Seaport Landing Site
Targeted Brownfields Assessment
Aberdeen, Washington

Technical Direction Document: 17-01-0004

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List of Abbreviations and Acronyms

Term	**Definition**
°C	degrees Celsius
µg/L	micrograms per liter
AST	Aboveground Storage Tanks
bgs	below ground surface
CLP	Contract Laboratory Program
COE	Corps of Engineers
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbons
CRQL	Contract Required Quantitation Limit
DCA	1,1-Dichloroethane
E & E	Ecology and Environment, Inc.
Ecology	Washington Department of Ecology
EMI	Electromagnetic Induction
EPA	United States Environmental Protection Agency
ESA	Level I Environmental Site Assessment
GCL	Groundwater Cleanup Level
GHHSA	Grays Harbor Historical Seaport Authority
GPS	Global Positioning System
GRP	Ground-penetrating Radar
IDW	Investigation-Derived Waste
IRA	Independent Remedial Action
MFA	Maul, Foster, & Alongi, Inc.
mg/kg	Milligrams per kilogram
MRL	Method Reporting Limit
MTCA	Washington State Model Toxics Control Act
MTCA A	Washington State Model Toxics Control Act Method A
MTCA B	Washington State Model Toxics Control Act Method B
MTCA C	Washington State Model Toxics Control Act Method C
NaOH	Sodium Hydroxide
NFA	No Further Action
NTU	Nephelometric Turbidity Unit
NWTPH-Dx	Northwest Total Petroleum Hydrocarbon Diesel Extended
PA	Preliminary Assessment
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls

List of Abbreviations and Acronyms (cont.)

Term	Definition
PCP	Pentachlorophenol
PES	PES Environmental, Inc.
PID	Photoionization Detector
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RAU	Remedial Action Unit
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
redox	Oxidation and Reduction
SCL	Soil Cleanup Levels
SHPO	State Historic Preservation Officer
SIM	Select Ion Monitoring
SQAP	Sampling and Quality Assurance Plan
SQS	Sediment Quality Standards
START	Superfund Technical Assessment and Response Team
SVOCs	Semivolatile Organic Compounds
SWCL	Surface Water Cleanup Level
TAL	Target Analyte List
TBA	Targeted Brownfields Assessment
TCA	1,1,1-Trichloroethane
TEFs	Toxicity Equivalent Factors
TEQ	Toxicity Equivalent Quotient
TM	Task Monitor
TPH	Total Petroleum Hydrocarbon
TPH-Dx	Diesel to Heavy Oil Range TPH
USACE	United States Army Corps of Engineers
UST	Underground Storage Tank
VI	Vapor Intrusion
VOCs	Volatile Organic Compound
WAC	Washington Administrative Code

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Introduction

Pursuant to the United States Environmental Protection Agency (EPA) Region 10 Superfund Technical Assessment and Response Team (START) Contract EP-S7-13-07 and Technical Direction Document Number 17-01-0004, Ecology and Environment, Inc. (E & E) performed a Targeted Brownfields Assessment (TBA) at the Seaport Landing site in Aberdeen, Washington. The EPA's Brownfields Economic Redevelopment Initiative is designed to empower states, cities, tribes, communities, and other stakeholders in economic redevelopment to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields sites (EPA 2002).

In November of 2016, the Grays Harbor Historical Seaport Authority (GHHSA) submitted a TBA request to the EPA. This request asked for sampling activities to identify the types and concentration of contaminants in the upland area of the property. The assessment would support planning for remedial actions and site improvements needed to support development of an education/interpretive center and various tourist attractions at the Seaport Landing site. The EPA approved this request, and START began work in late January of 2017.

The purpose of this project was to provide the GHHSA with an assessment to further define the extent of contamination that had been identified on the site. Work proceeded in coordination with stakeholders, including GHHSA; GHHSA's consultant, Maul, Foster, & Alongi, Inc. (MFA); the Washington Department of Ecology (Ecology); and the Quinault Tribe. As per the TBA request, this effort focused exclusively on the upland area of the site, and more specifically was limited to the area generally south of the inner harbor line.

This assessment involved sampling surface soil, subsurface soil, and groundwater related to specific areas of concern within the study area. While the potential need for subslab soil vapor and indoor air sampling and testing was identified in early project planning phases, as a result of sampling and testing performed by MFA, this soil vapor sampling was removed from the scope of the TBA. At each step of the TBA process, the EPA sought input and concurrence with stakeholders.

The objective of this TBA report is to present the results of the site sampling undertaken for site characterization purposes. This report is organized as follows:

- **Section 1 (Introduction):** Authority for performance of this work and summary of report contents.
- **Section 2 (Site Background):** Description of site conditions, history, and site concerns.

- **Section 3 (Recognized Environmental Conditions and Remedial Action Units):** Description of recognized environmental conditions (RECs) and remedial action units (RAUs) investigated for this TBA.
- **Section 4 (Regulatory Standards, Analytical Methods, and Field Investigation Methods):** Discussion of the regulatory standards applied to analytical results, sampling techniques employed, and the field effort approach.
- **Section 5 (RAU Investigations, Findings, and Follow-On Assessment Recommendations):** Discussion of site conditions, chemical concentrations that exceed regulatory criteria values, findings based on these exceedances, and recommended follow-on assessment strategies.
- **Section 6 (Site Summary and Conclusions):** Summary of TBA findings and related regulatory approaches.
- **Section 7 (References):** List of references cited throughout the text.

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Site Background

The following sections describe the site location and background, site history, general environmental setting, historical property use, previous investigations, future uses of the property, and the START site visit.

2.1 Site Description

Site Name	Seaport Landing
Site Address	500 N. Custer Street, Aberdeen, WA 98520
Latitude/Longitude	46.973031° North, -123.798486° West
Reference Point for Coordinates	Center of Site
Horizontal Collection Method	Google Earth
Horizontal Reference Datum	World Geodetic System 1984
Legal Description	Township 17 North, Sections 9 and 10, Range 9 West of Willamette Base Meridian
Parcel Number	029901100501, 029901100100, and 027401900000
Size (in acres)	80
Site Owner	Grays Harbor Historical Seaport Authority P.O. Box 2019 Aberdeen, WA 98520

2.2 Site Summary

The Seaport Landing site is a former lumber mill located in Aberdeen, Washington (see Figures 2-1 and 2-2). In total, the mill property included approximately 80 acres of land. In 2013, the GHHSA acquired portions of the site, including 24 acres of upland property, and assumed a sublease from the Washington Department of Natural Resources for the 14 acres of overwater property that had been leased by Weyerhaeuser Company from the State of Washington. Weyerhaeuser Company retained ownership of the balance of the mill site, including the former log storage area east of the Seaport Landing site.

The GHHSA-acquired property includes the majority of the structures located on the upland portion of the lumber mill site, consisting of the former Main Shipping Shed, two smaller log mills, a Maintenance Shop, larger storage shed, the former Planer/Grader Building, and multiple smaller office-type buildings. Surrounding properties include the former log storage area to the east, a former commercial boatyard to the west, and residential and commercial land use to the south. The Chehalis River is situated north of the site. West Curtis Street is located along the southern property boundary, providing roadway access to the site.

The portions of the site targeted for TBA-related sampling are generally near the center of the GHHSA-owned land area, including the area of the former maintenance building, repair shops, and the Planer/Grader Building, where anti-sap stain treatment had occurred (see Figures 2-2 and 2-3). As discussed in greater detail in Section 2.6, the site has been the subject of numerous environmental investigations that have identified multiple areas of contamination. This includes tideland sediments impacted by mercury, polychlorinated biphenyls (PCBs), phenol, benzoic acid, semi-volatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPHs), and soil and groundwater impacted by pentachlorophenol (PCP), TPH, chromium, lead, and SVOCs (including polycyclic aromatic hydrocarbons [PAHs]).

2.3 Site Ownership

The property has been owned/occupied by a variety of sawmills and companies. Based on an 1890 site map, the earliest of these was Aberdeen Lumber. Later owners/occupants included the Schafer Brothers Lumber and Door Co. Mill #4, Simpson Timber Company, and most recently, Weyerhaeuser Company. GHHSA acquired the site in 2013 with plans to convert the site to a mixed-use, working waterfront that includes docks, education centers, and a variety of tourism-related developments (GHHSA n.d.).

2.4 Environmental Setting

The Seaport Landing site is located in the alluvial meander plain of the Chehalis River in the northwestern margins of the Willapa Hills physiographic region of southwest Washington (MFA 2017). The topography of the Willapa Hills is generally characterized by gentle rolling hills, with straight moderate slopes descending to wide valley floors exemplified by the Chehalis River valley floor (Ecology 1998).

Variable thicknesses of alluvium, composed of river-deposited clays, silts, sands, and gravels, fills the floodplains, alluvial fans, and low river terraces of the Chehalis River valley (Ecology 1998). The thicknesses of the alluvial deposits can be greater than 100 feet near the ocean because of valley filling, which occurred as sea levels rose at the end of the most recent ice age, decreasing the ability of the river to transport sediments downstream. Well logs from resource protection wells in the vicinity of the site indicate that alluvium in the area is at least 60 feet thick and consists of clayey silts, silts, and sands. Logs from borings located along State Highway 12 to the north indicate that bedrock below the alluvium is silt/sandstone (PES 2010; MFA 2016a).

Past environmental investigations at the site indicate that subsurface soil consists generally of fill material composed of silts ranging from approximately 3 to 10 feet below ground surface (bgs) in the area of the Planer/Grader Building and Maintenance Shop. In places, these silts are overlain by wood debris, cobble to boulder gravel, and sand. The materials overlying the silts are inferred to be fill material. At depth, woody debris, gravels, and sands were typically logged to 10 feet bgs (PES 2010). Subsurface investigations conducted by MFA reached up to 25 feet bgs, encountering similar materials, namely sand, silt, gravel, and wood debris (MFA 2016a, 2017).

During drilling conducted for this TBA, the subsurface materials that were encountered were similar to what has been noted by others, and included sand, silt and gravel. Wood debris was encountered in many of the borings, beginning at 4 to 6 feet bgs. A fine silt/clay was also encountered in two borings on the south end of the study area (NA01 and PW02), that appeared to be consistent with historic river sediment. Groundwater was encountered between approximately 4 and 6 feet bgs.

Based on water table measurements from previous environmental investigations, groundwater flow in the area is generally to the northwest; however, flow direction and gradient may be tidally affected. Cross sections from a 1951 map of the site provided by Weyerhaeuser Company indicate that much of the area of the main mill facilities was tideland prior to, and during, the early development of the site in the late 1800s and early 1900s. Most of the early structures were constructed on wood-piling support platforms (PES 2010).

2.5 Historical Property Use

The Seaport Landing site historically operated as a lumber mill. The mill structures were originally configured to produce shingles and slats for housing construction. Mill tooling and capabilities were modified during World War II to facilitate on-site ship keel manufacturing (PES 2010). By 1948, a log debarker and planer were added, and production of dimensional lumber began (EMCON 1997). When milling operations began, lumber was rafted to the site on the Chehalis River and stored adjacent to the site, secured to the pilings along the mill shoreline. In the mid-1960s, as the tideland areas were filled, over-land transport became the predominant delivery method, and timber was delivered to the site by truck (PES 2010).

In its earliest iteration, many of the mill structures were constructed on overwater piers that extended several hundred feet from the original Chehalis River shoreline. These structures were accessed by planked, piling-supported drives and foot bridges. From the time of construction forward, land beneath the pier/plank supported developments was brought to its current surface grade with fill material. Sawdust and other wood waste was apparently included in this fill. The source for the remaining volume of fill is unknown (PES 2010).

The oldest and northernmost of the overwater mills was the “Big Mill” (see the former Mill Area at the top of Figure 2-2). In 1972, the Pee Wee Mill was added to filled tidelands east-southeast of the Big Mill. With subsequent building modifications, the Small Log Mill was also added to the southeast portion of the property, adjacent to the Pee Wee Mill (see the right half of Figure 2-2). The current Maintenance Shop was reportedly constructed in 1994, replacing the original structure that had been used for the same purposes, and was located in the same approximate footprint. The Big Mill was closed in 2006, and dismantled from 2006 to 2008. By 2009, all remaining milling operations had ended on site (PES 2010).

2.6 Previous Investigations

Brief, chronological recaps of reports that have been prepared discussing environmental characterization efforts for the site are provided below. Given the lengthy history of work at the site, the following summaries do not provide an exhaustive review of all reports created for the site. Only those reports that were both available to the START and cover areas directly under study during this investigation are presented.

2.6.1 Independent Remedial Action Report, EMCON (1997)

On January 17, 1997, EMCON presented an Independent Remedial Action (IRA) for the Weyerhaeuser Aberdeen Sawmill to the Weyerhaeuser Company. This report summarized environmental characterization and remedial efforts that had occurred at the site from 1989 through 1993, all focused on the Planer/Grader Building and immediately adjacent land area (EMCON 1997).

The first sampling at the site took place on October 15, 1989, to investigate potential releases of PCP and NP-1 anti-sapstain compounds. By that time, use of PCP as an anti-sapstain agent had been discontinued at the site. Samples collected during this 1989 investigation confirmed the release of PCP to surface soils. Following these efforts, additional sampling and testing was performed, beginning on May 24, 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 on May 24 and 25, 1990 (see Figure 2-3). 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 one location (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.

On August 30, 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. While several SVOCs were detected in both soils and groundwater samples collected from these locations, including naphthalene at low concentrations in well D-09, 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 either as an attachment to their cleanup report or otherwise from Ecology file records, limiting START's ability to confirm their findings, or identify other potential contaminants of concern (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 within the northern portion of the Planer/Grader Building. Work was staged to coincide with an upgrade to the anti-sap stain 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 site 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 Washington State Model Toxics Control Act (MTCA) Method C (MTCA C) cleanup level in effect at that time (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 328 mg/kg and the MTCA Method B (MTCA B) soil cleanup level established for the protection of groundwater is 0.00088 mg/kg. As a result, PCP concentrations in soils from six of the eight cleanup areas would now exceed current cleanup levels.

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).

2.6.2 Independent Remedial Action Report Addendum, EMCON (1998)

Following completion of the IRA, as discussed in Section 2.6.1, 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 site. As outlined in EMCON’s April 13, 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 (see Figure 2-3). PCP was not present above the analytical method reporting limit in this sample (EMCON 1998).

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

After obtaining this groundwater data and revising the Restrictive Covenant for the site (see Section 2.6.2), Ecology granted an NFA status for this PCP release. In light of the PCP contamination that had been left in place, maintenance of the site's NFA status required that the property owners comply with certain limitation on use, redevelopment, and conveyance, as memorialized in the restrictive covenant filed for the property (Ecology 1999).

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

On August 13, 2010, PES provided the Weyerhaeuser NR Company with the results of their Level I Environmental Site Assessment (ESA) of the Aberdeen Sawmill property (i.e., Seaport Landing Site). The goal of the report was to identify RECs associated with the site. 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 as relevant to the scope of this TBA. 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 (this release and associated characterization and remedial efforts were discussed in greater detail in Sections 2.6.1, 2.6.2, and 2.6.3).
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 at concentrations in excess of 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.

   As a means to assess whether additional USTs and subsurface environmental impacts may remain near the Maintenance Shop, subsequent subsurface characterization work, including a geophysical survey, was undertaken by MFA, and is discussed in greater detail in Section 2.6.7.

3. For a period of nine years ending in June of 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" (see Figure 2-2). 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, 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 EPA noted that conditions leading to the 1990 conviction had been corrected, and the site was removed from the EPA's list of "violating facilities." Although the exact relationship between a 1992 Resource Conservation and Recovery Act (RCRA) Preliminary Assessment (PA) of the site and this statement by EPA 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 building located west of the Maintenance Shop had functioned as both a hazardous waste storage area and a vehicle wash stand (see Figure 2-2). As releases had reportedly occurred in that area, the RCRA PA recommended follow-on sampling and testing near this 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 (see Sections 2.6.1, 2.6.2, and 2.6.3) (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 occasionally detected in these wells, including the TCA breakdown product 1,1-dichloroethane (DCA) (Cho et al. n.d.). Vinyl chloride was also apparently 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 site shoreline. Information on these spills/releases appear to have been found during review of the facility's Storm Water Pollution Prevention Plan, and other Weyerhaeuser Company-maintained files, as well as detailed during interviews with individuals that are knowledgeable of the site.
6. The past presence of an additional sawmill facility on property east of Shannon Slough, at the current-day location of the chip truck lift and chip piles, was also noted as an 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 site's general history, they identified the following potential sources of environmental impact (PES 2010):

7. Given that the site had been used for industrial purposes for more than 100 years, unknown/unassessed areas of environmental impact may be present on the site;
8. 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.
9. Wood-fired boilers and refuse burners were historically used on the site. 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 site (PES 2010):

10. The former Oil Tank and Chemical Storage Shed was located on 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.
11. As per Weyerhaeuser Company's responses provided on a March 22, 2000, questionnaire, multiple USTs were reportedly removed from the site between 1977 and 1979. In addition, PES's review of UST databases maintained by Ecology revealed that three USTs were removed from the site; two of these tanks (a 10,000-gallon diesel UST and a 600-gallon gasoline UST) were listed as removed in December 1988. Although there is conflicting data on whether the third UST stored used oil or leaded gasoline, as was discussed in item no. 2 of this section, its removal occurred in 1993. Interviews with individuals knowledgeable of the site, again as discussed in item no. 2 of this section, also provide anecdotal accounts of additional USTs potentially removed from the site.

    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 22, 2000, questionnaire and Ecology's files, or those described by site knowledgeable individuals is not clear.
12. The March 22, 2000, questionnaire also stated that although the fill pipe was left in place, a UST formerly located adjacent to the Guard Shack had been removed. Further documentation on this UST removal and/or related sampling and testing work was not available. This fill pipe was noted on site during the START site visit and the area of this tank was included in the MFA study discussed in Section 2.6.7.
13. Finally, 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.

2.6.5 Sediment Sampling Report, Maul Foster & Alongi, Inc. (2014)

On February 5, 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 appears to have been undertaken to document sediment conditions in the intertidal lease land at the end of Weyerhaeuser Company's occupancy of the site. Sampling locations included nearshore surface and subsurface sediments along the “pocket beach” north of the Maintenance Shop, and surface sediments farther offshore from the site, within the Chehalis River. The nearshore samples (CR-04, CR-05, and CR-06) were located both beneath the old “big mill” building footprint, and hydrologically downgradient of the Maintenance Shop (see Figure 2-3; MFA 2014).

Findings from that study potentially relevant to sampling efforts undertaken on the upland area under this TBA included the presence of significant quantities of wood waste 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 TPH and PCBs in both surface and subsurface sediments (MFA 2014). The report did not conclude the source of those impacts; however, given the development history of the site and that these sample locations are down-gradient of the maintenance area, spills/leaks/releases from the big mill or down-gradient migration from other upland sources may have caused this contamination.

2.6.6 Draft Disproportionate-Cost Analysis, Maul Foster & Alongi, Inc. (2016b)

On April 12, 2016, MFA presented GHHSA with a Draft Disproportionate Cost Analysis, focused on the contamination left in place beneath the Planer/Grader Building (MFA 2016b). 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 MTCA 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 2016b).

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 2016b). Additional discussion of soil, sediment, and groundwater sampling data from these locations is included in Section 2.6.8.

2.6.7 Focused Investigation Report, Maul Foster & Alongi, Inc. (2016a)

On July 14, 2016, MFA presented GHHSA with their Focused Investigation Report, summarizing and discussing subsurface characterization work performed in the uplands area of the site. 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 tidal lease lands. 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 2016a).

The geophysical survey was performed in light of the uncertainty regarding the number, location, and status of USTs reportedly located on the property. The geophysical survey targeted the area of both the Maintenance Shop and Guard Shack (see Figure 2-3). The geophysical survey identified numerous subsurface anomalies that may have been USTs; however, based on review of the geophysical data and discussions with site 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 Shack, no evidence that a UST remained at this location was encountered (MFA 2016a).

Three borings (B01, B02, and B03) were advanced surrounding the Maintenance Shop (see Figure 2-3). 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. Soils were observed upon recovery and field screened with a photoionization detector (PID). Field screening revealed soils with petroleum odors and elevated PID readings at approximately 5 feet bgs in borings B02 and B03. Soil samples were then collected from both of these borings at 5 feet bgs, and 4.5 feet bgs in B01. While diesel and/or heavy oil range TPH were present in soils from both B02 and B03, only the concentrations of TPH in B02 exceeded the current MTCA A cleanup levels. TPH concentrations in groundwater from both B02 and B03 were also above MTCA A cleanup levels, with concentrations of TPH in B02 significantly above cleanup levels (MFA 2016a).

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 2016a).

2.6.8 Study Area Investigation – Aquatic Lands Lease, Maul, Foster & Alongi, Inc. (2017)

On April 11, 2017, MFA completed and presented the Ecology with a review draft of their Study Area Investigation report (MFA 2017). The report was undertaken 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). In addition to summarizing the sampling and review performed on other portions of the Seaport Landing site, this report discussed the results of sediment and limited upland area sampling. Characterization efforts included collection of soil and groundwater samples from four upland borings, and numerous surface and subsurface sediment samples (MFA 2017).

This study further characterized the extent of wood waste 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 two closest borings to the TBA project site (CR-20 and CR-21) contained heavy-oil-range TPH 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 TPH 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 beneath the ground (or mudline) surface (MFA 2017).

2.7 Projected/Proposed Site Uses

GHHSA's redevelopment efforts of the site are intended to create a vibrant, mixed-use, working waterfront that incorporates historic elements of Grays Harbor, and provides a homeport for both the Lady Washington and Hawaiian Chieftain tall ships. The highest priorities for development include conversion of the former Maintenance Shop into an educational/interpretive center, and development of a hotel on the site. Ultimately, these developments would be expected to generate income from tourism and provide waterfront access for the community (GHHSA n.d.).

2.8 START Site Visit

On February 2, 2017, a site visit of the Seaport Landing site was conducted. Photographs of the site were taken during the site visit and are provided in Appendix A. Attendees included the following people:

- Brandi Bednarik, GHHSA;
- Christie Barchenger, GHHSA;

- Mike Stringer, MFA;
- Kyle Roslund, MFA;
- Joyce Mercuri, Ecology;
- Alan Bogner, Ecology;
- Tom Middleton, Ecology;
- Joanne LaBaw, EPA Task Monitor (TM); and
- Derek Pulvino, E & E Project Manager.

The following bulleted paragraphs summarize observations from the START site visit as related in part to the historic document review, and areas of potential environmental concern.

- The former Maintenance Shop is a steel-sided building with a slab-on-grade foundation (see Appendix A, Site Visit Photos 1, 4, and 5). This building was reportedly constructed in 1994, replacing a previously existing maintenance shop. Offices, a meeting room, and other similar amenities are located on the second floor of the building. The ground floor is divided into three principal spaces accessed by larger rollup garage doors on the building's east side. The northernmost ground-floor space is a former storage area that includes shelving, and several pieces of heavy equipment that remain from mill operations (see Appendix A, Site Visit Photo 24). The central area of the building has a high ceiling and is a former shop space that includes several individual offices on the western side of the space (see Appendix A, Site Visit Photo 25). The adjacent space to the south is an additional storage area (Appendix A, Site Visit Photo 26). A fire-suppression system related vault is located northwest of the Maintenance Shop's exterior (see Appendix A, Site Visit Photo 5). Property north of this building is generally vacant, and was once occupied in part by the historic sawmill building (see Appendix A, Site Visit Photo 2).

  According to a Surface Drainage Plan and RCRA-related sampling plan as appendices of the PES Level I ESA, a Satellite Waste Accumulation area had been located on the east-central side of this shop, and a sawmill related oil-water separator and 900-gallon hydraulic oil tank had been located on the north side of the original maintenance shop building.

- The southern portion of the Maintenance Shop also includes a Steam Cleaning Facility and inclusive water capture and treatment system (see Figure 2-2). The system was designed to recycle wash water used during cleaning work. Staining and discoloration was observed on the walls and floors within this building, though given that the area was in use for equipment storage during the START site visit, the integrity of the floor could not be visually assessed (see Appendix A, Site Visit Photos 46 through 48).

- The former Planer/Grader Building was generally devoid of equipment, and much of the building interior would be accessible by vehicle. Several below-ground concrete lined pits/trenches were noted in the northern portion of the building that appeared to have been used as conveyor line routings to feed sawn lumber into the building (see Appendix A, Site Visit Photos 7 and 8). Some sludge/soil was noted in these pits/trenches. The concrete slab had been removed from the southern interior portions of this structure (see Appendix A, Site Visit Photo 9). The historic spray room, chemical storage, and control rooms were noted to be smaller individual spaces within the northern portion of the building, where vehicular access would be more limited (see Appendix A, Site Visit Photos 10 and 16 through 18). Adjacent exterior areas of the building were generally open, paved, and accessible by vehicle.
- The area south of the planer/grader building was formerly occupied by a Paint Waste UST. This area was the location of confirmed subsurface release discussed in the fourth bullet of Section 2.6.4, where TCA, DCA, and TPH were detected in soil and/or groundwater (see Appendix A, Site Visit Photos 21 through 23).
- Several concrete pads and containment curbs were observed adjacent to the west/southwest exterior areas of the Planer/Grader Building. According to the PES Level I, one of these concrete containment pads had been the location of an anti-sapstain mixing tank. Numerous monitoring well monuments were noted around this building (see Appendix A, Site Visit Photos 6, 11, 12, and 23).
- The western margins of the site include a large asphalt paved, open area that had been and is currently used for storage and staging. A large, open storage building abuts the eastern side of this storage area. At the time of the site visit, discreet portions of the area were used to store nets, rope/line, and what appeared to be other pieces of fishing equipment. Additional line, netting, various wood pallets, and drop-in truck campers were stored adjacent to the west side of this building. Based on historic maps, the former Oil Tank and Chemical Storage Shed had been located near the northwest corner of the storage building. No evidence of this historic structure was noted (see Appendix A, Site Visit Photos 12 through 15, 19, and 20).
- A fuel and chemical storage building is, and has been, located east of the Maintenance Shop (see Figure 2-2). The construction date of this building is not known by the START. During the START site visit, numerous 55-gallon drums and a blind sump containing oil were noted in this building (see Appendix A, Site Visit Photos 2, and 27 through 30). An aboveground storage tank (AST) used to store hydraulic oil was present in this building. In addition, a surface drainage plan included in an appendix to the PES Level I depicts a two compartment diesel/gasoline tank near this building, and identifies the use of this building as being for chemical and hazardous waste storage.

As mentioned under the third bullet of Section 2.6.4, the RCRA PA report also discussed the use of this building as a hazardous waste storage area, and that releases had reportedly occurred in this area; follow-on sampling and testing was recommended. A facility map and operational flow-chart noted on the south side of this building observed during the field event also depict locations within the building used for chemical storage, steam cleaning, petroleum storage, and vendor deliveries (see Appendix A, Field Event Photos 43 and 44).

- A second vehicle maintenance area was located in the northwest corner of the Main Shipping Shed (see Figure 2-2). Pictures in the PES Level I depict below ground maintenance pits with inclusive oil storage tanks. An air compressor and discolored concrete were noted outside of the building during the site visit. During the field event, the START realized that the actual maintenance area had not been accessed (nor was this area accessed during the TBA field event) (see Appendix A, Site Visit Photo 41).
- An additional oil storage area was located in the southeast corner of the Main Shipping Shed (see Figure 2-2). During the START site visit, this was noted to consist of an aboveground vault, containing liquids (see Appendix A, Site Visit Photo 39). The cutoff saw room was located just south of this storage vault, where the concrete floor was noted to be discolored (see Appendix A, Site Visit Photo 40).
- While in operation, the Weyerhaeuser Company-operated sawmill had numerous tanks dispersed across the property to store hydraulic oil. In total, these tanks included an aggregate capacity for approximately 15,000 gallons of liquid, as documented in the Spill Plan included as an appendix to the PES Level I. The START site visit did not include an accounting of all potentially associated storage vessels.
- Two additional tanks used to store parts wash water that contained sodium hydroxide (NaOH) were also the reported location of a spill (see Figure 2-3). These tanks were located near the southwest corner of the Main Shipping Shed; however, no evidence of the tanks was encountered during the site visit (or later, during the field event).
- During the site walk, a groundwater monitoring well was observed on the northeast side of the Main Shipping Shed/Small Log Mill building (see Figure 2-2 and Appendix A, Site Visit Photo 33). Other features on the north side of this structure included a small AST (estimated less than 500-gallon capacity; see Appendix A, Site Visit Photo 32) and a covered storage area (see Appendix A, Site Visit Photo 31). As no other record of the well could be found, its purpose is unknown. Both the former Pee Wee Mill and Small Log Mill had been part of this larger structure (see Appendix A, Site Visit Photos 36 through 38).
- The area east of the site includes a drainage slough, the northern portion of which is currently subject to tidal influence (see Appendix A, Site Visit Photo 34). The area of this slough farther upland is located behind a tidal

gate to limit tidal influences and attendant water level fluctuations (see Appendix A, Site Visit Photo 35).

- Two buildings, including the former location of a backup generator, and the entrance to the Guard Shed are located on the south central portion of the property. While the generator had reportedly relied on an AST for fuel supply, this tank was not present (see Appendix A, Site Visit Photos 42 and 43). Additionally, an interpreted UST fill-port was observed on the north side of the Guard Shed that is reportedly related to a previously removed UST (see Appendix A, Site Visit Photo 44).

3 Recognized Environmental Conditions and Remedial Action Units

As discussed in Section 2, the Level I ESA completed by PES in 2010 identified multiple RECs at the site. Given the large number of RECs identified, the length of time the site has been industrially utilized, and the plans for phased development of the site, the stakeholders have agreed on an approach that divides the site into multiple RAUs. By creating these RAUs, and then identifying RECs associated with each RAU, the intent was to create an approach that best utilized available resources to move the site towards productive reuse. In keeping with this approach, the RAUs are discussed and defined below, graphically depicted on Figure 3-1, and presented in this section in order of priority, as determined by the stakeholders. RECs associated with each RAU are included as a subheading within the respective section.

It should be noted that sediment and potentially associated upland impacts have been documented adjacent to the GHHSA-owned subject property. Those impacts are in an area generally north of the "inner harbor line," which forms the boundary between the GHHSA-owned subject property, and property under the control of the Washington State Department of Natural Resources. As both the sediment/riverine environment and potentially contributory upland contamination are on a parcel not included in this TBA's subject property, further discussion of contamination in that area of the site has been omitted from this report, and RECs associated therewith are not named.

Discussion of the individual RAUs included in this TBA, and RECs identified within and/or associated with those areas, are provided in the sections that follow.

3.1 Remedial Action Unit 1

GHHSA plans to convert the former Maintenance Shop to an educational/ interpretive center. Given the relatively low capital requirements for this conversion and its potential to benefit and actively engage the community, further investigation of subsurface impacts in this area were identified as the highest priority for study, and comprise the features included in RAU1. RECs in this area include the following:

- **Contaminated Subsurface Soil and Groundwater near the Maintenance Shop:** Impacts on subsurface soil and groundwater around the Maintenance Shop have been confirmed. The source(s) of these impacts does not appear to be fully characterized. At least one UST has reportedly been removed from this area. Available records and interviews with individuals knowledgeable about the site attest to numerous additional USTs having been present on the site, some of which may have been located near this building. Previous reports also detail the presence of oil/water separator, hydraulic oil tank, and satellite waste accumulation areas near this building. Geophysical survey work discussed in Section 2.6.7 has not identified suspect USTs remaining in this area.

In addition to tanks, other potential sources of subsurface impact on this area include the Fuel and Chemical Storage Building east of the Maintenance Shop; steam cleaning work performed in the southern portion of the Maintenance Shop; and operations within the Maintenance Shop itself. Potential contaminants include metals, SVOCs, diesel to heavy oil range TPH (TPH-Dx), and VOCs.

3.2 Remedial Action Unit 2

To help generate income from tourism for the site and community, plans for the western portion of the site include potential construction of a hotel, restaurant, brewery, or other similar attraction(s). Such tourist-centric developments are likely to abut and/or overly portions of the Planer/Grader Building footprint where subsurface soil and groundwater are impacted by PCP. The former location of a UST that had stored paint waste is also included in RAU2. The extent of RAU2 generally conforms to the former Planer/Grader Building footprint. The two following RECs are included in RAU2:

- **Contaminated Subsurface Soil and Groundwater near the Former Planer/Grader Building:** Subsurface soil and groundwater have been impacted by PCP beneath the northern portion of the Planer/Grader Building. Occasional detections of naphthalene have also been reported. Hydraulic equipment and transformers have also been located adjacent to the exterior of this building. Historic site figures related to the site also list an oil-water separator associated with a “tilt hoist,” and a hydraulic oil drip pan adjacent to this building. While remediation (i.e., soil removal) has occurred in this area, soil and groundwater with PCP concentrations in excess of current-day MTCA cleanup levels remain. The full extent of soil impacted by PCP at concentrations above current MTCA cleanup levels is not currently known. Soils/sludges from unknown sources are also present in concrete pits/trenches located within and leading to this building. Potential contaminants in this area include metals, PCBs, SVOCs, VOCs, and TPH-Dx.
- **Contaminated Subsurface Soil and Groundwater near the Former Paint Waste UST:** Areas beneath/adjacent to the southern portion of the Planer/Grader Building have been impacted by releases associated with a previously removed Paint Waste UST and former on-site painting activity. The area near the Paint Waste UST has been impacted by TCA, other VOCs, and TPH, reportedly as either hydraulic oil or lube oil. While TCA concentrations were compliant with MTCA A cleanup levels, other contaminants remained above these action levels at the end of the cleanup work. Potential contaminants of concern in this area include TPH-Dx, VOCs, and SVOCs.

3.3 Remedial Action Unit 3

Potential impacts on the western part of the site, adjacent to the former Planer/Grader Building and surrounding area where future development is planned, encompass the third RAU. As shown on Figure 3-1, RAU3 includes the area of the property west and south of RAU2. The following REC has been identified in this area:

- **Unknown/Unassessed Condition of Soil and Groundwater near the Former Oil Tank and Chemical Storage Shed:** A historic property map from 1951 depicted the former Oil Tank and Chemical Storage Shed near the northwest corner of the Storage Shed. No sampling and testing has apparently been performed in this portion of the site. Potential contaminants include metals, SVOCs, TPH-Dx, and VOCs.

3.4 Remedial Action Unit 4

The fourth RAU includes other RECs identified on the GHHSA property, but these RECs appear to be generally outside of the areas targeted for the most immediate redevelopment efforts. These RECs include the following:

- **Unknown/Unassessed Conditions of Soil and Groundwater near the Former Vehicle Maintenance Area:** Vehicle maintenance had historically occurred in the northwest corner of the Main Shipping Shed. Several maintenance pits that included storage tanks were reportedly located in this area. The area where these pits are could not be/were not accessed or located at the time of the site visit or later during field work. Based on START's research, no soil and/or groundwater sampling has been conducted near/in this vehicle maintenance area.
- **Unknown/Unassessed Condition of Soil and Groundwater near a Former NaOH ASTs:** Two ASTs were formerly located near the southwest corner of the Main Shipping Shed that stored NaOH used for parts cleaning work. Liquids from these tanks were reportedly discharged to the sewer system until 1990. In 1990, due to the liquid's corrosiveness and high concentration of lead and zinc, spent solutions were disposed of off-site. At the time of decommissioning, a leak was found in the sewer discharge pipe. No information was available on actions taken to address or characterize potentially associated impacts. Potential contaminants of concern appear to be limited to metals.

Although the following RECs were also identified for RAU4, investigation of these areas was not included in this TBA:

- Releases of TPH to the Chehalis River;
- Unknown/unassessed conditions from the former sawmill located on the eastern adjacent property, near the chip lift truck; and
- Unknown/unassessed conditions of soil and groundwater near an oil storage area near the southeast corner of the Main Shipping Shed.

3.5 Remedial Action Unit 5

This area includes areas of potential impacts on the southcentral portion of the site where near-term redevelopment is not expected to occur. Activities in and/or uses of this area are also interpreted to have a relatively low risk of impact relative to other RAUs more immediately targeted for redevelopment or reuse. RAU5 includes the area of an AST associated with an on-site backup generator, and a reportedly decommissioned UST that had been located on the northern side of the Guard Shed (see Figure 3-1). Sampling of RAU5 was not proposed under the scope of this TBA.

4

Regulatory Standards, Analytical Methods, and Field Investigation Methods

E & E conducted field sampling at the Seaport Landing site from September 25, 2017, to September 29, 2017. Fieldwork was conducted in coordination with GHHSA, EPA, the U.S. Army Corps of Engineers (USACE), and other project stakeholders. The following subsections describe the expected contaminants at the site, the regulatory standards to be applied, and the types of sampling, analysis, and measurements that were conducted. Samples were collected in accordance with an approved sampling and quality assurance plan (SQAP; E & E 2017). Photographic documentation of the sample collection event is provided in Appendix A.

When deviations from the SQAP were required, they were noted in the field logbook, recorded on the sample plan alteration form (Appendix B), and approved by the EPA TM. Deviations from the SQAP are also detailed within the body of this TBA report as applicable.

4.1 Potential Site Contaminants

As discussed in Sections 2 and 3, multiple sources and areas of contamination have been identified on the property. These include former maintenance areas, chemical and hazardous material storage buildings, buildings historically used to treat sawn lumber with anti-sap stain compounds, stencil washing areas and related storage infrastructure, as well as historically utilized ASTs and USTs. In light of the foregoing information, contaminants of concern at the site include Target Analyte List (TAL) metals, SVOCs, PCBs, TPH-Dx, and VOCs.

For further discussion of sources of contamination targeted for investigation during this TBA, please refer to Section 3.

4.2 Regulatory Standards

Soil and groundwater sample results were compared to the MTCA values established under Washington Administrative Code (WAC) 173-340. The MTCA includes multiple cleanup levels, generally applied and grouped by a site’s current and/or anticipated land use. These cleanup levels address multiple routes of exposure, including contaminant exposure by way of direct contact with contaminated soil; the potential for contaminated soil to adversely affect groundwater and surface water quality; consumption and/or direct contact with contaminated groundwater and surface water by human, wildlife, and aquatic populations; and airborne exposure to hazardous materials either through vapor intrusion (VI) and/or contaminated dust.

The MTCA Method A cleanup levels were created for use at sites where cleanup is considered "routine" and there are relatively few hazardous substances (WAC 173-340-740(2)). The MTCA Method B cleanup levels are used in more complex scenarios and cover a much broader range of constituents than MTCA A. The MTCA B cleanup levels are considered the state's "universal" cleanup method. Under MTCA B, a set of "standard" cleanup levels are available, derived using generic default assumptions regarding exposure scenarios, as well as chemical fate, transport, and toxicity. MTCA B also allows for modification of certain default assumptions to develop site-specific cleanup levels (WAC 173-340-740(3)). MTCA C cleanup levels represent the third set of regulatory cleanup levels. The MTCA C approach is applicable to only industrial properties; use of these standards can circumscribe the options available for future site use upon completion of cleanup activities (WAC 173-340-745).

At present, multiple uncertainties remain in connection with the site's envisioned future uses. While general concepts for site reuse have been created, actual development details (i.e., location of buildings and parking lots, extent of beaches and exposed shoreline, areas targeted for demolition, etc.) are yet to be determined. Establishing these details and end uses will play a part in determining what cleanup level(s) are appropriate for the site. As such, analytical results from this TBA are compared to cleanup levels from both the MTCA A and MTCA B standards to represent a range of potential exposure scenarios. Cleanup levels considered for this project, and the rationale by which specific comparative values were selected, are outlined in the following paragraphs.

For soils, the most restrictive (i.e., lowest) cleanup level was used for data comparison, and that value was typically the MTCA B cleanup level established for the protection of groundwater, and more specifically the soil cleanup value established to protect drinking water from contaminants in saturated soils; however, in those instances where the MTCA Method A cleanup level was lower, that value was used instead. The second and less restrictive point of comparison used for soil data was the MTCA B cleanup level established to be protective of direct contact. The lower of the "cancer" and "non-cancer" cleanup level was selected for data comparison. The more and less restrictive values used for comparison are presented in the soil analytical summary tables. The soil analytical summary tables also include a third column that provides the background concentrations for select metals, as presented in *Natural Background Soil Metals Concentrations in Washington State* (Ecology 1994). In accordance with guidance provided in that Ecology document, detected metals concentrations that were higher than a regulatory cleanup value, but were lower than the 90th percentile background value for Western Washington (i.e., "Group W"), were not considered to require remedial action.

For groundwater samples, the two cleanup values used for comparative purposes were drawn from three sets of values. This includes the values established to protect drinking water and potential building occupant exposure to contaminants by way of Vapor Intrusion (VI) in one column of the table, and surface water–related values in a second column. Due to the site's location adjacent to Grays Harbor, the potential for groundwater to migrate from the site to Grays Harbor, and that it is unlikely that groundwater from the site will ever be the source of drinking water, Ecology also requested that groundwater data be compared to surface water cleanup values. The surface water cleanup value was generally the most restrictive cleanup level available for a given constituent, and is presented in the left "MTCA Cleanup Levels" column of the groundwater analytical summary data tables. Groundwater values, whether for protection of drinking water or in consideration of the VI pathway, are included in the right hand "MTCA Cleanup Levels" column. Again, the lowest groundwater cleanup level, whether for protection of drinking water quality, direct contact, or VI was used in the right hand "groundwater" cleanup level column.

Values for VI are drawn from the MTCA Method B Table B-1 cleanup level values, as referenced in the February 2016 update to Ecology Publication no. 09-09-047. The remaining soil, groundwater, and surface water values were obtained from the December 2017 Interim Update to the Cleanup Levels and Risk Calculation (i.e., CLARC) tables. In accordance with MTCA, and more specifically WAC 173-340-708(8)(e), the human health toxicity of cPAHs data was calculated using toxicity equivalent factors (TEFs) to derive a cPAH toxicity equivalent quotient (TEQ) value. All regulatory standards considered for this project are presented in Table 4-1.

4.3 Analytical Methods

Seventy-nine soil and groundwater samples, including six quality assurance/ quality control (QA/QC) samples, were collected during this TBA and were submitted for fixed laboratory analysis (Table 4-2). The samples were analyzed in varying combinations for TAL metals and SVOCs, including PAHs, PCBs, DRO, and RRO.

Copies of the QA/QC and data validation memoranda are provided in Appendix I. The following samples were submitted to fixed laboratories for analysis:

- **TAL Metals:** Forty soil samples, 18 groundwater samples, and four QA/QC samples were submitted for metals analysis using EPA Method ISM02.4. The samples were submitted to ChemTech Consulting, an EPA Contract Laboratory Program (CLP) laboratory, located in Mountainside, New Jersey.
- **SVOCs, including PAHs:** Fifty soil samples, 23 groundwater samples, and four QA/QC samples were submitted for SVOC analysis, including PAHs using EPA Method SOM02.4. Samples were analyzed with Select Ion Monitoring (SIM) in an effort to help achieve regulatory compliant

detection levels. The samples were submitted to Shealy Environmental, an EPA CLP laboratory, located in West Columbia, South Carolina.

- **PCBs:** Ten soil samples, five groundwater samples, and three QA/QC samples were submitted for PCB analysis using EPA Method SOM02.4. The samples were submitted to Shealy Environmental, an EPA CLP laboratory, located in West Columbia, South Carolina.
- **VOCs:** Thirty-eight soil samples, 18 groundwater samples, and six QA/QC sample were submitted for VOC analysis using EPA Method SOM02.4. In order to achieve lower detection and quantitation limits for vinyl chloride, soil analysis was performed under Modified Analysis 2810.1. These samples were submitted to Shealy Environmental, an EPA CLP laboratory, located in West Columbia, South Carolina.
- **TPH-Dx:** Fifty soil samples, 23 groundwater samples, and four QA/QC samples were submitted for TPH-Dx analysis using Northwest Total Petroleum Hydrocarbon Diesel Extended (NWTPH-Dx) analysis. The samples were submitted to the EPA Region 10 Laboratory, located in Manchester, Washington. The gas chromatograph program for this analysis subjected samples to temperature that started at 50 degrees Celsius (°C) and ramped up to 350°C. The system was calibrated using standards for diesel and motor oil. Diesel and motor oil range TPH products were then divided based on retention time ranges and chromatographic patterns, with each TPH fraction quantified using separate calibration curves.

  Samples analyzed for TPH-Dx were also subjected to silica gel cleanup. While all soil samples were analyzed both with and without silica gel cleanup, the summary tables only present the silica gel cleanup results.

4.4 Reporting of Sample Results

A total of 79 samples were collected during the field event (see Figure 4-1). A description of each sample submitted for fixed laboratory analysis is provided in Table 4-2. Table 4-3 summarizes the sample coding system used for formulating sample numbers. For example, the sample number PB03SB05 indicates the following:

- PB for the source code (in this case, for samples near the Planer/Grader Building).
- 03 for the sequential number of samples from a given source by matrix (in this case, the third subsurface soil sample).
- SB for the sample matrix (in this case, subsurface soil).
- 05 for the maximum depth of the sample interval.

The analytical results summary tables provided in Section 5 are a condensed version of the laboratory data provided in Appendix I. Omitted data and the presentation of data in the summary tables are as follows:

- Analytes that were not detected, detected at concentrations below contract required quantitation limits or method reporting limits, and/or some combination thereof, were omitted from their respective tables.
- All detected concentrations are shown in bold type; a non-detect concentration is shown as the sample quantitation or reporting limit reported by the laboratory (e.g., 0.66 U). When an analyte was detected at a concentration above the detection limit, but below the contract-required quantitation limit or method reporting limit, those data were JQ qualified.
- The regulatory standards provided in the first columns of these tables were used as the criteria to determine whether contamination is present in the samples. JQ qualified data were not compared to the regulatory standards.
- Analytes detected at concentrations greater than the regulatory criteria values were considered a potential concern, and the concentration is shaded, underlined, and italicized (as applicable).
- Analytes with no comparative regulatory criteria value are listed in the tables but could not be qualitatively evaluated.

Based on EPA Region 10 policy, evaluation of aluminum, calcium, iron, magnesium, potassium, and sodium (i.e., common earth crust metals) is generally used only in mass tracing, which is beyond the scope of this report. Furthermore, these analytes are not associated with toxicity to humans under normal circumstances (EPA 1996). For these reasons, these analytes are not evaluated or discussed here, but are provided in the analytical summary tables if they were detected above the instrument detection limit.

4.5 Sampling Methodologies

4.5.1 Surface Soil/Sludge Sampling

Surface soil/sludge samples were collected from 0 to 6 inches bgs using a dedicated stainless steel spoon. Collected material was placed in a dedicated stainless steel bowl, thoroughly homogenized and placed into prelabeled sample containers. The VOC aliquots were removed using 5 gram Core-N-One™ samplers (or equivalent) prior to homogenization. The VOC aliquots were all frozen (</= -7°C) in the field to extend the holding time.

4.5.2 Subsurface Soil Sampling

Subsurface soil samples were collected by a Geoprobe™ hydraulic direct-push sampling system. All borings were advanced as continuous cores in 4-foot sections. As originally proposed, borings were advanced to a maximum exploration depth of 12 feet bgs, or until groundwater was encountered, whichever happened first. As per information that had been provided prior to field work, groundwater was expected to be within 10 feet of the ground surface.

Soils were screened using visual and olfactory indicators (i.e., presence of staining, sheening, and odors) and with a PID to measure VOC concentrations. When field screening revealed the potential presence of contaminants, that soil interval was targeted for sampling; however, it should be noted that given the volume of soil necessary to fill soil containers associated with all of the analysis performed, additional soil from above and below the potentially contaminated interval was often included in the sample volume. The estimated depth interval from which the soil sample volume was collected is included in Table 4-2, as well as being provided in the top row of the respective soil analytical data summary tables.

After completion of field screening and lithologic/geologic core logging, stainless steel spoons were used to collect the sample interval directly from the polyvinyl chloride sampling sleeve into dedicated stainless steel bowls, the sample material was thoroughly homogenized and then placed into pre-labeled sample containers. Aliquots for VOC analysis were filled directly from the sampling sleeve and field frozen (</= -7°C) to extend the holding time. Two soil samples were collected from each boring. Borehole logs are included in Appendix C.

4.5.3 Groundwater Sampling

Groundwater samples were collected both from existing monitoring wells, and temporary borehole well-points advanced by the Geoprobe™. All existing monitoring wells were constructed with 2-inch diameter polyvinyl chloride casing. Borehole groundwater sampling used non-dedicated SP16 groundwater well-points (i.e., a groundwater–specific, 1.6-inch outside diameter sampling probe manufactured by Geoprobe™) advanced to the bottom of the targeted sampling depth. The probe was then pulled back 4 feet to expose the SP16's integral groundwater sampling screen.

For samples collected from temporary well-points, soil cores collected from the Geoprobe™ were used to identify the top of the groundwater table and the zone of saturated soil. A water level indicator was also deployed into most boreholes to confirm the depth to groundwater. Temporary well-points were then placed to allow for the screened interval to intercept the groundwater table. In the first samples collected, the well screen was deployed to 8 feet bgs to span the water table (i.e., locations MS02 and FC02); however, this interval was found to have low water productivity. To improve well productivity, subsequent groundwater samples were collected after coring 10 to 12 feet bgs before installing the well-point, or simply by pushing the well screen to deeper intervals without additional coring. As a result, the top of the well screen did not consistently extend above the top of the water table.

In all cases, samples were collected using dedicated Teflon lined tubing and a peristaltic pump. The sampling pump or tubing intake was set approximately 6 inches to 1 foot above the bottom of the well screen. Because of the SP16's relatively small diameter, the START was unable to place the water level indicator and sampling tubing into the sampling probe at the same time. As such, the depth to water was not recorded while purging and sampling from temporary locations. As mentioned in the previous paragraph, observations regarding groundwater depth in these locations were made based on the presence of saturated soils in soil boring cores, and water depth readings taken prior to purging and sampling. Depth to water was monitored while collecting groundwater samples from the previously installed monitoring wells.

Groundwater was purged using low-flow techniques, and samples were collected after groundwater monitoring parameters stabilized. To limit sustained drawdown, the purging pump rate was set between 0.1 and 0.5 liters per minute. Water quality parameters were monitored throughout the purging process, and samples were collected once water quality parameters stabilized to the tolerances outlined below over three consecutive readings spaced at approximately 3 minute intervals:

- ± 0.1 standard unit for pH;
- ± 3% for temperature and specific conductance;
- ± 10% for dissolved oxygen; and
- ± 10% for turbidity or less than 10 nephelometric turbidity units (NTU). In many cases, given the temporary nature of well-points and that these well-points are not designed and constructed to allow for proper well development, the turbidity target could not be practicably achieved. As a result many groundwater samples from temporary wells were collected when the sample turbidity was above 10 NTUs.

Samples were pumped directly into pre-labeled sample containers and preserved as required upon sample collection completion; however, VOC samples were collected in pre-preserved vials.

4.6 Historic Preservation Act Considerations

To coordinate TBA activities with the National Historic Preservation Act, the EPA contacted the Washington State Historic Preservation Officer (SHPO). The SHPO indicated that, given the location of the property, there was a potential to affect historic properties. In consideration of this information, the EPA made arrangements for an archeologist/cultural artifact observer from the USACE to be on site during the field event to review soil collected during sampling work.

If artifacts or human remains had been encountered or observed by the USACE archeologist, work at that location would have immediately stopped and the EPA

TM would have been immediately notified. No such artifacts or remains were encountered during drilling. Correspondences relating to National Historic Preservation Act coordination, as well as a brief letter report drafted by the USACE archeologist summarizing their observations during field activities, are provided in Appendix D.

4.7 Global Positioning System

Global positioning system (GPS) coordinates of TBA sample locations were collected utilizing a Trimble™ Geo7X handheld GPS. Recorded GPS coordinates by sample point are listed in Appendix E.

4.8 Investigation Derived Waste

Investigation derived waste (IDW) generated during the Seaport Landing TBA sampling event included disposable sampling supplies, disposable personal protection equipment, soil cuttings, decontamination water, and purge water. All disposable IDW was bagged in opaque plastic bags, transported back to the EPA warehouse in Seattle, Washington, and collected by Waste Management. Materials that could be recycled (plastic, cardboard, steel, and paper) were segregated from trash at the EPA warehouse in Seattle, Washington, and collected by Waste Management.

Borehole purge water and water generated while washing/decontaminating non-dedicated sampling equipment were contained in three 55 gallon drums. All IDW drums were labeled, and stored under cover on an asphalt paved surface at the site. One composite water sample was collected from these drums for waste characterization purposes. Soil remaining after completing sample collection was placed back in the hole from which it had been collected at the completion of soil and groundwater sampling activity.

The composited IDW water sample was submitted for TAL metals, SVOC, PCB, NWTPH-Dx, and VOC analyses. Sample results indicated that all IDW was non-hazardous. On March 13, 2018, all drums were picked up by Chemical Waste Management and transported for disposal at Waste Management's landfill in Arlington, Oregon. Waste manifests, along with the IDW characterization sample results, are included as Appendix F.

5

RAU Investigations, Findings, and Follow-On Assessment Recommendations

The TBA sampling strategy was designed to provide a site characterization by collecting environmental samples at locations that were biased toward areas that are most likely to be contaminated.

Investigative activities conducted at the site included a geophysical survey, limited surface soil sampling, subsurface soil sampling from borings, sampling of groundwater from temporary monitoring wells installed in borings, and sampling of groundwater from a select number of existing monitoring wells. Borehole and monitoring well logs are provided in Appendix C.

The following sections describe the geophysical survey and the RAU investigations, findings, and recommendations.

5.1 Geophysical Survey

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), a geophysical survey was conducted. The survey utilized both electromagnetic and ground-penetrating radar (GPR) equipment. This equipment was also used to clear proposed boring locations (for utilities, etc.) prior to drilling. Given that geophysical survey work had already taken place in the areas immediately adjacent to the Maintenance Shop and Guard Shack, this survey targeted the area of the Fuel and Chemical Storage Building east of the Maintenance Shop, and the former Oil Tank and Chemical Storage Shed west of the storage building (see Figure 3-1).

ECA Geophysics of Eagle, Idaho, conducted the geophysical survey of the Seaport Landing site from September 25 to 27, 2017. A combination of GPR and electromagnetic induction (EMI) equipment was utilized. In some instances, the geophysical contractor recommended that a selected boring location be moved to minimize the chances of encountering refusal.

EMI data were collected using a Geonics EM31MK II terrain conductivity meter to measure lateral soil conductivity changes, as well as to detect buried metal objects. GPR data were acquired by a Mala Geoscience Easy Locator GPR system, using a 350-megahertz antenna that was found capable of detecting objects in the upper 10 feet of soil. EMI survey locations were documented using an Archer Hemisphere 132 GPS receiver, with GPR data correlated to onsite locations, using the unit's calibrated wheel odometer. Both the EMI and GPR surveys were performed using east-west transects spaced approximately 5 feet apart, with 20-foot and 10-foot north-south transect spacing used in the west and east survey areas, respectively.

Several small metallic targets were detected in the EMI survey, but no GPR targets were associated with these EMI anomalies. Other than identifying the location and alignment of multiple abandoned utilities on the site, and what was interpreted as a buried spherical object in RAU3 that the geophysical contractor tentatively identified as a potential UST, no other features of note were identified during the geophysical survey. No USTs were identified in the survey area. The geophysical survey report, including maps of geophysical data, is included in Appendix G.

5.2 Remedial Action Unit 1

Sampling in RAU1 focused on the area of the property occupied by the Maintenance Shop and proposed for redevelopment as an educational/interpretive center. Sample locations were intended to answer the question of whether there were sources of contamination adjacent to the Maintenance Shop and other nearby development features. More specifically, samples in this area were collected near the Maintenance Shop and the Fuel and Chemical Storage Building, located to the east of the Maintenance Shop. Figure 4-1 shows the locations where six borings were advanced surrounding the Maintenance Shop and three borings were advanced in the vicinity of the Fuel and Chemical Storage Building.

5.2.1 Maintenance Shop

5.2.1.1 Sampling Locations and Field Observations

Three borings were advanced on the east side of the Maintenance Shop building (MS01, MS02, and MS06), two borings were advanced on the north side of the building (MS03 and MS05), and one boring was advanced near the northwest corner of the building (MS04). Field screening did not identify the potential presence of subsurface contamination at MS01, MS04, or MS06.

Boring MS06 was an opportunity boring placed in an inferred cross- to down-gradient location relative to FC02, proximal to a potential buried utility routing identified by the geophysical contractor. As will be discussed in Section 5.2.2.1, field screening revealed the potential presence of contamination in FC02. Boring MS06 was placed at a location intended to further assess whether such contamination may be migrating from that location towards the Maintenance Shop. Again, field screening did not identify the potential presence of contaminants in soils sampled from MS06.

The potential presence of petroleum-like contamination was noted in the three remaining borings near the Maintenance Shop:

- **MS02:** Soils from the 6- to 8-foot interval of MS02 displayed a slight petroleum odor.
- **MS03**: A strong petroleum odor was noted in soils from approximately 3 feet bgs to the bottom of this boring. An iridescent, petroleum-like sheen was also noted on water collected from this location.
- **MS05:** Given field screening observations in MS03, MS05 was an opportunity boring advanced as far west along the northern side of this building as practicable, limited by the presence of buried infrastructure. Wood waste was encountered from approximately 4 feet bgs to the bottom of recovery with a strong petroleum odor and iridescent sheen noted in/on the recovered soils and wood waste. An iridescent, petroleum-like sheen was also noted on water collected from this location.

5.2.1.2 Results Discussion

As summarized in Tables 5-1 and 5-2, and Figure 5-1, multiple metals were detected in every soil sample at concentrations above the most restrictive soil cleanup levels (SCL). One or more PAH exceeded the most restrictive MTCA SCL in 6 of the 12 soil samples, and cPAH TEQ values exceeded the most restrictive SCL in four samples, and the MTCA A cleanup level in one sample. Only thallium and manganese concentrations were above the MTCA B direct contact cleanup level; although typical background levels for thallium have not been established for Washington State, given the relatively consistent concentration of thallium across the site, these detections are interpreted to represent naturally occurring levels. No VOCs were detected in soil from this area at concentrations above even the most restrictive SCL.

Five soil samples contained heavy-oil-range TPH at concentrations in excess of MTCA A SCL (Figure 5-2) (MS03SB04, MS03SB07, MS04SB04, MS05SB04, and MS05SB06). With the exception of MS04SB04, the potential presence of soil contamination was noted during field screening in all of these locations. Based on field observations, petroleum impacts at both MS03 and MS05 appear to extend from approximately 2 feet bgs to the lower limits of soil recovery in the geoprobe core, coinciding in part with intervals of wood waste. In both MS03 and MS05, the highest petroleum concentrations were encountered in the deeper sample (20,000 parts per million [ppm] in MS03SB07 and 90,000 ppm in MS05SB06). An iridescent petroleum like sheen was noted in these sample matrices.

As summarized in Tables 5-1 and 5-3, and Figures 5-1 and 5-2, analytes exceeding the groundwater cleanup level (GCL) included manganese in three samples (MS01GW, MS02GW, and MS06GW), PCP in three samples (MS01GW, MS02GW, and MS03GW), and heavy-oil-range TPH in two samples (MS03GW and MS05GW). Concentrations of manganese in all six samples, arsenic in one sample (MS04GW), and copper and lead in one sample (MS03GW) exceeded the surface water cleanup level (SWCL). The cPAH TEQ value in one groundwater sample (MS03GW) also exceeded the SWCL and GCL. No VOCs were detected in groundwater from this area at concentrations exceeding even the most restrictive GCL or SWCL.

For these locations, a direct relationship was not apparent between the concentrations of TPH in the corresponding groundwater and deep soil samples. While heavy-oil-range TPH concentration in the deep soil sample from MS05SB06 was approximately 4.5 times higher than the TPH concentration in MS03SB07, the concentration of heavy-oil-range TPH in groundwater was approximately 46 times higher in MS03 than MS05. The top of the groundwater sampling screen in MS05 was set below the top of the water table, and above the top of the water table in MS03. Given that sheen indicative of floating free product was encountered in both MS03 and MS05, it is possible the higher concentration of heavy-oil-range TPH in groundwater from MS03 was a result of the groundwater screen extending above the water table, allowing for the free product to be more readily included in that sample.

In relation to PCP detected in groundwater above cleanup standards, PCP was also detected at low concentrations in groundwater from wells D-02 and D-04e during the 1990s monitoring efforts. However, given the sporadic and historic nature of those PCP detections and the hydrologically cross- to down-gradient location of those wells relative to the Maintenance Shop samples, it is not clear if or how those detections relate to PCP detected in groundwater in the vicinity of the Maintenance Shop.

5.2.1.3 Findings Summary

TPH-impacted soil and groundwater were identified in borings MS03 and MS05 (Figure 5-2). What appeared to be free product was observed on the groundwater table and in the soil matrix in both of these locations. Previous sampling work on the site has identified high concentrations of petroleum in soil, sediment, and groundwater samples that had been collected north and northwest of the Maintenance Shop, at locations hydrologically cross- to down-gradient of these samples. Sampling during this TBA appears to have identified a contiguous area of subsurface TPH impacts that extend from the Maintenance Shop north to the Chehalis River shoreline. The lateral (i.e., western and eastern) extent of this area of contamination is not well defined.

TPH was also identified in shallow soil samples collected from less than 4 feet bgs in MS01 and MS04 (Figure 5-2); however, only the TPH concentration in MS04 exceeded the MTCA A cleanup level. Borings MS01 and MS04 are located cross- to upgradient of borings MS03 and MS05. Based on the relative hydrologic positions, that TPH was not detected in deeper soil or groundwater samples from MS01 and MS04, and given the shallow nature of groundwater at the site, TPH contamination identified at MS01 and MS04 may represent isolated "hot spots" in shallow soil. If the TPH contamination at MS01 and MS04 indicates "hot spots," they may not be contributing to, or even contiguous with, the areas of heavy-oil-range TPH contamination at MS03, MS05, or other locations further downgradient.

Groundwater sampled from MS01, MS02, and MS03 also contained concentrations of PCP in excess of the SWCLs and GCLs. The highest concentration of PCP was in groundwater sampled from MS01 (19 µg/L) (Figure 5-2). MS01 is located hydrologically downgradient of MS02, and cross- to upgradient of MS03.

While PCP was not detected in any of the soil samples collected from these three boring, the ability to identify the source of these PCP groundwater impacts is limited by the quantitation limits the project laboratory was able to achieve for PCPs in soil. Based on a review of the analytical data, it appears the presence of other SVOCs/PAHs in many of the soil samples collected from RAU1 effectively raised the quantitation limits for this analytical suite. For some of the samples, laboratory dilutions of sample extractions resulted in PCP quantitation limits from approximately nine to 86 times greater than the SCL for the protection of groundwater. As a consequence, soil data from these locations may not be useful for determining whether spills and soil contamination at any specific location may be the source of PCP contamination in groundwater. The PCP quantitation limits were well below the direct contact standard for soil.

As will be discussed in Section 5.2.2.2, PCP was also detected in soil and groundwater sampled from FC01, advanced on the north side of the Fuel and Chemical Storage Building. FC01 is located cross- to upgradient of MS01, and cross- to downgradient of MS02 and MS03.

5.2.1.4 Recommended Sampling

As previously stated, TPH impacts at MS03 and MS05 would appear to extend downgradient from these boring locations towards, and perhaps all the way to, the Chehalis River/Grays Harbor shoreline, and laterally to at least MFA boring location B02. The full upgradient extent of this area of contamination is not known. Additional sampling and testing of subsurface soil and groundwater at intermediate locations between MS03/MS05 and the Chehalis River, as well as at locations northeast and northwest of MS03/MS05, is recommended to confirm the extent of contamination in this area. To better identify the upgradient extent of these TPH impacts, sampling and testing from locations within the Maintenance Shop building would likely be required.

Again, historic records appear to indicate that nested USTs, an oil/water separator, and a hydraulic oil tank had all been located in this area of the site. However, information is inconclusive regarding the location and/or status of those appurtenances, or whether they may be associated with spills or release. For recommended sampling related to PCP impacts, see Section 5.2.2.4.

5.2.2 Fuel and Chemical Storage Building

5.2.2.1 Sampling Locations and Field Observations

Three borings were advanced in the area surrounding this structure (Figure 4-1). This included borings FC01 north of, and FC02 west of, the northwest corner of the building. Boring FC03 was an opportunity boring advanced southeast of this structure, close to what appeared to have been an equipment area on the north side of the Main Shipping Shed. Varying degrees of petroleum-like contamination were noted at all three boring locations as follows:

- **FC01:** Soils from approximately 3 feet bgs to the bottom of the exploration displayed a slight petroleum odor, with an asphaltic "cold patch" like material also noted between approximately 2 and 3 feet bgs. Wood waste was encountered approximately 6 feet bgs.
- **FC02:** Soils recovered from the majority of this boring displayed a petroleum odor, with an asphaltic "cold patch" like material noted from approximately 6 inches to 2 feet bgs. The highest PID detections were encountered at approximately 5 feet bgs. An iridescent, petroleum-like sheen was noted on water collected from this location. As previously discussed, this location was approximately 3 feet south of a buried, east-west oriented line identified by the geophysical contractor.
- **FC03:** Boring FC03 was field selected in consultation with the EPA TM, and, although the location is within RAU4, for ease of reference this sample was named and grouped with other samples from the Fuel and Chemical Storage Building. A loading dock, palletized 5-gallon pails, and an AST were noted in this area. A narrow interval of wood waste was noted at 6 feet bgs, with strong petroleum odor and iridescent sheen noted on soil and water beneath this wood waste. Iridescent sheen was also noted on water sampled from this location.

5.2.2.2 Results Discussion

As summarized in Tables 5-1 and 5-2, and Figure 5-1, multiple metals were detected in every soil sample at concentrations above the most restrictive MTCA SCLs. One or more SVOC in four of six soil samples from this area, and the cPAH TEQ value in one sample, exceeded the most restrictive MTCA SCL, with the cPAH TEQ value also exceeding the MTCA A cleanup level. PCP was among the SVOCs present above the SCL in soils, detected in the deeper soil sample collected near the northwest corner of the Fuel and Chemical Storage Building (FC01SB07, Figure 5-1). Arsenic and thallium were the only analytes detected at concentrations above the MTCA B direct contact cleanup levels. Ethylbenzene, methylcylohexane, and xylene were the only VOCs detected in soil from this area, present in FC02SB06. Ethylbenzene was the only VOC present at a concentration above the MTCA B cleanup level for the protection of groundwater, but the concentration was well below the MTCA B direct contact cleanup level.

Two soil samples from this area contained heavy-oil-range TPH at concentrations in excess of the MTCA A SCL in two samples (Figure 5-2), with diesel range TPH also present above the MTCA A cleanup level in one of these samples. For the two soil samples with petroleum exceedances, petroleum odor and an iridescent sheen were noted in the sample matrix. An asphaltic/cold patch–like material was also observed in portions of the 0- to 4-foot boring intervals of FC01 and FC02. Based on field observations and analytical results, petroleum impacts appear to extend from near the ground surface to 4 feet bgs at FC01, and from near the ground surface to 6 feet bgs at FC02. While heavy-oil-range TPH was present in sample FC03SB08, a location where petroleum sheen was observed in the sample matrix during field screening, the concentration in soil was below the MTCA A SCL. Petroleum sheen and odors were noted in the 2 feet of soil/wood waste recovered in the 4- to 8-foot core interval, assumed to represent the soils from approximately 6 feet bgs to the bottom of the exploration (i.e., 8 feet bgs).

With respect to groundwater results (Tables 5-1 and 5-3), analytes exceeding the GCL included lead in two samples (FC01GW and FC03GW), manganese in two samples (FC01GW and FC02GW), and PCP and cPAH TEQ in one sample (FC01GW). Heavy-oil-range TPH also exceeded GCL in two samples (FC02GW and FC03GW), with diesel range TPH also above GCL in one sample (FC02GW). The concentration of arsenic, copper, lead, manganese, and zinc in FC01GW, and lead and manganese in FC03GW, were above the SWCL. TPH concentrations in the deep soil and groundwater samples were higher in FC02 than those in FC03. That said, as the top of the groundwater sampling screen appeared to have been set above the groundwater table in FC02 but below the water table in FC03. Therefore, TPH concentrations reported for groundwater may be a function of both actual contaminant levels, and the sampling technique employed. While several VOCs were detected in groundwater from this area, all were at concentrations well below even the most restrictive GCL or SWCL.

For FC01, PCP concentrations in both groundwater and the deep soil sample exceeded their respective cleanup levels. That said, PCP concentrations in soil and groundwater from FC01, MS01, MS02, and MS03 do not appear to be well correlated. While soil from FC01SB08 was the only sample that contained PCP above the SCL, this was the location with the lowest concentration of PCP in groundwater. Conversely, while PCP was not detected in any of the deeper soil samples at MS01, MS02, or MS03, PCP was detected at higher concentrations in groundwater collected from these locations.

5.2.2.3 Findings

TPH-Related Impacts

TPH-contaminated soil and/or groundwater was identified in one or more samples collected from each of the three borings advanced around the Fuel and Chemical Storage Building. On the north/northwest side of the building, only the shallow soil sample from FC01 contained heavy-oil-range TPH above the MTCA A cleanup level (Figure 5-2). At FC02, on the west side of the building, diesel- and heavy-oil-range TPH were both present at concentrations above MTCA cleanup levels in the deeper soil and groundwater samples. An iridescent, petroleum-like sheen was noted on soils at this location. At FC03, on the east/southeast side of the Fuel and Chemical Storage Building, heavy-oil-range TPH concentrations were above the MTCA A cleanup levels in only the groundwater sample (Figure 5-2). However, what appeared to be a petroleum-like sheen was also noted on soil and groundwater sampled from FC03.

Given their relative positions, and the varying depths and media at/in which contamination was identified around the Fuel and Chemical Storage Building, these samples do not appear to define a single area of contamination, and contamination in this area may be due to one or more sources or spills.

<u>PCP-Related Impacts</u>

The groundwater and the deep soil sample collected from FC01 both contained concentrations of PCP in excess of applicable MTCA cleanup levels. For soil, PCP was present at a concentration above the protection of groundwater, but not the direct contact cleanup level. PCP concentrations in groundwater exceeded both the SWCLs and GCLs (Figure 5-2). Based on the detection of PCP in only the deeper soil sample from this boring, and that this boring was placed hydrologically downgradient of the Fuel and Chemical Storage Building's hazardous waste storage area, it is possible that PCP impacts originated from a spill or release at that building.

FC01 is upgradient of MS01, the location in RAU1 where the highest concentration of PCP was detected in groundwater. While it is possible that PCP identified in groundwater at MS01 mobilized from releases in the vicinity, or upgradient of FC01, additional sampling and testing would be required to make this conclusion.

5.2.2.4 Recommended Sampling

<u>TPH Contaminated Areas</u>

For FC01 and FC02, given their location hydrologically downgradient of the Fuel and Chemical Storage Building, and due to concerns with spills reported in the 1992 RCRA PA report, operations and practices in this building may be the source of TPH impacts to soil and groundwater near this building. More specifically, the past presence of a hydraulic-oil AST, 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 closer to, and as practicable within the footprint of, this building may help identify the sources and/or location of related spills or releases. That ethylbenzene was present above the SCL and detected in groundwater below GCL/SWCL at FC02 may also suggest that gasoline range TPH is a contaminant of concern and should be included in future sampling in this area.

For FC03, although TPH concentrations in soil did not exceed cleanup levels, heavy-oil concentrations in groundwater did. 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. This boring was placed northwest, and hydrologically cross- to downgradient of an area where discolored concrete was observed beneath now removed mill equipment, and an AST (the use for which is not currently known), and palletized buckets were present at the time of drilling, all of which represent potential contamination sources. Historic 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 would be required to better delineate the extent and source of impacts in this area.

PCP Contaminated Areas

As previously mentioned, groundwater sampled from MS01, MS02, MS03, and FC01 all contained concentrations of PCP in excess of the SWCLs and GCLs. While the highest PCP concentration in groundwater was encountered in the sample collected from MS01, the deep soil sample from FC01 was the only soil sample with detectable PCP concentrations. While a Maintenance Building has been present at the location of the current building since at least the 1948, there are no known uses for PCP in this structure. Likewise, apart from the potential for PCP to have been stored in the hazardous material storage area on the northeast corner of the Fuel and Chemical Storage Building, there are no suspected or known uses of PCP in other portions of RAU1.

Locations FC01, MS01, and MS03 are hydrologically cross- to downgradient of the Fuel and Chemical Storage Building’s hazardous material storage area. MS02 is located cross to upgradient of these three boring locations and the hazardous material storage area. Given the relative hydrologic positions of MS02 and the hazardous material storage area, and that PCP was not detected in soil or groundwater from MS06 or FC02, spills or releases at the hazardous material storage area are not likely to be the source of PCP in groundwater at MS02.

To better delineate the extent of PCP impacts, additional soil and groundwater sampling and testing north of, and within, the Fuel and Chemical Storage Building’s hazardous material storage area is recommended. An additional boring(s) south of MS02 may also help define the upgradient extent of impact near the Maintenance Building. Analyzing soil and groundwater collected from other borings that may be advanced at the site for PCP may also help to better characterize the extent of these impacts.

5.3 Remedial Action Unit 2

Sampling in RAU2 focused on the area of the property primarily occupied by the Planer/Grader Building. This building included equipment for planing lumber, treating lumber with anti-sapstain solutions, end sealing the sawn lumber, and sorting and grading lumber. Contamination sources targeted for sampling in this area included locations where PCP-impacted soils had been left in place, locations near curbed concrete containments that appeared to be associated with removed electrical transformers and/or hydraulic equipment, historic oil-water separators, and the location where a release had been documented from a historic Paint Waste UST. Sample locations were selected to identify potential sources of contamination in these areas, as well as to address data gaps related to the extent of subsurface PCP impacts that may remain in the RAU2. Sampling locations are discussed in further detail in the paragraphs that follow.

5.3.1 Planer/Grader Building

5.3.1.1 Sampling Locations and Field Observations

Samples were collected from 10 locations in RAU2, including eight borings advanced around the northern portion of the Planer/Grader Building, and two surface soil/sludge samples (Figure 4-1). Six of the borings (PB01 through PB06) were placed as detailed in the SQAP. The two remaining borings were opportunity borings (PB09 and PB10), added in response to potential contamination identified during field screening at PB02. The two surface soil samples (PB07 and PB08) were collected from a concrete equipment trench on the northeast side of the Planer/Grader Building.

Borings PB01, PB02, and PB03 were placed to assess potential impacts related to transformer containment pads. After field screening identified potential impacts in PB02, the opportunity borings PB09 and PB10 were added to assess the potential down- and cross-gradient migration of impacts from the area of PB02. Locations for borings PB04, PB05, and PB06 were selected to assess data gaps related to the extent of subsurface PCP impacts. Field screening observations are provided below:

- **PB01:** This boring was placed north of the northwest corner of the Planer/Grader Building, near what appeared to have been the planer infeed. Field screening did not identify the potential presence of subsurface contamination or wood waste at this location.
- **PB02:** This boring was placed several feet west of a concrete containment pad, beneath the high-roof/awning on the northwest side of the Planer/Grader Building. Based on map data, the concrete pad may have been associated with hydraulic equipment. This boring also appears to have been downgradient of a historic oil-water separator. Wood waste with a strong petroleum/gear-oil odor was encountered from approximately 6 to 11.5 feet bgs. An iridescent, petroleum-like sheen was noted on the soil and water sampled from this location.

- **PB03:** Wood waste was encountered from 4.5 to 6 feet bgs in this boring, with no odors or other signs of potential impacts noted during field screening.
- **PB04:** This boring was advanced at a location within the reported limits of the historic PCP cleanup excavation. Soils in this area appeared to be imported fill. In order to obtain sufficient productivity for groundwater sampling, several attempts were made to set the well screen.
- **PB05:** This boring was placed at a location south of the apparent limits of PCP impacted soil cleanup work. A cold patch-like material was noted in soils between the ground surface and approximately 1.5 feet bgs. Wood waste was observed from 5 feet bgs to the bottom of the boring. The groundwater sample for this location was collected from a previously installed well (D-05).
- **PB06:** Wood waste was also encountered in this boring at 6 feet bgs. As the temporary well installed in this boring did not produce sufficient water for sample collection, the groundwater sample corresponding to this location was collected from well D-04e, located approximately 10 feet from boring PB06.
- **PB07 and PB08:** These samples were surface soil/sludge samples collected from within the concrete conveyor trench located north of the northwest corner of the Planer/Grader Building.
- **PB09:** This boring was placed northwest of PB02 to assess the potential for downgradient migration of contaminants from PB02. Wood waste was encountered in this boring at 5.5 feet bgs. No signs of contamination were noted while field screening this location.
- **PB10:** This boring was placed west/southwest of PB02 to assess the potential cross-gradient migration of contaminants from PB02. The upper approximately 16 inches of this boring was a concrete slab, with additional intervals of asphalt cold patch like material noted in soils beneath the concrete. Wood waste was encountered in this boring at 5.5 feet bgs. No other signs of contamination were noted while field screening this location.

5.3.1.2 Results Discussion

As summarized in Tables 5-1 and 5-4, and similar to other samples from the site, multiple metals were detected in every soil sample at concentrations above the most restrictive MTCA SCL, while one or more SVOC exceeded the most restrictive SCL in three of the 16 soil samples. PCP was detected at a concentration above the SCL for protection of groundwater quality in two samples, both of which were collected from boring PB04. Arsenic and thallium were the only analytes present at concentrations above the MTCA B direct contact cleanup level. Acetone was the only VOC detected in soil at a concentration above the contract required quantitation limit (CRQL); however, the concentrations were well below even the most restrictive SCL. Figures 5-3 and 5-4 graphically depict select inorganic and organic analytical data for samples collected in RAU2.

Two soil samples from RAU2, specifically from boring PB02, included heavy-oil-range TPH at concentrations in excess of the MTCA A SCL (Figure 5-4). Strong petroleum odors and an iridescent sheen were noted in the sample matrix while field screening both samples from this location. Based on field observations and analytical results, petroleum-contaminated soil and wood waste may extend from the ground surface up to approximately 9 feet bgs at this location.

Referencing Table 5-5, both surface soil samples (PB07SS and PB08SS) collected from soil/sludge accumulated in the bottom of the concrete conveyor trench on the northeast corner of the Planer/Grader Building contained multiple metals, SVOCs, and cPAH TEQ values at concentrations above the most restrictive SCL. Arsenic was the only contaminant that exceeded the MTCA B direct contact cleanup level, while one of the cPAH TEQ values exceeded the MTCA B direct contact value. Samples PB07 and PB08 also contained heavy-oil-range TPH at concentrations well above the MTCA A SCL.

In groundwater samples (see Tables 5-1 and 5-6), analytes exceeding the GCL included lead in one location, manganese in two locations, and vanadium and heavy-oil-range TPH in one location. One or more metals also exceeded the SWCL in PB02GW (arsenic, copper, lead, manganese, and vanadium), PB03GW (manganese) and PB09GW (arsenic, lead, and manganese). PCP concentrations in groundwater exceeded both the GCL and SWCL in PB04GW. In addition, the SVOC 2,4-dichlorophenol was present in groundwater from PB04GW at concentrations above both the GCL for protection of the VI pathway and the SWCL. While several VOCs were detected in groundwater at concentrations above the CRQL, none were detected at concentrations exceeding even the most restrictive GCL or SWCL.

The only location in RAU2 with detectable PCP in soil and groundwater was PB04. This boring location was selected to target an area where relatively high concentrations of PCP were reportedly left in place at the end of soil cleanup efforts that took place in the 1990s. It appears reasonable to presume that similar PCP cleanup level exceedances persist at other areas where historical PCP soil cleanup efforts took place. It is notable that groundwater sampled from monitoring well D-05, the location where PCP concentrations had regularly exceeded cleanup levels during past monitoring, did not contain PCP at a concentration above the contract required quantitation limit. While analytical data for PCP in soils at RAU2 are subject to the same concerns regarding quantitation limits as with RAU1 (i.e., dilutions and elevated quantitation limits providing non-detect results above the SCL), PCP was not detected above the CRQL in soils sampled from RAU2 outside the limits of previous remedial efforts. Additionally, given that PCP was not detected above the CRQL in other groundwater samples from RAU2, the cleanup of PCP contaminated soil appears to be generally effective in protecting groundwater quality at the site.

5.3.1.3 Findings

TPH-Related Impacts
Heavy-oil-range TPH was present in both the shallow and deep soil samples, as well as the groundwater sample collected from PB02, located on the west side of this building (Figure 5-4). Strong odors and apparent free product were noted on groundwater and the sample matrix collected in this location. After boring completion, the START also noted stained/discolored, and potential petroleum-impacted soil at the point where a conveyor line appears to have entered the Planer/Grader Building; that conveyor line entrance was approximately 10 feet north of PB02. Historic maps also indicate hydraulic equipment had been located at or in the vicinity of the curbed concrete containment structure adjacent to the boring, and an oil-water separator associated with “tilt-hoist” equipment was located upgradient of this boring. Based on sampling data from PB01, PB09, and PB10, cross- to downgradient migration of contaminants from PB02 appears to be limited.

Two surface soil samples were collected from the concrete conveyor trench on the north side of the Planer/Grader Building. Both samples contained heavy-oil-range TPH at high concentrations relative to MTCA A cleanup levels. Soil in this trench also contained cPAHs at concentrations above the MTCA B direct contact cleanup level. While numerous metals were also identified in these soil samples, none were at concentrations above the direct contact cleanup value.

PCP-Related Impacts
PCP-impacted soil and groundwater were identified in both the shallow and deep soil and the groundwater samples collected from PB04 (Figure 5-4). The concentrations of PCP in both soil samples from PB04 exceeded the value for protection of groundwater, but were below the direct contact cleanup value. This boring was placed at what appears to have been the approximate location of a cleanup confirmation sample collected by EMCON (sample #402). Sample #402 was collected from 16 feet bgs to represent soils left in place at the end of excavation work.

Since EMCON completed cleanup of PCP-impacted soil at the site in the early 1990s, the MTCA cleanup level for PCP has been significantly lowered. Assuming that the analytical data from PB04 are representative of other areas targeted by EMCON’s cleanup efforts, soils with PCP at concentrations above current day soil cleanup levels for protection of groundwater quality are likely to remain at many, if not all, of the areas previously subjected to cleanup. That said, PB04 was the only location within RAU2 where PCP was detected in soil and groundwater, and this boring was placed near/within the limits of previous remedial action.

5.3.1.4 Recommended Sampling

TPH Contaminated Areas
Additional subsurface sampling at locations generally south and east of PB02 would be needed to better understand the extent of impacts in this area. Boring locations would ideally be 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. Depending on the need to better bracket this area of impact, sampling north and west of PB02 may also be prudent.

Samples collected in this conveyor trench are assumed to be representative of surface soils/sludge within the entirety of the trench, and no additional sampling of these surface soils/sludge appears warranted. That said, as the integrity of the trench is not currently known, additional subsurface soil and groundwater sampling from locations adjacent to the trench may be warranted to assess whether leakage from the trench to the surrounding soils has impacted subsurface environmental conditions. If no additional samples are collected, all soil/sludge within the trench should be assumed to be contaminated.

PCP Contaminated Areas
Given the absence of PCP in other samples collected from RAU2, PCP that remains in RAU2 does not appear to be mobile, and remedial actions undertaken appear to be/have been protective of groundwater quality in the area surrounding the building. Additional sampling would be necessary to confirm this assumption and provide a more accurate estimate of the volume of soil with PCP concentrations above current cleanup levels. In deciding on the need for additional sampling to characterize the volume of remaining PCP-impacted soils, stakeholders will have to factor in site development plans, long-term stakeholder risk tolerance, and potential end uses for soils that may be excavated during construction.

5.3.2 Former Paint Waste UST

5.3.2.1 Sampling Locations and Field Observations

Two borings were advanced in the reported vicinity of the former Paint Waste UST (Figure 4-1). This tank had been located near the southeast corner of the Planer/Grader Building and was associated with historic subsurface releases and remedial activity. Boring PW01 was placed in a hydrologically downgradient location relative to the former UST location to assess the potential migration of contaminants from the UST. As the full extent of soil impacts was not apparently removed during UST closure, boring PW02 was advanced within an area of patched asphalt, interpreted as the former UST location. Field screening observations from these locations are provided below:

- **PW01:** While this boring was intended to assess subsurface environmental conditions downgradient of the former Paint Waste UST, the limited vertical clearance within this portion of the Planer/Grader Building prevented the field team from placing the boring closer to the historic UST. Other than encountering wood waste approximately 5.5 feet bgs, soils recovered from this boring were typical for the site. No odors, sheen, or elevated PID readings were noted while screening soils at this location. This boring was advanced within approximately 10 feet of the existing monitoring well D-02; groundwater representing this location was sampled from D-02.

- **PW02:** Wood waste was encountered from 2.6 to 6 feet bgs in this boring. Dark grey silt that appeared consistent with river sediment type deposits was encountered from 4 feet to the bottom of the boring. No odors or other signs of potential impacts were noted while screening soils from this boring. PW02 was advanced within approximately 3 feet of existing well D-03; groundwater was sampled from this well.

  At the start of groundwater sampling, 4.8 feet of water had been measured in well D-03. During purging, well D-03 was noted to have low productivity, and even with pumping less than 0.1 liters of water per minute, the well was purged dry. After pumping was stopped, the water level recovered less than 0.8 feet in the following 45 minutes, and only 2.35 feet in the following 23 hours. As such, this groundwater sample was collected the following day from water that accumulated in the well without any additional purging.

5.3.2.2 Results Discussion

As summarized in Tables 5-1 and 5-4, only one sample from this area of RAU2 (PW02SB03) included contaminants at concentrations above the most restrictive MTCA SCL. In this case, several PAHs individually and the cPAH TEQ value exceeded both the most restrictive SCL and the less restrictive MTCA B and/or A direct contact cleanup level. While diesel and heavy-oil TPH and several VOCs were also detected in soil from this area, none of these analytes were present at concentrations above even the most restrictive SCL. Only two SVOCs and one VOC was present in groundwater sampled from this area at concentrations above the CRQL; however, none of the analytes were at concentrations above cleanup levels (see Table 5-6).

5.3.2.3 Findings

The shallow soil sample collected from the boring advanced in the area of the removed Paint Waste UST (PW02SB03) contained multiple PAHs at concentrations exceeding groundwater protection or MTCA A direct contact cleanup value. The benzo(a)pyrene concentration and the calculated cPAH TEQ value for this sample also exceeded the MTCA B direct contact value. Analysis of both the deeper soil sample and groundwater from this boring demonstrate that impacts are vertically limited in this location. The presence of a low-permeability silt layer approximately 4 feet bgs at this location is likely to vertically limit contaminant migration.

5.3.2.4 Recommended Sampling

Analytical data generated during this field event confirm that soils remain impacted at/in the vicinity of the removed Paint Waste UST. These impacts are reported to extend beneath the adjacent building. Sampling and testing within this building footprint would be required in order to further assess the extent of impacts that may exist beneath this portion of the Planer/Grader Building. Given the limited vertical clearance in the building, if such sampling and testing was undertaken prior to the building's demolition, limited access drilling equipment would likely be required.

5.4 Remedial Action Unit 3

Sampling in RAU3 focused on the western portion of the property. While this area had primarily been used for lumber/timber storage, historic maps of the site depicted the former Oil Tank and Chemical Storage Shed in this area. Borings were placed in the vicinity of the shed's mapped location to assess whether it may represent a historic source of contamination. These borings are discussed in the paragraphs that follow.

5.4.1 Former Oil Tank and Chemical Storage Shed

5.4.1.1 Sampling Locations and Observations Summary

Three borings were advanced in RAU3 (Figure 4-1). This included two borings (OC01 and OC02) advanced in the vicinity of the reported past location of the Oil Tank and Chemical Storage Shed. The third boring (OC03) was advanced at a subsurface anomaly identified in RAU3 by the geophysical contractor. Field screening observations from these locations are provided below:

- **OC01 and OC02:** Other than encountering wood waste at approximately 6-feet bgs in both borings, soils recovered from this boring were typical for the site. No odors, sheen, or elevated PID readings were noted while screening soils at this location.
- **OC03:** Soils from the ground surface to approximately 3 feet bgs included the cold patch type material similar to that noted in other locations at the site, consisting of gravel covered by an oil/tar like substance. Otherwise, no odors or other signs of potential impacts were noted while screening this location. Wood waste was not encountered in this boring.

5.4.1.2 Results Discussion

As summarized in Tables 5-1 and 5-7, and similar to other samples from the site, multiple metals were detected in every soil sample from RAU3 at concentrations above the most restrictive MTCA SCL. SVOCs, represented by cPAH values, exceeded the most restrictive SCL in two of the six soil samples. Arsenic and thallium were the only contaminants present at concentrations above the MTCA B direct contact cleanup level. While one VOC and heavy-oil were detected at concentrations above the CRQL or method reporting limit (MRL), neither were at concentrations exceeding even the most restrictive soil cleanup level.

With respect to groundwater results (see Tables 5-1 and 5-8), manganese was the only analyte that exceeded both the GCL and SWCL (in all samples), and exceeded the GCL in two samples (OC02GW and OC03GW). Additionally, arsenic exceeded the SWCL in one sample (OC03GW). No VOCs, SVOCs, or TPH products were detected at concentrations above the CRQL or MRL.

5.4.1.3 Findings

The shallow subsurface soil samples from both OC01 and OC02 were impacted by total cPAH TEQ at concentrations above the MTCA A cleanup level for unrestricted land use, but below the MTCA B direct contact value. While heavy-oil-range TPH was also present in the shallow soil samples from OC01, OC02, and OC03, the concentrations were below cleanup levels (Figure 5-4). No organic constituents exceeded cleanup levels in the deeper samples from this area, nor has the full aerial extent of impacts apparently been defined in this area.

5.4.1.4 Recommended Sampling

At the oil tank and chemical storage shed, shallow subsurface soil samples from both OC01 and OC02 were impacted by total cPAH at concentrations above the MTCA A cleanup level for unrestricted land use but below the MTCA B direct contact cleanup level. Shallow soil samples from all three borings in this area also contained heavy-oil-range TPH; however, they were detected at concentrations below cleanup levels. Sources for these impacts could include the now-removed 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.

Additional sampling and testing would be necessary to further define the extent of these impacts. 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 what the buried “spherical” object identified by the geophysical contractor may be.

5.5 Remedial Action Unit 4

RAU4 is the final area of the site included in this sampling event. Sampling was undertaken in this area to address data gaps regarding areas of known or suspected contamination.

5.5.1 Former NaOH Release Area

5.5.1.1 Sampling Locations and Observations Summary

Tanks that stored wash water with residual NaOH generated during parts washing had been located in this area of the site. Potential release(s) from these tanks were identified during their removal, when significant corrosion was observed on the attached sewer pipe. No sampling and testing had occurred in this area. Soils in this boring (NA01) exhibited a slight petroleum odor and low PID detections at approximately 2.8 feet bgs. As the boring progressed, soils in the deeper portion of the boring transitioned to grey fine silt that appeared consistent with the interpreted river sediment encountered in the deeper interval of PW02. Similar to PW02/D-03, groundwater productivity was limited in this location, and a water sample could not be collected.

5.5.1.2 Results Discussion

As summarized in Tables 5-1 and 5-9, and similar to other samples from the site, multiple metals were detected in both soil samples collected from NA01 at concentrations above the most restrictive MTCA SCLs. Of these, only thallium was present in soil at a concentration above the MTCA B direct contact cleanup level. No SVOCs were detected at concentrations above the most restrictive SCL. No TPH products were detected at concentrations above the MRL.

Groundwater was not sampled from boring NA01.

5.5.2 Former Vehicle Maintenance Area

5.5.2.1 Sampling Locations and Observations Summary

One boring (VM01) was advanced on the north side of the former Vehicle Maintenance Area at the northwest corner of the Main Shipping Shed structure (Figure 4-1). No samples had been collected in this area in the past. No wood waste, staining, odors, or PID detections were noted in material recovered from this boring.

5.5.2.2 Results Discussion

As summarized in Tables 5-1 and 5-9, and similar to other samples from the site, multiple metals were detected in both soil samples collected from VM01 at concentrations above the most restrictive MTCA SCLs. Of these, only thallium was present in soil at a concentration above the MTCA B direct contact cleanup level. No TPH products were detected at concentrations above the MRL, and all of the SVOC and VOC detections were at concentrations well below even the most restrictive SCL.

With respect to groundwater results (see Table 5-8), manganese was the only analyte that exceeded the SWCL and GCL. Additionally, arsenic exceeded the SWCL. No VOCs, SVOCs, or TPH products were present in the groundwater sample at concentrations even close to approaching the SWCL or GCL.

6 Site Summary and Conclusions

As detailed in Section 5, laboratory analysis and field screening work conducted during this TBA identified multiple areas of soil and groundwater contamination. In several instances, these findings provide a greater understanding of the potential extent of previously identified areas of contamination. Work during this TBA has also identified multiple locations where subsurface contamination had not been encountered and/or existing data and site knowledge did not indicate a likelihood of the encountered contaminant being present. Sampling during this TBA, however, may not have identified the full nature and extent of subsurface contamination at the site. While follow-on cleanup work will likely be required, the project stakeholders agreed that this TBA will not include a discussion of potential site cleanup options.

6.1 Site Summary

This TBA focused on TAL metals; SVOCs, including PAHs and cPAHs; TPH-Dx; VOCs; and PCBs as the potential contaminants of concern at the site. The decision to focus on these contaminants was based on available information and professional judgment. As a general observation, data generated during this assessment identified a limited group of constituents from these analytical suites at concentrations above the various MTCA cleanup levels. Table 6-1 provides the frequencies of exceedance of regulatory criteria values across the entire site. Where more than one cleanup level was available and considered for a given analyte, this table includes both cleanup levels and the number of times a given analyte was present at a concentration exceeding the given cleanup level.

Constituents that were detected at concentrations that exceeded one or more MTCA cleanup level included heavy-oil-range TPH, PCP, several SVOCs, one or more of the cPAHs individually or as represented by the calculated benzo(a)pyrene TEF/TEQ value, and 11 metals. With regard to metals, however, several analytes that exceeded MTCA cleanup levels were present at concentrations in line with naturally occurring background levels. For this reason, they are likely not indicative of contamination.

For TPH products, heavy-oil-range TPH was detected in 28 of the 73 soil and groundwater samples. The concentrations of heavy-oil-range TPH exceeded MTCA A SCL in 11 soil and five groundwater samples. Diesel-range TPH was only detected in 3 of the 73 soil and groundwater samples. The concentrations of heavy-oil-range TPH exceeded MTCA A SCL in 11 soil and five groundwater samples. The one soil and one groundwater sample with diesel-range TPH concentrations above cleanup levels were both collected from a single boring (FC02) where heavy-oil-range TPH concentrations also exceeded cleanup levels. The third sample with detectable diesel-range TPH also contained heavy-oil-range TPH (PW02SB03); however, the total TPH-Dx concentration (i.e., the summed concentration of diesel and heavy-oil-range TPH) in this sample was below the MTCA A cleanup level.

With few exceptions, PCP, or one or more of the cPAHs (i.e., benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene) were the only SVOCs detected at concentrations above MTCA cleanup levels. PCP concentrations in soil exceeded the MTCA B protection of groundwater cleanup level in eight of the 50 samples; however, PCP concentrations were all below the MTCA B direct contact cleanup level. Five of the 23 groundwater samples collected during this TBA contained PCP at concentrations above both the MTCA SWCL and GCL. Nine of the 50 soil samples had cPAH TEQ values above one or more MTCA cleanup level. Four of the 23 groundwater samples had cPAH TEQ values in excess of the MTCA SWCL and GCL.

Other SVOCs detected at concentrations above MTCA cleanup levels were present in surface soil samples collected from the concrete trench north of the Planer/Grader Building; subsurface soils on the west side of the Planer/Grader Building; and subsurface soils north of the Fuel and Chemical Storage Building. SVOC exceedances in groundwater were almost universally related to the presence of PCP or the cPAHs. The only exception to this was sample PB04GW, which contained 2,4-dichlorophenol above both the surface water and GCL for protection of VI exposure risk.

While 11 metals (arsenic, barium, cadmium, copper, lead, manganese, nickel, silver, thallium, vanadium, and zinc) were detected in soil and groundwater at concentrations above one or more SCL, only three of these metals were present in soil at concentrations above the MTCA B direct contact cleanup level (arsenic, manganese, and thallium). Of these, manganese was the only one of these three metals that was also present at concentrations above the 90th percentile background soil concentration established by Ecology (Ecology 1994). Three metals (lead, manganese, and vanadium) in groundwater exceeded both the MTCA SWCL and/or GCL used for comparative purposes in this TBA. Manganese was the metal that most frequently exceeded the MTCA SWCL and GCL. As discussed in Appendix H, elevated concentrations of manganese may be the result of biochemical processes.

6.2 Regulatory Framework Considerations

As discussed in Section 4.2 of this report, the most restrictive cleanup values available for nearly all of the contaminants of concern in soil are meant to be protective of potable groundwater quality. For groundwater itself, the most restrictive cleanup level was almost universally a surface water cleanup level. For reasons outlined in the following paragraphs, these cleanup levels may not ultimately represent appropriate metrics by which to judge environmental contamination at the site.

Groundwater sampled during this TBA was collected from the shallow aquifer, located within several feet of the ground surface. The site is also located adjacent the Chehalis River's outlet to Grays Harbor, a tidally influenced, brackish surface waterbody. Given these factors, as well as the historically industrial nature of the site, and that drinking water at and near the site is provided by the municipality, groundwater from the site is unlikely to be used as a potable water source. As such, consumption of groundwater is not likely to represent a completed exposure pathway, and adherence to a soil cleanup level meant to protect such groundwater use is likely to be overly conservative.

That said, when reviewing contaminant levels in groundwater, data were also compared to both the groundwater and surface water cleanup levels. With few exceptions, the surface water cleanup values used were lower than the groundwater cleanup level available for the same constituent. Use of the surface water cleanup value was recommended by Ecology for many of the same reasons that make potable end-use of groundwater unlikely. In other words, given the shallow nature of groundwater, the site's location adjacent to a brackish surface water environment, and the potential migration of groundwater from the site to that surface waterbody, contaminants in groundwater at the site should not adversely affect the surface water quality of the adjacent waterbody. However, since all groundwater samples collected during this TBA were from locations 100 feet or more from the shoreline, a blanket application of the surface water cleanup values, without considering other fate and transport related factors such as dilution, soil adsorption, and microbial action, may also be overly conservative.

Depending on where the points of compliance are established for groundwater impacts at the site, calculating site-specific cleanup levels will likely be warranted. In that event, if site-specific levels are established for upland locations, once attenuation, dilution, dispersion, biodegradation, and other factors are taken into the account, the site-specific groundwater values established to be protective of surface water would likely be higher than the default MCTA SWCLs, but lower than the default GCLs. For the purposes of this report, both the SWCLs and GCLs were included to provide a "first approximation" of the range of cleanup values that may apply to the site and to help identify areas to target for further assessment.

Soil exposure scenarios appropriate to the site may best be represented by direct contact with contaminated media. For this reason, soil data were compared to two SCLs: the more restrictive values designed to be protective of groundwater quality, and the higher/less restrictive values that are protective of direct contact with soil. Similar to groundwater GCLs, the two SCLs are used to provide "first approximations" of areas where data from further assessment and/or soil remediation may lead to the greatest benefit to groundwater quality. However, if soil cleanup is required to create conditions that are protective of surface water quality, site-specific SCLs would likely need to be calculated, taking into account SWCLs that would need to be achieved, the location of points of compliance (i.e., how far from the shoreline), and other fate and transport related contaminant level reduction that may occur as groundwater migrates from the site to Grays Harbor.

6.3 Conclusions

Sampling during this TBA has 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.
- 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 is not well understood and additional sampling and testing would be required to identify related sources. Assessment strategies for identifying these contaminant sources are discussed in detail in Section 5 of this report; however, actual follow-on sampling approaches should be formulated in conjunction with site redevelopment planning efforts, taking viable exposure pathways and the potential utility of developing site-specific cleanup levels into consideration.

7

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Figures

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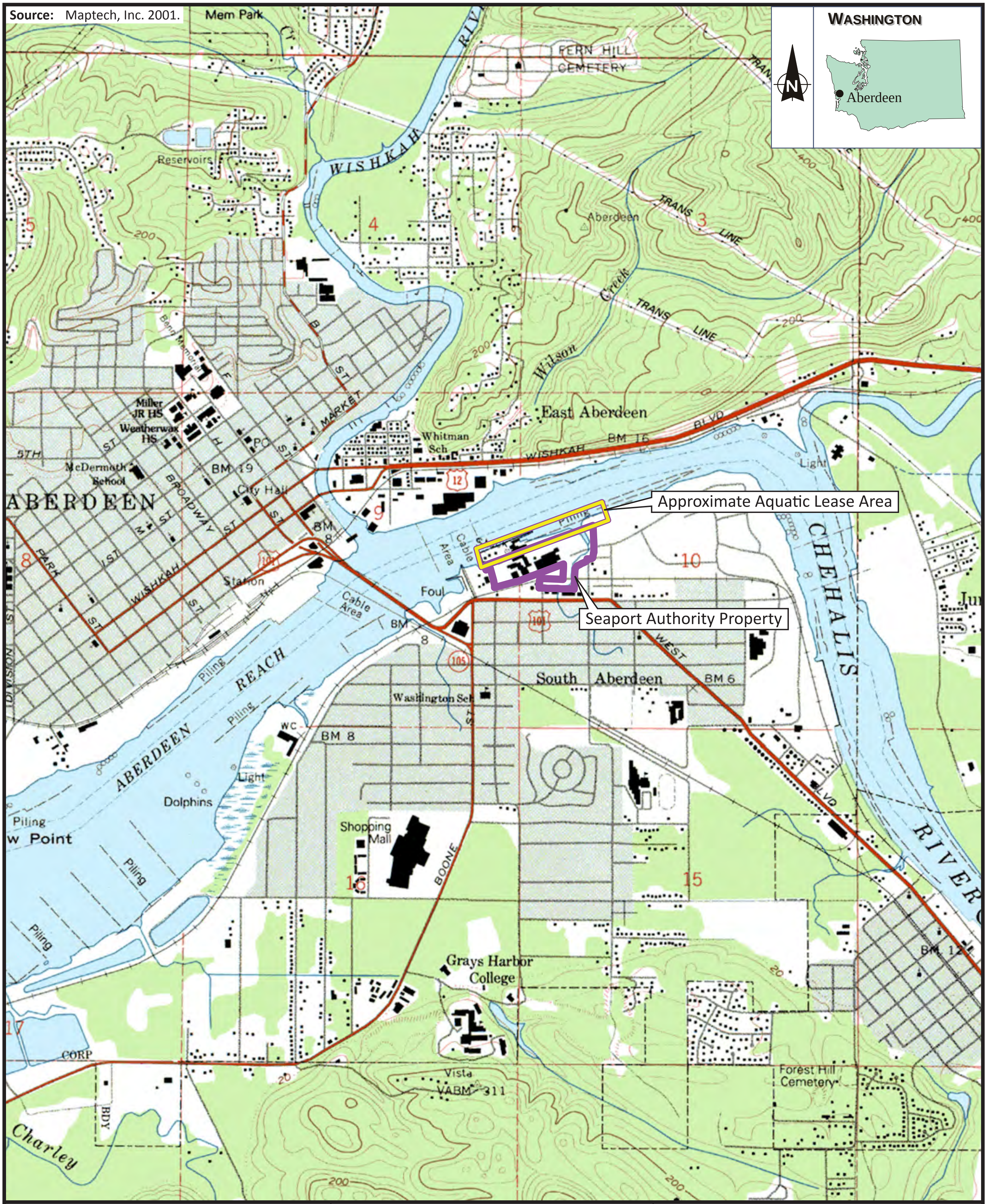

ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

SEAPORT LANDING
Aberdeen, Washington

0 1000 2000
Approximate Scale in Feet

Figure 2-1
SITE LOCATION MAP

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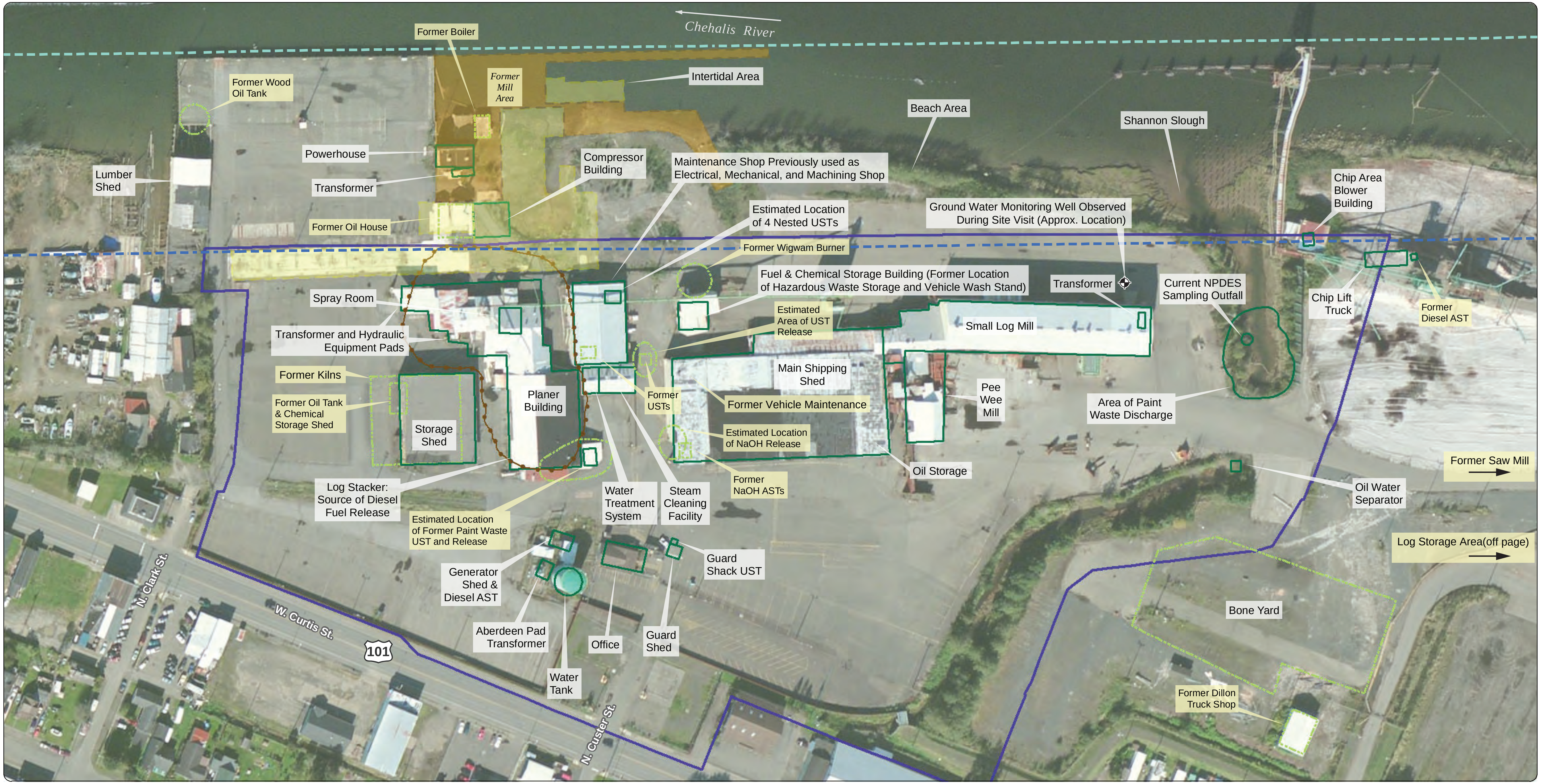

Sources:
Aerial photograph obtained from Esri ArcGIS Online.
Parcels and roads obtained from Grays Harbor County.
Harbor lines obtained from Washington Dept. of Natural Resources.
Former features from Level I Environmental Site Assessment,
PES Environmental; August 13, 2010.

MAUL FOSTER ALONGI

Date: 1/22/2016

Legend

🟨 Former Mill	- - - Inner Harbor Line
🟧 Former Wharf Extension	- - - Outer Harbor Line
🟩 Existing Buildings/Features	🟪 Seaport Authority Property
▨ Former Buildings/Features	
▨ Former PCP Release	

0 100 200
Feet

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SEAPORT LANDING
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Figure 2-2
SITE LAYOUT MAP

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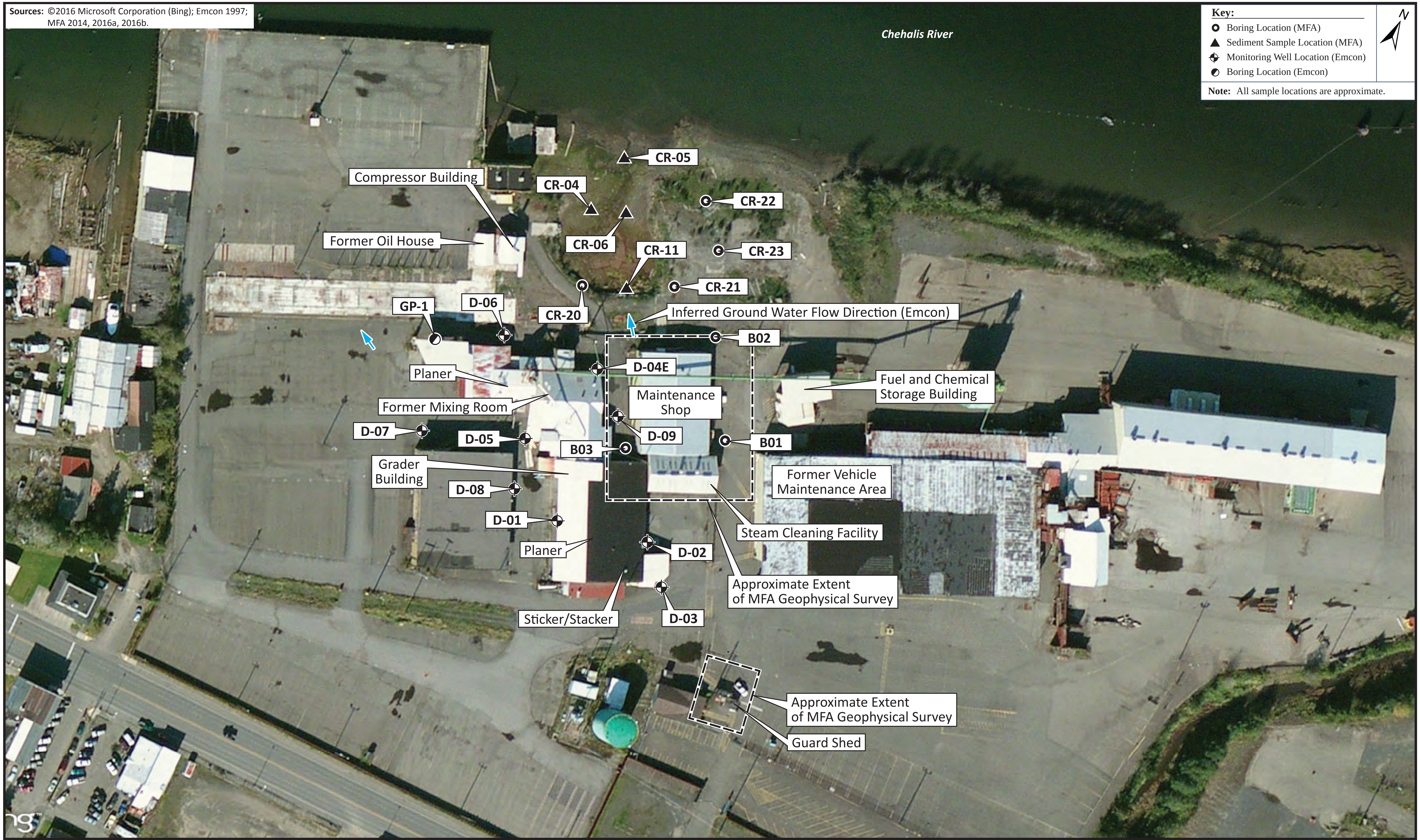

Sources: ©2016 Microsoft Corporation (Bing); Emcon 1997; MFA 2014, 2016a, 2016b.

ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

0 40 80 160
Approximate Scale in Feet

SEAPORT LANDING
Aberdeen, Washington

Figure 2-3
HISTORIC SELECT SAMPLE LOCATIONS (MFA)

Date:	Drawn by:	
4/4/18	AES	10:START IV\17010004\fig 2-3

Sources: ©2016 Microsoft Corporation (Bing); Emcon 1997; MFA 2014, 2016a, 2016b.

ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

0 50 100 200
Approximate Scale in Feet

SEAPORT LANDING
Aberdeen, Washington

Figure 3-1
REMEDIAL ACTION UNITS AND SELECT FEATURES

Date:	Drawn by:	
4/4/18	AES	10:START IV\17010004\fig 3-1

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Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

0 50 100 Feet

0 25 50 Meters

- ● Surface Soil Sample
- ⊕ Subsurface Soil and Groundwater Sample
- ⊗ Subsurface Soil Sample
- ✦ Existing Monitoring Well

Approximate Remedial Action Unit Area

- 🟦 RAU1
- 🟪 RAU2
- 🟧 RAU3
- 🟩 RAU4
- 🟥 RAU5

Figure 4-1
Sample Location Map

Seaport Landing

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Date: 5/11/2018

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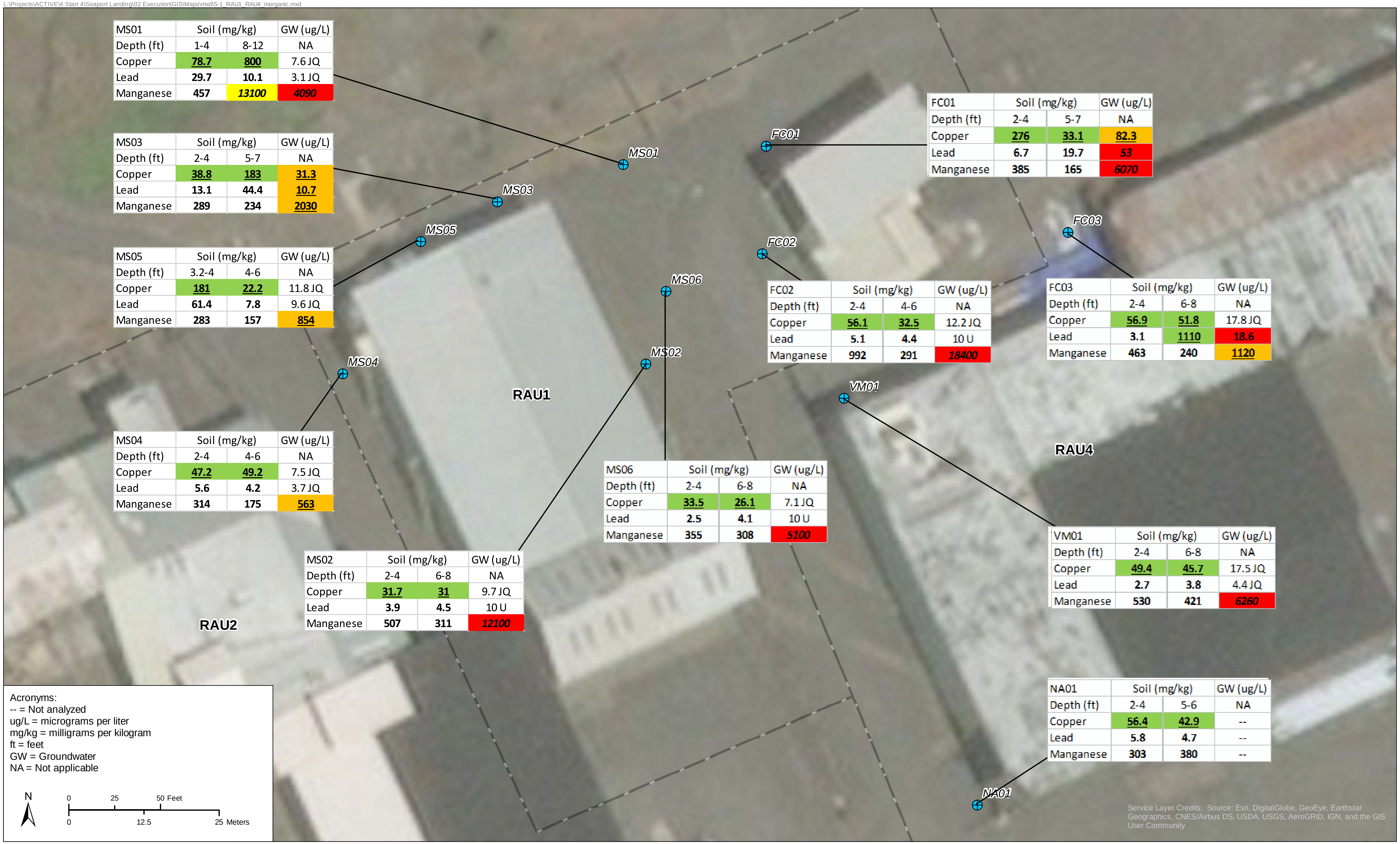

MS01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	1-4	8-12	NA
Copper	78.7	800	7.6 JQ
Lead	29.7	10.1	3.1 JQ
Manganese	457	13100	4090

MS03	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	5-7	NA
Copper	38.8	183	31.3
Lead	13.1	44.4	10.7
Manganese	289	234	2030

MS05	Soil (mg/kg)		GW (ug/L)
Depth (ft)	3.2-4	4-6	NA
Copper	181	22.2	11.8 JQ
Lead	61.4	7.8	9.6 JQ
Manganese	283	157	854

MS04	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	4-6	NA
Copper	47.2	49.2	7.5 JQ
Lead	5.6	4.2	3.7 JQ
Manganese	314	175	563

MS02	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	6-8	NA
Copper	31.7	31	9.7 JQ
Lead	3.9	4.5	10 U
Manganese	507	311	12100

MS06	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	6-8	NA
Copper	33.5	26.1	7.1 JQ
Lead	2.5	4.1	10 U
Manganese	355	308	5100

FC01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	5-7	NA
Copper	276	33.1	82.3
Lead	6.7	19.7	53
Manganese	385	165	6070

FC02	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	4-6	NA
Copper	56.1	32.5	12.2 JQ
Lead	5.1	4.4	10 U
Manganese	992	291	18400

FC03	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	6-8	NA
Copper	56.9	51.8	17.8 JQ
Lead	3.1	1110	18.6
Manganese	463	240	1120

VM01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	6-8	NA
Copper	49.4	45.7	17.5 JQ
Lead	2.7	3.8	4.4 JQ
Manganese	530	421	6260

NA01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	5-6	NA
Copper	56.4	42.9	--
Lead	5.8	4.7	--
Manganese	303	380	--

Acronyms:
-- = Not analyzed
ug/L = micrograms per liter
mg/kg = milligrams per kilogram
ft = feet
GW = Groundwater
NA = Not applicable

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

⊕ Subsurface Soil and Groundwater Sample

Note:
🟧 = Concentration exceeds MTCA surface water cleanup values
🟥 = Concentration exceeds MTCA surface water and/or groundwater cleanup value
🟩 = Concentration exceeds MTCA B protection of groundwater value
🟨 = Concentration exceeds MTCA B direct contact value
Please refer to analytical summary tables for additional detail on cleanup levels used and analytical qualifiers

Figure 5-1
Select Inorganic Subsurface Sample Results
RAU1 and RAU4
Seaport Landing

ecology and environment, inc.
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Date: 4/4/2018

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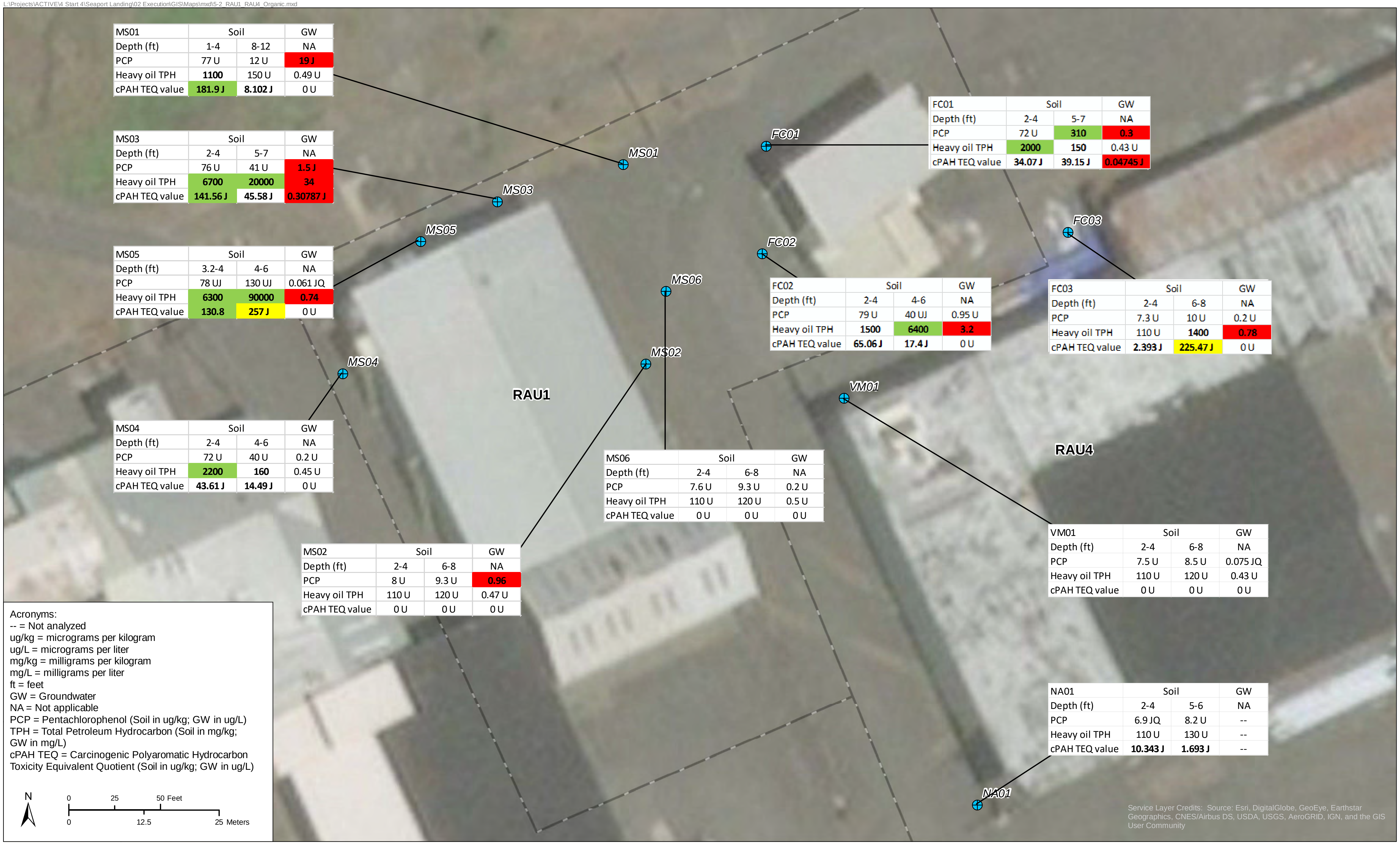

MS01	Soil		GW
Depth (ft)	1-4	8-12	NA
PCP	77 U	12 U	**19 J**
Heavy oil TPH	**1100**	150 U	0.49 U
cPAH TEQ value	**181.9 J**	**8.102 J**	0 U

MS03	Soil		GW
Depth (ft)	2-4	5-7	NA
PCP	76 U	41 U	**1.5 J**
Heavy oil TPH	**6700**	**20000**	**34**
cPAH TEQ value	**141.56 J**	**45.58 J**	**0.30787 J**

MS05	Soil		GW
Depth (ft)	3.2-4	4-6	NA
PCP	78 UJ	130 UJ	0.061 JQ
Heavy oil TPH	**6300**	**90000**	**0.74**
cPAH TEQ value	**130.8**	**257 J**	0 U

MS04	Soil		GW
Depth (ft)	2-4	4-6	NA
PCP	72 U	40 U	0.2 U
Heavy oil TPH	**2200**	**160**	0.45 U
cPAH TEQ value	**43.61 J**	**14.49 J**	0 U

MS02	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	8 U	9.3 U	0.96
Heavy oil TPH	110 U	120 U	0.47 U
cPAH TEQ value	0 U	0 U	0 U

MS06	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	7.6 U	9.3 U	0.2 U
Heavy oil TPH	110 U	120 U	0.5 U
cPAH TEQ value	0 U	0 U	0 U

FC01	Soil		GW
Depth (ft)	2-4	5-7	NA
PCP	72 U	**310**	**0.3**
Heavy oil TPH	**2000**	**150**	0.43 U
cPAH TEQ value	**34.07 J**	**39.15 J**	**0.04745 J**

FC02	Soil		GW
Depth (ft)	2-4	4-6	NA
PCP	79 U	40 UJ	0.95 U
Heavy oil TPH	**1500**	**6400**	**3.2**
cPAH TEQ value	**65.06 J**	**17.4 J**	0 U

FC03	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	7.3 U	10 U	0.2 U
Heavy oil TPH	110 U	**1400**	**0.78**
cPAH TEQ value	**2.393 J**	**225.47 J**	0 U

VM01	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	7.5 U	8.5 U	0.075 JQ
Heavy oil TPH	110 U	120 U	0.43 U
cPAH TEQ value	0 U	0 U	0 U

NA01	Soil		GW
Depth (ft)	2-4	5-6	NA
PCP	6.9 JQ	8.2 U	--
Heavy oil TPH	110 U	130 U	--
cPAH TEQ value	**10.343 J**	**1.693 J**	--

Acronyms:
-- = Not analyzed
ug/kg = micrograms per kilogram
ug/L = micrograms per liter
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
ft = feet
GW = Groundwater
NA = Not applicable
PCP = Pentachlorophenol (Soil in ug/kg; GW in ug/L)
TPH = Total Petroleum Hydrocarbon (Soil in mg/kg; GW in mg/L)
cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient (Soil in ug/kg; GW in ug/L)

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Legend

⊕ Subsurface Soil and Groundwater Sample

Note:
🟧 = Concentration exceeds MTCA surface water cleanup values
🟥 = Concentration exceeds MTCA surface water and/or groundwater cleanup value
🟩 = Concentration exceeds MTCA B protection of groundwater value
🟨 = Concentration exceeds MTCA B direct contact value
Please refer to analytical summary tables for additional detail on cleanup levels used and analytical qualifiers

Figure 5-2
Select Organic Subsurface Sample Results
RAU1 and RAU4
Seaport Landing

ecology and environment, inc.
Global Environmental Specialists

Date: 4/4/2018

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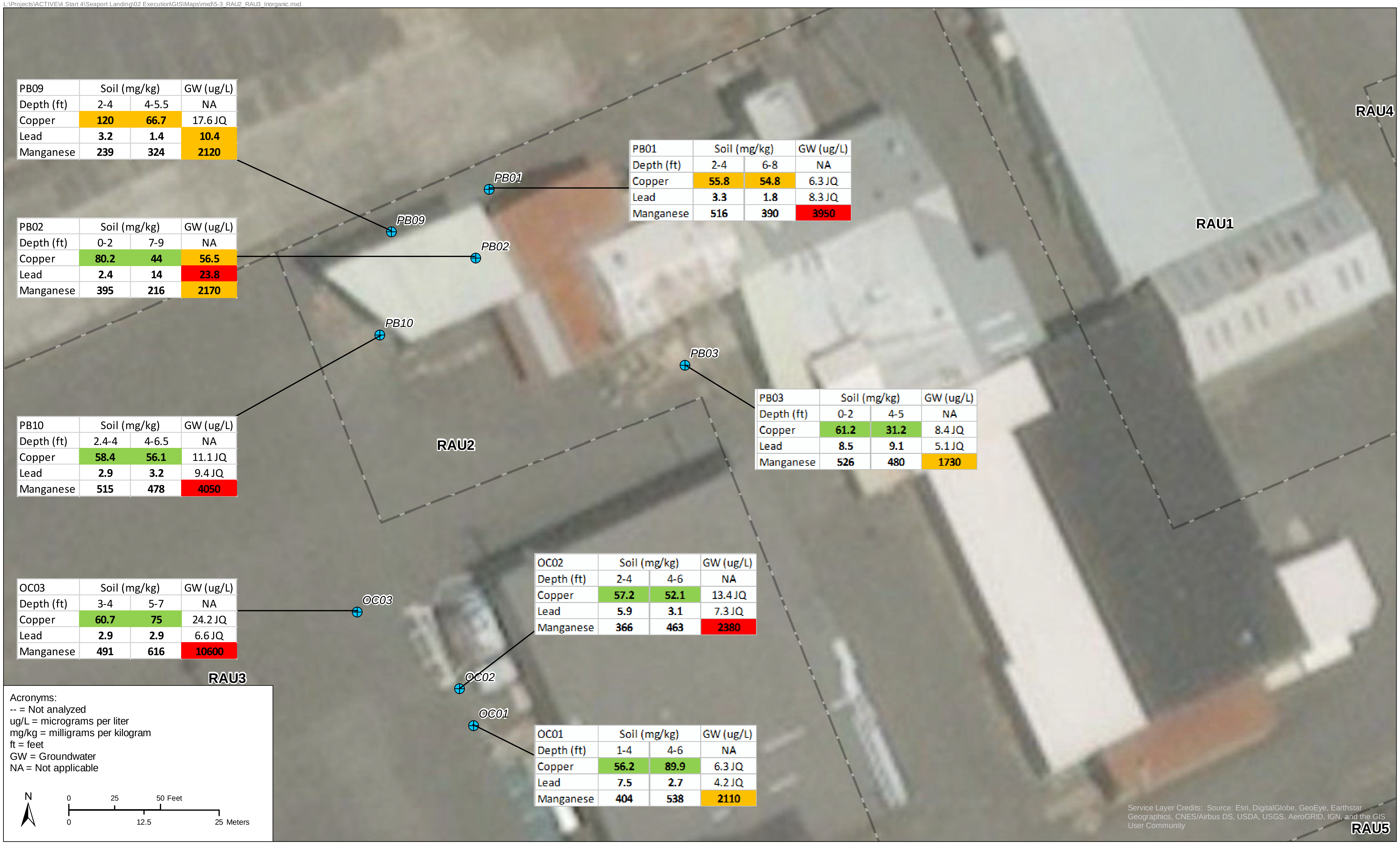

PB09	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	4-5.5	NA
Copper	**120**	**66.7**	17.6 JQ
Lead	**3.2**	**1.4**	**10.4**
Manganese	**239**	**324**	**2120**

PB01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	6-8	NA
Copper	**55.8**	**54.8**	6.3 JQ
Lead	**3.3**	**1.8**	8.3 JQ
Manganese	**516**	**390**	**3950**

PB02	Soil (mg/kg)		GW (ug/L)
Depth (ft)	0-2	7-9	NA
Copper	**80.2**	**44**	**56.5**
Lead	**2.4**	**14**	**23.8**
Manganese	**395**	**216**	**2170**

PB10	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2.4-4	4-6.5	NA
Copper	**58.4**	**56.1**	11.1 JQ
Lead	**2.9**	**3.2**	9.4 JQ
Manganese	**515**	**478**	**4050**

PB03	Soil (mg/kg)		GW (ug/L)
Depth (ft)	0-2	4-5	NA
Copper	**61.2**	**31.2**	8.4 JQ
Lead	**8.5**	**9.1**	5.1 JQ
Manganese	**526**	**480**	**1730**

OC03	Soil (mg/kg)		GW (ug/L)
Depth (ft)	3-4	5-7	NA
Copper	**60.7**	**75**	24.2 JQ
Lead	**2.9**	**2.9**	6.6 JQ
Manganese	**491**	**616**	**10600**

OC02	Soil (mg/kg)		GW (ug/L)
Depth (ft)	2-4	4-6	NA
Copper	**57.2**	**52.1**	13.4 JQ
Lead	**5.9**	**3.1**	7.3 JQ
Manganese	**366**	**463**	**2380**

OC01	Soil (mg/kg)		GW (ug/L)
Depth (ft)	1-4	4-6	NA
Copper	**56.2**	**89.9**	6.3 JQ
Lead	**7.5**	**2.7**	4.2 JQ
Manganese	**404**	**538**	**2110**

Acronyms:
-- = Not analyzed
ug/L = micrograms per liter
mg/kg = milligrams per kilogram
ft = feet
GW = Groundwater
NA = Not applicable

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Legend

⊕ Subsurface Soil and Groundwater Sample

Note:
🟧 = Concentration exceeds MTCA surface water cleanup values
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🟨 = Concentration exceeds MTCA B direct contact value
Please refer to analytical summary tables for additional detail on cleanup levels used and analytical qualifiers

Figure 5-3
Select Inorganic Subsurface Sample Results
RAU2 and RAU3
Seaport Landing

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Global Environmental Specialists

Date: 4/4/2018

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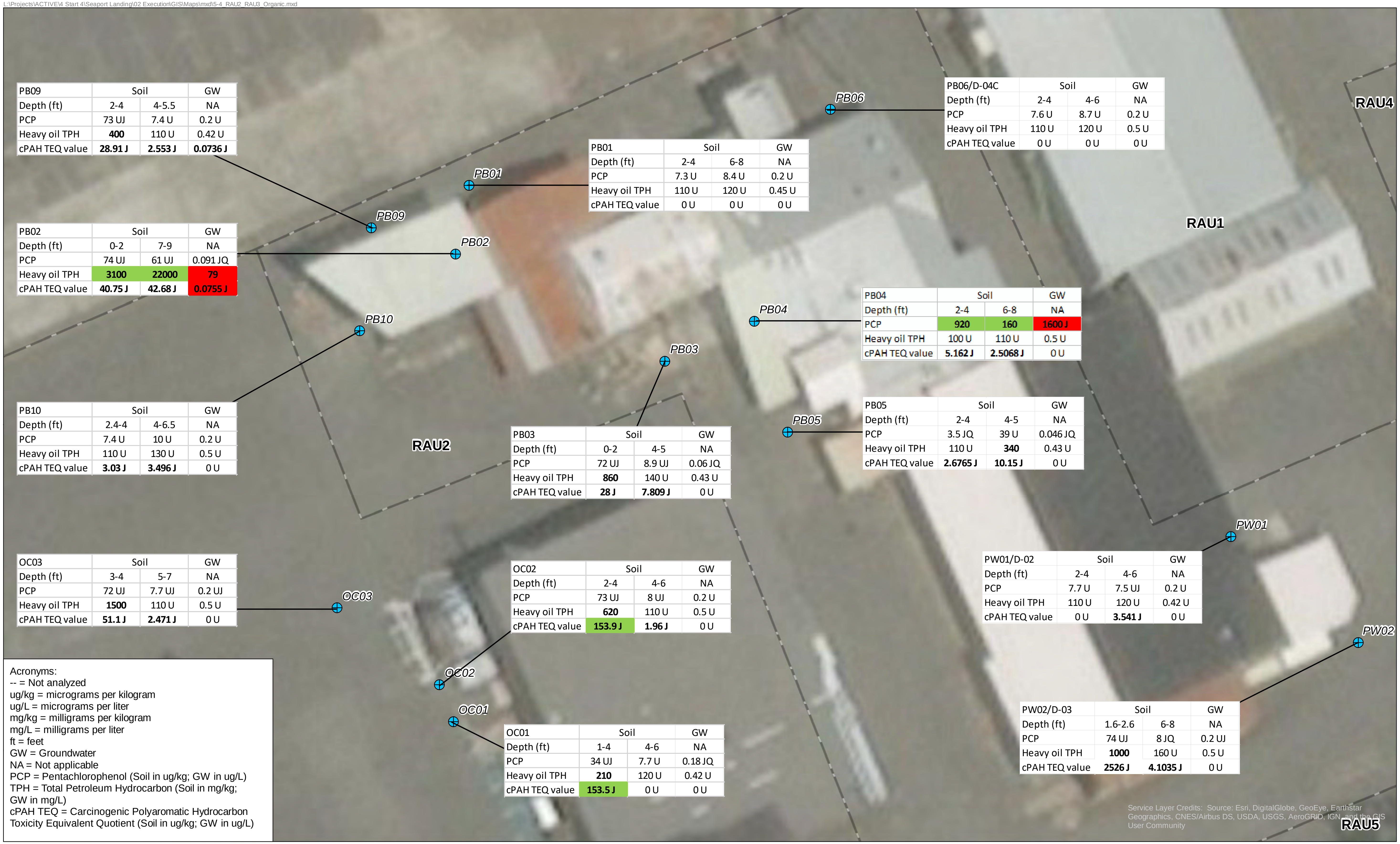

PB09	Soil		GW
Depth (ft)	2-4	4-5.5	NA
PCP	73 UJ	7.4 U	0.2 U
Heavy oil TPH	**400**	110 U	0.42 U
cPAH TEQ value	**28.91 J**	**2.553 J**	**0.0736 J**

PB02	Soil		GW
Depth (ft)	0-2	7-9	NA
PCP	74 UJ	61 UJ	0.091 JQ
Heavy oil TPH	**3100**	**22000**	**79**
cPAH TEQ value	**40.75 J**	**42.68 J**	**0.0755 J**

PB10	Soil		GW
Depth (ft)	2.4-4	4-6.5	NA
PCP	7.4 U	10 U	0.2 U
Heavy oil TPH	110 U	130 U	0.5 U
cPAH TEQ value	**3.03 J**	**3.496 J**	0 U

OC03	Soil		GW
Depth (ft)	3-4	5-7	NA
PCP	72 UJ	7.7 UJ	0.2 UJ
Heavy oil TPH	**1500**	110 U	0.5 U
cPAH TEQ value	**51.1 J**	**2.471 J**	0 U

PB01	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	7.3 U	8.4 U	0.2 U
Heavy oil TPH	110 U	120 U	0.45 U
cPAH TEQ value	0 U	0 U	0 U

PB06/D-04C	Soil		GW
Depth (ft)	2-4	4-6	NA
PCP	7.6 U	8.7 U	0.2 U
Heavy oil TPH	110 U	120 U	0.5 U
cPAH TEQ value	0 U	0 U	0 U

PB04	Soil		GW
Depth (ft)	2-4	6-8	NA
PCP	**920**	**160**	**1600 J**
Heavy oil TPH	100 U	110 U	0.5 U
cPAH TEQ value	**5.162 J**	**2.5068 J**	0 U

PB03	Soil		GW
Depth (ft)	0-2	4-5	NA
PCP	72 UJ	8.9 UJ	0.06 JQ
Heavy oil TPH	**860**	140 U	0.43 U
cPAH TEQ value	**28 J**	**7.809 J**	0 U

PB05	Soil		GW
Depth (ft)	2-4	4-5	NA
PCP	3.5 JQ	39 U	0.046 JQ
Heavy oil TPH	110 U	**340**	0.43 U
cPAH TEQ value	**2.6765 J**	**10.15 J**	0 U

OC02	Soil		GW
Depth (ft)	2-4	4-6	NA
PCP	73 UJ	8 UJ	0.2 U
Heavy oil TPH	**620**	110 U	0.5 U
cPAH TEQ value	**153.9 J**	**1.96 J**	0 U

PW01/D-02	Soil		GW
Depth (ft)	2-4	4-6	NA
PCP	7.7 U	7.5 UJ	0.2 U
Heavy oil TPH	110 U	120 U	0.42 U
cPAH TEQ value	0 U	**3.541 J**	0 U

OC01	Soil		GW
Depth (ft)	1-4	4-6	NA
PCP	34 UJ	7.7 U	0.18 JQ
Heavy oil TPH	**210**	120 U	0.42 U
cPAH TEQ value	**153.5 J**	0 U	0 U

PW02/D-03	Soil		GW
Depth (ft)	1.6-2.6	6-8	NA
PCP	74 UJ	8 JQ	0.2 UJ
Heavy oil TPH	**1000**	160 U	0.5 U
cPAH TEQ value	**2526 J**	**4.1035 J**	0 U

Acronyms:
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ug/kg = micrograms per kilogram
ug/L = micrograms per liter
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
ft = feet
GW = Groundwater
NA = Not applicable
PCP = Pentachlorophenol (Soil in ug/kg; GW in ug/L)
TPH = Total Petroleum Hydrocarbon (Soil in mg/kg; GW in mg/L)
cPAH TEQ = Carcinogenic Polyaromatic Hydrocarbon Toxicity Equivalent Quotient (Soil in ug/kg; GW in ug/L)

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Legend

⊕ Subsurface Soil and Groundwater Sample

N
0 25 50 Feet
0 12.5 25 Meters

Note:
🟧 = Concentration exceeds MTCA surface water cleanup values
🟥 = Concentration exceeds MTCA surface water and/or groundwater cleanup value
🟩 = Concentration exceeds MTCA B protection of groundwater value
🟨 = Concentration exceeds MTCA B direct contact value
Please refer to analytical summary tables for additional detail on cleanup levels used and analytical qualifiers

Figure 5-4
Select Organic Subsurface Sample Results
RAU2 and RAU3
Seaport Landing

ecology and environment, inc.
Global Environmental Specialists

Date: 4/4/2018

Tables

Table 4-1 Regulatory Criteria

Analyte	CAS #	Soil				Groundwater					Surface Water (Marine Waters)								
			MTCA B				MTCA B				MTCA B		Acute		Chronic		Human Health		
		MTCA A	Non-cancer	Cancer	Protective of GW (Saturated)	MTCA A	Non-cancer	Cancer	Protective of VI Non-cancer	Protective of VI Cancer	Non-cancer	Cancer	Aquatic Life WAC	Aquatic Life CWA	Aquatic Life WAC	Aquatic Life CWA	WAC	40 CFR 131	CWA
Metals		(mg/kg)				(μg/L)					(μg/L)								
Antimony	7440-36-0	--	32	--	0.27	--	6.4	--	--	--	1000	--	--	--	--	--	180	90	640
Arsenic	7440-38-2	20	24	0.67	0.15	5	4.8	0.058	--	--	18	0.098	69	69	36	36	10	0.14	0.14
Barium	7440-39-3	--	16000	--	83	--	3200	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	7440-41-7	--	160	--	3.2	--	32	--	--	--	270	--	--	--	--	--	--	--	--
Cadmium	7440-43-9	2	80	--	--	5	8	--	--	--	--	--	42	33	9.3	7.9	--	--	--
Chromium	7440-47-3	2000[a]	120,000[a]	--	24,000[a]	50	24,000[a]	--	--	--	--	--	--	--	--	--	--	--	--
Copper	7440-50-8	--	3200	--	14	--	640	--	--	--	2900	--	4.8	4.8	3.1	3.1	--	--	--
Lead	7439-92-1	250	--	--	150	15	--	--	--	--	--	--	210	210	8.1	8.1	--	--	--
Manganese	7439-96-5	--	11000	--	--	--	2200	--	--	--	--	--	--	--	--	--	--	--	100
Nickel	7440-02-0	--	1600	--	6.5	--	320	--	--	--	1100	--	74	74	8.2	8.2	190	100	4600
Selenium	7782-49-2	--	400	--	0.26	--	80	--	--	--	2700	--	290	290	71	71	480	200	4200
Silver	7440-22-4	--	400	--	0.69	--	80	--	--	--	26000	--	1.9	1.9	--	--	--	--	--
Thallium	7440-28-0	--	0.8	--	0.011	--	0.16	--	--	--	0.22	--	--	--	--	--	0.27	6.3	0.47
Vanadium	7440-62-2	--	400	--	80	--	80	--	--	--	--	--	--	--	--	--	--	--	--
Zinc	7440-66-6	--	24000	--	300	--	4800	--	--	--	17000	--	90	90	81	81	2900	1000	26000
Polychlorinated Biphenyls		(μg/kg)				(μg/L)					(μg/L)								
Aroclor 1016	12674-11-2	--	5.60	14	--	--	1.1	1.3	--	--	0.0058	0.003	--	--	--	--	--	--	--
Aroclor 1242	53469-21-9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	12672-29-6	--	--	--	--	--	--	--	--	--	--	--		--	--	--	--	--	--
Aroclor 1254	11097-69-1	--	1.60	0.5	--	--	0.32	0.044	--	--	0.0017	0.0001	--	--	--	--	--	--	--
Aroclor 1260	11096-82-5	--	--	0.5	--	--	--	0.044	--	--	--	--	--	--	--	--	--	--	--
PCBs	1336-36-3	1000	--	0.5	--	0.10	--	0.044	--	--	--	0.0001	10	--	0.03	0.03	0.00017	0.000007	0.000064
SVOCs		(μg/kg)				(μg/L)					(μg/L)								
1,1'-Biphenyl	92-52-4	--	40000000	130000	--	--	4000	5.5	--	--	--	--	--	--	--	--	--	--	--
2,2'-Oxybis(1-chloropropane)	108-60-1	--	3200000	14000	--	--	320	0.63	--	--	42000	37	--	--	--	--	--	900	4000
2,3,4,6-Tetrachlorophenol	58-90-2	--	2400000	--	--	--	480	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	--	8000000	--	1500	--	800	--	--	--	--	--	--	--	--	--	--	--	600
2,4,6-Trichlorophenol	88-06-2	--	80000	91000	2.7	--	8	4	--	--	17	3.9	--	--	--	--	0.28	--	2.8
2,4-Dichlorophenol	120-83-2	--	240000	--	10	--	24	--	--	--	190	--	--	--	--	--	34	10	60
2,4-Dimethylphenol	105-67-9	--	1600000	--	79	--	160	--	--	--	550	--	--	--	--	--	97	--	3000
2,4-Dinitrophenol	51-28-5	--	160000	--	9.2	--	32	--	--	--	3500	--	--	--	--	--	610	100	300
2,4-Dinitrotoluene	121-14-2	--	160000	3200	0.11	--	32	0.28	--	--	1400	5.5	--	--	--	--	0.18	--	1.7
2,6-Dinitrotoluene	606-20-2	--	24000	670	0.021	--	4.8	0.058	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	91-58-7	--	6400000	--	--	--	640	--	--	--	1000	--	--	--	--	--	180	100	1000
2-Chlorophenol	95-57-8	--	40000	--	27	--	40	--	--	--	97	--	--	--	--	--	17	--	800
2-Methylnaphthalene	91-57-6	--	320000	--	--	--	32	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	95-48-7	--	4000000	--	150	--	400	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	88-74-4	--	800000	--	--	--	160	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	--	--	2200	0.2	--	--	0.19	--	--	--	0.046	--	--	--	--	0.0033	--	0.15

Table 4-1 Regulatory Criteria

Analyte	CAS #	Soil				Groundwater					Surface Water (Marine Waters)								
			MTCA B				MTCA B				MTCA B		Acute		Chronic		Human Health		
		MTCA A	Non-cancer	Cancer	Protective of GW (Saturated)	MTCA A	Non-cancer	Cancer	Protective of VI Non-cancer	Protective of VI Cancer	Non-cancer	Cancer	Aquatic Life WAC	Aquatic Life CWA	Aquatic Life WAC	Aquatic Life CWA	WAC	40 CFR 131	CWA
4-Chloroaniline	106-47-8	--	320000	5000	0.077	--	32	0.22	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	106-44-5	--	8000000	--	--	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	--	4800000	--	5000	--	960	--	--	--	640	--	--	--	--	--	110	30	90
Acetophenone	98-86-2	--	8000000	--	--	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	120-12-7	--	24000000	--	110000	--	4800	--	--	--	26000	--	--	--	--	--	4600	100	400
Atrazine	1912-24-9	--	2800000	4300	--	--	560	0.38	--	--	--	--	--	--	--	--	--	--	--
Benzaldehyde	100-52-7	--	8000000	250000	--	--	800	11	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	56-55-3	--	--		43	--	--	0.12	--	--	--	--	--	--	--	--	0.021	0.00016	0.0013
Benzo(a)pyrene	50-32-8	100	24000	190	190	0.1	4.8	0.023	--	--	26	0.22	--	--	--	--	0.0021	0.000016	0.00013
Benzo(b)fluoranthene	205-99-2	--	--		150	--	--	0.12	--	--	--	--	--	--	--	--	0.021	0.00016	0.0013
Benzo(k)fluoranthene	207-08-9	--	--		1500	--	--	1.20	--	--	--	--	--	--	--	--	0.21	0.0016	0.013
Bis(2-Chloroethyl)ether	111-44-4	--	--	910	0.014	--	--	0.040	--	26	--	0.85	--	--	--	--	0.06	--	2.2
Bis(2-ethylhexyl)phthalate	117-81-7	--	1600000	71000	670	--	320	6.3	--	--	400	3.6	--	--	--	--	0.25	0.046	0.37
Butylbenzylphthalate	85-68-7	--	16000000	530000	650	--	3200	46	--	--	1300	8.2	--	--	--	--	0.58	0.013	0.1
Caprolactam	105-60-2	--	40000000	--	--	--	8000	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	218-01-9	--	--		4800	--	--	11.99	--	--	--	--	--	--	--	--	2.1	0.016	0.13
Cresol, m-	108-39-4	--	4000000	--	--	--	400	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	53-70-3	--	--		21	--	--	0.012	--	--	--	--	--	--	--	--	0.0021	0.000016	0.00013
Dibenzofuran	132-64-9	--	80000	--	--	--	16	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	84-66-2	--	64000000	--	4700	--	13000	--	--	--	28000	--	--	--	--	--	5000	200	600
Di-n-butylphthalate	84-74-2	--	8000000	--	3000	--	1600	--	--	--	2900	--	--	--	--	--	510	8	30
Di-n-octylphthalate	117-84-0	--	800000	--	13000000	--	160	--	--	--	--	--	--	--	--	--	--	--	--
Dioxane, 1,4-	123-91-1	--	2400000	10000	--	--	240	0.44	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	206-44-0	--	3200000	--	32000	--	640	--	--	--	90	--	--	--	--	--	16	6	20
Fluorene	86-73-7	--	3200000	--	5100	--	640	--	--	--	3500	--	--	--	--	--	610	10	70
Hexachlorobenzene	118-74-1	--	64000	630	44	--	13	0.055	--	--	0.24	0.00047	--	--	--	--	0.000052	0.000005	0.000079
Hexachlorocyclopentadiene	77-47-4	--	480000	--	9600	--	48	--	--	--	3600	--	--	--	--	--	630	1	4
Hexachloroethane	67-72-1	--	56000	25000	2.3	--	5.6	1.1	187	3.10	21	1.9	--	--	--	--	0.13	0.02	0.1
Indeno(1,2,3-cd)pyrene	193-39-5	--	--		420	--	--	0.12	--	--	--	--	--	--	--	--	0.021	0.00016	0.0013
Isophorone	78-59-1	--	16000000	1100000	15	--	1600	46	--	--	120000	1600	--	--	--	--	110	--	1800
Naphthalene	91-20-3	5000	1600000	--	240	160	160	--	167	8.93	4900	--	--	--	--	--	--	--	--
Nitrobenzene	98-95-3	--	160000	--	6.5	--	16	--	10514	160	1800	--	--	--	--	--	320	100	600
N-Nitroso-di-n-propylamine	621-64-7	--	--	140	0.0039	--	--	0.013	--	--	--	0.82	--	--	--	--	0.058	--	0.51
N-Nitrosodiphenylamine	86-30-6	--	--	200000	28	--	--	18	--	--	--	9.7	--	--	--	--	0.69	--	6
Pentachlorophenol	87-86-5	--	400000	2500	0.88	--	80	0.22	--	--	1200	1.5	13	13	7.9	7.9	0.1	0.002	0.04
Phenol	108-95-2	--	24000000	--	760	--	2400	--	--	--	560000	--	--	--	--	--	200000	70000	300000
Pyrene	129-00-0	--	2400000	--	33000	--	480	--	--	--	2600	--	--	--	--	--	460	8	30

Table 4-1 Regulatory Criteria

Analyte	CAS #	Soil				Groundwater					Surface Water (Marine Waters)								
			MTCA B				MTCA B				MTCA B		Acute		Chronic		Human Health		
		MTCA A	Non-cancer	Cancer	Protective of GW (Saturated)	MTCA A	Non-cancer	Cancer	Protective of VI Non-cancer	Protective of VI Cancer	Non-cancer	Cancer	Aquatic Life WAC	Aquatic Life CWA	Aquatic Life WAC	Aquatic Life CWA	WAC	40 CFR 131	CWA
VOCs		(µg/kg)				(µg/L)					(µg/L)								
1,1,1-Trichloroethane	71-55-6	2000	160000000	--	84	200	16000	--	5238	--	930000	--	--	--	--	--	160000	50000	200000
1,1,2,2-Tetrachloroethane	79-34-5	--	1600000	5000	0.08	--	160	0.22	--	6.20	10000	6.5	--	--	--	--	0.46	0.3	3
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	--	2400000000	--	--	--	240000	--	1100	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79-00-5	--	320000	18000	1.8	--	32	0.77	4.51	7.71	2300	25	--	--	--	--	1.8	0.9	8.9
1,1-Dichloroethane	75-34-3	--	16000000	180000	2.6	--	1600	7.7	--	11	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	75-35-4	--	4000000	--	2.5	--	400	--	130	--	23000	--	--	--	--	--	4100	4000	20000
1,2,4-Trichlorobenzene	120-82-1	--	800000	34000	29	--	80	1.5	39	--	230	2	--	--	--	--	0.14	0.037	0.076
1,2-Dibromo-3-chloropropane	96-12-8	--	16000	1300	--	--	1.6	0.055	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	106-93-4	5	720000	500	--	0.01	72	0.022	277	0.28	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	--	7200000	--	400	--	720	--	2571	--	4200	--	--	--	--	--	2500	800	3000
1,2-Dichloroethane	107-06-2	--	480000	11000	1.6	5	48	0.48	140	4.20	13000	59	--	--	--	--	120	73	650
1,2-Dichloropropane	78-87-5	--	7200000	27800	1.7	--	320	1.2	28	3.89	25000	43	--	--	--	--	3.1	--	31
1,4-Dichlorobenzene	106-46-7	--	5600000	190000	68	--	560	8.1	7808	4.85	3300	22	--	--	--	--	580	200	900
2-Butanone	78-93-3	--	48000000	--	--	--	4800	--	1739130	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	108-10-1	--	6400000	--	--	--	640	--	471429	--	--	--	--	--	--	--	--	--	--
Acetone	67-64-1	--	72000000	--	2100	--	7200	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	71-43-2	30	320000	18000	1.7	5	32	0.80	103	2.40	2000	23	--	--	--	--	1.6	--	16
Bromodichloromethane	75-27-4	--	1600000	16000	2.6	--	160	0.71	--	1.84	14000	28	--	--	--	--	3.6	2.8	27
Bromoform	75-25-2	--	1600000	130000	23	--	160	5.5	--	200	14000	220	--	--	--	--	27	12	120
Bromomethane	74-83-9	--	--	--	--	--	11	--	13	--	970	--	--	--	--	--	2400	--	10000
Carbon disulfide	75-15-0	--	8000000	--	270	--	800	--	400	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	56-23-5	--	320000	14000	2.2	--	32	0.63	59	0.54	550	4.9	--	--	--	--	0.35	--	5
Chlorobenzene	108-90-7	--	1600000	--	51	--	160	--	286	--	5000	--	--	--	--	--	890	200	800
Chloroform	67-66-3	--	800000	32000	4.8	--	80	1.4	495	1.20	6900	56	--	--	--	--	1200	600	2000
Chloromethane	74-87-3	--	--	--	--	--	--	--	153	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156-59-2	--	1600000	--	5.2	--	16	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	124-48-1	--	1600000	12000	1.8	--	160	0.52	--	4.53	14000	21	--	--	--	--	3	2.2	21
Dibromomethane (Methylene Bromide	74-95-3	--	800000	--	--	--	80	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	75-71-8	--	16000000	--	--	--	1600	--	6	--	--	--	--	--	--	--	--	--	--
Dichloropropene, 1,3-	542-75-6	--	2400000	10000	0.14	--	240	0.44	23	2	41000	34	--	--	--	--	2	1.2	12
Ethylbenzene	100-41-4	6000	8000000	--	340	700	800	--	2783	--	6900	--	--	--	--	--	270	31	130
Hexachlorobutadiene	87-68-3	--	80000	13000	30	--	8	0.56	--	0.81	930	30	--	--	--	--	4.1	0.01	0.01
Isopropylbenzene	98-82-8	--	8000000	--	--	--	800	--	--	--	--	--	--	--	--	--	--	--	--
Methyl acetate	79-20-9	--	80000000	--	--	--	8000	--	--	--	--	--	--	--	--	--	--	--	--
Methyl tert-butyl ether	1634-04-4	100	--	560000	7.2	20	--	24	87003	610	--	--	--	--	--	--	--	--	--
Methylene chloride	75-09-2	20	480000	500000	1.5	5	48	22	4865	4434	17000	3600	--	--	--	--	250	100	1000
Styrene	100-42-5	--	16000000	--	120	--	1600	--	8104	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	127-18-4	50	480000	480000	2.8	5	48	21	44	23	500	100	--	--	--	--	7.1	2.9	29
Toluene	108-88-3	7000	6400000	--	270	1000	640	--	15584	--	19000	--	--	--	--	--	410	130	520

Table 4-1 Regulatory Criteria

Analyte	CAS #	Soil				Groundwater					Surface Water (Marine Waters)								
			MTCA B				MTCA B				MTCA B		Acute		Chronic		Human Health		
		MTCA A	Non-cancer	Cancer	Protective of GW (Saturated)	MTCA A	Non-cancer	Cancer	Protective of VI Non-cancer	Protective of VI Cancer	Non-cancer	Cancer	Aquatic Life WAC	Aquatic Life CWA	Aquatic Life WAC	Aquatic Life CWA	WAC	40 CFR 131	CWA
trans-1,2-Dichloroethene	156-60-5	--	1600000	--	32	--	160	--	--	--	33000	--	--	--	--	--	5800	1000	4000
Trichloroethylene	79-01-6	30	40000		1.5	5	4		4	1.55	120	--	--	--	--	--	0.86	0.7	7
Trichlorofluoromethane	75-69-4	--	24000000	--	--	--	2400	--	120	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75-01-4	--	240000	--	0.08	0.2	24	--	57	0.35	6600	--	--	--	--	--	0.26	0.18	1.6
Xylene, m-	108-38-3	--	16000000	--	770	--	1600	--	310	--	--	--	--	--	--	--	--	--	--
Xylene, mixture	1330-20-7	9000	16000000	--	830	1000	1600	--	--	--	--	--	--	--	--	--	--	--	--
Xylene, o-	95-47-6	--	16000000	--	840	--	1600	--	440	--	--	--	--	--	--	--	--	--	--
Xylene, p-	106-42-3	--	16000000	--	960	--	1600	--	--	--	--	--	--	--	--	--	--	--	--
TPH		(mg/kg)				(µg/L)					(µg/L)								
Diesel	None	2000	--	--	--	500	--	--	--	--	--	--	--	--	--	--	--	--	--
Heavy oil	64742-65-0	2000	--	--	--	500	--	--	--	--	--	--	--	--	--	--	--	--	--

Note: Yellow highlighted cells are used to indicate the lowest regulatory criteria value for the given matrix. Refer to Section 4.2 of the TBA report for additional discussion on regulatory criteria used in this assessment.

a = Value is for Chromium III

Key:

-- = No associated cleanup level.
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
CAS = Chemical Abstracts Service
CFR = Code of Federal Regulations
CWA = Clean Water Act
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
MTCA = Model Toxics Control Act
PCBs = Polychlorinated biphenyls
SVOCs = Semivolatile organic compounds
TPH = Total petroleum hydrocarbons
VI = Vapor Intrusion
VOCs = Volatile organic compounds
WAC = Washington Administrative Code

Table 4-2 Sample and Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	Date	Sample Time	Sample Depth Interval [a]	Sampler	Sample Analysis						Description (See Boring Logs for Lithologic/Soil Description)
								TAL Metals	CLP-Aroclors	CLP TCL Semivolatiles-SIM	TCL Volatiles (Trace)	CLP TCL Volatiles (Low)	NWTPH-Dx	
Remedial Action Unit 1 (RAU1)														
Fuel and Chemical Storage Building														
17394200	FC01SB04	JJ450	Soil Subsurface	9/26/2017	8:19	2-4 ft.	D. Pulvino	X		X		X	X	Sample from north side of building. Slight petroleum odor noted in sample material.
17394201	FC01SB07	JJ451	Soil Subsurface	9/26/2017	8:56	5-7 ft.	D. Pulvino	X		X		X	X	Sample from north side of building. Slight petroleum odor noted in sample material. Wood waste at approximately 6.5 feet.
17394202	FC01GW	JJ488	Ground Water	9/26/2017	10:04	5.6 ft.	D. Pulvino	X		X	X		X	Groundwater sample from FC01GW. Core advanced to 12 feet and screen set from 5 to 9 feet bgs to aid well productivity.
17394203	FC02SB04	JJ452	Soil Subsurface	9/25/2017	17:58	2-4 ft.	D. Pulvino	X		X		X	X	Sample from west side of building. Location was within approximately 3 feet of buried line identified by geophysical contractor. Slight petroleum odor noted.
17394204	FC02SB06	JJ453	Soil Subsurface	9/25/2017	18:30	4-6 ft.	D. Pulvino	X		X		X	X	Sample from west side of building. Location was within approximately 3 feet of buried line identified by geophysical contractor. Stronger petroleum odor noted, sheen observed on sample material. Sample collected within top foot of water table.
17394205	FC02GW	JJ489	Ground Water	9/26/2017	9:00	5.32 ft.	D. Pulvino	X		X	X		X	Groundwater sample from FC02GW. Sheen noted on purge water generated prior to sampling. Screened from 5 to 9 feet bgs.
17394271	FC03SB04	JJ4C5	Soil Subsurface	9/29/2017	7:49	2-4 ft.	D. Pulvino	X		X		X	X	Sample from east/southeast of building, near old covered machinery area. Asphalt on top of sample interval, no strong odors.
17394272	FC03SB08	JJ4C6	Soil Subsurface	9/29/2017	7:57	6-8 ft.	D. Pulvino	X		X		X	X	Sample from east/southeast of building, near old covered machinery area. Sampled from bottom two feet of core, including wood waste. Strong petroleum odor and visible sheen on sample material. Potential free product.
17394273	FC03GW	JJ4D2	Ground Water	9/29/2017	8:50	3.84 ft.	D. Pulvino	X		X	X		X	Groundwater sample from FC03GW. Screen set from 4 to 8 feet bgs. Sheen noted on purge water generated prior to sampling.
Maintenance Shop														
17394206	MS01SB04	JJ454	Soil Subsurface	9/26/2017	9:38	1-4 ft.	J. Fetters	X		X		X	X	Sampled east/northeast of maintenance shop, at edge of asphalt paved area. No odors or PID noted.
17394207	MS01SB12	JJ455	Soil Subsurface	9/26/2017	10:13	8-12 ft.	J. Fetters	X		X		X	X	Sampled east/northeast of maintenance shop, at edge of asphalt paved area. No odors or PID noted.
17394208	MS01GW	JJ490	Ground Water	9/26/2017	11:05	4.58 ft.	D. Pulvino	X		X	X		X	Groundwater sample from MS01. Cored to 12 feet bgs, screen set at approximately 5 to 9 feet bgs.
17394209	MS02SB04	JJ456	Soil Subsurface	9/25/2017	16:19	2-4 ft.	D. Pulvino	X		X		X	X	Sampled on west side of maintenance shop by garage door entrance. No odors or PID hits.
17394210	MS02SB08	JJ457	Soil Subsurface	9/25/2017	16:40	6-8 ft.	D. Pulvino	X		X		X	X	Sampled on west side of maintenance shop by garage door entrance. Slight petroleum odor noted.
17394211	MS02GW	JJ491	Ground Water	9/25/2017	18:00	4.9 ft.	R. Nordeen	X		X	X		X	Groundwater sample from MS02. Well screen set from 4 to 8 feet with low water productivity. Sample collected without waiting for groundwater parameter stabilization. Takes nearly 1.5 hours to collect sample.
17394212	MS03SB04	JJ458	Soil Subsurface	9/26/2017	15:35	2-4 ft.	J. Fetters	X		X		X	X	Sample location near northeast corner of Maintenance Shop. First attempt hit refusal at approximately 2 feet bgs on what may have been old support piling. Slight petroleum odor noted at approximately 3 feet bgs.
17394213	MS03SB07	JJ459	Soil Subsurface	9/26/2017	16:12	5-7 ft.	D. Pulvino	X		X		X	X	Sample location near northeast corner of maintenance shop. Slight petroleum odor and sheen on sample.
17394214	MS03GW	JJ492	Ground Water	9/26/2017	17:20	5.2 ft.	D. Pulvino	X		X	X		X	Core advanced to 12 feet bgs, with screen set from 5 to 9 feet bgs. Sheen noted on purge water.

Table 4-2 Sample and Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	Date	Sample Time	Sample Depth Interval [a]	Sampler	Sample Analysis						Description (See Boring Logs for Lithologic/Soil Description)
								TAL Metals	CLP-Aroclors	CLP TCL Semivolatiles-SIM	TCL Volatiles (Trace)	CLP TCL Volatiles (Low)	NWTPH-Dx	
17394215	MS04SB04	JJ460	Soil Subsurface	9/27/2017	9:25	2-4 ft.	D. Pulvino	X		X		X	X	Sample location adjacent to northwest corner of maintenance shop. No discernable odor or PID hits.
17394216	MS04SB06	JJ461	Soil Subsurface	9/27/2017	9:55	4-6 ft.	D. Pulvino	X		X		X	X	Sample location adjacent to northwest corner of maintenance shop. No discernable odor. Sample may include some material drawn down from 0 to 4 foot interval.
17394217	MS04GW	JJ493	Ground Water	9/27/2017	10:46	4.85 ft.	D. Pulvino	X		X	X		X	Groundwater sample from location. Screen set 5 to 9 feet bgs to collect sample.
17394256	MS05SB04	JJ4B4	Soil Subsurface	9/28/2017	15:09	3.2-4 ft.	J. Fetters	X		X		X	X	Opportunity boring placed at westerly-most utility free location on north side of maintenance shop. Sample collected below layer of asphaltic "cold patch" like material. Slight petroleum odor noted on cutting shoe at bottom of interval. No elevated PID detections.
17394257	MS05SB06	JJ4B5	Soil Subsurface	9/28/2017	15:28	4-6 ft.	J. Fetters	X		X		X	X	Strong petroleum odor in sample matrix which consisted of mostly wood debris. Wood waste noted from 4 to 6 feet. Geoprobe cutting shoe clogged by wood debris. Sheen noted on sample, no elevated PID readings.
17394258	MS05GW	JJ4C7	Ground Water	9/28/2017	16:22	4.8 ft.	D. Pulvino	X		X	X		X	Well screen set at 5 to 9 feet in boring, potentially missing free product on top of water table. Oil sheen noted on purge water during sampling.
17394268	MS06SB04	JJ4C3	Soil Subsurface	9/29/2017	8:44	2-4 ft.	J. Fetters	X		X		X	X	Sample from parking lot area between maintenance shop and fuel and chemical storage building, along alignment of utility line that ran west from fuel and chemical storage building. No odors, PID hits, or wood waste encountered.
17394269	MS06SB08	JJ4C4	Soil Subsurface	9/29/2017	8:44	6-8 ft.	J. Fetters	X		X		X	X	Sampled from bottom interval of core, material similar to what was encountered in 0 to 4 foot interval. No odors, wood waste, or PID hits.
17394270	MS06GW	JJ4D1	Ground Water	9/29/2017	10:20	4.4 ft.	D. Pulvino	X		X	X		X	Temporary screen initially set from 6 to 10 feet given previously encountered poor productivity in MS02GW. Pull screen up to span 5 to 9 feet bgs for sampling.
Remedial Action Unit 2 (RAU2)														
Planer/Grader Building														
17394227	PB01SB04	JJ462	Soil Subsurface	9/26/2017	17:12	2-4 ft.	D. Pulvino	X	X	X			X	Boring near northwest side of planer building, north of what appears to have been planer infeed area. No odors or PID detections noted in sample media.
17394228	PB01SB08	JJ463	Soil Subsurface	9/26/2017	17:29	6-8 ft.	D. Pulvino	X	X	X			X	No odors, staining, or PID hits in sample.
17394229	PB01GW	JJ494	Ground Water	9/26/2017	18:30	4.2 ft.	D. Pulvino	X	X	X			X	Groundwater sample collected from location. Screen set at 5 to 9 feet bgs.
17394230	PB02SB02	JJ464	Soil Subsurface	9/27/2017	10:55	0-2 ft.	D. Pulvino	X	X	X			X	Boring advanced adjacent to west side of what appeared to be hydraulic equipment containment. No odors in interval, some of surface asphalt may have been incorporated into sample volume.
17394231	PB02SB09	JJ465	Soil Subsurface	9/27/2017	11:44	7-9 ft.	D. Pulvino	X	X	X			X	Includes bottom of 4 to 8 foot core and top interval of 8 to 12 foot core. Wood plugged cutting shoe while collecting 4 to 8 foot core. Sample included soil above and below wood in 4 to 8 foot and 8 to 12 foot interval (respectively). Some wood incorporated in sample. Strong gear-oil/petroleum-odor noted.
17394232	PB02GW	JJ495	Ground Water	9/27/2017	12:50	5.9 ft.	D. Pulvino	X	X	X			X	Groundwater sample collected from location. Screen set from 4 to 8 feet bgs to capture free product as available/present.
17394233	PB03SB02	JJ466	Soil Subsurface	9/27/2017	14:37	0-2 ft.	D. Pulvino	X	X	X			X	Boring advanced adjacent to south side of what appeared to be utility/transformer pad/containment. Sample included some of overlying vegetation and asphalt. No odors/PID hits.
17394234	PB03SB05	JJ467	Soil Subsurface	9/27/2017	15:23	4-5 ft.	D. Pulvino	X	X	X			X	Sample collected from two cores advanced to obtain sufficient recovery. Wood waste encountered at approximately 4.5 feet, comprised large portion of sample.
17394235	PB03GW	JJ496	Ground Water	9/27/2017	16:15	5.12 ft.	D. Pulvino	X	X	X			X	Groundwater sample from location. Screen set from 4 to 8 bgs.

Table 4-2 Sample and Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	Date	Sample Time	Sample Depth Interval [a]	Sampler	Sample Analysis						Description (See Boring Logs for Lithologic/Soil Description)
								TAL Metals	CLP-Aroclors	CLP TCL Semivolatiles-SIM	TCL Volatiles (Trace)	CLP TCL Volatiles (Low)	NWTPH-Dx	
17394236	PB04SB04	JJ468	Soil Subsurface	9/27/2017	17:06	2-4 ft.	D. Pulvino			X		X	X	Boring advanced beneath awning on west side of planer building, in area where PCP contamination was reportedly left in place. Sample appeared to be imported fill, and differed from what was encountered in other borings.
17394237	PB04SB08	JJ469	Soil Subsurface	9/27/2017	17:14	6-8 ft.	D. Pulvino			X		X	X	Sample collected from bottom of core. Given limited recovery in core, actual depth of sample recovery is uncertain. No odors or PID hits.
17394238	PB04GW	JJ497	Ground Water	9/28/2017	8:30	5.8 ft.	D. Pulvino			X	X		X	Screen originally set at 4 to 8 feet bgs then at 5 to 9 feet bgs. Third attempt with screen at 6 to 10 feet bgs obtained adequate groundwater productivity for sample collection. Sample collected on the day following well installation. Sulfur smell noted while purging
17394239	PB05SB04	JJ470	Soil Subsurface	9/27/2017	16:12	2-4 ft.	J. Fetters			X		X	X	Sample location approximately 10 feet south of well D-05, south of mapped PCP cleanup area. Asphaltic cold-patch like material noted in core and included in sample.
17394240	PB05SB05	JJ471	Soil Subsurface	9/27/2017	16:34	4-5 ft.	J. Fetters			X		X	X	Soil sample collected from material on top of wood waste. Wood waste and sawdust noted in bottom half of recovered material. No odors.
17394241	PB05GW	JJ498	Ground Water	9/27/2017	15:33	NR	D. Pulvino			X	X		X	Groundwater sample collected from previously installed well D-05. Screened interval not known.
17394242	PB06SB04	JJ472	Soil Subsurface	9/28/2017	13:33	2-4 ft.	J. Fetters			X		X	X	Boring placed at northeast corner of former planer/grader building, near existing well D-04e. Sample collected from soil at bottom of boring, no odors or PID detections.
17394243	PB06SB06	JJ473	Soil Subsurface	9/28/2017	13:50	4-6 ft.	J. Fetters			X		X	X	Sample collected from soil at top interval of core, from above wood waste encountered at approximately 6 feet bgs. Wood clogged geoprobe cutting shoe preventing additional recovery. No odors or elevated PID readings.
17394244	PB06GW	JJ499	Ground Water	9/28/2017	15:20	5 ft.	D. Pulvino			X	X		X	Attempted to collect sample from temporary well screen placed at 4 to 8 feet bgs in boring, however temporary well had limited productivity. Rather than attempt to reset screen, groundwater sample collected from monitoring well D-04e. Screened interval not known.
17394245	PB07SS	JJ474	Surface Soil	9/25/2017	14:04	0-6 in.	J. Fetters	X		X		X	X	Sample of soil within concrete conveyor system trench at northeast corner of Planer/Grader Building.
17394246	PB08SS	JJ475	Surface Soil	9/25/2017	14:15	0-6 in.	J. Fetters	X		X		X	X	Sample of soil within concrete conveyor system trench at northeast corner of Planer/Grader Building.
17394259	PB09SB04	JJ4B7	Soil Subsurface	9/27/2017	11:42	2-4 ft.	J. Fetters	X	X	X			X	Boring placed northwest of PB02 to assess potential downgradient migration of contaminants. No odors or PID hits in sample matrix.
17394260	PB09SB08	JJ4B8	Soil Subsurface	9/29/2017	11:57	4-5.5 ft.	J. Fetters	X	X	X			X	Sample of soil encountered in core on top of wood waste. Wood waste present from 5.5 feet bgs to bottom of core.
17394261	PB09GW	JJ4C8	Ground Water	9/29/2017	12:15	NR	D. Pulvino	X	X	X			X	Groundwater sample from boring. Screen set from 5 to 9 feet bgs.
17394262	PB10SB04	JJ4B9	Soil Subsurface	9/29/2017	10:28	2.4-4 ft.	J. Fetters	X	X	X			X	Boring placed west of PB02 to assess potential lateral migration of contaminants noted at PB02. Top of boring encountered approximately 16 inches of concrete. No odors or PID hits. Intervals of asphaltic "cold patch" like fill present in core. Sample collected from soil beneath "cold patch."
17394263	PB10SB08	JJ4C0	Soil Subsurface	9/29/2017	10:43	4-6.5 ft.	J. Fetters	X	X	X			X	Sample from bottom of core interval, incorporates wood waste encountered in bottom of exploration. Wood waste encountered at 5.5 feet bgs.
17394264	PB10GW	JJ4C9	Ground Water	9/29/2017	11:40	5.46 ft.	D. Pulvino	X	X	X			X	Groundwater sample from screen placed spanning 5 to 9 feet bgs.
Former Paint Waste UST														
17394247	PW01SB04	JJ476	Soil Subsurface	9/28/2017	12:44	2-4 ft.	J. Fetters			X		X	X	Boring downgradient of paint waste UST removal excavation, near existing monitoring well D-02. No odors or PID detections in soil.
17394248	PW01SB06	JJ477	Soil Subsurface	9/28/2017	13:01	4-6 ft.	J. Fetters			X		X	X	Sample collected from soil near top of core, includes some wood waste. Wood waste encountered at 5.5 feet, clogging geoprobe cutting shoe.
17394249	PW01GW	JJ4A0	Ground Water	9/28/2017	13:25	NR	D. Pulvino			X	X		X	Sample from adjacent existing monitoring well (D-02), collected after purging with low flow technique. Screen interval not known.

Table 4-2 Sample and Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	Date	Sample Time	Sample Depth Interval [a]	Sampler	Sample Analysis						Description (See Boring Logs for Lithologic/Soil Description)
								TAL Metals	CLP-Aroclors	CLP TCL Semivolatiles-SIM	TCL Volatiles (Trace)	CLP TCL Volatiles (Low)	NWTPH-Dx	
17394250	PW02SB03	JJ478	Soil Subsurface	9/28/2017	11:19	1.6-2.6 ft.	J. Fetters			X		X	X	Boring placed near interpreted margin of paint waste UST removal excavation within several feet of D-03. Sample collected from soil near top of core to minimize collection of wood waste in sample. Slightly elevated PID reading. Boring location moved several feet south and away from building based on input from geophysical contractor.
17394251	PW02SB08	JJ479	Soil Subsurface	9/28/2017	11:39	6-8 ft.	J. Fetters			X		X	X	Sample of darker grey silt located beneath wood waste. Material is similar to what was encountered in 4 to 8 foot interval at NA01 and may represent native river bottom sediment.
17394252	PW02GW	JJ4A1	Ground Water	9/29/2017	14:05	4.8 ft.	D. Pulvino			X	X		X	Sample collected from existing monitoring well (D-03). Well had low productivity, likely as a result of tight silt/clay in area. Well purged dry while collecting water quality parameters on 9/28. Due to extremely slow recovery, sample collected from water accumulated in well on 9/29 without additional purging or water quality parameter collection. Screened interval not known.
Remedial Action Unit 3 (RAU3)														
Former Oil Tank and Chemical Storage Shed														
17394221	OC01SB04	JJ480	Soil Subsurface	9/28/2017	9:12	1-4 ft.	D. Pulvino	X		X		X	X	Sample from south side of area where oil tank and chemical storage shed had been mapped. No odors or PID hits.
17394222	OC01SB06	JJ481	Soil Subsurface	9/28/2017	9:26	4-6 ft.	D. Pulvino	X		X		X	X	No odors or PID hits. Limited recovery in boring, with cutting shoe clogged by wood waste.
17394223	OC01GW	JJ4A2	Ground Water	9/28/2017	10:15	6 ft.	D. Pulvino	X		X	X		X	Groundwater sample with screen set in OC01 from 6 to 10 feet bgs. Groundwater at 6 feet prior to sample collection. Sulfur smell noted while collecting sample.
17394224	OC02SB04	JJ482	Soil Subsurface	9/28/2017	9:56	2-4 ft.	J. Fetters	X		X		X	X	Sample from north side of area where oil tank and chemical storage shed had been located. No odors or PID hits.
17394225	OC02SB06	JJ483	Soil Subsurface	9/28/2017	10:39	4-6 ft.	J. Fetters	X		X		X	X	Sample from north side of area where oil tank and chemical storage shed had been located. No odors or PID hits. Wood waste plugs cutting shoe at approximately 6 feet bgs.
17394226	OC02GW	JJ4A3	Ground Water	9/28/2017	11:37	NR	D. Pulvino	X		X	X		X	Groundwater sample with screen set in OC02 from 6 to 10 feet bgs.
17394265	OC03SB04	JJ4C1	Soil Subsurface	9/28/2017	16:12	3-4 ft.	J. Fetters	X		X		X	X	Boring placed on northwest/downgradient side of "UST/sphere" identified by geophysical contractor. Sample collected from soil in core beneath asphaltic "cold patch" material. No odors
17394266	OC03SB07	JJ4C2	Soil Subsurface	9/28/2017	16:35	5-7 ft.	J. Fetters	X		X		X	X	Collected from second core interval. No odors, elevated PID hits, or additional cold patch type material.
17394267	OC03GW	JJ4D0	Ground Water	9/28/2017	17:44	5.75 ft.	D. Pulvino	X		X	X		X	Sample from temporary well screen placed in boring OC03, screened from 5 to 9 feet bgs.
Remedial Action Unit 4 (RAU4)														
NaOH Release Area														
17394218	NA01SB04	JJ484	Soil Subsurface	9/27/2017	8:08	2-4 ft.	D. Pulvino	X		X			X	Sampled in reported vicinity of sodium hydroxide tank. Slight petroleum odor and low PID detection (5.9 ppm) at approximately 3 feet bgs.
17394219	NA01SB06	JJ485	Soil Subsurface	9/27/2017	8:53	5-6 ft.	D. Pulvino	X		X			X	Sampled from interval above grey silt/clay that appeared to be native sediment. Appears to be same material as encountered in 4 to 8 feet in PW02. Some wood included in sample volume. Minimal water accumulates in temporary well screened from 4 to 8 feet bgs. No water sample collected from this location.
Former Vehicle Maintenance Area														
17394253	VM01SB04	JJ486	Soil Subsurface	9/26/2017	11:20	2-4 ft.	J. Fetters	X		X		X	X	Sampled north of area where maintenance pits assumed to have been located. First attempt met with refusal at approximately 6 inches bgs on concrete slab. Move boring approximately 1 foot north. No odors noted.
17394254	VM01SB08	JJ487	Soil Subsurface	9/26/2017	11:43	6-8 ft.	D. Pulvino	X		X		X	X	Sampled north of area where maintenance pits assumed to have been located. No odors noted.

Table 4-2 Sample and Analysis Summary

EPA Sample ID	Sample Location ID	CLP Sample ID	Matrix	Date	Sample Time	Sample Depth Interval [a]	Sampler	Sample Analysis						Description (See Boring Logs for Lithologic/Soil Description)
								TAL Metals	CLP-Aroclors	CLP TCL Semivolatiles-SIM	TCL Volatiles (Trace)	CLP TCL Volatiles (Low)	NWTPH-Dx	
17394255	VM01GW	JJ4A5	Ground Water	9/26/2017	13:15	NR	D. Pulvino	X		X	X		X	Groundwater sample from VM01, screen set from 5 to 9 feet soil cored to 12 feet bgs.
Quality Assurance														
17394274	RI01WT	JJ4A6	Water	9/29/2017	16:50	NA	D. Pulvino	X		X	X		X	Rinsate sample collected from decontaminated cutting shoe
17394275	RI02WT	JJ4A7	Water	9/29/2017	17:05	NA	D. Pulvino	X	X	X	X		X	Rinsate sample collected from decontaminated cutting shoe
17394276	RI03WT	JJ4A8	Water	9/29/2017	17:20	NA	D. Pulvino	X	X	X	X		X	Rinsate sample collected from decontaminated temporary groundwater sampling screen.
17394278	TB01WT	JJ4B1	Water	9/26/2017	13:55	NA	R. Nordeen				X			Trip blank sample
17394279	TB02WT	JJ4B2	Water	9/29/2017	11:00	NA	R. Nordeen				X			Trip blank sample
17394281	ID01WT	JJ4B0	Water	9/29/2017	16:00	NA	D. Pulvino	X	X	X	X		X	Composite sample of water in three drums of rinsate and purge water.

Note: a = Sample depth interval provided for groundwater samples is measured top of water table prior to sampling, as data is available.

Key:

bgs = below ground surface
CLP = Contract Laboratory Program.
EPA = United States Environmental Protection Agency.
ft. = Feet
ID. = Identification
in. = inches
NA = Not Applicable

NR = Not Recorded
PID = Photo Ionization Detector
ppm = parts per million
SIM = Selective Ion Monitoring
TAL = Target Analyte List
TCL = Target Compound List
NWTPH-Dx = Northwest Total Petroleum Hydrocarbon as Diesel to Heavy-Oil

Table 4-3 Sample Coding

Digits	Description	Code	Example
1,2	Source Code	FC	Fuel and Chemical Storage Building
		ID	Investigation Derived Waste
		MS	Maintenance Shop
		NA	Former NaOH Tank
		OC	Former Oil Tank and Chemical Storage Shed
		PB	Planer/Grader Building
		PW	Former Paint Waste Tank
		RI	Rinsate
		VM	Former Vehicle Maintenance Shop
3,4	Consecutive Number	01	First number of source code
5,6	Matrix Code	GW	Ground Water
		SB	Subsurface Soil
		SS	Surface Soil
		WT	Water
7,8	Consecutive Number	01	Lowest depth of sample matrix

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 than 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	MTCA Cleanup Level*		Back-ground metals*	17394206	17394207	17394209	17394210	17394212	17394213	17394215	17394216	17394256	17394257	17394268	17394269
Station Location Description				MS01SB04	MS01SB12	MS02SB04	MS02SB08	MS03SB04	MS03SB07	MS04SB04	MS04SB06	MS05SB04	MS05SB06	MS06SB04	MS06SB08
CLP Sample Number				JJ454	JJ455	JJ456	JJ457	JJ458	JJ459	JJ460	JJ461	JJ4B4	JJ4B5	JJ4C3	JJ4C4
Sampling Interval (feet bgs)				1-4	8-12	2-4	6-8	2-4	5-7	2-4	4-6	3.2-4	4-6	2-4	6-8
Sampling Zone	A / GW	DC		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)	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
Sampling Zone	**A / GW**	**DC**		**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)	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
Sampling Zone	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	MTCA Cleanup Level*		17394208	17394211	17394214	17394217	17394258	17394270	17394202	17394205	17394273
Station Location Description			MS01GW	MS02GW	MS03GW	MS04GW	MS05GW	MS06GW	FC01GW	FC02GW	FC03GW
CLP Sample Number			JJ490	JJ491	JJ492	JJ493	JJ4C7	JJ4D1	JJ488	JJ489	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

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*		Background 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 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									
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	**230** 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	***2526*** **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.

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 5-5 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}	--	--	**170000**	**25000**

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
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

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.

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.

<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 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

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A Photographic Documentation

Photo 1 Northeast corner of maintenance shop, near previous boring location.

Direction: *Southwest* *Date: 2/2/17* *Time: 13:03*

Photo 2 Area north of maintenance shop. Former oil house, compressor building, and powerhouse in background.

Direction: *West* *Date: 2/2/17* *Time: 13:03*

Photo 3 View of small log mill and fuel/chemical storage building from north of maintenance shop.

Direction: *East* *Date: 2/2/17* *Time: 13:04*

Photo 4 Maintenance shop and fuel/chemical storage building.

Direction: *Southeast* *Date: 2/2/17* *Time: 13:04*

Photo 5 Fire suppression system vault and west side of maintenance building.

Direction: South-Southeast *Date: 2/2/17* *Time: 13:05*

Photo 6 Monitoring well near northeast corner of Planer Building.

Direction: West *Date: 2/2/17* *Time: 13:07*

Photo 7 Northern interior of Planer Building. Green walled room may have been old spray room.

Direction: North *Date: 2/2/17* *Time: 13:10*

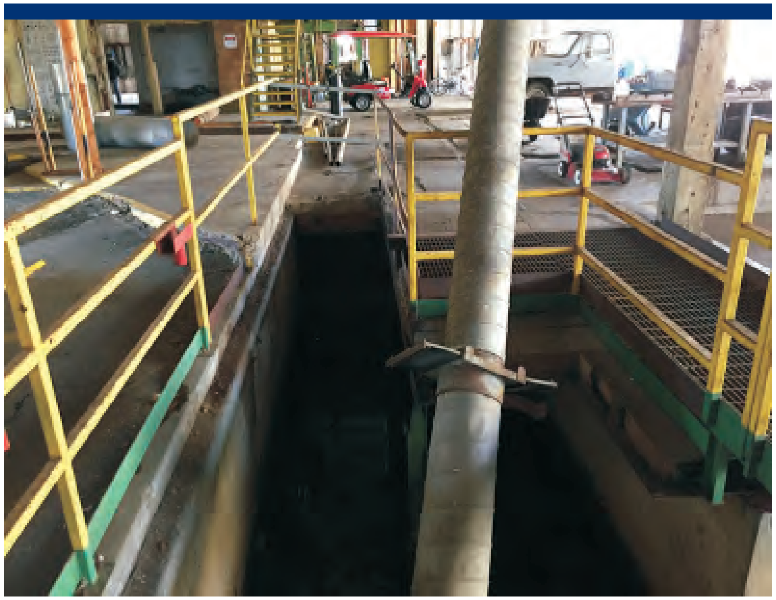

Photo 8 Trench/vault within Planer Building likely to have been for lumber conveyor system.

Direction: North *Date: 2/2/17* *Time: 13:11*

Photo 9 Southern sorter/grading space within Planer Bldg.

Direction: *South* *Date: 2/2/17* *Time: 13:11*

Photo 10 View within what appears to have been spray room.

Direction: *East* *Date: 2/2/17* *Time: 13:12*

Photo 11 Pads and containment curb on south side of Planer Building. Former use of both unclear.

Direction: *Northeast* *Date: 2/2/17* *Time: 13:14*

Photo 12 Additional containment curbed area on west side of Planer Building.

Direction: *Northeast* *Date: 2/2/17* *Time: 13:15*

Photo 13 Portion of property West-Northwest of Planer Building.

Direction: Northwest *Date: 2/2/17* *Time: 13:16*

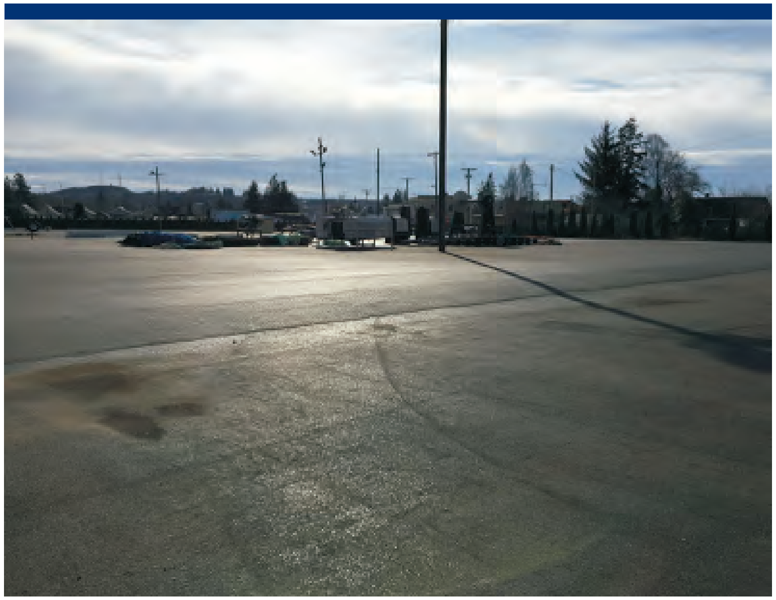

Photo 14 Area west of Storage Building.

Direction: South-Southwest *Date: 2/2/17* *Time: 13:18*

Photo 15 View along foundation for former Green Chain building.

Direction: Northeast *Date: 2/2/17* *Time: 13:18*

Photo 16 West interior of Planer Building.

Direction: South *Date: 2/2/17* *Time: 13:26*

Photo 17 Trench drain type feature on west side of Planer Building.

Direction: *West* *Date: 2/2/17* *Time: 13:27*

Photo 18 Interior of what appears to have been spray mixing area.

Direction: *East* *Date: 2/2/17* *Time: 13:29*

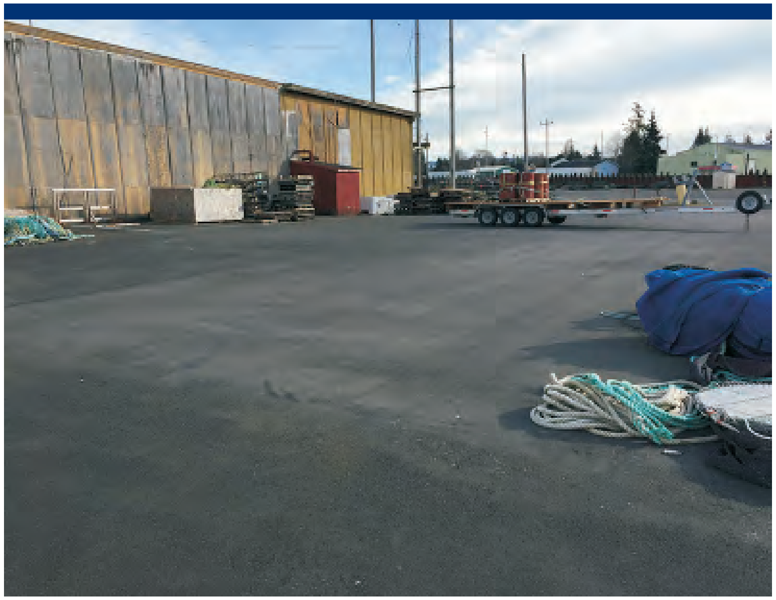

Photo 19 Southwest corner of storage building. Former oil tank and chemical storage shed at near side of building.

Direction: *Southeast* *Date: 2/2/17* *Time: 13:32*

Photo 20 Area between sorting/grading/stacking area and storage building.

Direction: *North* *Date: 2/2/17* *Time: 13:34*

Photo 21 South side of planer bldg where paint waste UST release was reported.

Direction: Northeast Date: 2/2/17 Time: 13:34

Photo 22 Southern interior of Stacking area of Planer Building.

Direction: Southeast Date: 2/2/17 Time: 13:35

Photo 23 Wells at/near southeast corner of Planer Building.

Direction: Northwest Date: 2/2/17 Time: 13:35

Photo 24 Equipment left in northern portion of Maintenance building near estimated location of four nested USTs.

Direction: East Date: 2/2/17 Time: 13:40

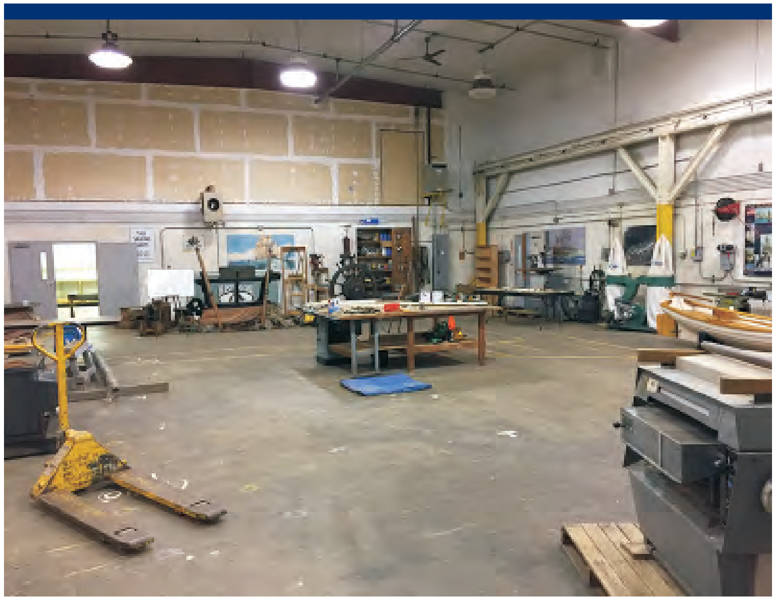

Photo 25 Central workshop area within maintenance building.

Direction: *South* *Date: 2/2/17* *Time: 13:41*

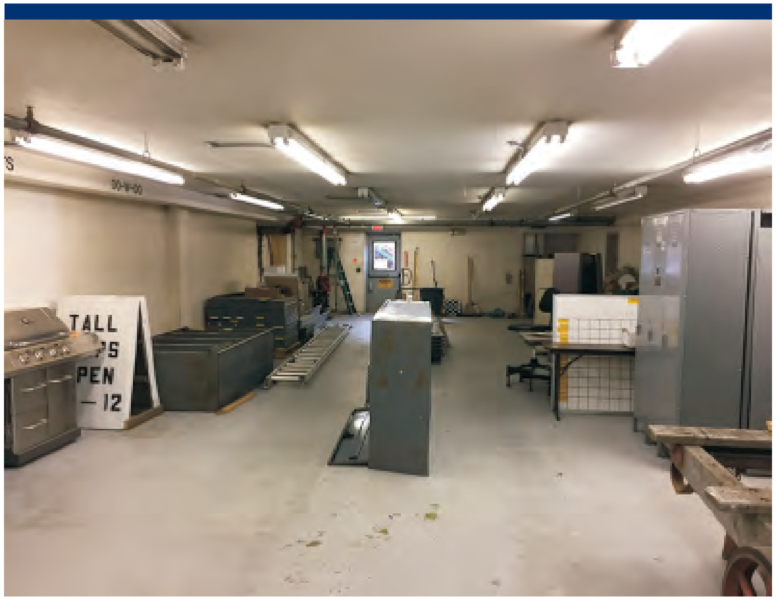

Photo 26 Southern room of maintenance building.

Direction: *West* *Date: 2/2/17* *Time: 13:42*

Photo 27 Fuel and chemical storage shed east of former maintenance shop.

Direction: *North* *Date: 2/2/17* *Time: 13:44*

Photo 28 Drums and stained concrete within fuel and chemical storage building. All drums checked were not empty.

Direction: *East* *Date: 2/2/17* *Time: 13:45*

Photo 29 View of maintenance building from fuel and chemical storage building.

Direction: West *Date: 2/2/17* *Time: 13:45*

Photo 30 Oil remaining within blind sump in fuel and chemical storage building.

Direction: Down *Date: 2/2/17* *Time: 13:46*

Photo 31 North side of shipping shed.

Direction: East *Date: 2/2/17* *Time: 13:47*

Photo 32 Small AST on north side of small log mill.

Direction: South *Date: 2/2/17* *Time: 13:50*

Photo 33 Monitoring well on north side of small log mill.

Direction: *Northeast* *Date: 2/2/17* *Time: 13:51*

Photo 34 Northern end of slough and chip area blower building on east side of site.

Direction: *North* *Date: 2/2/17* *Time: 13:53*

Photo 35 Slough south of driveway on east side of site. Area reportedly behind flood gate to minimize tidal influence.

Direction: *Southwest* *Date: 2/2/17* *Time: 13:57*

Photo 36 Former location of Pee Wee Mill.

Direction: *Northwest* *Date: 2/2/17* *Time: 14:08*

Photo 37 Former location of Pee Wee Mill.

Direction: *West* *Date: 2/2/17* *Time: 14:08*

Photo 38 Former location of Pee Wee Mill.

Direction: *Southwest* *Date: 2/2/17* *Time: 14:08*

Photo 39 Interior of Oil Storage at east side of Main Shipping Shed.

Direction: *North* *Date: 2/2/17* *Time: 14:11*

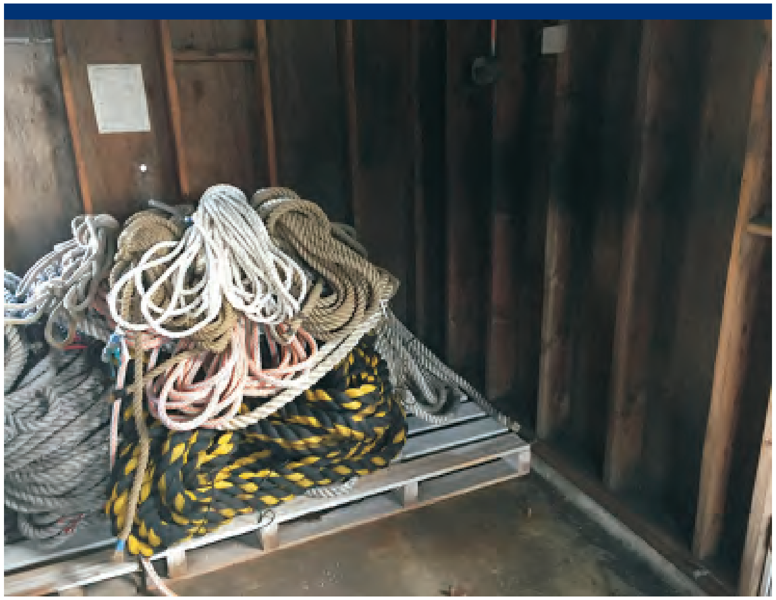

Photo 40 Discolored concrete at southeast corner of cutoff saw room.

Direction: *Down* *Date: 2/2/17* *Time: 14:13*

Photo 41 Compressor and discolored concrete at northwest corner of shipping shed near vehicle maintenance area.

Direction: *Northwest* *Date: 2/2/17* *Time: 14:15*

Photo 42 Containment interpreted as location of backup generator diesel AST. Former transformer pad behind.

Direction: *Southwest* *Date: 2/2/17* *Time: 14:21*

Photo 43 Containment interpreted as location of backup generator diesel AST. Former transformer pad in front.

Direction: *Northeast* *Date: 2/2/17* *Time: 14:21*

Photo 44 Interpreted UST fill line remaining on north side of guard shack.

Direction: *West* *Date: 2/2/17* *Time: 14:22*

Photo 45 Southeastern portion of site.

Direction: *East* *Date: 2/2/17* *Time: 14:23*

Photo 46 Equipment stored within former steam cleaning facility.

Direction: *West* *Date: 2/2/17* *Time: 14:25*

Photo 47 Northwest corner of steam cleaning facility with staining on walls.

Direction: *Northwest* *Date: 2/2/17* *Time: 14:26*

Photo 48 Steel basins in water treatment system room.

Direction: *North* *Date: 2/2/17* *Time: 14:27*

Photo 1 Boring location MS01, patched.

Direction: *North* *Date: 9/30/17* *Time: 07:30*

Photo 2 Boring location MS02, patched.

Direction: *Northwest* *Date: 9/30/17* *Time: 07:26*

Photo 3 Boring location MS03, patched.

Direction: *South* *Date: 9/30/17* *Time: 07:31*

Photo 4 Boring location MS04, patched.

Direction: *East* *Date: 9/30/17* *Time: 07:32*

Photo 5 Boring location MS05 and transformer vault.

Direction: *West* *Date: 9/30/17* *Time: 07:31*

Photo 6 Boring location MS05, patched. Opportunity sample.

Direction: *South* *Date: 9/30/17* *Time: 07:31*

Photo 7 Boring location MS06, patched. Opportunity sample.

Direction: *West* *Date: 9/30/17* *Time: 07:28*

Photo 8 Location where power appears to enter maintenance shop from transformer vault.

Direction: *West* *Date: 9/30/17* *Time: 07:31*

Photo 9 Location MS06, before sampling. Location FC02 in background was where petroleum odors had been noted.

Direction: *East* *Date: 9/28/17* *Time: 18:32*

Photo 10 View along north side of maintenance shop, showing, boring MS01 (near), MS03 (middle), and MS05 (far/temp well).

Direction: *West* *Date: 9/28/17* *Time: 18:30*

Photo 11 Boring location FC01, patched.

Direction: *South* *Date: 9/30/17* *Time: 07:30*

Photo 12 Boring location FC02, patched.

Direction: *East* *Date: 9/30/17* *Time: 08:00*

Photo 13 Boring location FC03, patched.

Direction: *East* *Date: 9/30/17* *Time: 07:45*

Photo 14 Sheen coming from dirt that came up in sample core from FC03.

Direction: *Down* *Date: 9/29/17* *Time: 09:29*

Photo 15 Located lines by geophysical contractor and location FC03 before drilling.

Direction: *East* *Date: 9/28/17* *Time: 18:29*

Photo 16 Locations FC01 (left), FC02 (middle, right), and VM01 (far).

Direction: *South* *Date: 9/28/17* *Time: 18:31*

Photo 17 Boring location PB01, patched.

Direction: South Date: 9/30/17 Time: 07:34

Photo 18 Small asphalt patch assumed to be associated with GP-1.

Direction: South Date: 9/28/17 Time: 18:50

Photo 19 Area of boring locations PB02 (cone rear left), PB09 (cone foreground), and PB10 (behind concrete column).

Direction: South Date: 9/30/17 Time: 07:34

Photo 20 Boring locations PB01 (background) and PB09 (foreground) on north side of planer building.

Direction: East Date: 9/30/17 Time: 07:34

Photo 21 Boring locations PB10 (foreground) and PB02 (cone, background), patched.

Direction: *East* *Date: 9/30/17* *Time: 07:35*

Photo 22 Boring location PB02, patched. Adjacent to suspected hydraulic oil containment vault.

Direction: *East* *Date: 9/30/17* *Time: 07:35*

Photo 23 Concrete trench box assumed to be associated with old planer feed line (beneath wood planking).

Direction: *East* *Date: 9/28/17* *Time: 18:51*

Photo 24 Stained soil at west wall of planer building, where conveyor feed appears to have entered building.

Direction: *Down* *Date: 9/30/17* *Time: 07:35*

Photo 25 Boring location PB03 and adjacent containment curb/vault, interpreted as past transformer location.

Direction: *North* *Date: 9/30/17* *Time: 07:38*

Photo 26 Location PB04 with two boring locations visible. Multiple attempts needed to get sufficient soil and water.

Direction: *North* *Date: 9/28/17* *Time: 18:59*

Photo 27 Boring location PB05, patched.

Direction: *South* *Date: 9/30/17* *Time: 07:38*

Photo 28 Locations PB04 (near) and PB03 (far, by near cone and concrete containment).

Direction: *West* *Date: 9/28/17* *Time: 18:59*

Photo 29 Locations PB04 (near) and PB05 (far), with well D-05 on right.

Direction: *South* *Date: 9/28/17* *Time: 18:59*

Photo 30 Boring location PB06, patched, with well D-04e in foreground.

Direction: *West* *Date: 9/30/17* *Time: 07:32*

Photo 31 Boring location PW01 (right) and monitoring well D-02 (left).

Direction: *South-Southwest* *Date: 9/30/17* *Time: 07:41*

Photo 32 Boring location PW02 (foreground, patched) and monitoring well D-03.

Direction: *North* *Date: 9/30/17* *Time: 07:40*

Photo 33 Boring locations OC01 (background) and OC02 (foreground), patched.

Direction: *South* *Date: 9/30/17* *Time: 07:37*

Photo 34 Boring locations OC01 (right) and OC02 (left), patched.

Direction: *East* *Date: 9/30/17* *Time: 07:36*

Photo 35 Boring location OC03 (patched) and UST/sphere identified by geophysical contractor.

Direction: *East* *Date: 9/30/17* *Time: 07:36*

Photo 36 Location OC03, with OC01 and OC02 in background.

Direction: *Southeast* *Date: 9/28/17* *Time: 18:54*

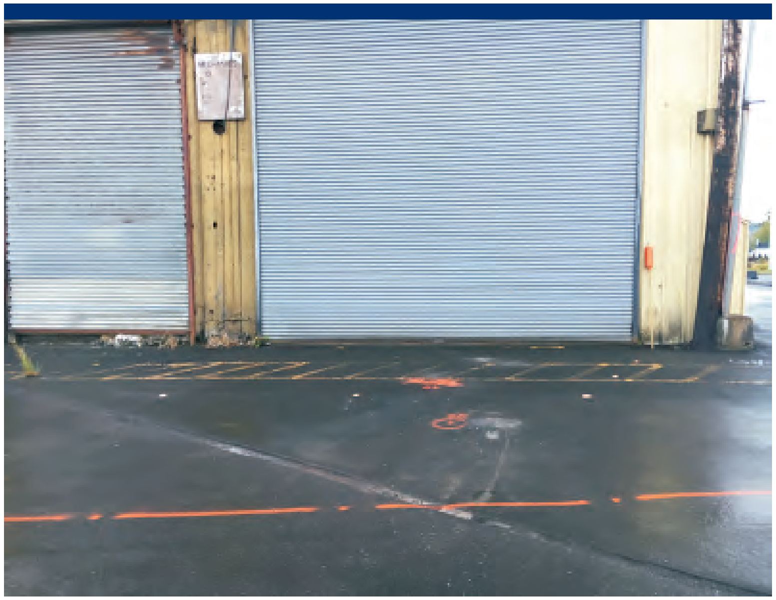

Photo 37 Boring location VM01, patched.

Direction: South Date: 9/30/17 Time: 07:26

Photo 38 Boring location NA01, patched.

Direction: Southeast Date: 9/30/17 Time: 07:42

Photo 39 Area north of inner harbor line. Reported to have been location where 5000-gallon (approx.) USTs removed in 1987.

Direction: West Date: 9/30/17 Time: 07:33

Photo 40 Area north of inner harbor line. Reported to have been location where 5000-gallon (approx.) USTs removed in 1987.

Direction: East Date: 9/30/17 Time: 07:34

Photo 41 Labeled IDW drums, stored under cover.

Direction: *West* *Date: 9/29/17* *Time: 16:34*

Photo 42 Labeled IDW drums, stored under cover.

Direction: *East* *Date: 9/29/17* *Time: 16:34*

Photo 43 Sign on south side of hazardous material storage shed, showing storage organization and handling decision tree.

Direction: *North* *Date: 9/30/17* *Time: 07:45*

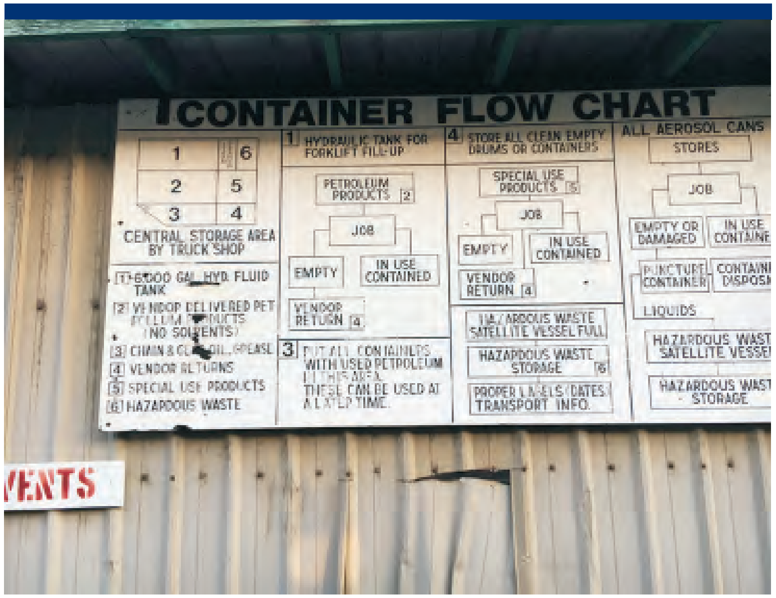

Photo 44 Sign on south side of hazardous material storage shed, showing storage organization and handling decision tree.

Direction: *North* *Date: 9/30/17* *Time: 07:45*

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B Sample Plan Alteration Forms

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SAMPLE PLAN ALTERATION FORM

Project Name and Number: Seaport Landing, TDD 17-01-0004

Materials to be Sampled:

Groundwater

Measurement Parameters:

Field sampling for off-site fixed laboratory analysis of metals, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and total petroleum hydrocarbon as diesel to heavy oil (TPH-Dx).

Standard Procedure for Field Collection and Laboratory Analysis (cite references):

Measuring Water Level and Well Depth standard operating procedure (SOP)(GEO 4.15), Evaluation of Existing Monitoring Wells SOP (GEO 4.19), Ground Water Well Sampling SOP (ENV 3.07); and analysis for metals (SW-846 Methods 6010, 6020, 7470, and 7471), SVOCs (SW-846 Method 8270D), VOCs (SW-846 Method 8260), and TPH-Dx (NWTPH-Dx).

Reason for Change in Field Procedure or Analytical Variation:

The Sampling and Quality Assurance Plan included several specific locations and methods for groundwater sample collection. These included the use of "low-flow" sampling methodology with samples to be collected after groundwater monitoring parameters had stabilized, and selection of three specific existing monitoring wells for groundwater sample collection. Field conditions necessitated several deviations from these prescribed methods and locations.

In the instance of groundwater sampled from boring locations MS02, FC02, and PW02/D-03, due to low groundwater production, the sampling points/monitoring wells were purged dry and samples were collected from water that recovered in the well. No water quality parameters were collected prior to sample collection in MS02 and FC02. Groundwater quality parameters were collected while purging PW02/D-03, however after the well was purged dry, slow recovery required waiting approximately 24 hours for a sufficient volume of water to be present for sample collection.

Boring location PB06 did not produce sufficient water for sample collection. As this boring was placed within several feet of an existing monitoring well (D-04e), the START sampled this well instead.

Finally, while sampling location NA01, the bottom of the boring intercepted a relatively dry, tight, fine silt. Neither the silt material nor the overlying soils were saturated, and only a few inches of water accumulated in a temporary well screen left in place at this location for several hours. Given the absence of groundwater, no sample was collected from this location.

Variation from Field or Analytical Procedure:

Three samples (MS02GW, FC02GW, and PW02GW/D-03GW) were collected without collecting corresponding water quality data, one sample was collected from an existing monitoring well rather than from boring PB06, and a groundwater sample was not collected from one proposed sampling location (NA01).

SAMPLE PLAN ALTERATION FORM (cont'd)

Project Name and Number: Seaport Landing, TDD 17-01-0004

Special Equipment, Materials, or Personnel Required:

None.

CONTACT	APPROVED SIGNATURE	DATE
Initiator: Derek Pulvino		10/19/2017
START TL: Linda Ader	Linda E Ader	10/19/2017
EPA TM: Joanne LaBaw	Joanne LaBaw	11/3/2017
EPA QA Manager: Donald M. Brown		11/3/2017

C Borehole Reports

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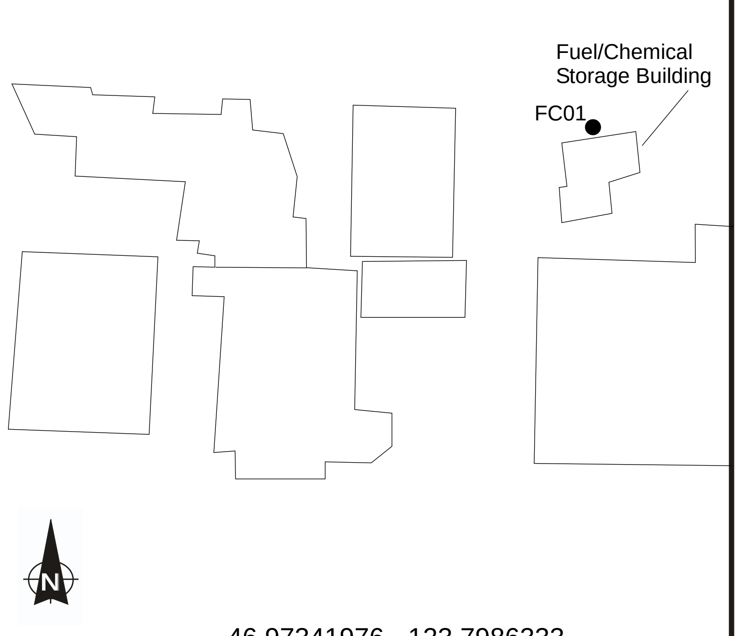
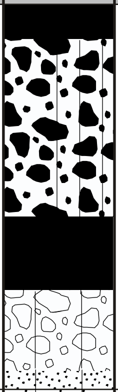
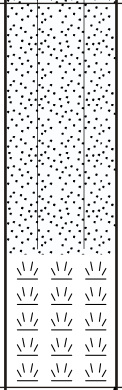
Drilling Log for FC01

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
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
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
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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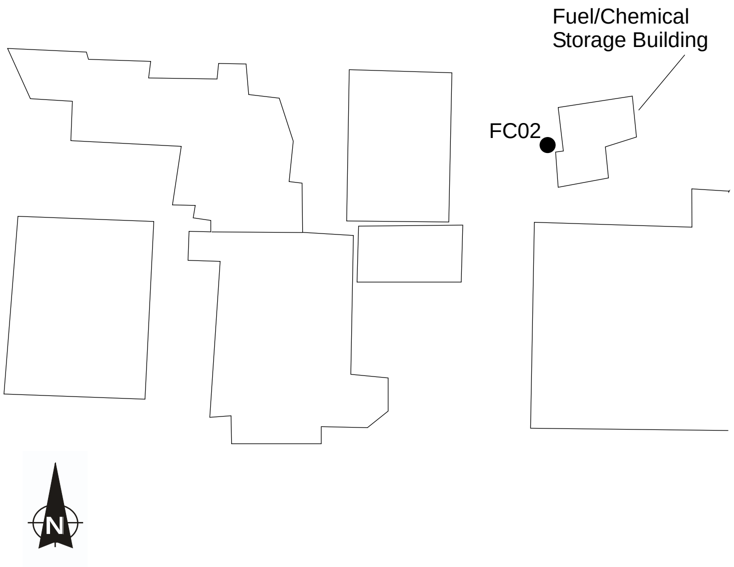
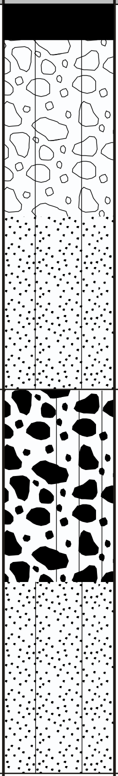
Drilling Log for FC02

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
1 2 3 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
5 6 7 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
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 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
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
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
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

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

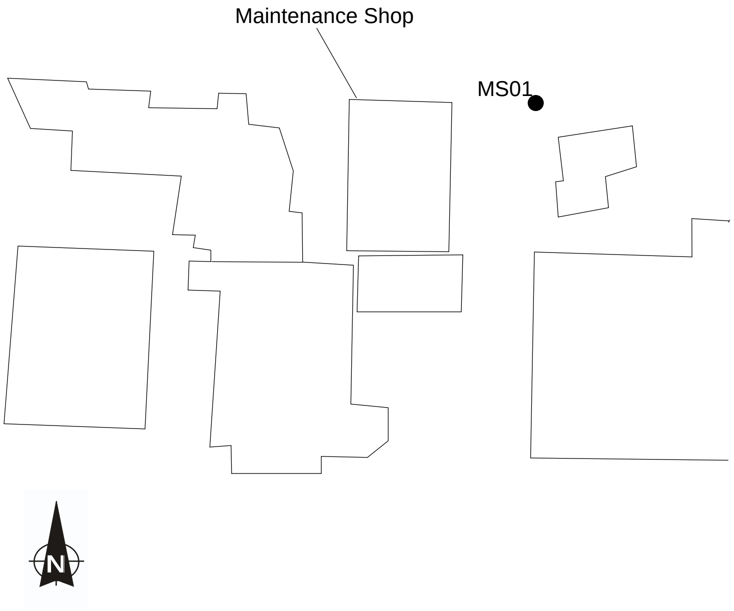
Geologist's Signature:

Rig Type(s): Geoprobe 6620DT

Depth to Water: 4.58 feet bgs

Total Depth of Borehole: 12 feet bgs

Borehole Location



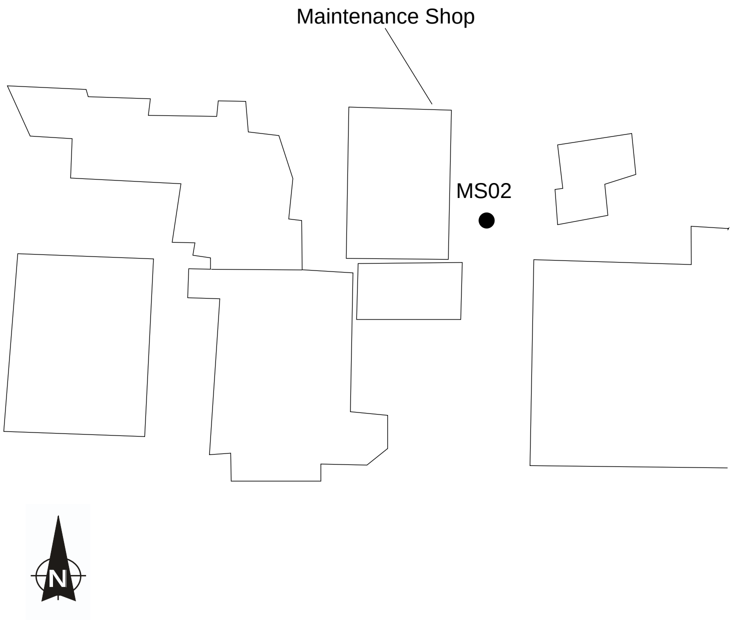
GPS Coordinates: 46.97340086, -123.798847

Depth (Feet)	Sample Number	Sample Times	Core Recovery	PID (PPM)	Soil Type	Comments
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
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
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

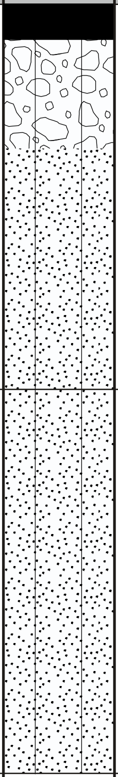
Drilling Log for MS02

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
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
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
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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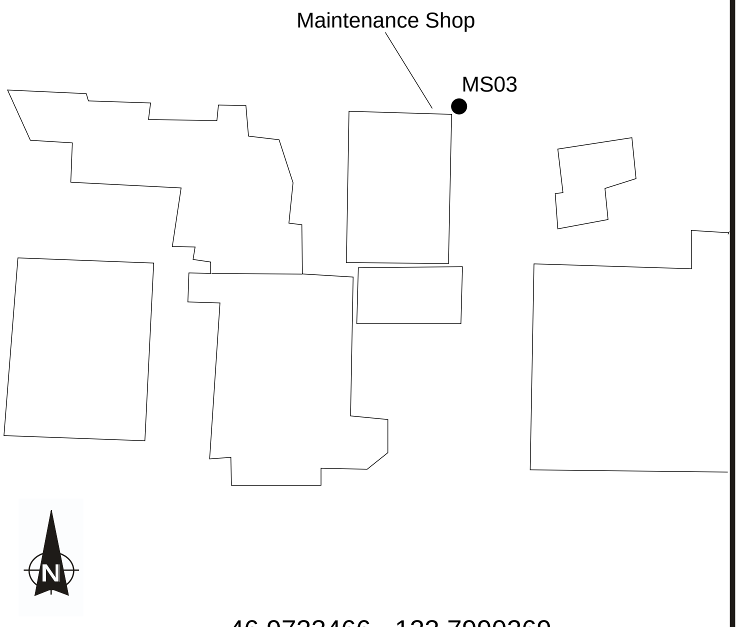
Drilling Log for MS03

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
1 2 3 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
5 6 7 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
9 10 11 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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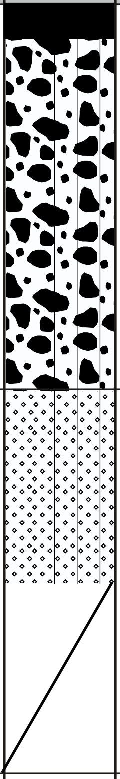
Drilling Log for MS04

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
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
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
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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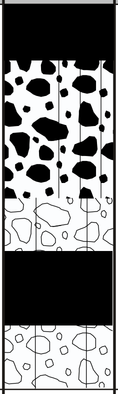
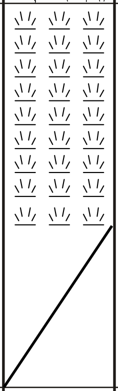
Drilling Log for MS05

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
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
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
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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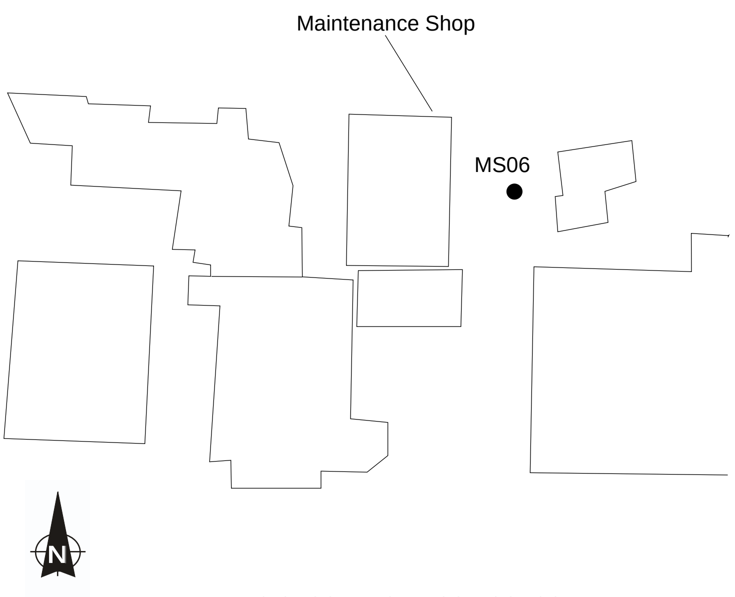
Drilling Log for MS06

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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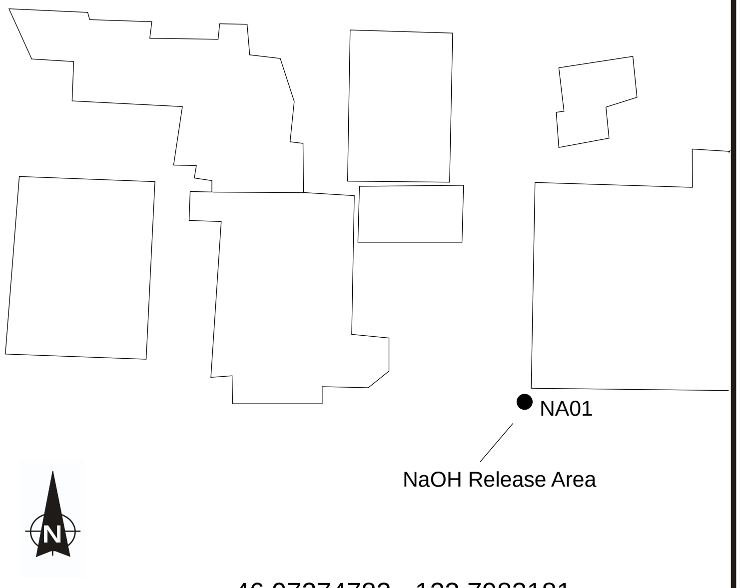
Drilling Log for NA01

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
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
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
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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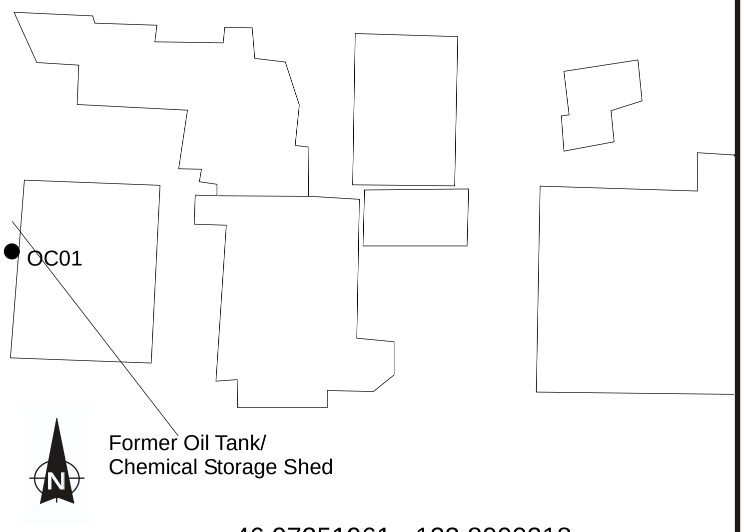
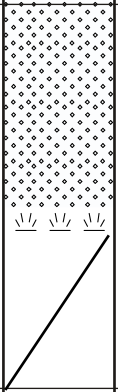
Drilling Log for OC01

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



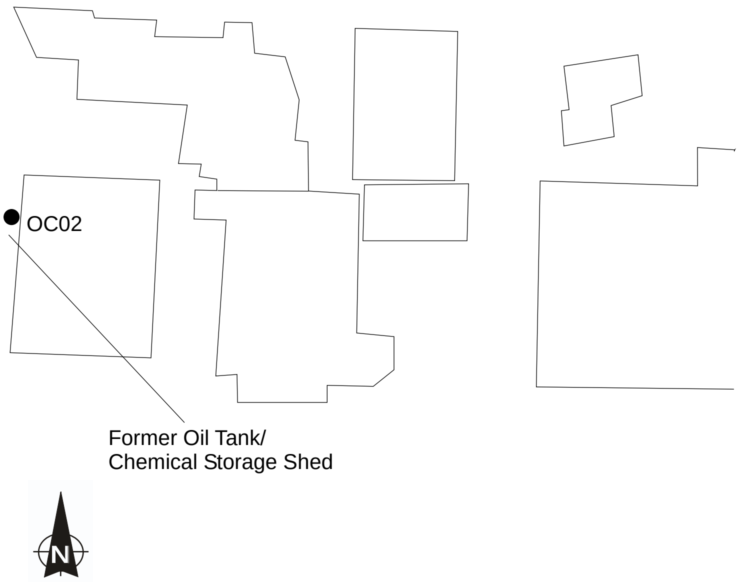
GPS Coordinates: 46.97251961, -123.8000218

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

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
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
5 6 7 8	OC06SB06 (4-6' bgs)	10:39	25%	0		6' - Wood waste, cutting shoe plugged, no recovery below
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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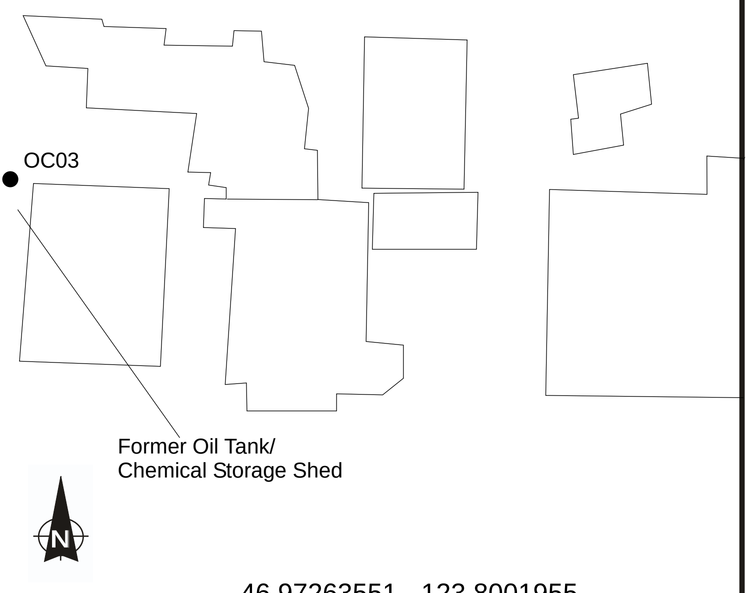
Drilling Log for OC03

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
1 2 3	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
4					▨	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
5 6 7	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
8					◸	7.5-8' - No recovery
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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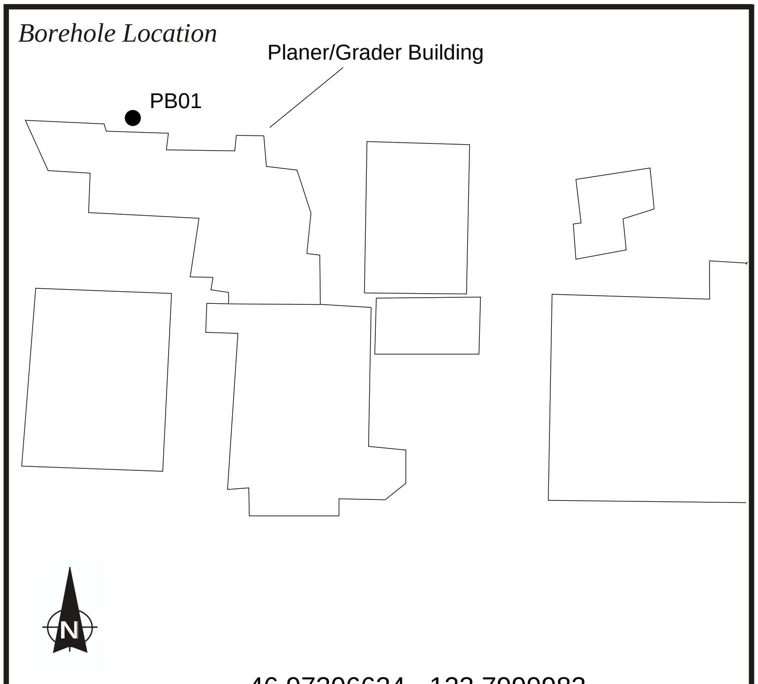
Drilling Log for PB01

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
						0-0.4' - Asphalt
1						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
2			80%	0		
3	PB01SB04 (2-4' bgs)	17:12				
4						No Recovery
5						
6			50%	0		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
7	PB01SB08 (6-8' bgs)	17:29				
8						
9						
10						
11						Total depth = 8 feet bgs Temporary well screen set 5 - 9 feet bgs Borehole back filled with 3/8" bentonite chips
12						

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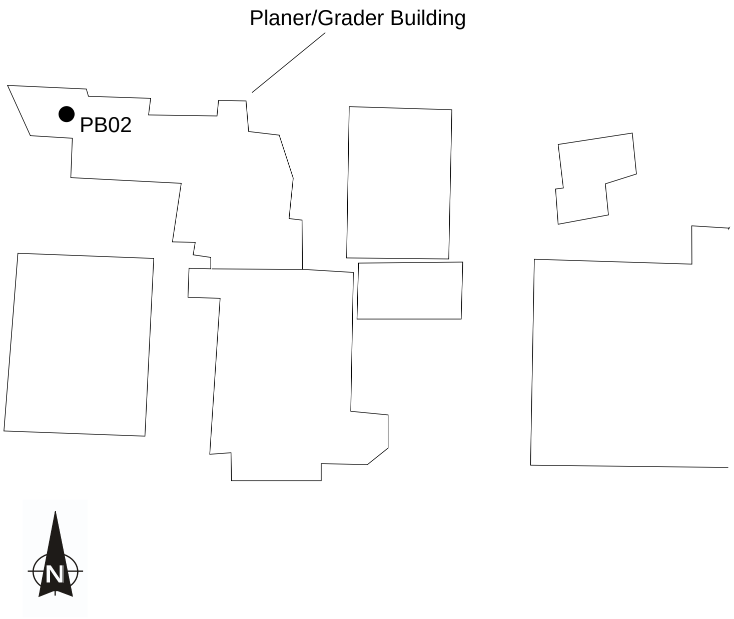
Drilling Log for PB02

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
1	PB02SB02 (0-2' bgs)	10:55				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
2			75%	0		
3						
4						
5						
6			10%	0		6-11.5' - Wood waste, petroleum-like odor noted
7						
8	PB02SB09 (7-9' bgs)	11:44				11.5-12' - SILT (ML) Silt: moist, gray, sulphur-like odor, thought to be native
9						
10			50%	0		
11						Total depth = 12 feet bgs Temporary well screen set 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips
12						

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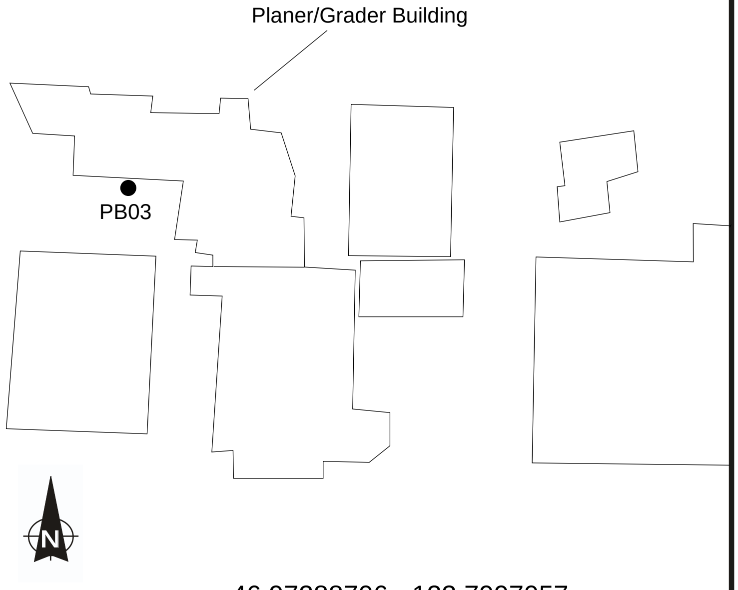
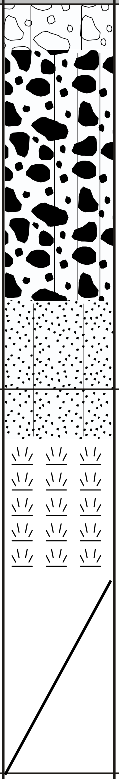
Drilling Log for PB03

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
1	PB03SB02 (0-2' bgs)	14:37				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
2			100%	0		
3						3.3-4.5' - Silty SAND (SM) - GW-GM) - Sand: fine to medium, angular to sub-angular; Silt: dry, loose, gray
4						
5	PB03SB05 (4-5' bgs)	15:23				4.5-6' - Wood waste
6			50%	0		6-8' - No recovery
7						
8						
9						
10						
11						Total depth = 8 feet bgs Temporary well screen set 4 - 8 feet bgs Borehole back filled with 3/8" bentonite chips
12						

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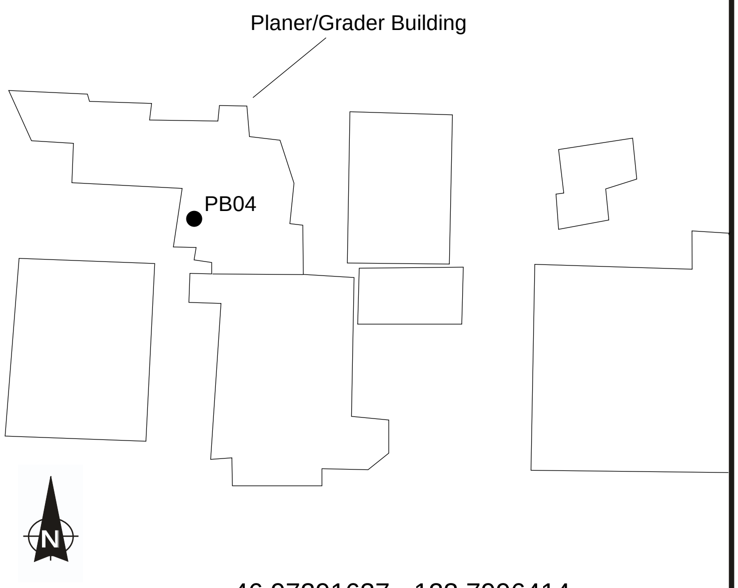
Drilling Log for PB04

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
1 2 3 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
5 6 7 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
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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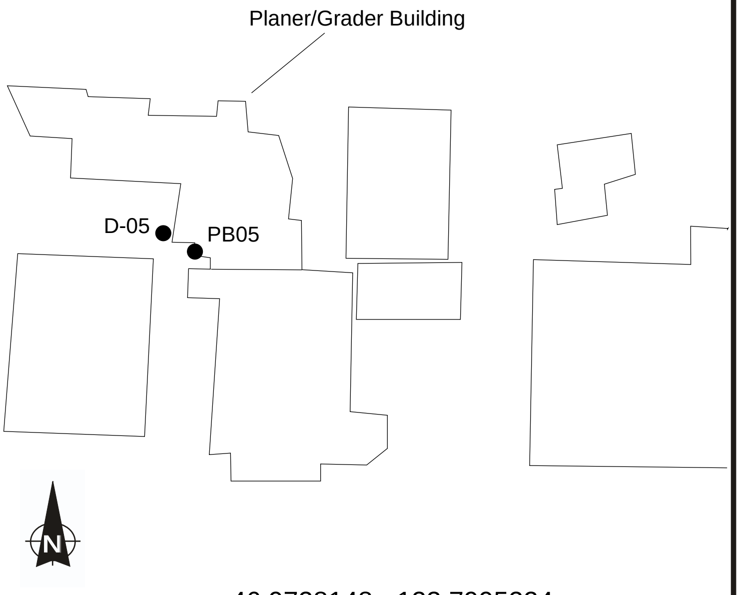
Drilling Log for PB05

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
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
5 6 7 8	PB05SB05 (4-5' bgs)	16:34	50%	0		5-6' - Wood waste 6-8' - No recovery
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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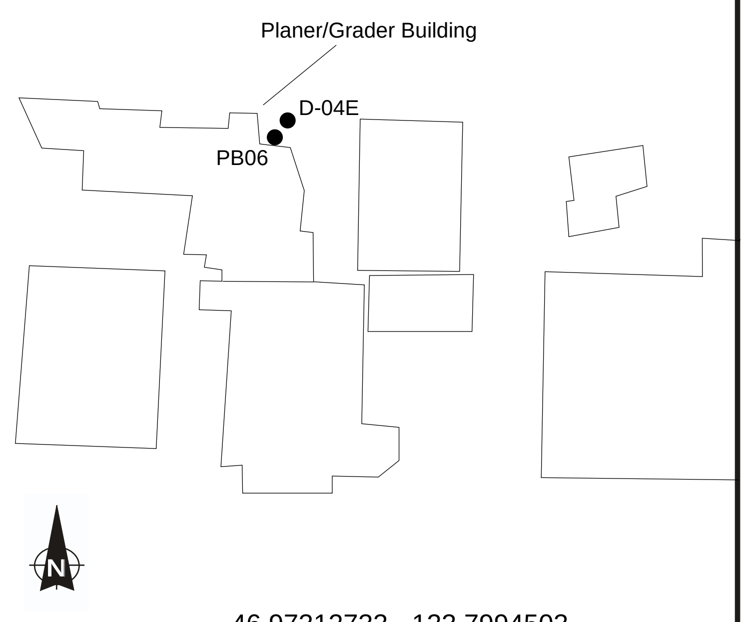
Drilling Log for PB06

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
						0-0.6' - Asphalt
1						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
2			75%	0		
3	PB06SB04 (2-4' bgs)	13:33				3.6-6' - Well-graded SAND (SW) - Sand: fine to medium, angular to sub-angular; Silt: moist, dark gray
4						
5	PB06SB06 (4-6' bgs)	13:50				
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 set at 4 - 8 feet bgs, water sample collected from MW D-04E Borehole back filled with 3/8" bentonite chips
12						

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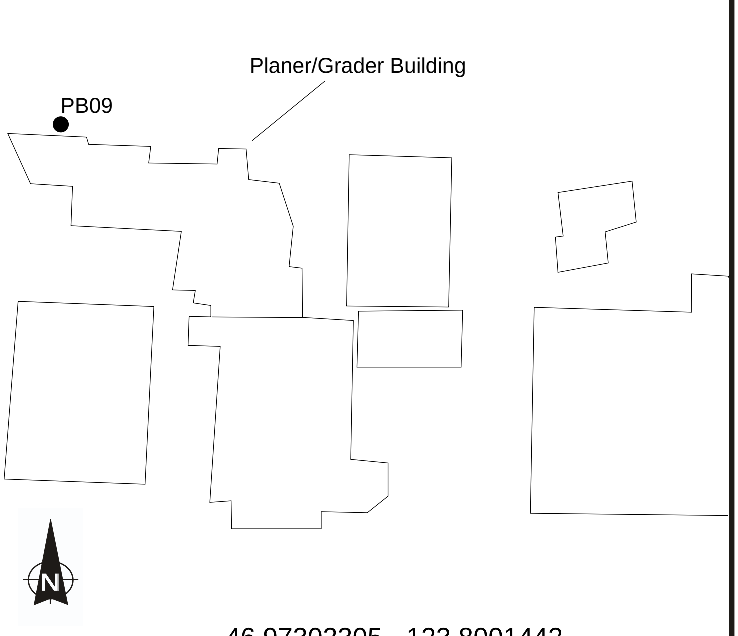
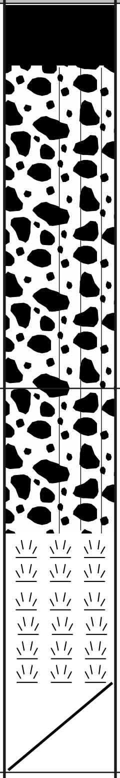
Drilling Log for PB09

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
1 2 3 4	PB09SB04 (2-4' bgs)	11:42	100%	0		0-0.5' - Asphalt 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
5 6 7 8	PB09SB06 (4-5.5' bgs)	11:57	50%	0		5.5-7' - Wood waste, cutting shoe plugged at 6.5' bgs no recovery below
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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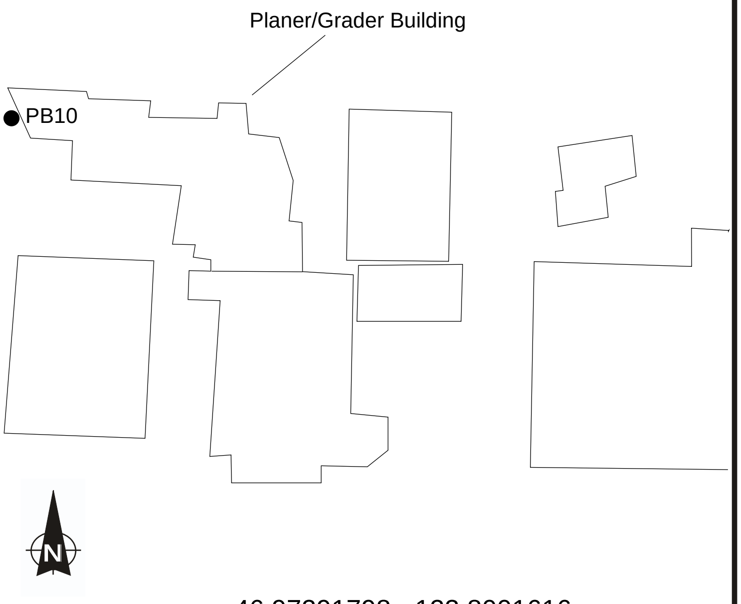
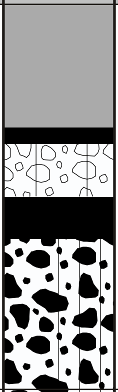
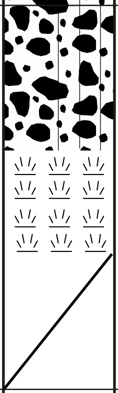
Drilling Log for PB10

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
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
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
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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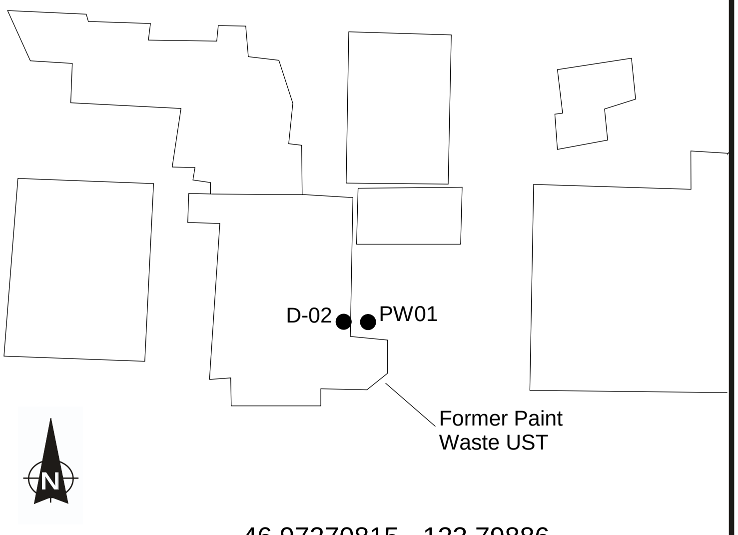
Drilling Log for PW01

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
						0-0.8' - 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	PW01SB06 (4-6' bgs)					
5		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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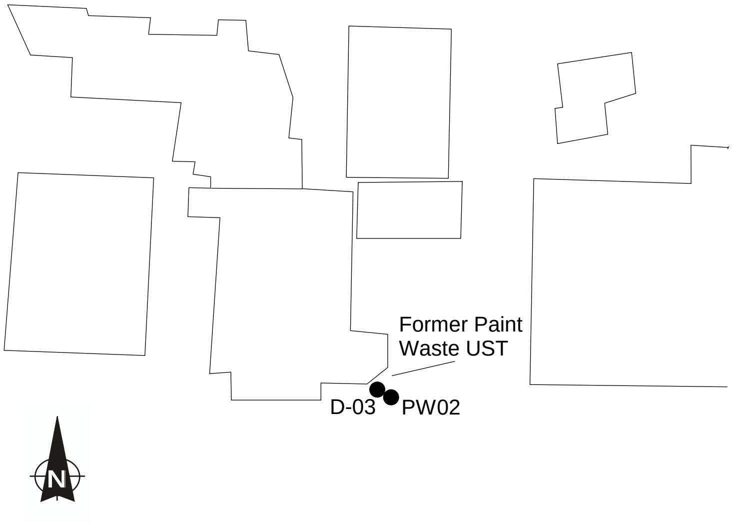
Drilling Log for PW02

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
1	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
2						
3						
4						
5	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)
6						
7						
8						
9						
10						
11						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
12						

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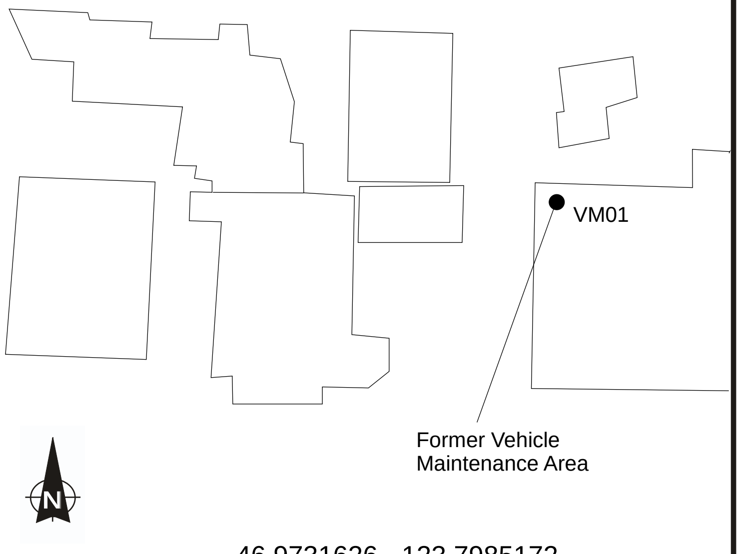
Drilling Log for VM01

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
						0-0.4' - Asphalt
1						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
2			100%	0		
3	VM01SB04 (2-4' bgs)	11:20				
4						
5						
6			75%	0		
7	VM01SB08 6-8' bgs)	11:43				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						
9						
10			75%	0		
11						Temporary screen set 5 to 9 feet bgs Total depth = 12 feet bgs Borehole back filled with 3/8" bentonite chips
12						

D National Historic Preservation Act Correspondence

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From: Labaw, Joanne <labaw.joanne@epa.gov>
Sent: Friday, August 11, 2017 2:09 PM
To: Pulvino, Derek
Subject: Fw: Grays Harbor Historical Seaport Soil Testing -- QIN comments
Attachments: QIN Ltr regarding EPA soil boring testing 8-11-17.pdf

FYI. I will be forwarding this to the Corps Archeologist as well.

From: Crocker, Peter <PCrocker@quinault.org>
Sent: Friday, August 11, 2017 1:50 PM
To: Labaw, Joanne
Cc: Brandi Bednarik (bbednarik@historicalseaport.org); James, Justine; Bingaman, Dave; Ravenel, Daniel; Mobbs, Mark
Subject: Grays Harbor Historical Seaport Soil Testing -- QIN comments

Ms. Labaw,

QIN has received your letter, dated 7/20/17, seeking comments on the sampling and assessment that is to be undertaken at the Grays Harbor Historical Seaport site. QIN has also received documents on that project from the Seaport itself. Hard copy of the attached letter will go out via U.S.P.S. Thank you for your outreach.

Peter Crocker
Assistant Attorney General
Quinault Indian Nation
136 Cuitan St.
PO Box 613
Taholah, WA 98587
(360) 276-8215, Ext. 1406
Cell: (360) 590-2327
Fax: (360) 276-8127

Quinault Indian Nation

POST OFFICE BOX 189 • TAHOLAH, WASHINGTON 98587 • TELEPHONE (360) 276-8211

August 9, 2017

United States Environmental Protection Agency
Region 10
1200 Sixth Ave, Suite 900
Seattle, WA 98101-3140

Dear Ms. Labaw,

Thank you for the opportunity to provide comments on the Targeted Brownfields Assessment (Assessment) at the Seaport Landing-Former Weyerhaeuser Aberdeen Sawmill site, as provided in your letter of July 20, 2017. Quinault Indian Nation (QIN) is also in possession of a memo dated July 11, entitled "Proposed Sampling and Assessment Approach," that was provided to us by Brandi Bednarik, Executive Director of the Grays Harbor Historical Seaport, which addresses the Assessment. Ms. Bednarik shall receive a c.c. of this letter.

QIN has a profound interest in the site, as it lies adjacent to the Chehalis River, which is a "usual and accustomed" area for the exercise of QIN treaty fishing rights. Therefore, as a general matter, QIN supports the study of potential contaminants, and any cleanup of the Seaport site that might arise from such study. In the interest of obtaining as much information as is possible, QIN requests the following:

- A copy of the Inadvertent Disclosure Form, to ensure that inadvertent discoveries and human remains will be properly addressed;
- A copy of the Maul, Foster and Alongi Study Area Investigation report of the leased tidelands, mentioned in the July 11th memo, page 9;
- A copy of any report that documents the results of the Sampling and Assessment Approach.

Additionally, QIN asks what rationale lies behind the Assessment? Does this arise as a statutory, regulatory, grant, or lease requirement?

Also, as disclosed in the documents sent to us and from other sources, we are aware that past efforts have been made to sample contamination and clean-up activities have occurred related to findings. There was past indication that the contaminants were not migrating to the Chehalis River waters. Will this project help to confirm that?

Finally, noting that the July 11th memo includes a "Proposed Sample Location Map," (Figure 4), but also mentions the possibility of up to six additional borings (at 15), how were the existing and locations determined and how will the prospective locations be determined? Are the determinations related to historical contamination source location?

Thank you,

Dave E Bingaman

Dave Bingaman, Director
Quinault Division of Natural Resources

Cc: Brandi Bednarik, Grays Harbor Historical Seaport

From: Labaw, Joanne <labaw.joanne@epa.gov>
Sent: Tuesday, July 18, 2017 3:45 PM
To: rob.whitlam@dahp.wa.gov
Cc: Brandi Bednarik; Pulvino, Derek
Subject: SHPO Review--Environmental Assessments
Attachments: SHPO_EZ1-Form_1_GHSeaport_ site.doc; Final_Seaport Landing_Sampling Locations_ 7-10-2017 (1).pdf

This submittal is intended to meet EPA's obligation to coordinate its activities with the State Historic Preservation Officer. This is for the former Weyerhaeuser sawmill site in Aberdeen, WA. EPA is conducting these environmental assessments for the Grays Harbor Historical Seaport Authority.

These environmental assessments are planned to take place in August of this year (2017).

EPA will make arrangements to ensure that the site assessors are prepared for inadvertent discovery. That is, our sampling and work plan will specifically require that should indications of artifacts or human remains be encountered, work would immediately stop and the EPA task monitor would be immediately notified. The EPA task monitor will then contact the SHPO.

If you have questions or need additional information, please do not hesitate to contact me.

Thank you.

Joanne LaBaw
US EPA Region 10 (ECL-122)
1200 Sixth Ave., Suite 900
Seattle, WA 98101
206-553-2594 (phone)

Sources: ©2016 Microsoft Corporation (Bing); Emcon 1997; MFA 2014, 2016a, 2016b.

ecology and environment, inc.
Global Environmental Specialists
Seattle, Washington

0 50 100 200
Approximate Scale in Feet

SEAPORT LANDING
Aberdeen, Washington

Figure 4
PROPOSED SAMPLE LOCATION MAP

Date:	Drawn by:	
6/14/17	AES	10:START IV\17010004\fig 4

PROJECT REVIEW SHEET – EZ1
HISTORIC & CULTURAL RESOURCES REVIEW

- **PROPERTY / CLIENT NAME:** Seaport Landing/Former Weyerhaeuser Aberdeen Sawmill

FUNDING AGENCY: US Environmental Protection Agency

Project Applicant: US EPA
Contact Person: Joanne LaBaw
Address: 1200 Sixth Ave., Suite 900
City, State: Seattle, WA **Zip:** 98101 **County:** Grays Harbor
Phone/ FAX: 206-553-2594
E-Mail: labaw.joanne@epa.gov

Funding Agency:
Organization: US EPA
Address: 1200 Sixth Ave., Suite 900
City, State: Seattle, WA **Zip:** 98101
Phone: 206-553-2594

PLEASE DESCRIBE THE TYPE OF WORK TO BE COMPLETED
(Be as detailed as possible to avoid having to provide additional information)

☒ **Provide a detailed description of the proposed project:**

Conducting a Phase II environmental site assessment for hazardous waste and petroleum contaminantion. Subsurface soil and groundwater samples will be collected. Four subslab vapor samples will be collected from under the former maintenance shop. Please see attached figure. No buildings or structures will be altered or demolished.

☒ **Describe the existing project site conditions:**

The Seaport site is a former lumber mill located in Aberdeen, Washington along the Chehalis River. In total, the mill property included approximately 80 acres of land and consists of a number of buildings associated with the mill. The majority of the site is paved.

☒ **Describe the proposed ground disturbing activities:**

Borings will be advanced into the subsurface using a direct push drill rig for the purpose of collecting subsurface soil samples. A total of 18 borings will be drilled. Borings will be advanced to a maximum exploration depth of 12 feet below ground surface, or until ground water is encountered, whichever is first.

Ground water is expected to be within 10 feet of the ground surface. Four subslab vapor samples will be collected from under the former maintenance shop. Please see attached figure.

☐ **Check if building(s) will be altered or demolished. If so please complete a DAHP Determination of Eligibility "EZ2 form" using our on-line Historic Property Inventory Database for each building, 45 years or older, effected by the proposed project.**

PLEASE ATTACH A COPY OF THE RELEVANT PORTION OF A 7.5 SERIES USGS QUAD MAP AND OUTLINE THE PROJECT INPACT AREA.

USGS Quad maps are available on-line at http://maptech.mytopo.com/onlinemaps/index.cfm

Project Location

Township: 17 N **Range:** 9 W of Willamette Meridian **Sections:** 9 & 10

Address: 500 North Custer Street **City:** Aberdeen **County:** Grays Harbor

Please see attached.

Place Map Here

Mail this form to:

Robert Whitlam, Ph.D.
State Archaeologist, DAHP
(360) 586-3080
rob.whitlam@dahp.wa.gov

(Within 30 days DAHP will email their opinion back to you.)

Please be aware that this form may only initiate consultation. For some projects, DAHP may require additional information to complete our review such as plans, specifications, and photographs. An historic property inventory form may need to be completed by a qualified preservation professional.

12/20/17

Archaeological Monitoring of EPA Brownfield Testing at Seaport Landing

By

Matthew Punke

Archaeologist, U.S. Army Corps of Engineers, Seattle District Office

Background

In 2013 Grays Harbor Historical Seaport Authority acquired 24 acres of land from Weyerhaeuser. The Grays Harbor Historical Seaport Authority desires to create an area where the public can visit and learn about historic tall ships. For the past century this land had been used as an industrial lumber mill, where known chemical releases occurred. As a result of the known contamination, the Environmental Protection Agency (EPA) in cooperation with Grays Harbor Historical Seaport Authority conducted soil and ground water testing. Through consultation with local tribes and the State Historic Preservation Officer, EPA determined it was necessary to have an archaeological monitor present during the testing. The archaeological monitor would inspect all testing materials collected to determine if any prehistoric archaeological materials were present subsurface, and if such materials were located, the monitor would ensure that testing would stop at that location.

EPA Testing Methods

The soil testing was conducted with a Geoprobe®, which collected core samples in an approximate 2-inch-diameter tube to a maximum depth of 12 feet (ft). Core samples were collected in clear, 4-foot-long tubes. Immediately after a sample was collected, the collection tube was opened and examined. After recording necessary data, soils were then collected for testing at offsite laboratories. Water samples were then taken from the hole left from the core sampling.

Site History

Prior to any testing, Ecology and Environment INC, contractors for the EPA, conducted a thorough investigation of the site history. Historic maps indicate that the earliest use of this site was by Aberdeen Lumber in 1890. The site changed ownership but remained an active mill throughout the 20th century.

Early maps indicate that the mill was originally built on piers that extended into the Chehalis River. Over time the area beneath the piers was filled with sawdust and other fill material from an unknown off site location. The modern mill was constructed on this fill material.

Monitoring Procedures

Matthew Punke, Archaeologist with the U.S. Army Corps of Engineers Seattle District, was present and monitored all ground disturbing activities. Monitoring took place from September 25th, 2017 through September 29th, 2017.

Twenty-four sample locations were monitored. After each sample was collected and opened, all soils were inspected by the onsite archaeologist. Because of the small amount of soils collected in the cores, all soils were inspected by hand. Hand inspection included separating soils, breaking apart larger soil clumps, and visually inspecting materials to determine if artifacts were present.

Monitoring Results

No prehistoric cultural materials were noted in any of the samples. All core samples appeared to have fill materials, including wood fragments and gravel, associated with the historic and modern use of the site. Only two boring locations encountered native soils during the testing, NAO1 and PWO2. NAO1 encountered native soils at 5.5 feet below ground surface, PW02 encountered native soils at 4 feet below ground surface. In both cases native soils were examined by the onsite archaeologist and no cultural materials were noted. Given the location of this site and site density in the immediate vicinity, there is still the possibility of subsurface prehistoric cultural materials on site. However, it is unlikely that intact historic materials will be encountered in the historic fill. The minimum depth of historic fill noted during testing was 4 feet below ground surface.

E

Global Positioning System Coordinates

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Location_Name	Comment	Key	Long	Lat
FC01	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7986333	46.97341976
FC02	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7986392	46.97330992
FC03	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7981828	46.97333183
MS01	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.798847	46.97340086
MS02	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7988134	46.97319754
MS03	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7990269	46.9733466
MS04	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.799266	46.97318775
MS05	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7991416	46.97330608
MS06	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7987831	46.97327172
NA01	Geoprobe boring, subsurface sample	Subsurface Soil Sample	-123.7983181	46.97274782
OC01	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8000218	46.97251961
OC02	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8000424	46.97255719
OC03	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8001955	46.97263551
PB01	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7999983	46.97306624
PB02	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8000875	46.9729848
PB03	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7997057	46.97288706
PB04	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7996414	46.97291637
PB05	Geoprobe boring, subsurface sample	Subsurface Soil Sample	-123.7995224	46.9728148
PB06	Geoprobe boring, subsurface sample	Subsurface Soil Sample	-123.7994503	46.97312733
PB09	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8001442	46.97302305
PB10	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.8001616	46.97291798
PW01	Geoprobe boring, subsurface sample	Subsurface Soil Sample	-123.79886	46.97270815
PW02	Geoprobe boring, subsurface sample	Subsurface Soil Sample	-123.7986699	46.97260028
VM01	Geoprobe boring, subsurface sample	Subsurface Soil and Groundwater Sample	-123.7985172	46.9731626
GP-1	Previous Temp Boring	Previous Temporary Boring	-123.8000278	46.97307182
D-01	Previously Existing Well	Existing Monitoring Well (Not Sampled)	-123.7992914	46.97264189
D-02	Previously Existing Well	Existing Monitoring Well (Sampled)	-123.79886	46.97270815
D-03	Previously Existing Well	Existing Monitoring Well (Sampled)	-123.7986699	46.97260028
D-04E	Previously Existing Well	Existing Monitoring Well (Sampled)	-123.7994226	46.97315315
D-05	Previously Existing Well	Existing Monitoring Well (Sampled)	-123.7995925	46.97284418
D-06	Previously Existing Well	Existing Monitoring Well (Not Sampled)	-123.7998951	46.97312416
D-07	Previously Existing Well	Existing Monitoring Well (Not Sampled)	-123.80004	46.97272715
D-08	Previously Existing Well	Existing Monitoring Well (Not Sampled)	-123.7995169	46.97268332
D-09	Previously Existing Well	Existing Monitoring Well (Not Sampled)	-123.7992099	46.973053
PB07/08	Surface Soil Samples	Surface Soil Sample	-123.7995764	46.97320897

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F

Investigation-Derived Waste Disposal Documentation

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CWMI

GENERATOR

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: CESQG

2. Page 1 of 1

3. Emergency Response Phone: (800)424-9300

4. Waste Tracking Number: CD-02222018-1

5. Generator's Name and Mailing Address:

US EPA REGION 10
500 NORTH CUSTER ST
ABERDEEN WA 98520

Generator's Phone: (206)624-9537

Generator's Site Address (if different than mailing address):

6. Transporter 1 Company Name: CHEMICAL WASTE MANAGEMENT

U.S. EPA ID Number: ORD089452353

7. Transporter 2 Company Name: ~~CHEMICAL WASTE MANAGEMENT~~ (R) UNION PACIFIC RAILWAY

U.S. EPA ID Number: NED001792910 (R) ~~ORD089452353~~

8. Designated Facility Name and Site Address:

CHEMICAL WASTE MANAGEMENT, INC.
17629 CEDAR SPRINGS LANE
ARLINGTON OR 97812-9709

Facility's Phone: (503)454-2643

U.S. EPA ID Number: ORD089452353

9. Waste Shipping Name and Description	10. Containers		11. Total Quantity	12. Unit Wt./Vol.	
	No.	Type			
1. MATERIAL NOT REGULATED BY D.O.T. OR336811	3	DM	1,200	P	[redacted]
2.					
3.					
4.					

13. Special Handling Instructions and Additional Information

1. OR336811-STAB01-NON HAZ LIQUID

WMXU 970922

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: Derek Pulvino on behalf of USEPA

Signature:

Month 3 Day 13 Year 18

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter Signature (for exports only): Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: PETELARAT

Signature:

Month 3 Day 13 Year 18

Transporter 2 Printed/Typed Name:

Signature:

Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name

Signature

Month Day Year

169-BLC-O 6 10498 (Rev. 9/09)

DESIGNATED FACILITY TO GENERATOR

461039

CWMI

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number CESQG

2. Page 1 of 1

3. Emergency Response Phone (800)424-9300

4. Waste Tracking Number CD-02222018-1

5. Generator's Name and Mailing Address
US EPA REGION 10
500 NORTH CUSTER ST
ABERDEEN WA 98520

Generator's Site Address (if different than mailing address)

Generator's Phone: (206)624-9537

6. Transporter 1 Company Name CHEMICAL WASTE MANAGEMENT
U.S. EPA ID Number ORD089452353

7. Transporter 2 Company Name ~~CHEMICAL WASTE MANAGEMENT~~ Ⓡ UNION PACIFIC RAILWAY
U.S. EPA ID Number ~~ORD089452353~~ Ⓡ NED001792910

8. Designated Facility Name and Site Address
CHEMICAL WASTE MANAGEMENT, INC
17629 CEDAR SPRINGS LANE
ARLINGTON OR 97812-9709

U.S. EPA ID Number ORD089452353

Facility's Phone: (503)454-2643

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	
1. MATERIAL NOT REGULATED BY D.O.T OR336811	3	DM	1,200	P	
2.					
3.					
4.					

13. Special Handling Instructions and Additional Information
1 OR336811-STAB01-NON HAZ LIQUID

WMXU 970922

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name Derek Pulvino on behalf of USEPA
Signature
Month 3 Day 3 Year 18

15. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter Signature (for exports only): Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name PETE LAURATI
Signature
Month 3 Day 3 Year 18

Transporter 2 Printed/Typed Name Eric Kirwan
Signature
Month 03 Day 19 Year 18

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☑ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)
U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)
Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name Pat Slider
Signature
Month 4 Day 4 Year 18

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

169-BLC-O 6 10498 (Rev. 9/09)

DESIGNATED FACILITY'S COPY

461039

CWMI/

NON-HAZARDOUS WASTE MANIFEST (Continuation Sheet)

19. Generator ID Number: CESQG

20. Page 2 of 2

21. Waste Tracking Number: CD-02222018-1

22. Generator's Name: US EPA REGION 10

23. Transporter 3 Company Name: COLUMBIA RIDGE LANDFILL — U.S. EPA ID Number: ORD987173457

24. Transporter ______ Company Name — U.S. EPA ID Number:

	25. Waste Shipping Name and Description	26. Containers No.	26. Containers Type	27. Total Quantity	28. Unit Wt./Vol.	

29. Special Handling Instructions and Additional Information

WMXU 970922

GENERATOR

30. Transporter ______ Acknowledgment of Receipt of Materials

Printed/Typed Name: Bobbi Jo Vaughn — Signature: Bobbi Jo Vaughn — Month Day Year: 12 22 18

31. Transporter ______ Acknowledgment of Receipt of Materials

Printed/Typed Name — Signature — Month Day Year

TRANSPORTER

32. Discrepancy

DESIGNATED FACILITY

170-BLC-O 6 10502 (Rev. 8/05)

DESIGNATED FACILITY'S COPY

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G Geophysical Survey Report

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Seaport Landing Geophysical Surveys

Aberdeen, Washington

November 29, 2017

Prepared for:

ecology and environment, inc.
Global Environmental Specialists

720 Third Avenue, Suite 1700
Seattle, WA 98104

Prepared by:

ECA Geophysics
372 S Eagle Road, Suite 146
Eagle, ID 83616
Project Number: 17ECA244

Certification

ECA Geophysics (**ECA**) recently completed a detailed geophysical survey of two areas of concern located within the Grays Harbor Historical Seaport (Seaport Landing or Site), which is located across the Chehalis River and approximately ¾ mile east-southeast of downtown Aberdeen, Washington. The work was performed at the request of Ecology and Environment, Inc. (**e&e**), utilizing methods and procedures consistent with good commercial or customary practice designed to conform to acceptable industry standards. The independent conclusions contained in this report represent **ECA**'s best professional judgment, based upon information and data available to us during the course of this assignment. Additionally, the conclusions and recommendations presented are based upon the conditions that existed and the information available at the time of the surveys.

Performed and written by:

Brett Smith

Brett D. Smith PE, LG

TABLE OF CONTENTS

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1.0 INTRODUCTION

During September 25-27, 2017 **ECA** performed electromagnetic induction (EMI) and ground penetrating radar (GPR) geophysical surveys at the Site. This work was performed at the request of **e&e**, to identify the presence of buried utilities, tanks and any other obstructions such as debris and/or previously excavated areas that may occur within the two survey areas shown in the Site Map in Appendix A. Throughout this report, the cardinal directions (N, E, S and W) are used, whereby N-S refers to the approximate NW-SE direction and E-W refers to the approximate NE-SW direction.

1.1 Survey Equipment

EMI

The Geonics Limited **Model EM-31 Mark2** terrain conductivity meter was utilized to measure lateral soil conductivity changes, as well as to detect buried metal at each survey area. The EM-31 system operates on the simple and reliable concept of magnetic induction (Maxwell's Law), whereby an electromagnetic field is transmitted through the soil and the associated electrical field current is ultimately picked up by the receiver and correlated directly to soil conductivity. More specifically, an alternating current is generated in a coil above the ground surface whereby the primary magnetic field (produced by the transmitter coil) and the secondary field (produced by currents in the soil) induce corresponding alternating currents in the receiver coil of the instrument. The fixed (12-ft) intercoil spacing produces a 20-ft diameter ellipsoidal electromagnetic field that penetrates the subsurface to a depth of 20 feet and extends laterally 10 feet (half of field width).

After compensating for the primary field, both the magnitude and relative phase of the secondary field are measured. These measurements are converted to components that are in-phase and 90 degrees out-of-phase with the transmitted field. The out-of-phase (quadrature-phase) component is converted to a measure of apparent ground conductivity in milliSiemens per meter (mS/m). This value is an estimate of the average conductivity of the ground within the upper 20 feet. The in-phase output of the EM-31 is a semi-quantitative signal representing the metallic nature of objects buried within the upper 12 feet and performs like a large metal detector. Small targets are effectively filtered out of the signal, such that the in-phase signal locates only larger targets such as steel drums and tanks. The in-phase component is converted to a measure of the ratio (in parts per thousand, ppt) of the secondary to primary electromagnetic fields and is displayed as magnetic susceptibility. Both data components were digitally recorded (in units of mS/m and ppt) and stored in the flash memory of the data logger.

GPR

The instrument utilized for this survey was the Mala Geoscience **Easy Locator** GPR system. This system operates at a frequency of 350 MHz and was found capable of imaging objects within the upper 10 feet of the soils underlying the Site. This GPR system utilizes high performance, non-conductive fiber optic cables that connect the control unit and the antenna. The control unit operates at a 100 kHz pulse repetition frequency, enabling rapid data acquisition without compromising data quality.

GPS

The Archer **Hemisphere GPS 132** is a high-performance global positioning system (GPS) receiver that provides *sub-meter* positions in real-time. GPS was not utilized with the GPR surveys, because the latter has excellent locational capability via its calibrated wheel odometer. The GPS system was utilized exclusively with the EMI survey method.

2.0 DATA ACQUISITION

Geophysical surveys must be designed to prevent aliasing or under-sampling surveyed areas with respect to the locations of target features. The following discussion addresses the each survey method, as well as the *locational* accuracy of the acquired data.

2.1 GPR Survey

The GPR system passed all calibration and instrument tests prior to being delivered to the project area. At the beginning of each survey, the GPR was moved over known buried objects of ascertainable depth. Such a *prove-out* confirmed that the GPR was detecting objects similar to those of interest to the project.

Proposed Boring Locations – A total of 24 proposed boring locations were surveyed exclusively with the GPR, as EMI is inappropriate for *accurately locating* buried lines, tanks and similar objects. Each proposed boring location was surveyed as shown below.

At a 2-ft line spacing and in two orthogonal directions, a total of fourteen 10 to 12 foot long traverses were made across each boring location, as shown in the above photograph. Any observed objects, as defined by a *symmetric* diffraction arc or hyperbola, were noted and the painted boring location was either deemed okay (ok) or relocated and repainted by **ECA**.

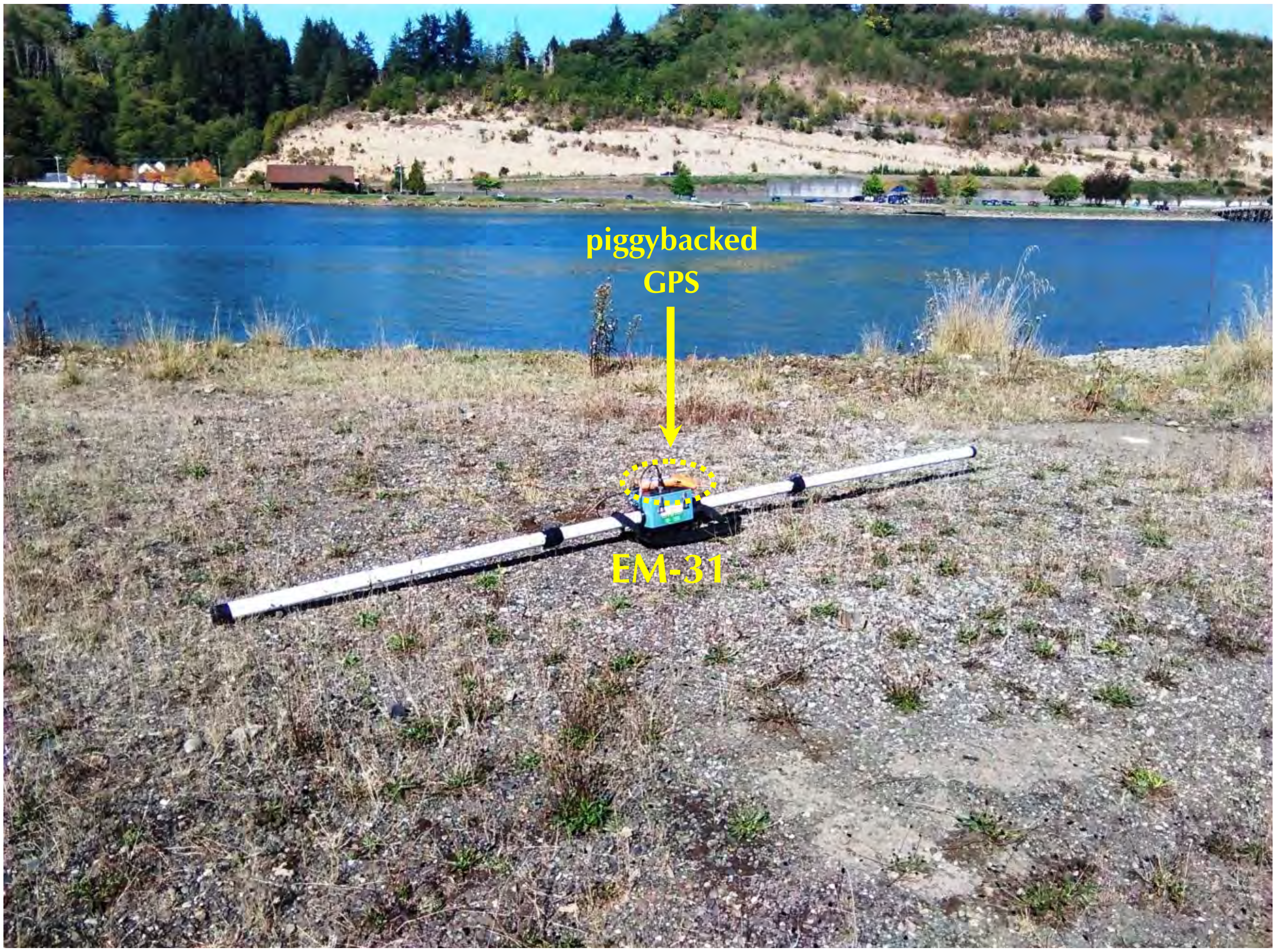
Survey Areas – The surveys were performed at a 5-ft line spacing in the E-W direction (both areas) and at a 20-ft N-S line spacing and 10-ft line spacing in the West Survey Area and East Survey Area, respectively. The coarser line spacing for the West Survey Area was utilized, after it was determined such a spacing adequately captured *linear* anomalies. The tighter 5-ft line spacing (used for both surveys in the E-W direction) adequately captured any N-S or E-W oriented three dimensional (3D) causative bodies, as confirmed by the buried spherical object that was identified within the West Survey Area, as shown in the Site Map and the photographs (Appendix D).

Properly performed GPR surveys utilize an additional survey in a direction that is orthogonal to the primary, tighter-spaced survey. This is done to avoid missing any narrow, linear features that are running *parallel to* the direction of the primary survey, since GPR best detects such features when approaching the *trend* of the latter in an *orthogonal* orientation. Traverses were performed by maintaining a simple line-of-sight bearing towards a visually prominent bright orange cone placed at the opposite boundary of the respective survey area. Because these targets were no more than 140 feet distant and the area flat, maintaining relatively straight traverses was feasible, even in those areas interrupted by the building within the East Survey Area.

The locational accuracy was excellent (within inches), due to the high-frequency (350 MHz) primarily downward-looking antenna that was utilized throughout the surveying effort.

2.2 EMI Survey

The EM-31 meter passed all calibration and instrument tests prior to being delivered to the Site. At the beginning of the day's surveying activities and atop low conductivity ground (see photo below), the instrument was calibrated to null the in-phase (magnetic susceptibility) component and to check the stability of the conductivity component. The magnetic susceptibility component was successfully nulled to within 0.2 to 0.5 ppt over a time interval at least one minute in duration, with 0.0 ppt as the desired result. The conductivity component was observed to fluctuate from 0.05 to 0.50 mS/m over a time interval at least one minute in duration. Such a reading deviation represented a *minimum* repeatability accuracy of at least 97 percent, within a conductivity environment that ranged from -17 to 2 mS/m.



In both areas, **ECA** performed a 5-ft line spaced unidirectional (E-W) survey. As stated in Section 1.1, the lateral reach of the EM-31 instrument is 10 feet, such that a 5-ft line spacing provides 400 percent coverage. **ECA** selected a 5 reading per second sampling rate, which translates to a worst-case (ie, most coarse) station spacing of *less than* 2 feet, as shown in Map 4 in Appendix B.

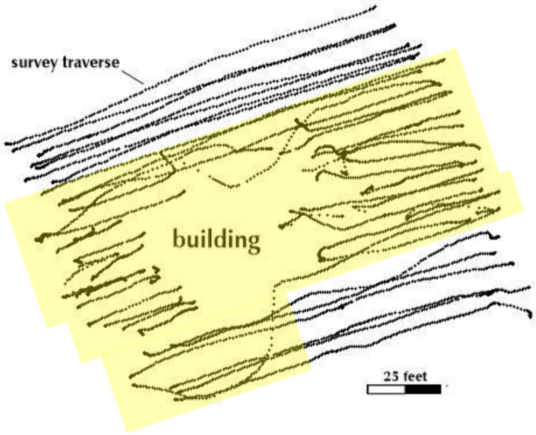
Additionally, an interconnected GPS system was simultaneously recording latitude and longitude coordinates that attached to every EMI data value. The actual station locations along each traverse can be seen by reviewing Maps 1 and 2 in Appendix B and Maps 4 and 5 in Appendix C, where each reading is represented by a small "+" on the map. These maps reveal somewhat straight and evenly-spaced traverses, except for those by the building within the East Survey Area (see Map 4), where *building shadowing* reduced the number of GPS satellites and thus the locational accuracy, which appears to be ±2.5 feet, as revealed by the 5-ft spaced traverses that occasionally *converge* in the map displays for both survey areas.

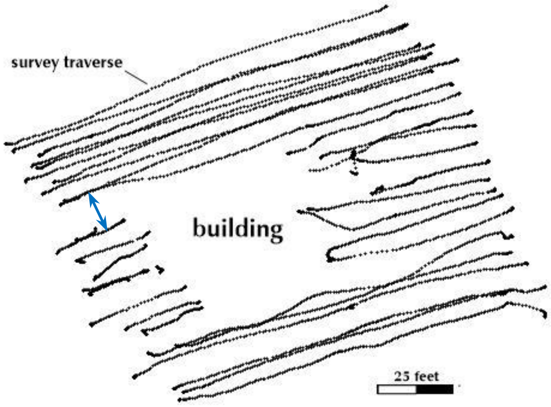
The locational accuracy appears to be good, as revealed in Map 6 (Appendix C), where an isolated EMI anomaly occurs *directly over* a known causative body (surface concrete structure).

3.0 DATA PROCESSING

3.1 EM-31

Because five traverses in the West Survey Area and seven traverses in the East Survey Area were *significantly mislocated* due to poor GPS signals in areas shadowed by buildings, the corresponding data were removed from each survey's database. To reveal the improvement from such editing, the before (L) and after (R) survey traverse displays for the East Survey Area are shown below.



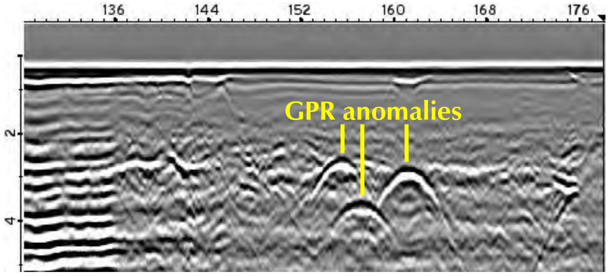


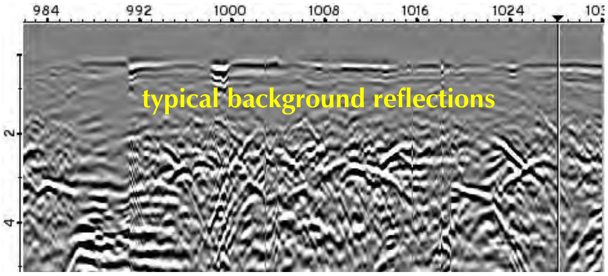
After the removal of the troublesome data (see yellow highlighted L side display), the *worst-case* distance between lines is ~13.5 ft (see double blue arrow in R side display). Since a 10-ft line spacing distance provides 200 percent coverage, the 35 percent greater distance provides 165 percent coverage, which is still enough additional data (ie, overlap) to create accurate EMI anomaly maps.

Other than line removals, no significant post-survey data processing was performed on the EMI data, as such comprise simple-valued potential-field numbers. The EMI conductivity, magnetic susceptibility and GPS data were checked for unrealistic magnitude changes and station locations and all data were found to be realistically plausible. All data files accompany this report in the Data CD in Appendix D.

3.2 GPR

The processing of the GPR data simply involved thorough *real-time* inspections of each of the GPR screen images (radargrams) made during each traverse. Below left is a typical radargram that shows diffraction arcs (GPR anomalies) associated with three buried linear causative bodies. Below right is a radargram of a typical anomaly-free traverse. The locations of all significant GPR anomalies are shown in Maps 3 and 6.





4.0 CREATION OF EMI CONTOUR MAPS

All EMI data were gridded and computer contoured, utilizing Golden Software's **Surfer** data gridding and mapping software. To preserve the integrity of the data while displaying high-resolution (grid node spacing *less than* one foot) contour maps, **ECA** applied the Minimum Curvature (MINC) operator to each dataset. MINC is an excellent gridding operator, because it minimizes (via biharmonic Laplacian differential equation) the tendency for data to extrapolate beyond grid nodes, as can happen with other operators. This feature of MINC creates contour maps that closely resemble all control points (ie, data).

The maps presented in Appendices B and C are displayed as color contour maps which allow the reviewer to gain a broad, yet sufficiently accurate perspective of features such as lateral conductivity changes and the presence of metal (magnetic susceptibility) in nearby buildings and buried objects.

Maps 1, 2, 4 and 5 have a layer that reveals the locations of the numerous discrete EMI readings that were recorded along each EMI survey traverse. The maps have cross-hatched grid lines with accurate coordinates that enable subsequent *onsite acquisition* of identified anomalies of interest.

5.0 DISCUSSION OF SURVEY RESULTS

The GPR provided real-time cross-sectional imaging of the upper 10 feet of the subsurface along each survey traverse, with the significant linear and 3D anomalies physically marked by spray painted lines on the ground surface, as shown in the photographs in Appendix D. The EMI color contour maps are plan view displays that reveal *lateral* changes in terrain conductivity and the presence of metallic debris within the upper 20 feet and 12 feet, respectively, of the subsurface.

The following discussion pertains to the *significant* GPR and EMI anomalies identified during this geophysical investigation. The Site Map displays the relative sizes and locations of the two survey areas, Maps 1 and 4 display conductivity anomalies, Maps 2 and 5 display magnetic susceptibility anomalies and Maps 3 and 6 summarily display the locations of identified GPR and magnetic susceptibility anomalies. Because magnetic susceptibility best detects the presence of metal-bearing objects, the following discussion focuses entirely upon GPR and *magnetic susceptibility* anomalies. The terrain conductivity maps (Maps 1 and 4) are still included in this report, for informational purposes.

5.1 West Survey Area

Inspection of the color contour maps reveals the following:

Map 2 reveals the locations (stations) of (for) recorded magnetic susceptibility data, as well as significant anomalies caused by adjoining metallic shipping containers, as well as causative bodies of interest to this investigation. This map reveals two bonafide EMI anomalies (SE portion of survey area) that appear to be associated with 3D metallic objects or debris buried within the upper 12 feet of the subsurface.

Map 3 is essentially Map 2 with the locations of the two *EMI anomalies of interest*, as well as all physically marked GPR anomalies that occur at depths ranging from 1.5 to 5.0 feet. All GPR anomalies appear to be caused by predominantly linear objects such as utilities and piping, with the exception of a singular 3D object presumed to be a spherical object or tank buried at a depth of ~5 feet.

5.2 East Survey Area

Inspection of the color contour maps reveals the following:

Map 5 reveals the stations for recorded magnetic susceptibility data, as well as significant anomalies caused by nearby metal-bearing buildings, as well as causative bodies of interest to this investigation. This map reveals at least nine bonafide EMI anomalies (S portion of survey area) that are far enough from the south adjacent building to *possibly* be associated with linear metallic objects or elongated debris buried within the upper 12 feet of the subsurface.

Map 6 is essentially Map 5 with the locations of the nine *EMI anomalies of interest*, as well as all physically marked GPR anomalies that occur at depths ranging from 0.5 to 3.5 feet. The GPR anomalies appear to be caused by predominantly linear objects such as utilities and piping. Two of these anomalies are coincident with a linear GPR anomaly that appears to be associated with the same causative body (ie, piping or conduit).

6.0 CLOSING COMMENTS

ECA performed this geophysical surveying project, utilizing best available methods and practices. However, all interpretations and opinions presented herein should in *no way* be considered as unequivocal facts. Geophysical data are simply displays of anomalous signatures that deviate from the normal field. Accordingly, **ECA** does not guarantee the validity or accuracy of offered interpretations, as they constitute simple conjecture based upon the limited information obtained at the time of this investigation.

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APPENDIX A

SITE MAP

ECA Geophysics
372 S Eagle Road, Suite 146
Eagle, ID 83616

SITE MAP

SCALE: 1 inch ~ 120 feet

N

ECA Project No. 17ECA244

WEST AND EAST SURVEY AREAS

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APPENDIX B

WEST SURVEY AREA ANOMALIES

(MAPS 1 – 3)

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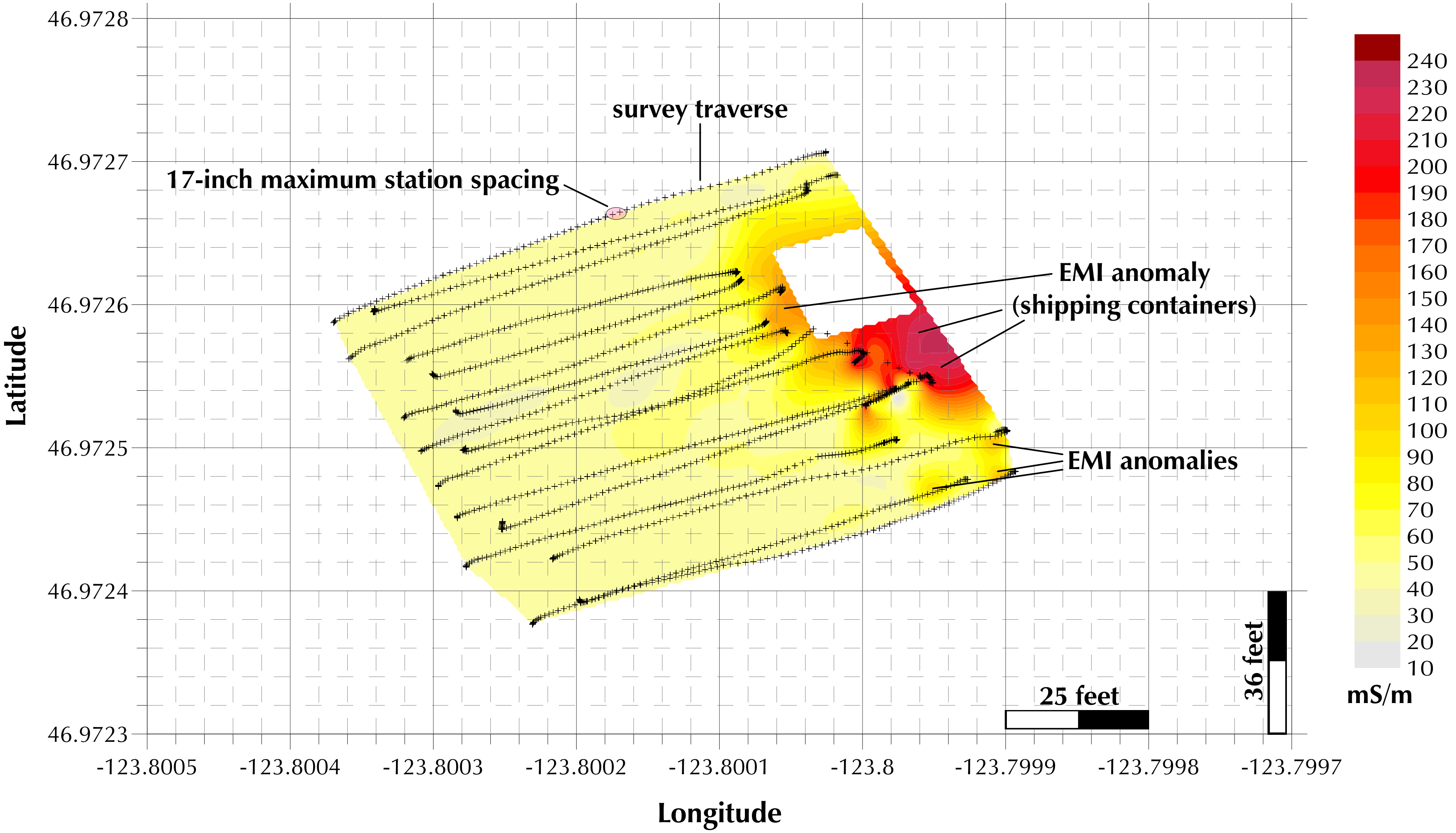
Map 1

West Survey Area

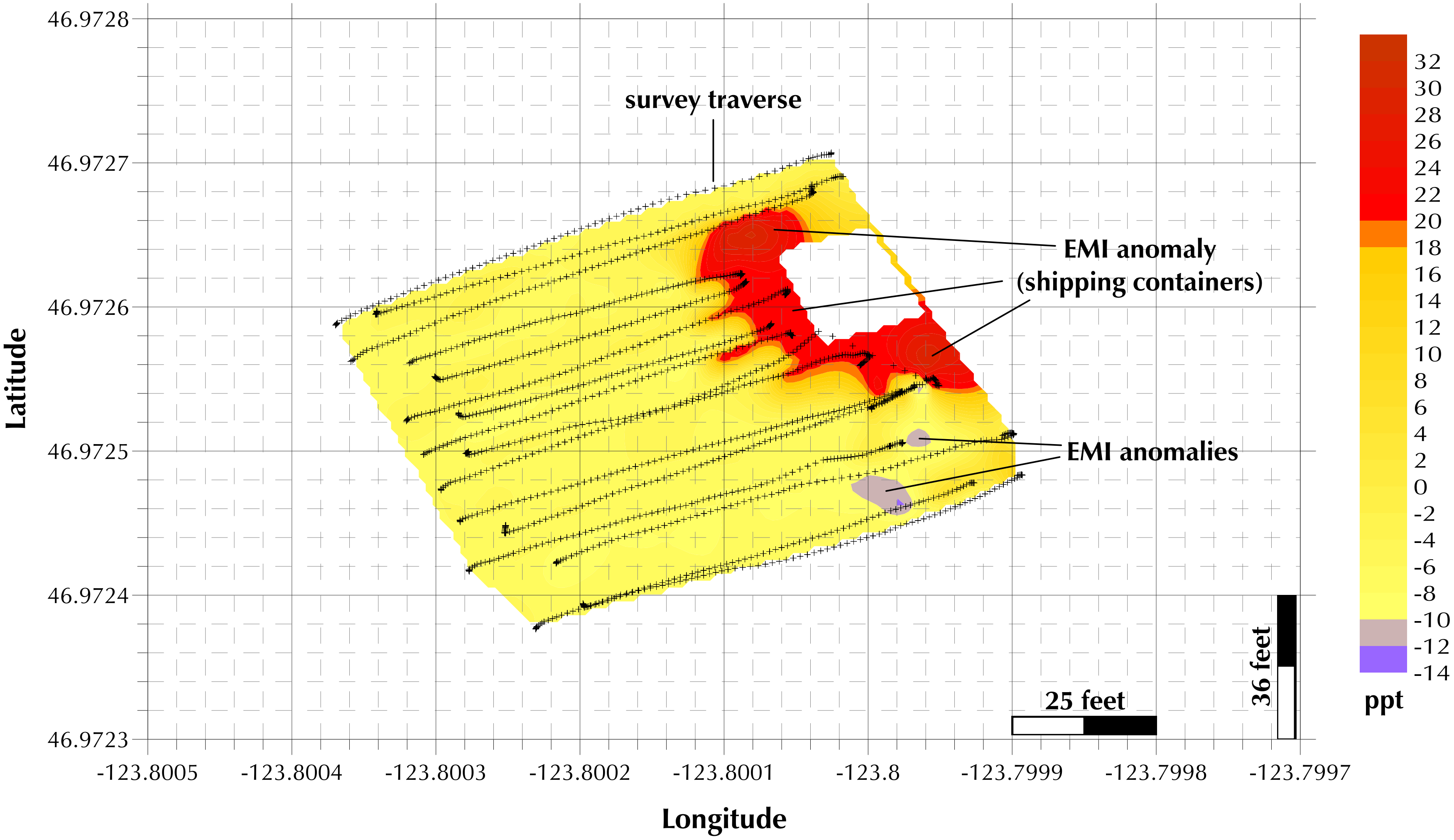
EMI terrain conductivity anomalies



Map 2

West Survey Area

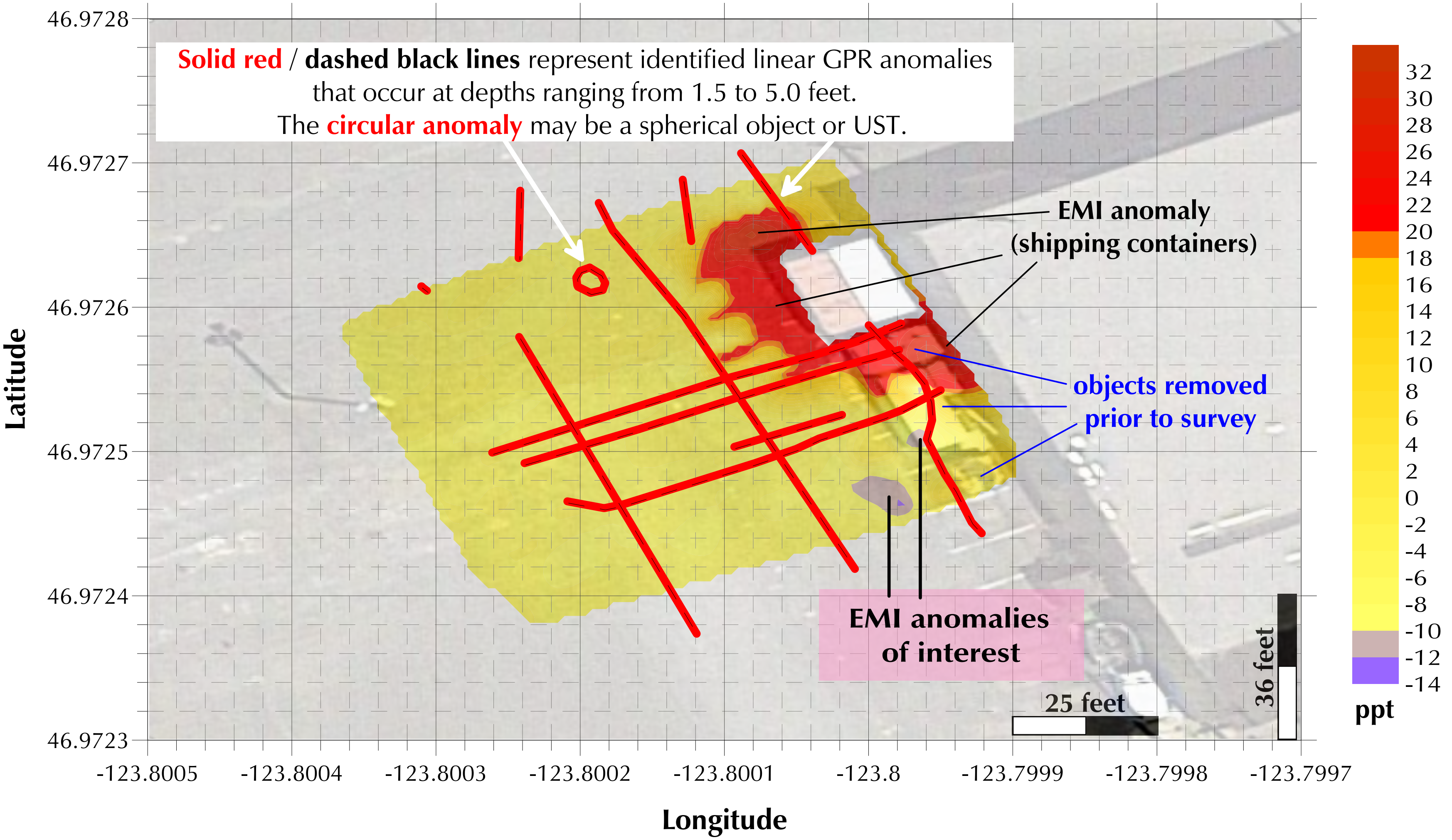
EMI magnetic susceptibility anomalies



Map 3

West Survey Area

GPR and EMI magnetic susceptibility anomalies



APPENDIX C

EAST SURVEY AREA ANOMALIES

(MAPS 4 – 6)

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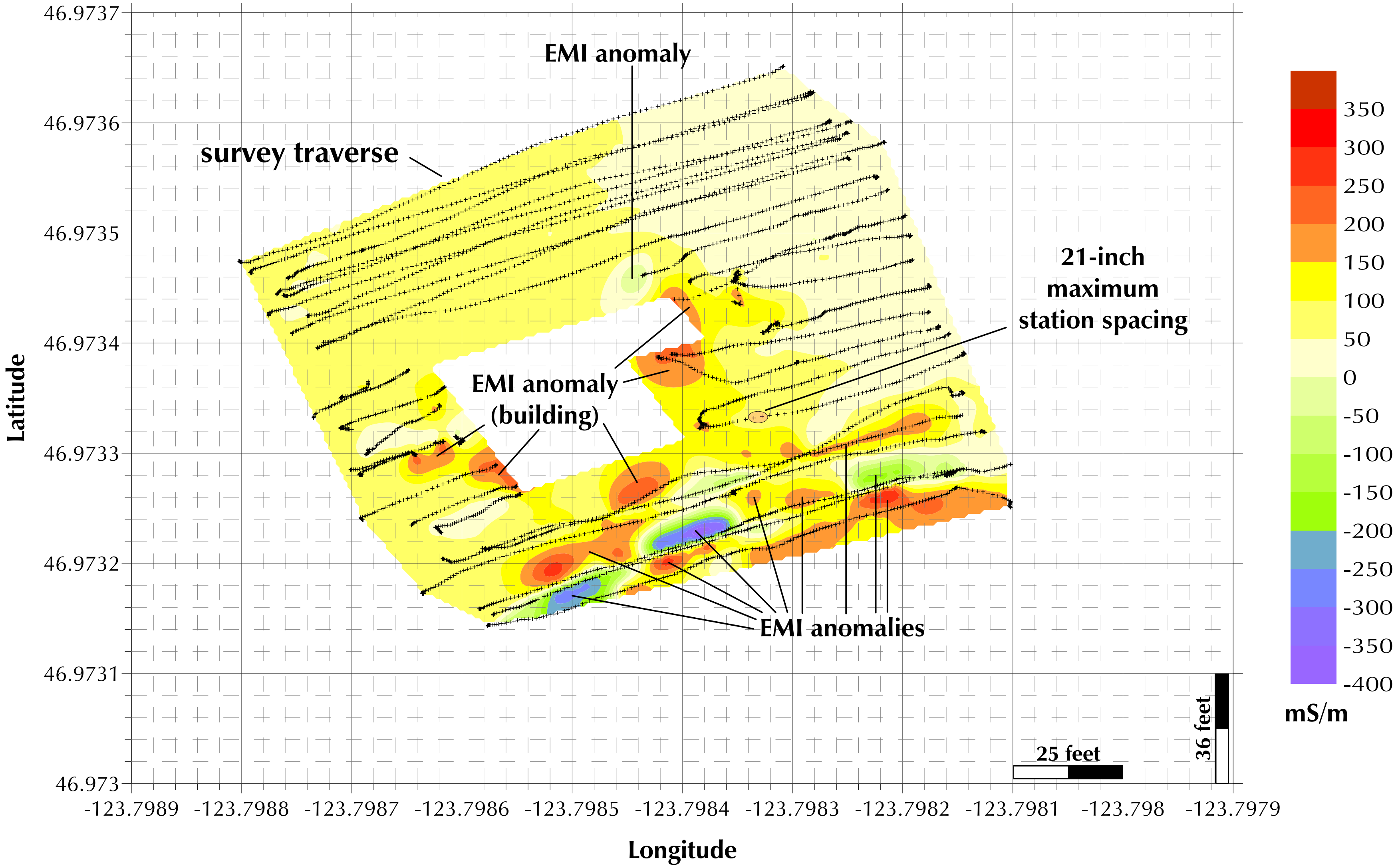
Map 4

East Survey Area

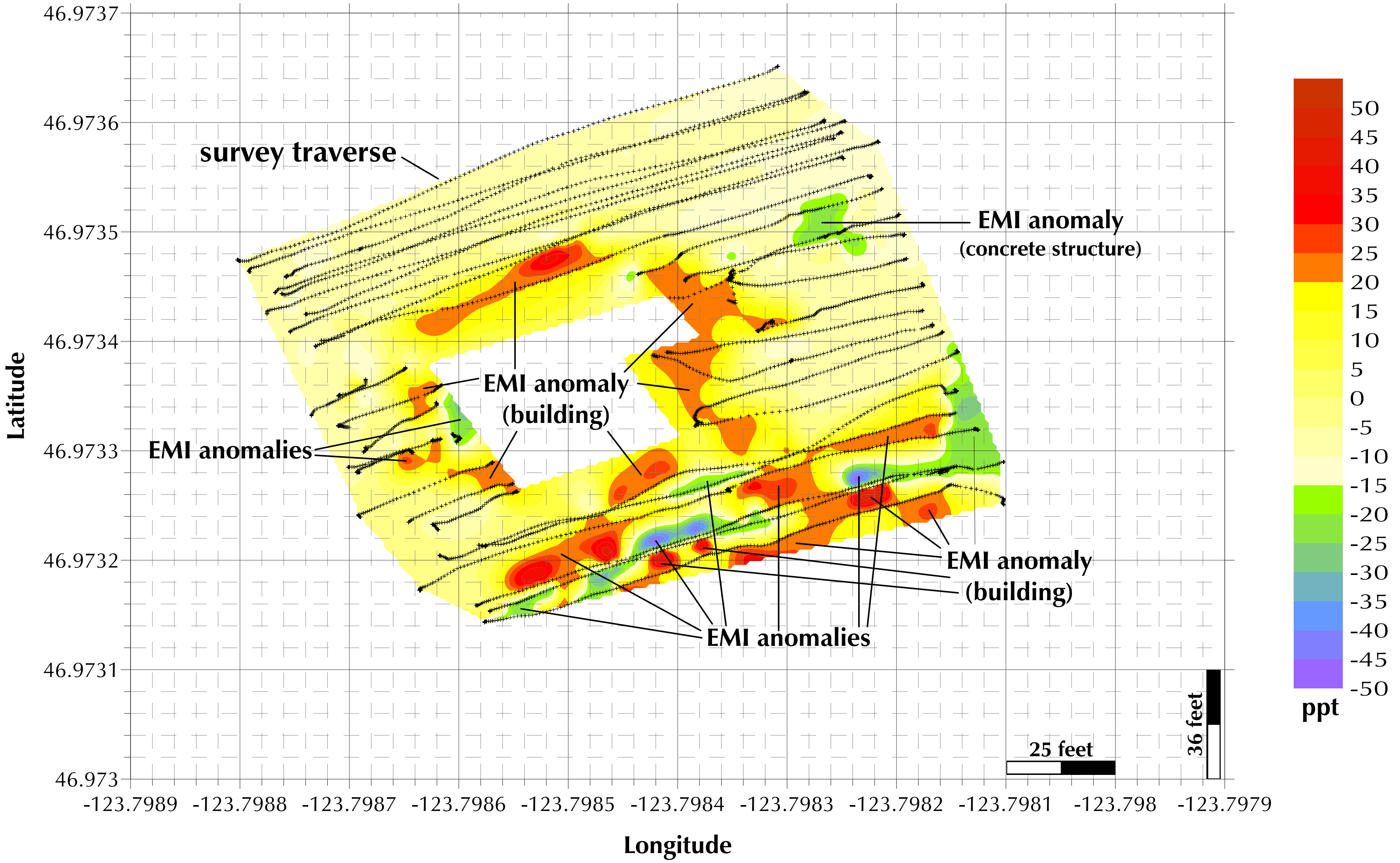
EMI terrain conductivity anomalies



Map 5

East Survey Area

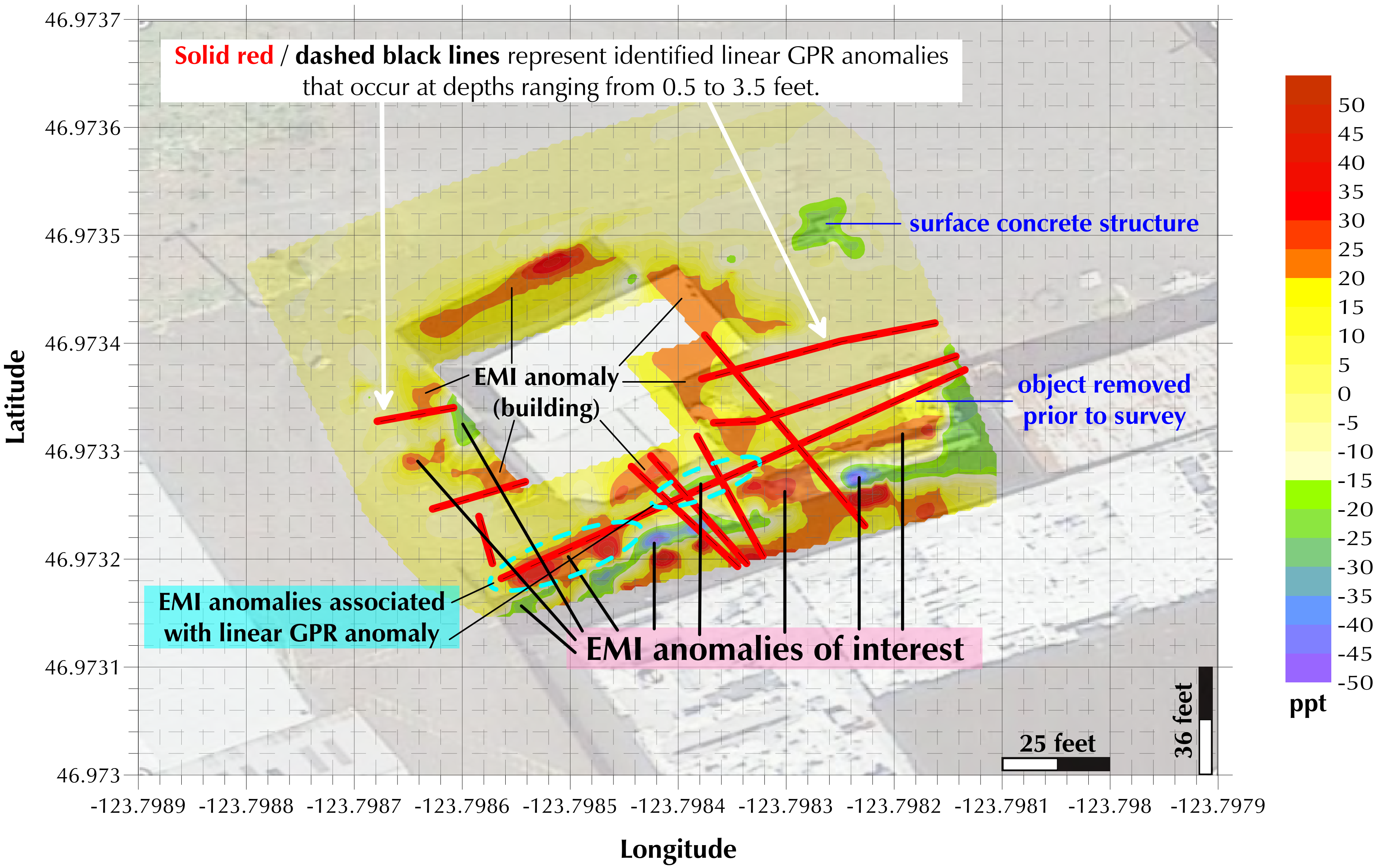
EMI magnetic susceptibility anomalies



Map 6

East Survey Area

GPR and EMI magnetic susceptibility anomalies



Solid red / **dashed black lines** represent identified linear GPR anomalies that occur at depths ranging from 0.5 to 3.5 feet.

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APPENDIX D

DATA CD

(PHOTOGRAPHS AND EMI DATA)

(not included in this electronic document)

H

Manganese in Groundwater Memorandum

ecology and environment, inc.
Global Environmental Specialists

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Seattle, Washington 98104
Tel: (206) 624-9537, Fax: (206) 621-9832

MEMORANDUM

DATE: April 24, 2018

TO: Brandon Perkins, Task Monitor, EPA, Seattle, WA, Mail Stop ECL-122

FROM: Derek Pulvino, START-IV Project Manager, E & E, Seattle, WA

SUBJECT: Manganese in Groundwater
Seaport Landing
Aberdeen, Washington

REF: Contract Number EP-S7-13-07
Technical Direction Document Number: 17-01-0004

A Targeted Brownfields Assessment (TBA) has been conducted on behalf of the United States Environmental Protection Agency (EPA) at the Seaport Landing site located in Aberdeen, Washington. This memorandum discusses findings related to occurrences of manganese in groundwater at concentrations that exceed the regulatory standards selected for this project.

Regulatory Standards

Washington State Model Toxics Control Act (MTCA) regulatory cleanup values were used for evaluating TBA data. These included groundwater cleanup levels (GCLs) and, due to the site's proximity to Grays Harbor, surface water cleanup levels (SWCLs). More specifically, the regulatory values used were those established to:

- Protect humans from ingestion of contaminated drinking water;
- Protect humans from inhalation of indoor air contaminated vapors emanating from groundwater; and
- Protect receptors via the migration of contaminated groundwater to adjacent marine waters of Grays Harbor.

In general, the MTCA SWCLs were lower than GCLs for a given constituent.

Manganese Results Discussion

In reviewing sampling data from the TBA, manganese was noted to be present at elevated concentrations in nearly all of the groundwater samples as compared to the GCL of 2,200 microgram per liter (µg/L) and the SWCL of 100 µg/L. Manganese concentrations in soil samples collected across the site were, however, typically within the expected naturally occurring range of concentrations. With the exception of one sample (MS01SB12), the average concentration of manganese encountered in soil at the Seaport Landing site was below the Western Washington 90th percentile background value, and was within the worldwide natural mean and the worldwide natural range of detected manganese concentrations.

Manganese concentrations detected in groundwater during the TBA ranged from 563 to 18,400 µg/L, all values that exceed the MTCA SWCL, and 10 of which also exceed the MTCA GCL. Concentrations of dissolved manganese in natural waters that are essentially free of anthropogenic inputs can range from 10 to >10 000 µg/L. However, dissolved manganese concentrations in natural surface waters rarely exceed 1,000 µg/L, are usually less than 200 µg/L, and can be lower still in groundwater (WHO 2004). Given the concentrations of manganese in soil, it does not appear that natural leaching processes alone are responsible for its elevated concentrations in groundwater at the site.

Another factor that could affect the increased manganese concentration in groundwater may relate to the biodegradation of petroleum hydrocarbons and/or other organic materials. The dominant destructive process for organic subsurface contaminants is biodegradation. Biodegradation of petroleum hydrocarbons occurs much more quickly in aerobic environments than in anaerobic environments. As a result, one of the most common limiting factors in bioremediation is availability of oxygen. In the subsurface environment, once aerobic degradation has depleted the oxygen, an anoxic zone may develop that encourages manganese reducing bacteria to grow. These reducing bacteria consume solid phase manganese, typically with +4 oxidative state (i.e., manganese dioxide or Mn(IV)), and then release it as the more water-soluble manganese in the +2 oxidative state (i.e., manganese chloride or Mn(II)). As such, the elevated concentrations of manganese at the site may be the result of biochemical processes.

References

WHO (World Health Organization), 2004, Concise International Chemical Assessment Document 63. Manganese and Its Compounds: Environmental Aspects. ISBN 92 4 153063 4, ISSN 1020-6167.

I

Analytical Results, Data Validation Memoranda, and Chains of Custody

APPENDIX I: *GRAYS HARBOR HISTORICAL SEAPORT AUTHORITY - TARGETED BROWNFIELD ASSESSMENT 5-11-18. This appendix is available from request from the Department of Ecology. It was removed from the main report because of its large size making the document unwieldy to navigate and to save electronically.*