasma analysis)
- Serial dilution checks
- Field duplicate sample analysis RPD
- Analyte identification
- Analyte quantitation and detection limits
- System performance
- Overall assessment of data

Data validation reports will provide the appropriate data validation label (i.e., S2AVM or S4VEM). The data validator will review data and assign data qualifiers to sample results, following method-specific guidelines (USEPA, 1986) and sections of the USEPA procedures for review of inorganic data (USEPA, 2017a) and organic data (USEPA, 2017b).

Data qualifiers are used to classify sample data as to their conformance to QC requirements. The most common qualifiers are:

- J—Estimate, qualitatively correct but quantitatively suspect.
- R—Reject, data not suitable for any purpose.
- U—Not detected at a specified detection limit.

Poor surrogate, blank contamination, or calibration problems, among other things, can require qualification of the sample data. Whenever sample data are qualified, the reasons for the qualifications will be stated in the data validation report.

6.5 Dioxin Data Handling

Dioxin data will be reported consistent with the attached Dioxin and Furan Analysis, Data Validation, and TEQ Calculation Rules memorandum (see Appendix B2) and with relevant USEPA guidance (USEPA, 2014).

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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TABLES

Table B-1
Soil Analytical Methods
Seaport Landing Upland Remedial Investigation Workplan

MAUL FOSTER ALONGI

Analyte Group	Method	Suggested Volume Per Container	Container Type	Preservative	Storage Temperature	Holding Times from Collection
Dioxins and Furans	USEPA 1613B/8290A	4 oz	Glass Jar	None	0 to 6°C	1 year
Total Metals[a]	USEPA 6020A	4 oz	Glass Jar	None	0 to 6°C	6 months[b]
Petroleum Hydrocarbon Identification	NWTPH-HCID	4 oz	Glass Jar	None	0 to 6°C	14 days
Gasoline-Range Organics	NWTPH-Gx	1 5035 kit[c]	VOA/Glass Jar[c]	[c]	0 to 6°C	14 days
Diesel- and Heavy-Oil-Range Organics	NWTPH-Dx	4 oz	Glass Jar	None	0 to 6°C	14 days
PCB Aroclors	USEPA 8082A	4 oz	Glass Jar	None	0 to 6°C	365 days
SVOCs	USEPA 8270D	4 oz	Glass Jar	None	0 to 6°C	14 days
PAHs	USEPA 8270D	4 oz	Glass Jar	None	0 to 6°C	14 days
VOCs	USEPA 8260B	1 5035 kit[c]	VOA/Glass Jar[c]	[c]	0 to 6°C	14 days

NOTES:

°C = degrees Celsius.

ml = milliliter.

NWTPH = Northwest Total Petroleum Hydrocarbons.

oz = ounces.

PAH = polycyclic aromatic hydrocarbon.

PCB = polychlorinated biphenyl.

SIM = selected ion monitoring.

SVOC = semivolatile organic compound.

USEPA = U.S. Environmental Protection Agency.

VOA = volatile organic analysis vial.

VOC = volatile organic compounds.

[a]arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc.

[b]Twenty-eight days for mercury.

[c]5035A Sample Kit = two preweighed, methanol-preserved, 40-ml VOAs containing a small magnetic stir bar for low-level analysis; one preweighed, sodium-bisulfate-preserved 40-ml VOA for medium-high-level analysis; and one 4-ounce jar for moisture content determination.

Table B-2
Groundwater Analytical Methods
Seaport Landing Upland Remedial Investigation Workplan

Analyte Group	Method	Suggested Volume Per Container	Container Type	Preservative	Storage Temperature	Holding Times from Collection
Total Metals[a]	USEPA 6020A	250 ml	Polyethylene	None	0 to 6°C	6 months[b]
Dissolved Metals[a,c]	USEPA 6020A	250 ml	Polyethylene	HNO_3 pH < 2	0 to 6°C	6 months[b]
Petroleum Hydrocarbon Identification	NWTPH-HCID	1 liter	Amber Glass	HCl pH < 2	0 to 6°C	14 days
Gasoline-Range Organics	NWTPH-Gx	3-40 ml	VOA	HCl pH < 2	0 to 6°C	14 days
Diesel- and Heavy-Oil-Range Organics	NWTPH-Dx	1 liter	Amber Glass	HCl pH < 2	0 to 6°C	14 days
PCB Aroclors	USEPA 8082A	1 liter	Amber Glass	None	0 to 6°C	14 days
SVOCs	USEPA 8270D	1 liter	Amber Glass	None	0 to 6°C	7 days
PAHs	USEPA 8270D	1 liter	Amber Glass	None	0 to 6°C	7 days
VOCs	USEPA 8260B	3-40 ml	VOA	HCl pH < 2	0 to 6°C	14 days
Sulfide	SM4500	250 ml	Polyethylene	Zinc Acetate	0 to 6°C	7 days

NOTES:
°C = degrees Celsius.
HCl = hydrochloric acid.
HNO_3 = nitric acid.
ml = milliliter.
NWTPH = Northwest Total Petroleum Hydrocarbons.
PAH = polycyclic aromatic hydrocarbon.
PCB = polychlorinated biphenyl.
SIM = selected ion monitoring.
SM = Standard Methods for the Examination of Water and Wastewater.
SVOC = semivolatile organic compound.
um = micron.
USEPA = U.S. Environmental Protection Agency.
VOA = volatile organic analysis vial.
VOC = volatile organic compounds.
[a]arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel, zinc.
[b]Twenty-eight days for mercury.
[c]Field-filtered through a 0.45-um filter. Filtered aliquot preserved with HNO_3.

Table B-3
Soil Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Total Metals									
Arsenic	1	0.15	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Cadmium	0.2	0.035	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Chromium	1	2000[(a)]	MTCA A	mg/kg	USEPA 6020A	75-125	40	80-120	90
Copper	1	14	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Lead	0.2	150	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Manganese	1	3700	MTCA B DC	mg/kg	USEPA 6020A	75-125	40	80-120	90
Mercury	0.08	0.1	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Nickel	1	6.5	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Zinc	4	300	MTCA B SPGS	mg/kg	USEPA 6020A	75-125	40	80-120	90
Hexavalent Chromium	2.25	0.9	MTCA B SPGS	mg/kg	USEPA 7199	75-125	20	80-120	90
Petroleum Hydrocarbons									
Gasoline-range organics	25	30/100[(b)]	MTCA A	mg/kg	NWTPH-Gx	75-125	30	80-120	90
Diesel-range organics	15	2000	MTCA A	mg/kg	NWTPH-Dx	75-125	30	80-120	90
Lube-oil-range organics	15	2000	MTCA A	mg/kg	NWTPH-Dx	75-125	30	80-120	90
VOCs									
1,1,1,2-Tetrachloroethane	25	38000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,1,1-Trichloroethane	25	84	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,1,2,2-Tetrachloroethane	25	0.08	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	100	2400000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,1,2-Trichloroethane	25	1.8	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,1-Dichloroethane	25	2.6	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,1-Dichloroethene	25	2.5	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,1-Dichloropropene	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
1,2,3-Trichlorobenzene	250	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
1,2,3-Trichloropropane	50	33	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,2,4-Trichlorobenzene	250	29	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90

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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
1,2,4-Trimethylbenzene	50	800000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,2-Dibromo-3-chloropropane	250	1300	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,2-Dibromoethane	25	5.0	MTCA A	ug/kg	5035/8260B	65-135	30	65-135	90
1,2-Dichlorobenzene	25	400	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,2-Dichloroethane	25	1.6	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,2-Dichloropropane	25	1.7	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,3,5-Trimethylbenzene	50	800000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
1,3-Dichlorobenzene	25	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
1,3-Dichloropropane	50	0.14	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
1,4-Dichlorobenzene	25	68	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
2,2-Dichloropropane	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
2-Butanone	500	48000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
2-Chlorotoluene	50	1600000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
2-Hexanone	500	400000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
4-Chlorotoluene	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
4-Isopropyltoluene	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
4-Methyl-2-pentanone	500	6400000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Acetone	1000	2100	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Benzene	12.5	1.7	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Bromobenzene	25	33	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Bromochloromethane	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
Bromodichloromethane	50	2.4	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Bromoform	50	23	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Bromomethane	500	3.3	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Carbon disulfide	500	270	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Carbon tetrachloride	25	2.2	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Chlorobenzene	25	51	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Chloroethane	500	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90

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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Chloroform	50	4.8	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Chloromethane	250	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
cis-1,2-Dichloroethene	25	0.0052	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
cis-1,3-Dichloropropene	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
Dibromochloromethane	100	1.8	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Dibromomethane	50	800000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Dichlorodifluoromethane	100	16000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Ethylbenzene	25	340	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Hexachlorobutadiene	100	30	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Isopropylbenzene	50	8000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
m,p-Xylene	50	NV	NV	ug/kg	5035/8260B	65-135	30	65-135	90
Methyl tert-butyl ether	50	7.2	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Methylene chloride	250	1.5	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Naphthalene	100	240	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
n-Butylbenzene	50	4000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
n-Propylbenzene	25	8000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
o-Xylene	25	840	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
sec-Butylbenzene	50	8000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Styrene	50	120	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
tert-Butylbenzene	50	8000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Tetrachloroethene	25	2.8	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Tetrahydrofuran	500	72000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Toluene	50	270	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
trans-1,2-Dichloroethene	25	32	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
trans-1,3-Dichloropropene	50	0.14	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Trichloroethene	25	1.5	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90
Trichlorofluoromethane	100	24000000	MTCA B DC	ug/kg	5035/8260B	65-135	30	65-135	90
Vinyl chloride	25	0.089	MTCA B SPGS	ug/kg	5035/8260B	65-135	30	65-135	90

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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
SVOCs									
1,2,4-Trichlorobenzene	6.67	29	MTCA B SPGS	ug/kg	USEPA 8270D	40-122	30	40-122	90
1,2-Dichlorobenzene	6.67	400	MTCA B SPGS	ug/kg	USEPA 8270D	7-120	30	7-120	90
1,2-Dinitrobenzene	66.7	8000	MTCA B DC	ug/kg	USEPA 8270D	47-123	30	47-123	90
1,3-Dichlorobenzene	6.67	NV	NV	ug/kg	USEPA 8270D	39-125	30	39-125	90
1,3-Dinitrobenzene	66.7	8000	MTCA B DC	ug/kg	USEPA 8270D	49-126	30	49-126	90
1,4-Dichlorobenzene	6.67	68	MTCA B SPGS	ug/kg	USEPA 8270D	5-120	30	5-120	90
1,4-Dinitrobenzene	66.7	8000	MTCA B DC	ug/kg	USEPA 8270D	45-129	30	45-129	90
1-Methylnaphthalene	5.33	34000	MTCA B DC	ug/kg	USEPA 8270D	45-132	30	45-132	90
2,3,4,6-Tetrachlorophenol	13.3	2400000	MTCA B DC	ug/kg	USEPA 8270D	43-134	30	43-134	90
2,3,5,6-Tetrachlorophenol	13.3	NV	NV	ug/kg	USEPA 8270D	50-124	30	50-124	90
2,3,5-Trimethylnaphthalene	2.67	NV	NV	ug/kg	USEPA 8270D	45-134	30	45-134	90
2,4,5-Trichlorophenol	13.3	1500	MTCA B SPGS	ug/kg	USEPA 8270D	43-134	30	43-134	90
2,4,6-Trichlorophenol	13.3	1500	MTCA B SPGS	ug/kg	USEPA 8270D	5-140	30	5-140	90
2,4-Dichlorophenol	13.3	10	MTCA B SPGS	ug/kg	USEPA 8270D	29-122	30	29-122	90
2,4-Dimethylphenol	13.3	79	MTCA B SPGS	ug/kg	USEPA 8270D	40-120	30	40-120	90
2,4-Dinitrophenol	66.7	9.2	MTCA B SPGS	ug/kg	USEPA 8270D	38-122	30	38-122	90
2,4-Dinitrotoluene	26.7	0.11	MTCA B SPGS	ug/kg	USEPA 8270D	35-123	30	35-123	90
2,6-Dimethylnaphthalene	2.67	NV	NV	ug/kg	USEPA 8270D	60-121	30	60-121	90
2,6-Dinitrotoluene	26.7	0.021	MTCA B SPGS	ug/kg	USEPA 8270D	51-133	30	51-133	90
2-Chloronaphthalene	2.67	6400000	MTCA B DC	ug/kg	USEPA 8270D	46-124	30	46-124	90
2-Chlorophenol	13.3	27	MTCA B SPGS	ug/kg	USEPA 8270D	50-122	30	50-122	90
2-Methylnaphthalene	5.33	320000	MTCA B DC	ug/kg	USEPA 8270D	44-120	30	44-120	90
2-Methylphenol	6.67	150	MTCA B SPGS	ug/kg	USEPA 8270D	50-122	30	50-122	90
2-Nitroaniline	53.3	800000	MTCA B DC	ug/kg	USEPA 8270D	40-122	30	40-122	90
2-Nitrophenol	26.7	NV	NV	ug/kg	USEPA 8270D	45-122	30	45-122	90
3,3'-Dichlorobenzidine	26.7	0.20	MTCA B SPGS	ug/kg	USEPA 8270D	5-137	30	5-137	90
3+4-Methylphenol(s)	6.67	4000000	MTCA B DC	ug/kg	USEPA 8270D	34-121	30	34-121	90
3-Nitroaniline	53.3	NV	NV	ug/kg	USEPA 8270D	32-122	30	32-122	90

Table B-3
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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
4,6-Dinitro-2-methylphenol	66.7	6400	MTCA B DC	ug/kg	USEPA 8270D	50-124	30	50-124	90
4-Bromophenyl phenyl ether	6.67	NV	NV	ug/kg	USEPA 8270D	36-123	30	36-123	90
4-Chloro-3-methylphenol	26.7	8000000	MTCA B DC	ug/kg	USEPA 8270D	44-120	30	44-120	90
4-Chloroaniline	6.67	0.077	MTCA B SPGS	ug/kg	USEPA 8270D	30-120	30	30-120	90
4-Chlorophenyl phenyl ether	6.67	NV	NV	ug/kg	USEPA 8270D	31-120	30	31-120	90
4-Nitroaniline	53.3	320000	MTCA B DC	ug/kg	USEPA 8270D	44-125	30	44-125	90
4-Nitrophenol	26.7	NV	NV	ug/kg	USEPA 8270D	22-121	30	22-121	90
Acenaphthene	2.67	5000	MTCA B SPGS	ug/kg	USEPA 8270D	40-122	30	40-122	90
Acenaphthylene	2.67	NV	NV	ug/kg	USEPA 8270D	41-124	30	41-124	90
Aniline	13.3	180000	MTCA B DC	ug/kg	USEPA 8270D	50-124	30	50-124	90
Anthracene	2.67	110000	MTCA B SPGS	ug/kg	USEPA 8270D	48-124	30	48-124	90
Azobenzene	6.67	9100	MTCA B DC	ug/kg	USEPA 8270D	44-120	30	44-120	90
Benz(a)anthracene	2.67	NV	NV	ug/kg	USEPA 8270D	48-132	30	48-132	90
Benzidine	53.3	4.3	MTCA B DC	ug/kg	USEPA 8270D	37-132	30	37-132	90
Benzo(a)pyrene	4	100	MTCA A	ug/kg	USEPA 8270D	48-124	30	48-124	90
Benzo(b)fluoranthene	4	NV	NV	ug/kg	USEPA 8270D	51-128	30	51-128	90
Benzo(b+k)fluoranthene(s)	8	NV	NV	ug/kg	USEPA 8270D	44-140	30	44-140	90
Benzo(e)pyrene	2.67	NV	NV	ug/kg	USEPA 8270D	48-126	30	48-126	90
Benzo(g,h,i)perylene	2.67	NV	NV	ug/kg	USEPA 8270D	36-120	30	36-120	90
Benzo(k)fluoranthene	4	NV	NV	ug/kg	USEPA 8270D	38-127	30	38-127	90
Benzoic acid	333	18000	MTCA B SPGS	ug/kg	USEPA 8270D	31-120	30	31-120	90
Benzyl alcohol	13.3	8000000	MTCA B DC	ug/kg	USEPA 8270D	33-131	30	33-131	90
Biphenyl	2.67	NV	NV	ug/kg	USEPA 8270D	43-125	30	43-125	90
Bis(2-Chloroethoxy) methane	6.67	NV	NV	ug/kg	USEPA 8270D	44-122	30	44-122	90
Bis(2-Chloroethyl) ether	6.67	0.014	MTCA B SPGS	ug/kg	USEPA 8270D	32-123	30	32-123	90
Bis(2-Chloroisopropyl) ether	6.67	NV	NV	ug/kg	USEPA 8270D	5-140	30	5-140	90
Bis(2-Ethylhexyl) adipate	66.7	NV	NV	ug/kg	USEPA 8270D	28-120	30	28-120	90
Bis(2-ethylhexyl)phthalate	40	670	MTCA B SPGS	ug/kg	USEPA 8270D	45-133	30	45-133	90
Butyl benzyl phthalate	26.7	650	MTCA B SPGS	ug/kg	USEPA 8270D	30-122	30	30-122	90

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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Carbazole	4	NV	NV	ug/kg	USEPA 8270D	30-120	30	30-120	90
Chrysene	2.67	NV	NV	ug/kg	USEPA 8270D	31-120	30	31-120	90
Dibenz(a,h)anthracene	2.67	NV	NV	ug/kg	USEPA 8270D	34-120	30	34-120	90
Dibenzofuran	2.67	80000	MTCA B DC	ug/kg	USEPA 8270D	34-120	30	34-120	90
Diethylphthalate	26.7	4700	MTCA B SPGS	ug/kg	USEPA 8270D	35-123	30	35-123	90
Dimethylphthalate	26.7	NV	NV	ug/kg	USEPA 8270D	7-120	30	7-120	90
Di-n-butylphthalate	26.7	3000	MTCA B SPGS	ug/kg	USEPA 8270D	16-120	30	16-120	90
Di-n-octyl phthalate	250	800000	MTCA B DC	ug/kg	USEPA 8270D	35-120	30	35-120	90
Fluoranthene	2.67	32000	MTCA B SPGS	ug/kg	USEPA 8270D	33-120	30	33-120	90
Fluorene	2.67	5100	MTCA B SPGS	ug/kg	USEPA 8270D	36-123	30	36-123	90
Hexachlorobenzene	2.67	44	MTCA B SPGS	ug/kg	USEPA 8270D	30-132	30	30-132	90
Hexachlorobutadiene	6.67	30	MTCA B SPGS	ug/kg	USEPA 8270D	23-120	30	23-120	90
Hexachlorocyclopentadiene	13.3	9600	MTCA B SPGS	ug/kg	USEPA 8270D	36-120	30	36-120	90
Hexachloroethane	6.67	2.3	MTCA B SPGS	ug/kg	USEPA 8270D	25-133	30	25-133	90
Indeno(1,2,3-cd)pyrene	2.67	NV	NV	ug/kg	USEPA 8270D	50-121	30	50-121	90
Isophorone	6.67	15	MTCA B SPGS	ug/kg	USEPA 8270D	29-122	30	29-122	90
Naphthalene	5.33	240	MTCA B SPGS	ug/kg	USEPA 8270D	47-127	30	47-127	90
Nitrobenzene	26.7	6.5	MTCA B SPGS	ug/kg	USEPA 8270D	44-125	30	44-125	90
N-Nitrosodimethylamine	6.67	20	MTCA B DC	ug/kg	USEPA 8270D	39-125	30	39-125	90
N-Nitroso-di-n-propylamine	6.67	0.0039	MTCA B SPGS	ug/kg	USEPA 8270D	5-120	30	5-120	90
N-Nitrosodiphenylamine	6.67	28	MTCA B SPGS	ug/kg	USEPA 8270D	60-121	30	60-121	90
Pentachlorophenol	26.7	0.88	MTCA B SPGS	ug/kg	USEPA 8270D	22-121	30	22-121	90
Perylene	2.67	NV	NV	ug/kg	USEPA 8270D	39-126	30	39-126	90
Phenanthrene	2.67	NV	NV	ug/kg	USEPA 8270D	42-127	30	42-127	90
Phenol	5.33	760	MTCA B SPGS	ug/kg	USEPA 8270D	5-120	30	5-120	90
Pyrene	2.67	33000	MTCA B SPGS	ug/kg	USEPA 8270D	40-125	30	40-125	90
Pyridine	13.3	80000	MTCA B DC	ug/kg	USEPA 8270D	40-125	30	40-125	90

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Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
PAHs									
Acenaphthene	10	5000	MTCA B SPGS	ug/kg	USEPA 8270D	40-122	30	40-122	90
Acenaphthylene	10	NV	NV	ug/kg	USEPA 8270D	32-132	30	32-132	90
Anthracene	10	110000	MTCA B SPGS	ug/kg	USEPA 8270D	47-123	30	47-123	90
Benz(a)anthracene	10	NV	NV	ug/kg	USEPA 8270D	49-126	30	49-126	90
Benzo(a)pyrene	10	100	MTCA A	ug/kg	USEPA 8270D	45-129	30	45-129	90
Benzo(b)fluoranthene	10	NV	NV	ug/kg	USEPA 8270D	45-132	30	45-132	90
Benzo(k)fluoranthene	10	NV	NV	ug/kg	USEPA 8270D	47-132	30	47-132	90
Benzo(b+k)fluoranthene(s)	20	NV	NV	ug/kg	USEPA 8270D	45-132	30	45-132	90
Benzo(g,h,i)perylene	10	NV	NV	ug/kg	USEPA 8270D	43-134	30	43-134	90
Carbazole	10	NV	NV	ug/kg	USEPA 8270D	50-122	30	50-122	90
Chrysene	10	NV	NV	ug/kg	USEPA 8270D	50-124	30	50-124	90
Dibenz(a,h)anthracene	10	NV	NV	ug/kg	USEPA 8270D	45-134	30	45-134	90
Dibenzofuran	10	80000	MTCA B DC	ug/kg	USEPA 8270D	44-120	30	44-120	90
Fluoranthene	10	32000	MTCA B SPGS	ug/kg	USEPA 8270D	50-127	30	50-127	90
Fluorene	10	5100	MTCA B SPGS	ug/kg	USEPA 8270D	43-125	30	43-125	90
Indeno(1,2,3-cd)pyrene	10	NV	NV	ug/kg	USEPA 8270D	45-133	30	45-133	90
1-Methylnaphthalene	10	34000	MTCA B DC	ug/kg	USEPA 8270D	40-120	30	40-120	90
2-Methylnaphthalene	10	320000	MTCA B DC	ug/kg	USEPA 8270D	38-122	30	38-122	90
Naphthalene	10	240	MTCA B SPGS	ug/kg	USEPA 8270D	35-123	30	35-123	90
Phenanthrene	10	NV	NV	ug/kg	USEPA 8270D	50-121	30	50-121	90
Pyrene	10	33000	MTCA B SPGS	ug/kg	USEPA 8270D	47-127	30	47-127	90
cPAH TEQ	NA	100	MTCA A	ug/kg	--	--	--	--	--

Table B-3
Soil Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

MAUL FOSTER ALONGI

Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
PCBs									
Aroclor 1016	4	5600	MTCA B DC	ug/kg	USEPA 8082A	47-134	30	47-134	90
Aroclor 1221	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1232	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1242	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1248	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1254	4	500	MTCA B DC	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1260	4	500	MTCA B DC	ug/kg	USEPA 8082A	53-140	30	53-140	90
Aroclor 1262	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Aroclor 1268	4	NV	NV	ug/kg	USEPA 8082A	--	30	--	90
Total PCBs	4	500	MTCA B DC	ug/kg	--	--	--	--	--
Dioxins/Furans									
2,3,7,8 - TCDF	1	NV	NV	pg/g	USEPA 1613	--	30	78-158	90
1,2,3,7,8 - PeCDF	5	NV	NV	pg/g	USEPA 1613	--	30	80-134	90
2,3,4,7,8 - PeCDF	5	NV	NV	pg/g	USEPA 1613	--	30	68-160	90
1,2,3,4,7,8 - HxCDF	5	NV	NV	pg/g	USEPA 1613	--	30	72-134	90
1,2,3,6,7,8 - HxCDF	5	NV	NV	pg/g	USEPA 1613	--	30	84-130	90
2,3,4,6,7,8 - HxCDF	5	NV	NV	pg/g	USEPA 1613	--	30	70-156	90
1,2,3,7,8,9 - HxCDF	5	NV	NV	pg/g	USEPA 1613	--	30	78-130	90
1,2,3,4,6,7,8, - HpCDF	5	NV	NV	pg/g	USEPA 1613	--	30	82-122	90
1,2,3,4,7,8,9 - HpCDF	5	NV	NV	pg/g	USEPA 1613	--	30	78-138	90
OCDF	10	NV	NV	pg/g	USEPA 1613	--	30	63-170	90
2,3,7,8 - TCDD	1	13	MTCA B DC	pg/g	USEPA 1613	--	30	67-158	90
1,2,3,7,8 - PeCDD	5	NV	NV	pg/g	USEPA 1613	--	30	70-142	90
1,2,3,4,7,8 - HxCDD	5	NV	NV	pg/g	USEPA 1613	--	30	70-164	90
1,2,3,6,7,8 - HxCDD	5	NV	NV	pg/g	USEPA 1613	--	30	76-134	90
1,2,3,7,8,9 - HxCDD	5	160	MTCA B DC	pg/g	USEPA 1613	--	30	64-162	90
1,2,3,4,6,7,8 - HpCDD	5	NV	NV	pg/g	USEPA 1613	--	30	70-140	90

Table B-3
Soil Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

MAUL FOSTER ALONGI

Analyte	Reporting Limit	Soil SLV	SLV Source	Units	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
OCDD	10	NV	NV	pg/g	USEPA 1613	--	30	78-144	90
Dioxin/Furan TEQ	NA	13	MTCA B DC	pg/g	--	--	--	--	--

NOTES:

SLV source is the lowest SLV selected from soil MTCA Method A unrestricted land use, MTCA Method B (the lower of available cancer or non-cancer value), and MTCA Method B protection of groundwater in saturated soil.

-- = no value.

cPAH = carcinogenic polycyclic aromatic hydrocarbon.

LCS = laboratory control sample.

mg/kg = milligrams per kilogram.

MS = matrix spike.

MTCA A = MTCA Method A unrestricted land use, soil.

MTCA B DC = MTCA Method B soil protective of direct contact, lower of available value for cancer or non-cancer.

MTCA B SPGS = MTCA Method B soil protective of groundwater, saturated.

NA = not applicable.

NV = no value.

NWTPH = Northwest Total Petroleum Hydrocarbons.

PAH = polycyclic aromatic hydrocarbon.

PCB = polychlorinated biphenyl.

pg/g = picograms per gram.

RPD = relative percent difference.

SIM = selected ion monitoring.

SLV = screening level value.

SVOC = semivolatile organic compound.

ug/kg = micrograms per kilogram.

TEQ = toxic equivalent.

USEPA = U.S. Environmental Protection Agency.

VOC = volatile organic compound.

[a]Value for chromium (III).

[b]Clean up level is for gasoline-range organics with benzene present/gasoline-range organics with no detectable benzene.

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Total and Dissolved Metals								
Arsenic	1	0.018	HHC W+O	USEPA 6020A	75-125	20	80-120	90
Cadmium	0.2	0.72	USEPA NRWC, Freshwater, CCC	USEPA 6020A	75-125	20	80-120	90
Chromium	1	50	MTCA A	USEPA 6020A	75-125	20	80-120	90
Copper	1	11	WAC, AL Freshwater, C	USEPA 6020A	75-125	20	80-120	90
Lead	0.2	2.5	WAC, AL Freshwater, C	USEPA 6020A	75-125	20	80-120	90
Manganese	50	50	HHC W+O	USEPA 6020A	75-125	20	80-120	90
Mercury	0.1	0.012	WAC, AL Freshwater, C	USEPA 6020A	75-125	20	80-120	90
Nickel	1	52	USEPA NRWC, Freshwater, CCC	USEPA 6020A	75-125	20	80-120	90
Zinc	4	100	WAC, AL Freshwater, C	USEPA 6020A	75-125	20	80-120	90
Hexavalent Chromium	1	10	WAC, AL Freshwater, C	USEPA 7199	85-115	20	85-115	90
Petroleum Hydrocarbons								
Gasoline-range organics	50	800/1000[a]	MTCA A	NWTPH-Gx	75-125	30	80-120	90
Diesel-range organics	100	500	MTCA A	NWTPH-Dx	75-125	30	80-120	90
Lube-oil-range organics	200	500	MTCA A	NWTPH-Dx	75-125	30	80-120	90
VOCs								
1,1,1,2-Tetrachloroethane	0.5	1.7	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,1,1-Trichloroethane	0.5	200	MTCA A	USEPA 8260B	70-130	30	70-130	90
1,1,2,2-Tetrachloroethane	0.5	0.1	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	2	240000	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,1,2-Trichloroethane	0.5	0.35	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
1,1-Dichloroethane	0.5	7.7	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,1-Dichloroethene	0.5	130	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
1,1-Dichloropropene	1	NV	NV	USEPA 8260B	70-130	30	70-130	90
1,2,3-Trichlorobenzene	2	NV	NV	USEPA 8260B	70-130	30	70-130	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
1,2,3-Trichloropropane	1	0.0015	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,2,4-Trichlorobenzene	2	0.036	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
1,2,4-Trimethylbenzene	1	80	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,2-Dibromo-3-chloropropane	5	0.055	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,2-Dibromoethane	0.5	0.010	MTCA A	USEPA 8260B	70-130	30	70-130	90
1,2-Dichlorobenzene	0.5	700	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
1,2-Dichloroethane	0.5	0.48	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,2-Dichloropropane	0.5	0.71	WAC, HH Freshwater	USEPA 8260B	70-130	30	70-130	90
1,3,5-Trimethylbenzene	1	80	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
1,3-Dichlorobenzene	0.5	2	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
1,3-Dichloropropane	1	34	MTCA B SW	USEPA 8260B	70-130	30	70-130	90
1,4-Dichlorobenzene	0.5	4.9	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
2,2-Dichloropropane	1	NV	NV	USEPA 8260B	70-130	30	70-130	90
2-Butanone	10	4800	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
2-Chlorotoluene	1	160	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
2-Hexanone	10	40	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
4-Chlorotoluene	1	160	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
4-Isopropyltoluene	1	NV	NV	USEPA 8260B	70-130	30	70-130	90
4-Methyl-2-pentanone	10	640	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Acetone	20	7200	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Benzene	0.25	0.44	WAC, HH Freshwater	USEPA 8260B	70-130	30	70-130	90
Bromobenzene	0.5	64	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Bromochloromethane	1	NV	NV	USEPA 8260B	70-130	30	70-130	90
Bromodichloromethane	1	0.7	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
Bromoform	1	4.6	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
Bromomethane	5	11	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Carbon disulfide	10	400	MTCA B VI	USEPA 8260B	70-130	30	70-130	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

MAUL FOSTER ALONGI

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Carbon tetrachloride	0.5	0.20	WAC, HH Freshwater	USEPA 8260B	70-130	30	70-130	90
Chlorobenzene	0.5	100	HHC W+O	USEPA 8260B	70-130	30	70-130	90
Chloroethane	5	18000	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
Chloroform	1	1.2	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
Chloromethane	5	150	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
cis-1,2-Dichloroethene	0.5	16	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
cis-1,3-Dichloropropene[(b)]	1	0.27	HHC W+O	USEPA 8260B	70-130	30	70-130	90
Dibromochloromethane	1	0.52	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Dibromomethane	1	80	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Dichlorodifluoromethane	1	5.6	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
Ethylbenzene	0.5	29	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
Hexachlorobutadiene	5	0.01	HHC W+O	USEPA 8260B	70-130	30	70-130	90
Isopropylbenzene	1	720	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
m,p-Xylene	1	NV	NV	USEPA 8260B	70-130	30	70-130	90
Methyl tert-butyl ether	1	20	MTCA A	USEPA 8260B	70-130	30	70-130	90
Methylene chloride	5	5.0	MTCA A	USEPA 8260B	70-130	30	70-130	90
Naphthalene	2	8.9	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
n-Butylbenzene	1	400	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
n-Propylbenzene	0.5	800	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
o-Xylene	0.5	1600	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
sec-Butylbenzene	1	800	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Styrene	1	1600	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
tert-Butylbenzene	1	800	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Tetrachloroethene	0.5	2.4	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
Tetrahydrofuran	10	7200	MTCA B GW	USEPA 8260B	70-130	30	70-130	90
Toluene	1	57	HHC W+O	USEPA 8260B	70-130	30	70-130	90
trans-1,2-Dichloroethene	0.5	100	HHC W+O	USEPA 8260B	70-130	30	70-130	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
trans-1,3-Dichloropropene[(b)]	1	0.27	HHC W+O	USEPA 8260B	70-130	30	70-130	90
Trichloroethene	0.5	0.3	HH, Freshwater, 40 CFR 131.45	USEPA 8260B	70-130	30	70-130	90
Trichlorofluoromethane	2	120	MTCA B VI	USEPA 8260B	70-130	30	70-130	90
Vinyl chloride	0.5	0.022	WAC, HH Freshwater	USEPA 8260B	70-130	30	70-130	90
SVOCs								
1,2,4-Trichlorobenzene	0.05	0.036	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	29-120	30	29-120	90
1,2-Dichlorobenzene	0.05	700	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	32-120	30	32-120	90
1,2-Dinitrobenzene	0.5	1.6	MTCA B GW	USEPA 8270D	59-120	30	59-120	90
1,3-Dichlorobenzene	0.05	2	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	28-120	30	28-120	90
1,3-Dinitrobenzene	0.5	1.6	MTCA B GW	USEPA 8270D	49-128	30	49-128	90
1,4-Dichlorobenzene	0.05	4.9	MTCA B VI	USEPA 8270D	29-120	30	29-120	90
1,4-Dinitrobenzene	0.5	1.6	MTCA B GW	USEPA 8270D	40-120	30	40-120	90
1-Methylnaphthalene	0.04	1.5	MTCA B GW	USEPA 8270D	41-120	30	41-120	90
2,3,4,6-Tetrachlorophenol	0.1	480	MTCA B GW	USEPA 8270D	50-128	30	50-128	90
2,3,5,6-Tetrachlorophenol	0.1	NV	NV	USEPA 8270D	50-121	30	50-121	90
2,3,5-Trimethylnaphthalene	0.02	NV	NV	USEPA 8270D	40-120	30	40-120	90
2,4,5-Trichlorophenol	0.1	300	HHC W+O	USEPA 8270D	53-123	30	53-123	90
2,4,6-Trichlorophenol	0.1	0.25	WAC, HH Freshwater	USEPA 8270D	50-125	30	50-125	90
2,4-Dichlorophenol	0.1	10	HHC W+O	USEPA 8270D	47-121	30	47-121	90
2,4-Dimethylphenol	0.1	85	WAC, HH Freshwater	USEPA 8270D	31-124	30	31-124	90
2,4-Dinitrophenol	0.5	10	HHC W+O	USEPA 8270D	23-143	30	23-143	90
2,4-Dinitrotoluene	0.2	0.039	WAC, HH Freshwater	USEPA 8270D	57-128	30	57-128	90
2,6-Dimethylnaphthalene	0.02	NV	NV	USEPA 8270D	40-125	30	40-125	90
2,6-Dinitrotoluene	0.2	0.058	MTCA B GW	USEPA 8270D	57-124	30	57-124	90
2-Chloronaphthalene	0.02	100	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	40-120	30	40-120	90
2-Chlorophenol	0.1	15	WAC, HH Freshwater	USEPA 8270D	38-120	30	38-120	90
2-Methylnaphthalene	0.04	32	MTCA B GW	USEPA 8270D	40-121	30	40-121	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

MAUL FOSTER ALONGI

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
2-Methylphenol	0.05	400	MTCA B GW	USEPA 8270D	30-120	30	30-120	90
2-Nitroaniline	0.4	160	MTCA B GW	USEPA 8270D	54-127	30	54-127	90
2-Nitrophenol	0.2	NV	NV	USEPA 8270D	47-123	30	47-123	90
3,3'-Dichlorobenzidine	0.1	0.0031	WAC, HH Freshwater	USEPA 8270D	27-129	30	27-129	90
3+4-Methylphenol(s)	0.05	NV	NV	USEPA 8270D	29-120	30	29-120	90
3-Nitroaniline	0.4	NV	NV	USEPA 8270D	41-128	30	41-128	90
4,6-Dinitro-2-methylphenol	0.5	1.3	MTCA B GW	USEPA 8270D	44-137	30	44-137	90
4-Bromophenyl phenyl ether	1	NV	NV	USEPA 8270D	54-124	30	54-124	90
4-Chloro-3-methylphenol	0.2	36	WAC, HH Freshwater	USEPA 8270D	52-120	30	52-120	90
4-Chloroaniline	0.05	0.22	MTCA B GW	USEPA 8270D	33-120	30	33-120	90
4-Chlorophenyl phenyl ether	0.05	NV	NV	USEPA 8270D	53-121	30	53-121	90
4-Nitroaniline	0.4	64	MTCA B GW	USEPA 8270D	35-120	30	35-120	90
4-Nitrophenol	0.2	NV	NV	USEPA 8270D	5-120	30	5-120	90
Acenaphthene	0.02	30	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	47-122	30	47-122	90
Acenaphthylene	0.02	NV	NV	USEPA 8270D	41-130	30	41-130	90
Aniline	0.1	7.7	MTCA B GW	USEPA 8270D	6-120	30	6-120	90
Anthracene	0.02	100	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	57-123	30	57-123	90
Azobenzene	0.05	0.80	MTCA B GW	USEPA 8270D	61-120	30	61-120	90
Benz(a)anthracene	0.02	0.00016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	58-125	30	58-125	90
Benzidine	1	0.00032	MTCA B SW	USEPA 8270D	5-127	30	5-127	90
Benzo(a)pyrene	0.03	0.000016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	54-128	30	54-128	90
Benzo(b)fluoranthene	0.03	0.00016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	53-131	30	53-131	90
Benzo(b+k)fluoranthene(s)	0.06	NV	NV	USEPA 8270D	53-131	30	53-131	90
Benzo(e)pyrene	0.02	NV	NV	USEPA 8270D	40-125	30	40-125	90
Benzo(g,h,i)perylene	0.02	NV	NV	USEPA 8270D	50-134	30	50-134	90
Benzo(k)fluoranthene	0.03	0.0016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	57-129	30	57-129	90
Benzoic acid	2	64000	MTCA B GW	USEPA 8270D	5-120	30	5-120	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Benzyl alcohol	0.2	800	MTCA B GW	USEPA 8270D	31-120	30	31-120	90
Biphenyl	0.02	NV	NV	USEPA 8270D	49-120	30	49-120	90
Bis(2-Chloroethoxy) methane	0.05	NV	NV	USEPA 8270D	48-120	30	48-120	90
Bis(2-Chloroethyl) ether	0.05	0.02	WAC, HH Freshwater	USEPA 8270D	43-120	30	43-120	90
Bis(2-Chloroisopropyl) ether	0.05	NV	NV	USEPA 8270D	37-130	30	37-130	90
Bis(2-Ethylhexyl) adipate	0.5	NV	NV	USEPA 8270D	40-125	30	40-125	90
Bis(2-ethylhexyl)phthalate	0.4	0.045	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	55-135	30	55-135	90
Butyl benzyl phthalate	0.4	0.013	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	53-134	30	53-134	90
Carbazole	0.03	NV	NV	USEPA 8270D	60-122	30	60-122	90
Chrysene	0.02	0.016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	59-123	30	59-123	90
Dibenz(a,h)anthracene	0.02	0.000016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	51-134	30	51-134	90
Dibenzofuran	0.02	16	MTCA B GW	USEPA 8270D	53-120	30	53-120	90
Dibenzothiophene	0.04	NV	NV	USEPA 8270D	40-125	30	40-125	90
Diethylphthalate	0.4	200	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	55-125	30	55-125	90
Dimethylphthalate	0.4	600	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	45-127	30	45-127	90
Di-n-butylphthalate	0.4	8	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	59-127	30	59-127	90
Di-n-octyl phthalate	0.4	160	MTCA B GW	USEPA 8270D	50-140	30	51-140	90
Fluoranthene	0.02	6	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	57-128	30	57-128	90
Fluorene	0.02	10	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	52-124	30	52-124	90
Hexachlorobenzene	0.02	0.000005	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	52-125	30	52-125	90
Hexachlorobutadiene	0.05	0.01	HHC W+O	USEPA 8270D	22-124	30	22-124	90
Hexachlorocyclopentadiene	0.1	1	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	5-127	30	5-127	90
Hexachloroethane	0.05	0.02	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	21-120	30	21-120	90
Indeno(1,2,3-cd)pyrene	0.02	0.00016	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	52-133	30	52-133	90
Isophorone	0.05	27	WAC, HH Freshwater	USEPA 8270D	42-124	30	42-124	90
Naphthalene	0.04	8.9	MTCA B VI	USEPA 8270D	40-121	30	40-121	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

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Analyte	Reporting Limit (ug/L)	GW SLV	SLV Source	Preferred Analytical Method	MS Accuracy (Percent)	Precision (RPD)	LCS Accuracy (Percent)	Completeness (Percent)
Nitrobenzene	0.2	10	HHC W+O	USEPA 8270D	45-121	30	45-121	90
N-Nitrosodimethylamine	0.05	0.00065	WAC, HH Freshwater	USEPA 8270D	6-120	30	6-120	90
N-Nitroso-di-n-propylamine	0.05	0.62	WAC, HH Freshwater	USEPA 8270D	49-120	30	49-120	90
N-Nitrosodiphenylamine	0.05	0.0044	WAC, HH Freshwater	USEPA 8270D	51-123	30	51-123	90
Pentachlorophenol	0.2	0.002	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	35-138	30	35-138	90
Perylene	0.02	NV	NV	USEPA 8270D	40-125	30	40-125	90
Phenanthrene	0.02	NV	NV	USEPA 8270D	59-120	30	59-120	90
Phenol	0.4	2400	MTCA B GW	USEPA 8270D	5-120	30	5-120	90
Pyrene	0.02	8	HH, Freshwater, 40 CFR 131.45	USEPA 8270D	57-126	30	57-126	90
Pyridine	0.2	8.0	MTCA B GW	USEPA 8270D	5-120	30	5-120	90
cPAH TEQ	NA	0.023	MTCA B GW	USEPA 8270D	--	--	--	--
PCBs								
Aroclor 1016	0.04	0.0030	MTCA B SW	USEPA 8082A	46-129	30	46-129	90
Aroclor 1221	0.04	NV	NV	USEPA 8082A	--	30	--	90
Aroclor 1232	0.04	NV	NV	USEPA 8082A	--	30	--	90
Aroclor 1242	0.04	NV	NV	USEPA 8082A	--	30	--	90
Aroclor 1248	0.04	NV	NV	USEPA 8082A	--	30	--	90
Aroclor 1254	0.04	0.00010	MTCA B SW	USEPA 8082A	--	30	--	90
Aroclor 1260	0.04	0.044	MTCA B GW	USEPA 8082A	45-134	30	45-134	90
Aroclor 1262	0.04	NV	NV	USEPA 8082A	--	30	--	90
Aroclor 1268	0.04	NV	NV	USEPA 8082A	--	30	--	90
Total PCBs	0.04	0.000007	HH, Freshwater, 40 CFR 131.45	USEPA 8082A	--	--	--	--
Conventionals								
Sulfide	50	NV	NV	SM4500	75-125	20	75-125	90

Table B-4
Groundwater Preferred Analytical Methods and Performance Criteria
Seaport Landing Upland Remedial Investigation Workplan

NOTES:

-- = no value.

HH, Freshwater, 40 CFR 131.45 = Human Health Fresh Water, 40 Code of Federal Regulations 131.45.

HHC W+O = Human Health for the consumption of Water + Organism.

LCS = laboratory control sample.

MS = matrix spike.

MTCA B GW = Model Toxic Control Act Method B, groundwater.

MTCA B SW = Model Toxic Control Act Method B, surface water.

Naphthalene

NA = not applicable.

NV = no value.

NWTPH = Northwest Total Petroleum Hydrocarbons.

PAH = polycyclic aromatic hydrocarbon.

PCB = polychlorinated biphenyl.

RPD = relative percent difference.

SLV = screening level value.

SM = Standard Methods for the Examination of Water and Wastewater.

SVOC = semivolatile organic compound.

TEQ = toxic equivalent.

ug/L = micrograms per liter.

USEPA = U.S. Eironmental Protection Agency.

USEPA NRWC, Freshwater, CCC = USEPA National Recommended Water Criteria, Freshwater, Criterion Continuous Concentration.

VOC = volatile organic compound.

WAC, AL Freshwater, C = Chronic 173-201A Washington Administrative Code Aquatic Life Fresh Water.

WAC, HH Freshwater = 173-201A Washington Administrative Code Human Health Fresh Water.

[(a)]Clean up level is for gasoline-range organics with benzene present/gasoline-range organics with no detectable benzene.

[(b)]cis-1,3-Dichloropropene and trans-1,3-Dichloropropene values are from 1,3-Dichloropropene.

Table B-5
Soil Quality Assurance/Quality Control
Sampling Requirements and Frequency
Seaport Landing Upland Remedial Investigation Workplan

Quality Control Sample[a]	Frequency	Acceptance Criteria
Field Quality Control Samples		
Equipment Rinsate Blanks	One per sampling event when using non-dedicated equipment	Below MRL[b]
Field Duplicate Samples	One per every 20 samples	50% RPD[b,c]
Trip Blank	One per sample cooler containing VOC samples	Below MRL[b]
Laboratory Quality Control Samples		
Surrogate Spiking	Added to all project and QC samples as appropriate for the analytical method	Within laboratory control limits
Method Blanks	Each analytical batch of samples per 20 samples received	Below MRL[b]
Laboratory Control Sample	Each analytical batch of samples per 20 samples received	Within laboratory control limits
Laboratory Control Sample Duplicate	Each analytical batch of samples per 20 samples received	Within laboratory control limits
Laboratory Duplicate Sample	Each analytical batch of samples per 20 samples received	30% RPD[b,c]

NOTES:

QC = quality control.

MRL = method reporting limit

RPD = relative percent difference.

VOC = volatile organic compound.

[a]Not all quality control samples are applicable to every sampling event or analytical method.

[b]Criteria may change based on data validation.

[c]RPD not evaluated for samples less than five times the MRL.

Table B-6
Groundwater Quality Assurance/Quality Control
Sampling Requirements and Frequency
Seaport Landing Upland Remedial Investigation Workplan

Quality Control Sample[a]	Frequency	Acceptance Criteria
Field Quality Control Samples		
Equipment Rinsate Blanks	One per sampling event when using non-dedicated equipment	Below MRL[b]
Field Duplicate Samples	One per every 20 samples	35% RPD[b,c]
Filter Blank	One per sampling event	Below MRL[b]
Trip Blank	One per sample cooler containing VOC samples	Below MRL[b]
Laboratory Quality Control Samples		
Matrix Spike/Matrix Spike Duplicate	Each analytical batch of samples per 20 samples received	Within laboratory control limits
Method Blanks	Each analytical batch of samples per 20 samples received	Below MRL[b]
Laboratory Control Sample	Each analytical batch of samples per 20 samples received	Within laboratory control limits
Laboratory Control Sample Duplicate	Each analytical batch of samples per 20 samples received	Within laboratory control limits
Laboratory Duplicate Sample	Each analytical batch of samples per 20 samples received	20% RPD[b,c]
Surrogate Spiking	Added to all project and QC samples as appropriate for the analytical method	Within laboratory control limits

NOTES:

QC = quality control.

MRL = method reporting limit.

RPD = relative percent difference.

VOC = volatile organic compound.

[a]Not all quality control samples are applicable to every sampling event or analytical method.

[b]Criteria may change based on data validation.

[c]RPD not evaluated for samples less than five times the MRL.

APPENDIX B1

FIELD FORMS

Maul Foster & Alongi, Inc.

2001 NW 19th Avenue, Suite 200 Portland, Oregon 97209 (971) 544-2139

Water Field Sampling Data Sheet

Client Name		**Sample Location**	
Project #		**Sampler**	
Project Name		**Sampling Date**	
Sampling Event		**Sample Name**	
Sub Area		**Sample Depth**	
FSDS QA:		**Easting**	**Northing**	**TOC**

Hydrology/Level Measurements

Date	Time	DT-Bottom	DT-Product	DT-Water	(Product Thickness) DTP-DTW	(Water Column) DTB-DTW	(Gallons/ft x Water Column) Pore Volume

(0.75" = 0.023 gal/ft) (1" = 0.041 gal/ft) (1.5" = 0.092 gal/ft) (2" = 0.163 gal/ft) (3" = 0.367 gal/ft) (4" = 0.653 gal/ft) (6" = 1.469 gal/ft) (8" = 2.611 gal/ft)

Water Quality Data

Purge Method	Time	Purge Vol (gal)	Flowrate l/min	pH	Temp (C)	E Cond (uS/cm)	DO (mg/L)	EH	Turbidity
Final Field Parameters									

Methods: (1) Submersible Pump (2) Peristaltic Pump (3) Disposable Bailer (4) Vacuum Pump (5) Dedicated Bailer (6) Inertia Pump (7) Other (specify)

Water Quality Observations:

Sample Information

Sampling Method	Sample Type	Sampling Time	Container Code/Preservative	#	Filtered
	Groundwater		VOA-Glass		
			Amber Glass		
			White Poly		
			Yellow Poly		
			Green Poly		
			Red Total Poly		
			Red Dissolved Poly		
			Total Bottles	0	

General Sampling Comments

Signature ______________________________

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Boring Log Form

Boring/Well No.: ____________

Site: ____________

Location: ____________

Project #: ____________

Drill Rig		MFA Staff:		Hole Dia:		Total Depth:	
Drilling Co.:			Water Level:		WLE Note:		
Start Date:		End Date:	Water Level:		WLE Note:		
Notes:							

Completion	Sample				Soil Type:				Color:	
	Top:		Time:	Depth:	Top:		Fines:		Moisture:	
	Length:				Bottom:		Sand:		PID:	
	Type:		Sample ID		Soil Class:		Gravel:		Line Type:	
	% Recov:				Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
	Top:		Time:	Depth:	Soil Type:				Color:	
	Length:				Top:		Fines:		Moisture:	
	Type:		Sample ID		Bottom:		Sand:		PID:	
	% Recov:				Soil Class:		Gravel:		Line Type:	
					Trace:				Impacts:	
					Notes:					
Borehole Notes:										

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Boring/Well Completion Form

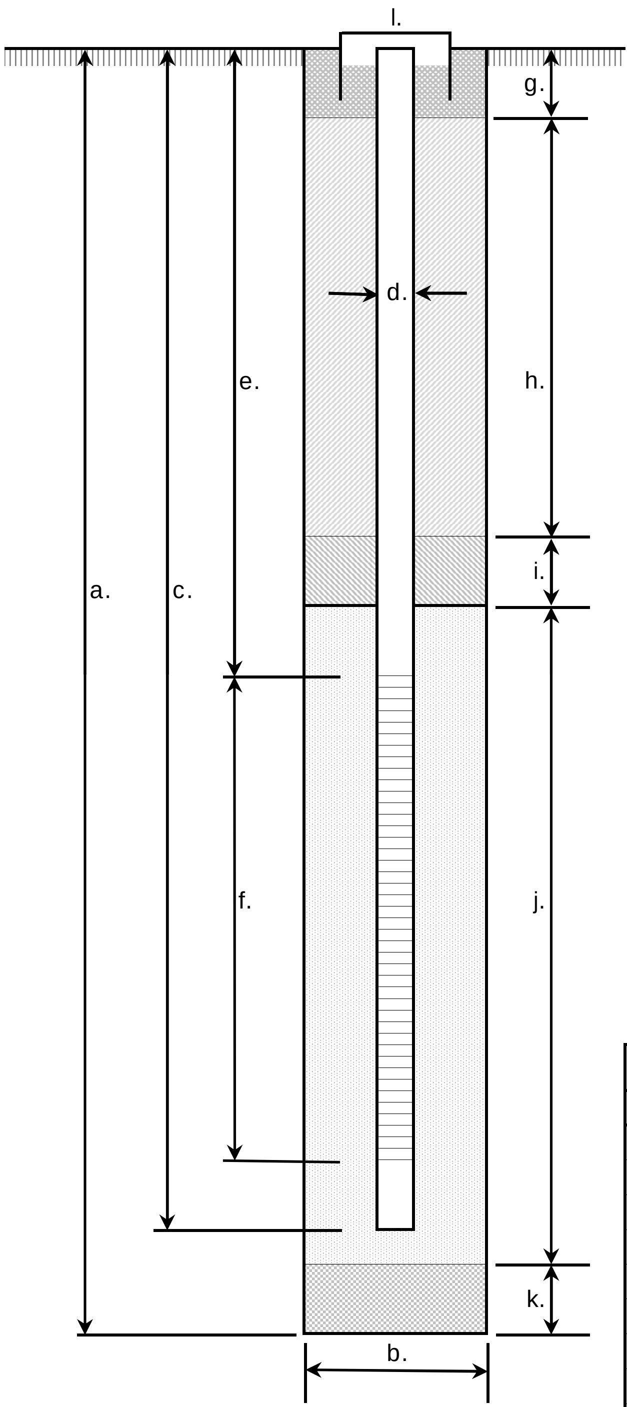
Boring/Well No.: ____________

Site: ____________

Location: ____________

Project #: ____________

Drilling Co.:		MFA Staff:		Start Date:		End Date:	
Drill Rig/ Method:				Well ID No.:		Start Card No.:	



Completion Details

a. Total Depth: ______ ft. bgs

b. Borehole diameter: ______ in.

c. Total Casing Length: ______ ft.

Material: ____________

d. Well diameter: ______ in.

e. Depth to top of screen: ______ ft. bgs

f Screen length: ______ ft.

screened interval: ______ ft. to ______ ft. bgs

Perforation type: ____________

Perforation size: ____________

g. Surface completion: ______ ft. bgs

completion material: ____________

Amount: ____________

h. Surface Seal: ______ ft. to ______ ft. bgs

Seal material: ____________

Amount: ____________

i. Secondary seal/pack: ______ ft. to ______ ft. bgs

Material: ____________

Amount: ____________

j. Filter Pack: ______ ft. to ______ ft. bgs

Material: ____________

Amount: ____________

Prepacked screen used: ____________ (Yes/No)

k. Seal or Slough: ______ ft. to ______ ft. bgs

Material: ____________

Amount: ____________

l. Type of well monument: ____________

Well height above/below ground surface: ______ ft. bgs

gINT Data

Top	Bottom	gINT Graphic

gINT Graphic Options*

Surface Completion
- CMNT11

Borehole Seal
- BENT11

Filter Pack
- FILT11, FILT11-A

Screen
- SLOT11

Sump
- PCAP11, PCAPBENT11

Backfill
- BENTBOTT, FILTBOTT, SLUFFBOTT

*more graphics available

Note:

APPENDIX B2

DIOXIN DATA USE

MEMORANDUM

To: File | Date: September 28, 2012

From: Erik Naylor | Project: 1044.02.06

RE: Dioxin and Furan Analysis, Data Validation, and TEQ Calculation Rules

The term dioxin is used to refer to a family of toxic chemicals that share a similar chemical structure and a common mechanism of toxic action. While there are 210 dioxin congeners, typically only the 17 most toxic congeners are reported by laboratories. The reported concentrations of the 17 dioxin congeners typically are validated to assess usability and then a toxicity equivalent concentration (TEQ) is calculated from the reported results to evaluate the toxicity of these compounds as a whole. The purpose of this memo is to provide an approach for dioxin data validation and TEQ calculation. Further, analytical method recommendations and requirements for laboratory deliverables are provided to enable consistent data validation and TEQ calculation using data from a variety of laboratories.

Critical to consistent data use is consistent use of terminology. Terms used in this memorandum are defined below.

- Method Detection Limit (MDL)—The minimum concentration of a compound that can be measured and reported with 99 percent confidence that the value is greater than zero according to the Washington State Department of Ecology's (Ecology), Model Toxics Control Act (MTCA) (Ecology, 2007).
- Estimated Detection Limit (EDL)—The sample- and analyte-specific EDL is an estimate made by the laboratory of the concentration of a given analyte that would have to be present to produce a signal with a peak height of at least 2.5 times the background noise signal level (U.S. Environmental Protection Agency [USEPA], 2005).
- Practical Quantitation Limit (PQL)—The lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using Ecology-approved methods (Ecology, 2007). This value is usually the lowest concentration used to calibrate the instrument after being adjusted for sample volume, sample extract volume, cleanups performed, and injection volume. PQLs should be no greater than 10 times the MDL (Ecology, 2007) and no greater than what is established by the USEPA in 40 Code of Federal Regulations (CFR) 136, 40 CFR 141-143, or 40 CFR 260-270.

- Estimated Maximum Potential Concentration (EMPC)—An EMPC is a value calculated for a reported analyte when the signal-to-noise ratio is at least 2.5:1 for both quantitation ions, but the ion abundance ratio criteria used for analyte confirmation are not met (USEPA, 2014). An EMPC value represents the maximum possible result of an analyte that could not be positively identified. The inability to positively identify the analyte could be a result of matrix interference, a coeluting compound, or low response.

- Toxic Equivalency Factor (TEF)—The factor by which each congener is multiplied in order to calculate its toxicity relative to 2,3,7,8-TCDD (Ecology, 2007). These values are summed to calculate the TEQ. TEFs depend on the endpoint being examined (i.e., birds, fish, mammals).

- TEQs—Concentrations of each congener are adjusted and summed to reflect their potency relative to 2,3,7,8-TCDD, one of the most toxic congeners. The TEQ is the sum of congener results multiplied by their specific TEF (Ecology, 2007).

ANALYTICAL METHODS

Dioxins are analyzed generally by USEPA Method 1613B or 8290, using a high-resolution gas chromatograph paired with a high-resolution mass spectrometer. A laboratory's PQL is usually the same for both methods. While the methods are very similar, Method 1613B is preferred, as it requires more rigorous quality assurance and quality control (QA/QC) through the use of six more internal standards than Method 8290. Because analytical technology and methodology have advanced rapidly since the methods were written, many laboratories combine elements of both methods to obtain the best results possible (Hoffman, E., and D. Fox 2010). Often the preparation and analyses are run using Method 1613B (for the additional QA/QC), while the calculations will be performed by Method 8290 (in order to obtain the sample- and analyte-specific EDLs). Method 1613B with calculated EDLs is the preferred method.

LABORATORY DELIVERABLES

It is important to work closely with the laboratory performing the dioxin analyses because different laboratories report data in different ways. The following items should be requested to ensure that the analytical report and electronic data deliverable (EDD) will contain all of the requisite information to validation the data and calculate TEQs:

- EDLs[1]and PQLs should be included in the final analytical report. EDLs, MDLs, and PQLs should all be included in the EDD.

- Results should be reported to the sample- and analyte-specific EDL. Results below the PQL but above the EDL will be qualified as estimates (J).

[1] Note that USEPA Method 1613B does not provide for the calculation of EDLs; therefore, the laboratory must use the calculation approach provided in Method 8290 to report the required limits.

- EMPC results should be reported at the EMPC value (EMPC values will be assigned a "U" qualifier [the analyte was not detected at or above the concentration qualified] at the time of validation).

TEQ concentrations will not be requested from the laboratory. If the laboratory provides TEQ concentrations, they will not be used because the data have not been validated TEQs should be calculated only after the data are validated.

VALIDATION

Dioxin data are validated much like other organic data, but there are a few issues that do not typically arise in other organic data sets. In addition to standard validation procedures (USEPA 2005), the following scenarios should be addressed in the fashion described below, consistent with other Ecology sites (Ecology and Environment and G. L. Glass, 2011):

- EMPC reported values should be assigned a U qualifier at the reported EMPC value.
- EMPC values that appear to be significantly elevated should be investigated further with the laboratory and may be assigned an R qualifier (unusable) when applicable.
- Non-detected results should be assigned a U qualifier and reported at the EDL value.

Further dioxin validation guidelines can be found in the National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (USEPA 2014). Data must be validated before TEQs are calculated.

TEQS

To express the overall toxicity of the 17 reported dioxins, the concentration of each congener is adjusted based on its toxicity relative to the most toxic congener, 2,3,7,8-TCDD, and then all 17 are added together. The adjustment factors, the TEFs, are provided by the 2005 World Health Organization. TEQs are commonly calculated by one of the following two methods:

- Non-detected values (U) are set as one half of the EDL. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.
- Non-detected values (U) are set as 0. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.

These methods result in two different TEQ values that can be shown as TEQ (U=1/2) and TEQ (U=0). TEQs should not be calculated to more significant figures than the original data. The table below illustrates these methods:

Dioxin	Result (ng/kg)	TEC[1] (U=1/2) (ng/kg)	TEC[1] (U=0) (ng/kg)	TEF Mammals
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	44	44	44	0.0003
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3000 J	3000	3000	0.0003
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	41	41	41	0.01
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	510	510	510	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	2.9 U	1.45	0	0.01
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	6.9 U	3.45	0	0.1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	7.4	7.4	7.4	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.2 U	2.6	0	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	27	27	27	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.5 U	0.25	0	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	22	22	22	0.1
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	3.4 U	1.7	0	0.03
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	3.2 U	1.6	0	1
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	2.4	2.4	2.4	0.1
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	3 U	1.5	0	0.3
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.4 U	0.7	0	0.1
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.23 U	0.115	0	1
Total Heptachlorodibenzofuran (HpCDF)	99	99	99	--
Total Heptachlorodibenzo-p-dioxin (HpCDD)	1,100	1100	1100	--
Total Hexachlorodibenzofuran (HxCDF)	97 J	97	97	--
Total Hexachlorodibenzo-p-dioxin (HxCDD)	250	250	250	--
Total Pentachlorodibenzofuran (PeCDF)	44	44	44	--
Total Pentachlorodibenzo-p-dioxin (PeCDD)	32 J	32	32	--
Total Tetrachlorodibenzofuran (TCDF)	19	19	19	--
Total Tetrachlorodibenzo-p-dioxin (TCDD)	8.2	8.2	8.2	--
TEQ (U=1/2)	**15.2**	--	--	--
TEQ (U=0)	**12.3**	--	--	--

NOTES:
-- = no value.
ng/kg = nanograms per kilogram.
[1]TEC is analyte-specific TEF adjusted concentration.

The difference between TEQ (U=1/2) and TEQ (U=0) values gives data reviewers an idea of how much the EDL substitution affects the TEQ summation (Hoffman, E., and D. Fox 2010).

SUMMARY

- USEPA Method 1613B is recommended for dioxin analysis (with Method 8290 EDL calculations).
- The laboratory must report a PQL and EDL for each sample and each congener, and provide a PQL, EDL, and MDL for each sample and each congener in the EDD.
- Results should be reported to the sample- and analyte-specific EDL. Results below the PQL but above the EDL will be qualified as estimates (J).
- EMPC results should be reported at the EMPC value (EMPC values will be assigned a "U" qualifier at the time of validation). However, if the EMPC is significantly elevated, additional qualification may be appropriate.
- Non-detected results should be assigned a U qualifier and reported at the EDL value.
- Laboratory data must be validated before a TEQ is calculated.
- TEQs should be calculated as follows: non-detected values (U) are set as one half of the EDL. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.

REFERENCES

Ecology. 2007. Model Toxics Control Act statute and regulation. Publication No. 94-06. Washington State Department of Ecology. November.

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Hoffman, E., and D. Fox. 2010. Polychlorinated dioxins and furans (PCDD/F): revisions to the supplemental quality assurance project plan (SQAPP). U.S. Environmental Protection Agency. November.

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APPENDIX C

BORING AND WELL LOGS FROM PREVIOUS INVESTIGATIONS

APPENDIX E

BORING LOGS

Table A-1

Borehole Completion Summary
Aberdeen Sawmill

SITE	SURVEY COORDINATES X	Y	Z	BORE DEPTH TOTAL feet bgs	DATE	DRILLING METHOD	DRILLER	CONSULTANT
D-01	817029	615028	14.40	14.0	05/24/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-02	817140	615049	14.20	14.5	05/24/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-03	817177	615007	13.48	9.0	05/24/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-04E	817009	615217	14.67	14.0	05/25/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-05	816958	615100	14.46	16.0	05/25/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-06	816896	615215	13.86	9.0	08/30/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-07	816840	615065	15.20	9.0	08/30/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-08	816969	615045	14.19	9.0	08/30/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.
D-09	817047	615175	14.98	9.0	08/30/90	Hollow Stem Auger	McDonald Holt Inc.	DOF, Inc.

TABLE A-2

Well Completion Summary
Aberdeen Sawmill

SITE	WELL DEPTH TOTAL (feet bgs)	CASING DIAMETER (inches)	SCREENED INTERVAL (feet bgs) TOP BOTTOM	FILTER PACK INTERVAL (feet bgs) TOP BOTTOM	FIRST SEAL INTERVAL (feet bgs) TYPE	FIRST SEAL INTERVAL (feet bgs) INTERVAL	SECOND SEAL INTERVAL (feet bgs) TYPE	SECOND SEAL INTERVAL (feet bgs) INTERVAL	GROUND SURFACE ELEVATION (feet)[1]	MP ELEVATION (feet)[1]
D-01	14.00	2.00	4.00-14.00	3.00-14.00	BE	1.00-3.00			14.40	14.26
D-02	14.00	2.00	4.00-14.00	3.00-14.50	BE	1.00-3.00			14.20	13.91
D-03	9.00	2.00	4.00-9.00	3.00-9.00	BE	1.00-3.00			13.48	13.06
D-04E	14.00	2.00	4.00-14.00	3.00-14.00	BE	1.00-3.00			14.67	14.38
D-05	14.00	2.00	4.00-14.00	3.00-16.00	BE	1.00-3.00			14.46	14.29
D-06	9.00	2.00	3.70-8.70	3.00-9.00	BE	1.50-3.00			13.86	13.71
D-07	9.00	2.00	3.70-8.70	3.00-9.00	BE	1.50-3.00			15.20	14.97
D-08	9.00	2.00	3.70-8.70	3.00-9.00	BE	1.50-3.00			14.19	13.94
D-09	9.00	2.00	3.70-8.70	3.00-9.00	BE	1.50-3.00			14.98	14.75

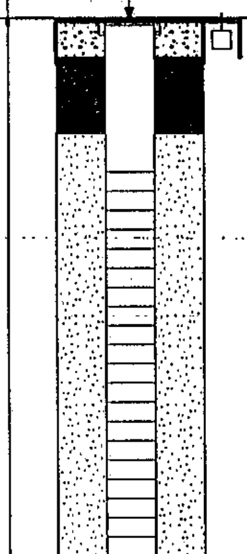
1) Measurements based on City of Aberdeen datum

Weyerhaeuser

Elevation: 14.40'	Site Identification: D-01	
Datum: City of Aberdeen	Location: Aberdeen--Wood Products	
Consulting Firm: DOF, Inc.	Purpose:	
Logged By:	Date(s): 05/24/90 - 05/24/90	Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 14.00'	Completed Depth: 14.00'

Drilling Method: Hollow Stem Auger		Blank Casing: type: PVC Diameter: 2.00" fm: 0.2' to: 4.00'
Permit No.:	Permit Date: / /	Screens: type: Slotted size: .010" Diameter: 2.00" fm: 4.00' to: 14.00'
X Coordinate: 817029	Y Coordinate: 615028	
Remarks: Based on consultant's boring log.		Annular Fill: type: Concrete fm: .00' to: 1.00'; type: Bentonite Chips fm: 1.00' to: 3.00'; type: Colorado Silica 10-20 Sand fm: 3.00' to: 14.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction	Notes
		S-1	31 51 R/5"		GP	GRAVEL: damp, light brown, slightly silty sandy GRAVEL.	MP. EL. 14.26	
		S-2	21 17 10		SP	SAND: moist, brown, slightly silty to silty, fine gravelly SAND.		
5		S-3	3 3 2			SAND: wet, brown, fine gravelly SAND.		
		S-4	1 1 1			SAND: wet, brown, fine gravelly SAND.		
10		S-5	1 1 2			SAND: wet, brown, fine gravelly SAND to 11.5 ft.		
		S-6			ML/OL	SILT: saturated dark SILT with trace organic at 11.5 ft. SILT: wet, dark gray SILT with wood fragments and organic.		
15								
20								
25								



Weyerhaeuser

Elevation: 14.20'	Site Identification: D-02
Datum: City of Aberdeen	Location: Aberdeen--Wood Products
Consulting Firm: DOF, Inc.	Purpose:
Logged By:	Date(s): 05/24/90 - 05/24/90 — Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 14.50' — Completed Depth: 14.00'

Drilling Method: Hollow Stem Auger		Blank Casing: type: PVC — Diameter: 2.00" fm: 0.3' to: 4.00'
Permit No.:	Permit Date: / /	Screens: type: Slotted size: .020" — Diameter: 2.00" fm: 4.00' to: 14.00'
X Coordinate: 817140	Y Coordinate: 615049	

Remarks: Based on consultant's boring log.

Annular Fill:

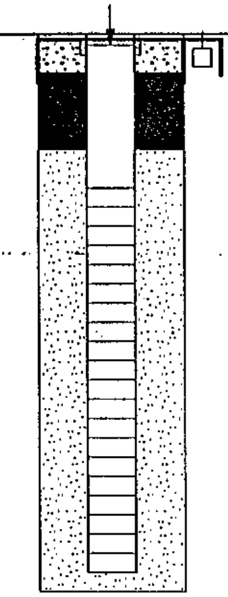
type	fm	to
Concrete	.00'	1.00'
Bentonite Chips	1.00'	3.00'
Colorado Silica 10-20 Sand	3.00'	14.50'

Sample No.	Blow Count	USCS Callout	Material Description
S-1	27 26 16	SP	SAND: moist, gray, slightly silty, fine gravelly SAND.
S-2	7 2 1		SAND: moist, brown, slightly silty fine gravelly SAND, with 1" Silt zone at 1/2 foot from sample end.
			SAND: wet, brown, fine gravelly SAND.
S-3	1 1		
S-4	2 5 2		SAND: wet, brown fine gravelly SAND, with traces of wood fragments.
S-5	1 2 4		SILT: saturated, brown, fine gravelly SAND to 10.5 ft.
		ML	SILT: saturated dark SILT with trace organic to 11 ft, then grading to brown-gray silt.
S-6	P P P		SILT: saturated, brown-gray SILT with wood fragments and organic.

Depth (ft): 5, 10, 15, 20, 25

Well Construction

MP. EL. 13.91



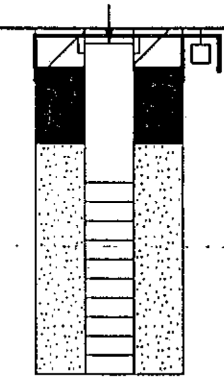
Notes

Weyerhaeuser

Elevation: 13.48'	Site Identification: D-03		
Datum: City of Aberdeen	Location: Aberdeen--Wood Products		
Consulting Firm: DOF, Inc.	Purpose:		
Logged By:	Date(s): 05/24/90 - 05/24/90	Borehole Dia.: 8.00"	
Contractor: McDonald Holt Inc.	Total Depth: 9.00'	Completed Depth: 9.00'	

Drilling Method: Hollow Stem Auger		Blank Casing: type: PVC	Diameter: 2.00" fm: 0.4'	to: 4.00'
Permit No.:	Permit Date: / /			
X Coordinate: 817177	Y Coordinate: 615007	Screens: type: Slotted size: .010"	Diameter: 2.00" fm: 4.00'	to: 9.00'
Remarks: Based on consultant's boring log.		Annular Fill:		
		type: Grout	fm: .00'	to: 1.00'
		type: Bentonite Chips	fm: 1.00'	to: 3.00'
		type: Colorado Silica 10-20 Sand	fm: 3.00'	to: 9.00'

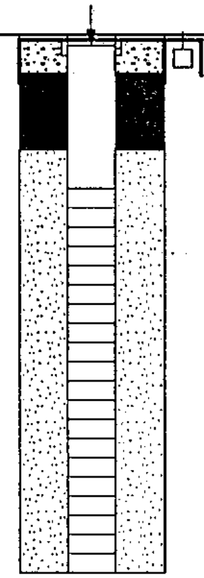
Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction MP. EL. 13.06	Notes
					GP	GRAVEL: crushed GRAVEL to 1.5', then moist, gray, slightly silty fine gravelly SAND		
		S-1	19 16 8		SP	SAND: moist, brown, fine gravelly SAND to 4 ft. Then moist to wet, brown gray SILT with wood fragmetns and organic.		
		S-2	4 2 2					
5		S-3	1 1 1		ML	SILT: wet, dark gray-black SILT with wood fragments, grading to lighter brown-gray at 5.5 ft.		
		S-4	1 1			SILT: wet, brown gray SILT with trace organic.		
10								
15								
20								
25								



Weyerhaeuser	Elevation: 14.67'	Site Identification: D-04E
	Datum: City of Aberdeen	Location: Aberdeen--Wood Products
	Consulting Firm: DOF, Inc.	Purpose:
	Logged By:	Date(s): 05/25/90 - 05/25/90 / Borehole Dia.: 8.00"
	Contractor: McDonald Holt Inc.	Total Depth: 14.00' / Completed Depth: 14.00'

Drilling Method: Hollow Stem Auger		Blank Casing: type: PVC Diameter: 2.00" fm: 0.3' to: 4.00'
Permit No.:	Permit Date: / /	Screens: type: Slotted size: .020" Diameter: 2.00" fm: 4.00' to: 14.00'
X Coordinate: 817009	Y Coordinate: 615217	
Remarks: Based on consultant's boring log.		Annular Fill: type: Concrete fm: .00' to: 1.00' type: Bentonite Chips fm: 1.00' to: 3.00' type: Colorado Silica 10-20 Sand fm: 3.00' to: 14.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction	Notes
					SP	SAND: moist, brown, slightly silty, fine gravelly SAND.	MP. EL. 14.38	
		S-1	10 13 11					
		S-2	6 6			SAND: moist, brown gray, medium to fine grained SAND with trace fine gravel and with a 1/2 inch SILT layer 2" above bottom.		
5		S-3	1 1			SAND: wet, fine gravelly SAND, only slight recovery in sample tube.		
		S-4	16 51 R/6"			SAND: wet, slightly silty fine to medium SAND to 7.5 ft, then WOOD.		
10		S-5	4 2 1			SAND: wet, brown, slightly silty fine to medium SAND.		
		S-6	1 2 1		ML	SILT: wet, brown-gray SILT with abundant wood fragments and organic to 13.5',		
					SP	then slightly silty fine to medium SAND with wood and organic.		
15								
20								
25								



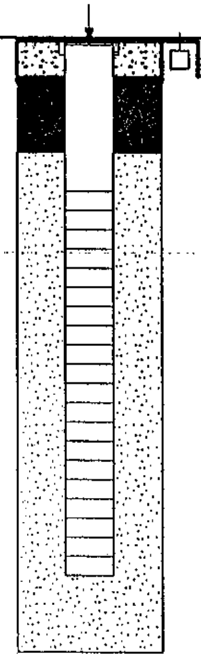
Weyerhaeuser

Elevation: 14.46'	Site Identification: D-05
Datum: City of Aberdeen	Location: Aberdeen--Wood Products
Consulting Firm: DOF, Inc.	Purpose:
Logged By:	Date(s): 05/25/90 - 05/25/90 / Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 16.00' / Completed Depth: 14.00'
Drilling Method: Hollow Stem Auger	Blank Casing: Diameter: 2.00" type: PVC fm: 0.2' to: 4.00'
Permit No.: / Permit Date: / /	Screens: Diameter: 2.00" type: Slotted size: .020" fm: 4.00' to: 14.00'
X Coordinate: 816958 / Y Coordinate: 615100	
Remarks: Based on consultant's boring log.	Annular Fill: type: Concrete fm: .00' to: 1.00'; type: Bentonite Chips fm: 1.00' to: 3.00'; type: Colorado Silica 10-20 Sand fm: 3.00' to: 16.00'

Depth (ft)	Sample No.	Blow Count	USCS Callout	Material Description
	S-1	21 14 14	SP	SAND: moist, brown, slightly silty, fine gravelly SAND, with an inch of wood at 2'.
	S-2	11 7 4		SAND: moist, brown, slightly silty, fine gravelly SAND with wood fragments. Becoming wet at 4'.
5	S-3A	50	WD	WOOD: wet, WOOD and WOOD CHIPS. No soil.
	S-3B	2 2 2		
	S-4	6 4 4 /3"		WOOD: wet, WOOD and WOOD CHIPS. No soil.
10	S-5	5 9 /4"		WOOD: wet, WOOD.
	S-6	1 1 2	ML	SILT: wet, brown-gray SILT with wood fragments and organic.
15	S-7	1 2 1		SILT: wet SILT with wood fragments and organic.
20				
25				

Well Construction

MP. EL. 14.29



Notes

Weyerhaeuser

Elevation: 13.86'	Site Identification: D-06	
Datum: City of Aberdeen	Location: Aberdeen--Wood Products	
Consulting Firm: DOF, Inc.	Purpose:	
Logged By:	Date(s): 08/30/90 - 08/30/90	Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 9.00'	Completed Depth: 9.00'

Drilling Method: Hollow Stem Auger		Blank Casing: Diameter: 2.00" type: PVC fm: 0.2' to: 3.70'
Permit No.:	Permit Date: / /	Screens: Diameter: 2.00" type: Slotted size: .010" fm: 3.70' to: 8.70'
X Coordinate: 816896	Y Coordinate: 615215	
Remarks: Based on consultant's boring log.		Annular Fill: type: Concrete fm: .00' to: 1.50'; type: Bentonite Chips fm: 1.50' to: 3.00'; type: Coloroda Silica 10-20 Sand fm: 3.00' to: 9.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction MP. EL. 13.71	Notes
		S-1	Bag 1-3'		GP	GRAVEL: paving and crushed rock to 6 inches. SAND and GRAVEL to 1.5 feet.		
					SP	Then slightly silty, fine gravelly SAND.		
		S-2	Bag 3-9'			SAND: wet, slightly silty, fine gravelly SAND.		
5								
10								
15								
20								
25								

Weyerhaeuser

Elevation: 15.20'	Site Identification: D-07
Datum: City of Aberdeen	Location: Aberdeen--Wood Products
Consulting Firm: DOF, Inc.	Purpose:
Logged By:	Date(s): 08/30/90 - 08/30/90 ; Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 9.00' ; Completed Depth: 9.00'

Drilling Method: Hollow Stem Auger

Permit No.: | Permit Date: / /

X Coordinate: 816840 | Y Coordinate: 615065

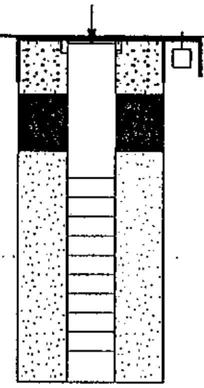
Remarks: Based on consultant's boring log.

Blank Casing: Diameter: 2.00"
type: PVC fm: 0.2' to: 3.70'

Screens: Diameter: 2.00"
type: Slotted size: .010" fm: 3.70' to: 8.70'

Annular Fill:
type: Concrete fm: .00' to: 1.50'
type: Bentonite Chips fm: 1.50' to: 3.00'
type: Colorado Silica 10-20 Sand fm: 3.00' to: 9.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction	Notes
					GP	SAND: 0'-3': Paving and crushed rock.	MP. EL. 14.97	
		S-1	50 50/4"		SP	At 3': moist, brown, slightly silty, fine gravelly SAND.		
5					WD	WOOD: Contact depth 4 to 7 feet, uncertain. Wood, with wet, slightly silty, fine gravelly SAND at 9 feet.		
		S-2	3 8 50/5"					
10								
15								
20								
25								



Weyerhaeuser

Elevation: 14.19'	Site Identification: D-08
Datum: City of Aberdeen	Location: Aberdeen--Wood Products
Consulting Firm: DOF, Inc.	Purpose:
Logged By:	Date(s): 08/30/90 - 08/30/90
	Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 9.00'
	Completed Depth: 9.00'

Drilling Method: Hollow Stem Auger

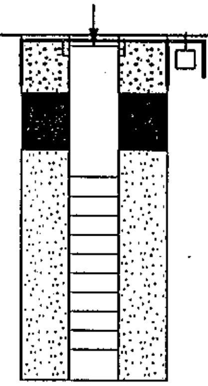
Permit No.:	Permit Date: / /
X Coordinate: 816969	Y Coordinate: 615045

Remarks: Based on consultant's boring log.

Blank Casing: type: PVC	Diameter: 2.00"	fm: 0.3'	to: 3.70'
Screens: type: Slotted, size: .010"	Diameter: 2.00"	fm: 3.70'	to: 8.70'
Annular Fill: type: Concrete		fm: .00'	to: 1.50'
type: Bentonite Chips		fm: 1.50'	to: 3.00'
type: Colorado Silica 10-20 Sand		fm: 3.00'	to: 9.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction	Notes
0–2					GP	SAND: 0'-2': Paving and crushed rock.	MP. EL. 13.94	
2–5		S-1	10 8 2		SP	Then: moist, gray brown, slightly silty, fine gravelly SAND.		
5–9		S-2	3 8 51 R/5"		WD	WOOD: Contact uncertain at 4 to 7 ft. Wood.		

Depth scale: 5, 10, 15, 20, 25



Weyerhaeuser

Elevation: 14.98'	Site Identification: D--09	
Datum: City of Aberdeen	Location: Aberdeen--Wood Products	
Consulting Firm: DOF, Inc.	Purpose:	
Logged By:	Date(s): 08/30/90 - 08/30/90	Borehole Dia.: 8.00"
Contractor: McDonald Holt Inc.	Total Depth: 9.00'	Completed Depth: 9.00'

Drilling Method: Hollow Stem Auger		Blank Casing: type: PVC Diameter: 2.00" fm: 0.3' to: 3.70'
Permit No.:	Permit Date: / /	Screens: type: Slotted size: .010" Diameter: 2.00" fm: 3.70' to: 8.70'
X Coordinate: 817047	Y Coordinate: 615175	

Remarks: Based on consultant's boring log.

Annular Fill:
type: Concrete fm: .00' to: 1.50'
type: Bentonite Chips fm: 1.50' to: 3.00'
type: Colorado Silica 10-20 Sand fm: 3.00' to: 9.00'

Depth (ft)	Recovery	Sample No.	Blow Count	Graphic Log	USCS Callout	Material Description	Well Construction MP. EL. 14.75	Notes
					GP	SAND: 0'-1.5': Paving and crushed rock.		
					SP	Then: moist, brown, slightly silty, fine gravelly SAND.		
		S-1	11 7 5					
5						WOOD: Contact uncertain at 4 to 7 ft. WOOD.		
					WD			
		S-2	3 8 51 R/5"					
10								
15								
20								
25								

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
1044.02.01-04	**B01**	**1 of 1**

Project Name	**Seaport Landing Uplands**	TOC Elevation (feet)	
Project Location	**Aberdeen, Washington**	Surface Elevation (feet)	
Start/End Date	**10/12/15 to 10/12/15**	Northing	
Driller/Equipment	**Cascade Drilling, Inc./**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**Geoprobe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
0			60	GP					0.0 to 0.2 feet: ASPHALT.
1									0.2 to 10.0 feet: SANDY GRAVEL (GWS); brown, 20% sand, fine to coarse; 80% gravel, fine to coarse, subangular to subrounded; moist to wet at 5.0 feet.
2									
3									
4									
5			50	GP GW		B01-S-4.5 PID = 2.5 ppm			
6	▼					PID = 5.1 ppm			
7									
8	▽								
9						B01-GW-10.0			
10									

Total Depth = 10.0 feet below ground surface.

Borehole Completion Details:
0.0 to 10.0 feet: 2.25-inch borehole.
0.0 to 10.0 feet: bentonite chips hydrated with potable water.

NOTES: (1) GP = Geoprobe. (2) GW = groundwater. (3) ppm = parts per million. (4) PID = Photoionization detector, soil headspace reading in ppm.

▽ **Water level observed at time of drilling.**

▼ **Water level Water level at time of sampling.**

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
1044.02.01-04	**B02**	**1 of 1**

Project Name	**Seaport Landing Uplands**	TOC Elevation (feet)	
Project Location	**Aberdeen, Washington**	Surface Elevation (feet)	
Start/End Date	**10/12/15 to 10/12/15**	Northing	
Driller/Equipment	**Cascade Drilling, Inc./**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**Geoprobe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Percent Recovery	Collection Method	Name (Type)	Soil Description
0–4	100	GP		0.0 to 4.0 feet: GRAVELLY SAND (SPG); brown; 10% fines; 50% sand, fine to coarse; 40% gravel, subangular to subrounded; moist.
1.5		GW		
4–4.5			PID = 9.2 ppm	4.0 to 4.5 feet: WOODWASTE; large chungs of wood and rock.
4.5–5				4.5 to 5.0 feet: GRAVEL w/ SILT (GP-GM); blackish brown; 30% fines, low plasticity; 20% sand; 50% gravel; moist.
5	0	GP	B02-S-5.0 PID = 110.4 ppm	@5.0 feet: Strong petroleum hydrocarbon-like odor.
5–10			B02-GW-6.0	5.0 to 10.0 feet: No recovery.

Total Depth = 10.0 feet below ground surface.

Borehole Completion Details:
0.0 to 10.0 feet: 2.25-inch borehole.
0.0 to 10.0 feet: bentonite chips hydrated with potable water.

NOTES: (1) GP = Geoprobe. (2) GW = groundwater. (3) ppm = parts per million. (4) PID = Photoionization detector, soil headspace reading in ppm.

▽ **Water level observed at time of drilling.**

▼ **Water level Water level at time of sampling.**

Maul Foster & Alongi, Inc.

Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
1044.02.01-04	**B03**	**1 of 1**

Project Name	**Seaport Landing Uplands**	TOC Elevation (feet)	
Project Location	**Aberdeen, Washington**	Surface Elevation (feet)	
Start/End Date	**10/12/15 to 10/12/15**	Northing	
Driller/Equipment	**Cascade Drilling, Inc./**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**Geoprobe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
0–0.5			**100**	**GP**					0.0 to 0.5 feet: TOPSOIL; black; 20% fines, low plasticity; 40% sand; 40% gravel, medium to coarse, subrounded; moist.
1									0.5 to 4.0 feet: SILTY SAND w/ GRAVEL; brown; 40% fines, medium plasticity; 45% sand; 15% gravel; moist.
2									
3									
4						**PID = 80.5 ppm**			4.0 to 10.0 feet: POORLY GRADED SAND (SP); gray; 10% fines; 80% sand, poorly graded; 10% gravel, large, subrounded; moist to saturated at 6.0 feet.
5			**100**	**GP GW**		**B03-S-5.0** **PID = 87.8 ppm**			
6									
7						**PID = 20.3 ppm**			
8									
9						**B03-GW-10.0**			
10									@ 9.5 feet: Woodwaste. Large chunks of wood chips and bark chips.

Total Depth = 10.0 feet below ground surface.

Borehole Completion Details:
0.0 to 10.0 feet: 2.25-inch borehole.
0.0 to 10.0 feet: bentonite chips hydrated with potable water.

NOTES: (1) GP = Geoprobe. (2) GW = groundwater. (3) ppm = parts per million. (4) PID = Photoionization detector, soil headspace reading in ppm.

▽ **Water level observed at time of drilling.**

▼ **Water level Water level at time of sampling.**

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Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
1044.02.01	CR-20	1 of 1

Project Name	**Seaport Landing**	TOC Elevation (feet)	**Mudline**
Project Location	**500 North Custer Street, Aberdeen, WA**	Surface Elevation (feet)	
Start/End Date	**10/12/2015 to 10/12/2015**	Northing	
Driller/Equipment	**Cascade Drilling, LP/GeoProbe Track rig**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**GeoProbe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
0.0–3.0									0.0 to 3.0 feet: No recovery.
3.0–3.3									3.0 to 3.3 feet: CLAYEY SAND (SC); dark brown; 40% fines, high plasticity; 40% sand; 20% gravel; trace organic material; moist.
3.3–7.0				GP		CR20-S-5.0			3.3 to 7.0 feet: SANDY GRAVEL (GWS); brownish gray; 30% sand, fine to coarse; 70% gravel, medium to coarse, subangular.
									@ 4.0 feet: Clay lens; reddish brown.
				GP		CR20-GW-5.0			@ 5.0 to 5.3 feet: Woodwaste; 80% woodwaste, primarily large woodchips; 20% black silty sand.
7.0–7.5									7.0 to 7.5 feret: CONCRETE.
7.5–10.0									7.5 to 10.0 feet: No recovery.

NOTES:

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Geologic Borehole Log/Well Construction

Project Number	Well Number	Sheet
1044.02.01	CR-21	1 of 1

Project Name	**Seaport Landing**	TOC Elevation (feet)	**Mudline**
Project Location	**500 North Custer Street, Aberdeen, WA**	Surface Elevation (feet)	
Start/End Date	**10/12/2015 to 10/12/2015**	Northing	
Driller/Equipment	**Cascade Drilling, LP/GeoProbe Track rig**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**GeoProbe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Sample Data: Interval	Sample Data: Percent Recovery	Sample Data: Collection Method	Sample Data: Number	Sample Data: Name (Type)	Sample Data: Blows/6"	Lithologic Column	Soil Description
0–3									0.0 to 3.0 feet: No recovery.
3–4.8				GP		CR21-S-5.0 PID = 102.9 ppm			3.0 to 4.8 feet: GRAVELLY SAND (SPG); brown; 10% fines, nonplastic; 40% sand, fine to medium; 50% gravel, subangular (rock fragments), medium to large; moist.
4.8–5									@ 4.8 to 5.0 feet: Woodwaste; 80% woodwaste, primarily large woodchips; 20% black silty sand.
5–8.5									5.0 to 8.5 feet: No recovery.
8.5–10				GP		PID = 53.5 ppm CR21-GW-10.0			8.5 to 10.0 feet: SILTY SAND (SM); blackish brown; 30% fines, nonplastic to medium plasticity; 50% sand, fine to medium; 20% gravel, medium, subrounded; wet.

NOTES:

Geologic Borehole Log/Well Construction

Maul Foster & Alongi, Inc.

Project Number	Well Number	Sheet
1044.02.01	**CR-22**	**1 of 1**

Project Name	**Seaport Landing**	TOC Elevation (feet)	**Mudline**
Project Location	**500 North Custer Street, Aberdeen, WA**	Surface Elevation (feet)	
Start/End Date	**10/13/2015 to 10/13/2015**	Northing	
Driller/Equipment	**Cascade Drilling, LP/GeoProbe Track rig**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**GeoProbe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
0–2									0.0 to 2.0 feet: No recovery.
2–3									2.0 to 3.0 feet: WELL GRADED SAND (SW); brown; 20% fines, nonplastic; 60% sand, fine to coarse; 20% gravel, subangular; rock shards, some organic material.
3–4.5				**GP**		**CR22-S-3.0 PID = 2.0 ppm**			3.0 to 4.5 feet: SILTY SAND (SM); reddish brown, 40% fines, medium plasticity; 60% sand, coarse; trace gravel.
4.5–4.8									@ 4.5 to 4.8 feet: Woodwaste lens, primarily bark chips and large wood chips.
4.8–5									4.8 to 5.0 feet: POORLY GRADED SAND (SP); gray; 10% fines, 90% sand, medium, poorly graded; saturated. (FILL)
5–7									5.0 to 7.0 feet: No recovery.
7–8									7.0 to 8.0 feet: POORLY GRADED SAND (SP); gray; 10% fines, 90% sand, medium, poorly graded; saturated. (FILL)
8–9									8.0 to 9.0 feet: Woodwaste.
9–10				**GP**		**PID = 8.8 ppm**			9.0 to 10.0 feet: SILT w/ WOODWASTE (ML); grayish brown; 70% fines, nonplastic; 30% woodwaste, primarily bark chips .

NOTES:

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Geologic Borehole Log/Well Construction

Maul Foster & Alongi, Inc.

Project Number	Well Number	Sheet
1044.02.01	**CR-23**	**1 of 1**

Project Name	**Seaport Landing**	TOC Elevation (feet)	**Mudline**
Project Location	**500 North Custer Street, Aberdeen, WA**	Surface Elevation (feet)	
Start/End Date	**10/13/2015 to 10/13/2015**	Northing	
Driller/Equipment	**Cascade Drilling, LP/GeoProbe Track rig**	Easting	
Geologist/Engineer	**M. Murray**	Hole Depth	**10.0-feet**
Sample Method	**GeoProbe**	Outer Hole Diam	**2.25-inch**

Depth (feet, BGS)	Well Details	Interval	Percent Recovery	Collection Method	Number	Name (Type)	Blows/6"	Lithologic Column	Soil Description
1									0.0 to 1.0 feet: No recovery.
2				**GP**		**CR23-S-3.0** **PID = 30.8 ppm**			1.0 to 1.5 feet: GRAVELLY SILT (MLG); brown; 40% fines, high plasticity; 10% sand; 25% gravel, subrounded, large; 25% woodwaste, primarily large woodchips and bark pieces.
3									1.5 to 2.5 feet: GRAVELLY SAND (SPG); grayish brown; 20% fines; 50% sand; 30% gravel, fine to medium, subrounded to subangular.
4									2.5 to 3.0 feet: GRAVEL w/ SAND (GW); 10% fines, 20% sand; 70% gravel, fine to large.
						PID = 57.7 ppm			3.0 to 4.0 feet: POORLY GRADED SAND (SP); gray; 20% fines; 70% sand, poorly graded, medium; 10% gravel. (FILL)
5									4.0 to 5.0 feet: Woodwaste; 80% woodwaste; 20% gray sandy silt.
6									5.0 to 7.5 feet: No recovery.
7									
8									7.5 to 9.0 feet: Woodwaste; 80% woodwaste; 20% gray sandy silt.
9									
10									9.0 to 10.0 feet: SILT w/ WOODWASTE (ML); dark brown; 70% fines, medium plasticity; 30% woodwaste, primarily bark chips.

NOTES:

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Drilling Log for FC01

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/26/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

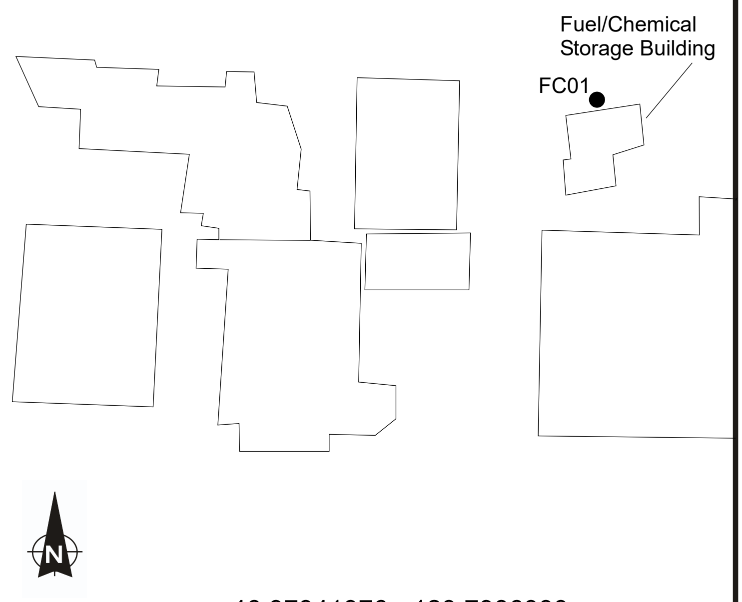
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5.6 feet bgs

Total Depth of Borehole: 12 feet bgs

Borehole Location



GPS Coordinates: 46.97341976, -123.7986333

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	FC01SB04 (2-4' bgs)	08:19	100%	2.8		0-0.4' - Asphalt 0.4-2.2' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 5 mm to 2 cm, rounded to sub-angular; Sand: fine to coarse, (predominantly fine to medium), angular to sub-angular; Silt: dry, grayish brown, loose, faint petroleum like odor, PID = 2.8 PPM at 1.5' bgs 2.2-3' - Asphalt - "cold patch" like material, Gravel: 2 mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance, PID = 0.9 PPM 3-3.8' - Silty GRAVEL (GM) - Gravel: sub-rounded to sub-angular, 2 mm to 4 cm; Silt: moist, dark gray to black, loose, does not form ribbon, slight petroleum like odor
4–8 (5, 6, 7, 8)	FC01SB07 (5-7' bgs)	08:56	100%	0		3.8-6.4' - Silty SAND (SM) - Sand: fine to medium, angular to sub-angular; Silt: moist, gray, firm, will not ribbon; Gravel: trace, rounded, 2 mm to 0.5 cm, rounded to sub-rounded 6.4-8' - Wood waste with Silty GRAVEL - Silt: moist, black to gray, soft; Gravel: trace, rounded, 0.5 cm to 3 cm
8–12 (9, 10, 11, 12)						8-12' - No recovery Total depth = 12 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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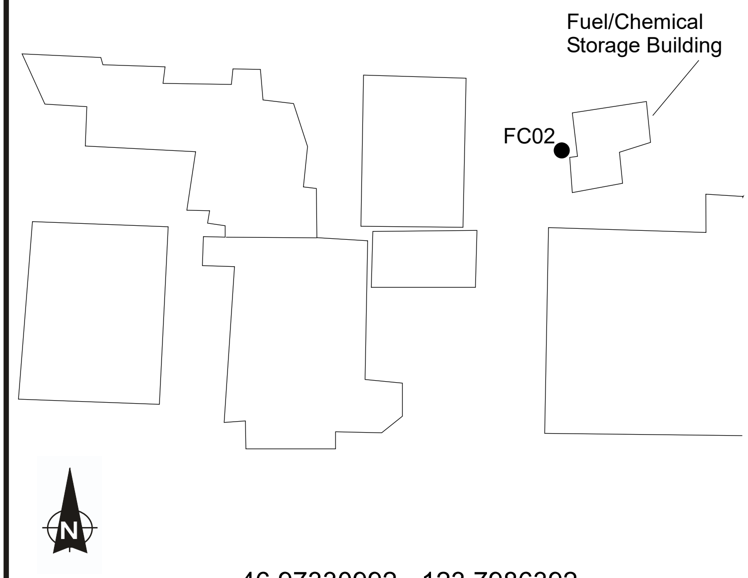
Drilling Log for FC02

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/25/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 5.32 feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97330992, -123.7986392

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	FC02SB04 (2-4' bgs)	17:58	100%	0.9		0-0.4' - Asphalt 0.4-2.2' - Silty GRAVEL (GM) - Gravel: fine, 2 mm to 0.5 cm, appears oil/creosote coated (cold patch like), very compliant, angular; Silt: dark gray to black, slight petroleum-like odor 2.2-4' - Silty SAND with gravel (SM) - Sand: fine to coarse, angular to sub-angular; Silt: moist, dark gray to black, soft, forms 1" ribbon, slight petroleum-like odor; Gravel: trace, rounded to sub-rounded, 1 cm to 2 cm
4–8	FC02SB06 (4-6' bgs)	18:30	90%	38		4-6' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-rounded; Sand: fine to medium, angular to sub-angular; Silt: moist, dark grayish brown, will not ribbon, PID = 38 PPM, strong petroleum odor 6-8' - Silty SAND (SM) - Sand: fine to medium, angular to sub-angular; Silt: saturated, dark grayish brown, will not ribbon; Gravel: trace, rounded, 0.5 cm to 1 cm; slight iridescent sheen noted, slight petroleum-like odor noted
8–12						Total depth = 8 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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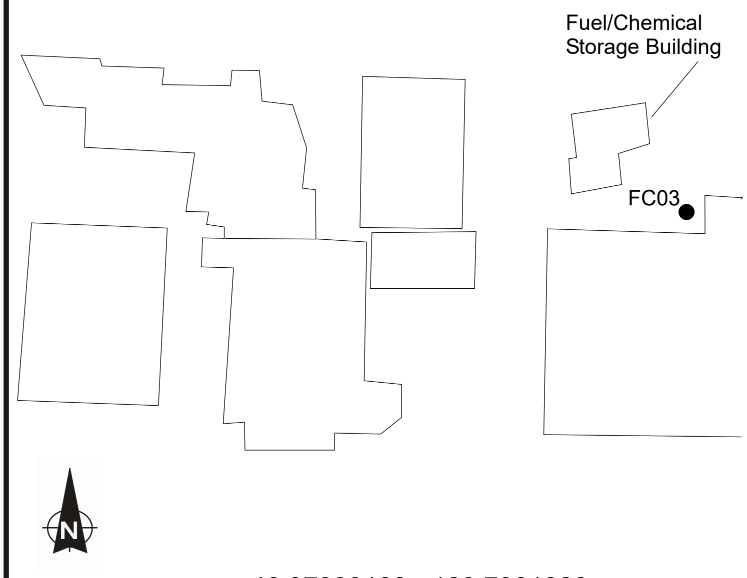
Drilling Log for FC03

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/29/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 3.84 Feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97333183, -123.7981828

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	FC03SB04 (2-4' bgs)	07:49	100%	0		0-0.4' - Asphalt 0.4-4' - Silty SAND (SM) - Sand: fine to coarse (predominantly fine to medium), angular to sub-angular; Silt: moist, grayish brown, soft; Gravel: trace, 2 mm to 2 cm, rounded to sub-rounded
4–8 (5, 6, 7, 8)	FC03SB08 (6-8' bgs)	07:57	50%	0		4-6' - No recovery 6-6.5' - Wood waste 6.5-8' - Silty SAND (SM) - Sand: fine to coarse (predominantly fine to medium), angular to sub-angular; Silt: moist, grayish brown, soft; Gravel: trace, 2 mm to 2 cm, rounded to sub-rounded; slight iridescent sheen noted on matrix, strong petroleum like odor noted
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set at 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for MS01

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/26/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

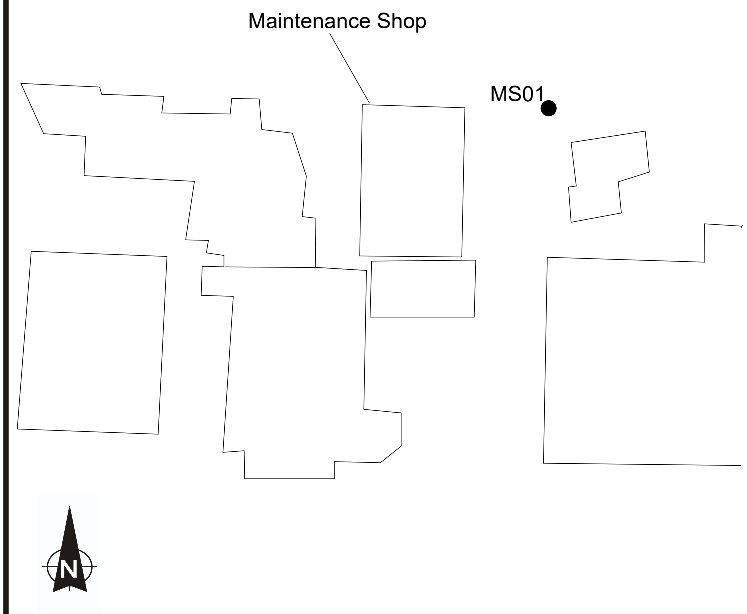
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 4.58 feet bgs

Total Depth of Borehole: 12 feet bgs

Borehole Location



GPS Coordinates: 46.97340086, -123.798847

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	MS01SB04 (1-4' bgs)	09:38	50%	0		0-0.4' - Asphalt 0.4-2.5' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 5 cm, rounded to angular; Sand: fine to coarse, (predominantly fine to medium), angular to sub-angular; Silt: moist, dark gray to black, soft, will not ribbon 2.5-4' - No recovery
4–8 (5, 6, 7, 8)			50%	0		4-8' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 2.5 cm, rounded to sub-rounded; Sand: fine to coarse, (predominantly medium to coarse), angular to sub-angular; Silt: saturated, grayish brown, soft, will not ribbon 6-8' - No recovery
8–12 (9, 10, 11, 12)	MS01SB12 (8-12' bgs)	10:13	50%	0		8-10' - Silty SAND (SM) - Sand: fine to coarse (predominantly medium), angular to sub-angular; Silt: saturated, dark gray to black; Gravel: trace, angular to sub-angular, 2 mm to 0.5 cm 10-12' - Wood waste Total depth = 12 feet bgs Temporary well screen set 4.6 - 8.6 feet bgs Borehole back filled with 3/8" bentonite chips

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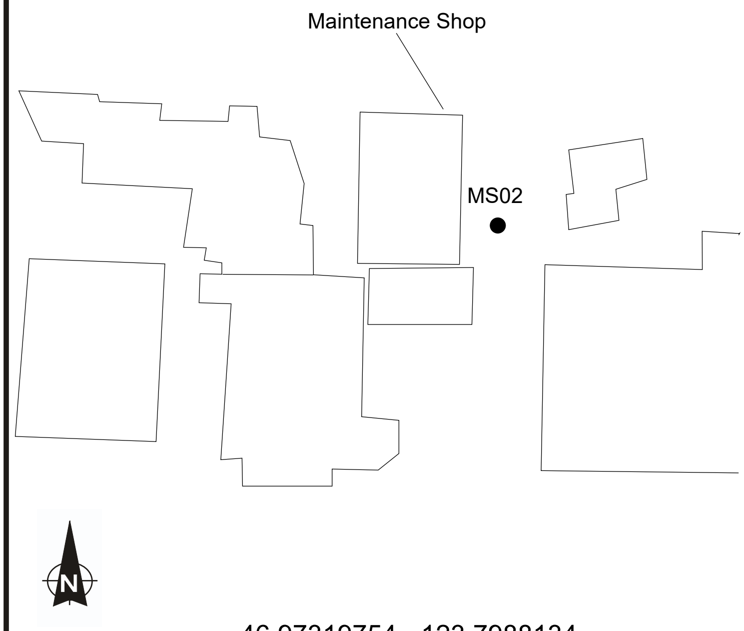
Drilling Log for MS02

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/25/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 4.9 feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97319754, -123.7988134

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	MS02SB04 (2-4' bgs)	16:19	100%	0		0-0.4' - Asphalt 0.4-1.3' - Silty GRAVEL (GM) - Gravel: fine, 2 mm to 1 cm (predominantly 0.5 cm), rounded to angular; Silt: moist, brownish black to black; Sand: trace, fine, sub-angular to angular 1.3-4' - Silty SAND with gravel (SM) - Sand: fine to medium, angular to sub-angular; Silt: moist, reddish brown to brown to 3' bgs, gray from 3' to 4' bgs, dense, will not ribbon; Gravel: trace, rounded to sub-rounded, 0.5 cm to 1.5 cm; no odor, no PID
4–8 (5, 6, 7, 8)	MS02SB08 (6-8' bgs)	16:40	75%	0		4-8' - Silty SAND with gravel (SM) - Sand: fine to medium, angular to sub-angular; Silt: saturated, loose, grayish brown, will not ribbon; Gravel: trace, rounded to sub-rounded, 1 cm to 2 cm; no odor, no PID
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for MS03

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/26/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 5.2 feet bgs
Total Depth of Borehole: 12 feet bgs

Borehole Location

GPS Coordinates: 46.9733466, -123.7990269

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	MS03SB04 (2-4' bgs)	15:35	75%	0		0-0.4' - Asphalt 0-4' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to sub-rounded; Sand: fine to coarse, (predominantly medium to coarse), angular to sub-angular; Silt: moist, dark grayish brown to black, soft, will not ribbon, increased moisture below 2' bgs; some wood waste noted throughout interval, petroleum-like odor noted at 3' bgs
4–8	MS03SB07 (5-7' bgs)	16:12	75%	0		4-12' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-rounded; Sand: fine to coarse, (predominantly fine to medium), angular to sub-angular; Silt: saturated with no free water, grayish brown to black, soft, will not ribbon, slight petroleum-like odor and iridescent sheen noted 4-8' bgs
8–12			50%	0		Total depth = 12 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for MS04

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/27/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 4.85 feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location

GPS Coordinates: 46.97318775, -123.799266

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	MS04SB04 (2-4' bgs)	09:25	80%	0		0-0.4' - Asphalt 0.4-4' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-rounded; Sand: fine to coarse (predominantly medium), angular to sub-angular; Silt: moist, dark grayish brown to black, soft, black material appears burnt
4–8 (5, 6, 7, 8)	MS04SB06 (4-6' bgs)	09:55	25%	0		4-6' - Well-graded SAND with silt (SW-SM) - Sand: fine to coarse (predominantly fine to medium), angular to sub-angular; Silt: saturated, brown to gray; Gravel: trace, 2 mm to 3 cm, rounded 6-8' - No recovery
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for MS05

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/28/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

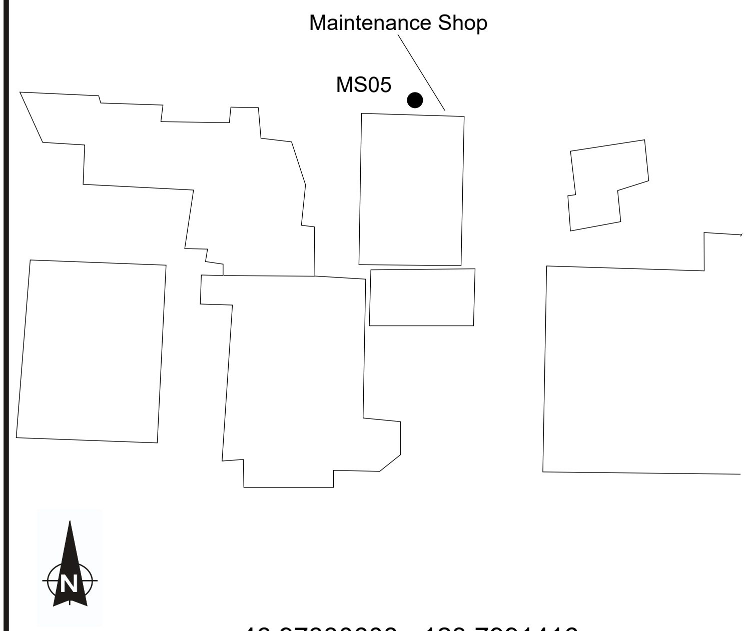
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 4.8 Feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97330608, -123.7991416

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	MS05SB04 (3.2-4' bgs)	15:09	75%	0		0-0.4' - Asphalt 0.4-2' - Well-graded GRAVEL with silt (GW/GM) - Gravel: 2 mm to 5 cm, rounded to angular, casts are black and appear coated with oil/tar; Sand: fine to coarse, angular to sub-angular; Silt: moist, brown to black, soft 2-2.5' - Silty GRAVEL (GM) - Gravel: 2 mm to 5 cm, rounded to sub-angular; Silt: slightly moist, reddish brown 2.5-3.2' - Asphalt - "cold patch" like material, Gravel: 2mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance 3.2-4' - Silty GRAVEL (GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-angular; Silt: moist, dark gray, few wood chips noted, slight petroleum-like odor noted in cutting shoe at 4' bgs
4–8 (5, 6, 7, 8)	MS05SB06 (4-6' bgs)	15:28	50%	0		4-6' - Wood waste, saturated, slight sheen on sample material, strong petroleum-like odor, though no PID readings, cutting shoe plugging at 6' bgs no recovery below
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set at 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for MS06

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/29/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

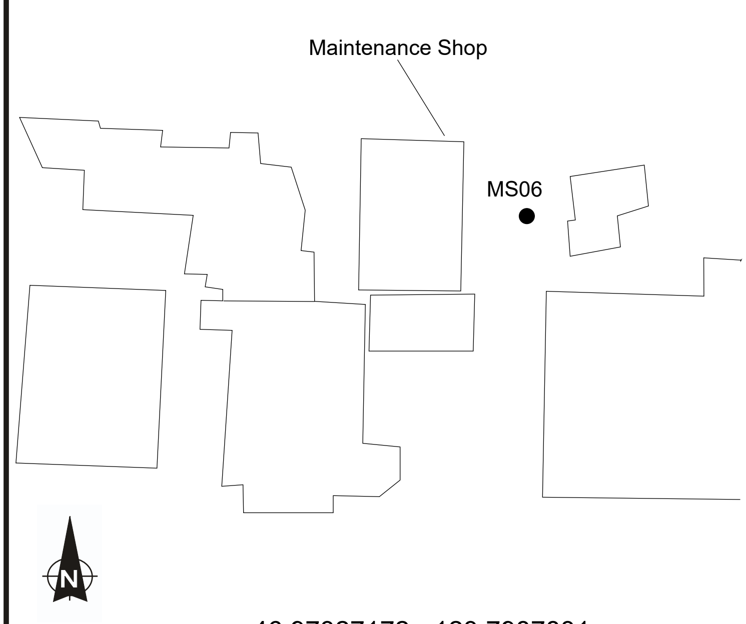
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 4.4 Feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97327172, -123.7987831

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
1, 2, 3, 4	MS06SB04 (2-4' bgs)	08:44	100%	0		0-1.1' - Asphalt/"cold patch" like material - Gravel: 2 mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance 1.1-3.1' - Well-graded GRAVEL with silt (GW/GM) - Gravel: 2 mm to 0.5 cm, rounded to sub-rounded; Sand: fine to coarse, (predominantly fine) angular to sub-angular; Silt: dry, grayish brown, moist 1.9 to 3.1' bgs 3.1-8' - Silty SAND (SM) - Sand: fine, angular to sub-angular; Silt: moist, dark gray; Gravel: trace, 2 mm to 0.5 cm, rounded to sub-rounded
5, 6, 7, 8	MS06SB08 (6-8' bgs)	08:44	75%	0		
9, 10, 11, 12						Total depth = 8 feet bgs Temporary well screen set at 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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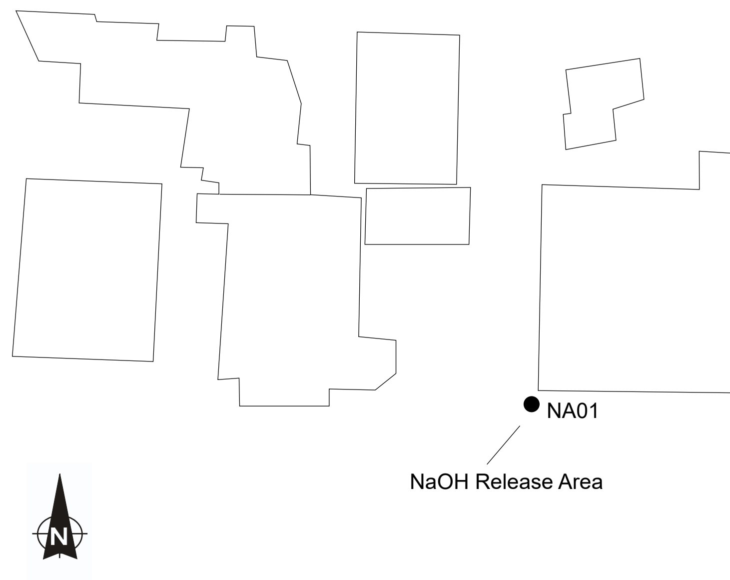
Drilling Log for NA01

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/27/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not Measured/Not Recoverable
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97274782, -123.7983181

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	NA01SB04 (2-4' bgs)	08:08	100%	5.9		0-4' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to sub-rounded, finer gravel = more angular; Sand: fine to coarse, angular to sub-angular; Silt: moist, dark grayish brown, soft, will not ribbon; PID = 5.9 PPM at 2.8' bgs, 1 PPM below
4–8 (5, 6, 7, 8)	NA01SB06 (5-6' bgs)	08:53	75%	0		4-5.5' - Silty GRAVEL (GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-rounded; Silt: moist, brown, soft, forms 1" ribbon 5.5-6.5' - SILT (ML) - moist saturated, dark gray with black mottling, soft, forms 1" ribbon 6.5-8' - No recovery
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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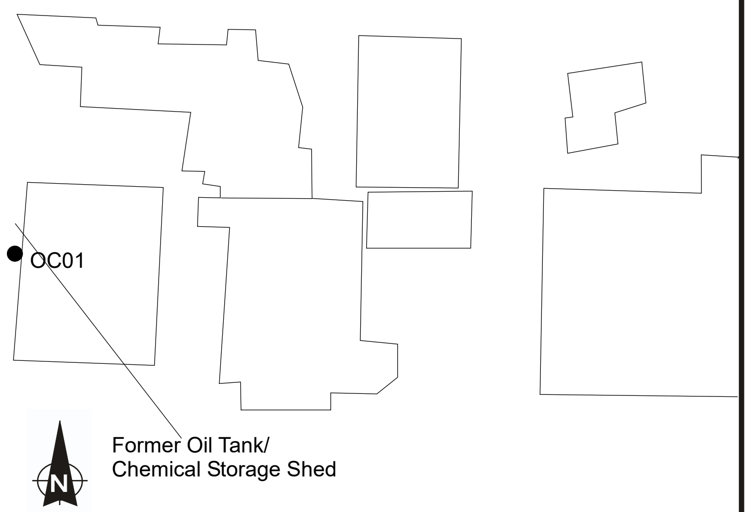
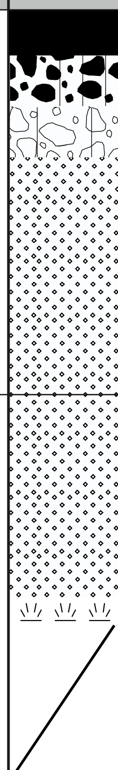
Drilling Log for OC01

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/28/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 6 feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97251961, -123.8000218

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
1 2 3 4	OC01SB04 (1-4' bgs)	09:12	75%	0		0-0.4' - Asphalt 0.4-1' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to angular; Sand: fine to course (predominantly medium to coarse), angular to sub-angular; Silt: dry, light brown 1-1.5' - Silty GRAVEL (GM) - Gravel: 2 mm to 5 cm, rounded to angular; Silt: moist, dark brown 1.5-6' - Well-graded SAND (SM) - Sand: medium to coarse (trace fine), angular to sub-angular; Silt: moist, dark brown to brown; Gravel: trace, 2 mm to 1.5 cm, rounded to sub-rounded
5 6 7 8	OC01SB06 (4-6' bgs)	09:26	50%	0		6' - Wood waste, cutting shoe plugged, no recovery below
9 10 11 12						Total depth = 8 feet bgs Temporary well screen set from 6 - 10 feet bgs Borehole back filled with 3/8" bentonite chips

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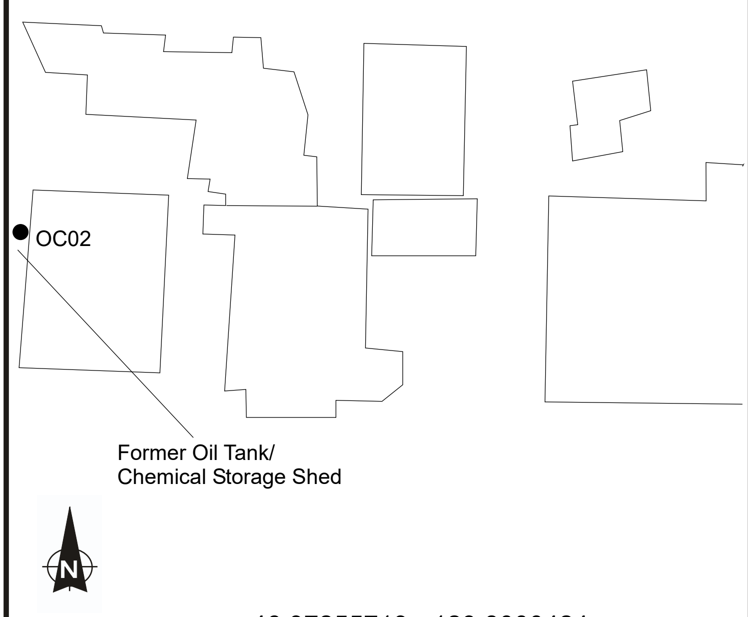
Drilling Log for OC02

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/28/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not Recorded
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97255719, -123.8000424

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	OC02SB04 (2-4' bgs)	09:56	90%	0		0-0.4' - Asphalt 0-1' - Silty GRAVEL (GM) - Gravel: 2 mm to 5 cm, rounded to angular; Silt: moist, dark brown 1-2.1' - Silty GRAVEL (GM) - Gravel: 2 mm to 3 cm, angular; Silt: moist, gray, soft 2.1-3.2' - Silty GRAVEL (GM) - Gravel: 2 mm to 0.5 cm, rounded to sub-rounded; Silt: moist, dark reddish brown, soft; Sand: trace, fine to medium 3.2-6' - Silty GRAVEL (GM) - Gravel: 2 mm to 3 cm, rounded to sub-rounded; Silt: moist, gray, soft; Sand: trace, fine
4–8 (5, 6, 7, 8)	OC06SB06 (4-6' bgs)	10:39	25%	0		6' - Wood waste, cutting shoe plugged, no recovery below
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Screened Interval Not Recorded Borehole back filled with 3/8" bentonite chips

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Drilling Log for OC03

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/28/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

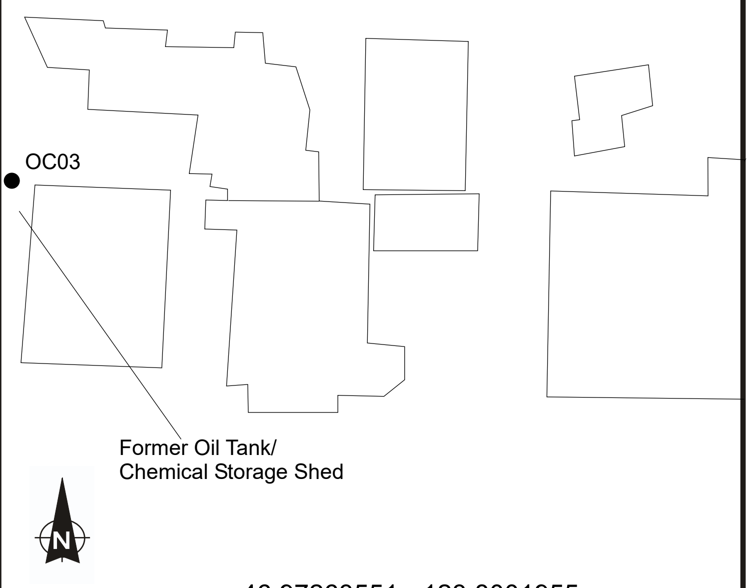
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5.75 Feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97263551, -123.8001955

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	OC03SB04 (3-4' bgs)	16:12	100%	0		0-3.1' - Asphalt - "cold patch" like material, Gravel: 2mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance; Sand: trace, fine, angular to sub-angular, gummy like consistency 3.1-4' - Silty GRAVEL (GM) - Gravel: 2 mm to 0.5 cm, rounded to sub-rounded; Silt: moist, grayish brown; Sand: trace, fine to medium, angular to sub-angular
4–8	OC03SB07 (5-7' bgs)	16:35	80%	0		4-7.5' - Well-graded SAND with silt (SW/SM) - Sand: fine to coarse (predominantly medium to course), angular to sub-angular; Silt: moist, dark gray soft 7.5-8' - No recovery
8–12						Total depth = 8 feet bgs Temporary well screen set at 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for PB01

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/26/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

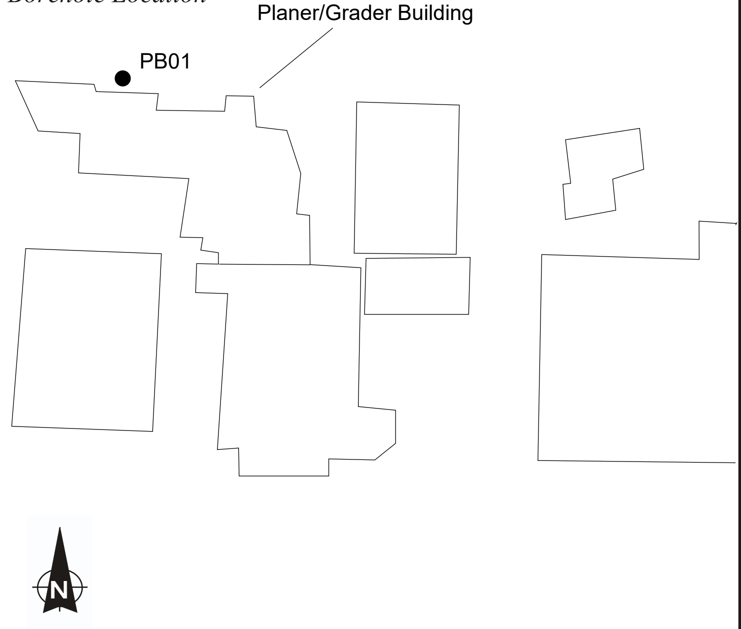
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 4.2 feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97306624, -123.7999983

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	PB01SB04 (2-4' bgs)	17:12	80%	0		0-0.4' - Asphalt 0.4-8' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 2 cm, rounded to sub-rounded; Sand: fine to medium, angular to sub-angular; Silt: moist, dark grayish brown to 2.5' bgs brown below
4–8 (5, 6, 7, 8)	PB01SB08 (6-8' bgs)	17:29	50%	0		No Recovery 6-8' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 2 cm, rounded to sub-rounded; Sand: fine to medium, angular to sub-angular; Silt: moist, dark grayish brown to 2.5' bgs brown below
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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Drilling Log for PB02

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/27/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

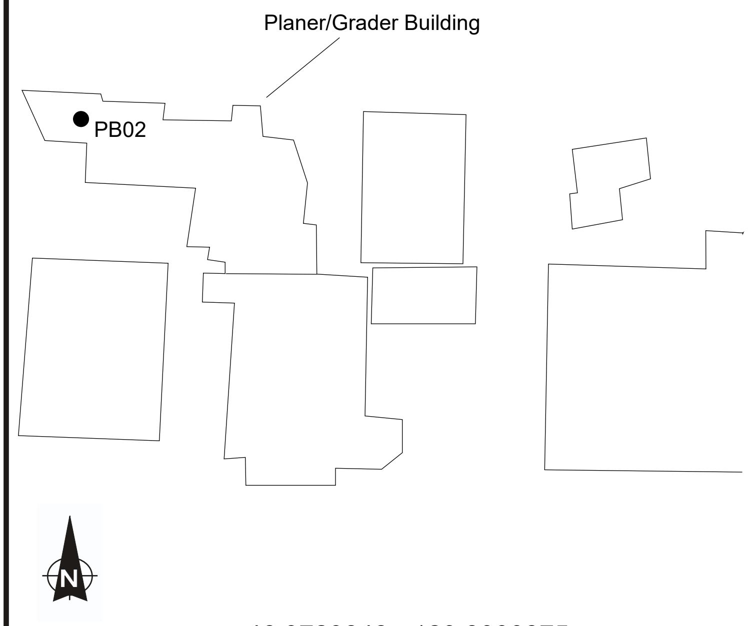
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5.12 feet bgs

Total Depth of Borehole: 12 feet bgs

Borehole Location



GPS Coordinates: 46.9729848, -123.8000875

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3)	PB02SB02 (0-2' bgs)	10:55	75%	0		0-6' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 2 cm, rounded to angular; Sand: fine to coarse, (predominantly medium to coarse), angular to sub-angular; Silt: moist, black to brown, soft, will not form ribbon
4–8 (5, 6, 7)	PB02SB09 (7-9' bgs)	11:44	10%	0		6-11.5' - Wood waste, petroleum-like odor noted
8–12 (9, 10, 11, 12)			50%	0		11.5-12' - SILT (ML) Silt: moist, gray, sulphur-like odor, thought to be native Total depth = 12 feet bgs Temporary well screen set 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips

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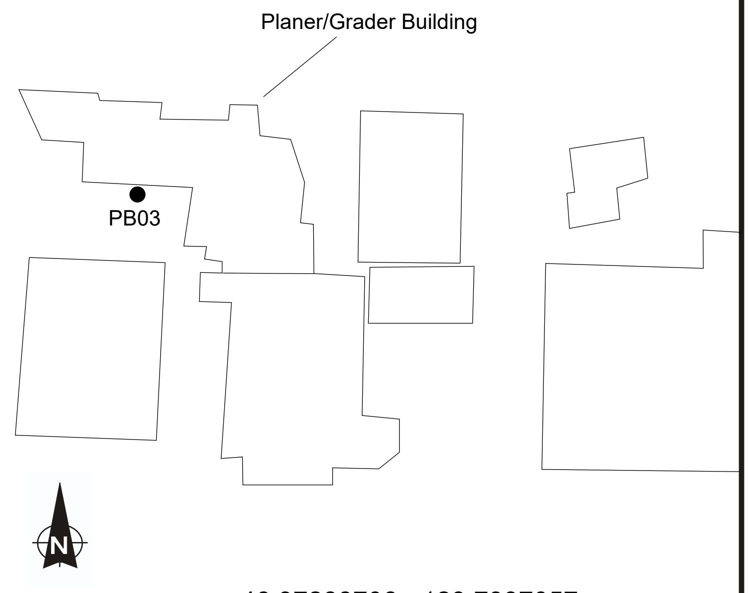
Drilling Log for PB03

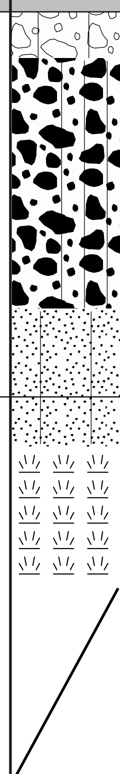
Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/27/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: 5.12 feet bgs
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97288706, -123.7997057

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	PB03SB02 (0-2' bgs)	14:37	100%	0		0-0.5' - Silty GRAVEL (GM) - Gravel: 2 mm to 1 cm, rounded to angular; Silt: dry, dark grayish brown, loose, mixed with asphalt 0.5-3.3' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to angular; Sand: fine to coarse, (predominantly medium to coarse), angular to sub-angular; Silt: dry, reddish brown, loose 3.3-4.5' - Silty SAND (SM) - GW-GM) - Sand: fine to medium, angular to sub-angular; Silt: dry, loose, gray
4–8	PB03SB05 (4-5' bgs)	15:23	50%	0		4.5-6' - Wood waste 6-8' - No recovery
8–12						Total depth = 8 feet bgs Temporary well screen set 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips



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Drilling Log for PB04

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/27/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

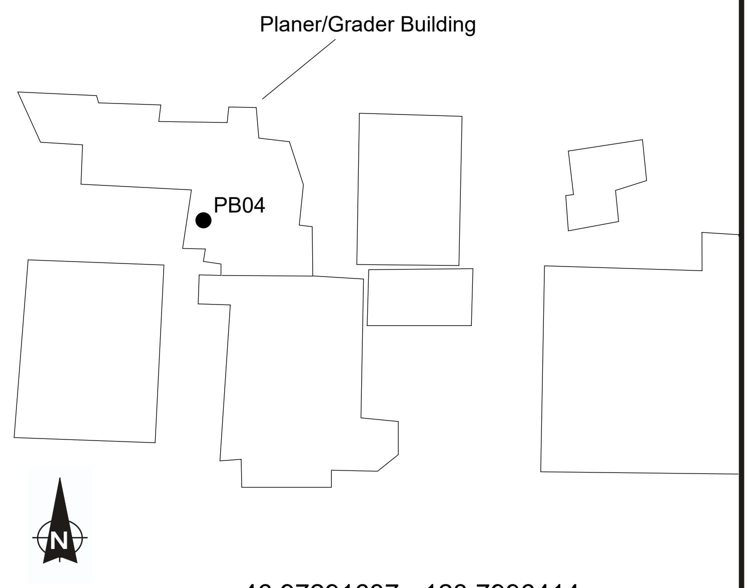
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5.8 feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97291637, -123.7996414

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	PB04SB04 (2-4' bgs)	17:06	50%	0		0-4' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 4 cm, rounded to angular; Sand: trace, fine, angular to sub-angular; Silt: dry, light brown
4–8	PB04SB08 (6-8' bgs)	17:15	25%	0		4-5' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1 cm, rounded to sub-angular; Sand: fine to coarse, angular to sub-angular; Silt: trace, saturated, dark grayish brown 5-8' - No recovery
8–12						Total depth = 8 feet bgs Temporary well screen set from 6 - 10 feet bgs Borehole back filled with 3/8" bentonite chips

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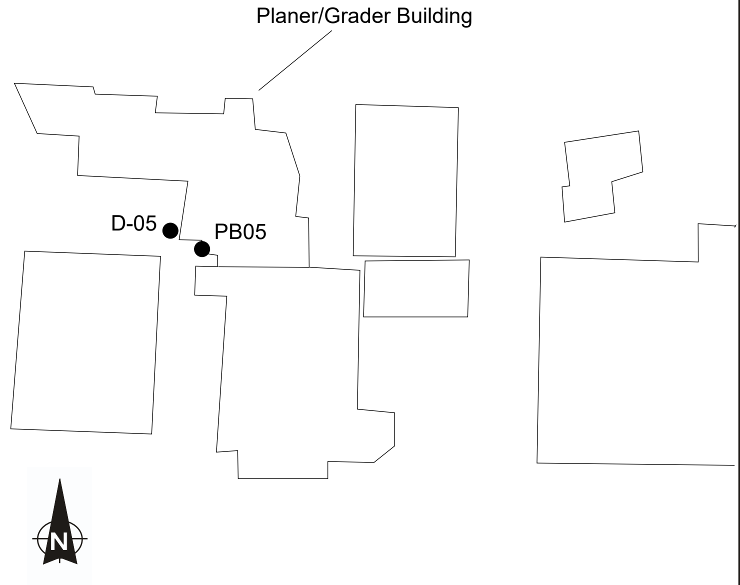
Drilling Log for PB05

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/27/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not measured
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.9728148, -123.7995224

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	PB05SB04 (2-4' bgs)	16:12	80%	0		0-1.5' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1 cm, rounded to sub-angular (smaller gravel = more angular), gravel appears to be coated with oil/tar (cold patch like); Sand: fine to coarse, angular to sub-angular; Silt: mixed with tar like substance 1.5-5' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to sub-angular; Sand: fine to coarse, angular to sub-angular; Silt: moist, grayish brown, soft, will not ribbon
4–8 (5, 6, 7, 8)	PB05SB05 (4-5' bgs)	16:34	50%	0		5-6' - Wood waste 6-8' - No recovery
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen not set, water sample collected from MW D-05 Borehole back filled with 3/8" bentonite chips

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Drilling Log for PB06

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/28/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

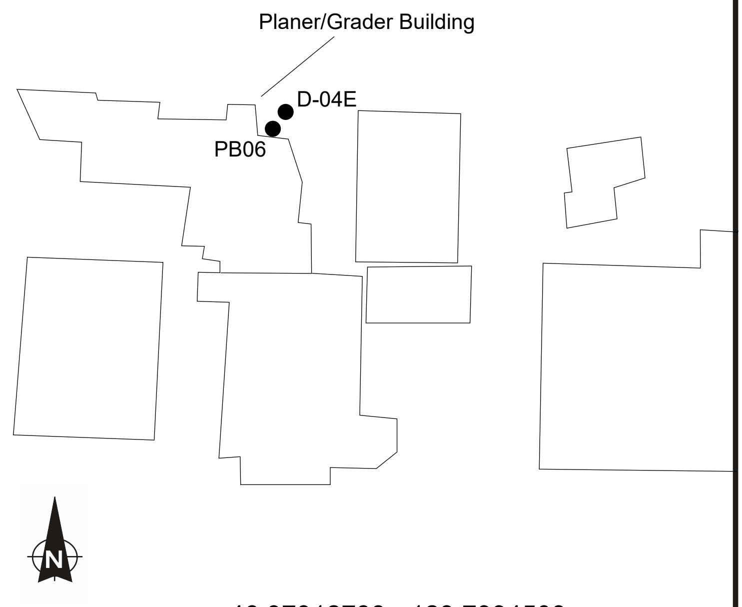
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5 Feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97312733, -123.7994503

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	PB06SB04 (2-4' bgs)	13:33	75%	0		0-0.6' - Asphalt 0.6-3.6' - Well-graded SAND with silt (SW/SM) - Sand: fine to medium, angular to sub-angular; Silt: moist, grayish brown, soft; Gravel: 2 mm to 1.5 cm, rounded to sub-rounded 3.6-6' - Well-graded SAND (SW) - Sand: fine to medium, angular to sub-angular; Silt: moist, dark gray
4–8	PB06SB06 (4-6' bgs)	13:50	50%	0		6' - Wood waste plugging cutting shoe, no recovery below
8–12						Total depth = 8 feet bgs Temporary well screen set at 4 - 8 feet bgs, water sample collected from MW D-04E Borehole back filled with 3/8" bentonite chips

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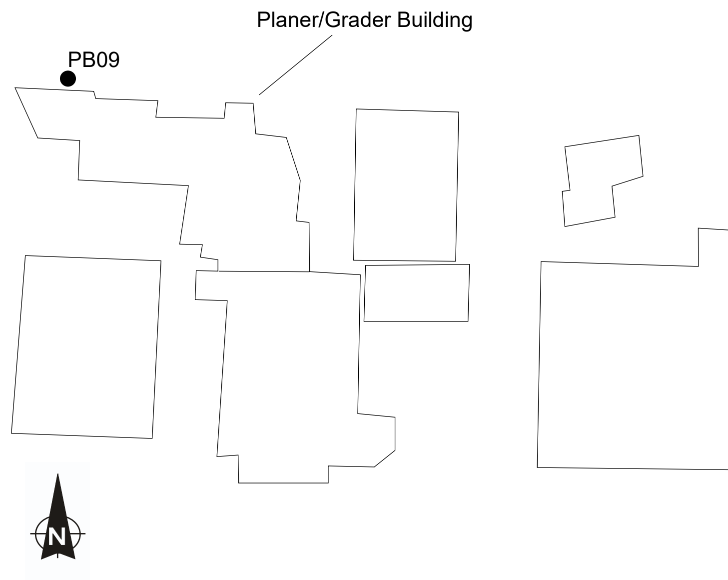
Drilling Log for PB09

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/29/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not Recorded
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97302305, -123.8001442

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0						0-0.5' - Asphalt
1						0.5-5.5' - Well-graded GRAVEL with silt (GW/GM) - Gravel: 2 mm to 3 cm, rounded to sub-angular; Sand: fine to medium, angular to sub-angular; Silt: moist, reddish brown, slightly firm
2			100%	0		
3	PB09SB04 (2-4' bgs)	11:42				
4						
5	PB09SB06 (4-5.5' bgs)	11:57				5.5-7' - Wood waste, cutting shoe plugged at 6.5' bgs no recovery below
6			50%	0		
7						
8						
9						
10						
11						Total depth = 8 feet bgs Screened Interval Not Recorded Borehole back filled with 3/8" bentonite chips
12						

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Drilling Log for PB10

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/29/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

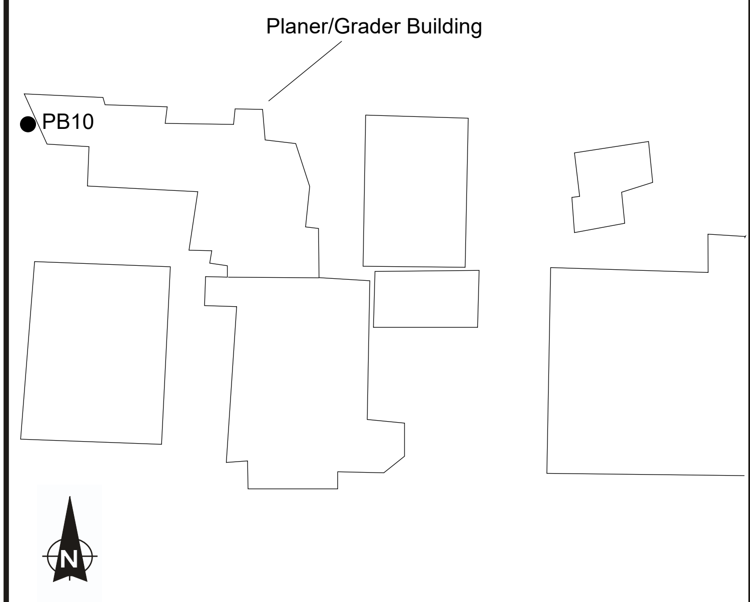
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 5.46 Feet bgs

Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97291798, -123.8001616

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	PB10SB04 (2.4-4' bgs)	10:28	100%	0		0-1.3' - Concrete 1.3-1.5' - Asphalt - "cold patch" like material, Gravel: 2 mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance 1.5-2' - Silty GRAVEL (GM) - Gravel: 2 mm to 1 cm, rounded to sub-angular; Silt: moist, grayish brown to orangish brown, firm; Sand: trace, coarse, angular to sub angular 2-2.4' - Asphalt - "cold patch" like material, Gravel: 2 mm to 0.5 cm rounded to sub-rounded, casts are black and appear coated with oil/tar substance
4–8 (5, 6, 7, 8)	PB10SB08 (4-6.5' bgs)	10:43	50%	0		2.4-5.5' - Well-graded GRAVEL with silt (GW/GM) - Gravel: 2 mm to 1.5 cm, rounded to sub-angular; Sand: fine to coarse, angular to sub-angular; Silt: moist, brown to grayish brown, soft 5.5-6.5' - Wood waste, cutting shoe plugged at 6.5' bgs no recovery below
8–12 (9, 10, 11, 12)						Total depth = 8 feet bgs Temporary well screen set at 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips

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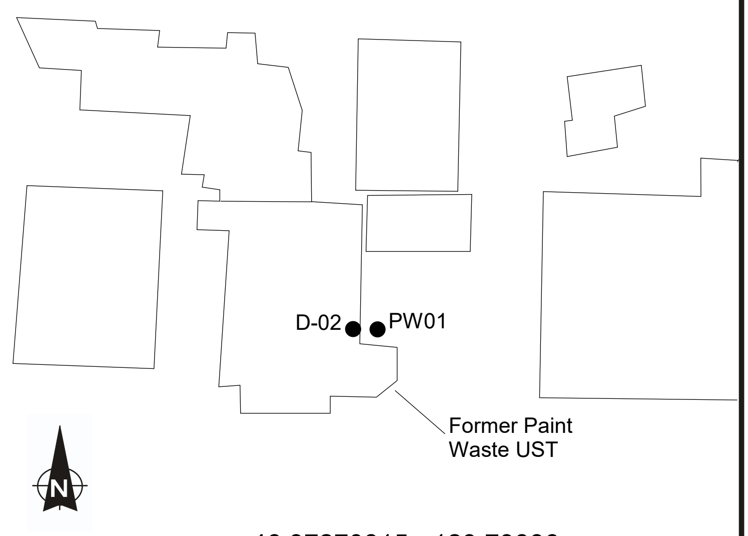
Drilling Log for PW01

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/28/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not measured
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97270815, -123.79886

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–1						0-0.8' - Asphalt
1						0.8-2.2' - Well-graded GRAVEL with silt (GW/GM) - Gravel: 2 mm to 2 cm, rounded to sub-rounded; Sand: medium to course, angular to sub-angular; Silt: moist, brown, soft
2	PW01SB04 (2-4 bgs)		100%	0		
3		12:44				2.2-5.5' - Lithology same as above with increased moisture content and slight increase in sand content, slight petroleum odor at 5.5' bgs
4						
5	PW01SB06 (4-6' bgs)	13:01				
6			50%	0		6' - Wood waste plugging cutting shoe, no recovery below
7						
8						
9						
10						
11						Total depth = 8 feet bgs Temporary well screen not set, water sample collected from MW D-02 Borehole back filled with 3/8" bentonite chips
12						

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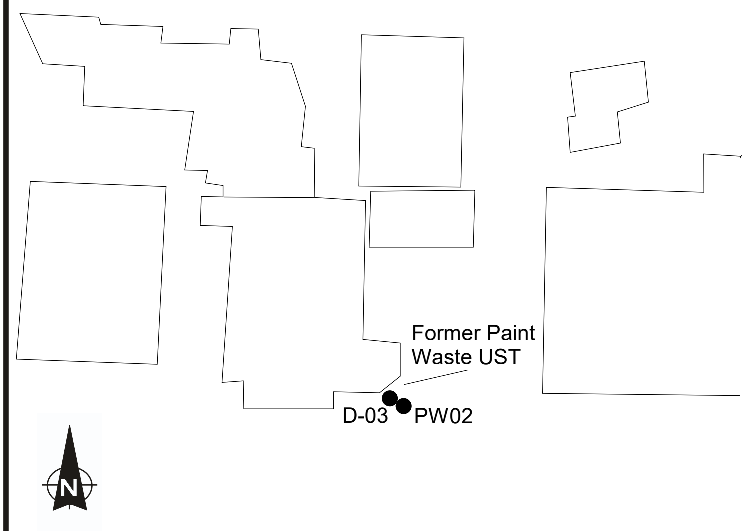
Drilling Log for PW02

Project Name: Seaport Landing TBA
Site Location: Aberdeen, Washington
Date Started/Finished: 9/28/2017
Driller's Name: A. Jensen
Geologist's Name: J. Fetters
Geologist's Signature:
Rig Type(s): Geoprobe 6620DT
Depth to Water: Not measured
Total Depth of Borehole: 8 feet bgs

Borehole Location



GPS Coordinates: 46.97260028, -123.7986699

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4	PW02SB03 (1.6-2.6' bgs)	11:19	50%	0.2		0-0.4' - Asphalt 0-2.6' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 1.5 cm, rounded to angular; Sand: fine to course (predominantly medium to coarse), angular to sub-angular; Silt: slightly moist, grayish brown 2.6' - Wood waste, cutting shoe plugged, no recovery below
4–8	PW02SB08 (6-8' bgs)	11:39	90%	0		4-8' - SILT (ML) with wood waste - Silt: moist, dark gray with black mottling, soft, forms 1.5" ribbon, high mica content; no wood waste below 6' bgs, though some organics noted (appears like grass)
8–12						Total depth = 8 feet bgs Temporary well screen not set, water sample collected from MW D-03 Borehole back filled with 3/8" bentonite chips

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Drilling Log for VM01

Project Name: Seaport Landing TBA

Site Location: Aberdeen, Washington

Date Started/Finished: 9/26/2017

Driller's Name: A. Jensen

Geologist's Name: J. Fetters

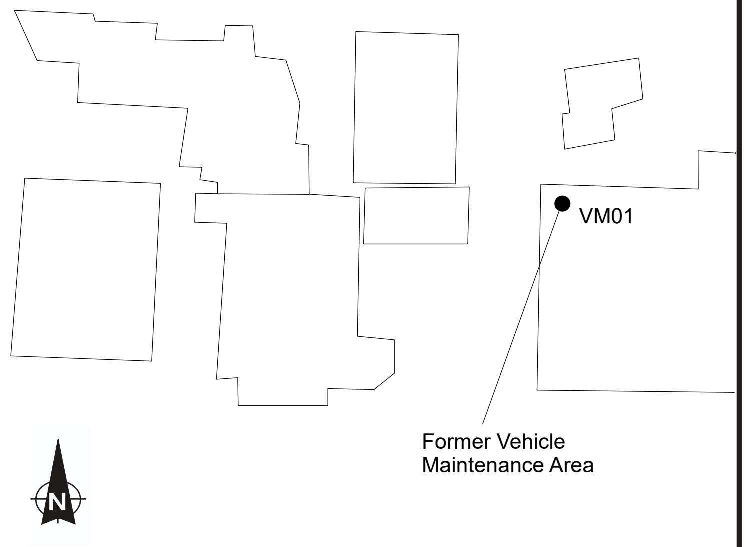
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: Not Recorded

Total Depth of Borehole: 12 feet bgs

Borehole Location



GPS Coordinates: 46.9731626, -123.7985172

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
0–4 (1, 2, 3, 4)	VM01SB04 (2-4' bgs)	11:20	100%	0		0-0.4' - Asphalt 0.4-6.5' - Well-graded GRAVEL with silt (GW-GM) - Gravel: 2 mm to 3 cm, rounded to sub-rounded; Sand: fine to coarse, (predominantly fine to medium), angular to sub-angular; Silt: slightly moist, gray to grayish brown above 2.8 feet bgs, orangish brown below, soft, will not ribbon
4–8 (5, 6, 7, 8)	VM01SB08 6-8' bgs)	11:43	75%	0		6.5-12' - Silty SAND (SM) - Sand: fine to coarse (predominantly fine), angular to sub-angular; Silt: moist, dark gray, loose, does not form ribbon; Gravel: trace, rounded to sub-rounded, 2 mm to 1.5 cm
8–12 (9, 10, 11, 12)			75%	0		Temporary screen set 5 to 9 feet bgs Total depth = 12 feet bgs Borehole back filled with 3/8" bentonite chips

APPENDIX D

ANAYTICAL DATA TABLES FROM PREVIOUS INVESTIGATIONS

Table 4-1
Soil Analytical Results
Grays Harbor Historical Seaport Authority Site
Aberdeen, Washington

			Location:	B01	B02	B03
			Sample Name:	B01-S-4.5	B02-S-5.0	B03-S-5.0
			Collection Date:	10/12/2015	10/12/2015	10/12/2015
			Collection Depth (ft bgs):	4.5	5	5
	MTCA A	MTCA B	Washington Background Metals, Group W, 90th Percentile			
Metals (mg/kg)						
Arsenic	20	0.67	8.5	20 U	10 U	10 U
Cadmium	2	80	0.1	0.6 U	0.6 U	0.5 U
Chromium	19/2000[a]	240/120000[a]	78	**45**	**24**	**43**
Lead	250	NV	11	6 U	**30**	5 U
Mercury	2	NV	0.13	0.03 U	**0.07**	0.03 U
VOCs (mg/kg)						
1,1,1,2-Tetrachloroethane	NV	38		0.0012 U	0.0015 U	0.0011 U
1,1,1-Trichloroethane	2	160000		0.0012 UJ	0.0015 U	0.0011 U
1,1,2,2-Tetrachloroethane	NV	5		0.0012 U	0.0015 U	0.0011 U
1,1,2-Trichloroethane	NV	18		0.0012 UJ	0.0015 U	0.0011 U
1,1-Dichloroethane	NV	180		0.0012 U	0.0015 U	0.0011 U
1,1-Dichloroethene	NV	NV		0.0012 U	0.0015 U	0.0011 U
1,1-Dichloropropene	NV	NV		0.0012 U	0.0015 U	0.0011 U
1,2,3-Trichlorobenzene	NV	NV		0.0059 U	0.0074 U	0.0053 U
1,2,3-Trichloropropane	NV	0.033		0.0023 U	0.003 U	0.0021 U
1,2,4-Trichlorobenzene	NV	34		0.0059 U	0.0074 U	0.0053 U
1,2,4-Trimethylbenzene	NV	NV		0.0012 U	**0.7**	0.0011 U
1,2-Dibromo-3-chloropropane	NV	1.3		0.0059 U	0.0074 U	0.0053 U
1,2-Dibromoethane	0.005	0.5		0.0012 U	0.0015 U	0.0011 U
1,2-Dichlorobenzene	NV	7200		0.0012 U	0.0015 U	0.0011 U
1,2-Dichloroethane	NV	11		0.0012 U	0.0015 U	0.0011 U
1,2-Dichloropropane	NV	28		0.0012 UJ	0.0015 U	0.0011 U
1,3,5-Trimethylbenzene	NV	800		0.0012 U	**0.21**	0.0011 U
1,3-Dichlorobenzene	NV	NV		0.0012 U	0.0015 U	0.0011 U
1,3-Dichloropropane	NV	NV		0.0012 U	0.0015 U	0.0011 U
1,4-Dichlorobenzene	NV	190		0.0012 U	0.0015 U	0.0011 U
2,2-Dichloropropane	NV	NV		0.0012 U	0.0015 U	0.0011 U
2-Butanone	NV	48000		**0.0082**	**0.037**	**0.0042 J**

Table 4-1
Soil Analytical Results
Grays Harbor Historical Seaport Authority Site
Aberdeen, Washington

			Location:	B01	B02	B03
			Sample Name:	B01-S-4.5	B02-S-5.0	B03-S-5.0
			Collection Date:	10/12/2015	10/12/2015	10/12/2015
			Collection Depth (ft bgs):	4.5	5	5
	MTCA A	MTCA B	Washington Background Metals, Group W, 90th Percentile			
2-Chloroethylvinyl ether	NV	NV		0.0059 UJ	0.0074 UJ	0.0053 UJ
2-Chlorotoluene	NV	1600		0.0012 U	0.0015 U	0.0011 U
2-Hexanone	NV	NV		0.0059 U	0.0074 U	0.0053 U
4-Chlorotoluene	NV	NV		0.0012 U	0.0015 U	0.0011 U
4-Isopropyltoluene	NV	NV		0.0012 U	**0.02**	0.0011 U
4-Methyl-2-pentanone	NV	6400		0.0059 U	0.0074 U	0.0053 U
Acetone	NV	72000		**0.055**	**0.19**	**0.026**
Acrolein	NV	40		0.059 U	0.074 U	0.053 U
Acrylonitrile	NV	NV		0.0059 U	0.0074 U	0.0053 U
Benzene	0.03	18		0.0012 UJ	0.0015 U	0.0011 U
Bromobenzene	NV	NV		0.0012 U	0.0015 U	0.0011 U
Bromodichloromethane	NV	16		0.0012 UJ	0.0015 U	0.0011 U
Bromoethane	NV	NV		0.0023 U	0.003 U	0.0021 U
Bromoform	NV	130		0.0012 UJ	0.0015 U	0.0011 U
Bromomethane	NV	112		0.0012 UJ	0.0015 UJ	0.0011 UJ
Carbon disulfide	NV	8000		**0.0013**	**0.0088**	**0.0034**
Carbon tetrachloride	NV	14		0.0012 UJ	0.0015 U	0.0011 U
Chlorobenzene	NV	1600		0.0012 U	0.0015 U	0.0011 U
Chlorobromomethane	NV	NV		0.0012 U	0.0015 U	0.0011 U
Chloroethane	NV	NV		0.0012 UJ	0.0015 UJ	0.0011 UJ
Chloroform	NV	32		0.0012 U	0.0015 U	0.0011 U
Chloromethane	NV	NV		0.0012 U	0.0015 U	0.0011 U
cis-1,2-Dichloroethene	NV	160		0.0012 U	0.0015 U	0.0011 U
cis-1,3-Dichloropropene	NV	10[c]		0.0012 UJ	0.0015 U	0.0011 U
Dibromochloromethane	NV	12		0.0012 UJ	0.0015 U	0.0011 U
Dibromomethane	NV	800		0.0012 UJ	0.0015 U	0.0011 U
Ethylbenzene	6	8000		0.0012 U	0.0015 U	0.0011 U
Freon 113	NV	2400000		0.0023 U	0.003 U	0.0021 U
Hexachlorobutadiene	NV	13		0.0059 U	0.0074 U	0.0053 U
Isopropylbenzene	NV	8000		0.0012 U	**0.019**	0.0011 U
m,p-Xylene	NV	NV		0.0012 U	**0.036**	0.0011 U
Methyl iodide	NV	NV		0.0012 UJ	0.0015 UJ	0.0011 UJ
Methylene chloride	0.02	480		0.0023 U	0.003 U	0.0021 U
Naphthalene	5	1600		0.0059 U	**0.005 J**	0.0053 U
n-Butylbenzene	NV	NV		0.0012 U	0.0015 U	0.0011 U
n-Propylbenzene	NV	8000		0.0012 U	**0.015**	0.0011 U

Table 4-1
Soil Analytical Results
Grays Harbor Historical Seaport Authority Site
Aberdeen, Washington

			Location:	B01	B02	B03
			Sample Name:	B01-S-4.5	B02-S-5.0	B03-S-5.0
			Collection Date:	10/12/2015	10/12/2015	10/12/2015
			Collection Depth (ft bgs):	4.5	5	5
	MTCA A	MTCA B	Washington Background Metals, Group W, 90th Percentile			
o-Xylene	16000	16000		0.0012 U	**0.11**	0.0011 U
sec-Butylbenzene	NV	8000		0.0012 U	**0.017**	0.0011 U
Styrene	NV	16000		0.0012 U	0.0015 U	0.0011 U
tert-Butylbenzene	NV	8000		0.0012 U	**0.0042**	0.0011 U
Tetrachloroethene	0.05	480		0.0012 U	0.0015 U	0.0011 U
Toluene	7	6400		**0.0007 J**	**0.0016**	0.0011 U
trans-1,2-dichloroethene	NV	1600		0.0012 U	0.0015 U	0.0011 U
trans-1,3-Dichloropropene	NV	10[c]		0.0012 UJ	0.0015 U	0.0011 U
trans-1,4-Dichloro-2-butene	NV	NV		0.0059 U	0.0074 U	0.0053 U
Trichloroethene	0.03	12		0.0012 U	0.0015 U	0.0011 U
Trichlorofluoromethane	NV	24000		0.0012 U	0.0015 U	0.0011 U
Vinyl Acetate	NV	80000		0.0059 U	0.0074 U	0.0053 U
Vinyl chloride	NV	0.67		0.0012 U	0.0015 U	0.0011 U
Xylenes, total	9	16000		0.0012 U	**0.146**	0.0011 U
SVOCs (mg/kg)						
1,2,4-Trichlorobenzene	NV	34		0.019 U	0.19 U	0.02 U
1,2-Dichlorobenzene	NV	7200		0.019 U	0.19 U	0.02 U
1,3-Dichlorobenzene	NV	NV		0.019 U	0.19 U	0.02 U
1,4-Dichlorobenzene	NV	190		0.019 U	0.19 U	0.02 U
1-Methylnaphthalene	NV	34		**0.015 J**	**0.17 J**	0.02 U
2,4,5-Trichlorophenol	NV	8000		0.096 U	0.96 U	0.099 U
2,4,6-Trichlorophenol	NV	80		0.096 U	0.96 U	0.099 U
2,4-Dichlorophenol	NV	240		0.096 U	0.96 U	0.099 U
2,4-Dimethylphenol	NV	1600		0.096 U	0.96 U	0.099 U
2,4-Dinitrophenol	NV	160		0.19 U	1.9 U	0.2 U
2,4-Dinitrotoluene	NV	3.2		0.096 U	0.96 U	0.099 U
2,6-Dinitrotoluene	NV	0.67		0.096 U	0.96 U	0.099 U
2-Chloronaphthalene	NV	6400		0.019 U	0.19 U	0.02 U
2-Chlorophenol	NV	400		0.019 U	0.19 U	0.02 U
2-Methylnaphthalene	NV	320		0.019 U	**0.17 J**	0.02 U
2-Methylphenol	NV	NV		0.019 U	0.19 U	0.02 U
2-Nitroaniline	NV	800		0.096 U	0.96 U	0.099 U
2-Nitrophenol	NV	NV		0.019 U	0.19 U	0.02 U
3,3-Dichlorobenzidine	NV	2.2		0.096 R	0.96 R	0.099 R
3-Nitroaniline	NV	NV		0.096 UJ	0.96 UJ	0.099 UJ
4,6-Dinitro-2-methylphenol	NV	NV		0.19 U	1.9 U	0.2 U
4-Bromophenylphenyl ether	NV	NV		0.019 U	0.19 U	0.02 U

Table 4-1
Soil Analytical Results
Grays Harbor Historical Seaport Authority Site
Aberdeen, Washington

			Location:	B01	B02	B03
			Sample Name:	B01-S-4.5	B02-S-5.0	B03-S-5.0
			Collection Date:	10/12/2015	10/12/2015	10/12/2015
			Collection Depth (ft bgs):	4.5	5	5
	MTCA A	MTCA B	Washington Background Metals, Group W, 90th Percentile			
4-Chloro-3-methylphenol	NV	NV		0.096 U	0.96 U	0.099 U
4-Chloroaniline	NV	5		0.096 U	0.96 U	0.099 U
4-Chlorophenylphenyl ether	NV	NV		0.019 U	0.19 U	0.02 U
4-Methylphenol	NV	NV		0.019 U	0.19 U	0.02 U
4-Nitroaniline	NV	NV		0.096 UJ	0.96 UJ	0.099 UJ
4-Nitrophenol	NV	NV		0.096 U	0.96 U	0.099 U
Acenaphthene	NV	4800		0.019 U	**0.5**	0.02 U
Acenaphthylene	NV	NV		**0.022**	0.19 U	0.02 U
Anthracene	NV	24000		**0.014 J**	**0.29**	0.02 U
Benzo(a)anthracene	NV	1.4		**0.026**	0.19 U	0.02 U
Benzo(a)pyrene	0.1	0.14		**0.02**	0.19 U	0.02 U
Benzo(ghi)perylene	NV	NV		**0.01 J**	0.19 U	0.02 U
Benzoic acid	NV	320000		0.19 U	1.9 U	0.2 U
Benzyl alcohol	NV	8000		0.019 R	0.19 R	0.02 R
Bis(2-chloro-1-methylethyl)ether	NV	14		0.019 U	0.19 U	0.02 U
Bis(2-chloroethoxy)methane	NV	NV		0.019 U	0.19 U	0.02 U
Bis(2-chloroethyl)ether	NV	0.91		0.019 U	0.19 U	0.02 U
Bis(2-ethylhexyl)phthalate	NV	71		**0.037 J**	0.48 U	**0.15**
Butylbenzylphthalate	NV	530		0.019 U	0.19 U	0.02 U
Carbazole	NV	NV		0.019 UJ	0.19 UJ	0.02 UJ
Chrysene	NV	140		**0.034**	**0.48**	0.02 U
Dibenzo(a,h)anthracene	NV	0.14		0.019 U	0.19 U	0.02 U
Dibenzofuran	NV	80		**0.012 J**	**0.33**	0.02 U
Diethyl phthalate	NV	64000		**0.018 J**	0.19 U	0.02 U
Dimethyl phthalate	NV	NV		0.019 U	0.19 U	0.02 U
Di-n-butyl phthalate	NV	8000		0.019 U	0.19 U	0.02 U
Di-n-octyl phthalate	NV	800		0.019 U	0.19 U	0.02 U
Fluoranthene	NV	3200		**0.053**	**1.2**	0.02 U
Fluorene	NV	3200		**0.01 J**	**0.59**	0.02 U
Hexachlorobenzene	NV	0.63		0.019 U	0.19 U	0.02 U
Hexachlorobutadiene	NV	13		0.019 U	0.19 U	0.02 U
Hexachlorocyclopentadiene	NV	480		0.096 U	0.96 U	0.099 U
Hexachloroethane	NV	25		0.019 U	0.19 U	0.02 U
Indeno(1,2,3-cd)pyrene	NV	1.4		**0.0096 J**	0.19 U	0.02 U
Isophorone	NV	1100		0.019 U	0.19 U	0.02 U
Naphthalene	5	1600		**0.083**	0.19 U	0.02 U
Nitrobenzene	NV	160		0.019 U	0.19 U	0.02 U
N-Nitrosodiphenylamine	NV	200		0.019 U	0.19 U	0.02 U

Table 4-1
Soil Analytical Results
Grays Harbor Historical Seaport Authority Site
Aberdeen, Washington

			Location:	B01	B02	B03
			Sample Name:	B01-S-4.5	B02-S-5.0	B03-S-5.0
			Collection Date:	10/12/2015	10/12/2015	10/12/2015
			Collection Depth (ft bgs):	4.5	5	5
	MTCA A	MTCA B	Washington Background Metals, Group W, 90th Percentile			
N-Nitrosodipropylamine	NV	0.14		0.019 U	0.19 U	0.02 U
Pentachlorophenol	NV	2.5		0.096 U	0.96 U	0.099 U
Phenanthrene	NV	NV		**0.069**	**1.6**	0.02 U
Phenol	NV	24000		0.019 UJ	0.19 UJ	0.02 UJ
Pyrene	NV	2400		**0.069**	**0.93**	0.02 U
Total Benzofluoranthenes	NV	1.4[b]		**0.037 J**	**0.26 J**	0.04 U
cPAH TEQ	0.1	NV		**0.014 J**	**0.0029 J**	0.02 U
Hydrocarbon Identification (Presence Absence)						
Diesel	NV	NV		ND	**DETECT**	ND
Gasoline	NV	NV		ND	ND	ND
Lube Oil	NV	NV		ND	**DETECT**	**DETECT**
TPH (mg/kg)						
Diesel	2000	NV		--	**5800**	64 U
Lube Oil	2000	NV		--	**19000**	**160**

NOTES:

Detections are in **bold** font.

Results that exceed MTCA cleanup levels and/or metals background conditions are shaded. Non-detect results are not evaluated against cleanup levels.

ft bgs = feet below ground surface.

Group W = Washington State region that includes Gray's Harbor area.

J = the result is an estimated value.

mg/kg = milligrams per kilogram (parts per million).

MTCA = Model Toxics Control Act

MTCA A = MTCA Method A soil, unrestricted land use.

MTCA B = MTCA Method B soil, lower of available cancer or non-cancer value.

ND = not detected.

NV = no value.

R = result is rejected.

U = the result is non-detect.

[a]Value is for hexavalent chromium/trivalent chromium.

[b]Value is for benzo(b)fluoranthene.

[c]Value is for 1,3-dichloropropene

Table 4-2
Groundwater Analytical Results
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

		Location:	B01	B02	B03
		Sample Name:	B01-GW-10.0	B02-GW-6	B03-GW-10
		Collection Date:	10/12/2015	10/12/2015	10/12/2015
	MTCA A	MTCA B			
Dissolved Metals (ug/L)					
Arsenic	5	0.058	50 U	50 U	50 U
Cadmium	5	8	2 U	2 U	2 U
Chromium	50	48/24000[a]	5 U	5 U	5 U
Lead	15	NV	20 U	20 U	20 U
Mercury	2	NV	0.1 U	0.1 U	0.1 U
Total Metals (ug/L)					
Arsenic	5	0.058	50 U	50 U	50 U
Cadmium	5	8	2 U	**2**	2 U
Chromium	50	48/24000[a]	**18**	**116**	**6**
Lead	15	NV	20 U	**80**	20 U
Mercury	2	NV	0.1 U	**0.1**	**0.7**
VOCs (ug/L)					
1,1,1,2-Tetrachloroethane	NV	1.7	0.2 U	0.2 U	0.2 U
1,1,1-Trichloroethane	200	16000	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	NV	0.22	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	NV	0.77	0.2 U	0.2 U	**0.29**
1,1-Dichloroethane	NV	7.7	0.2 U	0.2 U	**0.12 J**
1,1-Dichloroethene	NV	400	0.2 U	0.2 U	0.2 U
1,1-Dichloropropene	NV	NV	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	NV	NV	0.5 U	0.5 U	0.5 U
1,2,3-Trichloropropane	NV	0.0015	0.5 U	0.5 U	0.5 U
1,2,4-Trichlorobenzene	NV	1.5	0.5 U	0.5 U	0.5 U
1,2,4-Trimethylbenzene	NV	NV	0.2 U	**0.37**	0.2 U
1,2-Dibromo-3-chloropropane	NV	0.055	0.5 U	0.5 U	0.5 U
1,2-Dibromoethane	0.01	0.022	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	NV	720	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	5	0.48	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	NV	1.2	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	NV	80	0.2 U	**0.19 J**	0.2 U
1,3-Dichlorobenzene	NV	NV	0.2 U	0.2 U	0.2 U
1,3-Dichloropropane	NV	NV	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	NV	8.1	0.2 U	0.2 U	0.2 U
2,2-Dichloropropane	NV	NV	0.2 U	0.2 U	0.2 U
2-Butanone	NV	4800	5 U	**0.85 J**	5 U

Table 4-2
Groundwater Analytical Results
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

		Location:	B01	B02	B03
		Sample Name:	B01-GW-10.0	B02-GW-6	B03-GW-10
		Collection Date:	10/12/2015	10/12/2015	10/12/2015
	MTCA A	MTCA B			
2-Chloroethylvinyl ether	NV	NV	1 R	1 R	1 R
2-Chlorotoluene	NV	160	0.2 U	0.2 U	0.2 U
2-Hexanone	NV	NV	5 U	5 U	5 U
4-Chlorotoluene	NV	NV	0.2 U	0.2 U	0.2 U
4-Isopropyltoluene	NV	NV	0.2 U	0.2 U	0.2 U
4-Methyl-2-pentanone	NV	640	5 U	5 U	5 U
Acetone	NV	7200	5 U	5 U	5 U
Acrolein	NV	4	5 U	5 U	5 U
Acrylonitrile	NV	0.081	1 U	1 U	1 U
Benzene	5	0.80	0.2 U	0.2 U	0.2 U
Bromobenzene	NV	NV	0.2 U	0.2 U	0.2 U
Bromodichloromethane	NV	0.71	0.2 U	0.2 U	0.2 U
Bromoethane	NV	NV	0.2 U	0.2 U	0.2 U
Bromoform	NV	5.5	0.2 U	0.2 U	0.2 U
Bromomethane	NV	11	1 U	1 U	1 U
Carbon disulfide	NV	800	0.2 U	**0.4**	0.2 U
Carbon tetrachloride	NV	0.63	0.2 U	0.2 U	0.2 U
Chlorobenzene	NV	160	0.2 U	0.2 U	0.2 U
Chlorobromomethane	NV	NV	0.2 U	0.2 U	0.2 U
Chloroethane	NV	NV	0.2 U	0.2 U	**0.39**
Chloroform	NV	1.4	0.2 U	0.2 U	0.2 U
Chloromethane	NV	NV	0.5 U	0.5 U	0.5 U
cis-1,2-Dichloroethene	NV	16	0.2 U	0.2 U	**0.25**
cis-1,3-Dichloropropene	NV	0.44[b]	0.2 U	0.2 U	0.2 U
Dibromochloromethane	NV	0.52	0.2 U	0.2 U	0.2 U
Dibromomethane	NV	80	0.2 U	0.2 U	0.2 U
Ethylbenzene	700	800	0.2 U	0.2 U	0.2 U
Freon 113	NV	240000	0.2 U	0.2 U	0.2 U
Hexachlorobutadiene	NV	0.56	0.5 U	0.5 U	0.5 U
Isopropylbenzene	NV	800	0.2 U	0.2 U	0.2 U
m,p-Xylene	NV	NV	**0.27 J**	**0.4**	**0.15 J**
Methyl iodide	NV	NV	1 U	1 U	1 U
Methylene chloride	5	22	1 U	1 U	1 U
Naphthalene	160	160	0.5 U	0.5 U	0.5 U
n-Butylbenzene	NV	400	0.2 U	0.2 U	0.2 U

Table 4-2
Groundwater Analytical Results
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

		Location:	B01	B02	B03
		Sample Name:	B01-GW-10.0	B02-GW-6	B03-GW-10
		Collection Date:	10/12/2015	10/12/2015	10/12/2015
	MTCA A	MTCA B			
n-Propylbenzene	NV	800	0.2 U	0.2 U	0.2 U
o-Xylene	NV	160	**0.11 J**	**0.57**	0.2 U
sec-Butylbenzene	NV	800	0.2 U	0.2 U	0.2 U
Styrene	NV	1600	0.2 U	0.2 U	0.2 U
tert-Butylbenzene	NV	800	0.2 U	0.2 U	0.2 U
Tetrachloroethene	5	21	0.2 U	0.2 U	0.2 U
Toluene	1000	640	**1.2**	**0.34**	0.2 U
trans-1,2-dichloroethene	NV	160	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	NV	0.44[b]	0.2 U	0.2 U	0.2 U
trans-1,4-Dichloro-2-butene	NV	NV	1 U	1 U	1 U
Trichloroethene	5	0.54	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	NV	2400	0.2 U	0.2 U	0.2 U
Vinyl Acetate	NV	8000	0.2 U	0.2 U	0.2 U
Vinyl chloride	0.2	0.029	0.2 U	0.2 U	0.2 U
Xylenes, total	1000	1600	**0.38 J**	**0.97 J**	**0.25 J**
SVOCs (ug/L)					
1,2,4-Trichlorobenzene	NV	1.5	1 U	20 U	1 U
1,2-Dichlorobenzene	NV	720	1 U	20 U	1 U
1,3-Dichlorobenzene	NV	NV	1 U	20 U	1 U
1,4-Dichlorobenzene	NV	8.1	1 U	20 U	1 U
1-Methylnaphthalene	NV	1.5	1 U	20 U	1 U
2,4,5-Trichlorophenol	NV	800	5 U	100 U	5 U
2,4,6-Trichlorophenol	NV	4.0	3 U	60 U	3 U
2,4-Dichlorophenol	NV	24	3 U	60 U	3 U
2,4-Dimethylphenol	NV	160	3 U	60 U	3 U
2,4-Dinitrophenol	NV	32	20 UJ	400 UJ	20 UJ
2,4-Dinitrotoluene	NV	0.28	3 U	60 U	3 U
2,6-Dinitrotoluene	NV	0.058	3 U	60 U	3 U
2-Chloronaphthalene	NV	640	1 U	20 U	1 U
2-Chlorophenol	NV	40	1 U	20 U	1 U
2-Methylnaphthalene	NV	32	1 U	20 U	1 U
2-Methylphenol	NV	NV	1 U	20 U	1 U
2-Nitroaniline	NV	160	3 U	60 U	3 U
2-Nitrophenol	NV	NV	3 U	60 U	3 U
3,3-Dichlorobenzidine	NV	0.19	5 U	100 U	5 U

Table 4-2
Groundwater Analytical Results
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

		Location:	B01	B02	B03
		Sample Name:	B01-GW-10.0	B02-GW-6	B03-GW-10
		Collection Date:	10/12/2015	10/12/2015	10/12/2015
	MTCA A	MTCA B			
3-Nitroaniline	NV	NV	3 U	60 U	3 U
4,6-Dinitro-2-methylphenol	NV	NV	10 U	200 U	10 U
4-Bromophenylphenyl ether	NV	NV	1 U	20 U	1 U
4-Chloro-3-methylphenol	NV	NV	3 U	60 U	3 U
4-Chloroaniline	NV	0.22	5 U	100 U	5 U
4-Chlorophenylphenyl ether	NV	NV	1 U	20 U	1 U
4-Methylphenol	NV	NV	2 U	40 U	2 U
4-Nitroaniline	NV	NV	3 U	60 U	3 U
4-Nitrophenol	NV	NV	10 UJ	200 UJ	10 UJ
Acenaphthene	NV	960	1 U	20 U	1 U
Acenaphthylene	NV	NV	1 U	20 U	1 U
Anthracene	NV	4800	1 U	20 U	1 U
Benzo(a)anthracene	NV	0.12	1 U	20 U	1 U
Benzo(a)pyrene	0.1	0.012	1 U	20 U	1 U
Benzo(ghi)perylene	NV	NV	1 U	20 U	1 U
Benzoic acid	NV	64000	20 UJ	**97 J**	20 UJ
Benzyl alcohol	NV	800	2 U	40 U	2 U
Bis(2-chloro-1-methylethyl)ether	NV	0.63	1 U	20 U	1 U
Bis(2-chloroethoxy)methane	NV	NV	1 U	20 U	1 U
Bis(2-chloroethyl)ether	NV	0.040	1 U	20 U	1 U
Bis(2-ethylhexyl)phthalate	NV	6.25	3 U	60 U	3 U
Butylbenzylphthalate	NV	46	1 U	20 U	1 U
Carbazole	NV	NV	1 U	20 U	1 U
Chrysene	NV	12	1 U	**11 J**	1 U
Dibenzo(a,h)anthracene	NV	0.012	1 U	20 U	1 U
Dibenzofuran	NV	16	1 U	20 U	1 U
Diethyl phthalate	NV	13000	1 U	20 U	1 U
Dimethyl phthalate	NV	NV	1 U	20 U	1 U
Di-n-butyl phthalate	NV	1600	1 U	20 U	1 U
Di-n-octyl phthalate	NV	160	1 U	20 U	1 U
Fluoranthene	NV	640	1 U	**23**	1 U
Fluorene	NV	640	1 U	20 U	1 U
Hexachlorobenzene	NV	32	1 U	20 U	1 U
Hexachlorobutadiene	NV	0.56	3 U	60 U	3 U
Hexachlorocyclopentadiene	NV	48	5 UJ	100 UJ	5 UJ

Table 4-2
Groundwater Analytical Results
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

		Location:	B01	B02	B03
		Sample Name:	B01-GW-10.0	B02-GW-6	B03-GW-10
		Collection Date:	10/12/2015	10/12/2015	10/12/2015
	MTCA A	MTCA B			
Hexachloroethane	NV	1.1	2 U	40 U	2 U
Indeno(1,2,3-cd)pyrene	NV	0.12	1 U	20 U	1 U
Isophorone	NV	46	1 U	20 U	1 U
Naphthalene	160	160	1 U	20 U	1 U
Nitrobenzene	NV	16	1 U	20 U	1 U
N-Nitrosodiphenylamine	NV	18	1 U	20 U	1 U
N-Nitrosodipropylamine	NV	0.013	1 U	20 U	1 U
Pentachlorophenol	NV	0.22	10 UJ	200 UJ	10 UJ
Phenanthrene	NV	NV	1 U	**12 J**	1 U
Phenol	NV	2400	1 U	20 U	1 U
Pyrene	NV	480	1 U	**16 J**	1 U
Total Benzofluoranthenes	NV	0.12[c]	2 U	40 U	2 U
cPAH TEQ	0.1	NV	2 U	**15.11 J**	2 U
Hydrocarbon Identification (Presence/Absence)					
Gasoline	NV	NV	ND	**DETECT**	ND
Diesel	NV	NV	ND	**DETECT**	**DETECT**
Lube Oil	NV	NV	ND	**DETECT**	**DETECT**
TPH (ug/L)					
Diesel	500	NV	--	**40000 J**	**500 J**
Lube Oil	500	NV	--	**110000 J**	**1500 J**

NOTES:

Detections are in **bold** font.

Results that exceed MTCA cleanup levels are shaded. Non-detect results are not evaluated against cleanup levels.

ft bgs = feet below ground surface.

J = the result is an estimated value.

MTCA = Model Toxics Control Act

MTCA A = MTCA Method A groundwater.

MTCA B = MTCA Method B groundwater, lower of available cancer or non-cancer value.

ND = not detected.

NV = no value.

U = the result is non-detect.

ug/L = micrograms per liter.

[a]Value is for hexavalent chromium/trivalent chromium.

[b]Value is for 1,3-dichloropropene

[c]Value is for benzo(b)fluoranthene.

Table
Sub-Slab Soil Gas Analytical Results
Vapor Intrusion Study
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

Location:	Ecology VI Sub-Slab Soil Gas SLV - Method B		SS-1	SS-2	SS-3	SS-4	SS-5	SS-5A
Collection Date:	CUL	Risk Driver	7/26/2017	7/26/2017	7/26/2017	7/26/2017	7/26/2017	9/7/2017
VOCs (ug/m3)								
1,1,1,2-Tetrachloroethane	11.3	Cancer	4.9 U	5.2 UJ	5 U	4.9 UJ	12 UJ	5 U
1,1,1-Trichloroethane	76200	Noncancer	0.78 U	**2.5 J**	0.8 U	0.78 UJ	2.0 UJ	0.79 U
1,1,2,2-Tetrachloroethane	1.44	Cancer	0.98 U	1.0 UJ	1.0 U	0.99 UJ	2.5 UJ	1 U
1,1,2-Trichloroethane	3.05	Noncancer	0.78 U	0.83 UJ	0.8 U	0.78 UJ	2.0 UJ	0.79 U
1,1-Dichloroethane	52.1	Cancer	0.58 U	0.62 UJ	0.59 U	0.58 UJ	1.4 UJ	0.59 U
1,1-Dichloroethene	3050	Noncancer	0.57 U	0.6 UJ	0.58 U	0.57 UJ	1.4 UJ	0.57 U
1,2,4-Trichlorobenzene	30.5	Noncancer	5.3 U	5.6 UJ	5.4 U	5.3 UJ	13 UJ	5.4 U
1,2,4-Trimethylbenzene	107	Noncancer	**1.0**	**1.5 J**	**1.9**	**0.72 J**	**140 J**	**18**
1,2-Dibromoethane (EDB)	0.139	Cancer	1.1 U	1.2 UJ	1.1 U	1.1 UJ	2.8 UJ	1.1 U
1,2-Dichlorobenzene	3050	Noncancer	0.86 U	0.91 UJ	0.88 U	0.86 UJ	2.2 UJ	0.87 U
1,2-Dichloroethane	3.21	Cancer	0.58 U	0.62 UJ	0.59 U	0.58 UJ	1.4 UJ	0.59 U
1,2-Dichloropropane	8.33	Cancer	0.66 U	0.7 UJ	0.67 U	0.66 UJ	1.7 UJ	0.67 U
1,3-Butadiene	2.78	Cancer	0.32 U	0.34 UJ	0.32 U	0.32 UJ	0.8 UJ	0.32 U
2-Butanone (Methyl Ethyl Ketone)	76200	Noncancer	**7.5**	**8.6 J**	**5.3**	**5.6 J**	**7.9 J**	**2.7**
4-Methyl-2-pentanone	45700	Noncancer	**0.71**	**0.95 J**	**0.70**	0.59 UJ	1.5 UJ	0.59 U
Acetonitrile	914	Noncancer	1.2 U	1.3 UJ	1.2 U	1.2 UJ	3 UJ	--
Acrylonitrile	1.23	Cancer	1.6 U	1.6 UJ	1.6 U	1.6 UJ	3.9 UJ	--
Benzene	10.7	Cancer	0.46 U	**0.90 J**	0.47 U	0.46 UJ	1.2 UJ	**1.7**
Benzyl Chloride (alpha-Chlorotoluene)	1.7	Cancer	0.74 U	0.79 UJ	0.76 U	0.74 UJ	1.9 UJ	0.75 U
Bromodichloromethane	2.25	Cancer	0.96 U	1 UJ	0.98 U	0.96 UJ	2.4 UJ	0.97 U
Bromoform	75.8	Cancer	1.5 U	1.6 UJ	1.5 U	1.5 UJ	3.7 UJ	1.5 U
Bromomethane	76.2	Noncancer	2.8 U	3 UJ	2.8 U	2.8 UJ	7 UJ	2.8 U
Carbon Disulfide	10700	Noncancer	2.2 U	2.4 UJ	2.3 U	2.2 UJ	5.6 UJ	2.2 U
Carbon Tetrachloride	13.9	Cancer	0.90 U	0.96 UJ	0.92 U	0.91 UJ	2.3 UJ	0.91 UJ
Chlorobenzene	762	Noncancer	0.66 U	0.7 UJ	0.67 U	0.66 UJ	1.6 UJ	0.67 U
Chloroethane	152000	Noncancer	1.9 U	2 UJ	1.9 U	1.9 UJ	4.7 UJ	1.9 U
Chloroform	3.62	Cancer	0.70 U	0.74 UJ	0.71 U	0.7 UJ	1.8 UJ	0.71 U
Chloromethane	1370	Noncancer	1.5 U	1.6 UJ	1.5 U	1.5 UJ	3.7 UJ	1.5 U
Dibromochloromethane	3.09	Cancer	1.2 U	1.3 UJ	1.2 U	1.2 UJ	3.1 UJ	1.2 U
Ethyl Benzene	15200	Noncancer	**0.65**	**0.83 J**	**1.2**	0.62 UJ	**2.0 J**	**9.2**
Trichlorofluoromethane (Freon 11)	10700	Noncancer	**1.2**	**1.2 J**	0.82 U	**1.2 J**	2.0 UJ	**1.2**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	457000	Noncancer	1.1 U	1.2 UJ	1.1 U	1.1 UJ	2.8 UJ	1.1 U
Dichlorodifluoromethane (Freon 12)	1520	Noncancer	**2.1**	**2.1 J**	**2.2**	**2.0 J**	**1.9 J**	**3.1**
Hexachlorobutadiene	3.79	Cancer	7.6 U	8.1 UJ	7.8 U	7.7 UJ	19 UJ	7.7 U
Hexachloroethane	7.58	Cancer	6.9 U	7.4 UJ	7.1 U	7.0 UJ	17 UJ	--
Hexane	10700	Noncancer	0.50 U	**4.5 J**	**0.8**	**0.52 J**	1.3 UJ	**1.9**
Isopropylbenzene	6100	Noncancer	0.70 U	0.75 UJ	0.72 U	0.71 UJ	**2.0 J**	0.71 U
m,p-Xylene	1520	Noncancer	**2.5**	**3.1 J**	**4.8**	**2.0 J**	**6.3 J**	**41**
Methyl tert-butyl ether	321	Cancer	0.52 U	0.55 UJ	0.53 U	0.52 UJ	1.3 UJ	0.52 U
Methylene Chloride	8330	Cancer	0.99 U	1.0 UJ	1.0 U	1.0 UJ	2.5 UJ	1 U
Naphthalene	2.45	Cancer	3.7 U	4 UJ	3.8 U	3.8 UJ	9.4 UJ	3.8 U
o-Xylene	1520	Noncancer	**0.94**	**1.2 J**	**1.8**	**0.72 J**	**4.9 J**	**15**
Styrene	15200	Noncancer	0.61 U	0.65 UJ	0.62 U	0.61 UJ	1.5 UJ	**1.6**
Tetrachloroethene	321	Cancer	**2.0**	**36 J**	**1.5**	**1.3 J**	**5.4 J**	**7.8**
Toluene	76200	Noncancer	**2.6**	**9.1 J**	**4.5**	**2.2 J**	**4.2 J**	**31**
Trichloroethene	12.3	Cancer	0.77 U	0.82 UJ	0.78 U	0.77 UJ	1.9 UJ	0.78 U
Vinyl Acetate	3050	Noncancer	2.5 U	2.7 UJ	2.6 U	2.5 UJ	6.3 UJ	2.6 U

Table
Sub-Slab Soil Gas Analytical Results
Vapor Intrusion Study
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

Location:	Ecology VI Sub-Slab Soil Gas SLV - Method B		SS-1	SS-2	SS-3	SS-4	SS-5	SS-5A
Collection Date:	CUL	Risk Driver	7/26/2017	7/26/2017	7/26/2017	7/26/2017	7/26/2017	9/7/2017
Vinyl Chloride	9.33	Cancer	0.36 U	0.39 UJ	0.37 U	0.37 UJ	0.92 UJ	0.37 U
TPH (ug/m3)								
Diesel Range Organics	NV	NV	2000 U	2000 U	2000 U	2000 U	2000 U	--
VPH (ug/m3)								
C5-C6 Aliphatic Hydrocarbons	NV	NV	46 U	**68 J**	47 U	47 UJ	47 UJ	--
>C6-C8 Aliphatic Hydrocarbons	NV	NV	59 U	**250 J**	60 U	59 UJ	59 UJ	--
>C8-C10 Aliphatic Hydrocarbons	NV	NV	83 U	88 UJ	85 U	84 UJ	84 UJ	--
>C10-C12 Aliphatic Hydrocarbons	NV	NV	100 U	100 UJ	100 U	100 UJ	100 UJ	--
>C8-C10 Aromatic Hydrocarbons	NV	NV	70 U	75 UJ	72 U	71 UJ	**320 J**	--
>C10-C12 Aromatic Hydrocarbons	NV	NV	78 U	83 UJ	80 U	79 UJ	79 UJ	--
VPH - Calculated (ug/m3)								
C5-C8 Aliphatic Hydrocarbons	90000	Noncancer	59 U	**318 J**	60 U	59 UJ	59 UJ	--
>C8-C12 Aliphatic Hydrocarbons	4700	Noncancer	100 U	100 UJ	100 U	100 UJ	100 UJ	--
>C8-C12 Aromatic Hydrocarbons	6000	Noncancer	78 U	83 UJ	80 U	79 UJ	**359.5 J**	--
Helium (%)								
Helium	NV	NV	0.072 U	**0.24**	0.073 U	**0.087**	**0.12**	0.072 U

NOTES:

Detected results are in bold font.

Results that exceed Ecology VI Method B screening levels are shaded. Non-detect results are not evaluated against Method B levels.

Calculated VPH is the sum of aliphatic or aromatic hydrocarbons within the reported carbon range. The highest non-detect value is shown when both constituents are non-detect. When detect and non-detect values are summed, one-half the non-detect value is used.

-- = not analyzed.
> = greater than.
C = carbon range.
CUL = cleanup level.
J = the result is an estimated value.
NV = no value.
SLV = screening level value.
TPH = total petroleum hydrocarbons.
U = the result is non-detect.
ug/m3 = micrograms per cubic meter.
UJ = the result is non-detect and an estimated value.
VI = vapor intrusion.
VOCs = volatile organic compounds.
VPH = volatile petroleum hydrocarbons.

Table 5-1 Summary of Screening Value Exceedances in Soil and Groundwater by RAU

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
RAU1				
Metals in Soil (mg/kg)				
Arsenic	0.6 - 2.6	3/18	3/18	0.15 [c]
			3/18	0.67 [d]
Barium	26.5 - 812	17/18	13/18	83 [c]
			0/18	16,000 [e]
Cadmium	0.44 - 9.3	17/18	2/18	2 [f]
			0/18	80 [e]
Copper	22.2 - 800	18/18	18/18	14 [c]
			0/18	3,200 [e]
Lead	2.5 - 1,110	18/18	1/18	150 [c]
			1/18	250 [e]
Manganese	157 - 13,100	18/18	1/18	11,000 [e]
Nickel	6.2 -30.8	18/18	17/18	6.5 [c]
			0/18	1,600 [e]
Silver	0.56 - 6.7	13/18	13/18	0.69 [c]
			0/18	400 [e]
Thallium	1.8 - 5.1	16/18	16/18	0.011 [c]
			16/18	0.8 [e]
Vanadium	26.8 - 112	18/18	6/18	80 [c]
			0/18	400 [e]
Zinc	31.3 - 777	18/18	1/18	300 [c]
			0/18	24,000 [e]
Semivolatile Organic Compounds in Soil (µg/kg)				
Benzo(a)anthracene	0.69 - 270	12/18	8/18	43 [c]
Benzo(a)pyrene	5.5 - 170	12/18	3/18	100 [f]
			0/18	190 [d]
Benzo(b)fluoranthene	0.94 - 360	11/18	5/18	150 [c]
cPAH TEQ	2.393 - 257	14/18	5/18	100 [f]
			2/18	190 [d]
Pentachlorophenol	310	1/18	1/18	0.88 [c]
			0/18	2,500 [d]
Petroleum Hydrocarbons in Soil (mg/kg)				
Diesel-Range TPH	3,300	1/18	1/18	2,000 [f]
Heavy Oil Range TPH	150 - 90,000	12/18	7/18	2,000 [f]

Table 5-1 Summary of Screening Value Exceedances in Soil and Groundwater by RAU

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
Metals in Groundwater (µg/L)				
Arsenic	1.7 - 4.8	2/9	2/9	0.098 [d]
			0/9	5 [f]
Copper	3.1 - 82.3	2/9	2/9	3.1 [g]
			0/9	640 [e]
Lead	3.1 - 53	3/9	3/9	8.1 [g]
			2/9	15 [f]
Manganese	563 - 18,400	9/9	9/9	100 [h]
			6/9	2,200 [e]
Zinc	23.7 - 232	1/9	1/9	81 [g]
			0/9	4,800 [e]
Semivolatile Organic Compounds Groundwater (µg/L)				
cPAH TEQ	0.0475 - 0.308	2/9	2/9	0.000016 [f]
			1/9	0.023 [d]
Pentachlorophenol	0.061 - 19	4/9	4/9	0.002 [i]
			4/9	0.22 [d]
Petroleum Hydrocarbons in Groundwater (mg/L)				
Diesel-Range TPH	2.1	1/9	1/9	0.5 [f]
Heavy Oil Range TPH	0.74 - 34	4/9	4/9	0.5 [f]
RAU2				
Metals in Soil (mg/kg)				
Arsenic	2.1 - 7.7	3/12	3/12	0.15 [c]
			3/12	0.67 [d]
Barium	41.7 - 155	12/12	7/12	83 [c]
			0/12	16,000 [e]
Cadmium	0.62 - 6.6	12/12	2/15	2 [f]
			0/12	80 [e]
Copper	31.2 - 390	12/12	12/12	14 [c]
			0/12	3,200 [e]
Nickel	17.6 - 62.9	12/12	12/12	6.5 [c]
			0/12	1,600 [e]
Silver	0.93 - 4.9	9/12	9/12	0.69 [c]
			0/12	400 [e]
Thallium	3.0 - 5.6	10/12	10/12	0.011 [c]
			10/12	0.8 [e]

Table 5-1 Summary of Screening Value Exceedances in Soil and Groundwater by RAU

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
Vanadium	36.8 - 117	12/12	7/12	80 [c]
			0/12	400 [e]
Zinc	41.2 - 889	12/12	2/12	300 [c]
			0/12	24,000 [e]
Semivolatile Organic Compounds in Soil (µg/kg)				
Benzo(a)anthracene	1.3 - 2,600	5/22	1/22	43 [c]
Benzo(a)pyrene	1.8 - 1,800	9/22	1/22	100 [f]
			1/22	190 [d]
Benzo(b)fluoranthene	0.5 - 2,500	13/22	3/22	150 [c]
Dibenzo(a,h)anthracene	0.8 - 230	2/22	1/22	21 [c]
Indeno(1,2,3-cd)pyrene	0.68 - 580	5/22	1/22	420 [c]
cPAH TEQ	2.51 - 2526	16/22	3/22	100 [f]
			2/22	190 [d]
Pentachlorophenol	3.5 - 1,200	6/22	4/22	0.88 [c]
			0/22	2,500 [d]
Petroleum Hydrocarbons in Soil (mg/kg)				
Diesel-Range TPH	190	1/22	0/22	2,000 [f]
Heavy Oil Range TPH	340 - 170,000	8/22	4/22	2,000 [f]
Metals in Groundwater (µg/L)				
Arsenic	1.6 - 4.4	2/5	2/5	0.098 [d]
			0/5	5 [f]
Copper	6.3 - 56.5	5/5	1/5	3.1 [g]
			0/5	640 [e]
Lead	5.1 - 23.8	5/5	2/5	8.1 [g]
			1/5	15 [f]
Manganese	1,730 - 4,050	5/5	5/5	100 [h]
			2/5	2,200 [e]
Vanadium	10.3 - 96.8	1/5	1/5	80 [e]
Semivolatile Organic Compounds in Groundwater (µg/L)				
2,4-Dichlorophenol	21	1/10	1/10	10 [h]
			1/10	3 [j]
cPAH TEQ	0.074 - 0.76	2/10	2/10	0.000016 [f]
			1/10	0.023 [d]
Pentachlorophenol	0.046 - 1,600	4/10	1/10	0.002 [i]
			1/10	0.22 [d]
Petroleum Hydrocarbons in Groundwater (mg/L)				
Heavy Oil Range TPH	79	1/10	1/10	0.5 [f]

Table 5-1 Summary of Screening Value Exceedances in Soil and Groundwater by RAU

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
RAU3				
Metals in Soil (mg/kg)				
Arsenic	1	1/6	1/6	0.15 [c]
			1/6	0.67 [d]
Barium	43.7 - 106	6/6	3/6	83 [c]
			0/6	16,000 [e]
Copper	52.1 - 89.9	6/6	6/6	14 [c]
			0/40	3,200 [e]
Nickel	26.1 - 40.7	6/6	6/6	6.5 [c]
			0/6	1,600 [e]
Silver	0.82 - 1.3	5/6	4/6	0.69 [c]
			0/6	400 [e]
Thallium	3.1 - 5.9	6/6	6/6	0.011 [c]
			6/6	0.8 [e]
Vanadium	58.6 - 121	6/6	3/6	80 [c]
			0/6	400 [e]
Semivolatile Organic Compounds in Soil (µg/kg)				
Benzo(a)anthracene	33 - 140	2/6	2/6	43 [c]
Benzo(b)fluoranthene	3.4 - 260	2/6	2/6	150 [c]
Dibenzo(a,h)anthracene	21 - 25	2/6	1/6	21 [c]
cPAH TEQ	1.96 - 153.9	4/6	2/6	100 [f]
			0/6	190 [d]
Metals in Groundwater (µg/L)				
Arsenic	3.5	1/3	1/3	0.098 [d]
			0/3	5 [f]
Manganese	2,110 - 10,600	3/3	3/3	100 [h]
			2/3	2,200 [e]
RAU4				
Metals in Soil (mg/kg)				
Barium	108 - 134	4/4	4/4	83 [c]
			0/4	16,000 [e]
Copper	42.9 - 56.4	4/4	4/4	14 [c]
			0/4	3,200 [e]
Nickel	22.3 - 28.4	4/4	4/4	6.5 [c]
			0/4	1,600 [e]
Silver	0.91 - 1.1	3/4	3/4	0.69 [c]
			0/4	400 [e]

Table 5-1 Summary of Screening Value Exceedances in Soil and Groundwater by RAU

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
Thallium	3.7 - 6.2	4/4	4/4	0.011 [c]
			4/4	0.8 [e]
Vanadium	80.1 - 99.9	4/4	4/4	80 [c]
			0/4	400 [e]
Metals in Groundwater (µg/L)				
Arsenic	1.4	1/1	1/1	0.098 [d]
			0/1	5 [f]
Manganese	6,260	1/1	1/1	100 [h]
			1/1	2,200 [e]

Notes:

a Includes "J" and "JQ" qualified values. JQ values not included when tabulating frequency of regulatory exceedances.

b If more than one cleanup was used in analytical summary tables, both are presented in this column

c Value is MTCA Method B soil level for protection of groundwater

d Value is MTCA Method B level protective of cancer risk from exposure

e Value is MTCA Method B level protective of non-cancer risk from exposure

f Value is MTCA A level for soil and/or groundwater

g Value is protective of chronic exposure risk to aquatic life in marine surface water

h Value is protective of exposure risk to human health in marine surface water (CWA)

i Value is protective of exposure risk to human health in marine surface water (40 CFR)

j Value is protective of vapor intrusion from groundwater contaminants

Key:

CFR = Code of Federal Regulations

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbons Toxicity Equivalent Quotient

CWA = Clean Water Act

µg/kg = Micrograms per kilogram

µg/L = Micrograms per liter

J = The associated numerical value is an estimated quantity because the reported concentrations were less thai sample quantitation limits or because quality control criteria limits were not met.

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

mg/kg = Milligrams per kilogram

mg/L = Milligrams per liter

MTCA = Model Toxics Control Act

RAU = Remedial Action Unit

TPH = Total Petroleum Hydrocarbons

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Table 5-2 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 1

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs) Sampling Zone	MTCA Cleanup Level* A / GW	MTCA Cleanup Level* DC	Back-ground metals*	17394206 MS01SB04 JJ454 1-4	17394207 MS01SB12 JJ455 8-12	17394209 MS02SB04 JJ456 2-4	17394210 MS02SB08 JJ457 6-8	17394212 MS03SB04 JJ458 2-4	17394213 MS03SB07 JJ459 5-7	17394215 MS04SB04 JJ460 2-4	17394216 MS04SB06 JJ461 4-6	17394256 MS05SB04 JJ4B4 3.2-4	17394257 MS05SB06 JJ4B5 4-6	17394268 MS06SB04 JJ4C3 2-4	17394269 MS06SB08 JJ4C4 6-8
				Maintenance Shop											
Target Analyte List Metals (mg/kg)															
Aluminum	--	--	--	18300	21700	25200	26000	8050	23100	17000	22900	8670	6050	18900	22500
Arsenic	0.15 [a]	0.67 [c]	8.47	0.87 U	1.2 U	0.6 JQ	1 U	0.81 U	1 U	0.8 UJ	0.85 UJ	0.81 UJ	1.5 UJ	0.82 U	0.88 U
Barium	83 [a]	16000 [d]	--	106	400	126	142	66.9	64.8	73.1	106	94.6	26.5 JQ	108	133
Beryllium	3.2 [a]	160 [d]	0.8	0.67	1.2	0.72	0.79	0.48	0.88	0.7	0.89	0.48	0.24 JQ	0.67	0.75
Cadmium	2 [b]	80 [d]	0.1	1.7	9.3	0.91	0.95	1.7	1.6	1.1	1.2	1.1	0.44 JQ	1	0.92
Calcium	--	--	--	5830 J	110000 J	1220 J	1310 J	12200 J	1500 J	2850	3190	5070	4050	1560 J	1460 J
Chromium	2000 [b]	120,000 [d]	78.5	23.4 J	5.9 J	21.5 J	21.1 J	8.7 J	30.6 J	21.4	34	12.9	6.5	20.8 J	18.4 J
Cobalt	--	--	--	16.6	14.4	13.6	11.9	12.7	18	17.3	20.5	11.9	4 JQ	13.2	12.9
Copper	14 [a]	3200 [d]	52.9	78.7	800	31.7	31	38.8	183	47.2	49.2	181	22.2	33.5	26.1
Iron	--	--	--	33900 J	163000 J	21200 J	22200 J	31400 J	30300 J	27000	30500	27200	8460	21000 J	20400 J
Lead	150 [a]	--	10.9	29.7	10.1	3.9	4.5	13.1	44.4	5.6	4.2	61.4	7.8	2.5	4.1
Magnesium	--	--	--	7300 J	23900 J	3150 J	3130 J	8250 J	4370 J	4710	4660	6300	1460	3240 J	2860 J
Manganese	--	11000 [d]	691.8	457	13100	507	311	289	234	314	175	283	157	355	308
Nickel	6.5 [a]	1600 [d]	54.2	28.5	21	19.4	18.6	14.6	30.8	29.7	30.3	20	6.2	19.9	16.9
Potassium	--	--	--	851	11300	232 JQ	333 JQ	705	354 JQ	407	420 JQ	573	116 JQ	213 JQ	292 JQ
Silver	0.69 [a]	400 [d]	--	1.3 J	6.7 J	0.85 J	0.87 JQ	1.1 J	1.1 J	0.8 UJ	0.86 J	0.89 J	1.5 UJ	0.82 J	0.84 JQ
Sodium	--	--	--	468	3650	249 JQ	220 JQ	366 JQ	216 JQ	367 JQ	305 JQ	418	145 JQ	228 JQ	250 JQ
Thallium	0.011 [a]	0.8 [d]	--	3.2	3 U	3.4	3.5	2.1	4.4	4	5.1	3	1.8 JQ	2.8	2.9
Vanadium	80 [a]	400 [d]	--	82	42.2	66.1	67.6	57.1	112	83	93.6	53.8	26.8	70.7	60.2
Zinc	300 [a]	24000 [d]	85.6	91.4	117	38.7	41.9	53.3	101	55	50.4	63	31.3	35.4	40
Semivolatile Organic Compounds (µg/kg)															
2-Methylnaphthalene	--	320000 [d]	--	28 JQ	3.9 JQ	0.94 JQ	0.59 JQ	29 JQ	22	35 U	20 U	24 JQ	50 JQ	3.7 U	2.1 JQ
Acenaphthene	5000 [a]	4800000 [d]	--	25 JQ	4.9 JQ	4 U	7.6	140	100	35 U	20 U	39 U	960	0.83 JQ	2.9 JQ
Acenaphthylene	--	--	--	26 JQ	3.5 JQ	4 U	4.6 U	7.1 JQ	20 U	35 U	20 U	4.9 JQ	65 U	3.7 U	4.6 U
Anthracene	110000 [a]	24000000 [d]	--	52	2.3 JQ	4 U	4.6 U	89	50 J	35 U	20 U	17 JQ	310	3.7 U	4.6 U
Benzo(a)anthracene	43 [a]	--	--	130 J	6	4 U	4.6 U	140	58 J	63	20 U	58	270 J	3.7 U	4.6 U
Benzo(a)pyrene	100 [b]	190 [c]	--	130 J	5.5 JQ	4 U	4.6 U	86	23 J	30 JQ	8.3 JQ	75	130 J	3.7 U	4.6 U
Benzo(b)fluoranthene	150 [a]	--	--	230 J	9.9	4 U	4.6 U	190	130 J	35 U	19 JQ	360	340 J	3.7 U	4.6 U
Benzo(g,h,i)perylene	--	--	--	46 J	6	4 U	4.6 U	13 JQ	20 UJ	16 JQ	5.1 JQ	39 UJ	41 JQ	3.7 U	4.6 U
Benzo(k)fluoranthene	1500 [a]	--	--	79 J	2.1 JQ	4 U	4.6 U	170	20 UJ	35 U	20 U	77	560 J	3.7 U	4.6 U
Chrysene	4800 [a]	--	--	240 J	9.2	4 U	4.6 U	300	78 J	31 JQ	29	240	350 J	3.7 U	4.6 U
Dibenzo(a,h)anthracene	21 [a]	--	--	14 JQ	5.8 U	4 U	4.6 U	38 U	20 UJ	35 U	20 U	39 UJ	65 UJ	3.7 U	4.6 U

Table 5-2 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 1

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394206 MS01SB04 JJ454 1-4	17394207 MS01SB12 JJ455 8-12	17394209 MS02SB04 JJ456 2-4	17394210 MS02SB08 JJ457 6-8	17394212 MS03SB04 JJ458 2-4	17394213 MS03SB07 JJ459 5-7	17394215 MS04SB04 JJ460 2-4	17394216 MS04SB06 JJ461 4-6	17394256 MS05SB04 JJ4B4 3.2-4	17394257 MS05SB06 JJ4B5 4-6	17394268 MS06SB04 JJ4C3 2-4	17394269 MS06SB08 JJ4C4 6-8
Sampling Zone	A / GW	DC		Maintenance Shop											
Fluoranthene	32000 [a]	3200000 [d]	--	**230 J**	**15**	4 U	4.6 U	**500**	**370 J**	35 U	20 U	**74**	**1900 J**	3.7 U	4.6 U
Fluorene	5100 [a]	3200000 [d]	--	33 JQ	5.8 U	4 U	4.6 U	**130**	**170**	35 U	20 U	39 U	**820**	1.2 JQ	4.3 JQ
Indeno(1,2,3-cd)pyrene	420 [a]	--	--	**42 J**	4.2 JQ	4 U	4.6 U	6.6 JQ	20 UJ	35 U	20 U	39 UJ	65 UJ	3.7 U	4.6 U
Naphthalene	240 [a]	1600000 [d]	--	38 U	**12**	4 U	4.6 U	76 U	20 U	35 U	20 U	39 U	65 U	3.7 U	4.6 U
Pentachlorophenol	0.88 [a]	2500 [c]	--	77 U	12 U	8 U	9.3 U	76 U	41 U	72 U	40 U	78 UJ	130 UJ	7.6 U	9.3 U
Phenanthrene	--	--	--	**170**	**13**	4 U	4.6 U	**260**	**420 J**	35 U	20 U	**100**	**1000**	0.63 JQ	**7.5**
Pyrene	33000 [a]	2400000 [d]	--	**270 J**	**19**	4 U	4.6 U	**420**	**220 J**	22 JQ	10 JQ	**130**	**1400 J**	3.7 U	4.6 U
cPAH TEQ	100 [b]	190 [c]	--	**181.9 J**	**8.102 J**	0 U	0 U	**141.56 J**	**45.58 J**	**43.61 J**	**14.49 J**	**130.8**	***257* J**	0 U	0 U
Volatile Organic Compounds (µg/kg)															
2-Butanone	--	48000000 [d]	--	6.7 JQ	7.6 JQ	9.7 JQ	5.5 JQ	**21**	**68**	12 U	11 U	**13**	44 JQ	6.8 JQ	12 U
Acetone	2100 [a]	72000000 [d]	--	**18**	12 JQ	**54**	**30**	**58**	**210**	5.7 JQ	11 U	**36**	**100**	**42**	**13**
Ethylbenzene	340 [a]	8000000 [d]	--	4.3 U	8.1 U	5.5 U	8.7 U	6.6 U	29 U	5.9 U	5.3 U	6.6 U	23 U	5.2 U	5.8 U
Methylcyclohexane	--	--	--	4.3 U	8.1 U	5.5 U	8.7 U	6.6 U	29 U	5.9 U	5.3 U	6.6 U	23 U	5.2 U	5.8 U
m, p-Xylene	830 [e]	16000000 [f]	--	4.3 U	8.1 U	5.5 U	8.7 U	6.6 U	29 U	5.9 U	5.3 U	6.6 U	23 U	5.2 U	5.8 U
o-Xylene	840 [a]	16000000 [d]	--	4.3 U	8.1 U	5.5 U	8.7 U	6.6 U	29 U	5.9 U	5.3 U	6.6 U	23 U	5.2 U	5.8 U
Total Petroleum Hydrocarbons (mg/kg)															
Diesel Range Organics	2000 [b]	--	--	46 U	59 U	46 U	47 U	46 U	46 U	42 U	46 U	45 U	100 U	43 U	46 U
Heavy Oil Range Organics	2000 [b]	--	--	**1100**	150 U	110 U	120 U	**6700**	**20000**	**2200**	**160**	**6300**	**90000**	110 U	120 U

Table 5-2 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 1

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs) Sampling Zone	MTCA Cleanup Level* A / GW	MTCA Cleanup Level* DC	Back-ground metals*	17394200 FC01SB04 JJ450 2-4	17394201 FC01SB07 JJ451 5-7	17394203 FC02SB04 JJ452 2-4	17394204 FC02SB06 JJ453 4-6	17394271 FC03SB04 JJ4C5 2-4	17394272 FC03SB08 JJ4C6 6-8
				Fuel and Chemical Storage Building					
Target Analyte List Metals (mg/kg)									
Aluminum	--	--	--	13400	19200	17800	22500	18900	25100
Arsenic	0.15 [a]	0.67 [c]	8.47	2.6	1.9	0.86 U	0.69 JQ	0.86 U	1.5
Barium	83 [a]	16000 [d]	--	54	127	155	112	87.2	812
Beryllium	3.2 [a]	160 [d]	0.8	0.56	0.7	0.66	0.72	0.71	0.82
Cadmium	2 [b]	80 [d]	0.1	1.8	0.53	1.5	1	1.4	2.5
Calcium	--	--	--	6250 J	1820 J	10700 J	1490 J	3790 J	1450 J
Chromium	2000 [b]	120,000 [d]	78.5	14.6 J	21.9 J	22.6 J	21 J	25.8 J	42.7 J
Cobalt	--	--	--	23.6	8.8	16.1	12.4	17.9	33.8
Copper	14 [a]	3200 [d]	52.9	276	33.1	56.1	32.5	56.9	51.8
Iron	--	--	--	32800 J	12700 J	28200 J	22200 J	28900 J	27500 J
Lead	150 [a]	--	10.9	6.7	19.7	5.1	4.4	3.1	1110
Magnesium	--	--	--	7840 J	2160 J	6560 J	2990 J	5550 J	4270 J
Manganese	--	11000 [d]	691.8	385	165	992	291	463	240
Nickel	6.5 [a]	1600 [d]	54.2	30.3	17.5	23.9	19.3	29.2	29.1
Potassium	--	--	--	494	570	1100	233 JQ	307 JQ	243 JQ
Silver	0.69 [a]	400 [d]	--	1.2 J	0.56 JQ	1.1 J	0.84 J	1.1 J	1 J
Sodium	--	--	--	1080	221 JQ	760	298 JQ	300 JQ	198 JQ
Thallium	0.011 [a]	0.8 [d]	--	2.6	2.8	2.7	3.4	3.3	4
Vanadium	80 [a]	400 [d]	--	72.8	54.4	75.7	69.6	86.1	94.5
Zinc	300 [a]	24000 [d]	85.6	51.1	98.5	93.2	37.8	47.4	777
Semivolatile Organic Compounds (µg/kg)									
2-Methylnaphthalene	--	320000 [d]	--	62	25	540	2000	1.2 JQ	4.8 JQ
Acenaphthene	5000 [a]	4800000 [d]	--	17 JQ	4.9 JQ	50	290 J	0.34 JQ	13
Acenaphthylene	--	--	--	5.4 JQ	17 JQ	18 JQ	89 J	1.7 JQ	28
Anthracene	110000 [a]	24000000 [d]	--	16 JQ	14 JQ	41	160 J	3.6 U	32
Benzo(a)anthracene	43 [a]	--	--	32 JQ	30	62	20 UJ	0.69 JQ	200
Benzo(a)pyrene	100 [b]	190 [c]	--	24 JQ	28	50	20 UJ	3.6 U	170
Benzo(b)fluoranthene	150 [a]	--	--	35 U	44	39 U	33 J	0.94 JQ	300
Benzo(g,h,i)perylene	--	--	--	20 JQ	15 JQ	17 JQ	20 UJ	0.62 JQ	22 J
Benzo(k)fluoranthene	1500 [a]	--	--	35 U	18 JQ	39 U	20 UJ	3.6 U	5 U
Chrysene	4800 [a]	--	--	110	41	250	10 JQ	1.1 JQ	220
Dibenzo(a,h)anthracene	21 [a]	--	--	35 U	3.4 JQ	39 U	20 UJ	3.6 U	6.2 J

Table 5-2 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 1

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs) Sampling Zone	MTCA Cleanup Level*		Back-ground metals*	17394200 FC01SB04 JJ450 2-4	17394201 FC01SB07 JJ451 5-7	17394203 FC02SB04 JJ452 2-4	17394204 FC02SB06 JJ453 4-6	17394271 FC03SB04 JJ4C5 2-4	17394272 FC03SB08 JJ4C6 6-8
	A / GW	DC		Fuel and Chemical Storage Building					
Fluoranthene	32000 [a]	3200000 [d]	--	**43**	**82**	26 JQ	**29 J**	**3.8**	**390**
Fluorene	5100 [a]	3200000 [d]	--	30 JQ	22 U	**69**	**390**	3.6 U	**23**
Indeno(1,2,3-cd)pyrene	420 [a]	--	--	5.2 JQ	12 JQ	5.1 JQ	20 UJ	0.59 JQ	**24 J**
Naphthalene	240 [a]	1600000 [d]	--	35 U	**51**	73 U	**260**	**4.2**	**13**
Pentachlorophenol	0.88 [a]	2500 [c]	--	72 U	**310**	79 U	40 UJ	7.3 U	10 U
Phenanthrene	--	--	--	**110**	**70**	**260**	**810 J**	**4.5**	**110**
Pyrene	33000 [a]	2400000 [d]	--	**100**	**72**	**73**	**66 J**	**4.5**	**370**
cPAH TEQ	100 [b]	190 [c]	--	**34.07 J**	**39.15 J**	**65.06 J**	**17.4 J**	**2.393 J**	***225.47* J**
Volatile Organic Compounds (µg/kg)									
2-Butanone	--	48000000 [d]	--	5.4 JQ	2.9 JQ	14 JQ	680 U	3.5 JQ	22 U
Acetone	2100 [a]	72000000 [d]	--	**15**	**16**	**41**	680 U	**13**	**23**
Ethylbenzene	340 [a]	8000000 [d]	--	5.2 U	5.9 U	8.2 U	**370**	4.8 U	11 U
Methylcyclohexane	--	--	--	5.2 U	5.9 U	8.2 U	**1700**	4.8 U	11 U
m, p-Xylene	830 [e]	16000000 [f]	--	5.2 U	5.9 U	8.2 U	**790**	4.8 U	11 U
o-Xylene	840 [a]	16000000 [d]	--	5.2 U	5.9 U	8.2 U	**720**	4.8 U	11 U
Total Petroleum Hydrocarbons (mg/kg)									
Diesel Range Organics	2000 [b]	--	--	41 U	50 U	44 U	**3300**	44 U	55 U
Heavy Oil Range Organics	2000 [b]	--	--	**2000**	**150**	**1500**	**6400**	110 U	**1400**

Note: Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above MTCA A or MTCA B protection of GW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value is also above MTCA B direct contact value

* = Value in the left column is the most restrictive criteria available from MTCA A or the MTCA B default value for the protection of GW in saturated soil. Value in right column is the most restrictive MTCA B cancer/non-cancer (direct contact) value. Background metals concentrations are 90th percentile values from Group W.

a = MTCA Method B protection of GW

b = MTCA Method A Unrestricted Land Use (Chromium III used for Chromium)

c = MTCA B cancer direct contact value

d = MTCA Method B non-cancer direct contact value (Chromium III used for Chromium)

e = Value is MTCA A for protection of groundwater for xylene mixtures

f = Value is MTCA B non-cancer value for xylene mixtures

Key:

-- = Not available for given constituent

µg/kg = micrograms per kilogram

A/GW - MTCA A or MTCA B protection of GW standard

bgs = below ground surface

CLP = Contract Laboratory Program

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient Value is compared to cleanup levels for benzo(a)pyrene

DC = MTCA B direct Contact

EPA = United States Environmental Protection Agency

GW = Groundwater

ID = Identification.

J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or detection limit. See report for details on cPAH TEQ calculations.

Table 5-3 Groundwater Sample Analytical Results Summary - Remedial Action Unit 1

EPA Sample ID Station Location Description CLP Sample Number	MTCA Cleanup Level*		17394208 MS01GW JJ490	17394211 MS02GW JJ491	17394214 MS03GW JJ492	17394217 MS04GW JJ493	17394258 MS05GW JJ4C7	17394270 MS06GW JJ4D1	17394202 FC01GW JJ488	17394205 FC02GW JJ489	17394273 FC03GW JJ4D2
Sampling Zone	SW	GW	Maintenance Shop						Fuel and Chemical Storage Building		
Target Analyte List Metals (µg/L)											
Aluminum	--	--	**429**	**989**	**2540**	200 U	**1360**	**269**	**17800**	139 JQ	**2180**
Arsenic	0.098 [c]	5 [a]	1 U	1 U	1 U	**1.7**	1 U	1 U	**4.8**	1 U	1 U
Barium	--	3200 [b]	79.2 JQ	84.6 JQ	23.5 JQ	11.2 JQ	34.2 JQ	24.9 JQ	**288**	70.4 JQ	34.5 JQ
Calcium	--	--	**43100**	**11700**	**35100**	**16900**	**39600**	**7850**	**79900**	**38900**	**12600**
Chromium	--	50 [a]	10 U	10 U	10 U	10 U	10 U	10 U	**30.3**	10 U	10 U
Copper	3.1 [g]	640 [b]	7.6 JQ	9.7 JQ	**31.3**	7.5 JQ	11.8 JQ	7.1 JQ	**82.3**	12.2 JQ	17.8 JQ
Iron	--	--	**24400**	**34500**	**50500**	**28000**	**15500**	**34600**	**56200**	**52100**	**9280**
Lead	8.1 [g]	15 [a]	3.1 JQ	10 U	**10.7**	3.7 JQ	9.6 JQ	10 U	***53***	10 U	***18.6***
Magnesium	--	--	**16300**	**10300**	**14800**	**6420**	**12500**	**11000**	**37400**	**31400**	3960 JQ
Manganese	100 [h]	2200 [b]	***4090***	***12100***	**2030**	**563**	**854**	***5100***	***6070***	***18400***	**1120**
Potassium	--	--	**16400**	5000 U	**5080**	1780 JQ	4420 JQ	5000 U	**29700**	5000 U	5000 U
Sodium	--	--	**18300**	**28800**	**23700**	**10300**	**17100**	**29700**	**38100**	**60900**	4600 JQ
Vanadium	--	80 [b]	50 U	50 U	15.5 JQ	50 U	6.9 JQ	50 U	**68.8**	50 U	12.1 JQ
Zinc	81 [g]	4800 [b]	60 U	60 U	23.7 JQ	60 U	28.1 JQ	60 U	**232**	60 U	24.8 JQ
Semivolatile Organic Compounds (µg/L)											
2-Methylnaphthalene	--	32 [b]	0.095 U	0.045 JQ	0.48 U	0.1 U	0.1 UJ	0.1 U	0.04 JQ	**4.7 J**	0.04 JQ
Acenaphthene	30 [i]	960 [b]	**0.33 J**	**0.7**	**0.67 J**	0.013 JQ	**3.1 J**	**0.21**	**0.096**	0.43 JQ	0.019 JQ
Fluoranthene	6 [i]	640 [b]	0.095 U	0.095 U	0.44 JQ	0.1 U	**0.12 J**	0.1 U	0.043 JQ	0.48 U	0.019 JQ
Fluorene	10 [i]	640 [b]	0.095 U	0.095 U	**0.62 J**	0.1 U	**1.1 J**	0.1 U	0.079 JQ	**0.72 J**	0.1 U
Naphthalene	4900 [b]	8.93 [d]	0.022 JQ	**0.15**	0.48 U	0.1 U	**0.21 J**	**0.1**	**0.15**	**1.7 J**	0.034 JQ
Pentachlorophenol	0.002 [i]	0.22 [c]	***19*** **J**	***0.96***	***1.5*** **J**	0.2 U	0.061 JQ	0.2 U	***0.3***	0.95 U	0.2 U
Phenanthrene	--	--	0.04 JQ	0.019 JQ	**0.82 J**	0.1 U	0.1 UJ	0.012 JQ	0.091 JQ	**0.7 J**	0.1 U
Pyrene	8 [i]	480 [b]	0.029 JQ	0.095 U	0.37 JQ	0.1 U	**0.12 J**	0.1 U	0.045 JQ	0.48 U	0.1 U
cPAH TEQ	0.000016 [i]	0.023 [a]	0 U	0 U	***0.30787*** **J**	0 U	0 U	0 U	***0.04745*** **J**	0 U	0 U
Volatile Organic Compounds (µg/L)											
Acetone	--	7200 [b]	5 U	4 JQ	5 U	5 U	5 U	5 U	5 U	**5**	5 U
Cyclohexane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.3**	0.5 U
Ethylbenzene	31 [i]	800 [b]	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**1.1**	0.5 U
Methylcyclohexane	--	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.34 JQ	0.5 U	**1.2**	0.5 U
m, p-Xylene	--	1000 [e]	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**2.9**	0.5 U
o-Xylene	--	440 [f]	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	**2.8**	0.5 U
Total Petroleum Hydrocarbons (mg/L)											
Diesel Range Organics	--	0.5 [a]	0.2 U	0.19 U	0.35 U	0.18 U	0.17 U	0.2 U	0.17 U	***2.1***	0.2 U
Heavy Oil Range Organics	--	0.5 [a]	0.49 U	0.47 U	***34***	0.45 U	***0.74***	0.5 U	0.43 U	***3.2***	***0.78***

Notes:

Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above SW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value above SW and/or GW value

* = Value is the most restrictive criteria available for the given matrix.

a = MTCA Method A Unrestricted Land Use
b = MTCA Method B non-cancer value
c = MTCA Method B cancer value
d = MTCA Method B screening level protective of VI cancer value
e = Value is MTCA A for xylene mixtures
f = MTCA Method B screening level protective of VI non-cancer value
g = Aquatic life-chronic (WAC/CWA)
h = Human health (CWA)
i = Human health (40 CFR)

Key:

-- = Cleanup level not available
µg/L = micrograms per liter
CFR = Code of Federal Regulations
CLP = Contract Laboratory Program
CWA = Clean Water Act
cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient
Value is compared to cleanup levels for benzo(a)pyrene
EPA = United States Environmental Protection Agency
GW = Groundwater
ID = Identification
J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.
MTCA = Model Toxics Control Act
mg/L = milligrams per liter
Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.
SW = Surface Water
U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or reporting limit. See report for details on cPAH TEQ calculations.
WAC = Washington Administrative Code

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Table 5-4 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394227 PB01SB04 JJ462 2-4	17394228 PB01SB08 JJ463 6-8	17394230 PB02SB02 JJ464 0-2	17394231 PB02SB09 JJ465 7-9	17394233 PB03SB02 JJ466 0-2	17394234 PB03SB05 JJ467 4-5	17394236 PB04SB04 JJ468 2-4	17394237 PB04SB08 JJ469 6-8	17394239 PB05SB04 JJ470 2-4	17394240 PB05SB05 JJ471 4-5
Sampling Zone	A / GW	DC		Planer/Grader Building									
Target Analyte List Metals (mg/kg)													
Aluminum	--	--	--	**23900**	**21700**	**17400**	**17700**	**20200**	**23100**	NA	NA	NA	NA
Arsenic	0.15 [a]	0.67 [c]	8.47	0.78 UJ	0.84 UJ	0.81 UJ	***2.1*** **J**	0.78 UJ	1.1 UJ	NA	NA	NA	NA
Barium	83 [a]	16000 [d]	--	**92.8**	**81.6**	**70.7**	**91.3**	**88**	**122**	NA	NA	NA	NA
Beryllium	3.2 [a]	160 [d]	0.8	**0.77**	**0.78**	**0.72**	0.62 JQ	**0.78**	**0.66**	NA	NA	NA	NA
Cadmium	2 [b]	80 [d]	0.1	**1.1**	**1.1**	**1.4**	**0.69**	**1.3**	**0.62**	NA	NA	NA	NA
Calcium	--	--	--	**2910**	**2430**	**4030**	**2360**	**2160**	**2000**	NA	NA	NA	NA
Chromium	2000 [b]	120,000 [d]	78.5	**25**	**27.7**	**28.5**	**22.4**	**28.1**	**19.9**	NA	NA	NA	NA
Cobalt	--	--	--	**18.4**	**18**	**22.9**	**13.7**	**17.2**	**11.7**	NA	NA	NA	NA
Copper	14 [a]	3200 [d]	52.9	**55.8**	**54.8**	**80.2**	**44**	**61.2**	**31.2**	NA	NA	NA	NA
Iron	--	--	49170	**32000**	**32300**	**35300**	**23700**	**33100**	**19300**	NA	NA	NA	NA
Lead	150 [a]	--	10.9	**3.3**	**1.8**	**2.4**	**14**	**8.5**	**9.1**	NA	NA	NA	NA
Magnesium	--	--	--	**5870**	**5820**	**7450**	**3360**	**5470**	**3190**	NA	NA	NA	NA
Manganese	--	11000 [d]	691.8	**516**	**390**	**395**	**216**	**526**	**480**	NA	NA	NA	NA
Nickel	6.5 [a]	1600 [d]	54.2	**29.1**	**32.6**	**36.1**	**20.6**	**28.1**	**17.6**	NA	NA	NA	NA
Silver	0.69 [a]	400 [d]	--	**0.95 J**	**0.93 J**	**0.99 J**	1.3 UJ	**1.2 J**	1.1 UJ	NA	NA	NA	NA
Thallium	0.011 [a]	0.8 [d]	--	***4.7***	***5***	***4.7***	***5***	***4.3***	***3***	NA	NA	NA	NA
Vanadium	80 [a]	400 [d]	--	**87.9**	**90.6**	**94.6**	**71.8**	**85.7**	**54.8**	NA	NA	NA	NA
Zinc	300 [a]	24000 [d]	85.6	**50.8**	**47.7**	**66.2**	**58.4**	**158**	**71.3**	NA	NA	NA	NA
Semivolatile Organic Compounds (µg/kg)													
2,3,4,6-Tetrachlorophenol	--	2400000 [d]	--	180 U	210 U	1900 U	310 U	1800 U	220 U	**200**	36 JQ	190 U	1000 U
2-Methylnaphthalene	--	320000 [d]	--	3.6 UJ	4.1 UJ	10 JQ	6 JQ	7.6 JQ	**5.6**	0.72 JQ	3.5 U	3.7 U	3.7 JQ
Acenaphthene	5000 [a]	4800000 [d]	--	3.6 U	0.45 JQ	36 U	6.1 JQ	35 U	1.7 JQ	3.4 U	3.5 U	3.7 U	19 U
Acenaphthylene	--	--	--	3.6 U	4.1 U	36 U	30 U	35 U	**8.6**	0.84 JQ	3.5 U	0.62 JQ	19 U
Anthracene	110000 [a]	24000000 [d]	--	3.6 U	4.1 U	36 U	18 JQ	35 U	4.2 JQ	3.4 U	3.5 U	3.7 U	19 U
Benzo(a)anthracene	43 [a]	--	--	3.6 U	4.1 U	36 U	30 U	35 U	4.4 U	3.2 JQ	3.5 U	3.7 U	19 U
Benzo(a)pyrene	100 [b]	190 [c]	--	3.6 U	4.1 U	31 JQ	30 U	15 JQ	3.7 JQ	**3.5**	3.5 U	3.7 U	5 JQ
Benzo(b)fluoranthene	150 [a]	--	--	3.6 U	4.1 U	36 U	**170 J**	**49**	**16**	**7**	0.5 JQ	0.68 JQ	12 JQ
Benzo(g,h,i)perylene	--	--	--	3.6 U	4.1 UJ	**44 J**	30 UJ	35 UJ	4.4 UJ	**4.8**	3.5 U	0.58 JQ	19 U
Benzo(k)fluoranthene	1500 [a]	--	--	3.6 U	4.1 U	36 U	**57 J**	35 U	4.4 U	2.1 JQ	3.5 U	3.7 U	19 U
bis(2-Ethylhexyl)phthalate	670 [a]	71000 [c]	--	180 U	210 U	1900 UJ	**740 J**	1800 UJ	220 U	90 JQ	180 U	190 U	1000 U

Table 5-4 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID	MTCA Cleanup Level*		Back-ground metals*	17394227	17394228	17394230	17394231	17394233	17394234	17394236	17394237	17394239	17394240
Station Location Description				PB01SB04	PB01SB08	PB02SB02	PB02SB09	PB03SB02	PB03SB05	PB04SB04	PB04SB08	PB05SB04	PB05SB05
CLP Sample Number				JJ462	JJ463	JJ464	JJ465	JJ466	JJ467	JJ468	JJ469	JJ470	JJ471
Sampling Interval (feet bgs)				2-4	6-8	0-2	7-9	0-2	4-5	2-4	6-8	2-4	4-5
Sampling Zone	A / GW	DC		Planer/Grader Building									
Chrysene	4800 [a]	--	--	3.6 U	4.1 U	**75 J**	**48 J**	**110**	**9.9**	**6.2**	0.68 JQ	3.7 U	15 JQ
Dibenzo(a,h)anthracene	21 [a]	--	--	3.6 UJ	4.1 UJ	36 UJ	30 UJ	35 UJ	4.4 UJ	0.8 JQ	3.5 U	3.7 U	19 U
Fluoranthene	32000 [a]	3200000 [d]	--	3.6 U	4.1 U	36 U	**120 J**	**290**	**33**	**6.1**	1.4 JQ	0.95 JQ	2.8 JQ
Fluorene	5100 [a]	3200000 [d]	--	3.6 U	4.1 U	36 U	30 U	35 U	4.4 U	3.4 U	3.5 U	3.7 U	19 U
Naphthalene	240 [a]	1600000 [d]	--	3.6 U	4.1 U	36 U	30 U	35 U	**21**	3.4 U	3.5 U	3.7 U	19 U
Pentachlorophenol	0.88 [a]	2500 [c]	--	7.3 U	8.4 U	74 UJ	61 UJ	72 UJ	8.9 UJ	**920**	**160**	3.5 JQ	39 U
Phenanthrene	--	--	--	3.6 U	4.1 U	36 U	**52**	**410**	**31**	4.2 U	3.5 U	3.7 U	19 U
Pyrene	33000 [a]	2400000 [d]	--	3.6 U	4.1 U	36 U	**110 J**	**200**	**38**	**9.1**	1.2 JQ	1.4 JQ	19 U
cPAH TEQ	100 [b]	190 [c]	--	0 U	0 U	**40.75 J**	**42.68 J**	**28 J**	**7.809 J**	**5.162 J**	**2.5068 J**	**2.6765 J**	**10.15 J**
Volatile Organic Compounds (µg/kg)													
2-Butanone	--	48000000 [d]	--	NA	NA	NA	NA	NA	NA	11 U	11 U	3.1 JQ	11 U
Acetone	2100 [a]	72000000 [d]	--	NA	NA	NA	NA	NA	NA	11 U	11 U	**17**	8.5 JQ
Total Petroleum Hydrocarbons (mg/kg)													
Diesel Range Organics	2000 [b]	--	--	44 U	46 U	42 U	61 U	42 U	55 U	40 U	42 U	43 U	45 U
Heavy Oil Range Organics	2000 [b]	--	--	110 U	120 U	**3100**	**22000**	**860**	140 U	100 U	110 U	110 U	**340**

Table 5-4 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394242 PB06SB04 JJ472 2-4	17394243 PB06SB06 JJ473 4-6	17394259 PB09SB04 JJ4B7 2-4	17394260 PB09SB06 JJ4B8 4-5.5	17394262 PB10SB04 JJ4B9 2.4-4	17394263 PB10SB08 JJ4C0 4-6.5	17394247 PW01SB04 JJ476 2-4	17394248 PW01SB06 JJ477 4-6	17394250 PW02SB03 JJ478 1.6-2.6	17394251 PW02SB08 JJ479 6-8
Sampling Zone	A / GW	DC		Planer/Grader Building						Former Paint Waste Tank			
Target Analyte List Metals (mg/kg)													
Aluminum	--	--	--	NA	NA	**26200**	**26000**	**20600**	**22900**	NA	NA	NA	NA
Arsenic	0.15 [a]	0.67 [c]	8.47	NA	NA	0.82 UJ	0.84 UJ	0.83 U	0.92 U	NA	NA	NA	NA
Barium	83 [a]	16000 [d]	--	NA	NA	**97.9**	**106**	**85.5**	**94.3**	NA	NA	NA	NA
Beryllium	3.2 [a]	160 [d]	0.8	NA	NA	**0.9**	**0.94**	**0.66**	**0.7**	NA	NA	NA	NA
Cadmium	2 [b]	80 [d]	0.1	NA	NA	**1.2**	**1.2**	**1.5**	**1.5**	NA	NA	NA	NA
Calcium	--	--	--	NA	NA	**3250**	**1200**	**2950 J**	**5910 J**	NA	NA	NA	NA
Chromium	2000 [b]	120,000 [d]	78.5	NA	NA	**32.3**	**35.9**	**24.6 J**	**25.2 J**	NA	NA	NA	NA
Cobalt	--	--	--	NA	NA	**20.6**	**23.5**	**16.3**	**16.2**	NA	NA	NA	NA
Copper	14 [a]	3200 [d]	52.9	NA	NA	**120**	**66.7**	**58.4**	**56.1**	NA	NA	NA	NA
Iron	--	--	49170	NA	NA	**32200**	**37000**	**29000 J**	**28400 J**	NA	NA	NA	NA
Lead	150 [a]	--	10.9	NA	NA	**3.2**	**1.4**	**2.9**	**3.2**	NA	NA	NA	NA
Magnesium	--	--	--	NA	NA	**5490**	**6550**	**5020 J**	**4570 J**	NA	NA	NA	NA
Manganese	--	11000 [d]	691.8	NA	NA	**239**	**324**	**515**	**478**	NA	NA	NA	NA
Nickel	6.5 [a]	1600 [d]	54.2	NA	NA	**33.7**	**33.7**	**28.3**	**24.9**	NA	NA	NA	NA
Silver	0.69 [a]	400 [d]	--	NA	NA	**0.89 J**	**1.1 J**	**1.1 J**	**1.6 J**	NA	NA	NA	NA
Thallium	0.011 [a]	0.8 [d]	--	NA	NA	***5.7***	***5.3***	***3.8***	***3.1***	NA	NA	NA	NA
Vanadium	80 [a]	400 [d]	--	NA	NA	**112**	**98.1**	**87.6**	**84.5**	NA	NA	NA	NA
Zinc	300 [a]	24000 [d]	85.6	NA	NA	**53.7**	**45**	**43**	**46.8**	NA	NA	NA	NA
Semivolatile Organic Compounds (µg/kg)													
2,3,4,6-Tetrachlorophenol	--	2400000 [d]	--	190 U	220 U	1800 U	190 U	190 U	260 U	200 U	190 U	940 U	290 U
2-Methylnaphthalene	--	320000 [d]	--	0.54 JQ	4.3 UJ	12 JQ	1.4 JQ	3.2 JQ	1.5 JQ	0.95 JQ	3.7 U	15 JQ	3.1 JQ
Acenaphthene	5000 [a]	4800000 [d]	--	3.7 U	4.3 U	36 U	**7.1**	0.82 JQ	**12**	3.8 U	3.7 U	**1500**	5.7 U
Acenaphthylene	--	--	--	3.7 U	4.3 U	36 U	0.37 JQ	**3.7**	1.3 JQ	0.52 JQ	0.63 JQ	R	5.7 U
Anthracene	110000 [a]	24000000 [d]	--	3.7 U	4.3 U	36 U	1.7 JQ	3.7 U	5 U	3.8 U	3.7 U	**3000**	5.7 U
Benzo(a)anthracene	43 [a]	--	--	3.7 U	4.3 U	36 U	1.3 JQ	2.4 JQ	5 U	3.8 U	**5.8**	**2600**	5.7 U
Benzo(a)pyrene	100 [b]	190 [c]	--	3.7 U	4.3 U	19 JQ	3.6 U	1.8 JQ	5 U	3.8 U	1.9 JQ	***1800***	5.7 U
Benzo(b)fluoranthene	150 [a]	--	--	3.7 U	4.3 U	36 U	0.68 JQ	**4.5**	1.6 JQ	3.8 U	**5.1**	**2500**	5.7 U
Benzo(g,h,i)perylene	--	--	--	3.7 U	4.3 U	36 UJ	3.6 U	1.7 JQ	1.3 JQ	3.8 U	3.7 UJ	**350 J**	6.2 UJ
Benzo(k)fluoranthene	1500 [a]	--	--	3.7 U	4.3 U	36 U	3.6 U	3.7 U	5 U	3.8 U	1 JQ	**970**	0.85 JQ
bis(2-Ethylhexyl)phthalate	670 [a]	71000 [c]	--	190 U	220 U	1800 UJ	190 U	190 U	260 U	200 U	190 U	940 UJ	290 UJ

Table 5-4 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394242 PB06SB04 JJ472 2-4	17394243 PB06SB06 JJ473 4-6	17394259 PB09SB04 JJ4B7 2-4	17394260 PB09SB06 JJ4B8 4-5.5	17394262 PB10SB04 JJ4B9 2.4-4	17394263 PB10SB08 JJ4C0 4-6.5	17394247 PW01SB04 JJ476 2-4	17394248 PW01SB06 JJ477 4-6	17394250 PW02SB03 JJ478 1.6-2.6	17394251 PW02SB08 JJ479 6-8
Sampling Zone	A / GW	DC		Planer/Grader Building						Former Paint Waste Tank			
Chrysene	4800 [a]	--	--	3.7 U	4.3 U	**91**	1.5 JQ	**7**	1.8 JQ	3.8 U	**8.1**	**3800**	5.7 U
Dibenzo(a,h)anthracene	21 [a]	--	--	3.7 U	4.3 U	36 UJ	3.6 U	3.7 U	5 U	3.8 U	3.7 UJ	<u>**230**</u> **J**	5.7 UJ
Fluoranthene	32000 [a]	3200000 [d]	--	3.7 U	4.3 U	36 U	**9.2**	**9.7**	**9.8**	3.8 U	**8.7**	**7400**	5.7 U
Fluorene	5100 [a]	3200000 [d]	--	3.7 U	4.3 U	36 U	**6**	1.9 JQ	5 U	3.8 U	3.7 U	**1500**	5.7 U
Naphthalene	240 [a]	1600000 [d]	--	3.7 U	4.3 U	36 U	**5.4**	**9.4**	5 U	3.8 U	3.7 U	37 U	5.7 U
Pentachlorophenol	0.88 [a]	2500 [c]	--	7.6 U	8.7 U	73 UJ	7.4 U	7.4 U	10 U	7.7 U	7.5 UJ	74 UJ	8 JQ
Phenanthrene	--	--	--	3.7 U	4.3 U	**67**	**3.6**	**14**	5.6	3.8 U	3.7 U	**4900**	**6.5**
Pyrene	33000 [a]	2400000 [d]	--	3.7 U	4.3 U	36 U	**11**	**15**	**5**	3.8 U	**13**	**7400**	5.7 U
cPAH TEQ	100 [b]	190 [c]	--	0 U	0 U	**28.91 J**	**2.553 J**	**3.03 J**	**3.496 J**	0 U	0 U	<u>***2526***</u> **J**	**4.1035 J**
Volatile Organic Compounds (µg/kg)													
2-Butanone	--	48000000 [d]	--	4.3 JQ	4.7 JQ	NA	NA	NA	NA	6.9 JQ	11 U	7.3 JQ	**23**
Acetone	2100 [a]	72000000 [d]	--	**26**	9.7 JQ	NA	NA	NA	NA	**43**	**20**	**47**	**63**
Total Petroleum Hydrocarbons (mg/kg)													
Diesel Range Organics	2000 [b]	--	--	44 U	46 U	44 U	44 U	42 U	54 U	43 U	46 U	**190**	66 U
Heavy Oil Range Organics	2000 [b]	--	--	110 U	120 U	**400**	110 U	110 U	130 U	110 U	120 U	**1000**	160 U

Note: Bold type indicates the sample result is above the sample quantitation limit.

<u>**530**</u> Grey shaded cell with <u>**underlined and bolded type**</u> designates value above MTCA A or MTCA B protection of GW value

<u>***2200***</u> Tan shaded cell with <u>***underlined, bolded, and italized type***</u> designates value is also above MTCA B direct contact value

* = Value in the left column is the most restrictive criteria available from MTCA A or the MTCA B default value for the protection of GW in saturated soil. Value in right column is the most restrictive MTCA B cancer/non-cancer (direct contact) value. Background metals concentrations are 90th percentile values from Group W.

a = MTCA Method B protection of GW

b = MTCA Method A Unrestricted Land Use (Chromium III used for Chromium)

c = MTCA B cancer direct contact value

d = MTCA Method B non-cancer direct contact value (Chromium III used for Chromium)

Key:

-- = Not available for given constituent

µg/kg = micrograms per kilogram

A/GW - MTCA A or MTCA B protection of GW standard

bgs = below ground surface

CLP = Contract Laboratory Program

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient
Value is compared to cleanup levels for benzo(a)pyrene

DC = MTCA B direct Contact

EPA = United States Environmental Protection Agency

GW = Groundwater

ID = Identification.

J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or detection limit. See report for details on cPAH TEQ calculations.

Table 5-5 Surface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number Sample Depth (inches bgs)	MTCA Cleanup Level*		Back-ground metals*	17394245 PB07SS JJ474 0-6	17394246 PB08SS JJ475 0-6
Sampling Zone	A / GW	DC		Planer/Grader Building	
Target Analyte List Metals (mg/kg)					
Aluminum	--	--	--	**23900**	**6990**
Arsenic	0.15 [a]	0.67 [c]	8.47	***7.7***	***3.9***
Barium	83 [a]	16000 [d]	--	**77.1**	**41.7**
Beryllium	3.2 [a]	160 [d]	0.8	**1.3**	**1.3**
Cadmium	2 [b]	80 [d]	0.1	**6.6**	**6.6**
Calcium	--	--	--	**11000 J**	**6720 J**
Chromium	2000 [b]	120000 [d]	78.5	**56.1 J**	**85.4 J**
Cobalt	--	--	--	**22.9**	**17.8**
Copper	14 [a]	3200 [d]	52.9	**390**	**249**
Iron	--	--	49170	**117000 J**	**147000 J**
Lead	150 [a]	--	10.9	**67.2**	**40**
Magnesium	--	--	--	**5120 J**	**4050 J**
Manganese	--	11000 [d]	691.8	**880**	**888**
Nickel	6.5 [a]	1600 [d]	54.2	**62.9**	**59.2**
Silver	0.69 [a]	400 [d]	--	**4.3 J**	**4.9 J**
Sodium	--	--	--	**1720**	**800**
Vanadium	80 [a]	400 [d]	--	**45.1**	**36.8**
Zinc	300 [a]	24000 [d]	85.6	**889**	**775**
Semivolatile Organic Compounds (µg/kg)					
2-Methylnaphthalene	--	320000 [d]	--	440 U	**440**
Acenaphthene	5000 [a]	4800000 [d]	--	440 U	**370**
Acenaphthylene	--	--	--	440 U	**150**
Benzo(b)fluoranthene	150 [a]	--	--	440 UJ	**1000 J**
bis(2-Ethylhexyl)phthalate	670 [a]	71000 [c]	--	19000 JQ	**5300 J**
Chrysene	4800 [a]	--	--	**630 J**	**910 J**
Fluoranthene	32000 [a]	3200000 [d]	--	**2200 J**	**4700**
Fluorene	5100 [a]	3200000 [d]	--	440 U	**730**
Naphthalene	240 [a]	1600000 [d]	--	440 U	**430**
Pentachlorophenol	0.88 [a]	2500 [c]	--	**1200 J**	**460 J**
Phenanthrene	--	--	--	560 U	**4900**
Pyrene	33000 [a]	2400000 [d]	--	**980 J**	**2600**
cPAH TEQ	100 [b]	190 [c]		***336.3* J**	**163.3 J**

Table 5-5 Surface Soil Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number Sample Depth (inches bgs)	MTCA Cleanup Level*		Back-ground metals*	17394245 PB07SS JJ474 0-6	17394246 PB08SS JJ475 0-6
Sampling Zone	A / GW	DC		Planer/Grader Building	
Volatile Organic Compounds (µg/kg)					
2-Butanone	--	48000000 [d]	--	**100 J**	18 JQ
Acetone	2100 [a]	72000000 [d]	--	**1500 J**	**1500 J**
Total Petroleum Hydrocarbons (mg/kg)					
Heavy Oil Range Organics	2000 [b]	--	--	**<u>170000</u>**	**<u>25000</u>**

Note: Bold type indicates the sample result is above the sample quantitation limit.

<u>530</u> Grey shaded cell with **<u>underlined and bolded type</u>** designates value above MTCA A or MTCA B protection of GW value

<u>2200</u> Tan shaded cell with ***<u>underlined, bolded, and italized type</u>*** designates value is also above MTCA B direct contact value

* = Value in the left column is the most restrictive criteria available from MTCA A or the MTCA B default value for the protection of GW in saturated soil. Value in right column is the most restrictive MTCA B cancer/non-cancer (direct contact) value. Background metals concentrations are 90th percentile values from Group W.

a = MTCA Method B protection of GW

b = MTCA Method A Unrestricted Land Use (Chromium III used for Chromium)

c = MTCA B cancer direct contact value

d = MTCA Method B non-cancer direct contact value (Chromium III used for Chromium)

Key:

-- = Not available for given constituent

µg/kg = micrograms per kilogram

A/GW - MTCA A or MTCA B protection of GW standard

bgs = below ground surface

CLP = Contract Laboratory Program

DC = MTCA B direct Contact

EPA = Environmental Protection Agency

GW = Groundwater

ID = Identification

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or detection limit. See report for details on cPAH TEQ calculations.

Table 5-6 Groundwater Sample Analytical Results Summary - Remedial Action Unit 2

EPA Sample ID Station Location Description CLP Sample Number	MTCA Cleanup Level*		17394229 PB01GW JJ494	17394232 PB02GW JJ495	17394235 PB03GW JJ496	17394238 PB04GW JJ497	17394241 PB05GW JJ498	17394244 PB06GW JJ499	17394261 PB09GW JJ4C9	17394264 PB10GW JJ4C9	17394249 PW01GW JJ4C8	17394252 PW02GW JJ4C9
Sampling Zone	SW	GW	Planer/Grader Building								Former Paint Waste Tank	
Target Analyte List Metals (µg/L)												
Aluminum	--	--	200 U	**14100**	**281**	NA	NA	NA	**1900**	**1020**	NA	NA
Arsenic	0.098 [c]	5 [a]	1 U	**4.4**	1 U	NA	NA	NA	**1.6**	1 U	NA	NA
Barium	--	3200 [b]	18.5 JQ	**232**	13.7 JQ	NA	NA	NA	38.4 JQ	34.3 JQ	NA	NA
Calcium	--	--	**13300**	**20000**	**10500**	NA	NA	NA	**16100**	**29200**	NA	NA
Chromium	--	50 [a]	10 U	**19.7**	10 U	NA	NA	NA	10 U	10 U	NA	NA
Copper	3.1 [f]	640 [b]	6.3 JQ	**56.5**	8.4 JQ	NA	NA	NA	17.6 JQ	11.1 JQ	NA	NA
Iron	--	--	**26800**	**36100**	**10700**	NA	NA	NA	**24100**	**28200**	NA	NA
Lead	8.1 [f]	15 [a]	8.3 JQ	***23.8***	5.1 JQ	NA	NA	NA	**10.4**	9.4 JQ	NA	NA
Magnesium	--	--	**11700**	**13700**	**8810**	NA	NA	NA	**11000**	**16100**	NA	NA
Manganese	100 [g]	2200 [b]	***3950***	**2170**	**1730**	NA	NA	NA	**2120**	***4050***	NA	NA
Sodium	--	--	**31500**	**35000**	**26300**	NA	NA	NA	**30700**	**41700**	NA	NA
Vanadium	--	80 [b]	50 U	***96.8***	50 U	NA	NA	NA	10.3 JQ	50 U	NA	NA
Semivolatile Organic Compounds (µg/L)												
2,3,4,6-Tetrachlorophenol	--	480 [b]	5 U	5 UJ	5 U	**390 J**	5 U	5 U	5 U	5 U	5 U	5 UJ
2,4,5-Trichlorophenol	600 [g]	800 [b]	5 U	5 UJ	5 U	**150 J**	5 U	5 U	5 U	5 U	5 U	5 UJ
2,4-Dichlorophenol	10 [h]	2 [d]	5 U	5 UJ	5 U	***21*** J	5 U	5 U	5 U	5 U	5 U	5 UJ
2-Methylnaphthalene	--	32 [b]	0.1 U	**0.15 J**	**0.29**	5 UJ	**0.21**	0.1 U	**0.45**	0.048 JQ	0.041 JQ	0.1 UJ
3-Methylphenol + 4-Methylphenol	--	--	10 U	10 UJ	10 U	**12 J**	10 U	10 U	10 U	10 U	10 U	10 UJ
Acenaphthene	30 [h]	960 [b]	0.079 JQ	**0.26 J**	**0.4**	5 UJ	**0.12**	0.083 JQ	**4.9**	**0.8**	**0.11**	0.036 JQ
Anthracene	100 [h]	4800 [b]	0.1 U	0.1 UJ	0.1 U	5 UJ	0.1 U	0.1 U	**0.24**	0.031 JQ	0.061 JQ	0.1 UJ
Fluoranthene	6 [h]	640 [b]	0.1 U	0.027 JQ	0.03 JQ	10 UJ	0.1 U	0.1 U	**0.64**	0.028 JQ	0.021 JQ	0.1 UJ
Fluorene	10 [h]	640 [b]	0.1 U	**0.18 J**	**0.25**	5 UJ	0.065 JQ	0.1 U	**2.5**	**0.37**	0.083 JQ	0.1 UJ
Naphthalene	4900 [b]	8.93 [d]	0.1 U	**1.6 J**	**1.3**	5 UJ	**0.5**	0.018 JQ	**2.7**	**0.41**	**0.29**	0.1 UJ
Pentachlorophenol	0.002 [h]	0.22 [c]	0.2 U	0.091 JQ	0.06 JQ	***1600*** J	0.046 JQ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ
Phenanthrene	--	--	0.015 JQ	0.077 JQ	**0.14**	5 UJ	0.036 JQ	0.1 U	**1**	**0.11**	0.1 U	0.01 JQ
Pyrene	8 [h]	480 [b]	0.1 U	0.1 UJ	0.1 U	5 UJ	0.1 U	0.1 U	**0.6**	0.1 U	0.1 U	0.1 UJ
cPAH TEQ	0.000016 [h]	0.023 [a]	0 U	***0.755*** J	0 U	0 U	0 U	0 U	***0.0736*** J	0 U	0 U	0 U
Volatile Organic Compounds (µg/L)												
Acetone	--	7200 [b]	NA	NA	NA	**5.7**	5 U	5 U	NA	NA	**7.3**	**5.2**
Benzene	1.60 [i]	0.80 [c]	NA	NA	NA	**0.76**	0.5 U	0.5 U	NA	NA	0.5 U	0.5 U
Cyclohexane	--	--	NA	NA	NA	0.5 U	**1.5**	0.5 U	NA	NA	0.5 U	0.5 U
Methylcyclohexane	--	--	NA	NA	NA	**0.71**	**2.2**	0.5 U	NA	NA	0.5 U	0.5 U
Toluene	130 [h]	640 [b]	NA	NA	NA	**1.7**	**0.73**	0.5 U	NA	NA	0.5 U	0.5 U
m, p-Xylene	--	1000 [e]	NA	NA	NA	**0.51**	**0.53**	0.5 U	NA	NA	0.5 U	0.5 U
Total Petroleum Hydrocarbons (mg/L)												
Heavy Oil Range Organics	--	0.5 [a]	0.45 U	***79***	0.43 U	0.5 U	0.43 U	0.5 U	0.42 U	0.5 U	0.42 U	0.5 U

Notes:

Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above SW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value above SW and/or GW value

* = Value is the most restrictive criteria available for the given matrix.

a = MTCA Method A Unrestricted Land Use
b = MTCA Method B non-cancer value
c = MTCA Method B cancer value
d = MTCA Method B screening level protective of VI cancer value
e = Value is MTCA A for xylene mixtures
f = Aquatic life-chronic (WAC/CWA)
g = Human health (CWA)
h = Human health (40 CFR)
i = Human health (WAC)

Key:

-- = Cleanup level not available for given constituent
µg/L = micrograms per liter
CFR = Code of Federal Regulations
CLP = Contract Laboratory Program
cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient Value is compared to cleanup levels for benzo(a)pyrene
CWA = Clean Water Act
EPA = United States Environmental Protection Agency
GW = Groundwater
ID = Identification
J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.
MTCA = Model Toxics Control Act
mg/L = milligrams per liter
NA = Sample not analyzed for given constituent
SW = Surface Water
Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.
U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or reporting limit. See report for details on cPAH TEQ calculations.
WAC = Washington Administrative Code

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Table 5-7 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 3

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394221 OC01SB04 JJ480 1-4	17394222 OC01SB06 JJ481 4-6	17394224 OC02SB04 JJ482 2-4	17394225 OC02SB06 JJ483 4-6	17394265 OC03SB04 JJ4C1 3-4	17394266 OC03SB07 JJ4C2 5-7
Sampling Zone	A / GW	DC		Former Oil Tank and Chemical Storage Shed					
Target Analyte List Metals (mg/kg)									
Aluminum	--	--	--	**9770**	**21900**	**11300**	**23000**	**18300**	**33900**
Arsenic	0.15 [a]	0.67 [c]	8.47	0.79 UJ	0.86 UJ	***1* J**	0.89 UJ	0.77 UJ	0.88 UJ
Barium	83 [a]	16000 [d]	--	**43.7**	**85.2**	**51.3**	**94.3**	**76.3**	**155**
Beryllium	3.2 [a]	160 [d]	0.8	**0.49**	**0.85**	**0.51**	**0.79**	**0.6**	**1.2**
Cadmium	2 [b]	80 [d]	0.1	**1.2**	**1.6**	**1.1**	**1**	**0.86**	**1.7**
Calcium	--	--	--	**6270**	**4620**	**7800**	**2570**	**2730**	**2040**
Chromium	2000 [b]	120,000 [d]	78.5	**14.1**	**27.7**	**13.4**	**36.1**	**18.7**	**37.8**
Cobalt	--	--	--	**15.5**	**24**	**14.9**	**20.6**	**15.1**	**26**
Copper	14 [a]	3200 [d]	52.9	**56.2**	**89.9**	**57.2**	**52.1**	**60.7**	**75**
Iron	--	--	49170	**34300**	**39000**	**29300**	**28700**	**26100**	**46500**
Lead	150 [a]	--	10.9	**7.5**	**2.7**	**5.9**	**3.1**	**2.9**	**2.9**
Magnesium	--	--	--	**7880**	**6910**	**6960**	**5160**	**5170**	**7370**
Manganese	--	11000 [d]	691.8	**404**	**538**	**366**	**463**	**491**	**616**
Nickel	6.5 [a]	1600 [d]	54.2	**27.6**	**37.9**	**28.2**	**30.8**	**26.1**	**40.7**
Potassium	--	--	--	**1290**	**868**	**608**	**829**	251 JQ	**563**
Silver	0.69 [a]	400 [d]	--	**1 J**	**1.2 J**	**0.82 J**	0.89 UJ	0.77 UJ	**1.3 J**
Sodium	--	--	--	**433**	277 JQ	375 JQ	232 JQ	328 JQ	386 JQ
Thallium	0.011 [a]	0.8 [d]	--	***3.2***	***5.9***	***3.1***	***5.1***	***4***	***5.6***
Vanadium	80 [a]	400 [d]	--	**58.6**	**121**	**59.9**	**100**	**70.6**	**117**
Zinc	300 [a]	24000 [d]	85.6	**53.3**	**65**	**56.4**	**44.3**	**41.2**	**67.3**
Semivolatile Organic Compounds (µg/kg)									
2-Methylnaphthalene	--	320000 [d]	--	17 U	3.8 UJ	36 U	4 U	**66**	1.9 JQ
Benzo(a)anthracene	43 [a]	--	--	**140 J**	3.8 U	**120**	4 U	33 JQ	3.8 U
Benzo(a)pyrene	100 [b]	190 [c]	--	**99 J**	3.8 U	**99**	0.94 JQ	33 JQ	1.3 JQ
Benzo(b)fluoranthene	150 [a]	--	--	**240 J**	3.8 U	**260**	4 U	**64 J**	3.4 JQ
Benzo(g,h,i)perylene	--	--	--	**43 J**	3.8 U	**48 J**	4 UJ	10 JQ	1.2 JQ
Benzo(k)fluoranthene	1500 [a]	--	--	**70 J**	3.8 U	**89**	4 U	36 UJ	3.8 U
Chrysene	4800 [a]	--	--	**170 J**	3.8 U	**160**	4 U	**210**	**7.1**
Dibenzo(a,h)anthracene	21 [a]	--	--	**22 J**	3.8 U	21 JQ	4 UJ	25 JQ	3.8 UJ

Table 5-7 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 3

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394221 OC01SB04 JJ480 1-4	17394222 OC01SB06 JJ481 4-6	17394224 OC02SB04 JJ482 2-4	17394225 OC02SB06 JJ483 4-6	17394265 OC03SB04 JJ4C1 3-4	17394266 OC03SB07 JJ4C2 5-7
Sampling Zone	**A / GW**	**DC**		**Former Oil Tank and Chemical Storage Shed**					
Fluoranthene	32000 [a]	3200000 [d]	--	**210 J**	3.8 U	**150**	4 U	17 JQ	0.82 JQ
Indeno(1,2,3-cd)pyrene	420 [a]	--	--	**56 J**	3.8 U	**43 J**	4 UJ	20 JQ	3.8 UJ
Phenanthrene	--	--	--	**78 J**	3.8 U	**57**	4 U	**170**	3.2 JQ
Pyrene	33000 [a]	2400000 [d]	--	**170 J**	**3.9**	**130**	4 U	**97**	1.7 JQ
cPAH TEQ	100 [b]	190 [c]	--	**153.5 J**	0 U	**153.9 J**	**1.96 J**	**51.1 J**	**2.471 J**
Volatile Organic Compounds (µg/kg)									
Acetone	2100 [a]	72000000 [d]	--	10 U	8.9 JQ	**24**	**12**	**37**	**35**
Total Petroleum Hydrocarbons (mg/kg)									
Heavy oil	2000 [b]	--	--	**210**	120 U	**620**	110 U	**1500**	110 U

Note: Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above MTCA A or MTCA B protection of GW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value is also above MTCA B direct contact value

* = Value in the left column is the most restrictive criteria available from MTCA A or the MTCA B default value for the protection of GW in saturated soil. Value in right column is the most restrictive MTCA B cancer/non-cancer (direct contact) value. Background metals concentrations are 90th percentile values from Group W.

a = MTCA Method B protection of GW

b = MTCA Method A Unrestricted Land Use (Chromium III used for Chromium)

c = MTCA B cancer direct contact value

d = MTCA Method B non-cancer direct contact value (Chromium III used for Chromium)

Key:

-- = Not available for given constituent

µg/kg = micrograms per kilogram

A/GW - MTCA A or MTCA B protection of GW standard

bgs = below ground surface

CLP = Contract Laboratory Program

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient Value is compared to cleanup levels for benzo(a)pyrene

DC = MTCA B direct Contact

EPA = United States Environmental Protection Agency

GW = Groundwater

ID = Identification.

J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or detection limit. See report for details on cPAH TEQ calculations

Table 5-8 Groundwater Sample Analytical Results Summary - Remedial Action Units 3 and 4

EPA Sample ID Station Location Description CLP Sample Number	MTCA Cleanup Level*		17394223 OC01GW JJ4A2	17394226 OC02GW JJ4A3	17394267 OC03GW JJ4D0	17394255 VM01GW JJ4A5
Sampling Zone	SW	GW	Former Oil Tank and Chemical Storage Shed			Vehicle Maintenanc
Target Analyte List Metals (µg/L)						
Aluminum	--	--	200 U	**387**	**1890**	**5000**
Arsenic	0.098 [c]	5 [a]	1 U	1 U	**3.5**	**1.4**
Calcium	--	--	**18500**	**22900**	**59400**	**11300**
Iron	--	--	**20500**	**26000**	**76600**	**34400**
Magnesium	--	--	**8620**	**12300**	**33100**	**8680**
Manganese	100 [d]	2200 [b]	**2110**	***2380***	***10600***	***6260***
Potassium	--	--	4630 JQ	**5870**	**13500**	5000 U
Sodium	--	--	**16900**	**22700**	**25500**	**32900**
Semivolatile Organic Compounds (µg/L)						
Acenaphthene	30 [e]	960 [b]	0.02 JQ	0.014 JQ	0.02 JQ	**0.21**
cPAH TEQ	1.6E-05 [e]	0.023 [a]	0 U	0 U	0 U	0 U

Notes: Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above SW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value above SW and/or GW value

* = Value is the most restrictive criteria available for the given matrix.
a = MTCA Method A Unrestricted Land Use
b = MTCA Method B non-cancer value
c = MTCA Method B cancer value
d = Human health (CWA)
e = Human health (40 CFR)

Key:

-- = Cleanup level not available
µg/L = micrograms per liter
CFR = Code of Federal Regulations
CLP = Contract Laboratory Program
cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient
Value is compared to cleanup levels for benzo(a)pyrene
CWA = Clean Water Act
EPA = United States Environmental Protection Agency
GW = Groundwater
ID = Identification
J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.
MTCA = Model Toxics Control Act
Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.
SW = Surface Water
U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or reporting limit. See report for details on cPAH TEQ calculations.

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Table 5-9 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 4

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394218 NA01SB04 JJ484 2-4	17394219 NA01SB06 JJ485 5-6	17394253 VM01SB04 JJ486 2-4	17394254 VM01SB08 JJ487 6-8
Sampling Zone	A / GW	DC					
Target Analyte List Metals (mg/kg)							
Aluminum	--	--	--	**26300**	**28100**	**24200**	**25400**
Barium	83 [a]	16000 [d]	--	**134**	108	**125**	**111**
Beryllium	3.2 [a]	160 [d]	0.8	**0.89**	**0.77**	**0.83**	**0.78**
Cadmium	2 [b]	80 [d]	0.1	**1.1**	**1.1**	**1.4**	**1.2**
Calcium	--	--	--	**1630**	**2130**	**1750 J**	**1210 J**
Chromium	2000 [b]	120,000 [d]	78.5	**31.6**	**35.9**	**27.6 J**	**23.9 J**
Cobalt	--	--	--	**19**	**15.8**	**18.4**	**17.8**
Copper	14 [a]	3200 [d]	52.9	**56.4**	**42.9**	**49.4**	**45.7**
Iron	--	--	49170	**31000**	**29900**	**30000 J**	**26800 J**
Lead	150 [a]	--	10.9	**5.8**	**4.7**	**2.7**	**3.8**
Magnesium	--	--	--	**4670**	**3730**	**4110 J**	**3990 J**
Manganese	--	11000 [d]	691.8	**303**	**380**	**530**	**421**
Nickel	6.5 [a]	1600 [d]	54.2	**28.4**	**25.2**	**27.2**	**22.3**
Silver	0.69 [a]	400 [d]	--	**0.91 J**	0.99 UJ	**1.1 J**	**0.97 J**
Sodium	--	--	--	333 JQ	327 JQ	**531**	305 JQ
Thallium	0.011 [a]	0.8 [d]	--	***5.2***	***6.2***	***4***	***3.7***
Vanadium	80 [a]	400 [d]	--	**99.5**	**97.6**	**99.9**	**80.1**
Zinc	300 [a]	24000 [d]	85.6	**47.1**	**47.9**	**42.9**	**42.1**
Semivolatile Organic Compounds (µg/kg)							
Acenaphthene	5000 [a]	4800000 [d]	--	**80 J**	0.58 JQ	0.88 JQ	**4.8**
Anthracene	110000 [a]	24000000 [d]	--	**3.8 J**	4.1 U	3.7 U	4.2 U
Benzo(a)anthracene	43 [a]	--	--	**5.8**	4.1 U	3.7 U	4.2 U
Benzo(a)pyrene	100 [b]	190 [c]	--	**7.4**	0.82 JQ	3.7 U	4.2 U
Benzo(b)fluoranthene	150 [a]	--	--	**12**	1.7 JQ	3.7 U	4.2 U
Benzo(g,h,i)perylene	--	--	--	**4.6**	1.3 JQ	3.7 U	4.2 U
Benzo(k)fluoranthene	1500 [a]	--	--	**4.1**	4.1 U	3.7 U	4.2 U
Chrysene	4800 [a]	--	--	**9.3**	3 JQ	3.7 U	4.2 U
Fluoranthene	32000 [a]	3200000 [d]	--	**15**	3.6 JQ	3.7 U	4.2 U

Table 5-9 Subsurface Soil Sample Analytical Results Summary - Remedial Action Unit 4

EPA Sample ID Station Location Description CLP Sample Number Sampling Interval (feet bgs)	MTCA Cleanup Level*		Back-ground metals*	17394218 NA01SB04 JJ484 2-4	17394219 NA01SB06 JJ485 5-6	17394253 VM01SB04 JJ486 2-4	17394254 VM01SB08 JJ487 6-8
Sampling Zone	**A / GW**	**DC**					
Fluorene	5100 [a]	3200000 [d]	--	**22**	4.1 U	3.7 U	3.8 JQ
Indeno(1,2,3-cd)pyrene	420 [a]	--	--	**5.1**	0.58 JQ	3.7 U	4.2 U
Naphthalene	240 [a]	1600000 [d]	--	**10**	4.1 U	3.7 U	**4.2**
Phenanthrene	--	--	--	3.7 U	4.1 U	3.7 U	**7**
Pyrene	33000 [a]	2400000 [d]	--	**19**	2.9 JQ	3.7 U	4.2 U
cPAH TEQ	100 [b]	190 [c]	--	**10.343 J**	**1.693 J**	0 U	0 U
Volatile Organic Compounds (µg/kg)							
Acetone	2100 [a]	72000000 [d]	--	--	--	**9.8**	**26**

Note: Bold type indicates the sample result is above the sample quantitation limit.

530 Grey shaded cell with **underlined and bolded type** designates value above MTCA A or MTCA B protection of GW value

2200 Tan shaded cell with ***underlined, bolded, and italized type*** designates value is also above MTCA B direct contact value

* = Value in the left column is the most restrictive criteria available from MTCA A or the MTCA B default value for the protection of GW in saturated soil. Value in right column is the most restrictive MTCA B cancer/non-cancer (direct contact) value. Background metals concentrations are 90th percentile values from Group W.

a = MTCA Method B protection of GW

b = MTCA Method A Unrestricted Land Use (Chromium III used for Chromium)

c = MTCA B cancer direct contact value

d = MTCA Method B non-cancer direct contact value (Chromium III used for Chromium)

Key:

-- = Not available or analyzed for given constituent

µg/kg = micrograms per kilogram

A/GW - MTCA A or MTCA B protection of GW standard

bgs = below ground surface

CLP = Contract Laboratory Program

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient. Value is compared to cleanup levels for benzo(a)pyrene

DC = MTCA B direct Contact

EPA = United States Environmental Protection Agency

GW = Groundwater

ID = Identification.

J = The associated numerical value is an estimated quantity because the reported concentrations were less than the sample quantitation limits or because quality control criteria limits were not met.

mg/kg = milligrams per kilogram

MTCA = Model Toxics Control Act

Q = Detected concentration is below the method reporting limit/Contract Required Quantitation Limit.

U = The material was analyzed for but was not detected. For all but cPAH TEQ, the associated numerical value is the sample quantitation or detection limit. See report for details on cPAH TEQ calculations

Table 6-1 Summary of Screening Value Exceedances in Soil and Groundwater

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard[a]	Applicable Cleanup Levels[b]
Metals				
Soil (mg/kg)				
Arsenic	0.6 - 7.7	9/40	9/40	0.15 [c]
			8/40	0.67 [d]
Barium	26.5 - 812	40/40	39/40	83 [c]
			0/40	16000 [e]
Cadmium	0.44 - 9.3	40/40	4/40	2 [f]
			0/40	80 [e]
Copper	22.2 - 800	40/40	40/40	14 [c]
			0/40	3200 [e]
Lead	1.4 - 1110	40/40	1/40	150 [c]
			1/40	250 [e]
Manganese	157 - 13100	40/40	0/40	11000 [e]
Nickel	6.2 - 62.9	40/40	39/40	6.5 [c]
			0/40	1600 [e]
Silver	0.56 - 6.7	33/40	32/40	0.69 [c]
			0/40	400 [e]
Thallium	1.8 - 6.2	37/40	37/40	0.011 [c]
			37/40	0.8 [e]
Vanadium	26.8 - 121	40/40	21/40	80 [c]
			0/40	400 [e]
Zinc	31.3 - 889	40/40	3/40	300 [c]
			0/40	24000 [e]
Groundwater (μg/L)				
Arsenic	1.4 - 4.8	6/18	6/18	0.098 [d]
			0/18	5 [f]
Copper	6.3 - 82.3	18/18	18/18	3.1 [g]
			0/18	640 [e]
Lead	3.1 - 53	15/18	8/18	8.1 [g]
			3/18	15 [f]
Manganese	563 - 18400	18/18	18/18	100 [h]
			10/18	2200 [e]
Vanadium	6.9 - 96.8	8/18	1/18	80 [e]
Zinc	23.7 - 232	7/18	1/18	81 [g]
			0/18	4800 [e]

Table 6-1 Summary of Screening Value Exceedances in Soil and Groundwater

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
Petroleum Hydrocarbons				
Soil (mg/kg)				
Diesel-Range TPH	190 - 3300	2/50	1/50	2,000 [f]
Heavy Oil Range TPH	150 - 170,000	23/50	11/50	2,000 [f]
Groundwater (mg/L)				
Diesel-Range TPH	2.1	1/23	1/23	0.5 [f]
Heavy Oil Range TPH	0.74 - 79	5/23	5/23	0.5 [f]
Semivolatile Organic Compounds				
Soil (µg/kg)				
Benzo(a)anthracene	0.69 - 2,600	21/50	11/50	43 [c]
Benzo(a)pyrene	0.82 - 1,800	28/50	4/50	100 [f]
			1/50	190 [d]
Benzo(b)fluoranthene	0.5 - 2,500	30/50	10/50	150 [c]
Benzo(k)fluoranthene	0.85 - 970	14/50	0/50	1500 [c]
Chrysene	0.68 - 3,800	35/50	0/50	4800 [c]
Dibenzo(a,h)anthracene	0.8 - 230	9/50	4/50	21 [c]
Indeno(1,2,3-cd)pyrene	0.58 - 580	18/50	1/50	420 [c]
cPAH TEQ	1.693 - 2,526	38/50	9/50	100 [f]
			3/50	190 [d]
Pentachlorophenol	3.5 - 1,200	8/50	8/50	0.88 [c]
			0/50	2500 [d]

Table 6-1 Summary of Screening Value Exceedances in Soil and Groundwater

Analyte	Range of Detected Concentrations[a]	Frequency of Detection[a]	Frequency of Exceedance of Regulatory Standard [a]	Applicable Cleanup Levels [b]
Groundwater (µg/L)				
2,4-Dichlorophenol	21	1/23	1/23	10 [h]
			1/23	3 [j]
cPAH TEQ	0.0475 - 0.308	4/23	4/23	0.000016 [f]
			1/23	0.023 [d]
Pentachlorophenol	0.046 - 1600	11/23	11/23	0.002 [i]
			5/23	0.22 [d]

Notes:

a Includes "J" and "JQ" qualified values. JQ values not included when tabulating frequency of regulatory exceedances.

b If more than one cleanup was used in analytical summary tables, both are presented in this column

c Value is MTCA Method B soil level for protection of groundwater

d Value is MTCA Method B level protective of cancer risk from exposure

e Value is MTCA Method B level protective of non-cancer risk from exposure

f Value is MTCA A level for soil and/or groundwater

g Value is protective of chronic exposure risk to aquatic life in marine surface water

h Value is protective of exposure risk to human health in marine surface water (CWA)

i Value is protective of exposure risk to human health in marine surface water (40 CFR)

j Value is protective of vapor intrusion from groundwater contaminants

Key:

CFR = Code of Federal Regulations

cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbons Toxicity Equivalent Quotient

CWA = Clean Water Act

µg/kg = Micrograms per kilogram

µg/L = Micrograms per liter

mg/kg = Milligrams per kilogram

mg/L = Milligrams per liter

MTCA = Model Toxics Control Act

TPH = Total Petroleum Hydrocarbons

Table 7-2
Soil Analytical Results and Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
Total Metals (mg/kg)													
Antimony	NV	3200	--	--	--	--	3.3 U	5.2 U	3.2 U	4.9 U	5 U	3.5 U	3.2 U
Arsenic	20	0.67	10 U	10 U	10 U	6 U	3.3 U	5.2 U	3.2 U	4.9 U	5 U	3.5 U	3.2 U
Cadmium	2	80	0.6 U	0.5 U	0.6 U	0.2 U	0.55 UL	0.87 UL	0.54 UL	0.82 UL	0.83 UL	0.58 UL	0.53 UL
Chromium	19/2000[a]	240/120000[a]	**71 J**	**32 J**	**37**	**35.5**	**3.5**	**3.8**	**4**	**7.3**	6.6	**19**	**5.3**
Copper	NV	3200	--	--	--	--	**11**	**8.1**	**11**	**12**	14	**26**	**10**
Lead	250	NV	--	--	--	--	**2.6**	**3.3**	**2.8**	**5.9**	5.2	**5.4**	**4.8**
Mercury	2	NV	0.03 U	**0.02**	**0.09**	0.02 U	**0.023**	**0.043**	**0.04**	0.026 U	0.041	**0.021**	**0.046**
Selenium	NV	400	--	--	--	--	5.5 U	8.7 U	5.4 U	8.2 U	8.3 U	5.8 U	5.3 U
Silver	NV	400	--	--	--	--	**1.6**	1.7 U	**1.1**	**1.6**	**1.8**	**2.3**	**1.2**
Zinc	NV	24000	--	--	--	--	**32**	**30**	**25**	**54**	**45**	**43**	**25**
PCBs (ug/kg)													
Aroclor 1016	NV	5600	19 U	17 U	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1221	NV	NV	19 U	17 U	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1232	NV	NV	19 U	17 U	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1242	NV	NV	19 U	17 U	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1248	NV	NV	**530**	**34**	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1254	NV	500	**710 J**	**73 J**	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1260	NV	500	**930**	**56**	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Aroclor 1268	NV	NV	19 U	17 U	19 U	17 U	--	--	--	--	--	--	--
Total PCBs	1000	500	**2170 J**	**163 J**	19 U	17 U	11 U	21 U	13 U	17 U	19 U	12 U	14 U
SVOCs (ug/kg)													
1,2,4-Trichlorobenzene	NV	34000	280 U	92 U	38 U	19 U	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
1,2-Dichlorobenzene	NV	7200000	280 U	92 U	38 U	19 U	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
1,3-Dichlorobenzene	NV	NV	280 U	92 U	38 U	19 U	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
1,4-Dichlorobenzene	NV	190000	280 U	92 U	38 U	19 U	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
1-Methylnaphthalene	NV	34000	280 U	92 U	38 U	19 U	35 U	64 U	42 U	53 U	56 U	37 U	43 U
2,4,5-Trichlorophenol	NV	8000000	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2,4,6-Trichlorophenol	NV	80000	1400 U	460 U	190 U	93 U	170 U	320 U	210 U	270 U	280 U	180 U	220 U
2,4-Dichlorophenol	NV	240000	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2,4-Dimethylphenol	NV	1600000	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2,4-Dinitrophenol	NV	160000	2800 U	920 U	380 U	190 U	1200 U	2100 U	1400 U	1800 U	1900 U	1200 U	1400 U
2,4-Dinitrotoluene	NV	3200	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2,6-Dinitrotoluene	NV	670	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2-Chloronaphthalene	NV	6400000	280 U	92 U	38 U	19 U	23 U	43 U	28 U	35 U	37 U	24 U	29 U
2-Chlorophenol	NV	400000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U

Table 7-2
Soil Analytical Results and Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
2-Methylnaphthalene	NV	320000	280 U	**46 J**	**26 J**	19 U	23 U	43 U	28 U	35 U	37 U	24 U	**59**
2-Methylphenol	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2-Nitroaniline	NV	800000	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
2-Nitrophenol	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
3,3-Dichlorobenzidine	NV	2200	1400 R	460 R	190 R	93 R	230 U	430 U	280 U	350 U	370 U	240 U	290 U
3,4-Methylphenol	NV	80000	--	--	--	--	230 U	430 U	280 U	350 U	370 U	240 U	**680**
3-Nitroaniline	NV	NV	1400 R	460 R	190 R	93 R	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4,6-Dinitro-2-methylphenol	NV	NV	2800 U	920 U	380 U	190 U	1200 U	2100 U	1400 U	1800 U	1900 U	1200 U	1400 U
4-Bromophenylphenyl ether	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4-Chloro-3-methylphenol	NV	NV	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4-Chloroaniline	NV	5000	1400 R	460 R	190 R	93 R	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4-Chlorophenylphenyl ether	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4-Methylphenol	NV	NV	280 U	**92**	38 U	19 U	--	--	--	--	--	--	--
4-Nitroaniline	NV	NV	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
4-Nitrophenol	NV	NV	1400 U	460 U	190 U	93 U	1200 U	2100 U	1400 U	1800 U	1900 U	1200 U	1400 U
Acenaphthene	NV	4800000	**140 J**	**420**	38 U	19 U	23 U	43 U	28 U	35 U	37 U	24 U	29 U
Acenaphthylene	NV	NV	280 U	92 U	38 U	19 U	23 U	43 U	28 U	35 U	37 U	24 U	29 U
Anthracene	NV	24000000	280 U	**150**	38 U	19 U	23 U	43 U	28 U	35 U	37 U	24 U	29 U
Benzo(a)anthracene	NV	1400	**140 J**	**210**	**21 J**	19 U	29 U	53 U	**48**	44 U	46 U	31 U	36 U
Benzo(a)pyrene	100	140	**160 J**	**180**	**28 J**	19 U	**46**	64 U	**58**	53 U	56 U	37 U	43 U
Benzo(b)fluoranthene	NV	1370	--	--	--	--	**95**	43 U	**110**	35 U	37 U	24 U	29 U
Benzo(ghi)perylene	NV	NV	280 U	92 U	**32 J**	19 U	**52**	53 U	35 U	44 U	46 U	31 U	36 U
Benzo(k)fluoranthene	NV	13700	--	--	--	--	29 U	53 U	35 U	44 U	46 U	31 U	36 U
Benzoic acid	NV	320000000	2800 U	920 U	380 U	190 U	2900 U	5300 U	3500 U	4400 U	4600 U	3100 U	3600 U
Benzyl alcohol	NV	8000000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Bis(2-chloro-1-methylethyl)ether	NV	14000	280 U	92 U	38 U	19 U	170 U	320 U	210 U	270 U	280 U	180 U	220 U
Bis(2-chloroethoxy)methane	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Bis(2-chloroethyl)ether	NV	910	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Bis(2-ethylhexyl)phthalate	NV	71000	**570 J**	230 U	**3100**	47 U	1700 U	3200 U	2100 U	2700 U	2800 U	1800 U	2200 U
Butylbenzylphthalate	NV	530000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Carbazole	NV	NV	280 UJ	92 UJ	38 UJ	19 UJ	170 U	320 U	210 U	270 U	280 U	180 U	220 U
Chrysene	NV	140000	**470**	**480**	**75**	19 U	**49**	53 U	**170**	44 U	46 U	**49**	36 U
Dibenzo(a,h)anthracene	NV	140	280 U	92 U	38 U	19 U	46 U	86 U	56 U	71 U	74 U	49 U	58 U
Dibenzofuran	NV	80000	280 U	**100**	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Diethyl phthalate	NV	64000000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Dimethyl phthalate	NV	NV	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
Di-n-butyl phthalate	NV	8000000	280 U	92 U	38 U	19 U	230 U	430 U	280 U	350 U	370 U	240 U	290 U
Di-n-octyl phthalate	NV	800000	280 U	92 U	38 U	19 U	230 U	430 U	280 U	350 U	370 U	240 U	290 U
Fluoranthene	NV	3200000	**600**	**640**	**28 J**	**11 J**	**35**	43 U	**71**	35 U	37 U	**200**	**42**
Fluorene	NV	3200000	**160 J**	**300**	38 U	19 U	23 U	43 U	28 U	35 U	37 U	24 U	29 U
Hexachlorobenzene	NV	630	280 U	92 U	38 U	19 U	58 U	110 U	69 U	88 U	93 U	61 U	72 U
Hexachlorobutadiene	NV	13000	280 U	92 U	38 U	19 U	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
Hexachlorocyclopentadiene	NV	480000	1400 U	460 U	190 U	93 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Hexachloroethane	NV	25000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Indeno(1,2,3-cd)pyrene	NV	1400	280 U	92 U	38 U	19 U	46 U	86 U	56 U	71 U	74 U	49 U	58 U
Isophorone	NV	1100000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Naphthalene	5000	1600000	280 U	**65 J**	**270**	19 U	4.8 UH	22 U*	14 U*	13 U*	15 U*	8.2 U	**63**
Nitrobenzene	NV	160000	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
N-Nitrosodiphenylamine	NV	200000	280 U	92 U	38 U	19 U	58 U	110 U	69 U	88 U	93 U	61 U	72 U
N-Nitrosodipropylamine	NV	140	280 U	92 U	38 U	19 U	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Pentachlorophenol	NV	2500	1400 U	460 U	190 U	93 U	230 U	430 U	280 U	350 U	370 U	240 U	290 U
Phenanthrene	NV	NV	**510**	**920**	**23 J**	**11 J**	23 U	43 U	**62**	35 U	37 U	24 U	**100**
Phenol	NV	24000000	280 UJ	92 UJ	38 UJ	19 UJ	120 U	210 U	140 U	180 U	190 U	120 U	140 U
Pyrene	NV	2400000	**530**	**610**	**30 J**	**11 J**	**38**	43 U	**85**	35 U	37 U	**140**	**81**
Total Benzofluoranthenes	NV	1400[b]	**300 J**	**320**	**62 J**	37 U	--	--	--	--	--	--	--
cPAH TEQ	190[a]	NV	**240 J**	**250**	**41 J**	37 U	**63.5**	**48.3**	**82.9**	**40.0**	**42.1**	**28.2**	**32.5**
Dioxins and Furans (pg/g)													
1,2,3,4,6,7,8-HpCDD	NV	NV	**2650**	**373**	**1260**	**26**	--	--	--	--	--	--	--
1,2,3,4,6,7,8-HpCDF	NV	NV	**653**	**37.9**	**188**	**2.97**	--	--	--	--	--	--	--
1,2,3,4,7,8,9-HpCDF	NV	NV	**32**	**1.48**	12.5 U	0.221 U	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDD	NV	NV	**36.1**	**3.49**	**8.65**	0.193 U	--	--	--	--	--	--	--
1,2,3,4,7,8-HxCDF	NV	NV	**17**	**2.11**	**4.09 J**	**0.114 J**	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDD	NV	NV	**184**	**23.6**	**38.2**	**1.54**	--	--	--	--	--	--	--
1,2,3,6,7,8-HxCDF	NV	NV	**9.97**	**1.55**	**4.2 J**	0.153 U	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDD	NV	NV	**16.7**	**8.09**	**12.1**	**2.35**	--	--	--	--	--	--	--
1,2,3,7,8,9-HxCDF	NV	NV	**8.52**	**1.3**	**1.82 J**	0.155 U	--	--	--	--	--	--	--
1,2,3,7,8-PeCDD	NV	NV	**10.8**	**1.97**	**3.14 J**	**1.31**	--	--	--	--	--	--	--
1,2,3,7,8-PeCDF	NV	NV	4.85 U	**0.859 J**	**1.08 J**	0.0558 U	--	--	--	--	--	--	--
2,3,4,6,7,8-HxCDF	NV	NV	**40**	**1.58**	**7.81**	0.133 U	--	--	--	--	--	--	--
2,3,4,7,8-PeCDF	NV	NV	**5.51**	0.727 U	**0.807 J**	0.0598 U	--	--	--	--	--	--	--
2,3,7,8-TCDD	NV	13	**6.42**	0.467 U	1.41 U	**1.68**	--	--	--	--	--	--	--
2,3,7,8-TCDF	NV	NV	**5.07**	0.657 U	**0.552 J**	0.0538 U	--	--	--	--	--	--	--

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
OCDD	NV	NV	**18400**	**2480**	**30800 J**	**298**	--	--	--	--	--	--	--
OCDF	NV	NV	**1490**	**42.8**	**412**	**4.82**	--	--	--	--	--	--	--
Total HpCDDs	NV	NV	**4760**	**708**	**2900**	**52.5**	--	--	--	--	--	--	--
Total HpCDFs	NV	NV	3080 U	**114**	695 U	10.2 U	--	--	--	--	--	--	--
Total HxCDDs	NV	NV	843 U	**117**	**205**	27.3 U	--	--	--	--	--	--	--
Total HxCDFs	NV	NV	1340 U	95.5 U	**243**	5.78 U	--	--	--	--	--	--	--
Total PeCDDs	NV	NV	**140**	14.9 U	**18.2**	**13.3**	--	--	--	--	--	--	--
Total PeCDFs	NV	NV	316 U	36.3 U	48.6 U	**0.846**	--	--	--	--	--	--	--
Total TCDDs	NV	NV	79.6 U	4.89 U	13.6 U	11.4 U	--	--	--	--	--	--	--
Total TCDFs	NV	NV	50.9 U	7.08 U	5.25 U	0.103 U	--	--	--	--	--	--	--
Dioxin TEQ	13	NV	**90.0**	**11.4 J**	**35.8 J**	**3.82 J**	--	--	--	--	--	--	--
TPH (mg/kg)													
Gasoline-range Hydrocarbons	30/100	NV	--	--	--	--	4.7 U	11 U	5.6 U	7.1 U	11 U	7.3 U	**8.1**
Diesel-range Hydrocarbons	2000	NV	**480**	**620**	**120**	**21**	**61 Y**	**1100 Z**	**83 Y**	**230 Z**	**270 Z**	**67 Z**	**440 Z**
Lube Oil-range Hydrocarbons	2000	NV	**2600**	**3600**	**980**	**51**	**540**	**1000 Y**	**940**	**700 Y**	**780 Y**	**190 Y**	**630 Y**
Pesticides (ug/kg)													
Aldrin	NV	59	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Alpha-BHC	NV	160	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Beta-BHC	NV	556	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Delta-BHC	NV	NV	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Lindane	10	910	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
cis-Chlordane	NV	NV	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Gamma-Chlordane	NV	NV	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Chlordane	NV	2900	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
4,4'-DDD	NV	4200	--	--	--	--	2.3 U	4.2 U	2.7 U^	3.5 U^	3.8 U^	2.4 U^	2.8 U^
4,4'-DDE	NV	2900	--	--	--	--	2.3 U^	4.2 U	2.7 U^	3.5 U	3.8 U	2.4 U	2.8 U
4,4'-DDT	3000	2900	--	--	--	--	2.3 U^	4.2 U^	2.7 U^	3.5 U^	3.8 U^	2.4 U^	2.8 U^
Total DDTs	NV	NV	--	--	--	--	2.3 U	4.2 U	2.7 U	3.5 U	3.8 U	2.4 U	2.8 U
Dieldrin	NV	63	--	--	--	--	2.3 U^	4.2 U	2.7 U^	3.5 U	3.8 U	2.4 U	2.8 U
Endosulfan I	NV	480000	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Endosulfan II	NV	480000	--	--	--	--	2.3 U^	4.2 U	2.7 U^	3.5 U	3.8 U	2.4 U	2.8 U
Endosulfan Sulfate	NV	NV	--	--	--	--	2.3 U	4.2 U	2.7 U	3.5 U	3.8 U	2.4 U	2.8 U
Endrin	NV	24000	--	--	--	--	2.3 U	4.2 U	2.7 U	3.5 U	3.8 U	2.4 U	2.8 U
Endrin Aldehyde	NV	NV	--	--	--	--	2.3 U	4.2 U	2.7 U	3.5 U	3.8 U	2.4 U	2.8 U
Endrin Ketone	NV	NV	--	--	--	--	2.3 U	4.2 U	2.7 U	3.5 U	3.8 U	2.4 U	2.8 U
Heptachlor	NV	220	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
Heptachlor Epoxide	NV	110	--	--	--	--	1.1 U	2.1 U	1.3 U	1.7 U	1.9 U	1.2 U	1.4 U
Methoxychlor	NV	400000	--	--	--	--	11 U	21 U	13 U	17 U	19 U	12 U	14 U
Toxaphene	NV	910	--	--	--	--	110 U^	210 U^	130 U^	170 U^	190 U^	120 U^	140 U^
VOCs (ug/kg)													
1,1,1,2-Tetrachloroethane	NV	39000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
1,1,1-Trichloroethane	2000	160000000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,1,2,2-Tetrachloroethane	NV	5000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
1,1,2-Trichloroethane	NV	18000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,1-Dichloroethane	NV	180000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,1-Dichloroethene	NV	4000000	--	--	--	--	4.8 UH	22 U	14 U	13 U	15 U	8.2 U	22 U
1,1-Dichloropropene	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,2,3-Trichlorobenzene	NV	NV	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
1,2,3-Trichloropropane	NV	33	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
1,2,4-Trimethylbenzene	NV	NV	--	--	--	--	**3.2**	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
1,2-Dibromo-3-chloropropane	NV	1250	--	--	--	--	1.9 UJH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
1,2-Dichloroethane	NV	11000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,2-Dichloropropane	NV	28000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
1,3,5-Trimethylbenzene	NV	800000	--	--	--	--	4.8 UH	22 U*	14 U*	13 U*	15 U*	8.2 U	22 U*
1,3-Dichloropropane	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
2,2-Dichloropropane	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
2-Chlorotoluene	NV	1600000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
4-Chlorotoluene	NV	NV	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
Benzene	30	18200	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Bromobenzene	NV	NV	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
Bromochloromethane	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Bromoform	NV	130000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
Bromomethane	NV	110000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Carbon Tetrachloride	NV	14000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Chlorobenzene	NV	1600000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
Chlorodibromomethane	NV	12000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Chloroethane	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Chloroform	NV	32000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Chloromethane	NV	NV	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
cis-1,2-Dichloroethene	NV	160000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
cis-1,3-Dichloropropene	NV	10000[c]	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Cumene	NV	800000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	**8.3 ***	6 U*	3.3 U	8.8 U*

		Location:	CR-20	CR-21	CR-22	CR-23	SB1		SB2		SB3		
		Sample Name:	CR20-S-5.0	CR21-S-5.0	CR22-S-3.0	CR23-S-3.0	DNR-SB1B	DNR-SB1A	DNR-SB2A	DNR-SB2B	DNR-SB3A	DNR-SB3B	DNR-SB3C
		Collection Date:	10/12/2015	10/12/2015	10/13/2015	10/13/2015	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	3.3 - 5.0	3.5 - 5.0	3.0 - 4.5	1.5 - 3.0	0 - 4.25	4.25 - 5	0 - 3.75	3.57 - 5	0 - 3.5	3.5 - 4.25	4.25 - 5
	MTCA A Soil CUL	MTCA B Soil CUL											
Dibromomethane	NV	800000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Dichlorobromomethane	NV	16000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Dichlorodifluoromethane (CFC-12)	NV	16000000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Ethylbenzene	6000	8000000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
Ethylene Dibromide	5	500	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Methyl t-butyl ether	100	556000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Methylene Chloride	20	500000	--	--	--	--	14 UH	67 U	41 U	40 U	45 U	25 U	66 U
m, p-Xylene	NV	16000000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
n-Butylbenzene	NV	4000000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
n-Propylbenzene	NV	8000000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
o-Xylene	NV	16000000	--	--	--	--	0.96 UH	4.4 U*	2.7 U*	2.6 U*	3 U*	1.6 U	4.4 U*
p-Isopropyltoluene	NV	NV	--	--	--	--	**50**	**25 ***	5.5 U*	**70 ***	6 U*	3.3 U	**23 ***
sec-Butylbenzene	NV	8000000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
Styrene	NV	16000000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
tert-Butylbenzene	NV	8000000	--	--	--	--	1.9 UH	8.9 U*	5.5 U*	5.3 U*	6 U*	3.3 U	8.8 U*
Tetrachloroethene	50	480000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Toluene	7000	6400000	--	--	--	--	1.9 UH	8.9 U	5.5 U	**9.1**	6 U	3.3 U	8.8 U
trans-1,2-Dichloroethene	NV	1600000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
trans-1,3-Dichloropropene	NV	10000[c]	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Trichloroethene	30	12000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Trichlorofluoromethane (CFC-11)	NV	24000000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Vinyl Chloride	NV	240000	--	--	--	--	0.96 UH	4.4 U	2.7 U	2.6 U	3 U	1.6 U	4.4 U
Total Xylenes	--	--	--	--	--	--	--	--	--	--	--	--	--

Location:			SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
Sample Name:			DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
Collection Date:			April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
Collection Depth (ft bgs):			NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
Total Metals (mg/kg)											
Antimony	NV	3200	--	12 U	8.2 U	11 U	15 U	8.2 U	5.4 U	14 U	--
Arsenic	20	0.67	--	12 U	8.2 U	11 U	15 U	8.2 U	5.4 U	14 U	--
Cadmium	2	80	--	1.9 U	1.4 U	1.8 U	2.5 U	1.4 UL	0.89 U	2.4 U	--
Chromium	19/2000[a]	240/120000[a]	--	5 U	3.6 U	4.6 U	6.6 U	**11**	**3.5**	6.1 U	--
Copper	NV	3200	--	**12**	**5**	3.5 U	**5.7**	**35**	**8.3**	**5.2**	--
Lead	250	NV	--	5.8 U	4.1 U	5.3 U	7.6 U	**12**	2.7 U	7.1 U	--
Mercury	2	NV	--	0.073 U	0.053 U	0.054 U	0.061 U	0.049 U	**0.041**	0.068 U	--
Selenium	NV	400	--	19 U	14 U	18 U	25 U	14 U	8.9 U	24 U	--
Silver	NV	400	--	3.9 U	2.7 U	3.5 U	5 U	**7.1**	1.8 U	4.7 U	--
Zinc	NV	24000	--	**29**	**9.7**	**10**	**18**	**120**	**30**	**18**	--
PCBs (ug/kg)											
Aroclor 1016	NV	5600	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1221	NV	NV	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1232	NV	NV	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1242	NV	NV	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1248	NV	NV	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1254	NV	500	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1260	NV	500	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Aroclor 1268	NV	NV	--	--	--	--	--	--	--	--	--
Total PCBs	1000	500	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
SVOCs (ug/kg)											
1,2,4-Trichlorobenzene	NV	34000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	--	10 U*	--
1,2-Dichlorobenzene	NV	7200000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	--	5.2 U*	--
1,3-Dichlorobenzene	NV	NV	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	--	5.2 U*	--
1,4-Dichlorobenzene	NV	190000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	--	5.2 U*	--
1-Methylnaphthalene	NV	34000	--	280 U	210 U	230 U	340 U	100 U	140 U	300 U	--
2,4,5-Trichlorophenol	NV	8000000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2,4,6-Trichlorophenol	NV	80000	--	1400 U	1000 U	1100 U	1700 U	520 U	720 U	1500 U	--
2,4-Dichlorophenol	NV	240000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2,4-Dimethylphenol	NV	1600000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2,4-Dinitrophenol	NV	160000	--	9300 U	6900 U	7500 U	11000 U	3500 U	4800 U	9900 U	--
2,4-Dinitrotoluene	NV	3200	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2,6-Dinitrotoluene	NV	670	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2-Chloronaphthalene	NV	6400000	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
2-Chlorophenol	NV	400000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--

Table 7-2
Soil Analytical Results and Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

		Location:	SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
		Sample Name:	DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
		Collection Date:	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
2-Methylnaphthalene	NV	320000	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
2-Methylphenol	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2-Nitroaniline	NV	800000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
2-Nitrophenol	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
3,3-Dichlorobenzidine	NV	2200	--	1900 U	1400 U	1500 U	2200 U	690 U	950 U	2000 U	--
3,4-Methylphenol	NV	80000	--	1900 U	1400 U	1500 U	2200 U	690 U	950 U	2000 U	--
3-Nitroaniline	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4,6-Dinitro-2-methylphenol	NV	NV	--	9300 U	6900 U	7500 U	11000 U	3500 U	4800 U	9900 U	--
4-Bromophenylphenyl ether	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4-Chloro-3-methylphenol	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4-Chloroaniline	NV	5000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4-Chlorophenylphenyl ether	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4-Methylphenol	NV	NV	--	--	--	--	--	--	--	--	--
4-Nitroaniline	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
4-Nitrophenol	NV	NV	--	9300 U	6900 U	7500 U	11000 U	3500 U	4800 U	9900 U	--
Acenaphthene	NV	4800000	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
Acenaphthylene	NV	NV	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
Anthracene	NV	24000000	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
Benzo(a)anthracene	NV	1400	--	230 U	170 U	190 U	280 U	86 U	120 U	250 U	--
Benzo(a)pyrene	100	140	--	280 U	210 U	230 U	340 U	100 U	140 U	300 U	--
Benzo(b)fluoranthene	NV	1370	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
Benzo(ghi)perylene	NV	NV	--	230 U	170 U	190 U	280 U	86 U	120 U	250 U	--
Benzo(k)fluoranthene	NV	13700	--	230 U	170 U	190 U	280 U	86 U	120 U	250 U	--
Benzoic acid	NV	320000000	--	23000 U	17000 U	19000 U	28000 U	8600 U	12000 U	25000 U	--
Benzyl alcohol	NV	8000000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Bis(2-chloro-1-methylethyl)ether	NV	14000	--	1400 U	1000 U	1100 U	1700 U	520 U	720 U	1500 U	--
Bis(2-chloroethoxy)methane	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Bis(2-chloroethyl)ether	NV	910	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Bis(2-ethylhexyl)phthalate	NV	71000	--	14000 U	10000 U	11000 U	17000 U	5200 U	7200 U	15000 U	--
Butylbenzylphthalate	NV	530000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Carbazole	NV	NV	--	1400 U	1000 U	1100 U	1700 U	520 U	720 U	1500 U	--
Chrysene	NV	140000	--	230 U	170 U	190 U	280 U	86 U	120 U	250 U	--
Dibenzo(a,h)anthracene	NV	140	--	370 U	280 U	300 U	450 U	140 U	190 U	400 U	--
Dibenzofuran	NV	80000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Diethyl phthalate	NV	64000000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Dimethyl phthalate	NV	NV	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--

		Location:	SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
		Sample Name:	DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
		Collection Date:	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
Di-n-butyl phthalate	NV	8000000	--	1900 U	1400 U	1500 U	2200 U	690 U	950 U	2000 U	--
Di-n-octyl phthalate	NV	800000	--	1900 U	1400 U	1500 U	2200 U	690 U	950 U	2000 U	--
Fluoranthene	NV	3200000	--	190 U	140 U	150 U	220 U	69 U	**140**	200 U	--
Fluorene	NV	3200000	--	190 U	140 U	150 U	220 U	69 U	95 U	200 U	--
Hexachlorobenzene	NV	630	--	460 U	340 U	380 U	560 U	170 U	240 U	500 U	--
Hexachlorobutadiene	NV	13000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	--	5.2 U*	--
Hexachlorocyclopentadiene	NV	480000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Hexachloroethane	NV	25000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Indeno(1,2,3-cd)pyrene	NV	1400	--	370 U	280 U	300 U	450 U	140 U	190 U	400 U	--
Isophorone	NV	1100000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Naphthalene	5000	1600000	--	59 U*	19 U*	41 U	64 U*	16 U	25 U*	26 U*	--
Nitrobenzene	NV	160000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
N-Nitrosodiphenylamine	NV	200000	--	460 U	340 U	380 U	560 U	170 U	240 U	500 U	--
N-Nitrosodipropylamine	NV	140	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Pentachlorophenol	NV	2500	--	1900 U	1400 U	1500 U	2200 U	690 U	950 U	2000 U	--
Phenanthrene	NV	NV	--	190 U	140 U	150 U	220 U	69 U	**170**	200 U	--
Phenol	NV	24000000	--	930 U	690 U	750 U	1100 U	350 U	480 U	990 U	--
Pyrene	NV	2400000	--	190 U	140 U	150 U	220 U	69 U	**120**	200 U	--
Total Benzofluoranthenes	NV	1400[b]	--	--	--	--	--	--	--	--	--
cPAH TEQ	190[a]	NV	--	NC	NC	NC	NC	NC	NC	NC	--
Dioxins and Furans (pg/g)											
1,2,3,4,6,7,8-HpCDD	NV	NV	**600**	--	--	--	--	--	--	--	**55**
1,2,3,4,6,7,8-HpCDF	NV	NV	**32**	--	--	--	--	--	--	--	7.3 U
1,2,3,4,7,8,9-HpCDF	NV	NV	6.7 U	--	--	--	--	--	--	--	0.92 U
1,2,3,4,7,8-HxCDD	NV	NV	**4.4 J**	--	--	--	--	--	--	--	1.6 U
1,2,3,4,7,8-HxCDF	NV	NV	**4.6 J**	--	--	--	--	--	--	--	0.75 U
1,2,3,6,7,8-HxCDD	NV	NV	**19**	--	--	--	--	--	--	--	2.1 U
1,2,3,6,7,8-HxCDF	NV	NV	1.7 U	--	--	--	--	--	--	--	0.57 U
1,2,3,7,8,9-HxCDD	NV	NV	**7.8**	--	--	--	--	--	--	--	1.3 U
1,2,3,7,8,9-HxCDF	NV	NV	1.1 U	--	--	--	--	--	--	--	0.74 U
1,2,3,7,8-PeCDD	NV	NV	2.1 U	--	--	--	--	--	--	--	1 U
1,2,3,7,8-PeCDF	NV	NV	0.89 U	--	--	--	--	--	--	--	0.9 U
2,3,4,6,7,8-HxCDF	NV	NV	1.5 U	--	--	--	--	--	--	--	0.55 U
2,3,4,7,8-PeCDF	NV	NV	1.1 U	--	--	--	--	--	--	--	0.95 U
2,3,7,8-TCDD	NV	13	0.49 U	--	--	--	--	--	--	--	0.94 U
2,3,7,8-TCDF	NV	NV	1.5 U	--	--	--	--	--	--	--	1.9 U

		Location:	SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
		Sample Name:	DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
		Collection Date:	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
OCDD	NV	NV	**5900**	--	--	--	--	--	--	--	**570**
OCDF	NV	NV	**74**	--	--	--	--	--	--	--	**23 J**
Total HpCDDs	NV	NV	**1500**	--	--	--	--	--	--	--	**100**
Total HpCDFs	NV	NV	**110**	--	--	--	--	--	--	--	**16**
Total HxCDDs	NV	NV	**120**	--	--	--	--	--	--	--	4.6 U
Total HxCDFs	NV	NV	**73**	--	--	--	--	--	--	--	4.3 U
Total PeCDDs	NV	NV	2.1 U	--	--	--	--	--	--	--	1 U
Total PeCDFs	NV	NV	**7.5**	--	--	--	--	--	--	--	1.5 U
Total TCDDs	NV	NV	0.49 U	--	--	--	--	--	--	--	1.1 U
Total TCDFs	NV	NV	1.5 U	--	--	--	--	--	--	--	1.9 U
Dioxin TEQ	13	NV	**13**	--	--	--	--	--	--	--	**2.4**
TPH (mg/kg)											
Gasoline-range Hydrocarbons	30/100	NV	--	31 U	14 U	15 U	31 U	15 U	19 U	20 U	--
Diesel-range Hydrocarbons	2000	NV	--	220 U	180 U	180 U	260 U	85 U	**610 Y**	**320 Y**	--
Lube Oil-range Hydrocarbons	2000	NV	--	440 U	**1700**	**560**	530 U^	**220**	**2200**	**2300**	--
Pesticides (ug/kg)											
Aldrin	NV	59	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Alpha-BHC	NV	160	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Beta-BHC	NV	556	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Delta-BHC	NV	NV	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Lindane	10	910	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
cis-Chlordane	NV	NV	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Gamma-Chlordane	NV	NV	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Chlordane	NV	2900	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
4,4'-DDD	NV	4200	--	9 U^	6.8 U^	7.4 U^	11 U^	7 U^	4.9 U^	10 U^	--
4,4'-DDE	NV	2900	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
4,4'-DDT	3000	2900	--	9 U^	6.8 U^	7.4 U^	11 U^	7 U^	4.9 U^	10 U^	--
Total DDTs	NV	NV	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
Dieldrin	NV	63	--	9 U	6.8 U	7.4 U	11 U	7 U^	4.9 U	10 U	--
Endosulfan I	NV	480000	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Endosulfan II	NV	480000	--	9 U	6.8 U	7.4 U	11 U	7 U^	4.9 U	10 U	--
Endosulfan Sulfate	NV	NV	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
Endrin	NV	24000	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
Endrin Aldehyde	NV	NV	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
Endrin Ketone	NV	NV	--	9 U	6.8 U	7.4 U	11 U	7 U	4.9 U	10 U	--
Heptachlor	NV	220	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--

Table 7-2
Soil Analytical Results and Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

		Location:	SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
		Sample Name:	DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
		Collection Date:	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
Heptachlor Epoxide	NV	110	--	4.5 U	3.4 U	3.7 U	5.5 U	3.5 U	2.4 U	5 U	--
Methoxychlor	NV	400000	--	45 U	34 U	37 U	55 U	35 U	24 U	50 U	--
Toxaphene	NV	910	--	450 U^	340 U^	370 U	550 U^	350 U^	240 U	500 U	--
VOCs (ug/kg)											
1,1,1,2-Tetrachloroethane	NV	39000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
1,1,1-Trichloroethane	2000	160000000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,1,2,2-Tetrachloroethane	NV	5000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
1,1,2-Trichloroethane	NV	18000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,1-Dichloroethane	NV	180000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,1-Dichloroethene	NV	4000000	--	59 U	19 U	41 U	64 U	16 U	25 U	26 U	--
1,1-Dichloropropene	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,2,3-Trichlorobenzene	NV	NV	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
1,2,3-Trichloropropane	NV	33	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
1,2,4-Trimethylbenzene	NV	NV	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
1,2-Dibromo-3-chloropropane	NV	1250	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 UJ*	10 U*	--
1,2-Dichloroethane	NV	11000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,2-Dichloropropane	NV	28000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
1,3,5-Trimethylbenzene	NV	800000	--	59 U*	19 U*	41 U	64 U*	16 U	25 U*	26 U*	--
1,3-Dichloropropane	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
2,2-Dichloropropane	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
2-Chlorotoluene	NV	1600000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
4-Chlorotoluene	NV	NV	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
Benzene	30	18200	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Bromobenzene	NV	NV	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
Bromochloromethane	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Bromoform	NV	130000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
Bromomethane	NV	110000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Carbon Tetrachloride	NV	14000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Chlorobenzene	NV	1600000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
Chlorodibromomethane	NV	12000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Chloroethane	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Chloroform	NV	32000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Chloromethane	NV	NV	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
cis-1,2-Dichloroethene	NV	160000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
cis-1,3-Dichloropropene	NV	10000[c]	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Cumene	NV	800000	--	24 U*	**9.6 ***	17 U	26 U*	6.4 U	10 U*	**19 ***	--

Table 7-2
Soil Analytical Results and Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

		Location:	SB1, SB2, SB3	SB4		SB5		SB6			SB4, SB5, SB6
		Sample Name:	DNR-SB123B-COMP	DNR-SB4A	DNR-SB4B	DNR-SB5B	DNR-SB5A	DNR-SB6B	DNR-SB6A	DNR-SB6C	DNR-SB456B-COMP
		Collection Date:	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011	April-2011
		Collection Depth (ft bgs):	NA	0 - 2.7	2.75 - 5	0 - 4	4 - 5	0 - 1.5	1.5 - 3	3 - 5	NA
	MTCA A Soil CUL	MTCA B Soil CUL									
Dibromomethane	NV	800000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Dichlorobromomethane	NV	16000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Dichlorodifluoromethane (CFC-12)	NV	16000000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Ethylbenzene	6000	8000000	--	12 U*	7.6 *	8.3 U	13 U*	3.2 U	5 U*	**35 ***	--
Ethylene Dibromide	5	500	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Methyl t-butyl ether	100	556000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Methylene Chloride	20	500000	--	180 U	58 U	120 U	190 U	48 U	76 U	78 U	--
m, p-Xylene	NV	16000000	--	24 U*	**14 ***	17 U	26 U*	6.4 U	10 U*	**15 ***	--
n-Butylbenzene	NV	4000000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
n-Propylbenzene	NV	8000000	--	12 U*	3.9 U*	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
o-Xylene	NV	16000000	--	12 U*	**5 ***	8.3 U	13 U*	3.2 U	5 U*	5.2 U*	--
p-Isopropyltoluene	NV	NV	--	24 U*	**42 ***	17 U	26 U*	6.4 U	79 *	120 *	--
sec-Butylbenzene	NV	8000000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
Styrene	NV	16000000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
tert-Butylbenzene	NV	8000000	--	24 U*	7.8 U*	17 U	26 U*	6.4 U	10 U*	10 U*	--
Tetrachloroethene	50	480000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Toluene	7000	6400000	--	24 U	**68**	17 U	26 U	6.4 U	**11**	**19**	--
trans-1,2-Dichloroethene	NV	1600000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
trans-1,3-Dichloropropene	NV	10000[c]	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Trichloroethene	30	12000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Trichlorofluoromethane (CFC-11)	NV	24000000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Vinyl Chloride	NV	240000	--	12 U	3.9 U	8.3 U	13 U	3.2 U	5 U	5.2 U	--
Total Xylenes	--	--	--	-- ~~U~~	**19**	17 U	26 U	6.4 U	10 U	**15**	--

NOTES:

Detections are in **bold** font.

Results that exceed MTCA CULs are shaded except for arsenic and chromium because concentrations of these metals are below natural background conditions. Non-detect results are not evaluated against ~~cleanup levels~~ CULs.

-- = not analyzed.

^ = data qualifier as shown in 2011 SAIC Weyerhaeuser Aquatic Lands Lease Confirmatory Sampling Data Report. Data qualifier definition unavailable.

* = internal standard or LCS/LCSD exceeds control limits.

cPAH = carcinogenic PAHs.

CUL - cleanup level.

ft bgs = feet below ground surface.

J = result is an estimated value.

LCS = laboratory control sample.

LCSD = LCS duplicate.

mg/kg = milligrams per kilogram (parts per million).

MTCA = Model Toxics Control Act

MTCA A = MTCA Method A soil, unrestricted land use.

MTCA B = MTCA Method B soil, lower of available direct contact cancer or non-cancer value.

NC = not calculated due to significantly elevated reporting limits.

NV = no value.

PAH = polycyclic aromatic hydrocarbons.

PAH TEQ = PAH toxicity equivalence, based on benzo(a)pyrene.

PCBs = polychlorinated biphenyls.

pg/g = picograms per gram.

R = result is rejected.

SAIC = Science Applications International Corporation.

SVOCs = semivolatile organic compounds

TEQ = toxicity equivalence quotient.

TPH = total petroleum hydrocarbon.

U = result is non-detect.

ug/kg = micrograms per kilogram.

UH = the result is non-detect and was prepared or analyzed beyond the specified holding time.

UL = data qualifier as shown in 2011 SAIC Weyerhaeuser Aquatic Lands Lease Confirmatory Sampling Data Report. Data qualifier definition unavailable.

VOCs = volatile organic compounds.

Y = the chromatographic response resembles a typical fuel pattern (from a general Test America lab report qualifier definition page).

Z = data qualifier as shown in 2011 SAIC Weyerhaeuser Aquatic Lands Lease Confirmatory Sampling Data Report. Data qualifier definition unavailable.

[a]Value is for hexavalent chromium/trivalent chromium.

[b]Value is for benzo(b)fluoranthene.

[c]Value is for 1,3-dichloropropene.

[d]Value was updated from 100 ug/kg based on personal communication with the Washington Department of Ecology in 2019.

Table 7-3
Groundwater, Seep, and Stormwater Analytical Results and In-Water Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

Location:	Surface Water SLV[a]	SLV Source	CR-20	CR-21	CR-22	CR-23	SEEP-01	STORM-01
Sample Name:			CR20-GW-5.0	CR21-GW-10	CR22-GW-9.0	CR23-GW-6.0	Seep-01	Storm-01
Collection Date:			10/12/2015	10/12/2015	10/13/2015	10/13/2015	10/12/2015	1/12/2016
Collection Depth (well screen midpoint, ft bgs):			5.5	7.5	6.5	3.5	0	NA
Dissolved Metals (ug/L)								
Arsenic	150[b]	EPA AQ CCC	50 U	50 U	50 U	50 U	--	0.2 U
Cadmium	0.72[b]	EPA AQ CCC	2 U	2 U	2 U	2 U	--	0.1 U
Chromium	74[b,c]	EPA AQ CCC	5 U	5 U	5 U	5 U	--	**1**
Copper	11[b,d]	EPA AQ BLM[c]	--	--	--	--	--	0.5 U
Lead	3.2[b]	EPA AQ CCC	--	--	--	--	--	0.1 U
Mercury	0.77[b]	EPA AQ CCC	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Silver	26000	MTCA B SW	--	--	--	--	--	0.2 U
Zinc	17000	MTCA B SW	--	--	--	--	--	**37**
Total Metals (ug/L)								
Arsenic	0.018	EPA HH WO	50 U	50 U	50 U	50 U	--	**0.6**
Cadmium	41[e]	MTCA B SW	2 U	2 U	2 U	2 U	--	0.1 U
Chromium	240000[c]	MTCA B SW	5 U	**66**	**13**	**11**	--	**1.2**
Copper	1300	EPA HH WO	--	--	--	--	--	**4.3**
Lead	NV	NV	20 U	20 U	20 U	20 U	--	**2**
Mercury	NV	NV	0.1 U	**0.1**	**0.1**	0.1 U	0.1 U	**0.2**
Silver	3.2	EPA AQ CMC	--	--	--	--	--	0.2 U
Zinc	120	EPA AQ CCC/CMC	--	--	--	--	--	**60**
PCBs (ug/L)								
Aroclor 1016	0.0030	MTCA B SW	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1221	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1232	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1242	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1248	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1254	0.00010	MTCA B SW	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1260	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Aroclor 1268	NV	NV	1 U	1 U	1 U	1 U	1 U	1 U
Total PCBs	0.000064	EPA HH WO/O	1 U	1 U	1 U	1 U	1 U	1 U
SVOCs (ug/L)								
1,2,4-Trichlorobenzene	0.071	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
1,2-Dichlorobenzene	1000	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
1,3-Dichlorobenzene	7	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
1,4-Dichlorobenzene	300	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
1-Methylnaphthalene	NV	NV	1 U	1 U	**1.7**	**2**	1 U	--
2,4,5-Trichlorophenol	300	EPA HH WO	5 U	5 U	5 U	5 U	5 U	--
2,4,6-Trichlorophenol	1.5	EPA HH WO	3 U	3 U	3 U	3 U	3 U	--
2,4-Dichlorophenol	10	EPA HH WO	3 U	3 U	3 U	3 U	3 U	--
2,4-Dimethylphenol	100	EPA HH WO	3 U	3 U	3 U	3 U	3 U	3.3 U

Location:	Surface Water SLV[a]	SLV Source	CR-20	CR-21	CR-22	CR-23	SEEP-01	STORM-01
Sample Name:			CR20-GW-5.0	CR21-GW-10	CR22-GW-9.0	CR23-GW-6.0	Seep-01	Storm-01
Collection Date:			10/12/2015	10/12/2015	10/13/2015	10/13/2015	10/12/2015	1/12/2016
Collection Depth (well screen midpoint, ft bgs):			5.5	7.5	6.5	3.5	0	NA
2,4-Dinitrophenol	10	EPA HH WO	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	--
2,4-Dinitrotoluene	0.049	EPA HH WO	3 U	3 U	3 U	3 U	3 U	--
2,6-Dinitrotoluene	NV	NV	3 U	3 U	3 U	3 U	3 U	--
2-Chloronaphthalene	800	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
2-Chlorophenol	30	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
2-Methylnaphthalene	NV	NV	1 U	1 U	**1.7**	**2**	1 U	1.1 U
2-Methylphenol	NV	NV	1 U	1 U	1 U	1 U	1 U	1.1 U
2-Nitroaniline	NV	NV	3 U	3 U	3 U	3 U	3 U	--
2-Nitrophenol	NV	NV	3 U	3 U	3 U	3 U	3 U	--
3,3-Dichlorobenzidine	0.049	EPA HH WO	5 U	5 U	5 U	5 U	5 U	--
3-Nitroaniline	NV	NV	3 U	3 U	3 U	3 U	3 U	--
4,6-Dinitro-2-methylphenol	2	EPA HH WO	10 U	10 U	10 U	10 U	10 U	--
4-Bromophenylphenyl ether	NV	NV	1 U	1 U	1 U	1 U	1 U	--
4-Chloro-3-methylphenol	500	EPA HH WO	3 U	3 U	3 U	3 U	3 U	--
4-Chloroaniline	NV	NV	5 U	5 U	5 U	5 U	5 U	--
4-Chlorophenylphenyl ether	NV	NV	1 U	1 U	1 U	1 U	1 U	--
4-Methylphenol	NV	NV	2 U	2 U	2 U	**1.4 J**	2 U	2.2 U
4-Nitroaniline	NV	NV	3 U	3 U	3 U	3 U	3 U	--
4-Nitrophenol	NV	NV	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	--
Acenaphthene	70	EPA HH WO	1 U	1 U	**4.1**	**0.8 J**	1 U	1.1 U
Acenaphthylene	NV	NV	1 U	1 U	1 U	1 U	1 U	1.1 U
Anthracene	300	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Benzo(a)anthracene	0.0012	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Benzo(a)pyrene	0.00012	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Benzo(ghi)perylene	NV	NV	1 U	1 U	1 U	1 U	1 U	1.1 U
Benzoic acid	NV	NV	20 UJ	20 UJ	20 UJ	**14 J**	20 UJ	22 U
Benzyl alcohol	NV	NV	2 U	2 U	2 U	2 U	2 U	2.2 U
Bis(2-chloro-1-methylethyl)ether	200	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
Bis(2-chloroethoxy)methane	NV	NV	1 U	1 U	1 U	1 U	1 U	--
Bis(2-chloroethyl)ether	0.03	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
Bis(2-ethylhexyl)phthalate	0.32	EPA HH WO	3 U	3 U	3 U	3 U	3 U	3.3 U
Butylbenzylphthalate	0.10	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Carbazole	NV	NV	1 U	1 U	**0.7 J**	1 U	1 U	--
Chrysene	0.12	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Dibenzo(a,h)anthracene	0.00012	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Dibenzofuran	NV	NV	1 U	1 U	**1.4**	1 U	1 U	1.1 U
Diethyl phthalate	600	EPA HH WO/O	1 U	1 U	1 U	1 U	1 U	1.1 U
Dimethyl phthalate	2000	EPA HH WO/O	1 U	1 U	1 U	1 U	1 U	1.1 U
Di-n-butyl phthalate	20	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U

Table 7-3
Groundwater, Seep, and Stormwater Analytical Results and In-Water Screening Criteria
Seaport Landing Aquatic Land Lease
Aberdeen, Washington

Location:	Surface Water SLV[a]	SLV Source	CR-20	CR-21	CR-22	CR-23	SEEP-01	STORM-01
Sample Name:			CR20-GW-5.0	CR21-GW-10	CR22-GW-9.0	CR23-GW-6.0	Seep-01	Storm-01
Collection Date:			10/12/2015	10/12/2015	10/13/2015	10/13/2015	10/12/2015	1/12/2016
Collection Depth (well screen midpoint, ft bgs):			5.5	7.5	6.5	3.5	0	NA
Di-n-octyl phthalate	NV	NV	1 U	1 U	1 U	1 U	1 U	1.1 U
Fluoranthene	20	EPA HH WO/O	1 U	1 U	**0.7 J**	1 U	1 U	1.1 U
Fluorene	50	EPA HH WO	1 U	1 U	**2**	1 U	1 U	1.1 U
Hexachlorobenzene	0.000079	EPA HH WO/O	1 U	1 U	1 U	1 U	1 U	1.1 U
Hexachlorobutadiene	0.01	EPA HH WO/O	3 U	3 U	3 U	3 U	3 U	3.3 U
Hexachlorocyclopentadiene	4	EPA HH WO/O	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	--
Hexachloroethane	0.1	EPA HH WO/O	2 U	2 U	2 U	2 U	2 U	--
Indeno(1,2,3-cd)pyrene	0.0012	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Isophorone	34	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
Naphthalene	4700	MTCA B SW	1 U	1 U	**13**	**5.5**	1 U	1.1 U
Nitrobenzene	10	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
N-Nitrosodiphenylamine	3.3	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
N-Nitrosodipropylamine	0.005	EPA HH WO	1 U	1 U	1 U	1 U	1 U	--
Pentachlorophenol	0.03	EPA HH WO	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	11 U
Phenanthrene	NV	NV	1 U	1 U	**1.7**	**0.6 J**	1 U	1.1 U
Phenol	4000	EPA HH WO	1 U	1 U	1 U	1 U	1 U	1.1 U
Pyrene	20	EPA HH WO	1 U	1 U	**0.5 J**	1 U	1 U	1.1 U
Total Benzofluoranthenes	0.0012[e]	EPA HH WO	2 U	2 U	2 U	2 U	2 U	2.2 U
TPH (ug/L)								
Diesel-range Hydrocarbons	500	MTCA A GW	**1000**	**720**	**450**	**3400 J**	**220**	100 U
Lube Oil-range Hydrocarbons	500	MTCA A GW	**1600**	**3100**	**960**	**3200 J**	**330**	200 U
Dioxins/Furans (pg/L)								
Dioxin/Furan TEQ	0.005[f]	EPA HH WO	--	--	--	--	--	**7.25 J**

NOTES:

Detections are in **bold** font.

Results that exceed screening levels are shaded. Non-detect results are not evaluated against screening levels.

BLM = biotic ligand model.

CUL = cleanup level.

EPA AQ BLM = USEPA national recommended water quality criteria for freshwater aquatic life, biotic ligand model.

EPA AQ CCC = USEPA national recommended water quality criteria for freshwater aquatic life, criterion continuous concentration.

EPA AQ CCC/CMC = USEPA national recommended water quality criteria for freshwater aquatic life. The criterion continuous concentration and criterion maximum concentrations are equivalent.

EPA AQ CMC = USEPA national recommended water quality criteria for freshwater aquatic life, criterion maximum concentration.

EPA HH WO = USEPA national recommended water quality criteria for human health, consumption of water and organism.

EPA HH WO/O = USEPA national recommended water quality criteria for human health. The consumption of water and organism and consumption of water criteria are equivalent.

ft bgs = feet below ground surface.

J = result is an estimated value.

MTCA = Model Toxics Control Act.

MTCA A GW = MTCA Method A CUL for groundwater.

MTCA B SW = MTCA Method B, lower of available cancer or non-cancer CUL for surface water.

NA = not applicable.

NV = no value.

PCB = polychlorinated biphenyl.

pg/L = picogram per liter.

SLV = screening level value.

SVOC = semivolatile organic compound.

TEQ = toxicity equivalence quotient.

Total PCBs = sum of PCB Aroclors. The highest non-detect value is used when all constituents are non-detect.

TPH = total petroleum hydrocarbon.

U = result is non-detect at method reporting limit.

ug/L = micrograms per liter.

UJ = result is non-detect at or above method reporting limit. Reported value is estimated.

USEPA = U.S. Environmental Protection Agency.

[a]SLV is lower of available USEPA national recommended water quality criteria for freshwater aquatic life or human health. MTCA B SW CUL is provided when USEPA criteria are not available. MTCA A GW CUL provided for TPH.

[b]Freshwater criterion is expressed in terms of the dissolved metal in the water column.

[c]Value is for trivalent chromium.

[d]Freshwater chronic ambient water quality criteria generated using the BLM. Water quality parameters used as inputs to the BLM were measured by the Washington Department of Ecology in Longfellow Creek in 2012 and are reported here: https://fortress.wa.gov/ecy/publications/documents/1303041.pdf.

[e]Value is for MTCA B nonpotable surface water.

[e]Value is for benzo(b)fluoranthene, as a value for total benzofluoranthenes is not available.

[f]Value is for 2,3,7,8-TCDD.

APPENDIX E

OCTOBER 2019 GEOPHYSICAL SURVEY REPORT

PACIFIC GEOPHYSICS
Applied Geophysics

GEOPHYSICAL SURVEY REPORT

Underground Storage Tank Survey

Former Lumber Mill
500 N Custer Street,
Aberdeen, Washington

Project number: 190904
Survey Dates: October 22-25, 28-31, 2019

Prepared for:
Maul, Foster, and Alongi [MFA]

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Introduction

Pacific Geophysics conducted a geophysical survey at the Aberdeen Seaport property formerly owned by Weyerhaeuser and operated as a lumber mill. The survey was conducted to detect underground storage tanks (USTs), other metallic objects or anomalous areas, and utility corridors across the majority of the property. An additional goal was to clear several proposed borehole locations of underground obstructions across the site.

A magnetometer, hand-held metal detectors and ground penetrating radar (GPR) were used for the survey.

This report includes descriptions of the site and scope of work, methodology and results of the geophysical survey.

Site Description

The magnetic survey was conducted across the areas shown in Figure 1. The west and southwest asphalt lots (West), the south asphalt lot (South), and the asphalt areas around and east of the east building (East) now used as a truss-manufacturing facility. From personal communication with the manager of the truss-making facility, an auto wrecking/salvage facility occupied part of the site in the past.

Many metallic surface objects were seen across the site, including chain-link fences, piled building debris, a vehicle scale, poles, bollards, catch basins, and vaults. These features, including the buildings, interfered with the magnetic survey. Buried metallic objects of interest located near or under these objects may have been missed because of the magnetic noise produced by the surface objects.

No surface evidence of USTs, like fill ports and vent pipes, was seen in the areas covered with the magnetometer. During the clearance of one of the boreholes, a UST vent pipe and fuel pump piping were seen by the guard shack.

Scope of Work

The project included the following scopes:

- To detect possible underground storage tanks (USTs) and other metallic objects including underground infrastructure,
- To detect anomalous fill areas containing ferrous metal,
- To detect utility corridors,
- To clear several proposed borehole locations of buried obstructions for drilling.

Jeff Mann and Nikos Tzetos of Pacific Geophysics conducted the survey for Ms. Emily Hess of MFA in October 2019. This report was written by Nikos Tzetos, reviewed by Jeff Mann and emailed to Ms. Hess on November 11, 2019.

Geophysical Equipment and Survey Procedures

General Procedures:

A magnetometer is the first instrument used to investigate a site for subsurface ferrous metallic objects because it enables the operator to rapidly scan the subsurface. Data are collected across an accurately measured survey grid established on the site. For this particular survey, the magnetometer was coupled to a Juniper Systems Geode 2 sub-meter-accuracy GPS unit.

Upon completing the data acquisition phase of the survey, contour maps of the earth’s local magnetic field are produced. Small, handheld metal detectors are then used to more thoroughly investigate the magnetic anomalies detected with the magnetometer. These instruments are excellent at detecting and characterizing buried metal objects; however, they do not record data, and are not adequate to survey large areas.

Ground Penetrating Radar (GPR) is usually the last method used to investigate a site for buried metallic objects. The shape of radar reflections produced by buried objects may assist in the interpretation of magnetic anomalies. GPR is the only instrument capable of detecting disturbed-soil zones caused by excavations or UST pits.

Magnetic Survey:

At this site, a Geometrics G858 Portable Cesium Magnetometer was used to acquire the magnetic data. Magnetic data positions were accurately located with the Geode GPS. Traverses were made along survey lines spaced approximately every 5 feet; however, data were collected wherever the operator walked, for example, around piles of building material and small buildings. All data shown in the following figures are shown in the UTM coordinate system in feet.

Colored contour maps showing the earth’s local magnetic field at the time of the survey were created and printed in the field. Data were contoured and examined using a contour interval of 250 nT (nanoTesla). Magnetic anomalies higher in amplitude than the normal local magnetic background are shown in red, and are usually found over areas where ferrous objects are located below the sensor, carried at a height of about 3 feet. The objects may be surface objects such as manholes or other surface features, or buried objects of interest, such as USTs, drums, pipes and debris. Magnetic anomalies at or below the amplitude of the local magnetic field are shown in blue, and are caused by ferrous objects located above the sensor. Buildings, fences, metal posts, and cars, usually produce magnetic lows. Depending on their size and orientation, large buried objects may produce both positive (red) and negative (blue) anomalies.

Surface objects can produce significant magnetic interference that can conceal buried objects of interest. The metallic objects that produced significant magnetic interference at this site are noted above in the Site Description.

Hand-held instruments:

An Aquatronics A6 Tracer and a Schonstedt GA92XTd magnetic gradiometer were used to locate and investigate the anomalies detected by the magnetometer. These instruments can pinpoint the peaks and troughs of the anomalies, and in many cases determine if an object is linear (pipe or utility) or three-dimensional (UST).

The transmitter unit of a Radio Detection RD8000 PDL pipe and cable detector may be used to electrically charge an accessible metal pipe or utility. The charged object can then be "traced" using the receiver unit. The receiver can also detect some metallic features indirectly, using the system's "radio" function.

Ground Penetrating Radar:

Following the hand-held instrument survey, a GSSI SIR-2000 GPR system coupled to radar antennas of various frequencies may be used to investigate suspicious magnetic anomalies. Radar data collected across the anomalies may give clues to the size and shape of the buried metallic objects producing them. A GSSI 400-MHz antenna was used in this survey.

The collection of radar data is very time consuming; therefore, GPR is not a cost-effective method to blindly scan a site for buried metallic objects; however, it is one of the only methods capable of detecting non-metallic features, including PVC and clay pipes, septic tanks, drywells and trenches and excavations. GPR was used at this site to detect disturbed-soil zones and to clear boreholes.

Additional information regarding these instruments, methods, surveys and limitations with references can be found in the Appendix.

Results

West Areas (Figure 2):
Magnetic data produced with this survey are shown as filled and colored contours, contoured at an interval of 500 nT (nanoTesla).

Several magnetic anomalies were investigated. Most are interpreted to be caused by non-three-dimensional, or small 3D objects. Several pipes and concrete pads were detected. Anomaly A is caused by a concrete vault.

Two prominent groups of anomalies can be seen in Figure 2:

Anomalies labeled B are possibly caused by remnants of a building. Several pipes were detected within this footprint and are shown in the figure.

Anomalies labeled C were readily detected with the Schonstedt but did not with the Tracer, which is an unusual occurrence. It is possible that non-contiguous metallic debris (small, individual pieces of ferrous metal) is causing them. GPR traverses were made across the anomalies and an area with varying degrees of disturbance was detected.

At the time of the survey, a large puddle limited access to the southeast corner of this area, labeled on Figure 2 a puddle extent.

A conductive pipe was detected south of the swales. It extends from a vault to the east, up to the western property line (Figure 2). Several pipes trending mostly WSW-

ENE were detected in the area north of the swales. A known drain pipe between catch basins was detected and is shown in the figure. Also shown are pipes of unknown function between the concrete pads in the north of this survey area.

South Area (Figure 3):
This area appeared to be fairly clean. Most anomalies are interpreted to be caused by surface metal, pipes, concrete pads, or small objects. Anomalies marked D1 appear to be caused by ferrous debris. The characteristics of this zone are similar to anomalies C above. Only the Schonstedt and magnetometer responded to the ferrous metal comprising the zone. No response from the Tracer was detected across this anomaly. The anomaly extends farther to the east.

East Area, Lower Portion (Figure 4):
No anomalies caused by buried 3D objects were detected in this area. Anomalies D1 discussed above continue into D2. Anomalies D and E are interpreted to be caused by buried metallic debris.

Anomalies F, G, and H could only be detected with the Schonstedt hand-held magnetometer indicating they are caused by ferrous debris. No distinct objects or soil disturbances were seen in radar profiles. These anomalies are not caused by USTs. A metallic pipe, possibly a drain to the slough, was detected in this area (please see Figure 4).

Anomalies I are caused by surface objects and/or the building.

Several pipes are shown in Figures 3 and 4. They were detected during the borehole clearance process. A known storm pipe was detected between catch basins; it extends to the east toward the slough but it could not be determined if it drains in the slough. Other pipes trending in the same WSW-ENE direction were detected and are shown in the figures. One may be a water line. Two are extending toward the slough. It is unknown whether they exit the property at the slough.

East Area, Upper Portion (Figure 5):
A large metal structure on a concrete pad caused anomaly J. Two sets of large bollards/lumber stops caused a very large negative anomaly (K). Zones containing ferrous debris with the same characteristics as anomalies C, D1, D2, and E were detected in the south corner of this area (L) and at the south end of anomaly K. Several other anomalies were investigated and are caused by pipes and surface objects.

Borehole Clearance:
Fifty two proposed borehole locations were cleared using GPR and hand-held instruments across the entire property.

During the clearance of RAU5-01, a UST vent pipe and fuel pump piping were seen by the guard shack. The pipes were traced a few feet toward the west, to an asphalt patch located under a covered bulletin board. No metallic object was detected under the patch. This may be the former location of a fuel UST. A possible tank excavation was detected, whose edges coincided with a patch seen on the surface (asterisk, Figure 1).

Figure 6 is an overlay of the resulting magnetic maps on a base photo from Google Earth.

Conclusion

No USTs were detected with the magnetic survey across three areas at the former lumber mill. Most anomalies detected with the survey were caused by surface objects, piping and concrete pads.

Seven large areas containing ferrous debris were detected.

Fifty two borehole locations were cleared with hand-held detectors and GPR.

Limitations

The conclusions presented in this report were based upon widely accepted geophysical principles, methods and equipment. This survey was conducted with limited knowledge of the site, the site history and the subsurface conditions.

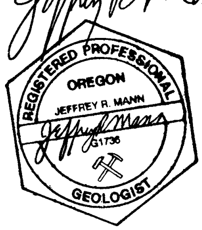
The goal of near-surface geophysics is to provide a rapid means of characterizing the subsurface using non-intrusive methods. Conclusions based upon these methods are generally reliable; however, due to the inherent ambiguity of the methods, no single interpretation of the data can be made. As an example, rocks and roots produce radar reflections that may appear the same as pipes and tanks.

Under reasonable site conditions, geophysical surveys are good at detecting changes in the subsurface caused by manmade objects or changes in subsurface conditions, but they are poor at identifying those objects or subsurface conditions.

Objects of interest are not always detectable due to surface and subsurface conditions. The deeper an object is buried, the more difficult it is to detect, and the less accurately it can be located.

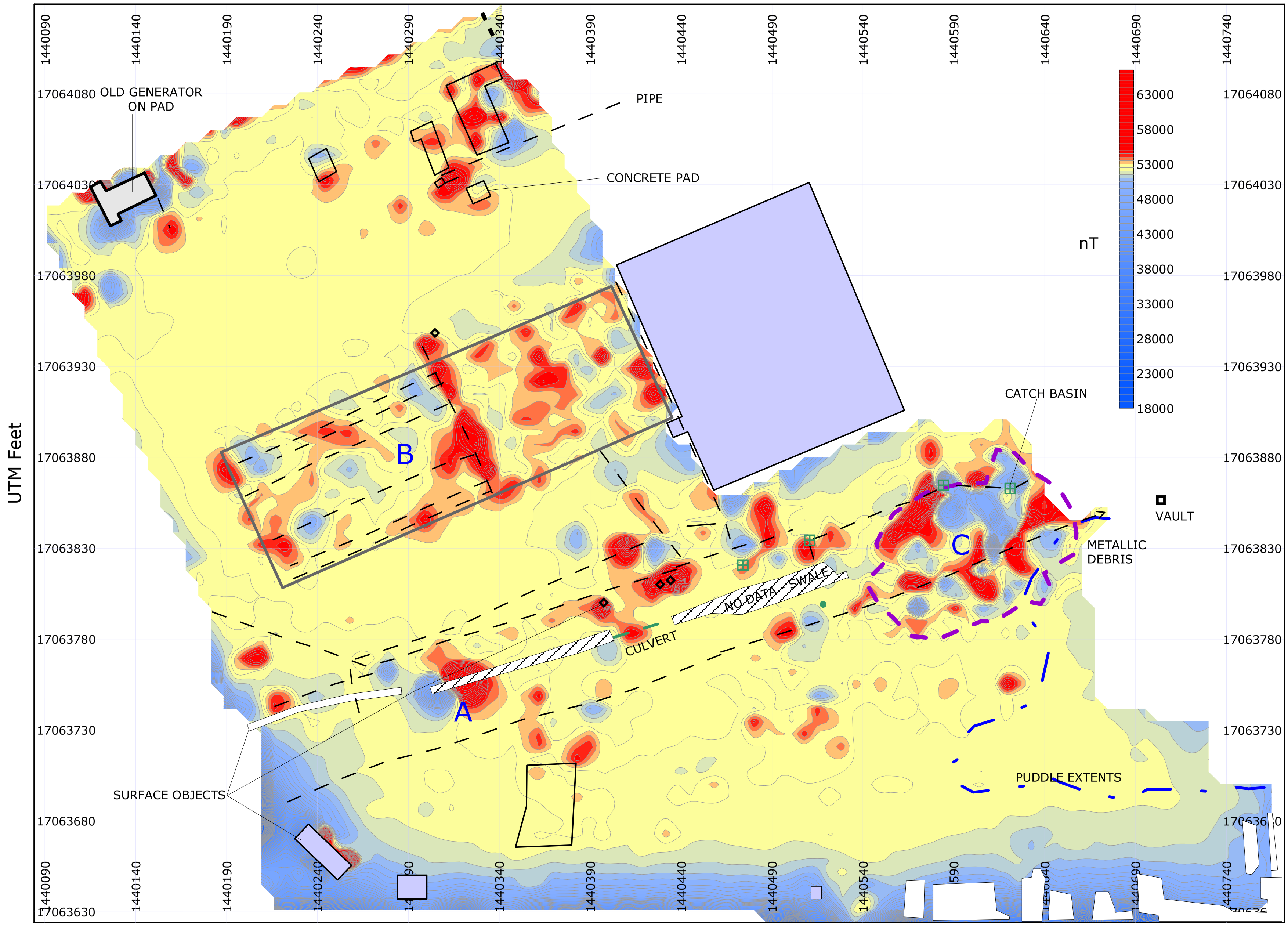
The only way to see an object is to physically expose it.

Jeff Mann — November 11, 2019
Pacific Geophysics



Nikos Tzetos — November 11, 2019
Pacific Geophysics

FIGURE	Site Aerial Photo and Survey Areas	
1	Project: 190904	Former Lumber Mill 500 N Custer Street, Aberdeen, Washington
	Drawn by : NT	Prepared for: Maul, Foster, and Alongi
		Base Photo from Google Earth Pro



Contour Interval: 500 nT

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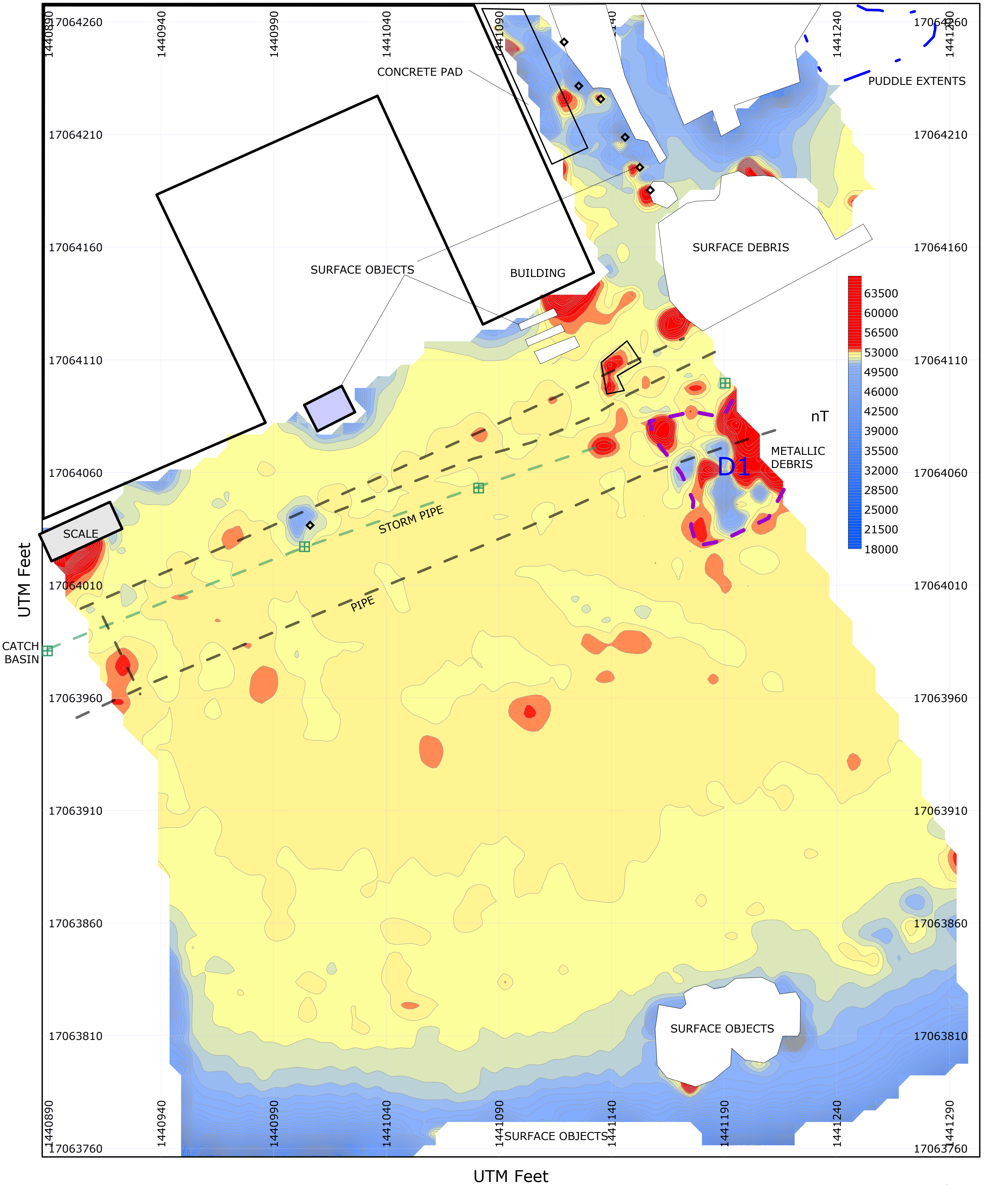
N

FIGURE	Magnetic Contour Map - West	
2	Project: 190904	Former Lumber Mill 500 N Custer Street, Aberdeen, Washington
	Drawn by : NT	Prepared for: Maul, Foster, and Alongi
		Survey Date: Oct. 22-25, 28-31, 2019



Contour Interval: 500 nT

PACIFIC GEOPHYSICS
Applied Geophysics

FIGURE 3

Magnetic Contour Map - South

Project: 190904	Former Lumber Mill 500 N Custer Street, Aberdeen, Washington
Drawn by : NT	Prepared for: Maul, Foster, and Alongi
	Survey Date: Oct. 22-25, 28-31, 2019

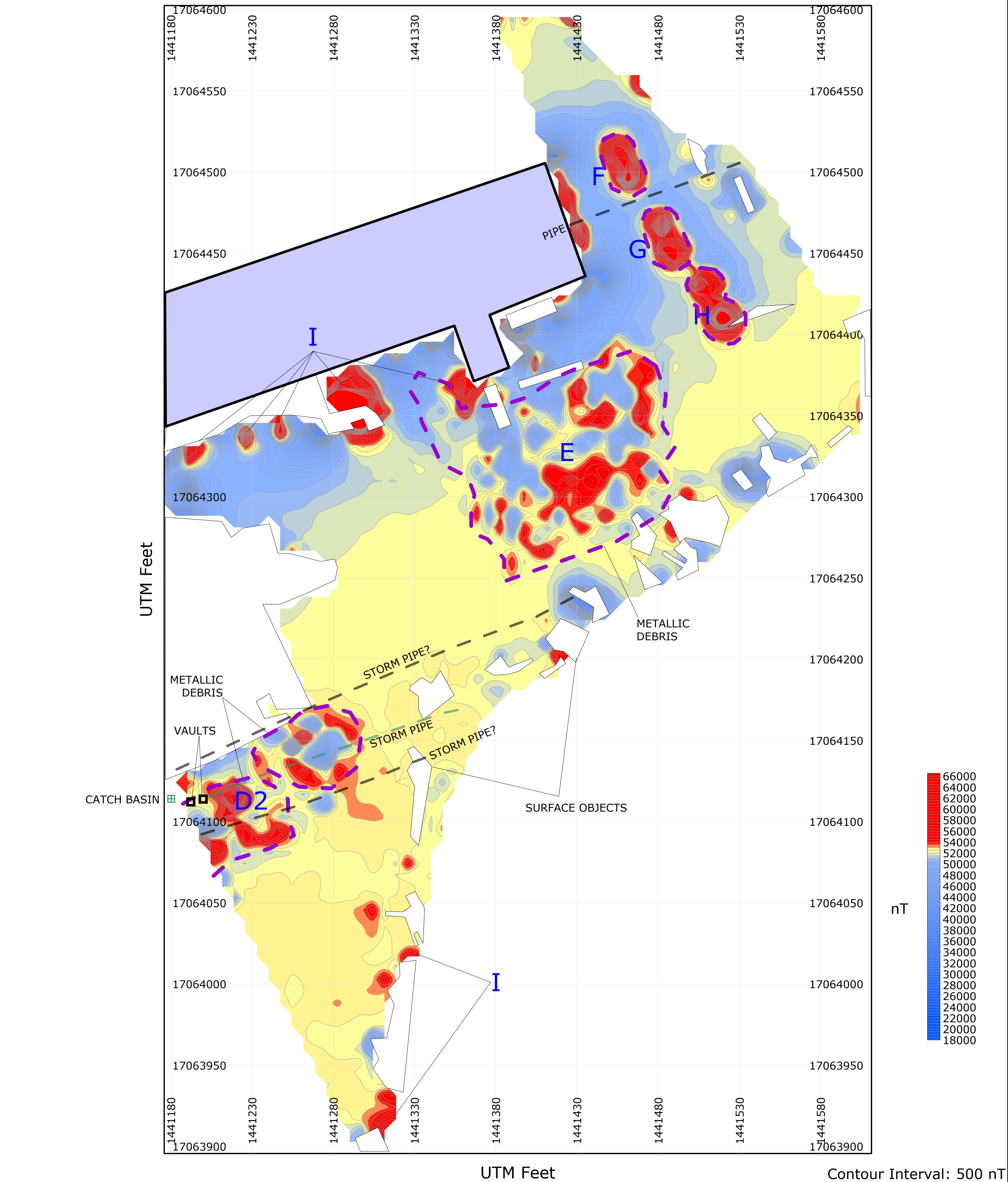


FIGURE 4

Magnetic Contour Map - East, Lower

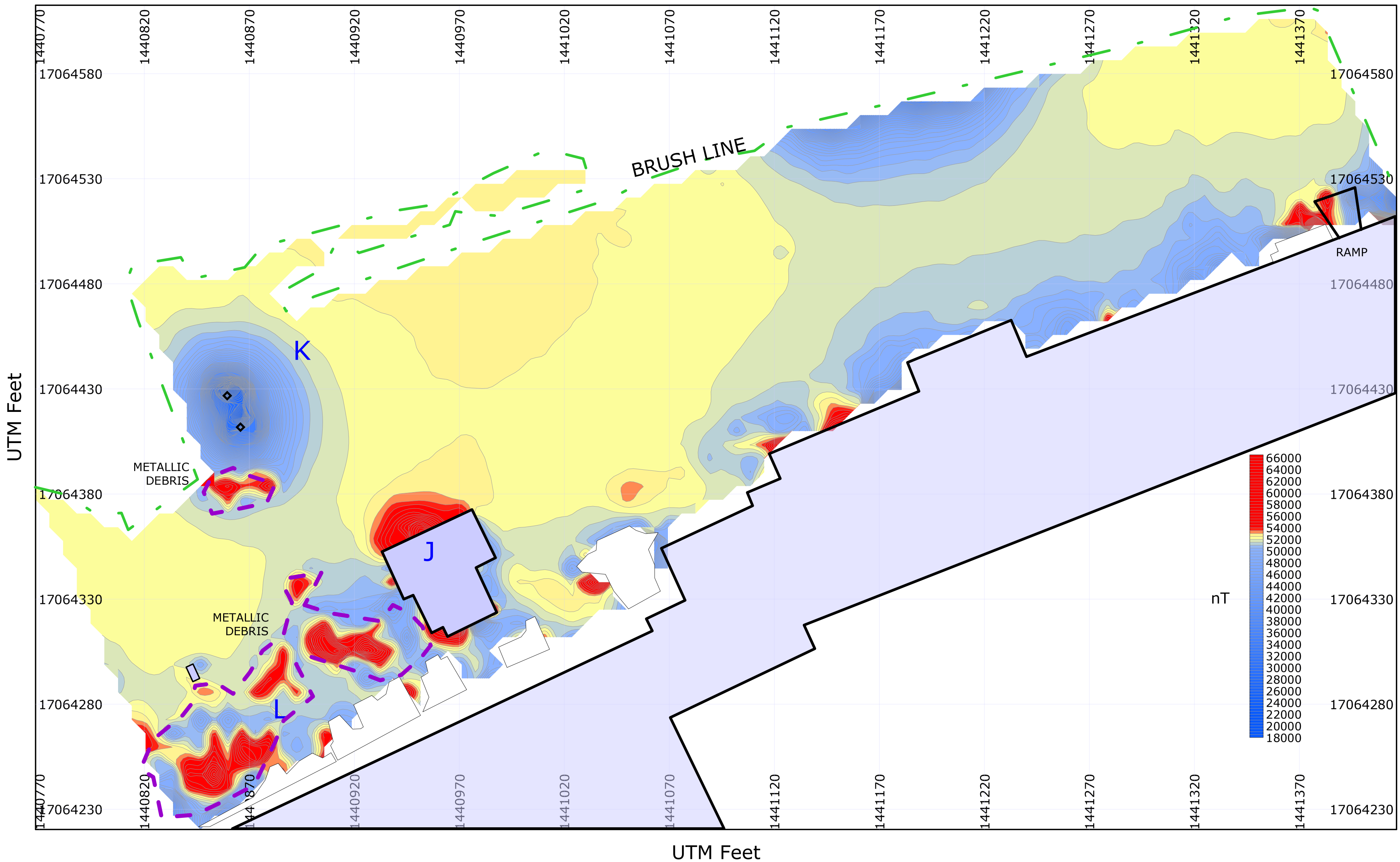
Project: 190904

Former Lumber Mill
500 N Custer Street,
Aberdeen, Washington

Drawn by : NT

Prepared for: Maul, Foster, and Alongi

Survey Date: Oct. 22-25, 28-31, 2019



Contour Interval: 500 nT

PACIFIC GEOPHYSICS Applied Geophysics

FIGURE	Magnetic Contour Map - East, Upper	
5	Project: 190904	Former Lumber Mill 500 N Custer Street, Aberdeen, Washington
	Drawn by : NT	Prepared for: Maul, Foster, and Alongi
		Survey Date: Oct. 22-25, 28-31, 2019

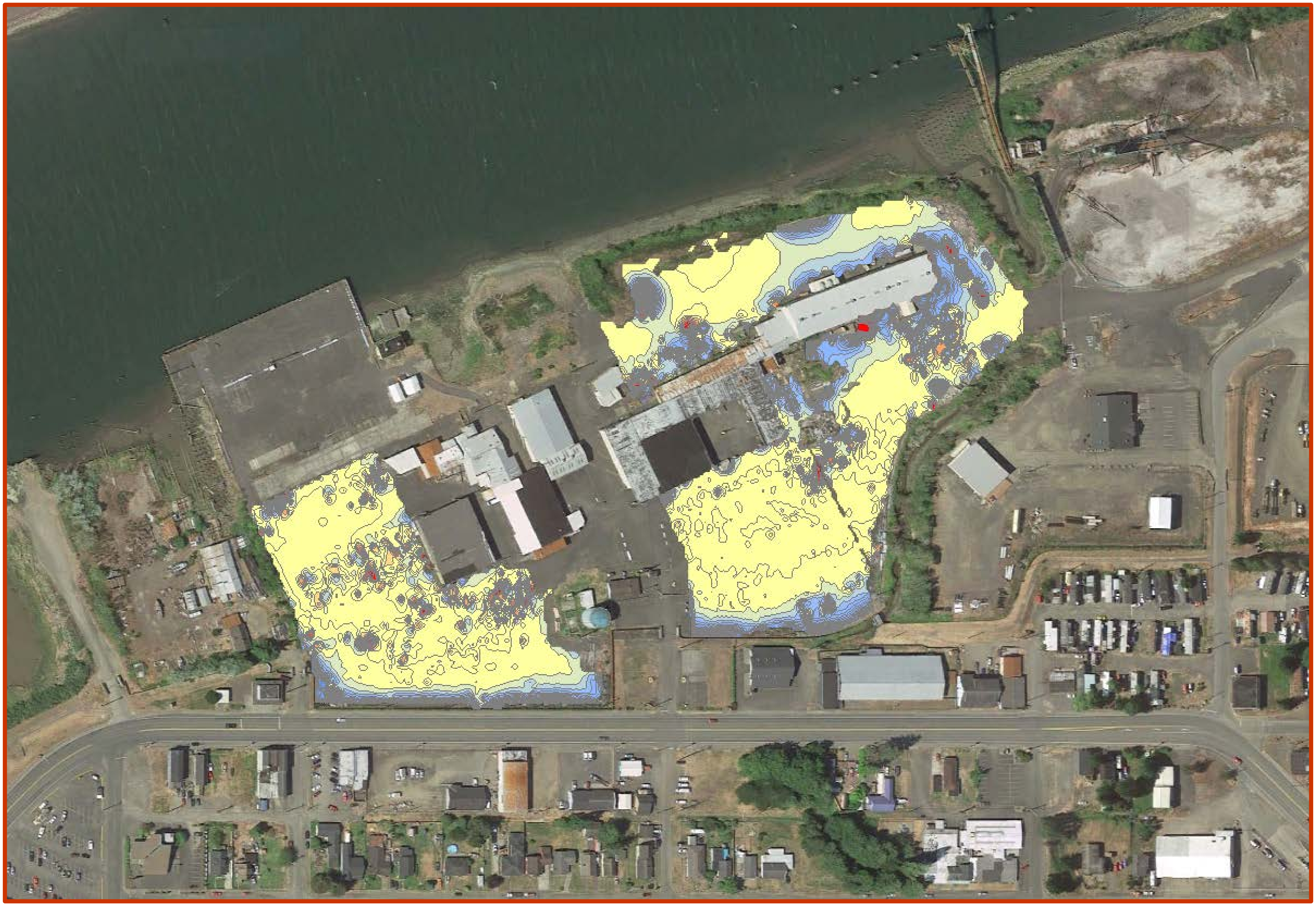


FIGURE	Magnetic-Contour Overlay	
6	Project: 190904	Former Lumber Mill 500 N Custer Street, Aberdeen, Washington
	Drawn by : NT	Prepared for: Maul, Foster, and Alongi
		Base Photo from Google Earth Pro

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Appendix A. Geophysical Survey Methods

Magnetometer Surveys

Small disturbances in the Earth's local magnetic field are called "magnetic anomalies". These may be caused by naturally occurring features such as metallic mineral ore bodies, or from manmade features such as metal buildings, vehicles, fences, and underground storage tanks. The magnetometer only detects changes produced by ferrous objects. Aluminum and brass are non-ferrous metals and cannot be detected using a magnetometer.

A magnetometer is an electronic instrument designed to detect small changes in the Earth's local magnetic field. Over the years different technologies have been used in magnetometers. The Geometrics G-858 Portable Cesium Magnetometer used to collect magnetic data for Pacific Geophysics uses one of the most recent methods to detect magnetic anomalies. A detailed discussion describing the method this unit uses is available at Geometrics.com.

This magnetometer enables the operator to collect data rapidly and continuously rather than the older instruments that collected data at discreet points only. The G-858 is carried by hand across the site. The sensor is carried at waist level. Typically individual data points collected at normal walking speed are about 6" apart along survey lines usually 5 feet apart, depending on the dimensions of the target objects.

It is critical to know the exact location of each data point so that if an anomaly is detected it can be accurately plotted on a magnetic contour map. At most small sites, data are collected along straight, parallel survey lines set up on the site before the data collection stage begins. For very large, complex sites, the G-858 can be connected to a Global Positioning System (GPS) antenna which allows the operator to collect accurately-located data without establishing a survey grid. With GPS, data are collected and positioned wherever the operator walks. A limitation using GPS is that the GPS antenna must have line of sight with the GPS satellites. Data can be mislocated if the GPS antenna is under trees or near tall buildings.

Data are stored in the unit's memory for later downloading and processing. A magnetic contour map of the data is plotted in the field. Geographical features are plotted on the map. Magnetic anomalies appearing to be caused by objects of interest are then investigated on the site using several small hand-held metal detectors. If an object appears to be a possible object of interest, it may be investigated with GPR.

Magnetic contour maps may be printed in color in order to highlight anomalies caused by ferrous objects located under the magnetic sensor. Usually, ferrous objects situated below the sensor produce magnetic "highs" and anomalies located above the sensor produce magnetic "lows". Magnetic highs are of interest to the operator since most objects of interest are located underground.

Depending on the orientation, shape and mass of a metallic object, a high/low pair of magnetic anomalies may be present. In the northern hemisphere the magnetic low is located north of the object and the magnetic high toward the south. The object producing the anomaly is located part way between the high and the low anomalies.

Magnetometer surveys have limitations. Magnetometers only detect objects made of ferrous (iron-containing) metal. Large ferrous objects (buildings, cars, fences, etc.) within several feet of the magnetometer create interference that may hide the anomaly produced by a nearby object of interest.

Ground Penetrating Radar

A Geophysical Survey Systems, Inc. (GSSI) SIR-2000 GPR system coupled to GSSI antennas of various central frequencies is used to obtain the radar data for our surveys.

GPR antennas both transmit and receive electromagnetic energy. EM energy is transmitted into the material the antenna passes over. A portion of that energy is reflected back to the antenna and amplified. Reflections are displayed in real-time in a continuous cross section. Reflections are produced where there is a sufficient electrical contrast between two materials. Changes in the electrical properties (namely the dielectric constant) that produce radar reflections are caused by changes in the moisture content, porosity, mineralogy, and texture of the material. Metallic objects of interest exhibit a strong electrical contrast with the surrounding material and thus produce relatively strong reflections. Non-metallic objects of interest (septic tanks, cesspools, dry wells, and PVC and clay tile pipes) are not always good reflectors.

Radar data are ambiguous. It can be difficult to distinguish the reflection produced by an object of interest from the reflection caused by some natural feature. Rocks or tree roots have reflections that appear similar to reflections from pipes. In concrete investigations reflections produced by metal rebar look exactly like those from electrical conduit or post-tension cables. Objects with too small an electrical contrast may produce no reflections at all and may be missed. Target objects buried below objects with contrasting properties that also produce reflections may be missed (e.g. USTs below roots, concrete pieces, pipes or rocks). If an object of interest like a UST is buried below the depth of penetration of the radar signal, it will be missed.

In addition to interpreting ambiguous data, radar has several limitations that cannot be controlled by the operator. The radar signal is severely attenuated by electrically conductive material, including wet, clay-rich soil and reinforced concrete. The quality of the data is affected by the surface conditions over which the antenna is pulled. Ideally the antenna should rest firmly on a smooth surface. Rough terrain and tall grass reduce the quality of radar data.

It is the job of an experienced interpreter to examine the GPR profiles and deduce if reflections are from objects of interest. A GPR interpreter cannot see underground, but can only interpret reflections based on experience.

The only way to truly identify an object is to excavate.

Hand-held Metal detectors

Two small, non-recording metal detectors are used to locate suspect magnetic anomalies detected using the G-858 Magnetometer in order to determine the likely cause of the anomaly. First, the magnetic contour map and a Schonstedt Magnetic Gradiometer are used to locate the center of the magnetic anomalies.

Once the anomaly is located an Aqua-Tronics Tracer is used to determine if the object producing the anomaly is a possible object of interest. Most anomalies are at least in part produced by features observed on the ground surface.

Schonstedt Magnetic Gradiometer: This magnetometer has two magnetic sensors separated vertically by 10”. The magnetic field surrounding a ferrous object is strongest near the object and decreases rapidly as the distance increases. If the magnitude measured by the sensor located in the tip of the Schonstedt is very high, and the magnetic field measured by the sensor located farther up the shaft of the Schonstedt is low, there is a large vertical magnetic gradient and the instrument responds with a loud whistle indicating the object is near the surface. If there is a small difference in the magnitudes measured by the two sensors, the object is deeper. The instrument responds with a softer tone. A discussion of this instrument is available at Schonstedt.com.

Aqua-Tronics A-6 Tracer: The Aqua-Tronics A-6 Tracer uses a different method of detecting metallic objects. This instrument measures the electrical conductivity of a metal object. It is capable of detecting any electrically conductive metal, including non-ferrous aluminum and brass. The Tracer is capable of detecting three-dimensional objects as well as pipes.

The Tracer consists of a transmitter coil and a receiver coil. In the absence of any electrically conductive material in the vicinity of the Tracer, the electromagnetic field around each coil is balanced.

Basically the electromagnetic field produced by the transmitter induces an electric current into the area surrounding the instrument. Nearby conductive objects distort the EM field. The balance between the two coils is disturbed and the instrument produces an audible tone and meter indication.

Radio Detection RD8000 PDL pipe and cable detector: This instrument may be used to detect buried, conductive pipes and utilities. It consists of a transmitter and a receiver and can be used in two configurations.

The transmitter may be used to directly apply a small electrical current to exposed, electrically conductive pipes and utilities. The RD receiver is then able to “trace” the underground portion of the pipe or utility, under some conditions for several hundred feet. The transmitter can also induce an electrical current into buried pipes and utilities where direct contact is not available.

The receiver can also be used alone. It has the capability to locate pipes and utilities by detecting the very small electrical currents induced into the features by nearby AM/FM radio stations.

The receiver also has an AC power function that may be used to detect underground power lines.

APPENDIX F

WATER LEVEL MEASUREMENT WORK PLAN

MAUL FOSTER ALONGI
109 East 13th Street | Vancouver, WA 98660 | 360 694 2691 | www.maulfoster.com

November 13, 2019
Project No. 1044.02.06

Tom Middleton, LHG
Washington Department of Ecology
Southwest Region – Toxics Cleanup Program
tmid461@ecy.wa.gov

Re: Work plan for water level measurement for groundwater/surface water interaction study on the Weyerhaeuser Sawmill Aberdeen/Seaport Landing Site

Dear Mr. Middleton,

On behalf of Grays Harbor Historical Seaport Authority (GHHSA), Maul Foster & Alongi, Inc. (MFA) has prepared this work plan describing procedures and specific locations for proposed manual and continuous water level measurements at monitoring wells and a staff gauge on the Seaport Landing property, formerly the Weyerhaeuser Sawmill Aberdeen, located at 500 North Custer Street in Aberdeen, Washington (the Site; see Figure 5-3 of the upland remedial investigation work plan [RI work plan]). This work plan is an Appendix of the RI work plan for the Site.

Water level data is needed to support the remedial investigation (RI) of the Site, required by Washington State Department of Ecology (Ecology) Agreed Order DE 15953, dated March 28, 2019. GHHSA seeks to collect continuous and manual groundwater elevation data from wells on the Site and the Chehalis River surface water elevation data to inform development of the RI hydrogeologic conceptual site model, following the U.S. Environmental Protection Agency's (USEPA) Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model.[1]

PROCEDURES

Manual Water Level Monitoring

GHHSA intends to collect manual depth to water measurements at the wells identified in the attached Table and Figure 5-3 of the RI work plan. Manual measurements will be collected approximately every 12 weeks to coincide with when data is downloaded from pressure transducers. The purpose of the manual monitoring is to compare the readings to those collected during the continuous monitoring.

[1] USEPA. 2011. Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model. Office of Superfund Remediation and Technology Innovation. Office of Solid Waste and Emergency Response (5102G). EPA 542-F-11-011. July.

Depth to groundwater will be measured with an electronic well sounding (water level) probe. The unit of measurement on the probe measuring tape is decimal feet with tic marks corresponding to 1-, 0.1-, and 0.01-foot increments. This probe is capable of sensing depth from the top of the well casing to the nearest 0.01 foot.

The following procedures will be followed at the time measurements will be taken:

1. Prior to measurements being taken, all wells will be checked for security damage or evidence of tampering and record pertinent observations. Note any maintenance tasks that should be completed, such as well cap or padlock replacement.

2. Unlock and remove the cap from the well casing. If the well cap was tightly sealed, after removing the well cap, allow the pressure to equalize. Whenever possible, multiple wells will be opened and returned to in order of cap removal to allow additional time to equilibrate. Water level measurements will be taken 1 minute apart until three consecutive readings are within 0.02 feet. Proximity to the Chehalis River and tidal effects will be considered when making a determination that the water level has reached static level. Water levels may change with the rise or fall of the tide preventing water levels from stabilizing within 0.02 feet. If water level is not stabilizing but is rising or falling at a steady rate consistent with the rise or ebb of the tide, the water level and time of measurement will be recorded and noted potential for tidal influence.

3. The water level probe sensor head will be lowered into the well opening until an auditory or visual signal is obtained. The sensor will be slightly raised and lowered to determine the strongest signal, indicating the top of the water level surface in the well casing.

4. Water depth measurements will be read from the probe measuring tape at the point on the tape corresponding to the surveyed measure point at the top of the well casing and recorded in the site-specific field form or logbook to the nearest 0.01 foot. The recorded depth will be subtracted from the elevation of the surveyed measure point elevation to calculate the elevation of the water surface at the well. The date and time of measurement and any additional information such as odor, sheen, or non-aqueous phase liquid (NAPL) presence on the water level probe or interface probe will be recorded.

5. After the measurements have been taken, the exposed tape and water level or interface probe sensor head will be decontaminated prior to rolling it onto the equipment reel as described below.

6. Dispose of personal protective equipment and decontamination materials as solid waste.

Continuous Water Level Monitoring

VanEssen Instruments CTD-Diver model non-vented pressure transducers will be placed in the wells identified in the attached Table and Figure 5-3 of the RI work plan. The CTD-Diver is equipped with a four-electrode conductivity sensor that measures electrical conductivity as well as measuring and recording pressure and temperature (see Attachment for technical specifications of the transducers). Well access for continuous water level monitoring will proceed as described above in steps 1 and 2 for manual water level monitoring. Each transducer will be decontaminated (as described below) and inspected to ensure the instrument is in working order prior to deployment. Upon deployment in each monitoring well, a manual water level measurement will be taken according to the procedures described above, and the transducers will be set to record groundwater levels to the nearest 0.01 feet at 15-minute intervals. Manual depth-to-water measurements will be collected: (1) from the monitoring well before installing the pressure transducer; (2) during the deployment period when the data is downloaded; and (3) at the completion of the transducer deployment period to check transducer calibration. The data will be periodically (approximately every 12 weeks) downloaded from the transducers.

In addition, a pressure transducer and staff gauge will be installed within the Chehalis River to provide surface water elevation and conductivity measurements adjacent to the Site.

Decontamination

Before and after use, the water level probe, transducer instruments, and suspension cables will be decontaminated as follows:
Decontamination of non-disposable equipment is performed at sites where environmental contamination is known or suspected. This is done to minimize the potential for cross-contamination between sampling locations (potentially resulting in unrepresentative samples and/or causing the spread of contamination) and to protect human health and safety.

Sampling equipment (e.g., water level meter, transducers, etc.) will be decontaminated as follows:

1. Soap wash (dilute solution of Alconox or equivalent in distilled water solution)
2. Distilled water rinse

Materials generated during decontamination procedures will be disposed of a solid waste.

SCHEDULE

In order to collect groundwater and surface water elevation data to understand seasonal variation and influence between the upland in and in-water systems at the Site, transducers will be installed for approximately 12 months. The deployment dates have not been determined at this time pending Ecology approval of this RI work plan. GHHSA intends to collect manual depth to water level measurements during the transducer deployment periods as described above.

Please contact us if you have any questions.

Sincerely,

Maul Foster & Alongi, Inc.

Emily Hess

Emily Hess, LG
Project Geologist

Kyle Roslund, LG
Senior Geologist

Attachments: Table—Proposed Water Level Elevation Monitoring Locations
Technical Specifications for VanEssen CTD-Diver

TABLE

PROPOSED WATER LEVEL ELEVATION
MONITORING LOCATIONS

MAUL FOSTER ALONGI

Table
Proposed Water Level Elevation Monitoring Locations
Grays Harbor Historical Seaport Authority
Aberdeen, Washington

Well	Proposed Monitoring Method
D-01	Manual
D-02	Manual and Transducer
D-03	Manual and Transducer
D-04E	Manual and Transducer
D-05	Manual
D-06	Manual
D-07	Manual
D-08	Manual
D-09	Manual and Transducer
RAU4-UNK	Manual and Transducer
RAU2-08 (Proposed)	Manual and Transducer
RAU2-09 (Proposed)	Manual and Transducer
RAU3-03 (Proposed)	Manual and Transducer
RAU4-03 (Proposed)	Manual and Transducer
RAU6-02 (Proposed)	Manual and Transducer

ATTACHMENT

TECHNICAL SPECIFICATIONS FOR VANESSEN CTD-DIVER

CTD-Diver

3 Parameters in 1 Housing

Where there is a need to monitor groundwater levels and saltwater intrusion, injected wastewater, or contamination from chemical discharges and landfill sites, the CTD-Diver with its rugged, corrosion proof ceramic housing, is the instrument of choice.

The CTD-Diver is equipped with a four-electrode conductivity sensor that measures electrical conductivity from 0 to 120 mS/cm. There are two options for measuring conductivity: true or specific conductivity at 77 °F. Additionally, pressure and temperature are measured and recorded.

Technical Specification

Length	5.3 inch
Diameter	0.87 inch
Weight	3.4 ounce
Memory	48,000 measurements
Wetted parts	
housing	ceramic (ZrO_2)
o-rings	Viton ®
pressure sensor	piezoresistive ceramic
cap / nose cone	Nylon PA6 30% glass fiber
Battery life	10 years (dependant on usage)
Sample interval	1 second to 99 hours
Sample methods	fixed, event dependent, averaging, and pumping test

Temperature

Range	-4 to 176	°F
Calibrated	32 to 122	°F
Accuracy+	± 0.18	°F
Resolution	0.018	°F

Conductivity

Range 1	0 to 120	mS/cm
Range 2	0 to 30	mS/cm
Accuracy+	± 1%	of reading
Resolution	0.1%	of reading

Pressure

Part number	DI 271	DI 272	DI 273	
Range	33	164	328	ftH_2O
Accuracy+	± 0.2	± 1.0	± 2.0	inH_2O
Resolution	0.08	0.40	0.79	inH_2O

+typical accuracy

- Mine tailings
- Pollution monitoring
- Water quality monitoring